ICES WGHMM Report 2007

ICES Advisory Committee on Fishery Management

ICES CM 2007/ACFM:21

Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim (WGHMM)

8 – 17 May 2007

Vigo, Spain

ICES
International Council for the Exploration of the Sea
CIEM
Conseil International pour l'Exploration de la Mer

International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

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

Recommended format for purposes of citation:

ICES. 2007. Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim (WGHMM), 8 - 17 May 2007, Vigo, Spain. ICES CM 2007/ACFM:21. 700 pp.

Contents

0 Executive Summary

The ICES Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim [WGHMM] met in Vigo, Spain, from 8-17 May 2007. In the remit of the WG there are 19 stocks, including *Nephrops* Functional Units (FU), distributed from ICES Division IIIa to IXa: 2 stocks of hake (northern: Div. IIIa to VIIIa,b and southern: Div VIIIc and IXa), 4 stocks of anglerfish (*L.piscatorius* and *L. budegassa* in Sub-areas VII and VIII and in Div. VIIIc and IXa), 3 stocks of megrim (*L. whiffiagonis* in Sub-areas VII and VIII and *L. Whiffiagonis* and *L. boscii* in Div. VIIIc and IXa), 1 stock of sole (Bay of Biscay, Div. VIIIa,b), 4 FU of *Nephrops* in Sub-area VII, 2 FU of *Nephrops* in Div. VIIIa,b (Bay of Biscay *Nephrops*), 2 FU of *Nephrops* in Div VIIIc and 5 FU of *Nephrops* in Div IXa. The stock of sole was included in WGHMM for the first time this year. There were 21 participants (2 in part-time and 1 by correspondence) from 5 countries (Portugal, Spain, France, UK and Ireland). The main terms of reference were to carry out stock assessments and to provide catch forecasts for 2008 for the fish stocks and to evaluate the recovery plans for the stocks of hake. *Nephrops* ToRs were to update catch information.

A large amount of inter-session work was carried out and 28 Working Documents (Annex A) were presented to this year meeting. The WG not only accomplished the ToRs but also further contributed to the implementation of the mixed fisheries approach through the presentation of new information. This includes a fleet definition supplied by Ireland for the Celtic-Biscay Shelf and by Portugal and Spain for the Atlantic Iberian Peninsula waters. As a result, Section 2 presents a description of the Fishery Units, plots of LPUE time series of the commercial fleets, used to depict some possible similarities between trends, and presents a proposal for fleet segmentation of the Spanish and Portuguese fleets operating in Divisions VIIIc and IXa. Moreover, the WG considered that although ToRs requested only for the update of catch for *Nephrops*, any biological information and survey data available for 2006 were included in this year report and used to depict abundance trends and assess the stocks status. For the Bay of Biscay *Nephrops*, the WG carried out an update assessment, in agreement with the working plan defined during the AMAWGC meeting. Following stated intentions and recommendations from last year Review Group, stochastic assessment and forecasts are provided for the southern stock of hake. An operating model, allowing for explicit modelling of the TAC setting rules under recovery plans, was used to evaluate the recovery plans for both stocks of hake.

In the Introduction Section (Sec 1) the WG presents a synthesis by stock, including plots of landings and stock key parameters by group of species and by area. The WG makes several recommendations regarding biological studies, surveys, data quality, assessment methodology and software.

Finally, it is noted that several assessments were performed using the FLR framework and alternative approaches to current age-based assessments with XSA were presented and discussed during this year meeting. These include statistical GADGET for southern hake and a length-based spatial model for northern hake. The WG recommends further development of these models for stock assessment. Also, a probabilistic approach was used to reconstruct the Bay of Biscay *Nephrops* discard data. This approach was considered promising and the WG recommends its analysis within WGMG and development for a benchmark assessment.

1 Introduction

1.1 Terms of Reference

It was decided at the 94th Annual Science Conference that the **Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim** [WGHMM] (Chair: M. Azevedo, Portugal) will meet in Vigo, Spain from 8-17 May 2007, to:

a) assess the status of and provide management options for 2008 for

1. hake in Subareas III, IV, VI, VII, VIII, and IX (northern and southern hake)

2. anglerfish and megrim in Subareas VII, VIII, and IX

3. sole in Subarea VIII (Bay of Biscay)

b) Update catch information for Nephrops in Division VIIbcjk and Subareas VIII, and IX

c) for the stocks mentioned in a) perform the tasks described in C.Res. 2006/2/ACFM01.

Generic ToRs:

1) Set appropriate deadlines for submission of data. Data submitted after the deadline can be disregarded at the discretion of the WG Chair.

2) Compile all relevant fisheries data, including data on different catch components (landings, discards, bycatch) and data on fishing effort. Data should be disaggregated by fisheries/fleets.

3) Assess the state of the stocks according to the schedule for benchmark and update assessments as shown below.

4) Provide specific information on possible deficiencies in the 2007 assessments and forecasts,
• any major inadequacies in the data on landings, effort or discards;
• any major expertise that was lacking
• any major inadequacies in research vessel surveys data,
• any major difficulties in model formulation or available software.

The consequences of these deficiencies for both the assessment of the status of the stocks and the projection should be clarified

1) Consider knowledge on important environmental drivers for stock productivity (based on input from e.g. WGRED and for the North Sea NORSEPP). If such drivers are considered important for management advice, incorporate such knowledge into assessment and prediction and comment on the consequences for long term targets of high yield and low risk.

2) Consider existing knowledge of important impacts of fisheries on the ecosystem

3) Evaluate existing management plans and develop options for management strategies including target and limit reference points. If mixed fisheries are considered important consider the consistency of target reference points and management strategies

4) Assess the influence of individual fleet activities on the stocks. For mixed fisheries, assess the technical interactions;

5) Provide an overview of major regulatory changes (technical measures, TACs, effort control and management plans) and evaluate or assess their (potential) effects.

6) Where misreporting and/or discarding is considered significant provide qualitative and where possible quantitative information, by fisheries and describe the methods used to obtain the information and its influence on the assessment and predictions.
7) Present an overview of the sampling on a national basis of the basic assessment data for the stocks considered according to the template that is supplied by the Secretariat
8) Implement the roadmap for medium and long term strategy of the group as developed in AMAWGC.

WGHMM will report by 28 May 2007 for the attention of ACFM (October 2007).

The plan for 2007 regarding types of assessment for the fish stocks assessed by this Working Group were as follows: i) **Observation** – **2 stocks**: northern hake and southern hake; ii) **Benchmark** – **2 stocks**: anglerfish *L. piscatorius* and *L. budegassa* in VIIIc+IXa; iii) **Update – 7 stocks**: megrim *L.whiffiagonis* in VII and VIIIa,b,d, anglerfish *L.piscatorius* and *L. budegassa* in VIIb-k and VIIIa,b,d,e, Bay of Biscay sole (Div VIIIa,b), *L.whiffiagonis* and L. *boscii* in VIIIc and IXa and Bay of Biscay Nephrops (Div VIIIa,b, FU 23-24).

The WG considered that although ToRs requested only for the update of catch for Nephrops, any biological information and survey data available for 2006 should be used to depict abundance trends and included in this year report.

During the meeting the WG further received a request to test intercatch and provide fleet definition. Both tasks were accomplished during the meeting. Intercatch test was done successfully using the Megrim *L whiffiagonis* in VIIIc+IXa and information on fleet definition was sent to ICES.

1.2 Stock Synthesis

The stocks assessed within WGHMM are distributed from ICES Division IIIa to IXa. Figures 1.1 to 1.3 show the distribution area by stock, including the Functional Units (FUs) of *Nephrops*.

The Chair notes that a large amount of inter-session work was carried out by the WG members. A total of 28 Working Documents were presented at the meeting, covering the following subjects: fleet segmentation, discards and misreporting, data revision, auxiliary information, assessment methodologies and stock preliminary assessments and evaluation of recovery plans (Annex A). Most of the contents of the referred WDs were included in this year's report. As such, it was possible for a WG dealing with so many stocks (19 stocks including *Nephrops* FUs) to accomplish this year's ToRs. Plenary sessions represented a high proportion of the WG time schedule. This working practice, while enhancing an overall collaboration and expertise interchange between members, maybe reviewed next year to allow more time for sub-group work. However, the Chair considers that the quality of the WGHMM work has not been affected as a result of this year's working practice.

A summary of past and current practices for stock assessment, as well as of 2007 type of assessment and WG proposal for 2008, is presented in Table 1.1. A stock synthesis follows by species: hakes, anglerfish, megrims, sole and *Nephrops*.. In Figures 1.4, landings and stock assessment key parameters (fishing mortality, recruitment and SSB) as estimated by XSA are plotted by group of species. In Figure 1.5 estimates are plotted by stock and by area (northern *versus* southern), including *Nephrops* landings and LPUE data series.

Northern hake

Hake is caught in nearly all fisheries in Subareas VII and VIII and also in some fisheries in Subareas IV and VI (Figure 1.1). Spain accounts for the main part of the landings with 59% of the total in 2006. France is now taking 26% of the total, UK 6%, Denmark 3%, Ireland 3%, and other countries (Norway, Belgium, Netherlands, Germany, and Sweden) contribute small amounts. Landings in 2006 were 41.8 th tonnes (Figure 1.4), below the TAC of 43.9 th tonnes.

The Northern hake emergency plan (EC 1162/2001, EC 2602/2001 and EC 494/2002) has been followed up by a recovery plan in 2004 (EC 811/2004). The recovery plan is aimed at achieving a SSB of 140 000 tonnes (B_{pa}). This is to be achieved by limiting fishing mortality to F=0.25 and by allowing a maximum change in TAC between years of 15%.

An age-based assessment (XSA) was performed using 4 commercial CPUE series and 4 surveys. Discards were not included in the assessment. Some improvement in discard data availability (number of fleets sampled and area coverage) has been observed. However, sampling does not cover all fleets contributing to hake catches, discard rates of several fleets are simply not known and when data are available, it is not possible to incorporate them in a consistent way.

This year assessment is very consistent with last year. SSB has increased since the low value observed in 2000 (Figure 1.4) and appears to have been very close to B_{pa} over the last 3 years. The SSB increase appears to be due to a combination of good recruitment and moderate fishing mortality. In fact, F has decreased since the mid-1990s (Figure 1.4) and has been around F_{pa} since 2001. However, the current fishing mortality, estimated at 0.24, is above fishing mortalities that are expected to lead to high long-term yields and low risk of stock depletion ($F_{0.1}$ = 0.10 and F_{max} = 0.17).

High variability in the most recent recruitment estimates is moderate as more data are available for those year classes. However, there are still large uncertainties associated with the level of the most recent recruitments which are only estimated by FR-EVHOES (this year, the 2005 and 2006 recruitments), and until this is confirmed, it was decided to replace 2005 and 2006 recruitments by geometric mean recruitments. Applying a fishing mortality of F = 0.25 as defined in Article 5.2 of the agreed recovery plan is expected to lead to an SSB of around 160.5 th tonnes in 2009, with estimated landings in 2008 of 54 th tonnes. This would imply an increase in TAC of 3%.

The evaluation of the management plans carried out during the WG suggest that given the dynamics assumed and if perfectly implemented then the recovery plan would be successful in meeting its aims with a high probability (>95%) but at a longer term (around 10 years) than what was estimated in last year assessment. The results are reasonably robust to a range of plausible stock recruitment relationships.

Details on answers to last year Review Group comments, available data and analysis carried out during the WG are provided in **Section 3** of the report and **Annex C**.

Southern hake

Hake in Divisions VIIIc and IXa (Figure 1.1) is caught in a mixed fishery by Spanish and Portuguese trawlers and artisanal fleets. The Spanish trawl fleet is quite homogeneous and uses mainly two gears, pair trawl and bottom trawl. The artisanal fleet is very heterogeneous and uses a wide variety of gears, traps, large and small gillnets, longlines, etc. Even though the percentage of hake in the landings of Spanish trawlers is small, these vessels account for 55% of the total Spanish hake landings in recent years. Hake is caught by the Portuguese fleet in the trawl and artisanal mixed fishery together with other fish species and crustaceans. Recently, hake represents 5% of the total Portuguese landings from trawl and 2% from the artisanal fishery. Spain accounts for the main part of the landings, with 81% of the total in 2006. Landings in 2006 were 10.7 th tonnes including Cádiz (Figure 1.4), above the TAC of 6.66 th tonnes.

A Recovery Plan for southern hake was enacted in 2006 (CE 2166/2005). This plan aims to rebuild the stock to within safe biological limits, i.e. 35 th tonnes of spawning stock biomass (B_{pa}), and drive fishing mortality to 0.27. This is to be achieved with a reduction of 10 % in the fishing mortality rate in the year of its application as compared with the fishing mortality rate estimated for the preceding year and by allowing a maximum change in TAC between years of 15%. The regulation also includes effort management in addition to TAC measures.

This year two different age-based assessments were performed: (i) XSA that assumes exact catch-at-age matrix, tuned with two commercial LPUE series and two surveys and (ii) a Bayesian VPA, assuming observation and process error, using three surveys and providing uncertainty of key parameters estimates. Discards were not included in the assessments. Discard sampling is available for a limited number of years, the raising procedure used to estimate Spanish discard data needs to be reviewed and is still necessary to test and agree on methodology to reconstruct catch-at-age data to include discards.

The SSB continually decreased between 1982 and 1998 and has remained at low levels (Figure 1.4). There are signs of a light SSB increase in the last three years. SSB in 2006 is estimated to be 15 th tonnes (XSA) and 18 th tonnes [15, 22] (median [95% CI]), from the Bayesian VPA. Recruitment was high in the mid-1980s and has been at a much lower level since then, although signals of good recruitments in last years are apparent. The Bayesian assessment indicates CVs of R estimates in 2005 and 2006 of 22% and 33%, respectively. Fishing mortality has been above F_{lim} (0.55) for most of the time after 1994. The *status quo* fishing mortality is estimated at 0.55 (XSA) and at 0.45 [0.35, 0.57] (Bayesian). These estimates are at or included the F_{lim} and Fpa (0.40).

The WG considered several options for the short-term forecasts, STF (10% F reduction, F_{sq} scaled, F_{sq} un-scaled) but results are presented for STF based on un-scaled *status quo* F (mean F_{04-06}) because landings have increased in 2006 and were above the TAC and fishing mortality has increased despite a 10% effort reduction as envisaged by the recovery plan.

Deterministic (using XSA output) and stochastic (using Bayesian VPA parameter estimates and uncertainty) STF were performed using the same basis: F_{sq} (XSA: 0.55, Bayesian: 0.45 [0.35, 0.57]) and R in 2006 to 2009 replaced by GM_{89-05} (XSA: 47 million, Bayesian: 49 million [40, 60]), to allow comparisons.

According to the deterministic STF at F_{sq}, landings in 2007 and 2008 are 9.6 and 9.8 th tonnes, respectively. Deterministic STF of landings in 2007 are below the lower 95%CI of the stochastic STF (9.8 th tonnes) and in 2008 are outside the 95%CI though close to the lower limit ([10.1, 14.8]). The deterministic STF of SSB gives 16 th tonnes in 2008 and 2009. The stochastic STF of SSB in 2009 is 22.5 th tonnes ([16.4, 29.4]). Differences between forecasts are due to the combination of lower F_{sq} and higher starting population number in 2006 used in the stochastic STF.

The results from the evaluation of the recovery plan carried out during the WG, using two different approaches and a B_{pa} of 35 th tonnes as the lower bound for SSB, does not change the perception presented last year. The fact that the TAC was overshot by an high percentage, the confirmation that discards may have increased, and the likely increase trend in F in the last 3 years, raise concerns about the implementation of the recovery plan. On the other hand the confirmation of the high recruitments in 2004 and the increasing trend in SSB in the last years show that the stock may have a higher productivity than perceived before. However, it is clear that if the upward trend in F does not stop, SSB and yield will decrease in the next years. Moreover, the opportunity to rebuild the stock protecting recent recruitments will be lost, if it has not been already.

Details on answers to last year Review Group comments, available data and analysis carried out during the WG are provided in **Section 7** of the report and **Annexes G** and **H**.

Anglerfish (L.piscatorius and L. budegassa) in Sub-areas VII and VIII

L. piscatorius and *L. budegassa* are both caught on the same grounds and by the same fleets and are usually not separated by species in landings. Anglerfish are an important component of mixed fisheries taking hake, megrim, sole, cod, plaice, and *Nephrops*. A trawl fishery by Spanish and French vessels developed in the Celtic Sea and Bay of Biscay in the 1970s, and overall annual landings may have attained 35–40.0 th tonnes by the early 1980s. Landings decreased between 1981 and 1993; since 2000, landings have shown an increasing trend. France and Spain together still report more than 75% of the total landings of both species combined. The remainder is taken by the UK and Ireland (around 10% each) and Belgium (less than 5%).

An updated age-based assessment (XSA) was carried out this year for both stocks. Retrospective patterns exist in the absolute estimates of SSB, recruitment, and F. For *L. piscatorius* there is a clear underestimation of SSB and overestimation of fishing mortality in recent years. For *L. budegassa*, the retrospective pattern is very strong and the historical pattern is not well defined in the overall level of stock size and in recent trends. The recruitment estimates of the most recent years appear to be very uncertain. The patterns in the residuals (especially cohort effects) and in the standardised catch at age proportions, successive modes observed in the survey data confirm the need of ageing validation studies. Moreover, discards are suspected to have become an important part of the total two *Lophius* species catches in recent years and there are no reliable estimates of those discards. There is no minimal landing size for anglerfish but an EU Council Regulation (No. 2406/96), laying down common marketing standards for certain fishery products fixes a minimum weight of 500 g for anglerfish. When the minimum landing size does not fit with the selective properties of the gears, this is expected to lead to discarding of undersized fish. In 2006, the landings data showed that discarding practices have increased. The working group concluded that no changes in the model formulation could result in a better assessment since the problems encountered are due to a recent deterioration of available catch data, especially discard estimates, and ageing problems.

The working group agreed to reject the XSA results to serve as a basis for a diagnostics of the state of these stocks. However, survey data indicate that ***L. piscatorius*** biomass have been increasing over the 1997 - 2006 time-series and good incoming recruitment. Landings have been increasing from 2000 to 2004 and have been relatively stable since then. As for ***L. budegassa*** indications are that landings and biomass have been reasonably stable over the time-series. There are also indications of good incoming recruitment from survey data. The WG notes that the majority of the anglerfish catch consists of young fish. Giving the signals of good incoming years an improvement of the selection pattern is expected to give a higher long-term yield.

Details on answers to last year Review Group comments, available data and analysis carried out during the WG are provided in **Section 4** of the report and **Annex D**.

Anglerfish(L. piscatorius and L. budegassa) in Divisions VIIIc and IXa

Southern anglerfish comprises two species, *Lophius piscatorius* and *L. budegassa*, in ICES Divisions VIIIc and IXa (Figure 1.1). Both species are caught in mixed bottom trawl fisheries and in artisanal fisheries using mainly fixed nets. The two species are not usually landed separately, for the majority of the commercial categories, and they are recorded together in the ports' statistics. Therefore, estimates of each species in Spanish landings from Divisions VIIIc and IXa and Portuguese landings of Division IXa are derived from their relative proportions in market samples. ***L. piscatorius*** is caught by Spanish and Portuguese bottom trawlers and gillnet fisheries. For some gillnet fishery, it is an important target species, while it is also a by catch of the trawl fishery targeting hake or crustaceans. In the Portuguese trawl fleet, the combined weight of both *Lophius* species represented less than 1% of the total landings in weight and in the artisanal fleet this value reached 2% between 2000 and 2002. Since 1997 Spanish landings represented on average 83% of the total *L. piscatorius* stock landings. ***L. budegassa*** as with *L. piscatorius*, it is an important target species for the artisanal fleet, while it is a by catch for the trawl fleet targeting hake or crustaceans. Since 1997 Spanish landings represented on average 72% of the total *L. budegassa* stock landings. The general trend of both species combined landings reflects the trends of each species, with landings increasing in the early eighties and reaching maximum in 1986, of 9.4 th tonnes, and in 1988, of 10.0 th tonnes, and decreasing after to the minimum of the time series in 2001 and 2002, of 1.8 th tonnes. During the last years, landings increased reaching in 2006 4.1 th tonnes (3.0 th t for *L. piscatorius* and 1.1 th t for *L. budegassa*), well above the TAC, of 2.0 th tonnes.

As benchmark assessments, the analysis was performed by species. Improvements in the basic data were performed: a new standardized CPUE series for a Spanish artisanal fleet was available this year and the Portuguese trawl fleet series was split into two sub-components, one directed to fish and the other to crustaceans. Also, age-based data was available for the first time this year. Catch (1996-2006) and CPUE-at-age-data were screened by an Exploratory Data Analysis, followed by a separable analysis and by exploratory runs using XSA. Also, the Schaefer production model was fitted by species using ASPIC (parameter estimates and bootstrap confidence intervals) and a Bayesian approach with MCMC (parameter estimates and credible intervals).

A final XSA assessment is presented for each species. However, the WG considered the XSA assessments only as exploratory: cohorts could not be followed along years but groups of consecutive cohorts seemed to have the expected behaviour of a unique age. This effect may be due to a biased criterion of age reading that reads more than one age per year-class. Also, XSA assumptions of constant catchability-at-age may also be inconsistent with likely changes in commercial fleet related with target species and efficiency. Therefore, the WG decided to use the ASPIC parameter estimates and uncertainty to analyse relative (to the MSY reference points) biomass and fishing mortality trends. As last year, the WG considers that $\mathbf{B}_{\mathrm{MSY}}$ and $\mathbf{F}_{\mathrm{MSY}}$ reference points should be used as a lower boundary for the biomass and an upper boundary for F. $\mathbf{B}_{\mathrm{MSY}}$ and $\mathbf{F}_{\mathrm{MSY}}$ are defined in the context of a production model and correspond to lower exploitation levels than those adopted for stocks with similar population dynamics for which PA points are based on an analytical assessment.

Both stocks biomass (*Lophius piscatorius* and *L. budegassa*) are considered to be below the level associated with harvesting at maximum sustainable yield. The fishing mortality is estimated to be above $\mathbf{F}_{\mathrm{MSY}}$ in both stocks. The fishing mortality in 2006 is estimated to be 1.5 and 1.4 times higher than $\mathbf{F}_{\mathrm{MSY}}$ for respectively *L. piscatorius* and *L. budegassa*. Landings have increased over the last 4 years but remain relatively low in terms of historical levels. Fishing mortality reductions of 40% or higher in 2008 are required to bring SSB back to $\mathbf{B}_{\mathrm{MSY}}$ in the medium term for both species. Landings in 2001 and 2002 might have reduced fishing mortality to $\mathbf{F}_{\mathrm{MSY}}$. Catches in that order could be considered as a preliminary guidance for maximum landings in a recovery plan.

This year assessment of anglerfish in Divisions VIIIc and IXa allowed to evaluate the status of each species separately. However, the assessments are completely dependent on commercial CPUE data which may be biased due to targeting, local depletions, and changes in efficiency. Moreover, production models analyse trends of total biomass and do not account for any changes in the population structure that may have occurred recently (e.g. recruitment failure, if occurs, will not be detected using production models). Landings and CPUE for *L. piscatorius* have increased in recent years, while for *L. budegassa* they have been relatively stable at very low levels. For *L. budegassa* an increment in the landings length distributions can be observed in smaller lengths in the Spanish trawlers of Divisions VIIIc and IXa. A high year class might be entering the fishery but this needs to confirmed next year.

Details on answers to last year Review Group comments, available data and analysis carried out during the WG are provided in **Section 8** of the report and **Annex I**.

Megrim (L. whiffiagonis) in Subareas VII and VIII

Northern megrim *L. whiffiagonis* (Figure 1.1) is caught in a mixed demersal fishery on anglerfish, hake, and *Nephrops*, both as a targeted fishery and as a valuable bycatch. Landings in 2005 (12.7 th tonnes) and 2006 (12.0 th tonnes) have been well below the agreed TACs (2005: 21.5 th tonnes; 2006: 20.4 th tonnes). Discarding of smaller megrim even above the minimum landing size (MLS) of 20 cm is substantial.

An updated age-based assessment (XSA) was carried out using landings and discards data, calibrated by two commercial CPUE series and two surveys. This year exploratory runs to depict catchability trends in commercial tuning fleets were carried out. As past year there are large retrospective revisions in stock trends mainly due to apparent change of catchability of the main fleet exploiting the stock from the first to the last year of the series. The current assessment model (XSA) imposes constant catchability-at-age and hence retrospective assessments lead to large interannual changes in recent stock status. Moreover, limited discards data are available in the time-series (filling in of the missing years is problematic because discarding practices in the fisheries are very variable over time) and survey information is also limited, particularly on the strength of the incoming year classes (although attempts for including the Irish and Spanish Porcupine Grounfd Fish Surveys have been carried out this year). Due to all the above, the analytical assessment with XSA was not considered reliable and, hence, could not be used for the short-term forecast.

However, indications are that landings and SSB have been reasonably stable over the time-series and there are no indications of reduced recruitment as two surveys give signals of abundance oscillating around similar values during the last years.

Details on answers to last year Review Group comments, available data and analysis carried out during the WG are provided in **Section 5** of the report and **Annex E**.

Megrims (L. whiffiagonis and L. boscii) in Divisions VIIIc and IXa

Southern megrims *L. whiffiagonis* and *L. boscii* (Figure 1.1) are caught in mixed fisheries targeting demersal fish including southern hake and *Nephrops* and are usually not separated by species in landings. Both species are bycatch in the mixed bottom trawl fisheries by Portuguese and Spanish fleets and are also taken in small quantities by the Portuguese artisanal fleet. The majority of the catches are taken by Spanish trawlers. Landings have decreased for both species since the late 1980s reaching their lowest value in 2002 (*L. whiffiagonis*: 117 tonnes; *L. boscii*: 720 tonnes). Since 2003 landings have begun to increase, In 2006 were 210 tonnes for *L. whiffiagonis* and 1092 tonnes for *L. boscii*.

The current assessments are reasonably consistent with those from previous years. This year updated age-based assessments (XSA) were conducted for each species separately. They are based on landings data, two commercial LPUE series, and one CPUE survey series. Discards data are not used in this assessment because of the lack of data in some years (discards data will be introduced into the assessment when the time-series is sufficiently long). Age information prior to 1990 is not available on an annual basis and has been extrapolated for some years.

SSB of both species has decreased since the late 1980s. For *L. whiffiagonis*, SSB has stabilised close to the historic low. For *L. boscii*, SSB shows an upwards trend after reaching a historical minimum in 2001. For *L Boscii*, recruitment appears rather variable, without displaying any clear pattern over time while for *L Whiffiagonis* recent recruitments have been at low levels. Fishing mortality has declined in parallel with the landings.

At recent levels of fishing mortality for both species, SSB has been stable for *L. whiffiagonis* and showing some signs of increase for *L. boscii*. The WG considers that fishing mortality should not be allowed to increase. The current level of exploitation (*L. whiffiagonis*: 0.24 and *L. boscii*: 0.31) would correspond to landings in 2008 of around 230 tonnes for *L. whiffiagonis* and around 1200 tonnes for *L. boscii*, yielding combined landings of 1430 tonnes.

Details on answers to last year Review Group comments, available data and analysis carried out during the WG are provided in **Section 9** of the report.

Bay of Biscay Sole

Bay of Biscay sole is caught in ICES Div VIIIa,b (Figure 1.1). The fishery has two main components: the major one is a French gill net fishery directed at sole (about two third of total catches) and the other one is a French and Belgian trawl fishery (French otter trawlers and Belgian beam trawlers). The otter trawlers have more mixed species catches than beam trawlers which are directed at sole. The French coastal boats of these two fisheries have a larger proportion of young fish in their catch than offshore boats. In 2002, landings were increased to 5.5 th tonnes by hydrodynamic conditions very favourable to the fixed nets' fishery (frequent strong swell periods in the first quarter). In the absence of such apparently rare conditions, the landings in 2003-2006 were ranging from between 4.0 and 4.5 th tonnes, well below the 2002 level and at the lowest level since 1985.

In 2006 a multiannual plan for the sustainable exploitation of the stock of sole in the Bay of Biscay (EC regulation 388/2006, 23 February) was established which set the objective of bringing the spawning stock biomass above 13.0 th tonnes (B_{pa}) in 2008. This objective is to be attained by gradually reducing the fishing mortality rate on the stock (10 %reduction in fishing mortality rate in its year of application compared to the fishing mortality rate estimated for the preceding year) and by allowing a maximum change in TAC between years of 15%. Once the SSB is evaluated by ICES to be equal to or above the 13.0 th tonnes, a long-term target fishing mortality shall be decided as well as a rate of reduction to reach it.

The assessment this year (update) is consistent with last year. The time series starts in 1984 as data prior to 1984 are not considered reliable. The age-based analytical assessment was again conducted with XSA using landings and CPUE data series from two surveys (ending in 2002) and two commercial fleets. Partial discard information is available from 1984 to 2003, but is no longer included in the assessment in 2004 because of the low contribution of discards to the catch and therefore to the assessment. No recruitment indices are available for this stock.

SSB has declined from the high levels of 1992-94 (16.0-16.6 th tonnes), and has been below **B**pa since 1999. In 2006 SSB is estimated to be 11.3 th tonnes. Fishing mortality has generally increased since 1984 and has been around **F**lim (0.58) from 1992 to 2001. In 2002 the fishing mortality was exceptionally high (0.81); it has decreased below **F**pa (0.42) in 2004, but it has increased again above **F**pa in the two last years. F in 2006 is estimated to be 0.52. Since 1992 recruitment (age 2) has been at a lower, but stable level up to 2000. Since then three low recruitments have occurred in 2001, 2004 and 2005.

For the STF the exploitation pattern is the un-scaled mean over the period 2004-2006 (over 2004-2005 at age 2) because the reliability of the last year F estimate is considered to be too low to do a correction for a light and short trend when, furthermore, no information are available on the 2006 landings at the time of the WG. This *status quo* F is estimated at 0.46. The recruitment in 2006 is estimated by XSA to be at 27.7 million. The WG considered that this estimate could not be accepted because it is no more reliable than in the preceding year. It was overwritten by a short series GM from 1993 (22.7 million) as in preceding assessments since there is observed fall in the recruitment since 1993. This $GM_{93\text{-}05}$ was also assumed for subsequent recruitments. According to the EU management plan, landings should be less than 4.2 th tonnes in 2008, as they must be less than those resulting in a 10% reduction in F (in

2008 compared to F_{sq}), as long as SSB is below 13.0 th tonnes. This catch for 2008 corresponds to a fishing mortality of 0.41, which is slightly below $\mathbf{F}_{pa}$, and SSB in 2009 (12.6 th tonnes) is predicted to be just below B_{pa}. However, the WG notes that predictions are weakened when variability of the recruitment increases, as observed in recent years. That should lead to a larger than 10% reductions in F if one want to secure the reach of the target SSB in the short term and then the objective of the management plan.

Details on answers to last year Review Group comments, available data and analysis carried out during the WG are provided in **Section 6** of the report and **Annex F**.

Nephrops in Sub-area VII

Nephrops in Sub-area VII includes FU16, FU17, FU 18 and FU 19 (Figure 1.2).

For **FU 16** (Porcupine bank) landings have been variable over time. Maximum landings of more than 4.0 th tonnes were observed in the early 1980s before declining to less than 1.0 th tonnes in the early 2000s. Landings increased in the last two years have been close to 2.0 th tonnes.

There are some length–structured data available, but growth rates cannot be well determined. There are concerns about the accuracy of the landings statistics in some fleets. Analytical assessments are not feasible at present. However, there is mean size data for the Spanish Porcupine Bank survey since 2001-2006. LPUE and effort data are available for the Spanish, French and Irish fleets. These data have been used to assess the state of the stock.

For most fleets, landings and LPUEs were at low levels in the early 2000s. Landings and LPUEs seem to have increased more recently but decline again in 2006. The mean size indicators in all fleets and surveys indicate a large change in mean size in the last few years. This may indicate poor recent recruitment and increased exploitation. Accordingly, the WG considers that the increased targeting of this stock is undesirable and effort and catches should be reduced substantially below recent levels until a sustainable expansion of the fishery can be justified.

For **FU 17** (Aran Grounds) the maximum landings of 1.4 th tonnes were reported in 1998. Since then the reported landings have shown a declining trend with some fluctuations.

Analytical assessments are not feasible at present. Landings length compositions by sex are available for 1995–2000. Since 2001 a catch and discard sampling programme has been in place which shows some discarding of smaller individuals. Sampling in 2006 was very limited due to the non-cooperation with sampling programmes. An effort and LPUE data set for Irish *Nephrops* trawlers from 1995–2006 is available. Since 2002 there has been an annual UWTV survey which provides the first fishery independent information for this stock. These data have been used to assess the state of the stock.

The LPUEs have fluctuated without trends around 37kg/hr over the time-series but show an increase in the last three years. The UWTV survey series shows increased burrow density from 2002–2004 followed by a decrease to the lowest in the series in 2006. Currently there is no serious concern about the stock status since burrow densities are still very high and LPUEs have increased. However, current management does not constrain landings from this fishery as the TAC is set for a much larger area and reported landings statistics are not thought to be reliable. Input control by constraining effort and fleet capacity around current levels would be an appropriate first step in managing this fishery.

For **FU 19** (Ireland SW and SE coast) landings have been variable throughout the time-series, reaching the highest observed levels in 2002–2004, between 1.1 and 1.2 th tonnes. Landings in 2005 and 2006 have been below average.

Analytical assessments are not feasible at present. Length–frequency data of the landings were collected on an irregular basis in the years 1996–1997, 1999, and 2002 to 2006. Spatial and temporal coverage is problematic because landings from FU 19 originate from several discrete grounds. LPUE data are available for the Irish *Nephrops* fleet in FU 19 from 1995–2006. These data have been used to assess the state of the stock. The LPUEs are lower that other areas around Ireland and have fluctuated without a detectable trend over the short time-series. It is noted that during the LPUE period the fleet composition has changed substantial due to fleet renewal and fleet decommission schemes and there has been increasing enforcement of monkfish quota causing increased specialisation in *Nephrops*. Currently there is no serious concern about the stock status. However, current management does not constrain landings from this fishery as the TAC is set for a much larger area and reported landings statistics are not thought to be reliable. The WG considers that *Nephrops* fisheries in FU 19 should be constrained to recent levels of effort and landings at an appropriate geographical scale (FU).

Details on available data and analysis carried out during the WG are provided in **Section 10** of the report.

Nephrops in ICES Division VIIIa,b

There are two Functional Units in ICES Division VIIIa,b: FU 23 (Bay of Biscay North) and FU 24 (Bay of Biscay South), together called Bay of Biscay *Nephrops* (Figure 1.2). *Nephrops* in FUs 23-24 is exploited by French trawlers almost exclusively. Landings declined until 2000, from 5.9 th tonnes in 1988 to 3.1 th tonnes and have been stabilised in recent years. Landings in 2006 were 3.4 th tonnes, below the TAC, of 4.0 th tonnes. In the end of 2005 the MLS was increased from 8.5 to 9.0 cm total length. The slight decrease in landings in 2006 compared to 2005 (3.7 th tonnes) may be due to the change in MLS and fishing effort limitations (not allowing *Nephrops* catch during week-ends, individual quotas). Discards represent most of the catches of the smallest individuals and are high in recent years. The average weight of discards per year on the period 1987-2006 was about 1.7 th tonnes whereas discards of the recent sampled years (2003-2006) reached 2.9 th tonnes.

An age-based assessment was performed with XSA and one commercial LPUE series from the Le Guilvinec district (*Nephrops* specialists), with effort derived from sales records and cross-validated with logbook datasets. Catch-at-age data was generated by deterministic slicing of sampled length distributions. Discard data were available for 1987, 1991, 1998 and since 2003. Missing years were filled in by extrapolation assuming proportionality between landed and discarded amounts by quarter. Catch-at-age data were combined for males and females.

This year assessment (XSA update) gives a downward revision for the SSB level and an upward revision of F in recent years by 10% whereas recruitment (age 1) estimates until 2004 are close and consistent with last year. Uncertainty on the stock parameter estimates is not provided by the current assessment approach (XSA) but revisions in the order of 10% are likely to be within confidence bounds. The spawning biomass has been increasing since 2000 and is estimated to be 12.1 th tonnes in 2006, the highest of the time series (1987-2006). The high SSB in 2006 is mainly due to the combination of a high recruitment in 2004, estimated to be the strongest of the whole time series 1987-2004, and a decrease in the fishing mortality in recent years. Current fishing mortality, estimated to be 0.41, is however well above the F_{max} of 0.16. (0.41 is Fbar(2-5) including landings+discards, 0.16 is the F_{max} corresponding only to landings). There are no exploitation boundaries for this stock.

Recruitment in 2005 is estimated to be 2081 million but since terminal year's estimates are rather uncertain and the results of the retrospective analysis for this year class are noisy, the XSA estimate was not accepted. Different options were considered to replace this estimate. However, taking into account that several signals confirm that a high recruitment occurred in

2005, the XSA estimate was replaced by a year class strength at the level of the recruitment in 2004 (1006 million). From 2006 onwards the recruitment was assumed to be $GM_{87\text{-}04}$ (672 million). Despite a decrease in F in recent years, the retrospective analysis shows a tendency to revise F upwards and, likely increases in catch efficiencies may result in under-estimation of F. Therefore, STF was carried out using un-scaled F_{sq} (mean 04-06), of 0.48. To take account of changes in the exploitation pattern in 2006 possibly due to the change in the MLS, F was split into landings and dead discards F, based on the scaled values of F discards at age estimated in 2006. At *status quo* F, landings are predicted to increase in 2007 to 4.7 th tonnes, 10% above the TAC, of 4.3 th tonnes, and to decrease slightly in 2008 to 4.5 th tonnes. SSB is reduced in 2008 and 2009 to 13.9 and 12.9 th tonnes, respectively, though this is higher than the SSB long-term average (9.1 th tonnes). However, the WG notes that the uncertainty on the assumed recruitments in 2005 and 2006 is high and these have a significant impact in the STF.

Details on answers to last year Review Group comments, available data and analysis carried out during the WG are provided in **Section 11** of the report and **Annex K**.

Nephrops in ICES Division VIIIc

There are two Functional Units in Div. VIIIc (Figure 1.3): FU 25 (North Galicia) and FU 31 (Cantabrian Sea).

FU 25 (North Galicia): *Nephrops* is caught in the mixed bottom trawl fishery in the North and Northwest Iberian Atlantic. The fishery takes place throughout the year, with the highest landings in spring and summer. Since the decline of the main target species in the area, the bottom fisheries have targeted a variety of species, including hake, anglerfish, megrim, horse mackerel and mackerel. At present, the trawl fleet comprises three main components: baca bottom trawl, high vertical opening trawl (HVO) and bottom pair trawl, each targeting a different species. Only the baca trawl catches *Nephrops*.

Landings were reported only by Spain. Since the early 90s landings declined from about 400 t to less than 100 t. There was a slight increase to 143 t in 2002, despite of the fishery being virtually closed during November and December, due to an oil spill off Spain's NW coast, Landings declined again to 89 t in 2003, when the fishery remained partially closed from January to April 2003. The estimates of landings in 2006 were 62 t, the lowest value recorded during the time series. The time series of the commercial landings gives a clear declining trend, with actual figures representing 10% of the landings in the 70s.

There are some length–structured data available, but growth rates cannot be well determined. Analytical assessments are not feasible at present. LPUE and effort data are available and have been used to assess the state of the stock. The overall trend in fishing effort is decreasing, with current effort being approximately half the level in 1999. The long time series of effort shows a marked decrease between 1976 and 1987, then effort remained quite stable (fluctuating around 5000 trips) until 1995. Since then, fishing effort decreased up to the recent low levels of 1700 trips. Effort of the bottom trawl in this fishery is directed primarily at a set of demersal and bottom species, with *Nephrops* making only a small contribution to overall fishery landings. LPUE shows an overall decreasing trend. After a period with quite variable LPUE until 1993, LPUE remained relatively stable around 40 kg/trip between 1993 and 1997. Since then LPUE fluctuated at low level (around 29 kg/trip). Given the very low state of the stock and likely recruitment failure, the WG considers that the current recovery plan, implemented in January 2006 (Council Regulation (EC) No 2166/2005) may not be enough the reverse the downward abundance trend. Therefore, strong measures should be considered.

FU 31 (Cantabrian Sea): *Nephrops* landings from FU 31 are reported by Spain (the only participant in the fishery) and are available for the period 1983-2006. The highest landings were recorded in 1989 and 1990. Since 1996 landings have declined sharply from 129 t to 15 t in 2006, similar to the lowest value in the time series obtained in 2005 (14 t).

There are some length–structured data available, but growth rates cannot be well determined. Analytical assessments are not feasible at present. LPUE and effort data are available. These data have been used to assess the state of the stock.

Mean size of males and females in the landings, 1988-2005, shows a general increasing trend for both sexes. In 2006, a slight decrease was detected. The fishing effort data series includes two bottom trawl fleets operating in the Cantabrian Sea with home ports in Avilés and Santander. Total effort is not available for the period 2004-2006 due to the lack of information from Avilés. The available time series of effort shows a period of relative stability from the early 1980s to the beginning of the 1990s. Since 1992, effort shows a marked downward trend. The increased use of other gears (HVO and pair trawl in recent years) has resulted in the reduction in effort by the baca trawl fleet, the only gear fishing for *Nephrops*. In 2006, the effort shows a slight increase. The LPUE data series show fluctuations around the general downward trend. In recent years the LPUE has remained at low levels. Given the very low state of the stock and likely recruitment failure, the WG considers that the current recovery plan, implemented in January 2006 (Council Regulation (EC) No 2166/2005) may not be enough the reverse the downward abundance trend. Therefore, strong measures should be considered.

Details on available data and analysis carried out during the WG are provided in **Section 12** of the report.

Nephrops in ICES Division IXa

There are five Functional Units in Div. IXa (Figure 1.3): FU 26 (West Galicia); FU 27 (North Portugal); FU 28 (Alentejo, Southwest Portugal); FU 29 (Algarve, South Portugal) and FU 30 (Gulf of Cádiz).

FU 26+27 (West Galicia and North Portugal): *Nephrops* is caught as a by-catch in the mixed bottom trawl fishery in the North and Northwest Iberian Atlantic. The commercial species of the fishery are hake, anglerfish, megrim, blue whiting, mackerel, horse mackerel and a set of other fish and cephalopods. The fishery takes place throughout the year, with the highest yields of *Nephrops* in spring and summer. The overall decline of some bottom commercial species in the area (mainly hake in the last decade) has influenced the fishing strategies of the trawl fleets in terms of gear modalities and target species. At present, the trawl fleet fishing in the area comprises three components: baca bottom trawl, high vertical opening trawl (HVO) and bottom pair trawl, each targeting a different species. Only the baca bottom trawl catches *Nephrops*. Trawl vessels can change the gear from year to year and consequently the target species and the fishing effort applied vary. The increasing use of pair trawlers and HVO (fishing for mackerel and horse mackerel) that do not catch *Nephrops* has reduced the fishing effort on the species in recent years.

Landings are reported by Spain and minor quantities by Portugal. The catches are taken by the Spanish fleets fishing on the West Galicia (FU 26) and North Portugal (FU 27) fishing grounds, and by the Portuguese artisanal fleets fishing with traps on FU 27. *Nephrops* represents a minor percentage in the composition of total trawl landings but is a very valuable species for the profitability of these fleets. Along the time series, landings by the Spanish fleets are mostly from FU 26, together with smaller quantities taken from FU 27. Two periods can be distinguished in the time series of landings available 1975-2004. During 1975-1989, landings fluctuated between 600 and 800 t. From 1990 onwards there has been a marked downward trend in landings. In 2006 the landings were 44 t, similar to the lowest level recorded in the time series (2005, landings 42 t). Total Portuguese landings from FU 27 have decreased since 1989, from about 90 t to the recent 12 t.

There are some length–structured data available, but growth rates cannot be well determined. Analytical assessments are not feasible at present. LPUE and effort data are available. These data have been used to assess the state of the stock.

Fishing effort and LPUE data are available for Marín trawl fleet (SP-MATR) for the period 1994-2006. The overall trend for the LPUE of SP-MATR is decreasing. This fleet accounts for more than 40% of the landings from these FUs. Given the severely depleted *Nephrops* stock and likely recruitment failure, the WG considers that the current recovery plan, implemented in January 2006 (Council Regulation (EC) No 2166/2005) may not be enough to recover the stock. Therefore, strong measures should be considered.

FU 28+29 (SW and S Portugal): *Nephrops* is taken by a multi-species and mixed bottom trawl fishery. The trawl fleet comprises two components, namely the trawl fleet fishing for fish and the trawl fleet fishing for crustaceans. The trawl fleet fishing for fish operates off the entire coast while the trawl fleet directed to crustaceans operates mainly in the Southwest and South Portugal, in deep waters, where crustaceans are more abundant. The fish trawlers are licensed to use a mesh size >= 65 mm and the crustacean trawlers are licensed for two different mesh sizes, 55 mm for catching shrimps and >= 70 mm for Norway lobster. There are two main target species in the crustacean fishery, which are the Norway lobster and the deepwater rose shrimp. These two species have a different but overlapping depth distribution. Rose shrimp occurs from 100 to 350 meters of depth whereas Norway lobster distributes from 200 to 800 meters. From 2003 to 2005, the number of fishing trips directed to *Nephrops* presents an increasing trend. The number of fishing trips directed to one species or to the other depends on the abundance of these species each year.

Up to 1992 the estimated landings from FUs 28 and 29 have fluctuated between 450 and 530 t, with a long-term average of about 480 t. Between 1990 and 1996, the landings fell drastically, to an all time low of 132 t. From 1997 to 2005 landings have increased to levels observed during the early 1990s but decreased again in 2006. The value of total landings in 2006 was 248 t. Estimates of *Nephrops* discards in the Portuguese crustacean trawl fishery for the period 2004-2006 varied between 7 t (CV=76.1%) in 2006 and 44 t (CV=35.5%) in 2005.

Last year an age-based assessment, with XSA, was performed by sex. Results were used as indicative of stock trend. No assessment update was performed this year but data on fishing effort, LPUE and abundance from crustacean trawl surveys was used to assess the state of the stock. Total fishing effort (fishing days), estimated from the LPUE obtained from fishing logs, decreased from a peak value in 1985 to much lower values in the early 1990s. From 1999 to 2002, fishing effort increased substantially. Since 1989, LPUE has declined considerably, from almost 120 kg/day in 1989 to a mean of about 50 kg/day in the period 1995-2003. This seems to be mostly the result of a decrease in male LPUE. Female LPUE was more or less stable throughout the whole period, with exception of a peak in 1995. The total LPUE shows an increase in 2003-2005, dropping again in 2006. The average *Nephrops* CPUEs (kg/h trawling) from the crustacean surveys (used as overall biomass index) also shows an increase in the period 2003-2005, mainly due to the increase of small individuals present in the area and a drop in 2006.

Based on last year assessment results, an evaluation of the recovery plan for *Nephrops* was performed using a stochastic projection method to assess the short and medium term effects on *Nephrops* male SSB and landings from the reduction of the fishing effort, as stated in the recovery plan implemented in January 2006 (Council Regulation (EC) No 2166/2005). The males were chosen because they constitute the most important and exploited component of the stock. The projections were performed for a 10-year period simulating two situations: (i) status quo fishing mortality (average for the period 2003-2005) for the entire period, and (ii) 10% annual decrease in fishing mortality for the first three years of the period. The reduction was considered for only three years because it is expected that the southern stock of hake reaches its F_{target} within this period. The simulations indicate that at the current levels of fishing mortality, *Nephrops* SSB will not show any recovery. However, if fishing mortality is reduced annually by 10% during three years then SSB will increase and it is expected to reach the level of the early 90's in 2016 with a probability of 50%.

FU 30 (Gulf of Cádiz): *Nephrops* in the Gulf of Cádiz are caught in a mixed fishery targeted by the trawl fleet. Landings are clearly seasonal with high values from April to September. The species represents 1.5% of the total trawl landings from the area and the main landings ports are Huelva with 45%, Isla Cristina and Puerto de Santa María with 21% and Sanlúcar de Barrameda with 10% of the total *Nephrops* landings. Landings were reported by Spain and minor quantities by Portugal. Landings decreased from 108 tonnes in 1994 to 49 tonnes in 1996, the lowest all time recorded. Since then, *Nephrops* landings show a gradual increase up to a maximum value of 281 tonnes in 2003. In 2004, a decrease in landings has been recorded (more than 50%), followed by a new increase in 2005 (232 tonnes). In 2006, landings showed a similar value (225 tonnes). Estimated discarding rates were similar with 5.2% and 4.9% by weight, in 2005 and 2006, respectively.

Limited data is available to assess these stocks. The biomass and the abundance indices of *Nephrops* by depth strata, estimated from the Spanish bottom trawl spring surveys (SPS-GFS) carried out from 1993 to 2007 were used. The 2004 survey values are the lowest in the survey time series and this decrease has also been detected in the commercial LPUE for 2004. The results of the spring survey in 2005 show an increase relative to the previous year. This increase in 2005 is also detected, to a lesser extent, in the trend of the commercial LPUEs. In 2006, a new decrease was observed, while in the commercial LPUE was detected an increase. The results from 2007 survey confirm the descending trend. The indices obtained from these surveys could be useful abundance indices, but they have to be considered with caution, as these surveys are not carried out during the main fishing season of *Nephrops.*

Besides the Recovery plan implemented in January 2006 (Council Regulation (EC) No 2166/2005), currently a Fishing Plan is being followed by the trawl fleet in FU 30, Gulf of Cádiz (ORDEN APA/2883/2006, 19th September, B.O.E nº 225), which will be applied until next September and consequently affects to *Nephrops*. This plan restricts the daily fishing hours and establishes two days of fishing repose each week. Furthermore, the plan establishes a fishing closed season of 45 days, which took place last year between September 21st and November 4th. This annual fishing plan started in 2004 and it is still in force. The effects of the closed season on *Nephrops* have not yet been evaluated. Although this plan may not have had an effect on the *Nephrops* fishery as the main directed effort occurs from April to September, the 2006 effort shows a decrease both in the total fleet effort and in directed effort. It is expected that continuing measures result in a further decrease of the fishing intensity on *Nephrops* and, hence, promote the recovery of the stock.

Details on available data and analysis carried out during the WG are provided in **Section 13** of the report.

It is emphasized that currently the practice is to manage the three distinctive *Nephrops* stocks (FU 26+27, FU 28+29 and FU 30) by a joint TAC. This leads to unbalanced exploitation of the individual stocks as do not take account of the different stock status. Therefore, the WG, considers that a fine-scale management of catches and/or effort at a geographic scale that corresponds to the *Nephrops* stock distribution should be implemented.

1.3 Recommendations

The WG makes several recommendations regarding biological studies, surveys, data quality, methodology and software. In the end of this section a text table summarizes the WGHMM 2007 recommendations and indicates to whom action is addressed.

1.3.1 Biological studies

To validate age determination for hake and anglerfish stocks the WG recommends that large scale tagging experiments are carried out.

1.3.2 Recommendations on Surveys

(i) Portuguese Surveys

The WGHMM was asked to consider the importance of two Portuguese trawl surveys, the groundfish survey for hake (PESCADA-BD) and the *Nephrops* survey in FUs 28-29 (PT-CTVS), for the assessments developed in this WG.

Southern Hake and Iberian *Nephrops* are stocks under a recovery plan. For this reason, these surveys were considered to be of highest priority (level 1) for funding in the current Data Collection Regulation (DCR).

The STECF/SGRN-07-01 meeting, held in February 2007, defined 3 prioritization criteria for the list of surveys to be considered for co-funding by the new DCR; both Portuguese surveys do not accomplish the criterion 1 (no obvious international coordination) and the groundfish survey for hake was classified as a “pilot” survey.

Both surveys were proposed to be coordinated by the International Bottom Trawl Surveys Working Group (IBTSWG) but this WG stated in the 2007 report that “The IBTSWG is only willing to coordinate both surveys if recommended by the assessment working groups”.

Since 1997 that the information provided from the Portuguese *Nephrops* survey in FU 28+29 has been used, either for the analysis of abundance trends or as a tuning fleet. Biological information collected in these surveys have been used for the estimation of maturity parameters for male and female populations and length-weight relationships, also used by this WG.

Nephrops surveys also provide data for other demersal stocks assessed in this WG, as hake, anglerfish and megrims. The cpue series of these surveys was used this year in the assessment of the black anglerfish (*Lophius budegassa*).

From the present year onwards, the trawl survey will be combined with an UWTV survey and will provide both estimates of *Nephrops* abundance and catchability, which could be used for the UWTV trawl surveys calibration. The WKNEPHTV could continue to be another forum for the coordination of this survey as is currently the case of UWTV surveys carried out by other UE research Institutes.

The Portuguese groundfish survey for hake started in 2005 and since then is performed annually. This survey is carried out in the hake spawning season – in line with the recommendations of WKMAT (ICES, 2007) – and is the only source for hake maturity since the commercial samples are mainly composed by un-gutted fish.

Data have been used to map the geographical distribution of mature hake, estimate the maturity ogive for southern stock of hake and monitor the abundance of spawning stock biomass.

In two years time, this survey can provide an important input to the assessment of the Southern hake as a tuning fleet. The groundfish surveys also provide data for southern anglerfish and megrims, which assessments are performed within this WG, and for other stocks as horse mackerel, mackerel and blue whiting assessed in WGMHSA.

Given their obvious importance in assessment and provision of management advice, the **WGHMM highly recommends the acceptance of these two surveys for coordination by IBTSWG and WKNEPHTV**. WGHMM will continue to use these surveys in assessment and the quality control, quality assurance, review and co-ordination within IBTS and WKNEPHTV (or equivalent) would be very important. Indeed WGHMM is willing to give feed back to these groups on the utility of surveys in the assessment process.

(ii) BB Sole Survey

The Biscay sole assessment is tuned almost entirely by commercial fleets since no recent survey indices are available for this stock. Although the data examination conducted in 2005 allows some confidence in the LPUE trends, they may not reflect the abundance trend exactly. Furthermore no information is available on the incoming recruitments. Predictions are consequently largely based on the geometric mean which may contribute to 80% of the predicted landing in the TAC year and to 60% of SBB in the year following the TAC year. This problem has become an important source of concern for the WG because the observed increase in variability of recruitment in recent years. The WG considers therefore that the lack of fishery independent data is an important deficiency of the Bay of Biscay sole assessment. Consequently the WG express its strong interest for the new survey ORHAGO which aim at an abundance index series for the Bay of Biscay sole and it considers that such a survey is priority need for this assessment.

(iii) UWTV for *Nephrops*

The group recommends that the use of UWTV surveys as a means to assess stock abundance trends and in the provision on management advice should be further explored and support the continuation of an ICES Workshop on UWTV survey methodology.

1.3.3 Discard and Misreporting

(i) Discards

In order to be able to better assess the recruiting year classes in stocks where discards make up an important part of catches, discards data from the actual sampling programmes should be made ready available to the assessment group. However, discard data has to be studied before incorporating them to the analysis due to the different discard practices between years and countries. Thus, discard estimates obtained in a certain year are applied to subsequent ones with many concerns. Annual discard estimates are still essential.

The WG again recommends the analysis and development of methods for discard data estimation and reconstruction of discard data series for inclusion in the assessment. The alternative methodology presented in this year meeting for the Bay of Biscay *Nephrops*, using a probabilistic approach, should be considered and analysed by the WGMG.

(ii) Misreporting

The general ToR 10 asks Workings Groups to “Where misreporting and/or discarding is considered significant provide qualitative and where possible quantitative information, by fisheries and describe the methods used to obtain the information and its influence on the assessment and predictions”. This WG did not address this ToR for two reasons: Firstly because in many fisheries the landings information are estimated by scientists rather than obtaining the data from official sources. Secondly, there were concerns that the information if provided would be used by control authorities to the detriment of some countries and fisheries. This may lead to future data availability problems and reduce opportunities to work with the fishing industry. However the WG recognised that not documenting sources of landings and misreporting information may lead to stakeholder and client concerns about the lack of transparency in the ICES process. With that in mind last year the WG recommended that in future for each stock a tables be drawn up to fully document the sources of landings and misreporting information (if any) from which the accuracy of landings and their impact on assessment and forecast can be easily evaluated. An attempt to fulfil the table presented last year will be performed next year.

1.3.4 Methodology and software

(i) Assessment methodology

Following last year Review Group recommendations this year WGHMM carried out assessments and forecasts using stochastic approaches (e.g. Bayesian VPA for the southern hake stock). Moreover, alternative approaches to current age-based assessment were further development (e.g. Statistical GADGET for the southern hake and a Length-based spatial model for the northern hake) as well as the application of an Operating Model (OM) used to evaluate the recovery plans for both hake stocks and allowing for explicit modelling of TAC setting rules under recovery plans.

The WG aims to further develop assessment methods and forecast approaches that take into account uncertainty in a realistic and coherent fashion and that can be used as an alternative assessment methodology for stocks where ageing is considered problematic.

(ii) Integrated software (Fishery Library in R - FLR)

In this year meeting several assessments were performed with the FLR framework (www.flr-project.org). These included (i) exploratory analysis with FLEDA to extract signals from the basic data and to assess data consistency previous to the application of assessment methods, (ii) XSA assessments with FLXSA and (iii) short term forecasts with FLSTF.

The WG recommends that this framework is used in next meetings and that other assessment methods that allow for more flexibility in basic assumptions (e.g. exact catch-at-age matrix, constant catchability-at-age) can be used when fully implemented and tested in FLR.

Summary of WGHMM 2007 recommendations:

Recommendation	Action
1.3.1 Large scale tagging experiments to validate age determination for hake and anglerfish stocks	ICES - ACFM
1.3.2 Coordination of Portuguese PESCADA-BD and PT-CTVS trawl surveys	ICES - IBTSWG
1.3.2 Coordination of UWTV in Portuguese PT-CTVS survey	ICES - WKNEPHTV
1.3.2 Coordination of BB Sole survey	ICES - WGBEAM
1.3.2 Continuation of WKNEPHTV - UWTV stock size estimates methodology	ICES – ACFM
1.3.3 Analysis and development of methods for reconstruction of discard data series for inclusion in the assessment	ICES – ACFM & WGMG
1.3.4 Assessment methodology - stochastic assessments and forecasts; length-base methods; Operating Model (OM)	ICES – ACFM & WGMG
1.3.4 Use of integrated software (Fishery Library in R - FLR) for the assessment	FLR core team ICES - ACFM

1.4 Data Available

As in previous years, data for 2007 were prepared in advance of the meeting, and all revisions to data are referred in the appropriate stock sections.

1.4.1 Landings

Several stocks assessed by the Group are managed by means of TACs that apply to areas other than those corresponding to individual stocks, notably in Subarea VII, or to a combination of species in the cases of anglerfish and megrim. In many cases, national statistics for recent years are either not currently available officially or are of a preliminary nature. As a consequence, the official landings provided to ICES (http://www.ices.dk/fish/statlant.asp) by statistical offices are of limited relevance for the assessments. Therefore, official figures by species and area (Table 1.2) have been used to update the table in each stock section in which the figures actually used by the Working Group are given. Other deficiencies in the landings data, if any, are discussed in each stock section.

Mapping the spatial distribution of landings and effort data by ICES statistical rectangle is not common practice for WGHMM. However such analysis can be extremely useful when evaluation changes in spatio-temporal patterns of the fleets. This is particularly useful when dealing with fairly widely distributed stock like HMM. In recent years WGIBTS has provided integrated maps of the spatial distributions of catches on surveys. These types of data are useful in interpreting difference in trends between surveys and commercial fleets. This year the WG wanted to investigate whether trends in the Spanish Porcupine survey were representative of the stock. Only partial landings statistics were available for some fleets and countries. These showed that the majority of the landings were not from the Porcupine Bank but from the western parts of the Celtic Sea and Grand Sole Bank (Figure E.4).

1.4.2 Discards

Details on discard data available is presented in each stock section. For the stocks in the remit of the Group, discards are included in the assessment of megrim in Subareas VII and VIII and *Nephrops* in Div. VIIIa,b (FU 23-24). For several stocks discard data is sparse or sampling do not cover all fleets contributing to catches. Furthermore, reconstructing an historical series is still problematic (stock sections and recommendations).

1.4.3 Biological information

Biological sampling levels by country and stock are summarised in Table 1.3. The sampling levels have improved in recent years for some countries due to their participation in EU-funded projects and in the Data Collection Regulation (Commission Regulation (EC) 1639/2001). Nevertheless, the Group needs more than this minimum information from this Regulation to carry out properly the assessments.

As mentioned in previous reports the enforcement of the minimum legal size for Hake (for both northern and southern stocks) had caused some difficulties in obtaining information on the catch of small fish. In the case of the Megrim in Subareas VII and VIII the French data (length distributions, catch at age by FU and ALKs) for 2003 and 2004 was not available for the assessment. In case of both stocks of anglerfish in Divisions VIIIc and IXa, catch and CPUE-at-age data were available this year for the first time.

The Group has shown their concerns on validation of age readings mainly affecting to Anglers and Hake’s stocks (see recommendations). Regarding this problem, ageing workshops have been carried out concluding that there is a general needs for validation of ages (or criteria).

Table 1.1 Summary of WGHMM past (2006) and current (2007) practices for stock assessment. Proposal for type of assessment in 2008 included.

Stock	2006 WG	2007 WG final	2007 Other	Type Ass in 2007	Proposal for 2008
Northern hake	XSA, Retro, ST, YPR	XSA, Retro, ST, YPR	(i) simulated ALK (faster growth); (ii) spatial length based model	Obsv	Up
Southern hake	XSA, Retro, ST, MT, YPR	XSA, Bayesian VPA, Retro, ST-D, ST-S, YPR	(i) Ev. Rec. Plan; (ii) GADGET model	Obsv	Obsv
Angler-L. piscatorius VII, VIIIa-b	XSA, Retro, ST, MT, YPR	Abundance trends	(i) exploratory XSA	Up	Exp
Angler-L. budegassa VII, VIIIa-b	XSA, Retro,ST, MT, YPR	Abundance trends	(i) exploratory XSA	Up	Exp
Angler-L. piscatorius VIIIc, IXa		ASPIC, Bayesian Schaefer, ST	(i) exploratory XSA	Bench	Up
Angler-L. budegassa VIIIc, IXa		ASPIC, Bayesian Schaefer, ST	(i) exploratory XSA	Bench	Up
Anglerfish combined VIIIc, IXa	ASPIC, ST		(i) comparision with last year		
Megrim-L. whiffiagonis VII, VIIIa-b	XSA, Retro,ST, MT, YPR	Abundance trends	(i) exploratory XSA	Up	Bench
Megrim-L. whiffiagonis VIIIc, IXa	XSA, Retro, ST, YPR	XSA, Retro, ST, YPR		Up	Up catch
Megrim-L. boscii VIIIc, IXa	XSA, Retro, ST, YPR	XSA, Retro, ST, YPR		Up	Bench
Bay of Biscay Sole	XSA, Retro, ST, YPR	XSA, Retro, ST, YPR		Up	Up
Nephrops VII - FU16	Abundance trends	Abundance trends; mean size		Up catch	Exp
Nephrops VII - FU17	Abundance trends	Abundance trends		Up catch	Up ab trends
Nephrops VII - FUs18-19	Abundance trends	Abundance trends; mean size		Up catch	Up ab trends
Nephrops VIIIa,b- FUs23-24	XSA, Retro, ST, YPR (sex comb)	XSA, Retro, ST, YPR (sex comb)		Up catch	Bench
Nephrops VIIIc- FU25	XSA (sex comb)	Abundance trends		Up catch	Exp
Nephrops VIIIc- FU31	Abundance trends	Abundance trends		Up catch	Up catch
Nephrops IXa- FUs26-27	XSA, Retro (sex comb)	Abundance trends		Up catch	Up catch
Nephrops IXa- FUs28-29	XSA, Retro (by sex)	Abundance trends		Up catch	Exp
Nephrops IXa - FU30	Abundance trends	Abundance trends		Up catch	Up catch

ST - short-term projections; ST-D - deterministic short-term projections; ST-S - stochastic short-term projections; MT - medium-term projections; YPR - Yield per recruit analysis; LCA - Length cohort analysis

Obsv - Observation; Up- Update; Bench - Benchmark; Exp - Experimental

Table 1.2 Official Statistics

Please note that the Netherlands 2001 have reported 1 t of hake in area not known
France 2001 data are final shaded figures are corrections
France 1999 have reported 7378 t of hake in area not know

Official Statistics

HAKE IIIa

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Denmark	158	249	358	428	334	406	295	234
Germany	+	+	1	2	2	6	6	7
Netherlands	-	-	-	-	1	2	2	1
Norway	31	37	40*	38	44	58	84	84
Sweden	15	22	43	32	38	56	47	46.7
Total	204	308	442	500	418	528	4.34	372.7

***Preliminary**

HAKE IVa

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	3	7	-	1	-	-	-	
Denmark	84	114	218	194	244	182	268	412
Faroe Islands	4	-	-	5	-	1	2	
France	109[1*]	169	107	28	20	80	-	132.3
Germany	17	21	14	23	15	22	36	58
Netherlands	4	4	-	-	-	1	15	3
Norway	207	218	233	208	235	245	291	
Sweden	8	8	16	11	14	11	15	453
UK (E/W/NI)	7	7	3	2	1	1	3	9.2
UK (Scotland)	328	338	240	233	203	292	408	
United Kingdom								676.1
Total	771	886	831	705	732	835	1038	1743.6

***Preliminary. [1]Includes IVb,c.**

HAKE IVb

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	48	49	84	66	46	77	67	53.5
Denmark	604	448	467	541	621	769	692	713
France	…[1*]	+	-	-	-	-	-	
Germany	50	25	57	46	64	72	77	66
Netherlands	63	25	37	18	21	21	23	33
Norway	2	1	14*	11*	7	14	14	18
Sweden	4	4	3	8	3	6	9	4.9
UK (E/W/NI)	24	21	24	15	18	19	21	
UK (Scotland)	31	24	29	26	34	33	34	
United Kingdom								76.8
Total	826	597	715	731	814	1011	937	965.2

***Preliminary. [1]Included in IVa.**

Official Statistics

HAKE IVc

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	+	1	1	1	-	-	-	0.3
Denmark	-	+	+	+	-	-		0
France	…[1*]	1	-	-	-	3	-	0
Germany	-	-	-	-	-	-	-	0
Netherlands	1	-	1	+	-	-	-	
UK (E/W/NI)	+	+	-	+	-	-	-	
UK (Scotland)	+	+	-	+	-	-	-	
United Kingdom								0
Total	1	2	2	1	-	3	-	0.3

[*]Preliminary. [1]Included in IVa.

HAKE VIa

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	-	-	+	-	-	-	-	-
Denmark	-	+	+	-	-	-	-	-
France	…[1*]	655	622	223	191	338	587	833
Germany	1	1	+	-	-	-	0	0
Ireland	248	266	101	32	79	105		130.7
Netherlands	30	11	24	+	-	-		
Norway	+	-	-[*]	-[*]	-	-		
Spain	1,499	2,917	420	1,432	-	1484		
UK (E/W/NI)	211	168	55	70	83	101		
UK (Scotland)	1,016	865	691	405	278	632		
United Kingdom							3295	1229.6
Total	3,005	4,883	1,913	2,162	631	2660	3882	2193.3

[*]Preliminary. [1]Included in VIIg-k.

HAKE VIb

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
France	…[1*]	1	-	1	-	-	-	1
Ireland	2	2	1	-	1	-	-	0.5
Portugal	-	-	-	+	-	-	-	
Spain	24	2	+	2	-	-	1	
UK (E/W/NI)	+	+	-	-	-	-	-	
UK (Scotland)	6	15	2	1	4	1	1	
United Kingdom								2.8
Total	32	20	3	4	5	1	2	4.3

[*]Preliminary. [1]Included in VIIg-k.

Official Statistics

HAKE VIIa

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	6	6	4	3	2	3	5	1.9
France	…[1*]	8	3	4	3	1	-	1.2
Ireland	52	65	36	27	67	28	29	20.1
Netherlands	+	-	-	-	-	-	-	
UK (E/W/NI)	501	403	239	229	236	296	279	
UK (Isle of Man)	3	3	1	+	-	-	-	
UK (Scotland)	13	8	6	4	8	5	2	
United Kingdom								214
Total	575	493	289	267	316	333	315	237.2

[*]Preliminary. [1]Included in VIIg-k.

HAKE VIIb,c

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	+	-	-	-	-	-	-	-
France	…[1*]	508	483	639	742	403	-	628
Ireland	479	366	234	100	168	194	192	235
Norway	+	-	-[*]	+[*]	-	-	-	
Spain	1,097	1,204	685	181	679	774	977	
UK (E/W/NI)	396	350	150	115	150	115	116	
UK (Scotland)	66	86	39	65	34	44	53	
United Kingdom								358
Total	2,038	2,514	1,591	1100	1773	1530	1338	1221

[*]Preliminary. [1]Included in VIIg-k.

HAKE VIId

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	+	+	1	+	-	-	-	0.2
France	…[1*]	14	22	42	9	6	-	13.3
Netherlands	-	-	+	-	-	-		
UK (E/W/NI)	+	+	+	+	-	-		
UK (Scotland)	+	+	-	-	-	-		
United Kingdom					-			0
Total	+	14	23	42	9	-	-	13.5

[*]Preliminary. [1]Included in VIIg-k.

Official Statistics

HAKE VIIe

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	+	+	+	+	+	1	1	0.6
France	…[1*]	265	269	363	252	250	-	98.6
Ireland	-	1	-	-	-	-	-	0
UK (E/W/NI)	117	128	183	111	180	123	111	
United Kingdom								63.7
Total	117	394	452	474	432	374	112	162.9

[*]Preliminary. [1]Included in VIIg-k.

HAKE VIIf

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	4	8	5	2	4	6	5	4.2
France	…[1*]	139	164	199	89	114	-	47.5
Ireland	-	+	-	-	2	1	3	0.8
Spain	+	17	-	-	-	-	5	
UK (E/W/NI)	142	147	124	157	115	82	144	
UK (Scotland)	-	-	-	-	-	-	-	
United Kingdom								51.1
Total	146	311	293	358	210	203	157	103.6

[*]Preliminary. [1]Included in VIIg-k.

HAKE VIIg-k

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	12	15	9	5	7	8	6	12
France	3,218[1*]	3,152[2]	3,180	4,610[2]	3662	4914-	-	4043
Ireland	1,311	1,337	752	539	760	716	714	714
Netherlands	-	3	-	-	1	-	-	
Spain	10,159	9,393	5,389	5,777	7536	9047	8177	
UK (E/W/NI)	2,444	1,803	840	1,133	1136	1017	798	
UK (Scotland)	231	153	144	96	176	205	195	
United Kingdom								1120
Total	17,375	15,856	10,314	12,160	13278	15907	9890	5889

[*]Preliminary. [1]Includes VI and VII. [2]Note: Not including 27 t for 2000 and 11 t for 2002 reported as area VII.

Official Statistics

HAKE VIII

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	19	31	20	14	12	11	9	10
France	4527[1*]	5174	3107	4799	5850	4655		2917
Netherlands	-	-	10	-	-	-		
Portugal	29	32	50	42	24	39	31	32
Spain	9013	9988	4,348	5,117	6640	9595	9848	
UK (E/W/NI)	-	+	-	-	-	30	45	
UK (Scotland)	-	-	-	-	-	18	71	
United Kingdom								48
Total	13588	15225	7535	9972	12526	14348	10004	3007

[*]Preliminary. [1]4,515 t reported in VIIIa,b.d.e and 12 t reported in VIIIc, IX.

HAKE IX

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
France	-	-	+	-	-	-		
Portugal	2,946	2,940	2,930	2,557	2,137	1997	2246	2190.4
Spain	1,139	1,335	1,295	901	-	970	754	
Total	4,085	4,275	4,225	3,458	2,137	1618	3000	2190.4

[*]Preliminary.

Official Statistics

ANGLER (= MONK) VIIa

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	63	60	128	171	175	143	103	
France	…[1*]	41	61	53	48	28	-	
Ireland	196	227	213	200	189	183	171	170.8
Netherlands	1	2	+	-	-	-	-	
UK (E/W/NI)	263	166	190	228	209	198	158	
UK (Isle of Man)	9	5	2	1	+	3	-	
UK (Scotland)	10	9	19	20	18	52	2	
United Kingdom								149.5
Total	542	510	613	673	639	607	434	320.3

[*]Preliminary. [1]See VIIg-k.

ANGLER (= MONK) VIIb,c

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
France	…[1*]	1,056	467	1,090	1431	1012	--	
Germany	26	47	31	13	+	23	80	
Ireland	789	733	572	419	390	421	519	620
Netherlands	-	-	1	-	-	-	-	
Norway	1	+	+*	+*	-	-	442	
Spain	393	575	597	272	225	382	231	
UK (E/W/NI)	363	298	285	299	320	194	120	
UK (Scotland)	88	70	36	38	100	189		
United Kingdom								490
Total	1,660	2,779	1,989	2131	2466	2221	1392	1110

[*]Preliminary. [1]See VIIg-k.

ANGLER (=MONK) VIId

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	11	7	20	17	20	17	14	
France	…[1*]	24	17	23	40	38	-	
Netherlands	-	-	+	-	-	1	-	
Spain	-	-	-	-	-	1	-	
UK (E/W/NI)	10	6	10	19	17	9	7	
UK (Scotland)	1	+	+	-	-	-	-	
United Kingdom								2.5
Total	22	37	47	59	77	65	21	2.5

[*]Preliminary. [1]See VIIg-k.

Official Statistics

ANGLER (=MONK) VIIe

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	6	3	12	30	48	223	169	0.7
France	…[1*]	1,065	1,310	2270	3227	3341	-	
Ireland	-	6	1	-	8	3	2	1.8
Netherlands	2	-	-	1	2	1	3	
UK (E/W/NI)	477	491	840	952	875	953	1032	
United Kingdom								12174
Total	485	1,565	2,164	3253	4160	4521	1206	1219.9

[*]Preliminary. [1]See VIIg-k.

ANGLER (=MONK) VIIf

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	101	191	175	153	287	425	318	
France	…[1*]	187	251	185	252	-	-	
Ireland	-	1	1	6	1	-	15	32.7
Spain	+	1	-	-	-	-	-	
UK (E/W/NI)	356	399	451	331	297	328	204	
United Kingdom								203.8
Total	457	779	878	675	837	1084	537	236.5

[*]Preliminary. [1]See VIIg-k.

ANGLER (=MONK) VIIg-k

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	195	230	274	255	415	416	307	
France	8007[1*]	5665[2]	6574[3]	6370	8663	7944	-	
Germany	150	152	87	139	150	174	62	
Ireland	2621	2275	1716	1543	1184	1403	1823	2138
Netherlands	-	-	4[4]	9	11	10	13	
Spain	2063	1830	2850	2242	1688	1577	1606	
UK (E/W/NI)	1803	1550	1452	1540	1520	1681	1813	
UK (Scotland)	104	97	85	113	135	125	354	
United Kingdom								1866
Total	14943	11799	13042	12211	13766	13330	5978	4004

[*]Preliminary. [1]Includes the whole of VII. [2]Excluding 4 t reported as sub-area VII and 2 t reported as Unknown area. [3]Excluding 6 t reported as sub-area VII. [4]Excluding 5 t reported as Unknown area.

Official Statistics

ANGLER (=MONK) VIII

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	150	81	149	226	116	6	181	
France	3291*	2974	3145	4066	5831	6468	-	
Netherlands	-	-	25	-	-	-	-	
Portugal	1	1	1	+	1	-	-	
Spain	3269	2282	1137	1555	2396	2937	1678	
UK (E/W/NI)	+	+	1	+	+	-	-	
UK (Scotland)	-	-	-	-	-	-	1	
United Kingdom								88
Total	6710	5338	4458	5847	8344	9411	1860	88

***Preliminary.**

ANGLER (=MONK) IX

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
France	-	1	+	23	-	-		
Ireland	-	-	-	-	1	-	-	
Portugal	1034	846	587	493	714	405	439	137.2
Spain	917	688	264	261	-	528	209	
Total	1951	1,535	851	777	715	933	648	137.2

***Preliminary.**

Official Statistics

MEGRIM VIIa

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	2	2	2	4	4	2	2	
France	…[1*]	5	1	1	2	-	-	
Ireland	27	31	24	34	29	20	9	
UK (E/W/NI)	14	8	4	4	7	5	3	
UK (Isle of Man)	-	-	-	+	-	-	-	
UK (Scotland)	1	1	7	11	7	5	-	
United Kingdom								0.3
Total	44	47	38	54	49	32	14	0.3

[*]Preliminary. [1]See VIIg-k.

MEGRIM VIIb,c

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	2	-	-	-	1	-	4	
France	…[1*]	337	197	365	467	288	-	
Ireland	606	604	739	473	520	524	353	
Spain	372	551	529	252	371	551	574	
UK (E/W/NI)	99	110	54	64	54	29	102	
UK (Scotland)	31	27	7	6	14	24	18	
United Kingdom								104
Total	1110	1629	1526	1160	1427	1416	733	104

[*]Preliminary. [1]See VIIg-k.

MEGRIM VIId

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	+	+	+	+	+	1	-	
France	…[1*]	+	2	+	2	14	-	
Spain	-	-	-	-	-	-	-	-
UK (E/W/NI)	1	+	+	+	2	-	-	-
UK (Scotland)	+	+	+	-	-	-	-	-
United Kingdom								0
Total	1	+	2	+	4	15	-	0

[*]Preliminary. [1]See VIIg-k.

Official Statistics

MEGRIM VIIe

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006
Belgium	+	-	+	+	+	2	3	
France	…[1*]	57	57	56	74	80	-	
Ireland	2	11	1	-	4	6	2	
Netherlands	1	-	-	-	-	-	-	
UK (E/W/NI)	207	217	208	131	130	149	148	
United Kingdom								146.9
Total	210	285	266	187	208	235	153	146.9

[*]Preliminary. [1]See VIIg-k.

MEGRIM VIIf

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	36	46	25	12	58	99	61	
France	…[1*]	40	55	34	42	55	-	
Ireland	-	3	-	1	2	30	18	
Spain	1	+	-	-	-	-	-	
UK (E/W/NI)	227	196	194	120	140	191	113	
United Kingdom								55.6
Total	264	285	274	167	242	375	192	55.6

[*]Preliminary. [1]See VIIg-k.

MEGRIM VIIg-k

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	91	69	53	51	102	119	87	
France	2674[1*]	2646[2]	2767	2048[3]	2010	1650	-	
Ireland	1962	2132	2264	1973	1698	1714	1811	
Netherlands	1	-	1	-	-	-	-	
Spain	4527	5748	5908	4996	7098	6972	5438	
UK (E/W/NI)	1659	1662	1256	1473	1416	1259	1415	
UK (Scotland)	23	39	24	22	51	46	57	
United Kingdom								1329
Total	10937	12296	12273	10563	12375	11760	8808	1329

[*]Preliminary. [1]Includes the whole of VII. [2]2000: Excluding 3 t reported in sub-area VII. [3]2002: Excluding 2 t reported in sub-area VII.

Official Statistics

MEGRIM VIII

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006
Belgium	7	5	5	7	1	+	4	2
France	986*	780	646	592	544	510	-	459
Portugal	1	+	+	+	+	+	+	-
Spain	1,280	1,261	1,082	682	898	902	1369	-
UK (E/W/NI)	+	+	-	-	+	-	-	-
Total	2,274	2,046	1,733	1,281	1,443	1412	1373	461

***Preliminary.**

MEGRIM IX

COUNTRY	1999	2000	2001	2002	2003	2004	2005	2006*
Portugal	53	54	27	31	48	126	112	42.5
Spain	302	276	180	138	+	286	373	
Total	355	330	207	169	48	412	485	42.5

***Preliminary.**

Official Statistics

NEPHROPS **VIIbcj (L) 16-17**

Country	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	-	-	-	-	1	-	1	
France	-	50	54	36	15	12	-	27
Ireland	2,209	1,656	1,442	1,772	1,483	1140	1357	1178
Spain	139	154	264	299	225	343	217	
UK (E/W/NI)	77	70	56	39	21	28	34	
UK (Scotland)	14	7	7	11	5	6	6	
UK								40
Total	2,439	1,937	1,823	2,157	1,749	1529	1645	1245

***Preliminary.**

NEPHROPS **VIIIab (N) 23-24**

Country	1999	2000	2001	2002	2003	2004	2005	2006*
Belgium	1	-	1	2	1	-	1	7
France	-	2935	3462	2875	3834	3310	-	2661
Spain	6	9	11	9	17	11	2	
Total	7	2944	3474	2886	3852	3321	3	2668

***Preliminary.**

NEPHROPS **VIIIc (O) 25-31**

Country	1999	2000	2001	2002	2003	2004	2005	2006*
France	-	18	22	17	8	9	-	21
Portugal	-	-	-	1	4	4	2	
Spain	213	138	142	187	115	78	82	
Total	213	156	164	205	261	91	84	21

***Preliminary.**

NEPHROPS **IXa (Q) 26-27-28-29-30**

Country	1999	2000	2001	2002	2003	2004	2005	2006*
Ireland	-	-	-	-	1	-	-	
Portugal	216	211	282	365	56	385	208	240.6
Spain	174	269	271	189	147	77	52	
Total	390	480	553	554	204	462	260	240.6

***Preliminary.**

Table 1.3 **Biological sampling levels by stock and country. Number of fish measured and aged from landings in 2006.**

		Angler (*L.pisc*.)		Angler (*L.bude*.)		Megrim (*L.whiff*.)		Megrim (*L. boscii*)	Sole
		VIIb–k & VIIIa,b	VIIIc & IXa	VIIb–k & VIIIa,b	VIIIc & IXa	VIIb–k & VIIIa,b	VIIIc & IXa	VIIIc & IXa	VIIIa,b
Belgium	No. lengths								2000
	No. ages								400
	No. samples**								7
E & W (UK)	No. lengths	12339		441		9173			
	No. ages					1209			
	No. samples*	96		59		70			
France	No. lengths	11697		2321		7520			34608
	No. ages	609		260					2081
	No. samples*	172		172		42			284
Portugal	No. lengths		5254		4322		574	15324	
	No. ages***				570				
	No. samples*		1014		878		13	248	
Republic of Ireland	No. lengths	5927		695		14206			
	No. ages	899		243		1399			
	No. samples**	144		72		89			
Spain	No. lengths	13538	9328	8062	4674	17242	4310	22852	
	No. ages	792	850	590		1862	787	732	
	No. samples	136	248	134	248	329	170	190	
Total	**No. lengths**	**43501**	**14582**	**11519**	**8996**	**48141**	**4884**	**38176**	**36608**
	No. ages	**2300**	**850**	**1093**	**570**	**4470**	**787**	**732**	**2481**
Total No. in international landings (thousands)			**923**		**1030**	**68602**	**1177**	**10023**	**15196**
No. Measured as % of annual number caught		**#DIV/0!**	**1.6**	**#DIV/0!**	**0.9**	**0.1**	**0.4**	**0.4**	**0.2**

(1) Includes *L. pisc*. and *L. bud.*

(2) Not available

* Vessels

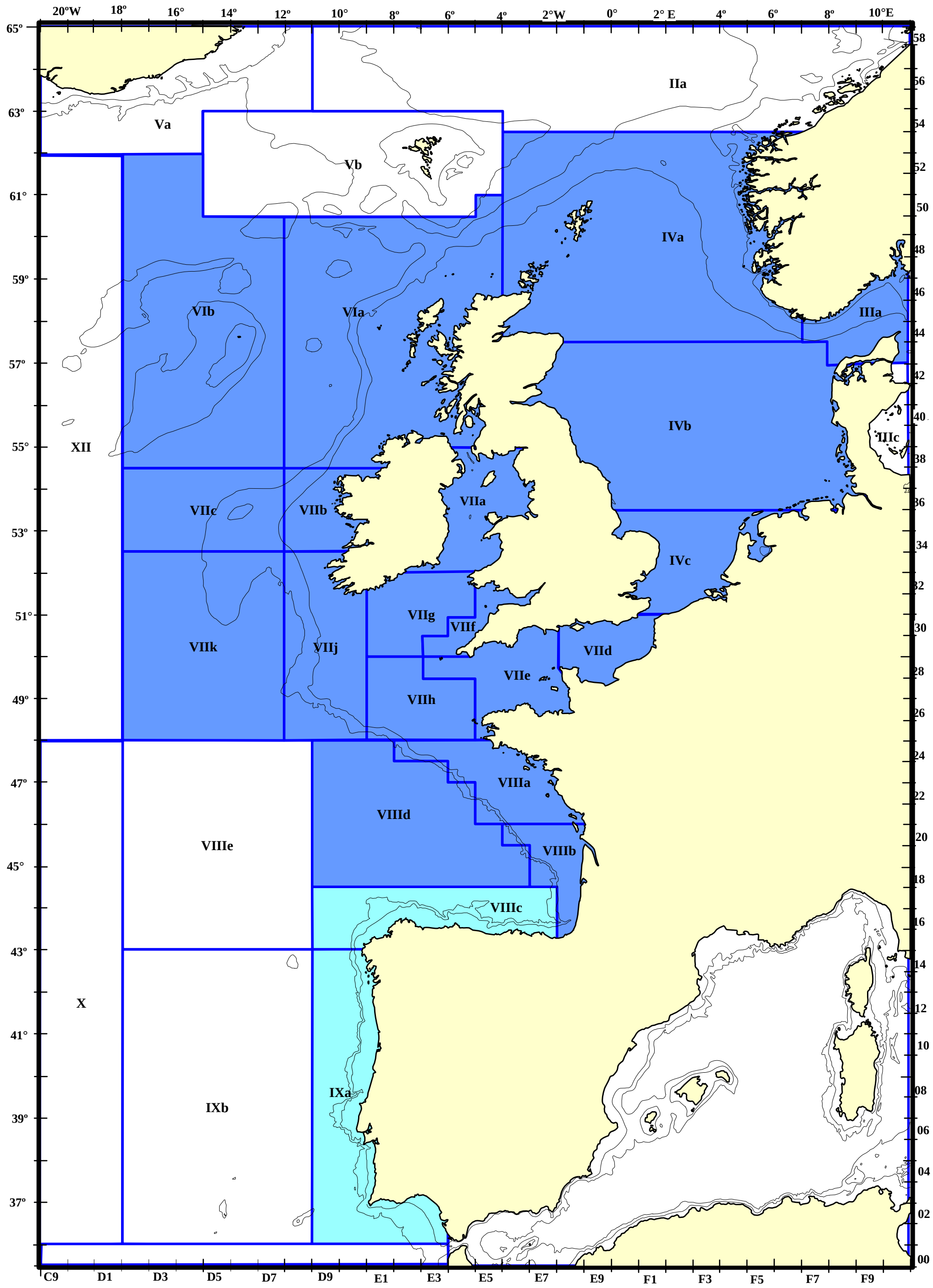
** Categories

*** Ages, surveys

****Boxes

Table 1.3 (continued)

		Hake		Nephrops						
		IVa+VI & VII & VIIIa,b	VIIIc & IXa	OR (MA L)	FU 16	FU17	FU19	VIIIab FU 23-24	VIIIc FU 25-31	IXa FU 26-30
Scotland (UK)	No. lengths									
	No. ages									
	No. samples*									
E & W (UK)	No. lengths	11336								
	No. ages	0								
	No. samples*	128								
France	No. lengths	18058			1700			31111		
	No. ages	3526								
	No. samples***	275			4			829		
Portugal	No. lengths		109271							13135
	No. ages***		1889							
	No. samples*		974							45
Republic of Ireland	No. lengths	4588			0	1202	4714			
	No. ages	900								
	No. samples*	95			0	3	8			
Spain	No. lengths	105238	66362	838	11922				12916	9630
	No. ages	2753	1633							
	No. samples*	409	574	8	28				75	85
Total	**No. lengths**	**139220**	**175633**	**838**	**13622**	**1202**	**4714**	**31111**	**12916**	**22765**
	No. ages	**3928**	**3522**		**0**	**0**	**0**	**0**	**0**	**0**
Total No. in international landings (thousands)		**53530**	**22896**	**960**	**25032**	**?**	**?**	**469044**	**1322**	**17675**
No. Measured as % of annual number caught		**0.3**	**0.8**	**0.1**	**0.1**			**0.01**	**0.98**	**0.1**



Northern hake stock: Div. IIIa, Subareas IV,VI & VII and Div. VIIIa,b,d
Northern Anglerfish *L. piscatorius* and ***L. budegassa***: Div. VIIb-k & VIIIa,b
Northern Megrim *L. Whiffiagonis*: Div. VIIb-k & VIIIa,b,d
Bay Biscay Sole: Div. VIIIa,b,d
Southern hake stock: Div. VIIIc & IXa
Southern Anglerfish *L. piscatorius* and ***L. budegassa***: Div. VIIIc & IXa
Southern Megrim *L. Whiffiagonis* and ***L. boscii***: Div. VIIIc & IXa.

Figure 1.1. Map of ICES Divisions. Northern (IIIa, IV, VI, VII and VIIIabd) and Southern (VIIIc and IXa) Divisions with different shading.

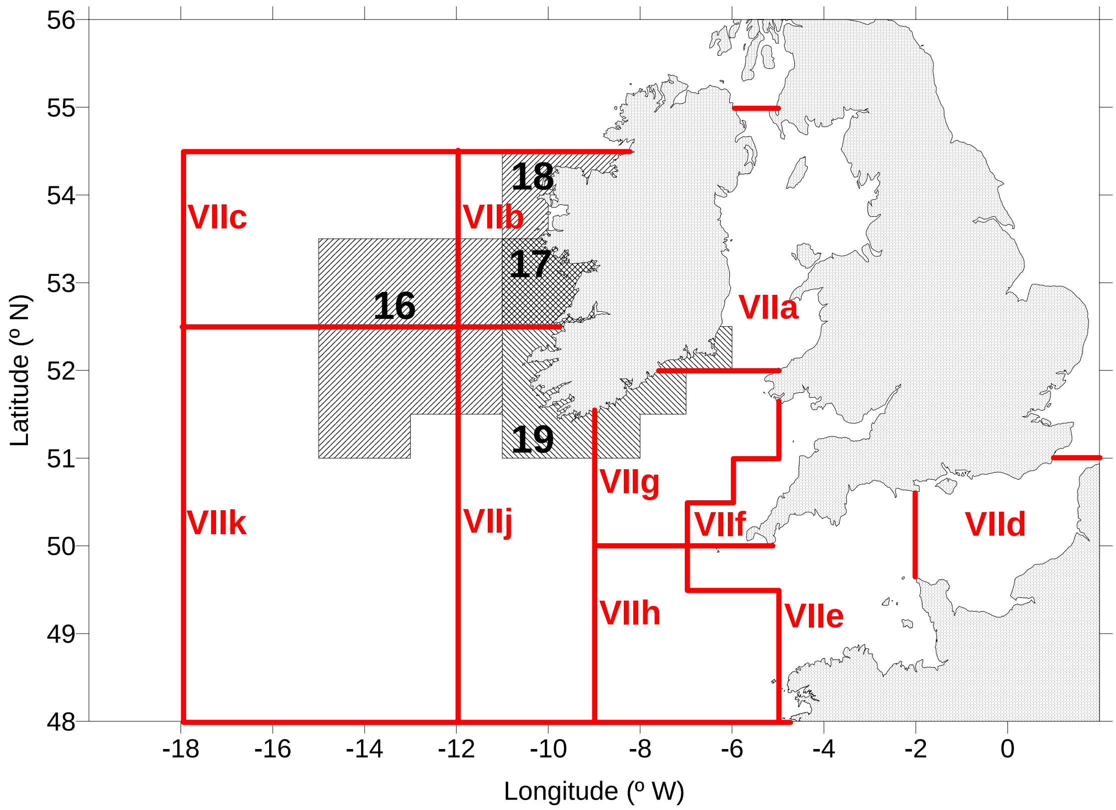


Figure 2.2. Nephrops in Sub-area VII: Functional Units 16-19.

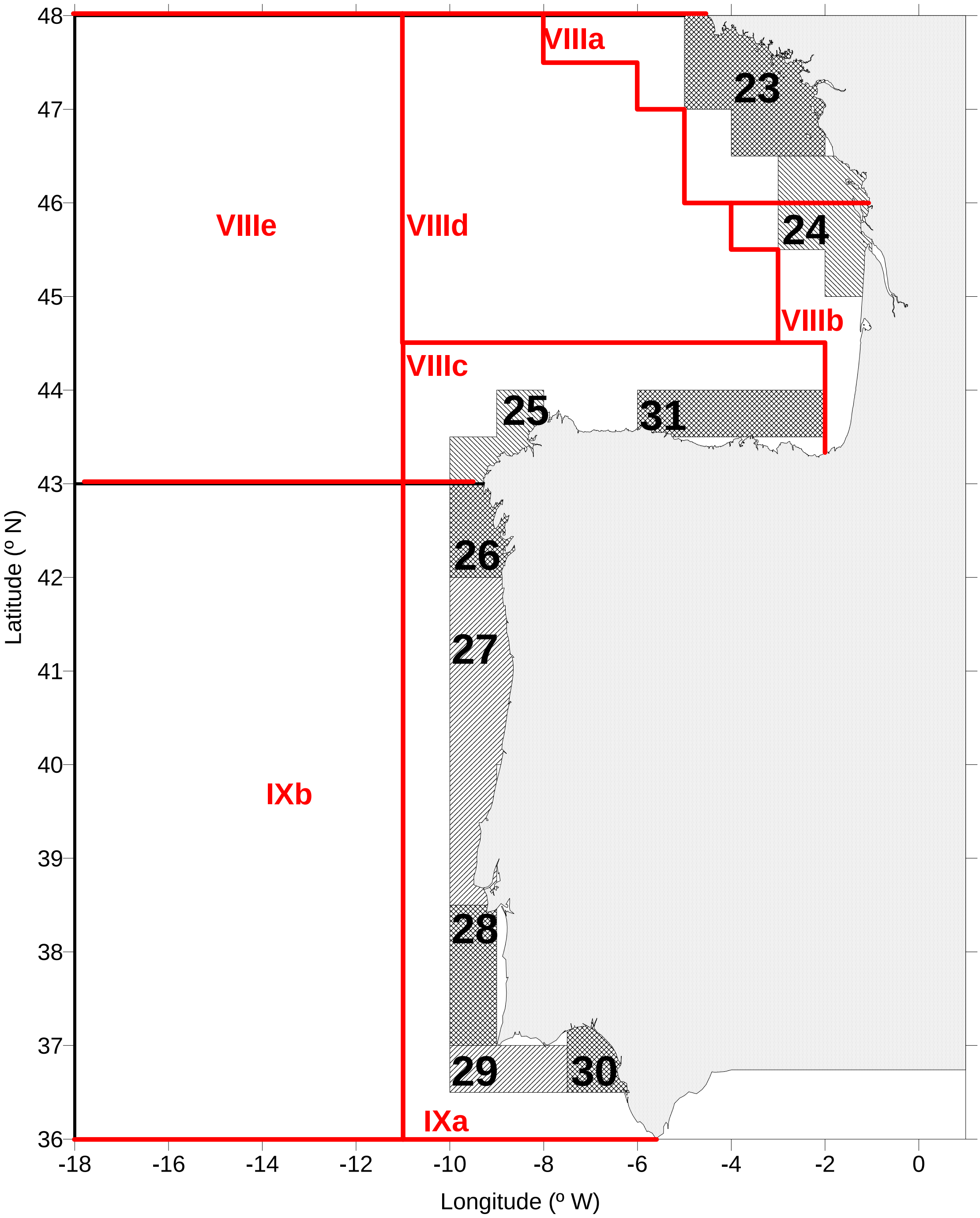


Figure 3.3. Nephrops in Div. VIII and IXa

FUs 23-24: Div. VIIIa,b.
FUs 25 and 31: Div. VIIIc.
FUs 26-30: Div. IXa.

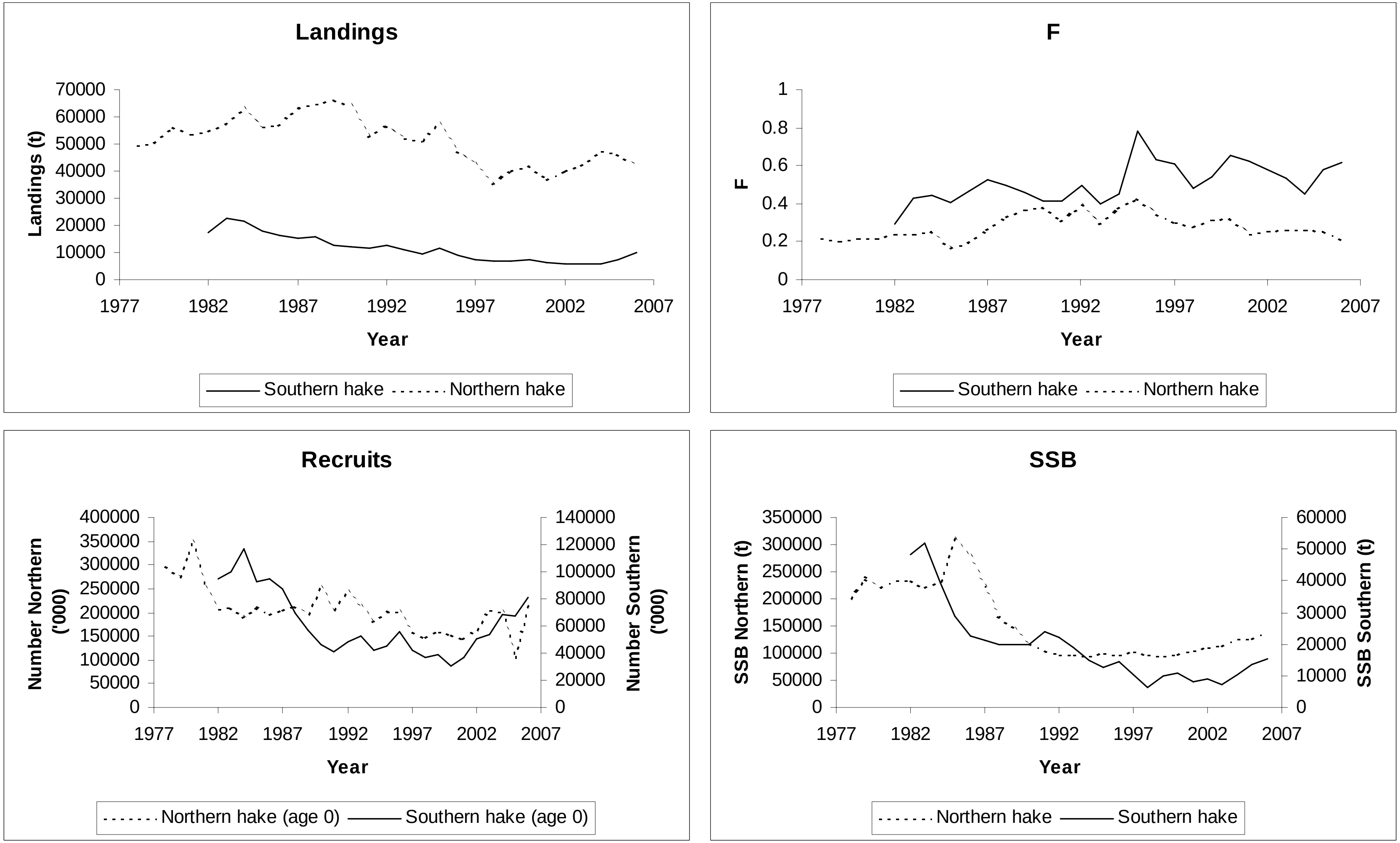


Figure 1.4 Summary of landings, spawning biomass (SSB), recuitment (R) and fishing mortality (F) by group of species: hakes, anglerfish, megrims and *Nephrops*.

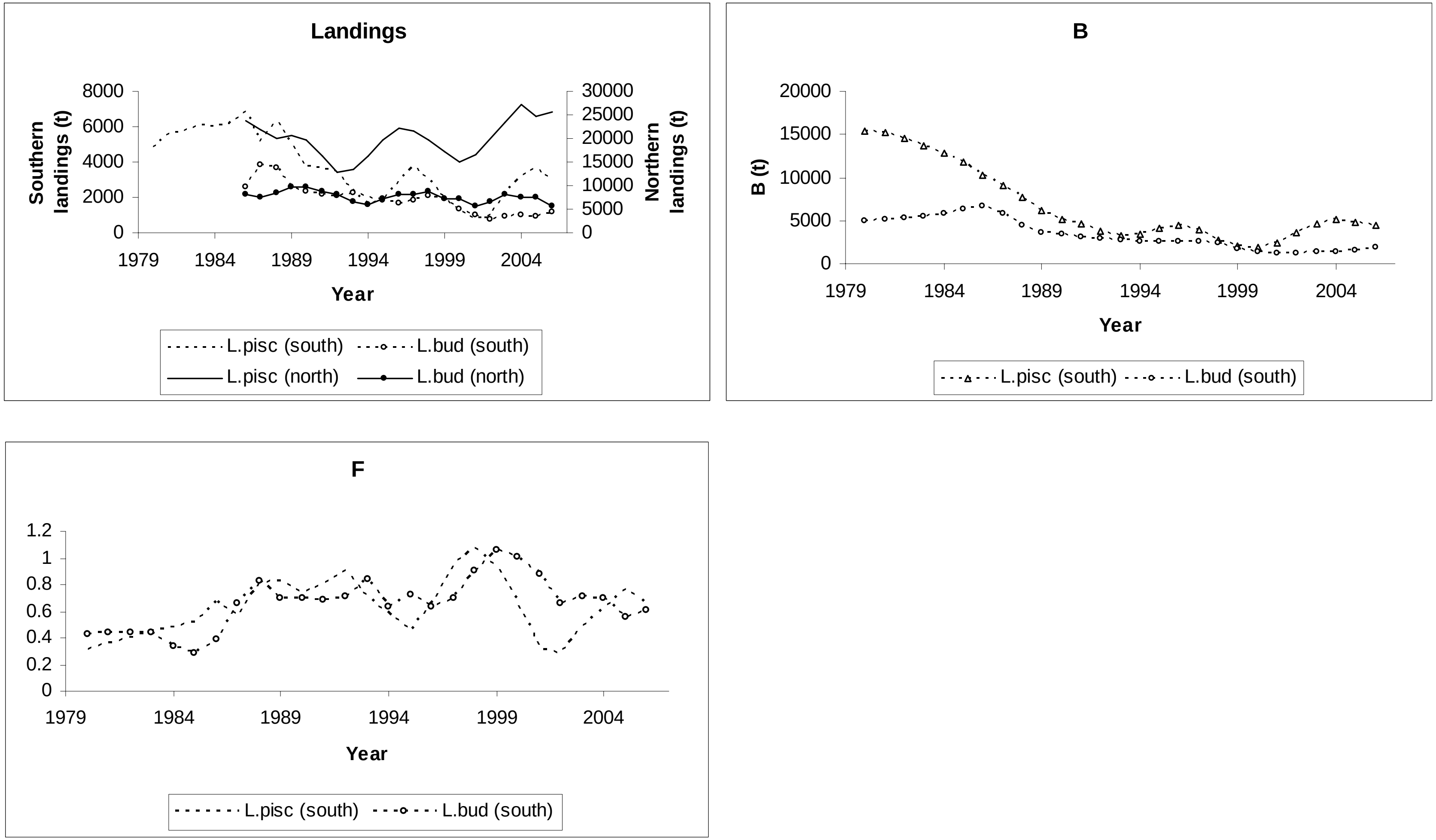


Figure 1.4 Cont: Parameter estimates of northern anglerfish *L. piscatorius* and *L. budegassa* with XSA rejected by the WG; Parameter estimates for southern anglerfish with Schaefer production model

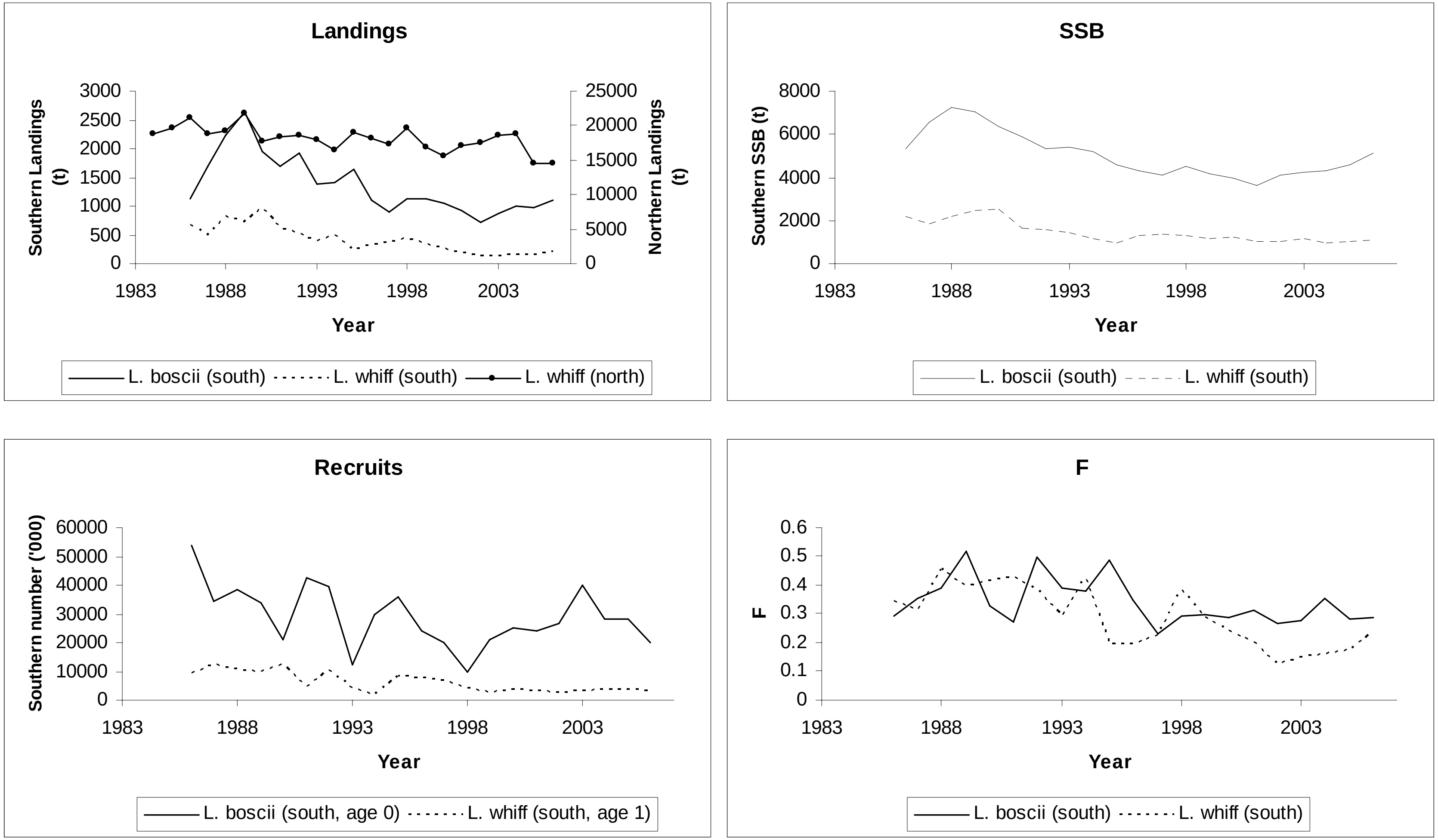


Figure 1.4 Cont: Parameter estimates of northern *L. whiffiagonis* with XSA rejected by the WG.

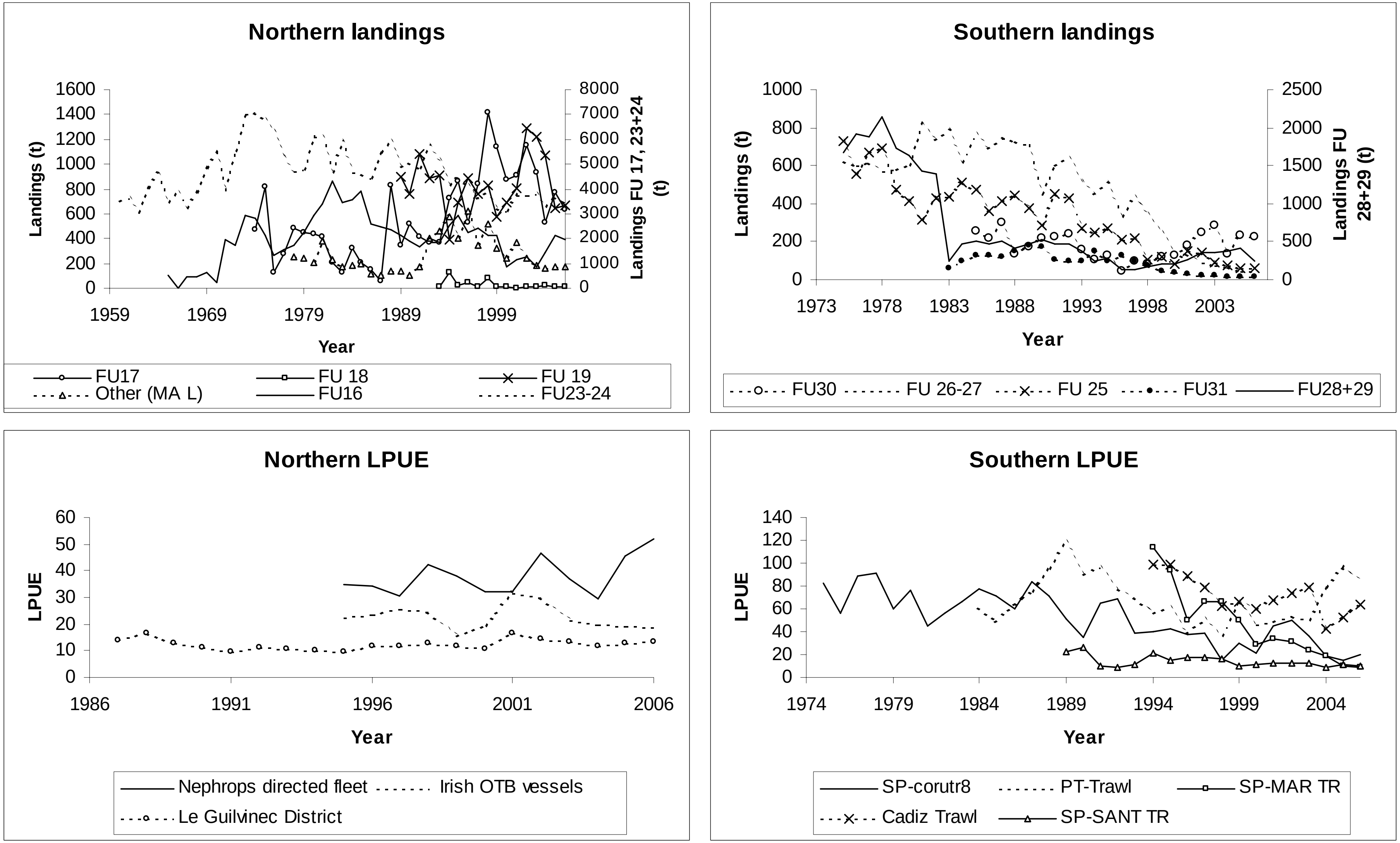


Figure 1.4 Cont: ***Nephrops*** **(LPUE series).**

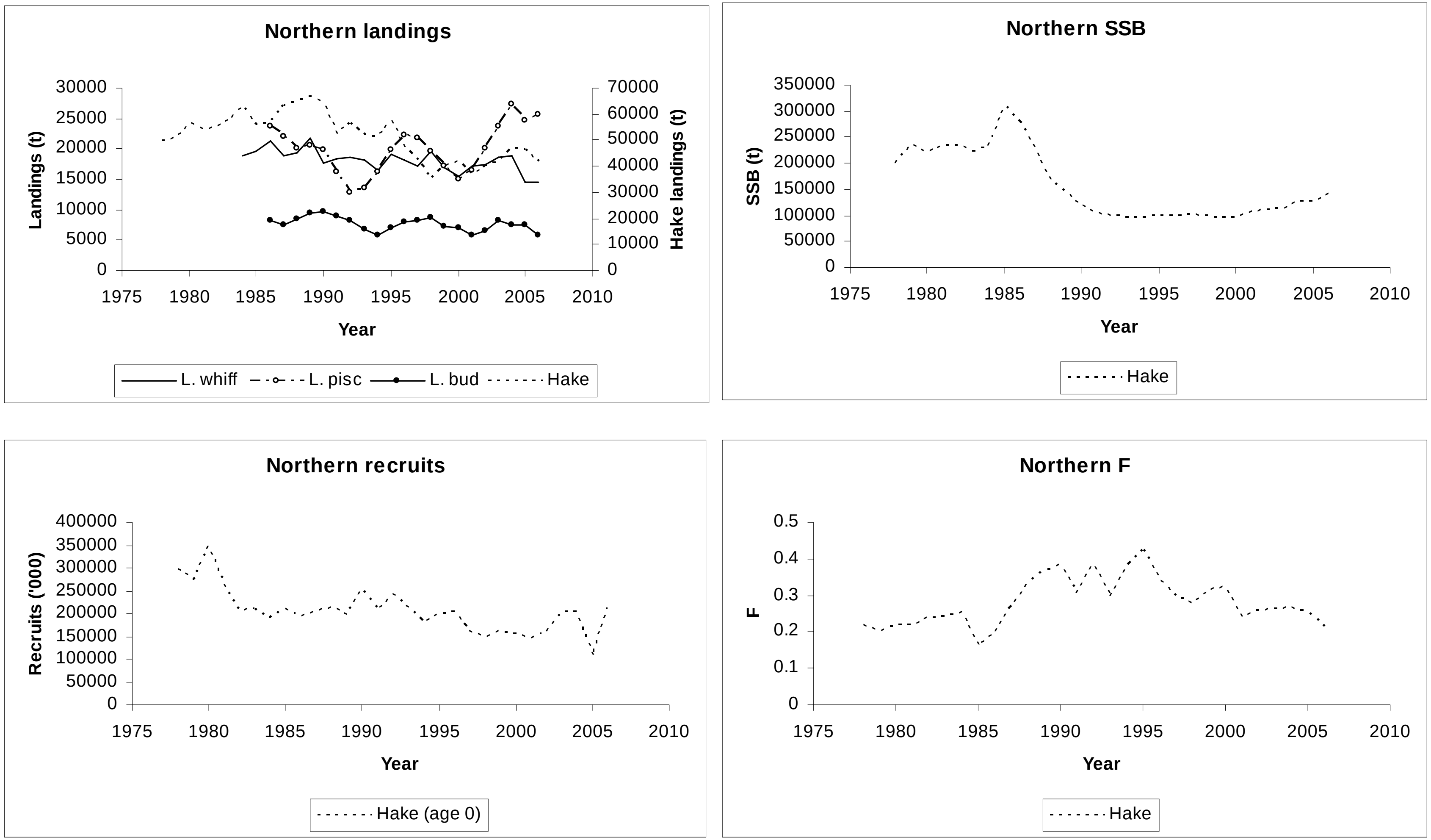


Figure 1.5 Stock summary of landings, spawning stock biomass (SSB), recruitment ® and fishing mortality (F) by area. Stock key parameter estimates for Northern megrim (*L. whiffiagonis*) and northern anglerfish (*L. piscatorius* and *L budegassa*) with XSA rejected by the WG.

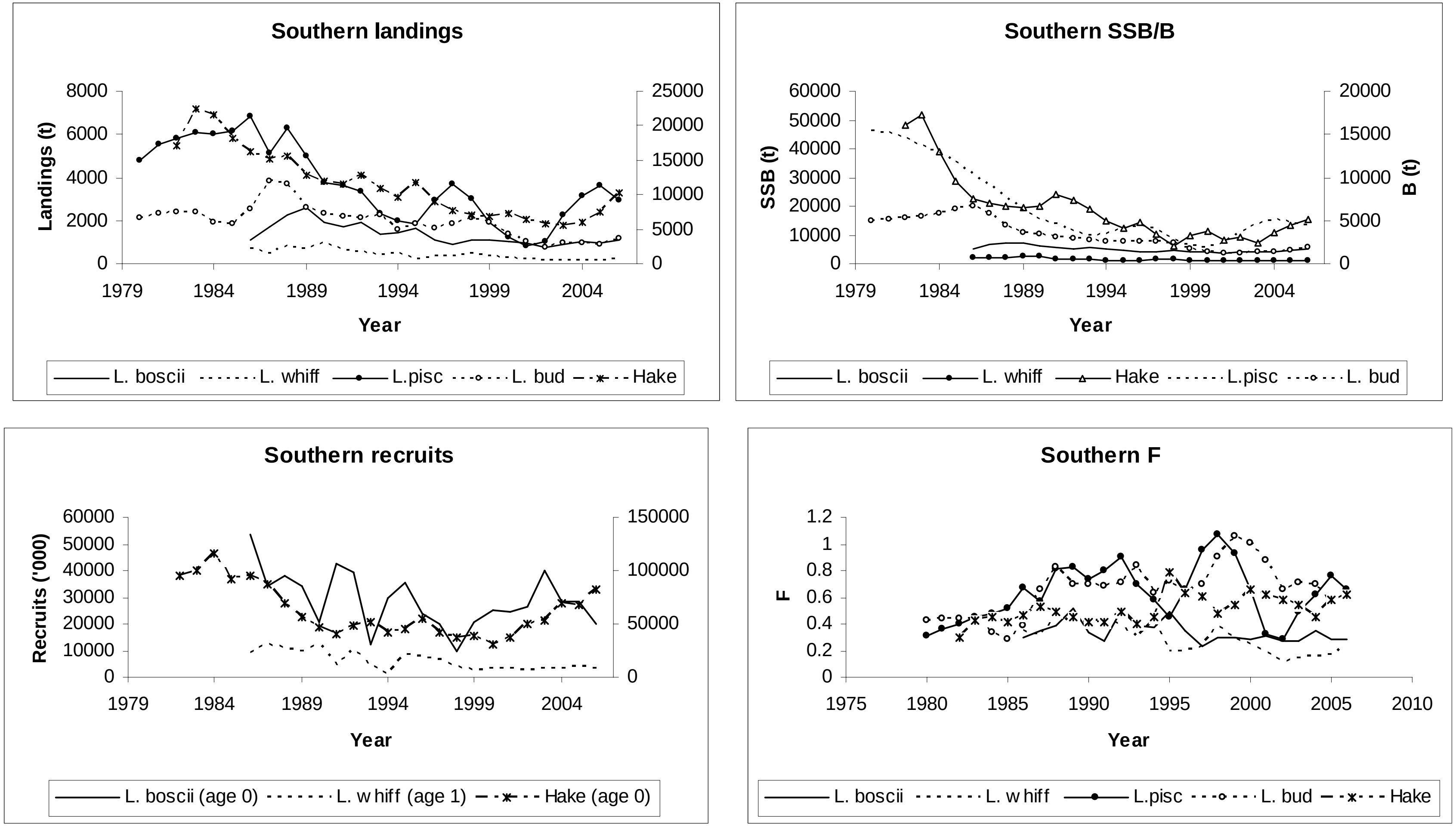


Figure 1.5 Continuation (Southern area). Southern anglerfish (*L. piscatorius* and *L. budegassa*) parameter estimates with Schaefer production model.

2 Fisheries description

2.1 Celtic – Biscay Shelf (Subarea VII and Divisions VIIIa,b,d).

2.1.1 Current fishery units.

The fleets operating in the ICES Subarea VII and Divisions VIIIabd are used in the WGHMM following the Fishery Units (FU) defined by the "ICES Working Group on Fisheries Units in sub-areas VII and VIII" (ICES, 1991):

Fishery Unit	Description	Sub-area
FU1	Long-line in medium to deep water	VII
FU2	Long-line in shallow water	VII
FU3	Gill nets	VII
FU4	Non-Nephrops trawling in medium to deep water	VII
FU5	Non-Nephrops trawling in shallow water	VII
FU6	Beam trawling in shallow water	VII
FU8	Nephrops trawling in medium to deep water	VII
FU9	Nephrops trawling in shallow to medium water	VIII
FU10	Trawling in shallow to medium water	VIII
FU12	Long-line in medium to deep water	VIII
FU13	Gill nets in shallow to medium water	VIII
FU14	Trawling in medium to deep water	VIII
FU15	Miscellaneous	VII & VIII
FU16	Outsiders	IIIa, IV, V & VI
FU00	French unknown	

2.1.2 Tuning fleets CPUE time series.

The LPUE time series of the commercial fleets were plotted for all the stocks in order to analyze for some possible similarities between trends. Those LPUEs time series which are not used in the stocks assessment are plotted in Annex B. Nevertheless the LPUEs plots used as tuning fleets in the Northern stock assessments are included in this section because they were considered useful to identify changes in target species or fishing strategies. For the Spanish tuning fleets some patterns were observed (Figure 2.1). SP-VIGOTR7 shows an increase in megrim and anglerfish LPUEs since the late 90s for, while a comparable increase is not observed in the LPUE of hake. Conversely, the SP-CORUTR7 shows an increase in the LPUE of hake starting at a similar period. These trends could be related with the gradual specialization of these fleets, with the SP-VIGOTR7 increasingly targeting benthonic species and SP-CORUTR7 specializing in demersal species. On the other hand, LPUEs of SP-BAKON8 and SP-BAKON7 has been increasing from 1993 until 1999, except for black anglerfish which have remained quite stable in those years. From 1999 onwards, there has been a rapid increase in anglerfish LPUEs in SP-BAKON8 while; on the contrary, SP-BAKON7 shows a steady decrease from 2000 until now. For this fleet and in this last period a change in the target species occurred. SP-BAKON7 directed the effort to hake and megrim instead of anglers. Despites a peak in 1996, hake LPUE series has remained stable from 1997 to 2002. After a really large increase in 2003, LPUEs decreased but appears to be maintained at those high levels in the last 2 years.

2.1.3 Updating of the fleet segmentation.

Under the implementation of the mixed fisheries approach in the ICES WG's new information updating some national fleet segmentations was presented in last years report: the UK fleets (ICES, 2004), the Spanish fleets (STECF, 2003; ICES, 2005) and the French fleets (ICES, 2006). It is necessary to take into account this new information in relation to the métiers definition did not change the Fishery Units used in the single stock assessments. However, the hierarchical desegregation of FU in métiers was essential for carrying out mixed fisheries assessments in previous WG. At the present WG, new information about fleet definition was supplied by Ireland.

Ireland

Due to the increasing need to take into account "mixed fisheries" approach in management, assessment and sampling of fish stocks, an Irish national project has investigated appropriate fleet segmentation. To do this effectively, groups of fishing trips must be defined with homogeneous fishing patterns or tactics into métiers. In 2003, SGDFF (ICES, 2003) proposed a three step open framework to identify métiers. This combined quantitative statistical analysis and *ad hoc* qualitative classification. This has been the approach used in the project using a combination of several multivariate statistical methods (PCA, MCA & HAC) which were applied to identify Irish métiers (Davie and Lordan, in preparation). Various variable including landing profile (by weight), vessel length category, gear and mesh size and month were used in the statistical analyses.

Once the métiers were defined the landings and effort were segmented accordingly. The Table 2.1 provides a summary of the results of this analysis for landings of hake, monkfish, megrim and *Nephrops*. A total of 37 clear demersal métiers were identified covering different areas, gears, mesh sizes and landings profiles. In addition, there were another 11 groups with no clear associations (so called "mop-up groups"). The results suggest that hake is the target species (>20% of landed weight) of only two métiers (21 and 36) but these métiers only account for around 27% of the total Irish landings of hake over the four years examined (2003-2006). The remaining landings were spread across several other métiers. Megrim and monkfish were targeted by two trawl (10 & 11) and two beam trawl métiers (26 & 27). These accounted for 38% of the megrim landings and 32% of the monkfish landings respectively. Around another 30% of the megrim and monkfish catches were made by other mixed otter trawl using large and small meshes.

Several, *Nephrops* directed trawl métiers were identified. These are characterised by very high proportions of landed weights (>50%) consisting of *Nephrops*. For WGHMM metier 3 & 4 catch the majority of the landings from the Aran Grounds (FU17). The majority of Irish landings from the Porcupine Bank (FU16) are caught by metier 7. Whereas in FU 19 the situation is more complex with the directed *Nephrops* metier in VIIj (i.e. metier 9) only accounting for a small (~16%) of the total landings.

The segmentation here is given in detail on purpose. It is expected that some segments can and will be collapsed for sampling and reporting purposes depending on further information on the size, age and discarding homogeneity of the species within métiers. The results of this analysis will also be presented to the fishing industry through the NWWRAC later in May 2007. The objective will be to see if the results conform to their view of metier segmentation and discuss the suitability of these segments in the management process particularly in the context of MSY objectives.

2.2 Atlantic Iberian Peninsula Shelf (Divisions VIIIc and IXa).

2.2.1 Current fishery units.

The Fishery Units operating in the Atlantic Iberian Peninsula waters were described originally in the report of the "Southern hake task force" meeting (STECF, 1994), which was improved with subsequent contributions:

COUNTRY	FISHERY UNIT	FISHERY COMPONENTS	AREA	TARGET SPECIES	DESCRIPTION
Spain	**Small gillnet**	Small gillnet "Beta"	Division VIIIc and IXa North	Hake.	Mesh size of 60 mm.
	Gillnet	Gillnet "Volanta"	Division VIIIc		Mesh size of 90 mm.
		Gillnet "Rasco"	Division VIIIc	Anglerfish	Mesh size of 280 mm.
	Long line	Long line fleet	Division VIIIc	Hake + Great Fork beard + Conger	
	Northern Artisanal	Northern Artisanal			Miscellaneous fleet
	Southern Artisanal	Southern Artisanal	South of Division IXa		Miscellaneous fleet
	Northern Trawl fleet	Pair Bottom Trawl Fishery (VHVO gear)	Divisions VIIIc and IXa North.	Blue whiting + hake	Mesh size of 55 mm Vertical opening of 25 m.
		Bottom Trawl Fishery ("baca" gear)	Divisions VIIIc and IXa North.	Horse mackerel + Blue whiting+ Mackerel+ hake + megrim + monk + nephrops	Mesh size of 65 mm Opening: 1.2-1.5 m
		Bottom Trawl Fishery (HVO gear)	Divisions VIIIc West and IXa North	Horse mackerel + mackerel	Mesh size of 65 mm Vertical opening of 5-5.5 m
	Southern trawl fleet (Gulf of Cádiz)	Gulf of Cadiz Trawl fleet	South of Division IXa	Sparids + Cephalopods + Sole+ Hake + Horse mackerel + Blue whiting + Shrimp + Norway lobster	Mesh size of 40 mm Vertical opening reduced.
Portugal	**Artisanal**	Two components (inshore and Offshore)	Division IXa	Hake + octopus + pout + horse mackerel + others	80 mm mesh size (gillnet); 100 mm mesh size (trammel); long line not available
	Trawl	fish	Division IXa	Horse mackerel + hake + monk + nephrops	Mesh size of 65 mm
		crustaceans	Division IXa	Nephrops + pink shrimp + red shrimp + hake + monk	Mesh size of 55 mm

2.2.2 Tuning fleets CPUE time series.

The LPUE time series of the tuning fleets used to tune the Southern stock assessments were plotted for all the stocks to investigate possible similarities in trends. The LPUE time series from commercial fleets not currently used in tuning are presented in Annex B. For the Spanish tuning fleets, the most conspicuous common trend is observed in SP-CORUTR8c (Figure 2.1), where the LPUE shows a sharp decline from the beginning to the middle of the time series for all the stocks. This behaviour may be related with changes in the fishing strategy, when the use of a new VHVO gear for targeting pelagic species was being increasingly used instead of the traditional gear targeting demersal species. Even though it is only used to tune one stock, a similar trend can be observed in SP-AVILESTR.

The Portuguese trawl fleet (P-TR) is used as a tuning fleet in the Southern Hake stock assessment. The LPUEs of this fleet fluctuates along the period without a clear trend (Figure2.3).

2.2.3 Updating the fleet segmentation.

Various revisions of Spanish Fishery Units have been proposed recently. These were made in more detail but under a qualitative way (Lart *et al*., 2002; STECF, 2002; Velasco et al., 2003) or applying analytical methodologies on partial information (Punzón *et al*., 2001; Silva *et al*., 2002; Bellido *et al*., 2003; Jiménez *et al*., 2004). The importance of developing a more accurate definition of these fleet components has led the Spanish Oceanographic Institute (IEO), together with the Basque (AZTI) and Portuguese (IPIMAR) institutes, to request a scientific project from the European Commission (DG FISH/2004/03-33; acronym: "*IBERMIX*") to deal with this issue. The preliminary IBERMIX results have been presented in previous WGs (Castro and Punzón, 2005; Silva and Cardador, 2006; Duarte and Cardador, 2006). Due to the importance of this WG to the Iberian demersal stocks, some definitive results have been brought forward this year in order to present a proposal of fleet segmentation at this WGHMM07 as follows.

Spain

The Spanish data used in the IBERMIX project comes from the official logbooks (vessels bigger than 10 m) for the period 2003-2005, provided by the Spanish Ministry of Agriculture, Fisheries and Food (MAPA). The original database was depurated for the analysis, and the information used was ICES statistical rectangle, effort (number of fishing trips), date of landing, landed weight by species and/or species groups, and type of gear. Regarding methodology, a non-hierarchical cluster analysis, the CLARA (Clustering Large Applications) method, was performed to classify the catch profiles in order to obtain the most appropriate métiers. This analysis is based in the k-medoid partitioning method (PAM), identifying from the dissimilarity matrix as many medoids as the number of clusters to be extracted and assigning each element to the nearest medoid, but it is adapted to large data sets (Kaufman and Rousseeuw, 1990).

Before to analyze the fleet components, the Spanish fleets operating in the Atlantic Iberian Peninsula waters need to be split into two main groups depending on the operating area due to the ecological and administrative differences they present: the Northern Spanish waters (ICES Div. VIIIc and IXa North) and the Atlantic Southern Spanish waters (ICES Div. IXa South; i.e. Gulf of Cadiz). All the fleets were analyzed in the IBERMIX project, however only the mixed fisheries with catches of the demersal stocks dealt within the WGHMM are presented here.

Regarding the Northern Spanish coastal trawl fleet, both the bottom otter trawlers (OTB) and the bottom pair trawlers (PTB) were analyzed separately (WD01). Up to four catch profiles were identified in the bottom otter trawl fleet: 1) targeting horse mackerel; 2) targeting mackerel; 3) targeting blue whiting; and 4) targeting a mixed of demersal species as hake, megrim, monk, and Nephrops. Taking into account the technical features of the trips and the limitations of the Nantes matrix (which establish the biological sampling at level 5) (STECF, 2005), the two first were found to be part of an OTB targeting pelagic species (**SP-OTB-8c9aN-pel**), while the two last targeting demersal species share the same fishing strategy (**SP-OTB-8c9aN-dem**). The catch profiles of both of these two OTB components are presented in Table 2.2. The bottom pair trawl fleet (PTB), which only operates in ICES Div. VIIIc and IXa North, showed two catch profiles: 1) around 90% of trips targeting blue whiting; and 2) trips targeting mackerel. However, taking into account the sampling limitations of monitoring so small number of trips in the second trip type, it was decided to keep this fleet as an only fishery unit (**SP-PTB**). The catch profile of this fleet is presented in Table 2.3.

Similarly, the trawl fleet operating in the Gulf of Cádiz (WD05), despite of the knowledge of it was formed by two traditional métiers in the past, operating in coastal and deeper waters respectively, due to recent changes in the stock abundance and in the fleet regulations, which have homogenized this fleet, it is proposed not to disaggregate it in metiers. The catch profile of this fleet (**SP-OTB-9S**) is presented in Table 2.4.

In the case of the Northern fixed gear fleets, the set long line fleets (LLS) and the set gillnet fleet (GNS) were analyzed separately in order to describe their trip types in detail (WD02). From the resulting clusters in set long line fleet, only 4 métiers were found to be consistent enough through the time series: 1) targeting conger; 2) targeting hake (**SP-LLS-HKE**); 3) targeting pollack; 4) targeting seabass. Taking into account the specific interest of the WGHMM in demersal stocks, one métier targeting hake can be extracted from the set long line total landings. The catch profile of SP-LLS-HKE and the remaining set long line are presented in Table 2.5. Regarding the Northern Spanish set gillnet fleet, 2 significant métiers were found: 1) targeting hake (**SP-GNS-HKE**); and 2) targeting monkfish (**SP-GNS-MNZ**) The catch profile of SP-GNS-HKE, SP-GNS-MNZ and the remaining set gillnet are presented in Table 2.6.

As a result, and taking into account the results of the multivariate analysis, the knowledge of the fishery and the sampling limitations in order to follow the DCR guidelines, the following fleet segmentation is proposed:

Spanish fleets in ICES Div. VIIIc-IXa	
Current fleets in WGHMM	**New fleet segmentation proposed**
Gillnet (MNZ)	SP-SGN-MNZ
Gillnet (HKE)	**SP-SGN-HKE**
Small Gillnet (HKE)	
Long line	SP-SLL
Trawl N	**SP-OTB-8c9aN-dem**
	SP-OTB-8c9aN-pel
	SP-PTB-8c9aN
Trawl S (Cádiz)	SP-OTB-9aS
Artisanal N	SP-artisanal-8c9aN
Artisanal S (Cádiz)	SP- artisanal-9aS

Comparing the current fleet segmentation used at WGHMM and the new segmentation proposed, only two fleets present changes in the aggregation level. As a results, set gillnet and northern trawl fleets will need further analysis in order to determine the possible effect of new length distributions on the catch-at-age data used in the assessments.

Portugal

The analyses were based on daily commercial landings for the years 2003-2005. The data, provided by the Portuguese Fisheries Administration (DGPA), comprised the species composition of landings, in weight and in value, per vessel and per day in the Portuguese continental auction markets. Given that fishing is highly driven by the market value of the product, it was assumed that the revenue obtained with the catch would be best descriptor of the activity of the fishing fleets. Based on this assumption, the analyses were performed on landings value per species instead of landings weight.

The trips were classified using the a non-hierarchical clustering algorithm named Partitioning around Medoids (PAM), described in Kaufmann and Rousseeuw (1990) and its variant for large volumes of data (CLARA – Clustering LARge Applications).

Regarding the Portuguese mobile gears fleets analyzed (WD03) only the bottom otter trawl results are relevant to this WG, where two catch profiles were identified: 1) targeting fish and 2) targeting crustaceans. Table 2.7 summarizes the results for these metiers for the period 2003-2005.

In the case of the Portuguese artisanal fleet (WD04), only two trip types related with the demersal stocks dealt with in the WGHMM were match with their correspondent gear: 1) Bottom long line (**PT-LLS**); and 2) Nets (gillnets and trammel together: **PT-GNS/GRT**). Table 2.8 summarizes the results for these metiers for the period 2003-2005.

As a result, and taking into account the results of the multivariate analysis, the knowledge of the fishery and the sampling limitations in order to follow the DCR guidelines, the following fleet segmentation is proposed:

Portuguese fleets in ICES Div. VIIIc-IXa	
Current fleets in WGHMM	**New fleet segmentation proposed**
Artisanal	PT-GNS/GTR
	PT-LLS
Trawl	PT-OTB-crustaceans
	PT-OTB-fish

Finally, the application of both these two subdivisions in the National Sampling Programme need further analysis in order to determine the possible effect of the new length distributions on the catch-at-age data used in the assessments.

Table 2.1. Catch profiles of the métiers of the Irish fleet.

		% of Species landings				% of Metier Landings			
Nº	Metier Name	Hake	Megrim	Monkfish	Nephrops	Hake	Megrim	Monkfish	Nephrops
1	Clean Nephrops OTB VIIa	0%	0%	1%	26%	0%	0%	2%	92%
2	Mixed Nephrops OTB VIIa	1%	0%	2%	10%	1%	0%	4%	68%
3	Clean Nephrops OTB VIIb	0%	1%	0%	5%	0%	4%	3%	88%
4	Mixed Nephrops OTB VIIb	1%	2%	1%	5%	1%	9%	8%	65%
5	Clean Nephrops OTB VIIg	1%	1%	3%	17%	1%	2%	4%	78%
6	Mixed Nephrops OTB VIIg	2%	4%	4%	10%	2%	7%	8%	53%
7	Nephrops OTB VIIc & VIIk	2%	0%	3%	5%	5%	2%	15%	72%
8	Nephrops OTB VIa	0%	0%	0%	0%	5%	7%	9%	56%
9	Nephrops OTB VIIj	0%	1%	1%	2%	1%	9%	9%	53%
10	Megrim & Monkfish Small OTB VIa, VIIb,g,j	3%	10%	11%	1%	3%	25%	30%	7%
11	Megrim & Monkfish Large OTB VIIj	3%	5%	8%	0%	5%	21%	37%	2%
12	Haddock OTB VIIg & VIIj	1%	2%	1%	0%	1%	9%	8%	4%
13	Plaice & Ray Small OTB VIa, VIIa,b,g,j	0%	0%	1%	0%	0%	1%	3%	2%
14	Plaice & Ray Large OTB VIIa	0%	0%	0%	0%	0%	0%	2%	0%
15	BSPR OTB VIa, VIIa,b,g,j	0%	1%	1%	0%	1%	5%	5%	5%
16	Whiting Small OTB VIa,VIIa,b,g,j	1%	0%	1%	0%	0%	0%	1%	1%
17	PSCWD Small OTB VIa,VIIb,g,j	2%	3%	2%	1%	2%	5%	4%	6%
18	WCHD Small OTB VIIa & VIIa.g	0%	0%	0%	0%	1%	1%	4%	8%
19	PSCWD Large OTB VIIa,g,a.g	0%	0%	0%	0%	1%	1%	2%	1%
20	PSCWD Large OTB VIa,b,VIIb,j	1%	2%	1%	0%	2%	8%	4%	1%
21	LWFH Large OTB VIa,b,VIIb,c,j,k	13%	2%	3%	1%	20%	7%	11%	8%
22	LWLFH Small OTB VIa,b,VIIa,b,g,j	1%	1%	1%	0%	6%	10%	8%	5%
23	Deepwater spp Large Single Trawl VIa, VIIb,c,j,k	0%	0%	0%	0%	0%	0%	0%	0%
24	Whiting & Haddock Small SSC VIa,VIIa,b,g,j	4%	2%	1%	0%	3%	3%	2%	0%
25	Whiting & Haddock Large SSC VIIa,b,g,j	6%	2%	1%	0%	6%	4%	3%	0%
26	MMWLS Small TBB VIIa,e,g,h,j	2%	14%	9%	1%	2%	26%	19%	3%
27	MMWLS Large TBB VIIg,h,j	2%	9%	4%	0%	3%	33%	14%	3%
28	RPBS Small TBB VIIa,g,h,j	0%	0%	1%	0%	0%	1%	6%	0%
29	RPBS Large TBB VIIa,g	0%	0%	0%	0%	0%	2%	4%	0%
30	Scallop DRB All Areas	0%	0%	0%	0%	0%	0%	0%	0%
31	Crab & Other GNS VIIa,b,g,j	0%	0%	0%	0%	0%	0%	0%	0%
32	SLPD Small GNS VIIa,b,g,j,k	2%	0%	0%	0%	4%	1%	1%	0%
33	SLPD Large GNS VIIa,b,g,j,k	4%	0%	1%	0%	7%	0%	2%	0%
34	Cod GNS VIIa,g	1%	0%	0%	0%	3%	1%	2%	0%
35	Ray & Other GNS VIIa,b,g,j	0%	0%	0%	0%	1%	0%	19%	0%
36	Hake & Forkbeard GNS VIIb,c,g,j,k	13%	0%	0%	0%	51%	1%	3%	0%
37	Crab & Other FPO All areas	0%	0%	0%	0%	0%	0%	0%	0%
38	Multiple Meshes	1%	0%	1%	0%	9%	8%	12%	14%
39	Non-Metier DRB	0%	0%	0%	0%	0%	0%	0%	0%
40	Non-Metier FPO	0%	0%	0%	0%	0%	0%	1%	7%
41	Non-Metier GNS	2%	0%	1%	0%	4%	1%	5%	1%
42	Non-Metier SSC	4%	2%	1%	0%	8%	8%	6%	3%
43	Non-Metier TBB	1%	4%	2%	1%	2%	16%	9%	7%
44	Non-Metier <70mm Mesh Otter Trawl	0%	0%	0%	0%	0%	0%	0%	0%
45	Non-Metier >=100mm Mesh Otter Trawl	11%	13%	14%	3%	3%	9%	11%	5%
46	Non-Metier 70-99mm Mesh Otter Trawl	11%	16%	14%	8%	2%	7%	7%	10%
47	Non-Metier Zero Mesh Otter Trawl	1%	1%	1%	0%	0%	1%	1%	1%
48	'Rare'/other gears	1%	0%	0%	0%	1%	0%	1%	1%

Table 2.2. Catch profiles of the métiers of the Northern Spanish OTB fleet.

	SP-OTB-8c9aN-demersal			SP-OTB-8c9aN-pelagic		
spp	**2003**	**2004**	**2005**	**2003**	**2004**	**2005**
Eledone cirrhosa	4.6	3.7	4.1	0.4	0.2	0.2
Illex spp.	3.6	4.8	2.9	0.2	0.2	0.2
Lepidorhombus spp.	5.3	5.7	6.4	0.9	0.6	0.6
Lophius spp.	8.9	8.6	11.5	1.3	0.9	1.0
Merluccius merluccius	8.6	4.3	5.5	1.4	0.9	1.1
Micromesistius poutassou	29.1	31.0	32.1	1.4	1.2	3.1
Nephrops norvegicus	1.3	1.0	0.9	0.1	0.0	0.0
Scombrus spp	5.4	7.6	7.5	**35.8**	**33.8**	**46.8**
Trachurus spp.	12.5	11.2	8.3	**56.1**	**60.1**	**44.8**
Trisopterus spp.	4.1	4.7	4.3	0.3	0.3	0.4
Others	16.7	17.4	16.6	2.2	1.7	1.9
TOTAL LANDINGS (t)	7282	7657	6513	20677	29376	32179
Effort (days)	7833	8943	7183	5339	7437	7832

Table 2.3. Catch profiles of the metiers of the Northern Spanish PTB fleet.

	SP-PTB-8c9aN		
spp.	**2003**	**2004**	**2005**
Illex spp.	2.7	0.6	0.5
Lophius spp.	0.4	0.4	0.4
Merluccius merluccius	3.8	4.8	9.3
Micromesistius poutassou	**68.9**	**74.0**	**64.7**
Scombrus spp	17.0	14.2	18.5
Trachurus spp.	4.8	4.7	5.7
Others	2.5	1.3	0.9
TOTAL LANDINGS (t)	24412	29612	32163
Effort (days)	8409	10223	9198

Table 2.4. Catch profiles of the metiers of the Southern Spanish OTB fleet.

	SP-OTB-9aS		
spp.	**2003**	**2004**	**2005**
Citharus linguatula	0.9	1.6	2.5
Dicologoglosa cuneata	0.8	1.0	1.4
Galeorhinus galeus	0.0	0.0	0.4
Lithognatus mormyrus	0.0	0.2	0.2
Loligo spp.	2.5	0.0	4.9
Lophius spp.	0.5	0.4	0.4
Melicertus kerathurus	1.4	1.4	2.0
Merluccius merluccius	6.3	6.6	6.5
Micromesistius poutassou	32.3	46.2	5.3
Mullus spp.	0.5	0.3	0.9
Nephrops norvegicus	1.1	0.5	0.6
Octopus vulgaris	5.5	5.8	24.2
Ommastrephidae	0.0	0.0	0.2
Other	22.8	20.8	25.1
Pagellus bogaraveo	0.0	0.2	0.4
Pagellus spp.	0.5	0.8	1.4
Parapenaeus longirostris	13.9	4.0	6.8
Raja spp.	0.0	0.3	0.4
Scomber spp.	0.0	0.0	0.0
Sepia officinalis	5.6	5.4	10.5
Solea spp.	1.6	0.9	0.7
Squilla mantis	0.9	1.6	2.8
Torpedo spp.	0.2	0.0	0.0
Trachurus spp.	2.7	1.9	2.3
TOTAL LANDINGS (t)	10783	6824	5338
EFFORT (days)	18434	18297	26963

Table 2.5. Catch profiles of the metiers of the Northern Spanish long line fleet.

	SP-LLS-HKE			remaining LLS		
spp	**2003**	**2004**	**2005**	**2003**	**2004**	**2005**
Belone belone	0.0	0.0	0.0	0.2	0.9	0.3
Beryx spp	0.0	0.4	0.4	1.8	1.9	2.0
Brama brama	0.0	0.0	0.3	1.5	0.9	57.1
Conger conger	1.2	0.6	0.5	37.5	40.2	17.7
Dicentrarchus labrax	0.0	0.0	0.0	1.7	2.5	0.8
Elasmobranchii	0.0	0.1	0.0	18.2	10.9	3.5
Merluccius merluccius	**83.6**	**82.9**	**87.1**	0.4	0.3	0.6
Micromesistius poutassou	2.3	1.3	1.5	1.5	1.3	0.3
Phycis spp	0.3	0.2	0.5	9.6	9.4	4.1
Pollachius pollachius	0.3	0.2	0.4	5.1	8.3	3.1
Polyprion americanus	0.0	0.0	0.0	0.6	0.4	0.2
Scomber scombrus	3.2	8.4	3.1	2.3	5.3	4.4
Sparidae	2.8	1.1	1.1	4.2	3.7	1.3
Trachurus trachurus	0.9	0.7	0.3	0.4	0.3	0.2
Trisopterus spp	0.6	0.8	0.2	0.7	0.6	0.2
Others	4.8	3.4	4.6	14.2	13.1	4.2
TOTAL LANDINGS (t)	92	146	181	1023	1334	3202
EFFORT (days)	278	705	850	4590	6812	6527

Table 2.6 Catch profiles of the métiers of the Northern Spanish set gillnet fleet.

	SP-GNS-HKE			SP-GNS-MNZ			remaining GNS		
spp	**2003**	**2004**	**2005**	**2003**	**2004**	**2005**	**2003**	**2004**	**2005**
Beryx spp	0.1	0.1	0.1	0.0	0.0	0.0	0.5	0.6	0.2
Crustaceans	0.0	0.0	0.0	0.2	0.2	0.2	3.1	2.7	1.2
Dicentrarchus labrax	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.6	0.4
Dicologlossa cuneata	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1
Elasmobranchii	0.1	0.2	0.0	1.0	1.9	1.1	6.1	4.6	1.4
Loliginidae	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.2
Lophius spp	0.2	0.7	0.1	**94.1**	**92.9**	**96.2**	5.4	3.8	1.1
Merluccius merluccius	**82.3**	**76.7**	**88.3**	0.2	0.3	0.0	11.3	7.1	5.1
Micromesistius poutassou	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Mullus spp	0.3	0.6	0.1	0.0	0.0	0.0	3.9	4.3	1.5
Octopodidae	0.0	0.1	0.0	0.0	0.0	0.0	0.6	0.9	0.1
Phycis spp	0.1	0.1	0.1	0.0	0.0	0.0	0.3	0.1	0.0
Pleuronectiformes	0.0	0.0	0.0	0.6	0.5	0.0	1.9	1.6	0.5
Scomber spp	1.4	2.9	1.5	0.0	0.2	0.2	8.8	10.2	7.9
Sepia officinalis	0.0	0.0	0.0	0.0	0.1	0.0	2.0	2.4	0.8
Sparidae	0.3	0.6	0.3	0.0	0.0	0.0	2.5	1.8	0.7
Trachurus spp	0.7	3.8	1.6	0.1	0.1	0.0	9.0	10.6	3.6
Trisopterus spp	1.4	1.1	0.8	0.1	0.1	0.0	10.8	10.0	2.9
Others	13.0	12.9	7.1	3.5	3.6	2.0	33.2	38.0	13.2
TOTAL LANDINGS (t)	659	891	1078	288	618	1044	1077	1393	5257
EFFORT (days)	3972	5065	4101	1739	2623	3451	11757	15295	29440

Table 2.7. Catch profiles of the métiers of the Portuguese trawl fleet.

	PT-OTB-Fish			PT-OTB-Crustaceans		
Species	**2003**	**2004**	**2005**	**2003**	**2004**	**2005**
Aristaeopsis edwardsiana	1.6	1.4	1.1	1.8	5.4	2.1
Aristeus antennatus	0.8	0.2	0.1	3.8	3.6	1.1
Lophius sp.	1.4	0.8	0.6	2.0	3.4	2.1
Merluccius merluccius	9.6	8.3	9.9	2.2	4.0	3.2
Microchirus sp.	1.6	1.6	1.7	0.0	0.0	0.0
Micromesistius poutassou	3.5	4.7	6.1	0.2	1.7	1.8
Nephrops norvegicus	3.7	0.2	0.1	**21.9**	**40.9**	**56.4**
Octopodidae	9.3	5.0	3.6	0.2	0.2	0.1
Pagellus acarne	5.8	4.6	4.3	0.0	0.0	0.0
Parapenaeus longirostris	0.4	0.1	0.1	**66.0**	**37.9**	**29.6**
Scomber japonicus	1.3	1.6	1.6	0.0	0.0	0.0
Scomber scombrus	1.8	1.4	2.5	0.0	0.0	0.0
Skates/Rays	3.1	2.3	1.7	0.1	0.1	0.1
Squids	4.4	10.3	6.5	0.0	0.1	0.0
Trachurus trachurus	**27.8**	**37.5**	**39.3**	0.1	0.1	0.2
Trisopterus luscus	4.5	3.9	3.9	0.0	0.0	0.0
Zeus faber	3.8	3.1	3.4	0.0	0.0	0.0
Other	**16.9**	14.4	13.6	1.8	2.4	4.3

Table 2.8. Catch profiles of the metiers of the Portuguese artisanal fleet.

	PT-LLS		PT-GNS/GRT	
Groups of species	**2004**	**2005**	**2004**	**2005**
Aphanopus carbo	45.7	44.9	0.9	0.7
Chamelea gallina	0	0	0	0
Conger conger & other	6	0	1.5	0
Lophius spp. & other	12.6	8.9	6.9	4.6
Merluccius merluccius & other	4.4	6.7	11.4	13.1
Microchirus spp. & other	0.2	0	3.3	0
Mixed species	20	34.3	19.4	40.6
Octopus vulgaris	0.4	0.3	9	4.6
Octopus vulgaris & other	1.1	1	14.6	10.4
Other species	3.3	2.8	2.3	1.3
Raja spp. & other	0	0.8	0	5.1
Pagellus acarne & other	0.5	0	1.4	0
Sepia officinalis & other	0.6	0	2.2	0
Solea lascaris & *Solea* spp.	0	0	0.2	0
Solea spp. & other	0.7	0.1	17.1	11.8
Solenidae	0	0	0	0
Spisula solida	0	0	0	0
Trisopterus luscus & other	0.2	0.1	7.8	7.8
Zeus faber & other	4.3	0	2	0

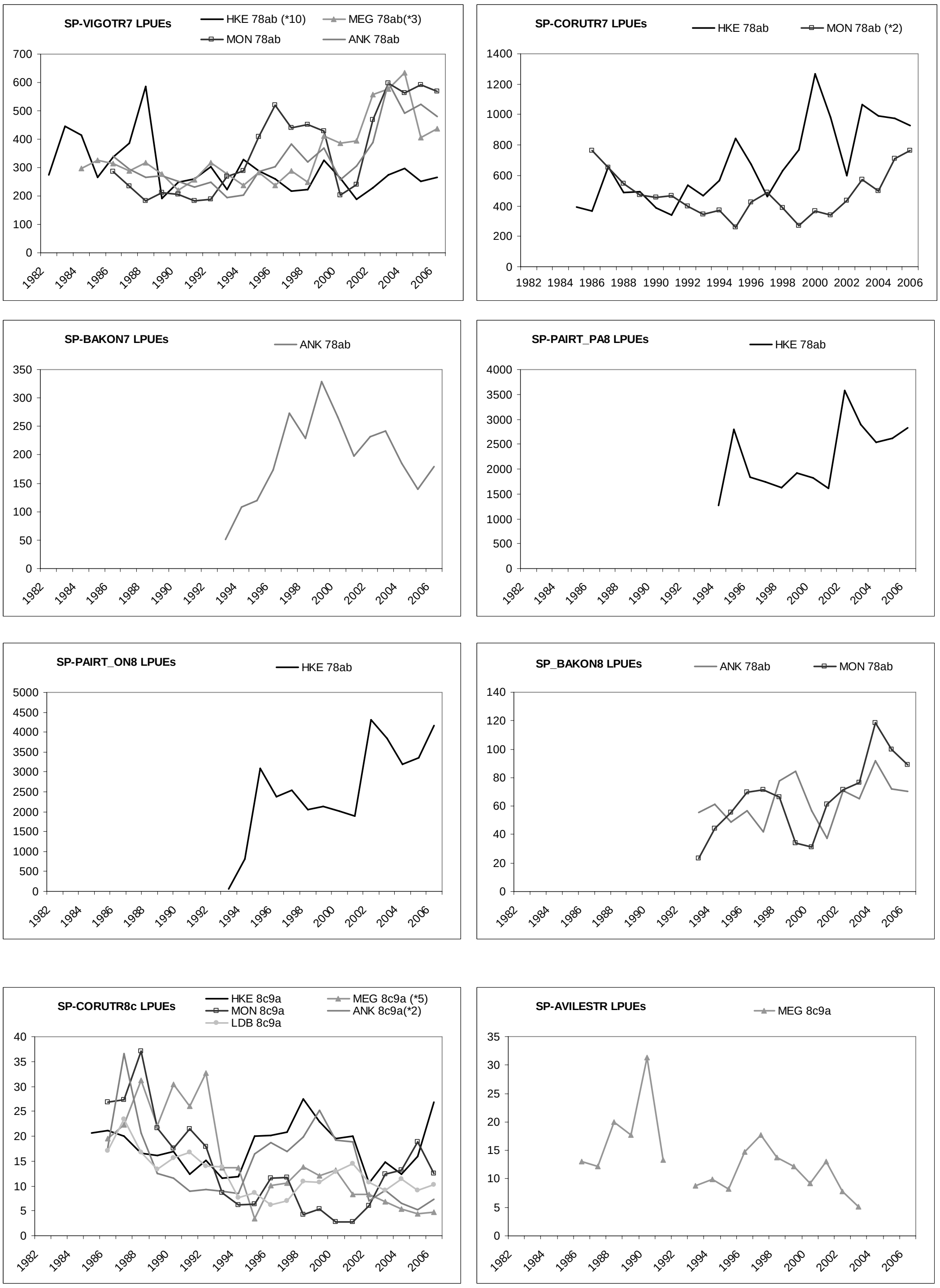


Figure 2.1. Spanish tuning fleets LPUE time series.

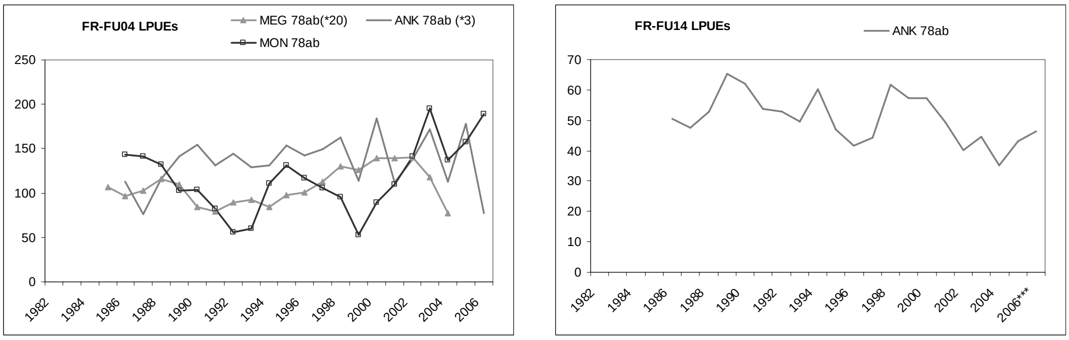


Figure 2.2. French tuning fleets LPUE time series.

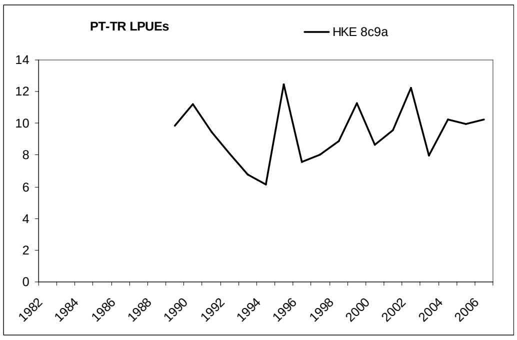


Figure 2.3. Portuguese tuning fleets LPUE time series.

3 Northern Stock of Hake

Type of assessment : updates, stock on observation list.

No data revision has been carried out this year.

Review group issues :

- discards: see comments in section 3.2.1
- removal of SP-Coruna fleet: this issue, and the related one on the "taper time weighting", has been addressed in previous WGs (see section 3.3.2). This year, it was discussed again but no firm conclusion was reached. It was felt by the group that this issue may be linked to both data and methodological problems. Some work will be carried out in inter-session to further investigate the issue.
- UK-WCGFS. This survey has been terminated as an abundance survey (see section 3.2.3).

A preliminary assessment using a spatially disaggregated length based model was presented (see WD 23).

Following concerns over the accuracy of aging data and the calculation of historic catch-at-age data, the group decided, as last year, to conduct alternative runs, one with the observed ALK based on otolith readings provided to the group and another with a simulated ALK (see section 3.3).

The WG proposed an update assessment for next year.

3.1 General

3.1.1 Ecosystem aspects

European hake (*Merluccius merluccius*) is widely distributed over the northeast Atlantic shelf, from Norway to Mauritania, with a larger density from the British Islands to the south of Spain (Casey and Pereiro, 1995) and in the Mediterranean and Black sea. For many decades, this species has been a very important resource for many demersal fisheries of the region. It is landed as targeted or incidental catch by a wide variety of gears (bottom trawls, nets, and longlines).

Although, as shown by genetic studies (Plá and Roldán, 1994; Roldán et al., 1998), there is no evidence of multiple populations in the northeast Atlantic, ICES assumes since the end of the 70s two different stock units : the so called Northern stock, in Division IIIa, Sub-areas II, IV, VI and VII and Divisions VIIIa,b,d, and the Southern stock in Divisions VIIIc and IXa, along the Spanish and Portuguese coasts. The main argument for this choice was that the Cap Breton canyon (close to the border between the Southern part of Division VIIIb and the more Eastern part of Division VIIIc, i.e. approximately between the French and Spanish borders) could be considered as a geographical bound limiting exchanges between the two populations. In a recent study Mattiucci *et al* (2004) did not find any differentiation between southern Bay of Biscay and Celtic Sea hakes. Given the importance of stock limits in our understanding of the hake population dynamics, the Group agreed on the need for further studies. Tagging experiments and genetic studies would provide valuable information on that issue and is supported by the Working Group participants.

Hake is a demersal species of medium-large size with a maximum size and weight about 140 cm and 15 kg respectively. At present it is believed that it has a medium lifespan, with a maximum age of about 12 years. It lives mostly between 70 and 370 m, although it is found also in shallower and deeper waters. Usually it is close to the bottom during daytime and then moves vertically in the water column during the night.

Hake spawn from February through July along the shelf edge, the main areas extending from north of the Bay of Biscay to the south and west of Ireland. After a pelagic life, 0-group hakes reach the bottom in depths of more than 200 m, then moving to shallower water with a muddy seabed (75–120 m) by September. There are two major nursery areas: in the Bay of Biscay and off southern Ireland. The spawning occurs in several batches in the same spawning season and fecundity is not well known. Males reach the first maturity at a lower length and age than females (about 39 cm and 3.4 years, and 47 cm and 4.2 years, respectively). Their eggs are spherical, pelagic, transparent and with a fat globule.

Hake movements have been studied from the seasonal distribution of catches. From the beginning of the year until March/April adult hake are present in the North of the Bay of Biscay. They appear on the shelf edge in the Celtic Sea in June and July. Between August and December a large hake fishery is centred to the west and southwest of Ireland, with a decline in catch rates in shallower waters.

Although a comprehensive study on the role of hake in its ecosystem has not yet been carried out, some partial studies are available. In a working document presented to the WGin 2004, Lucio et al. (2003) show that hake belongs to a very extended and diverse community of commercial species. The main species concerned are megrim, anglerfish, Nephrops, sole, seabass, ling, blue ling, greater forkbeard, tusk, whiting, blue whiting, Trachurus spp, conger, pout, conger, cephalopods (octopus, Loligidae, Ommastrephidae and cuttlefish), rays… The relative importance of these species in the hake fishery varies largely in relation to the different gears, sea areas and countries involved.

Hake is preyed upon by sharks and other fishes. Cannibalism on juveniles by adults is also quoted. Adults feed on fish (mainly on blue whiting and other gadoids, sardine, anchovy and other small pelagic fish); juvenile hake prey mainly upon planktonic crustaceans (above all euphausids, copepods and amphipods).

Hake is the host of various parasites; larvae of the Anisakis nematode are common in the general body cavity, mainly inside the liver and around the gonads, and in some parts of the muscle surrounding the general body cavity. Adult fish are much more infested than juveniles. The variation in the degree of infestation by nematodes along the years and its eventual influence on the reproductive potential of the fish are still unknown.

Both the multi species aspect of the fishery and the ecological factors or environmental conditions impacting on hake population dynamics are not taken into account at present in the evaluation and in the management. This is obviously because our knowledge on these issues is still very limited. It must however be born in mind that in the case of hake, any management measures will have implications on other commercial species but also on non-commercial communities.

3.1.2 Fishery description

Historically, a set of different Fishery Units (FU) was defined by the ICES Working Group on Fisheries Units in Sub-areas VII and VIII in 1985, in order to study the fishing activity related to demersal species (ICES, 1991). Since then they have been used practically unchanged by the ICES Southern Shelf Demersal Stocks Working Group (SSDS), and most of them continue to be related only to Sub-areas VII and VIII. To take into account the hake catches from other areas, a new Fishery Unit was introduced in the beginning of the nineties (FU 16: Outsiders). This Fishery Unit was created on the basis of combination between mixed areas and mixed gears (trawl, seine, long line, and gill net). The FU have been defined as in Section 2.1.1.

The “ad-hoc” Working Group “On the preparation of future recovery measures for Northern Hake” held in Vigo (Anon. 2001) suggested that, in the future, the possibility of splitting some of the FU’s in order to achieve a more precise monitoring of hake catches should be considered. Differences in the target species, in the exploitation pattern and in the dimensions of the gears used by the different fleet components, as well as changes observed in the proportion of these components in recent years, could support this eventual splitting. As an example, in the case of the FU 4 and FU 14 (trawling in medium to deep waters), four Spanish components have been included in the same FU throughout the 80’s and 90’s: the baka-trawl, the bou-trawl (which was very important in the ‘80s and ‘90s, but disappeared in 2000), the traditional pair-trawl, the new bottom pair-trawl (operating with “Naberan” Very High Vertical Opening (VHVO) nets) since 1993, which is now the main Spanish gear used in the Bay of Biscay targeting hake. During the same period, French trawlers have progressively adopted twin nets.

The main part of the fishery (close to 90% of the total landings) was conducted in six Fishery Units, three of them from Sub-area VII: FU 1 (Long-line in medium to deep water in Sub-area VII), FU 3 (Gill nets in Sub-area VII) and FU 4 (Non-Nephrops trawling in medium to deep water in Sub-area VII), two from Sub-area VIII: FU 13 (Gill nets in shallow to medium water) and FU 14 (Trawling in medium to deep water in Sub-area VIII) and one in Sub-areas IIIa, IV, V and VI, representing respectively 22%, 13%, 20%, 8%, 13% and 15% of the total in 2006.

From the information reported to the Working Group, Spain accounts for the main part of the landings with 59% of the total in 2006. France is now taking 26% of the total, UK 6%, Denmark 3%, Ireland 3% and other countries (Norway, Belgium, Netherlands, Germany, and Sweden) contributing small amounts.

3.1.3 Summary of ICES advice for 2007 and management for 2006 and 2007

ICES advice for 2007

Following the agreed recovery plan, ICES indicates that a fishing mortality of F = 0.25 is expected to lead to an SSB of around 158,000 t in 2008 with estimated landings in 2007 of 53,800 t. This would imply an increase in TAC of 23%. According to Article 5.5a of the recovery plan, the annual increase of TAC should be limited to 15% between any two years. This corresponds to a TAC of 50 485 t in 2007 and an expected SSB in 2008 of 160 600 t. ICES also indicates that the fishing mortality which is consistent with taking high long-term yield and achieving low risk of depleting the productive potential of the stock is 0.17, which would imply landings of less than 38,600 t in 2007.

Like the main stocks of the EU, the Northern hake stock is managed by a TAC and quotas. The TACs for recent years are presented below:

TAC (t)	2002	2003	2004	2005	2006	2007
IIIa, IIIb,c,d (EC Zone)	813	904	1178	1284	1323	1588
IIa (EC Zone), IV	946	1053	1373	1496	1541	1850
Vb (EC Zone), VI, VII, XII, XIV	15118	16823	21926	23888	24617	29541
VIIIa,b,d,e	10083	11220	14623	15932	16412	19701
Total Northern Stock [IIa-VIIIabd]	26960	30000	39100	42600	43893	52680

Management for 2006 and 2007

The minimum legal sizes for fish caught in Sub areas IV-VI-VII and VIII is set at 27 cm total length (30cm in Division IIIa) since 1999 (Council Reg. no 850/98).

From 14th of June 2001, an Emergency Plan was implemented by the Commission for the recovery of the Northern hake stock (Council Regulations N°1162/2001, 2602/2001 and 494/2002). In addition to a TAC reduction, 2 technical measures were implemented. A 100 mm minimum mesh size has been implemented for otter-trawlers when hake comprises more than 20% of the total amount of marine organisms retained onboard. This measure did not apply to vessels less than 12 m in length and which return to port within 24 hours of their most recent departure. Furthermore, two areas have been defined, one in Sub area VII and the other in Sub area VIII, where a 100 mm minimum mesh size is required for all otter-trawlers, whatever the amount of hake caught.

Some fleets from Spain stopped fishing during up to two months in 2001, 2002 and 2003 and one month in 2004, 2005 and 2006.

There are explicit management objectives for this stock under the EC Reg. No 811/2004 implementing measures for the recovery of the northern hake stock. It is aiming at increasing the quantities of mature fish to values equal or greater than 140,000t. This is to be achieved by limiting fishing mortality to 0.25 and by allowing a maximum change in TAC between years of 15%.

In Sub area VIII, for 2006 and 2007, otter-trawlers using a squared mesh panel are allowed to use 70 mm mesh size in the area, mentioned above, where 100 mm minimum mesh size is required for all otter-trawlers. Furthermore, there was a ban on gillnets in Sub-Area VIa,b and VIIb,c,j,k fishing in more than 200m depth (EC Reg. No 51/2006) during the first semester of 2006.

3.2 Data

3.2.1 Commercial catches and discards

Total landings from the Northern stock of hake by area for the period 1961-2006 as used by the WG are given in Table 3.1. They include landings from Divisions IIIa and IVa,c, Sub-areas IV, VI and VII, and Divisions VIIIa,b,d, as reported to ICES. Unallocated landings are also included in the table, which are higher over the first decade (1961-1970), when the uncertainties in the fisheries statistics were high.

Except in 1995, landings decreased steadily from 66 500 t in 1989 to 35 000 t in 1998. Up to 2003, landings have fluctuated around 40 000 t. In 2004 and 2005, an important increase in landings had been observed with 47 123 t and 46 300 t of hake landed respectively. In 2006, the total landings decreased to 41,810 t.

Over the period 1995 to 2001, the decrease in landings was mainly observed in Sub-area VIII from 28 100 t in 1995 to 9 200 t in 2001. At the same time, landings in Sub-area VII fluctuated around 20 000 t (23 100 t in 2001). In Sub-areas IVa-VI, a decrease in landings is observed from 1995 to 1998 (5 300 t and 3 200 t respectively). In Sub-area VIII, after an increase in the landings of more than 6 000 t in 2002 , there has been a stabilization in 2003 and 2004 at 15 300 and 15 500 t respectively. The observed increase in landings between 2003 and 2004 is mainly located in Sub-area VII and in Sub-areas IVa-VI where landings have increased by 1 660 t and 3 470 t respectively. In 2006, landings have decreased in both Sub-area VII and VIII.

Until 2002, the only discards series available for the WG were those of the French artisanal and coastal trawl fisheries in the Bay of Biscay, estimated on the basis of the length compositions obtained during FR-RESSGASC surveys. The RESSGASC survey used for their estimation ended in 2002.

A new sampling program of discards in the French Nephrops trawlers fishery of the Bay of Biscay started in June 2002. Estimates obtained by this program for 2003 and 2004 and 2005 (respectively 1034t (with a CV of 18%), 1360t (with a CV of 19%) and 1596t (with a CV of 19%)) were significantly different (by a factor 2 to 10) from previous estimates for that fishery. Such discrepancies could be explained by changes in the sampling, changes in the discarding practices, variations in the abundance of small fishes or by a combination of the three. In 2006, discards estimates were significantly smaller at 532t (with a CV of 16%).

Discards were estimated for Danish trawlers and seiners fishing in Sub-area IV since 1995 and for gill-netters from 1995 to 2001. Their values are quite variable from year to year from 100 to 300t.

Additional information on discards was available for the Irish otter trawlers fishery in Sub-areas VI and VII from 1996 to 2001 and for 2004 and 2006 (values from 150 to 1360 t, not raised in 2006) and for UK-EW from 2000 to 2006.

Estimates of discards for the Spanish trawl fleets operating in the ICES Sub-area VII and Div. VIIIabd are available for 1988, 1989, 1994, from 1999 to 2001 and from 2003 to 2006. In Sub-area VII, an increase in estimated discards rate was observed in 2003, 2004, 2005 and 2006 when compared to previous years. Discards were estimated to vary from very small amounts to more than 1000t in 2004 and 2005. CVs were highly variable from 20% to more than 100%. The current raising procedure based on landings is not considered satisfactory (see WD7) and will be revised in the near future. This may lead to important revision in discards estimates for those fleets.

All information available suggest that discards rate could be high (up to 95%) in some years, area and for some fleets. Improvement in discard data availability (number of fleets sampled and area coverage) has been observed in recent years. However, sampling do not cover all fleets contributing to hake catches, discards rates of several fleets are simply not known and when data are available, it is not possible to incorporate them in a consistent way. Furthermore, reconstructing an historical series is still problematic. As last year, the Group therefore decided not to include discard estimates into the full time series of catch at age data.

3.2.2 Biological sampling

The sampling level is given in Table 1.1.

Length compositions of the 2006 landings by Fishery Unit and quarter were provided by Denmark, France, Ireland, Spain and UK(E&W), which together contribute the majority of the catches. Annual catch figures were provided by other countries and, in most instances, were taken from the official statistics. Length compositions samples are not available for each FU of each country in which landings are observed. It is therefore necessary to calculate the length compositions of catches or landings of some countries using samples from other FU and/or countries. The length distribution substitutions are outlined in Table 3.2. The international length compositions for 2006 by fishery units are given in Table 3.3. The length distribution of catches (landings and discards) over the period 1978-2006 is given in Figure 3.1.

Since 1998, the number of fish from 15 cm to 25 cm in length have decreased in the landings, and then the mean length in landings and catches over the period 1998-2006 have higher values in the series (more than 35 cm) (Figure 3.2).

2006 quarterly ALKs were available from France and Spain.

Spanish quarterly ALKs were available from two Institutes. From the AZTI Institute where sampling was conducted on the Basque fleet fishing mainly in Sub-area VIII and partly in Sub-area VII, and from the IEO Institute where sampling was conducted on the Spanish fleet fishing in Sub-area VII.

After examination of all ALK available, it was decided to use, as in previous years, an annual ALK obtained by summing the number of otolith read at age. As last year, the French and both Spanish ALKs were combined and the resulting ALK was applied to the annual length composition of the international landings, in order to estimate the landing-at-age composition and mean weights at age.

ALKs based on otolith (sagitta) reading for Northern hake are used from 1992; prior to that, age composition of the catches was estimated using the numerical method. From 1992 to 1998 only French ALKs were employed, in 1999 French and Spanish (from AZTI) were merged, and since 2000 French and Spanish (AZTI and IEO) were combined.

Results obtained during the 4th otolith exchange conducted in 2003 (Pineiro *et al*., 2005, WD 8 of last year WG) indicated that while for younger fish (up to age 3), the age estimation criteria are similar between readers, this is not the case for older fish. Furthermore, in 2003 the precision (consistency between readers) of age estimation has decreased when compared to previous otoliths exchange conducted in 2001 (from 25 to 48%).

Related to this issue, some preliminary results on growth and accuracy of age determination from otolith reading were obtained from a tagging study conducted in 2002 in the Bay of Biscay (de Pontual et al. 2003., de Pontual, pers. comm.). They show an under-estimation of growth and inaccuracy in the current ageing criteria used by hake otoliths readers. However, the small size of the sample analysed and its spatial and temporal coverage makes it difficult to draw reliable conclusions.

From those results, the 3rd Workshop on European Hake Age reading held in 2004 (Pineiro *et al*., 2005) recommended to interrupt the supply of age reading data to WGHMM, while still collecting samples, and to carry out validation studies.

In 2005, while sharing the workshop concerns, the Working Group suggested that in the context of an age-structured assessment and in the absence of validated criteria, an alternative would be to generate an ALK based on historical data or to use numerical methods. The group noted that while this approach would reduce the effort devoted to otolith reading, which may be used to improve age determination, it would also smooth out yearly variations in the age composition without really addressing/solving the issue of inaccuracy of ageing criteria.

This year, no new information was provided to the WG on this issue. As a consequence, to assess the consequences of inaccurate age reading, the group decided to carry out, as last year, an alternative assessment using a “simulated ALK” based on different growth assumptions (Bertignac and de Pontual, 2007).

The landing-at-age matrices input to XSA obtained with the observed ALK is given in table 3.4 and the one obtained with the “simulated” ALKs is available in ICES Files (“Table-Landings-ALK.xls”). The corresponding mean weights at age in the landings (also used as mean weights in the stock) are given in Table 3.5 and in ICES Files (“Table-Weight-ALK.xls”) respectively. Abundance of age groups 0 and 1 in the landings have been much lower since 1998.

As in previous years, quarterly ALKs have been applied to quarterly catch compositions for the Basque VHVO bottom pair trawlers and for the Otter “Baka” trawl of Ondarroa. For the rest of the commercial fleets used in the assessment an annual ALK has been used.

The landing-at-age and effort data available for XSA tuning are given in Table 3.6 for the observed ALK and in ICES Files for the simulated ALK (“Table-Tuning-Data-ALK.xls”).

The natural mortality is assumed to be constant at age (0.2) for all runs.

The maturity ogives, for both sexes combined are:

Age	0	1	2	3	4	5	6+
Current ALK*	0.0	0.0	0.0	0.2	0.6	0.9	1.0
Simulated ALK	0.0	0.1	0.7	0.9	1.0	1.0	1.0

*(Martin, 1991; ICES CM 1993/Assess: 3)

The SSB is calculated at the 1st January.

3.2.3 Abundance indices from surveys

The FR-RESSGASCS surveys was conducted in the Bay of Biscay from 1978 to 2002, the FR-EVHOES survey conducted in the Bay of Biscay and in Celtic Sea with a new design since 1997, the UK-WCGFS survey conducted in Celtic Sea from 1988 to 2004 when it stopped, and the SP-PGFS survey conducted on the Porcupine bank since 2001. Table 3.6, and Figure 3.3a and b show the abundance indices (only for ages 0, 1 and 2 for the three first) obtained from these surveys.

The decision by Cefas to cancel the WCGFS in 2004 was a difficult decision to take but was reached after careful consideration of Cefas’ commitments and priorities. However, the survey was not a Priority 1 survey under the EC DCR. Cefas recognizes the importance of a continuing UK contribution to sampling in the area previously surveyed and is collaborating with Marine Institute, Ireland and the RCM NEA to collect biological samples.

Over the period 1978-1997 the FR-RESSGASCS surveys were conducted on a quarterly time period. Survey data prior to 1987 have been excluded, since there was a change of vessel at that time. Weather conditions encountered by FR-RESSGASCS in 2002 gives to this index a poor reliability and it was decided not to use it. Since 1987, the recruitment index has been following a slight decreasing trend. For age 1 and 2, the index has fluctuated without trend.

From 1997, the FR-EVHOES survey is conducted in autumn and covers both the Bay of Biscay and the Celtic Sea with a new design. After two consecutive years of increases, the abundance index for age 0 dropped in 2003, showed a sharp increase in 2004 and dropped again in 2005. The index has increased again in 2006 without reaching the 2002 and 2004 levels. Abundance indices for ages 1 and 2 are variable with no marked trend. As in last year, the group noted that the strong signals observed in age 0 in recent years (2001, 2002 and 2004) did not appear the following year in the age 1 index. Furthermore, conflicting signals are observed between Age 0, Age 1 and Age 2 of the 2003 cohort. While it was not possible to propose any satisfactory explanation to such apparent inconsistency, it was suggested, as in previous years, that this may reflect an ageing problem.

The UK-WGCFS survey was conducted in March in the Celtic Sea from 1988 to 2004 and thus does not include 0-group fish (Figure 3.3a). Numbers at age 1 and 2 were estimated from length compositions using a mixed distribution by statistical method. Indices at age 1 and 2 show high variability and no trends.

The SP-PGFS survey is conducted on Porcupine’s Bank since 2001. Abundance index from younger ages (Age 0, 1 and 2) followed an increasing trends since 2003 while decreasing trends are observed on age 5 and 6. Age 0 index increased sharply in 2006. Age 4 followed an increasing trend since 2004 which is somehow inconsistent with subsequent age trends. This may be due to problem with the ALK used and/or migration from other areas. This will be investigated in the future. It was noted as last year that this survey may provide indices of abundances mainly on older ages.

Spatial distribution of FR-EVHOES age 0 index are given in Figure C.1. In 1999, the Erika shipwreck limited the spatial coverage of this survey in the Bay of Biscay.

Index of abundance from two Irish Groundfish Surveys have been provide to the group (ISCSG from 2000 to 2002 and IGFS from 2003 to 2006). The data series not being long enough has not been used in the current assessment but may be considered for inclusion in the future

3.2.4 Commercial catch-effort data

Commercial fleets used in the assessment to tune the model

Total effort and LPUE data for the period 1982-2006 are given in Table 3.7a,b and LPUE are presented in Figure 3.4a,b.

Data from several Spanish fleets are candidates for tuning the VPA, namely trawlers from A Coruña and Vigo fishing in Sub-area VII (SP-CORUTR7 and SP-VIGOTR7), pair trawlers from Ondarroa and Pasajes fishing in Sub-area VIII (SP-PAIRT-ON8 and SP-PAIRT-PA8) Effort and LPUE data for the period 1982-2006 are given in Table 3.7a and Figure 3.4a

The A Coruña trawler fleet, targeting mainly hake, operates in deeper waters close to the slope in Div. VIIb-c, j-k, while the trawler fleet from Vigo, targeting megrim, works in shallower waters in Div. VIIj-h and catch hake as by-catch. Both pair trawler fleets from Ondarroa and Pasajes are targeting hake in the Bay of Biscay

Since 1985, the LPUE of A Coruña trawlers has fluctuated, with an increasing trend reaching its maximum value in 2000. Over the same period, LPUE from Vigo trawlers followed a slight decreasing trend, becoming less variable during the last 15 years. Since 2002, it shows an increasing trend.

LPUE from Ondarroa and Pasajes pair trawlers have followed similar trends and have been quite variable. Two peak values have been observed in 1995 and 2002. In 2005, both fleets have experienced a decrease in effort (expressed in number of days) which correspond to a decrease in number of vessels. This decrease has continued further for the Pasajes pair trawlers.

Commercial fleets not used in the assessment to tune the model

Effort and LPUE data for some other Spanish fleets fishing in Subarea VI, VII and Divisions VIIIa,b,d and from French fleets fishing in Divisions VIIIa,b,d provided to the Working Group are given in Table 3.7b and Figure 3.4b.

For the fleets for which a long enough series of LPUE is available (i.e., Ondarroa “Baka” trawlers fishing in Subarea VI, VII and Div. VIIIa,b,d, Pasajes “Bou” trawlers fishing in Sub-area VIII, longliners from A Coruña, Celeiro and Burela in VII, longliners from Avilés in VIIIa,b,d and trawlers from Santander in VIIIa,b,d) there is no marked trend in the LPUE, except for Ondarroa “Baka” trawlers in Subarea VII targeting hake and megrim until 1996 and megrim and anglerfish with lower hake LPUE since then.

Due to important reductions in the availability of log-book information in recent years for both French fleets from Les Sables and Lesconil, LPUE values for the years 1996 onwards have low reliability. Effort and LPUE for the period 1987-2003 are given in Table 3.7b and presented in Figure 3.4b only for the period 1987-1995.

LPUE values of Spanish gill-netters that started to fish hake in Subareas VII and VIII in 1998 present in general an increasing trend in both sea areas until 2002. LPUE of the gillnet fleets operating in Subareas VII decreased in 2006. It is to be noted that only a small number of ships are involved in the gillnet fishery which makes LPUEs very sensitive to small changes in the number of trips. It is also noted that for gill-netters and long liners, LPUEs expressed in kg/day are maybe not the most appropriate.

3.3 Assessment

Following concerns over the accuracy of aging data and the calculation of historic catch-at-age data, the group decided, as last year, to conduct two preliminary runs, one with the observed ALK based on otolith readings provided to the group (referred as "2006 Update") and another with a simulated ALK as presented above (referred as "Simulated ALK"). As no data revisions have been carried out and/or new information has been provided since last year, the runs were simple updates with one more year added to the data.

3.3.1 Input data

For all runs, discards have been removed from the whole series (see section 3.2.1).

The Group did not have confidence in the estimate of age 0 in the landings because of inconsistencies in the data for this age group in recent years. Therefore, age 0 was removed from the catch at age matrix (replaced with 0 landings) and from the commercial fleet data. However, age 0 is still used in the assessment because indices for age 0 are available from surveys.

Large numbers of individuals are present in the 8-plus group of landings data used in the run "2006 Update", mainly before 1992 (Table 3.4) while it is not the case for the "Simulated ALK" one (Table "Table - Landings ALK.xls" in ICES Files).

3.3.2 Model

As in previous years, the model chosen by the Group to assess the history of the stock dynamics was XSA.

Data screening

A separable VPA was carried out to screen the landing-at-age data set of "2006 Update" using a terminal F of 0.4 at age 3, and 1 for terminal S. The results show that, except for age 1 where some very large residuals were detected (see file "Separable-residuals.xls" in ICES Files), residuals are generally small and do not follow any systematic pattern in recent years.

Exploratory XSA runs

In the 1998 WG it was found that the SSB estimates for 1985-1987 were very sensitive to the q plateau options between age 5, 6, and 7 (which is the last true age). To reduce this effect, it was decided to extend the ten years window to a twelve-year period in order to tune to the longest available and well behaved fleet data series. In the 1999 and 2000 assessments, SSB estimates for 1985-1987 were still sensitive to the extent of the tuning period, and the longest (13 years and 14 years respectively) provided the best pattern for these years, whilst other estimates were very similar for other years. In 2001 assessment, it was decided to use the whole tuning data available and a taper time weighting to reduce the influence of the older years. At that time, this choice did not change radically the estimates of trends in F and SSB. Those settings have been maintained in subsequent assessments.

This year, the group investigated again the influence of the taper time weighting and a third run was conducted without taper. It is labeled "Update 2006 with no taper".

Final run

The same settings as in 2006 were retained for the final runs. Eight fleets were selected for the "2006 Update" run and the "2006 Update no taper" exploratory run. Seven fleet were selected for the "simulated ALK" run. Not like last year when all the runs were presented in the core of the report and not as annex as is usually the case, it was decided, this year, to present in the report and comment the outputs only for the "2006 Update" run. Complete outputs for the two other runs can be found in ICES Files and summary plots are presented in annex (Figures C2 and C3). However, in order to compare alternative hypothesis in terms of age reading and confidence levels in earlier years tuning fleets indices, a comparison of the trends for the three runs is still presented in the core of the report (Figure 3.8 a-b).

Final XSA settings used this year, and previous configurations are detailed below:

	WG 2006				WG 2007			
Fleets	"2005 Update"		"Simulated ALK"		"2006 Update"		"Simulated ALK"	
SP-CORUTR7	85-05	3-7	-	-	85-06	3-7	-	-
SP-VIGOTR7	82-05	2-7	82-05	1-5	82-06	2-7	82-06	1-5
SP-PAIRT_ON8	94-05	2-6	94-05	1-3	94-06	2-6	94-06	1-3
SP-PAIRT_PA8	94-05	3-6	94-05	1-3	94-06	3-6	94-06	1-3
FR-RESSGASCS	87-01	0-5	87-01	0-5	87-01	0-5	87-01	0-5
FR-EVHOES	97-05	0-5	97-05	0-4	97-06	0-5	97-06	0-4
UK-WCGFS	88-04	1-2	88-04	1-2	88-04	1-2	88-04	1-2
SP-PGFS	01-05	2-7	01-05	0-7	01-06	2-7	01-06	0-7
Taper		Yes (3 over 20)		Yes (3 over 20)		Yes (3 over 20)		Yes (3 over 20)
Tuning range		Full		Full		Full		Full
Ages catch dep. stock size		No		No		No		No
q plateau		6		6		6		6
F shrinkage se		1.0		1.0		1.0		1.0
year range		5		5		5		5
age range		4		4		4		4

3.3.3 Assessment results

The diagnostics from the final XSA for this run is given in Table 3.8.

Survivors at age 0 and 1 (year class 2005 and 2006) are only estimated by the FR-EVHOES indices. For age 2, four fleets contribute to the estimation of survivors : SP-VIGOTR7, SP-PAIRT-ON8, FR-EVHOES, surveys and SP-PGFS and their estimates are not very consistent. FR-EVHOE contributes the most with 63% of the weight. For the older ages there is a reasonable consistency in the estimates of survivors between indices. However, for several indices, inconsistencies are apparent between age groups survivors estimates. This is particularly true for the FR-EVHOE survey indices (see the year class 2004 in the detailed XSA output in ICES files: "2006_update.csv").

Log-catchability residuals resulting from XSA for each fleet and selected ages are presented in Figures 3.5.a to c. Some trends in catchabilities are apparent on SP-CORUTR7 even though these trends were not apparent in single fleet runs.

Due to the short period covered by SP-PGFS survey, the retrospective analysis was carried out for the "2006 update" run without this fleet. (Figure 3.6). It showed a tendency to under-estimate F and over-estimate SSB slightly in recent years. Furthermore, SSBs are revised upwards for the earlier part of the series as more years are used in the analysis. In that case, the earlier years of the SP-VIGOTR7 and SP-CORUTR7 tuning series are not used in the assessment and only the F shrinkage remains. Recruitments tend to be poorly estimated. Low values are revised upward and high values downwards when new years are added to the data series.

Mean F2006 was estimated at 0.21 and SSB at 139 900 t.

Summary results from the final XSA are given in Tables 3.9 to 3.11 and Figure 3.7.

3.3.4 Year-class strength and recruitment estimations

The 2004 year class is estimated at 203 million. This estimate, 9% over the GM90-04 (186 million), is mainly determined by the FR-EVHOES surveys (with a weight of 64%). The Working Group noted that this year class was estimated to be much lower than during last year's fit (480 million, a 57% decrease).

Due to the end of UK-WCGFS (stopped in 2004), the recruitment in 2005 is now only estimated by FR-EVHOES (with a weight of 86%). This recruitment (106 millions) is 42% less than GM90-04. It must be noted that it has been revised downwards compared to last year estimates (153 million, a 31% decrease). The 2006 year class is estimated at 212 million, 14% over GM90-04. As, each year, there are large uncertainties associated with the level of the most recent recruitments which are only estimated by FR-EVHOES (this year, the 2005 and 2006 recruitments), until this is confirmed, it was decide to replace 2005 and 2006 recruitments by GM90-04 (186 million).

3.3.5 Historic trends in biomass, fishing mortality and recruitment

A comparison of the three runs showing the assessment uncertainty, is presented in Figure 3.8a and b.

No trends are observed in mean F over the period covered by the assessment for all fits. In recent years, a decreasing trend is observed from 1995 to 2006.

SSB trends can be split into two different periods:

- Before 1998, the three runs exhibit large differences and give different perceptions of the stock history. After a plateau at high level before 1986, SSB estimated in the "2006 update" run decreased sharply to a low level and stays at that low level. Such a decrease was not observed in the "2006 update with no taper" trends which is more stable. SSB from the "simulated ALK" also decreases, after a maximum reached in 1984, but at a much lower rate than in the "2006 update" case.

- After 1998, the three trends are similar and SSB increases. This increase is however sharper in the "simulated ALK" run than in the two others.

For all fits, recruitment show similar trends with a slight declined in the 90s.

3.4 Catch options and prognosis

The group noted that due to the impossibility to account, in a satisfactory manner, for discards into the assessment, fishing mortalities on young ages used in the predictions are under-estimated. This would lead to over-optimistic projections at status quo but could also reduce the impact of a decrease in F or an effective improvement in fishing pattern.

3.4.1 Short – Term projection

Results of short term predictions and yield per recruit are presented only for the “2006 Update” run.

Input data for the catch predictions are given in Table 3.12.

The Working Group decided to use the average F at age of the last three years for prediction purposes.

Mean weights in landings are the averages for 2004-2006. Population at age 3 and above at the start of 2007 was the XSA estimates. GM90-04 recruitments at age 0 was assumed for 2005 and subsequent years.

Landings and SSB predicted for various levels of fishing mortality in 2008 are given in Table 3.13 and Figures 3.9. The detailed output of predictions for 2007-2009 under status quo F is given in Table 3.14. The contribution of different year classes to predicted landings in 2008 and SSB in 2009 is summarised in Table 3.15. The estimates of year classes for which GM90-04 recruitment has been assumed will contribute to 15% of landings in 2008 and 18% to SSB in 2009.

Maintaining status quo F is expected to result in increase in landings close to the 2007 TAC (52,680 t). SSB is also expected to increase.

3.4.2 yield and biomass per recruit analysis

Results of equilibrium landings and SSB per recruit based on the status quo exploitation pattern are presented in Tables 3.16. Considering the yield curve, F_{max} and $F_{0.1}$ are respectively estimated to be 70% and 40% of reference F. The maximum yield is 3% above the current yield.

3.5 Biological reference points

In 2003, ACFM updated precautionary reference points following a revision of the assessment model and input data in recent years. The new points are presented in the table below together with previous values.

	WG 1998	ACFM 1998	ACFM 2003
$\mathbf{F}_{lim}$	No proposal	0.28 (= $\mathbf{F}_{loss}$ WG 98)	0.35(= $\mathbf{F}_{loss}$ WG 03)
$\mathbf{F}_{pa}$	No proposal	0.20 (= $\mathbf{F}_{lim}$*$e^{-1.645*0.2}$)	0.25(= $\mathbf{F}_{lim}$*$e^{-1.645*0.2}$)
$\mathbf{B}_{lim}$	No proposal	120 000 t (~ $\mathbf{B}_{loss}$= B_{94})	100 000t(~ $\mathbf{B}_{loss}$= B_{94})
$\mathbf{B}_{pa}$	119 000 t (=$\mathbf{B}_{loss}$= B_{94})	165 000 t (= $\mathbf{B}_{lim}$*$e^{1.645*0.2}$)	140 000t(= $\mathbf{B}_{lim}$*$e^{1.645*0.2}$)

Due to the uncertainty associated with the perception of the current stock history, it is neither possible to assess the validity of the current precautionary reference points nor possible to propose any revisions. It must be noted that current precautionary reference points are not valid for the “2005 Update with no taper” and “Simulated ALK” runs

3.6 Evaluation of Recovery Plan

3.6.1 Background

Following concerns in the late 1990s about the low level of the stock biomass and the possibility of recruitment failure a range of technical measures were introduced (Council Regulations N°1162/2001, 2602/2001 and 494/2002) aimed at improving the selection pattern and protecting juveniles. Subsequently a recovery plan was introduced (Council regulation EC Reg. No 811/2004).

The technical measures comprise a 100 mm minimum mesh size for otter-trawlers when hake comprises more than 20% of the total amount of marine organisms retained onboard, with a dispensation for those vessels less than 12 m in length and which return to port within 24 hours of their most recent departure. Further, two areas have been defined, one in Sub area VII and the other in Sub area VIII, where a 100 mm minimum mesh size is required for all otter-trawlers, irrespective of the proportion of hake caught.

The recovery plan consists of setting a TAC equivalent to a target F of 0.25 (Fpa), or a lower F to prevent decline in SSB, and with the constraint that annual change in TAC should not exceed 15%.

An STECF “Hake Technical Measures meeting” (Lisbon, 2003) was requested to evaluate the impact of the technical measures in 2003. No simulations were conducted during that meeting and the group concluded that, with the information available, it was not able to measure any impact. WGHMM has also been asked previously to evaluate the measures, but considers that the scarcity of detailed spatially structured information and natural variations in the system preclude attributing improvements in the stock situation as the direct consequence of the technical measures.

Previous work to evaluate management plans has been carried out for this stock (Kell et al., 2005), but this was done before changes to the reference points were made and before the introduction of the technical measures and recovery plan. The software CS (version 4) was used to evaluate an HCR for northern hake at an STECF sub-group in 2002, but the Measures for the recovery of the northern hake stock that were finally established in 2004 are different from the one tested above and have not yet been evaluated.

An evaluation of the management plans was carried out during last year WG. It suggested that given the dynamics assumed and if perfectly implemented then the recovery plan would be successful in meeting its aims with a high probability (>95%) and is in accordance with the precautionary principle. The results were reasonably robust to a range of plausible stock recruitment relationships.

The Group considered however that a more complete evaluation of the management plan was still required. This would imply more information and /or more explicit modelling regarding the major sources of uncertainty including: stock recruitment relationships, discarding, TAC overshoot and growth rates using more realistic levels of uncertainty. The Group thus recommended further work be carried out to obtain information in these areas and that more in depth analyses be carried out to evaluate the potential effects on assessment and management.

This year, further analysis was thus carried out using an operating model developed as part of FLR (see : “http://www.flr-project.org/doku.php?id=team:paperflcore”).

3.6.2 Approach and models

Simulations were carried out using an algorithm coded in FLR (WD 24: Garcia *et al* 2007). The simulation algorithm is divided in different models that simulate the different subprocesses of a management procedure. The operating model which describes the population and the fishery dynamics, the observation model that is used to obtain the necessary information from the simulated system to run the assessment model, the management decision model which takes the output of the assessment to feed the Harvest Control Rule (HCR) and derive a TAC and the implementation model which describes the commitment of the fishery with the TAC set.

Medium to long-term stochastic projections were carried out to evaluate the recovery plan using data from 2006 assessment and three different stock recruitment relationships fitted to the data by maximum loglikelihood, Ricker, Segmented Regression and Segmented Regression with breakpoint in B_{lim} = 100000 tonnes.

3.6.3 Assumptions and input data

The population was initialized in 1978 using the numbers at age estimated by the XSA and was carried forward until 2005 using the fishing mortality estimated by the it, the survival and Baranov catch equations and the stock recruitment relationship with a multiplicative lognormal error around it. In 2006 it was assumed that the fleet would fully accomplish with the TAC set (43900t). In the projection part an assessment was carried out yearly and the HCR associated with the recovery plan was applied to the output of it to calculate a TAC for the next year. The fishing mortality was then estimated each year using the TAC set and the real population numbers simulated within the algorithm. The selection pattern and the weights at age in the projection part were the un-scaled average for the last three years.

As there is no prior information about the plausibility of each the stock recruitment relationship, the same weight was given to the simulations obtained with each of the stock recruitment relationships.

3.6.4 Results

The spawning stock biomass of the northern hake stock has been increasing recently and in 2006 was estimated to be around Bpa (1400,00t), while F was just below Fpa. The recovery plan therefore implies a slight increase in Fsq, provided that SSB does not reduce.

Under the assumed dynamics the results are shown in figures 3.10 and 3.11 and table 3.17.

At present the probability of SSB being below Bpa is 67% and it will increase until 95% in the medium to long term (2020). Afterwards it will start increasing and in the last year of the simulation, 2030, the probability of being above Bpa will decrease until 10%. Regarding Blim, in the first two years the probability of being above it, will be 90 and 95% respectively, and from 2008 to 2027 the probability will be 100% , however in the last three years of the simulation it will decrease slightly.

SSB will continue increasing until 2011, when it will reach, in median, a value of 182,400t, and then it will start decreasing until 2027, stabilising around 110,000t.

Yield will increase during the initial phase of the plan, reaching, in median, 69,000t in 2015, then it will fluctuate around 62,000t.

Despite the Recovery plan establishes a maximum F of 0.25, the probability of being above Fpa = 0.25 will be always greater than 20%, and it will be very close to 100% in several years. This mismatch between the HCR and the reality is a consequence of two facts, first the data used in the HCR is the output of the assessment, which not corresponds exactly with the true values in the population, in fact, in the simulation, XSA overestimates SSB and underestimates F systematically. Second, within the HCR assumptions must be made about the recruitment in the year of application of the HCR and the year after, in this simulation, within the HCR it is assumed that the recruitment will be equal to a geometric mean of the estimated recruitment from 1990 to two years before the last year in the assessment, as it was done in the sort term forecast last year. If the SSB is decreasing the assumption of a geometric mean recruitment will lead to a substantial overestimation of it.

The constraint of 15% change in TAC in violated in two years, 2016 and 2022, because in these years the estimated SSB is below Blim.

In figure 3.11 the SSB obtained with each stock recruitment relationship is shown, whereas using Ricker or Segmented Regression with breakpoint in Blim the SSB initial projections years is above Bpa in all the iterations of the simulation n whit Segmented Regression stock recruitment relationship it is below Blim with a probability of 100%.

3.6.5 Conclusions

Last year analysis of recovery plan suggested that it would be successful in meeting its aims with a probability greater than 95% in the sort term, however using this approach it would be successful with a probability of almost 95% but in 12 years time.

This analysis shows the importance of considering the uncertainty in the stock recruitment relationship, both in the functional form and the deviation around it, and the bias in the HCR performance due to the error in the assessment.

There are other sources of uncertainty in the population and the management process that should also be taken into account to analyse properly the robustness of the whole management strategy to them. Uncertainty in biological parameters such as growth, maturity and natural mortality, uncertainty in the data such as bias in the abundance indices and the catch at age matrix and on the assessment model. Furthermore, the uncertainty in the implementation due to differences between HCR output and advice and the compliance of the fleets with it must be taken into account.

3.7 Comments on the assessment

As in last year, discards were removed from the whole catch-at-age matrix and it was decided to exclude the age 0 in the international catch at age matrix.

Several sources of uncertainties remain for this stock:

- CPUE indices on the earlier year of the series.
- Non validated ageing criteria.
- Decrease in the precision of age estimation in recent years.
- Substantial uncertainty associated with total catches, particularly on small ages.
- Estimation of recruitment in recent years due mainly to inconsistencies in younger age indices from the FR-EVHOES survey. As this survey is thought to provide a reliable age 0 index, this may reveals an ageing problem and/or be the consequence of using an spatially aggregated index for a stock with spatially variable recruitment (Figure C.1.).

Alternative runs conducted by the WG indicate that results are very sensitive to each of this uncertainties.

The assessment is consistent with last year in terms of F and SSB (Figures 3.12). High variability in the most recent recruitment estimates is moderated as more data are available for those year classes.

To validate age determination the Working Group participants support the project of conducting a large scale tagging experiment.

3.8 Management considerations

Despite the difficulties to describe the current state of the stock and perceive the historical stock dynamics with confidence, consistencies in the recent trends between runs should be taken into consideration for management purpose.

The main concern regarding this stock was the low levels of SSB since 1992. In all this year assessments, there are some indications of an increase in SSB, although its strength is uncertain.

After increasing estimates of recruitments in recent years (1998-2002), FR-EVHOES survey index indicates a drop in 2003 a sharp increase in 2004 and again a drop in 2005. In 2006, the index increased again without reaching the 2004 level.

Short-term forecasts of SSB and yield are influenced by several strong year classes estimated in recent years. It should be noted however that year class strengths are poorly estimated as shown by the retrospective analysis.

The Group is concerned by the under-estimation of F on young ages, as it introduces bias in short-term and long-term projections.

The evaluation of the management plans carried out during the WG suggest that given the dynamics assumed and if perfectly implemented then the recovery plan would be successful in meeting its aims with a high probability (>95%) but at a longer term (12 years) than what was estimated in last year assessment. The results are reasonably robust to a range of plausible stock recruitment relationships

References

Mattiucci, S., Abaunza, P., Ramadori, L., Nascetti, G. (2004). Genetic identification of *Anisakis* larvae in European hake from Atlantic and Mediterranean waters for stock recognition. *Journal of Fish Biology,* 65(2): 495-510

Bertignac, M., and de Pontual, H. (2007). Consequences of bias in age estimation on assessment of the northern stock of European hake (*Merluccius merluccius*) and on management advice – ICES Journal of Marine Science, 64, 8p.

Table 3.1. Northern Hake. Estimates of catches ('000 t) by area for 1961-2006.

	Landings (1)					Discards (2)	Catches (3)
Year	IVa+VI	VII	VIIIa,b	Unallocated	Total	VIIIa,b	Total
1961	-	-	-	95.6	95.6	-	95.6
1962	-	-	-	86.3	86.3	-	86.3
1963	-	-	-	86.2	86.2	-	86.2
1964	-	-	-	76.8	76.8	-	76.8
1965	-	-	-	64.7	64.7	-	64.7
1966	-	-	-	60.9	60.9	-	60.9
1967	-	-	-	62.1	62.1	-	62.1
1968	-	-	-	62.0	62.0	-	62.0
1969	-	-	-	54.9	54.9	-	54.9
1970	-	-	-	64.9	64.9	-	64.9
1971	8.5	19.4	23.4	0	51.3	-	51.3
1972	9.4	14.9	41.2	0	65.5	-	65.5
1973	9.5	31.2	37.6	0	78.3	-	78.3
1974	9.7	28.9	34.5	0	73.1	-	73.1
1975	11.0	29.2	32.5	0	72.7	-	72.7
1976	12.9	26.7	28.5	0	68.1	-	68.1
1977	8.5	21.0	24.7	0	54.2	-	54.2
1978	8.0	20.3	24.5	-2.2	50.6	2.4	52.9
1979	8.7	17.6	27.2	-2.4	51.1	2.7	53.8
1980	9.7	22.0	28.4	-2.8	57.3	3.2	60.5
1981	8.8	25.6	22.3	-2.8	53.9	2.3	56.3
1982	5.9	25.2	26.2	-2.3	55.0	3.1	58.1
1983	6.2	26.3	27.1	-2.1	57.5	2.6	60.1
1984	9.5	33.0	22.9	-2.1	63.3	1.9	65.1
1985	9.2	27.5	21.0	-1.6	56.1	3.8	59.9
1986	7.3	27.4	23.9	-1.5	57.1	3.0	60.1
1987	7.8	32.9	24.7	-2.0	63.4	2.0	65.3
1988	8.8	30.9	26.6	-1.5	64.8	2.0	66.8
1989	7.4	26.9	32.0	0.2	66.5	2.3	68.8
1990	6.7	23.0	34.4	-4.2	59.9	1.5	61.4
1991	8.3	21.5	31.6	-3.9	57.6	1.7	59.3
1992	8.6	22.5	23.5	2.1	56.6	1.7	58.3
1993	8.5	20.5	19.8	3.3	52.1	1.5	53.6
1994	5.4	21.1	24.7	0	51.3	1.9	53.1
1995	5.3	24.1	28.1	0	57.6	1.2	58.9
1996	4.4	24.7	18.0	0	47.2	1.5	48.8
1997	3.3	18.9	20.3	0	42.6	1.8	44.4
1998	3.2	18.7	13.1	0	35.0	0.8	35.8
1999	4.3	24.0	11.6	0	39.8	0.8	40.6
2000	4.0	26.0	12.0	0	42.0	0.6	42.6
2001	4.4	23.1	9.2	0	36.7	0.5	37.2
2002	2.9	21.2	15.9	0	40.1	0.3	40.4
2003*	2.8	23.7	15.3	0	41.9	-	41.9
2004*	4.5	27.2	15.5	0	47.1	-	47.1
2005*	5.3	26.7	14.4	0	46.4	-	46.4
2006*	6.1	24.9	10.8	0	41.8	-	41.8

(1) Spanish data for 1961-1972 not revised, data for Sub-area VIII for 1973-1978 include data for Divisions VIIIa,b only. Data for 1979-1981 are revised based on French surveillance data. Includes Divisions IIIa, IVb,c from 1976. There are some unallocated landings (moreover for the period 1961-1970).

(2) Discards have been estimated from 1978 and only for Divisions VIIIa,b.

(3) From 1978 total catches used for the Working Group.

(*) Year for which no discards estimates is available

Table 3.2. HAKE Northern stock. Derivation of quarterly length compositions by country and fishery unit for 2006

Country: Unit	Quarter	France	Ireland	Spain	UK(E+W)	Scotland	Denmark	Others
1	1			SP1.Q1.05	SP1.Q1.05			
	2			2	2			
	3			3	3			
	4			4	4			
2	1	SP1.Q1.05			SP1.Q1.05			
	2	2			2			
	3	3			3			
	4	4			4			
3	1	SP3+EW3.Q1.05		SP3.Q1.05	EW3.Q1.05			
	2	2		2	2			
	3	3		3	3			
	4	4		4	4			
4	1	SP4.Q1.05		SP4.Q1.05	EW4.Q1.05			
	2	2		2	2			
	3	3		3	3			
	4	4		4	4			
5	1	EW5.Q1.05			EW5.Q1.05			
	2	2			2			
	3	3			3			
	4	4			4			
6	1				EW6.Q1.05			
	2				2			
	3				3			
	4				4			
8	1	Raised to ALL						
	2							
	3							
	4							
9	1	FR9.Q1.05						
	2	2						
	3	3						
	4	4						
10	1	FR10.Q1.05						
	2	2						
	3	3						
	4	4						
12	1	FR12.Q1.05		SP12.Q1.05				
	2	2		2				
	3	3		3				
	4	4		4				
13	1	FR13.Q1.05		SP13.Q1.05				
	2	2		2				
	3	3		3				
	4	4		4				
14	1			SP14.Q1.05				
	2			2				
	3			3				
	4			4				
15	1		IR15.Q1.05					IR.15.Annual
	2		2					
	3		3					
	4		4					
16	1	SP+DK.16.Annual	SP+DK.16.Annual	SP16.Q1.05	SP+DK.16.Annual	SP+DK.16.Annual	DK16.Annual	SP+DK.16.Annual
	2			2				
	3			3				
	4			4				
00	1	Raised to All						
	2							
	3							
	4							
ALK	1	Annual (FR+SP)						
	2							
	3							
	4							

Table 3.3 Northern Hake. Annual length compositions of landings by fishery unit for 2006. (no estimations of discards were available).

	UNIT															Landings	Discards			Catches
Length	1	2	3	4	5	6	8	9	10	12	13	14	15	16	00	All	9	10		All
5																				
6																				
7																				
8																				
9																				
10																				
11																				
12																				
13																				
14																				
15																				
16																				
17																				
18																				
19																				
20																				
21																				
22																				
23												7				7				
24									1							1				
25				2				2	4			2				11				
26				28				37	21		0	42		1		131				
27				52				128	69		3	192	0	4		453				
28				220				213	119		31	539	1	24		1159				
29				277	1			226	154		73	1019	2	35		1807				1807
30			0	351	1	0		261	232	0	122	1511	4	47		2556				2556
31				384	3	0		260	158	0	155	1537	8	51		2585				2585
32			2	436	7	0		202	130	0	228	1605	15	64		2720				2720
33			1	367	7	0		185	136	0	162	1352	21	64		2320				2320
34	0	0	5	452	17	0		170	132	1	143	1256	29	75		2305				2305
35	2	0	15	420	20	1		137	129	0	114	1010	41	73		1984				1984
36	5	0	7	430	26	1		115	130	0	136	748	39	100		1758				1758
37	4	0	20	469	32	1		101	71	1	215	715	42	98		1789				1789
38	13	1	21	483	26	2		90	97	2	111	655	62	117		1697				1697
39	11	1	28	538	33	2		74	49	2	132	675	65	163		1791				1791
40	25	1	23	607	23	2		52	28	3	87	625	38	243		1776				1776
41	35	2	29	661	19	2		50	30	2	100	523	26	268		1768				1768
42	55	3	13	678	18	2		41	39	4	63	415	23	277		1649				1649
43	37	2	40	573	18	1		25	17	4	66	318	17	223		1356				1356
44	69	4	26	589	19	1		23	26	5	51	210	16	238		1291				1291
45	78	4	35	536	10	1		17	22	6	44	173	20	217		1175				1175
46	103	5	40	468	13	1		16	21	6	43	140	22	215		1103				1103
47	124	6	51	414	4	1		11	15	9	38	84	20	140		928				928
48	184	9	60	409	5	0		8	11	14	20	78	21	136		967				967
49	223	11	62	336	8	0		5	6	9	30	65	37	140		945				945
50	239	12	55	286	7	0		5	11	14	31	61	24	87		840				840
51	254	13	65	247	3	0		6	10	17	29	57	22	81		814				814
52	233	12	62	237	5	0		3	11	12	42	32	17	82		755				755
53	239	12	62	206	2	0		6	14	11	50	31	22	71		734				734
54	260	13	67	186	2	0		3	11	12	62	29	18	97		768				768
55	241	12	84	194	3	0		3	10	14	59	33	18	61		741				741
56	235	12	78	174	1	0		4	3	13	53	33	21	61		696				696
57	238	12	77	136	5	0		3	4	14	53	23	16	118		706				706
58	225	12	81	124	5	0		4	4	13	57	20	10	230		794				794
59	222	11	93	95	2	0		5	3	16	84	19	16	112		687				687
60	211	11	100	108	2	0		3	3	14	81	23	8	143		715				715
61	190	10	97	88	4	0		4	2	16	67	19	16	52		572				572
62	201	10	97	85	4	0		3	4	11	60	17	10	137		647				647
63	172	9	109	69	4	0		2	6	9	76	15	10	83		570				570
64	157	8	84	67	6	0		3	2	16	69	11	15	66		510				510
65	144	7	93	69	6	0		3	3	9	59	12	16	180		608				608
66	148	8	90	52	4	0		3	2	7	47	11	15	91		485				485
67	129	7	90	40	4	0		1	2	6	32	9	10	22		354				354
68	122	6	76	33	2	0		1	1	7	38	8	14	29		341				341
69	114	6	68	29	1	0		3	2	6	40	5	9	60		347				347
70	107	6	77	25	7	0		2	2	5	33	5	13	8		293				293
71	97	5	62	21	4	0		2	0	5	35	3	15	8		260				260
72	96	5	58	19	3	0		2	1	5	22	4	6	7		230				230
73	78	4	51	16	2	0		0	1	3	32	3	7	40		240				240
74	74	4	52	11	2	0		1	1	2	23	3	5	4		183				183
75	65	3	56	10	4	0		1	1	3	23	2	8	112		290				290
76	62	3	45	8	3	0		0	0	0	35	1	5	43		208				208
77	55	3	39	7	1	0		0	0	1	12	1	4	42		167				167
78	47	2	42	5	4	0		0	0	0	11	1	5	105		226				226
79	44	2	32	4	3	0		0	0	0	9	1	8	78		183				183
80	41	2	29	3	1	0			1	0	8	0	1	8		95				95
81	29	1	28	3		0		0	0	0	3	0	4	4		73				73
82	21	1	26	1	1	0			0	0	4	0	2	36		94				94
83	17	1	25	2				1		0	5	0	2	2		55				55
84	11	1	20	1				0	0	0	3	0	3	2		40				40
85	10	1	16	0	1			0		0	3	0	2	5		39				39
86	6	0	12	0				0		0	1	0	1	5		26				26
87	5	0	13	1	1	0				0	1	0	1	2		23				23
88	3	0	10	0	1			0		0	2	0	1	2		18				18
89	2	0	6	1	0					0	0	0	1	2		12				12
90	1	0	8	0				0	0			0	1	0		9				9
91	1	0	4	0		0					0		1	0		6				6
92	1	0	4	0	0			0			0	0	1	0		7				7
93	1	0	4	0							8	0	0	0		14				14
94	1	0	2	0				0			0	0		0		3				3
95	0	0	2	0							0	0		0		3				3
96	0	0	2	0				0			0	0		0		3				3
97	0	0	2	0		0					0					3				3
98	0	0	1	0							0		0	0		2				2
99	0	0	2	0												2				2
100	1	0	7	0		0		0			0	0		0		8				8
Total N '	5818	300	2845	12845	419	22		2527	1965	328	3530	15990	972	5389		53530				53530
Catch to	9141	471	5401	8255	369	16	279	784	687	455	3307	5391	1011	6069	174	41810				41810

Table 3.4. Northern Hake. Age Composition of the Landings ("Current ALK")

Table 1 Landings numbers at age Numbers*10**-3

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
AGE													
0	1067	515	2208	3525	3471	2242	3734	24126	246	3476	26810	4103	37196
1	35743	27147	29306	40909	33962	34497	16515	12457	23312	9204	14233	16352	20701
2	31482	30751	27015	30497	68206	27618	13470	8401	19799	19362	14461	23560	35202
3	16385	13221	15264	14689	14057	23042	14941	10841	19791	13048	22351	21195	15736
4	8279	7125	12592	10060	10031	15823	18113	5943	7815	16132	10515	14153	13500
5	8402	6765	9150	8705	5634	7574	9158	4969	4676	9187	9515	9556	7614
6	5297	4984	4208	4173	4264	5083	7799	5597	3832	5807	7883	6837	6870
7	2310	3642	3114	3896	2648	2891	3993	4151	2704	3421	6498	3914	4961
+gp	4344	5954	6355	6592	5813	6085	7356	10946	9499	8897	8006	9295	8075
TOTALNUM	113308	100104	109212	123047	148085	124855	95080	87431	91673	88534	120272	108964	149854
TONSLAND	49521	50637	56473	53920	54996	57508	63288	56100	57093	63368	64824	66472	64288
SOPCOF %	103	103	103	96	102	99	100	100	100	100	100	99	102

YEAR	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
AGE													
0	20445	8101	30789	1586	4091	5948	3650	115	52	89	0	0	1
1	43381	20969	36349	35225	22032	12345	27534	2078	1018	744	198	318	744
2	16801	17759	17726	36775	31317	10827	27875	14771	12624	10125	6068	14648	7386
3	16370	19512	16506	22515	28102	15789	14693	16229	20546	19738	11142	18532	15317
4	11857	16907	9132	13459	13787	8563	7153	8556	11012	13100	7223	6808	10530
5	6356	10272	5588	7459	9869	7573	4489	6778	6821	7416	6054	4332	7828
6	4749	6461	5763	4639	5384	8026	4373	3382	4742	5695	5294	5022	5915
7	4506	4215	6012	4616	3380	4305	3513	2087	2834	2754	3601	3396	2940
+gp	6616	6560	6097	4156	4588	4837	5548	3820	2542	3305	3725	4784	2646
TOTALNUM	131082	110757	133961	130429	122549	78212	98829	57815	62191	62965	43305	57840	53307
TONSLAND	52373	56618	52146	51259	57619	47213	42600	35010	39814	42022	36675	40105	41877
SOPCOF %	99	100	100	100	100	100	100	100	100	100	100	100	100

YEAR	2004	2005	2006
AGE			
0	14	192	0
1	1540	1764	453
2	10873	11508	10913
3	14905	13313	16479
4	7653	7394	8204
5	7950	7152	5906
6	6205	6261	4598
7	4107	4119	2574
+gp	4251	3806	4404
TOTALNUM	57498	55509	53530
TONSLAND	47123	46367	41810
SOPCOF %	100	100	100

Table 3.5. Northern Hake. Landings weight at age ("Current ALK")

03/05/2007

Table 2 Landings weights at age (kg)

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
AGE														
0	0.021	0.023	0.021	0.015	0.013	0.014	0.013	0.028	0.015	0.014	0.020	0.014	0.013	0.019
1	0.067	0.071	0.083	0.068	0.058	0.065	0.070	0.077	0.086	0.058	0.070	0.091	0.065	0.063
2	0.177	0.179	0.179	0.173	0.154	0.169	0.183	0.199	0.199	0.195	0.177	0.196	0.178	0.202
3	0.357	0.354	0.357	0.358	0.360	0.340	0.337	0.363	0.346	0.353	0.337	0.347	0.356	0.343
4	0.570	0.570	0.570	0.570	0.560	0.562	0.566	0.562	0.565	0.565	0.564	0.567	0.564	0.574
5	0.836	0.834	0.830	0.829	0.840	0.838	0.843	0.835	0.837	0.836	0.835	0.839	0.841	0.833
6	1.153	1.153	1.156	1.155	1.149	1.152	1.149	1.146	1.155	1.155	1.156	1.152	1.156	1.163
7	1.513	1.517	1.516	1.519	1.517	1.514	1.516	1.514	1.510	1.512	1.512	1.519	1.504	1.490
+gp	2.979	2.735	2.815	2.925	2.899	2.935	2.894	2.620	2.895	2.926	2.562	2.557	2.464	2.459
0 SOPCOF	1.029	1.025	1.027	0.957	1.024	0.990	1.005	1.000	0.999	0.995	0.998	0.990	1.020	0.993

Table 2 Landing weights at age (kg)

YEAR	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
AGE														
0	0.032	0.024	0.025	0.038	0.024	0.040	0.057	0.028	0.019	0.000	0.034	0.075	0.059	0.033
1	0.051	0.059	0.054	0.082	0.051	0.065	0.092	0.099	0.093	0.106	0.125	0.146	0.123	0.114
2	0.155	0.146	0.141	0.190	0.180	0.154	0.179	0.192	0.187	0.180	0.200	0.219	0.222	0.211
3	0.303	0.332	0.305	0.354	0.347	0.302	0.322	0.310	0.318	0.311	0.301	0.344	0.342	0.318
4	0.524	0.570	0.547	0.552	0.533	0.463	0.484	0.534	0.551	0.605	0.548	0.595	0.621	0.587
5	0.797	0.869	0.812	0.837	0.822	0.794	0.790	0.949	0.882	1.057	0.938	0.963	0.982	1.002
6	1.150	1.127	1.183	1.209	1.183	1.212	1.198	1.439	1.265	1.287	1.409	1.403	1.387	1.518
7	1.519	1.595	1.658	1.708	1.610	1.683	1.613	1.770	1.669	1.591	1.696	1.958	1.771	1.943
+gp	2.359	2.479	2.574	2.528	2.441	2.494	2.637	2.644	2.484	2.361	2.269	2.651	2.58	2.751
0 SOPCOF	1.005	0.999	1.000	1.000	1.000	1.000	0.999	1.000	1.000	1.000	1.002	1.000	1.0003	1.0003

Table 2 Landing weights at age (kg)

YEAR	2006
AGE	
0	0.085
1	0.141
2	0.222
3	0.345
4	0.607
5	0.971
6	1.408
7	1.77
+gp	2.7
0 SOPCOF	1.0001

Table 3.6. Northern Hake. Commercial fleets and Surveys tuning data

SP-CORUTR7

1985	2006								
1	1	0	1						
2	7								EFF.
10000	63	269	579	561	622	473	347	1985	14268
10000	1132	2052	639	374	290	187	173	1986	11604
10000	927	2057	3180	1684	751	264	160	1987	12444
10000	426	1250	1160	1191	860	508	239	1988	12852
10000	128	926	1228	1152	824	370	268	1989	12420
10000	141	641	1186	827	647	322	201	1990	11328
10000	258	1239	1212	699	373	236	132	1991	9852
10000	99	1958	3248	1774	556	216	133	1992	6828
10000	102	1289	1355	1025	967	528	167	1993	5748
10000	72	1483	2789	1767	636	428	123	1994	5736
10000	1223	5363	3775	2399	830	270	189	1995	4812
10000	112	1257	1646	2003	1533	564	420	1996	4116
10000	375	1104	1024	1037	852	466	442	1997	4044
10000	113	2094	2445	2506	876	332	289	1998	3924
10000	558	3219	4385	2280	767	309	130	1999	3732
10000	523	5843	7176	3675	1735	427	279	2000	2868
10000	44	1732	3049	2705	1879	943	561	2001	2640
10000	399	2384	1988	1136	848	467	512	2002	2556
10000	509	4566	5501	3001	1310	397	227	2003	3084
10000	383	2855	4033	2943	1417	748	519	2004	2820
10000	821	2154	3013	2815	1591	765	430	2005	2748
10000	340	2785	3802	2644	1266	545	406	2006	2688

SP-VIGOTR7

1982	2006									
1	1	0	1							
1	7									EFF.
10000	51	389	142	96	34	12	4	2	1982	75194
10000	188	638	455	142	34	16	8	4	1983	75233
10000	5	147	231	248	81	30	10	4	1984	76448
10000	15	85	70	45	40	41	23	16	1985	71241
10000	102	151	132	79	45	20	11	11	1986	68747
10000	14	229	135	163	70	37	16	9	1987	66616
10000	24	284	505	168	120	61	28	10	1988	65466
10000	104	168	144	57	23	10	5	5	1989	75853
10000	22	326	169	96	27	13	6	4	1990	80207
10000	42	279	242	80	32	15	8	3	1991	78218
10000	15	304	404	167	38	7	3	1	1992	63398
10000	4	83	200	82	27	18	7	3	1993	59879
10000	3	241	382	131	55	15	8	3	1994	56546
10000	19	172	260	117	62	18	5	3	1995	50697
10000	0	59	183	90	61	40	12	9	1996	54162
10000	2	100	148	77	41	27	13	11	1997	50576
10000	0	110	198	97	50	18	8	7	1998	53596
10000	0	114	330	167	59	21	8	3	1999	50842
10000	3	144	304	120	38	24	8	5	2000	55185
10000	0	58	162	66	39	24	10	6	2001	56776
10000	2	151	228	69	27	20	11	12	2002	50410
10000	23	239	292	90	43	21	7	4	2003	54369
10000	21	184	251	113	50	25	14	10	2004	53472
10000	23	217	130	62	49	28	13	8	2005	52455
10000	9	116	253	85	45	23	11	10	2006	53924

SP-PAIRT-ON8

1994	2006									
1	1	0	1							
1	7									EFF.
1000	14	450	2396	1503	199	76	12	1	1994	362
1000	111	2816	4639	2008	249	35	3	0	1995	959
1000	230	1046	1887	1154	245	99	23	4	1996	1332
1000	249	2153	2964	995	217	74	44	3	1997	1290
1000	144	1840	2152	534	45	16	2	0	1998	1482
1000	14	792	2628	747	118	20	3	0	1999	1787
1000	44	1328	3336	994	148	51	6	1	2000	1214
1000	0	1095	3358	969	135	20	4	0	2001	1153
1000	0	2494	8446	1264	173	24	2	0	2002	1281
1000	0	358	3404	2044	242	117	20	0	2003	1436
1000	15	1083	4007	1015	406	146	15	1	2004	1288
1000	324	3303	3677	1097	259	202	76	5	2005	1107
1000	42	2130	6346	1945	271	114	33	3	2006	1236

Table 3.6. (continued) Northern Hake. Commercial fleets and Surveys tuning data

SP-PAIRT-PA8

1994	2006									
1	1	0	1							
1	7									EFF.
1000	0	37	1050	834	181	106	10	1	1994	423
1000	122	2578	4228	1615	227	46	3	1	1995	746
1000	35	803	1811	1035	303	140	36	6	1996	1367
1000	231	1930	2602	854	195	69	41	2	1997	1752
1000	1	1267	2172	651	113	61	11	1	1998	1462
1000	0	403	2730	1520	300	96	22	3	1999	1180
1000	2	235	2751	1066	236	154	35	13	2000	1233
1000	0	230	2602	979	209	67	9	1	2001	587
1000	0	1552	4357	1953	585	249	27	3	2002	720
1000	0	277	3121	1430	548	274	25	2	2003	754
1000	198	1261	3231	1047	460	217	35	2	2004	733
1000	170	1912	2552	1369	402	173	59	0	2005	252
1000	56	1641	4484	1527	211	90	27	3	2006	182

FR-RESSGASCS

1987	2002									
1	1	0	1							
0	7									
1000	26289	46857	16060	2981	1227	438	255	140	287	1987
1000	23567	33399	12807	7885	1675	576	271	230	198	1988
1000	6125	67091	20389	6907	1887	793	445	239	304	1989
1000	13369	35760	35099	6829	1502	701	374	291	486	1990
1000	10089	39926	9309	5897	792	311	173	94	213	1991
1000	8822	26680	12912	4685	1506	341	134	89	256	1992
1000	11288	24745	31522	6187	766	198	98	100	168	1993
1000	12019	37975	42109	8908	1301	311	106	102	102	1994
1000	11717	47214	23658	6935	1231	723	317	183	122	1995
1000	17003	23658	11805	2665	428	194	144	90	170	1996
1000	5006	24399	33165	5300	788	204	83	58	117	1997
1000	3820	12034	14509	2947	776	341	72	41	79	1998
1000	8935	20366	13514	3182	636	135	58	132	129	1999
1000	6966	16022	14354	5583	745	134	123	79	204	2000
1000	13390	33552	29293	5354	904	160	45	41	71	2001
1000	6807	6898	20653	18303	1463	429	270	171	89	2002*

FR-EVHOES Total — * not used

1997	2006									
1	1	0.83	0.92							
0	7									
1000	40354	6473	8164	1828	300	106	11	4	43	1997
1000	36875	5177	3630	1826	481	72	15	38	46	1998
1000	28205	13404	9071	2342	393	98	87	34	76	1999
1000	32233	2197	3881	1630	616	94	44	4	14	2000
1000	56465	8493	4523	2194	554	103	47	20	51	2001
1000	103477	8355	6202	3615	339	108	34	0	38	2002
1000	28742	8557	4965	1170	199	64	62	14	56	2003
1000	146235	14469	3934	1266	205	48	20	40	91	2004
1000	38937	16480	8718	1736	245	56	34	11	18	2005
1000	65410	4556	5111	1318	462	135	43	31	5	2006

UK-WCGFS

1988	2004		
1	1	0.17	0.25
1	2		
1000	415421	153500	1988
1000	627974	343607	1989
1000	484365	563599	1990
1000	2442891	353970	1991
1000	442857	441300	1992
1000	2363194	210976	1993
1000	1975125	449223	1994
1000	1227609	450588	1995
1000	634164	235538	1996
1000	1064510	263486	1997
1000	781341	218355	1998
1000	1953670	455483	1999
1000	483676	360107	2000
1000	203427	72974	2001
1000	1172148	236674	2002
1000	1837968	319931	2003
1000	845976	301246	2004

SP-PGFS

2001	2006									
1	1	0.67	0.75							
0	7									
1000	310	95	341	975	1114	1964	2917	2143	1509	2001
1000	64	115	1498	2438	971	1709	1343	885	2068	2002
1000	554	409	422	1968	3066	6715	4287	1367	666	2003
1000	2392	1671	520	656	1752	4039	3225	2622	2503	2004
1000	2323	3317	5734	3222	3306	2190	1693	867	550	2005
1000	16091	379	337	1743	4726	2563	1462	772	439	2006

Table 3.7.a. NORTHERN HAKE. Effective effort indices and LPUE values of . commercial fleets used in the assessment to tune the model

Sub-area VII

	A Coruña trawl in VII			Vigo trawl in VII*		
Year	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort**	LPUE**
1982				2051	75194	27
1983				3284	75233	44
1984				3062	76448	40
1985	5612	14268	393	1813	71241	25
1986	4253	11604	366	2311	68747	34
1987	8191	12444	658	2485	66616	37
1988	6279	12852	489	3640	65466	56
1989	6104	12420	491	1374	75853	18
1990	4362	11328	385	2062	80207	26
1991	3332	9852	338	2007	78218	26
1992	3662	6828	536	1813	63398	29
1993	2670	5748	464	1338	59879	22
1994	3258	5736	568	1858	56549	33
1995	4069	4812	846	1461	50696	29
1996	2770	4116	673	1401	54162	26
1997	1858	4044	459	1099	50576	22
1998	2476	3924	631	1201	53596	22
1999	2880	3732	772	1652	50842	32
2000	3628	2868	1265	1487	55185	27
2001	2585	2640	979	1071	56776	19
2002	1534	2556	600	1152	50410	23
2003	3286	3084	1065	1486	54369	27
2004	2802	2820	994	1595	53472	30
2005	2681	2748	976	1323	52455	25
2006	2498	2688	929	1422	53677	26

* Before 1988 landings and effort refer to Vigo trawl fleet only, from 1988 to 2002 to combined Vigo+Marín tra

** Effort in days/100HP; LPUE in kg/(day/100HP)

Sub-area VIII

	Ondarroa pair trawl in VIIIa,b,d			Pasajes pair trawl in VIIIa,b,d		
Year	Landings(t)*	Effort(days)	LPUE(Kg/day)	Landings(t)*	Effort(days)	LPUE(Kg/day)
1982	--			--		
1983	--			--		
1984	--			--		
1985	--			--		
1986	--			--		
1987	--			--		
1988	--			--		
1989	--			--		
1990	--			--		
1991	--			--		
1992	--			--		
1993	64	68	930	--		
1994	815	362	2250	540	423	1276
1995	3094	959	3226	2089	746	2802
1996	2384	1332	1790	2519	1367	1843
1997	2538	1290	1966	3045	1752	1738
1998	2043	1482	1378	2371	1462	1622
1999	2135	1787	1195	2265	1180	1920
2000	2004	1214	1651	2244	1233	1820
2001	1899	1153	1648	941	587	1603
2002	4314	1281	3368	2570	720	3571
2003	3832	1436	2669	2187	754	2902
2004	3197	1288	2482	1859	733	2535
2005	3350	1107	3026	658	252	2611
2006	4173	1236	3377	516	182	2837

* Landings of the pair trawl (two boats)   * Landings of the pair trawl (two boats)

Table 3.7.b. Effective effort indices and LPUE values of commercial fleets not used in the assessment to tune the model..

Sub-area VI

	Ondarroa trawl in VI		
Year	Landings(t)	Effort(days)	LPUE(Kg/day)
1994	164	635	259
1995	164	624	262
1996	259	695	372
1997	127	710	179
1998	89	750	118
1999	197	855	230
2000	243	763	318
2001	239	1123	213
2002	233	1234	189
2003	138	718	193
2004	306	411	743
2005	291	337	864
2006	304	368	827

Sub-area VII

	A Coruña long line in VII			Celeiro long line in VII			Burela long line in VII			Ondarroa trawl in VII*		
Year	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort(days)	LPUE(Kg/day)
1985	3577	4788	747	n/a	n/a		n/a	n/a		n/a	n/a	
1986	3038	4128	736	n/a	n/a		n/a	n/a		n/a	n/a	
1987	2832	4467	634	n/a	n/a		n/a	n/a		n/a	n/a	
1988	3141	3766	834	n/a	n/a		n/a	n/a		n/a	n/a	
1989	2631	3503	751	n/a	n/a		n/a	n/a		n/a	n/a	
1990	2342	3682	636	n/a	n/a		n/a	n/a		n/a	n/a	
1991	2223	3217	691	n/a	n/a		n/a	n/a		n/a	n/a	
1992	2464	2627	938	n/a	n/a		n/a	n/a		n/a	n/a	
1993	2797	2568	1089	n/a	n/a		n/a	n/a		538	1094	492
1994	2319	2641	878	4062	6516	623	2278	3804	599	1084	980	1106
1995	2507	2161	1160	5209	6420	811	2905	3444	843	528	1214	435
1996	2111	1669	1265	5988	6720	891	3245	3636	892	291	1170	249
1997	830	900	922	4174	6144	679	2299	3540	649	109	540	202
1998	292	372	784	2817	4668	603	1639	3000	546	137	1196	115
1999	323	395	817	3447	4980	692	1982	2880	688	195	1384	141
2000	281	276	1018	3699	4440	833	2282	2928	779	249	1850	135
2001	229	276	830	3383	3756	901	3034	3672	826	164	1451	113
2002	214	300	712	2769	3984	695	2399	3732	643	195	949	206
2003	648	1188	545	3386	4404	769	2514	3636	691	112	1022	110
2004	280	312	899	3990	4596	868	3255	3852	845	111	910	122
2005	199	288	691	4177	3930	1063	3074	3507	876	76	544	140
2006	256	312	822	4372	4560	959	3639	5184	702	102	487	210

* From 1996 hake no more targeted

	A Coruña gillnet in VII			Celeiro gillnet in VII			Ondarroa gillnet in VII			Burela gillnet in VII		
Year	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort(days)	LPUE(Kg/day)
1998	192	324	593	818	1572	520	34	73	462	238	444	536
1999	206	252	817	805	1068	754	50	58	869	451	444	1016
2000	237	204	1162	994	1308	760	81	84	969	353	600	588
2001	188	168	1119	674	1008	669	118	117	1007	215	252	852
2002	217	156	1388	631	912	692	189	132	1429	223	276	807
2003	126	192	656	454	660	688				280	348	805
2004	135	144	937	513	756	679				260	264	983
2005	326	300	1087	624	857	728				228	230	992
2006	182	180	1011	497	924	537				56	144	388

Sub-area VIII

	Ondarroa trawl in VIIIa,b,d*			Santander trawl in VIIIa,b,d			Avilés long line in VIIIa,b,d			Avilés gillnet in VIIIa,b,d		
Year	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort	LPUE(Kg/day)	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort(days)	LPUE(Kg/day)
1993	2244	5590	401	n/a	n/a		n/a	n/a				
1994	2817	5619	501	175	640	273	1145	2340	489			
1995	2069	4474	463	131	620	211	1145	2184	524			
1996	944	4378	216	62	530	117	819	2184	375			
1997	2348	4286	548	65	805	81	700	1896	369			
1998	287	3002	96	95	1445	66	353	1044	338	218	780	279
1999	81	2337	34	89	1830	49	567	1392	407	213	564	378
2000	157	2227	70	79	1520	52	553	1344	411	219	492	445
2001	341	2118	161	94	1590	59	893	1974	453	482	780	618
2002	321	2107	152	252	1260	200	314	744	423	392	504	778
2003	230	2296	100	212	1405	151	513	828	620	n/a	n/a	n/a
2004	165	2159	76	200	995	201	592	n/a	n/a	885	n/a	n/a
2005	257	2263	114	120	596	202	n/a	n/a	n/a	n/a	n/a	n/a
2006	216	2398	90	83	636	131	310	1075	288	406	1054	385

* From 1998 hake no more targeted

	Les Sables trawl in VIIIa,b,d*			Lesconil trawl in VIIIa*			Pasajes Bou trawl in VIIIabd		
Year	Landings (t)	Effort (day)**	LPUE (Kg/day)	Landings (t)	Effort (day)**	LPUE (Kg/day)	Landings (t)	Effort*	LPUE*
1982	n/a			n/a			n/a		
1983	n/a			n/a			n/a		
1984	n/a			n/a			n/a		
1985	n/a			n/a			n/a		
1986	n/a			n/a			2394	46719	51
1987	536	8165	66	313	7180	44	3423	50664	68
1988	658	9189	72	361	7140	51	2830	42160	67
1989	895	9192	97	426	5932	72	2912	47193	62
1990	608	9635	63	321	5510	58	3168	50776	62
1991	422	8274	51	382	5451	70	2775	47844	58
1992	166	6865	24	148	5699	26	2790	56228	50
1993	160	6827	23	244	5677	43	2954	55195	54
1994	226	5358	42	215	3830	56	2758	42228	65
1995	476	6600	72	192	4624	42	2800	32819	85
1996	(153)	(4875)	(31)	(80)	(3019)	(27)	666	9502	70
1997	(127)	(4568)	(28)	(20)	(781)	(26)	417	7085	59
1998	(47)	(3309)	(14)	(15)	(597)	(24)	217	3664	59
1999	**(79)**	**(3163)**	**(25)**	**(14)**	**(194)**	**(73)**	--		
2000	**(47)**	**(1759)**	**(27)**	**(26)**	**(362)**	**(71)**	--		
2001	**(45)**	**(1425)**	**(32)**	**(18)**	**(298)**	**(59)**	--		
2002	**(46)**	**(1086)**	**(43)**	**(17)**	**(286)**	**(59)**	--		
2003	**(19)**	**(875)**	**(22)**	**(11)**	**(249)**	**(45)**	--		
2004	**--**	**--**	**--**	**--**	**--**	**--**	--		
2005	**--**	**--**	**--**	**--**	**--**	**--**	--		

* Part of the fleet only; ** (1 day = 20 fishing hours)

* Twin trawls excluded; ** (1 day = 9 fishing hours)

*Effort in days/100HP;LPUE in kg/(day/100HP)

Table 3.8. Northern Hake. XSA tuning Diagnostics (""Update 2006"")
Extended Survivors Analysis

Hake Northern stock (WGHMM 2007) Update WGHMM2007

CPUE data from file nhake-update.cpu

Catch data for 29 years. 1978 to 2006. Ages 0 to 8.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
SP-CORUTR7	1985	2006	3	7	0	1
SP-VIGOTR7	1982	2006	2	7	0	1
SP-PAIRT-ON8	1994	2006	2	6	0	1
SP-PAIRT-PA8	1994	2006	3	6	0	1
FR-RESSGASCS	1987	2006	0	5	0	1
FR-EVHOES Total	1997	2006	0	5	0.83	0.92
UK-WCGFS	1988	2006	1	2	0.17	0.25
SP-PGFS	2001	2006	2	7	0.67	0.75

Time series weights :

Tapered time weighting applied
Power = 3 over 20 years

Catchability analysis :

Catchability independent of stock size for all ages

Catchability independent of age for ages >= 6

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 = 1.000

Minimum standard error for population
estimates derived from each fleet = .300

Prior weighting not applied

Tuning converged after 57 iterations

1

Regression weights

	0.751	0.82	0.877	0.921	0.954	0.976	0.99	0.997	1	1

Fishing mortalities

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	0	0	0	0	0	0	0	0	0	0
1	0.203	0.018	0.009	0.006	0.002	0.003	0.006	0.01	0.012	0.006
2	0.288	0.16	0.142	0.12	0.065	0.171	0.089	0.118	0.099	0.094
3	0.253	0.271	0.348	0.344	0.188	0.288	0.272	0.26	0.207	0.2
4	0.241	0.229	0.298	0.393	0.203	0.168	0.263	0.212	0.198	0.19
5	0.282	0.378	0.288	0.336	0.317	0.18	0.297	0.325	0.314	0.24
6	0.426	0.356	0.499	0.415	0.429	0.474	0.398	0.407	0.462	0.342
7	0.492	0.371	0.575	0.613	0.507	0.543	0.568	0.535	0.524	0.349

Table 3.8. (Continued) Northern Hake. XSA tuning Diagnostics (""Update 2006"")

1

XSA population numbers (Thousands)

	AGE							
YEAR	0	1	2	3	4	5	6	7
1997	1.60E+05	1.65E+05	1.23E+05	7.28E+04	3.70E+04	2.02E+04	1.39E+04	1.00E+04
1998	1.49E+05	1.31E+05	1.11E+05	7.56E+04	4.63E+04	2.38E+04	1.25E+04	7.45E+03
1999	1.60E+05	1.22E+05	1.06E+05	7.72E+04	4.72E+04	3.02E+04	1.33E+04	7.16E+03
2000	1.54E+05	1.31E+05	9.88E+04	7.50E+04	4.46E+04	2.87E+04	1.85E+04	6.64E+03
2001	1.44E+05	1.26E+05	1.07E+05	7.18E+04	4.35E+04	2.47E+04	1.68E+04	1.00E+04
2002	1.63E+05	1.18E+05	1.03E+05	8.19E+04	4.87E+04	2.91E+04	1.47E+04	8.95E+03
2003	2.04E+05	1.33E+05	9.61E+04	7.10E+04	5.03E+04	3.37E+04	1.99E+04	7.50E+03
2004	2.03E+05	1.67E+05	1.08E+05	7.20E+04	4.43E+04	3.16E+04	2.05E+04	1.09E+04
2005	1.07E+05	1.66E+05	1.36E+05	7.88E+04	4.55E+04	2.93E+04	1.87E+04	1.12E+04
2006	2.12E+05	8.72E+04	1.34E+05	1.01E+05	5.25E+04	3.06E+04	1.75E+04	9.66E+03

Estimated population abundance at 1st Jan 2007

0.00E+00	1.74E+05	7.10E+04	1.00E+05	6.74E+04	3.56E+04	1.97E+04	1.02E+04

Taper weighted geometric mean of the VPA populations:

1.72E+05	1.40E+05	1.12E+05	7.69E+04	4.59E+04	2.83E+04	1.67E+04	8.66E+03

Standard error of the weighted Log(VPA populations) :

0.2145	0.2138	0.1188	0.112	0.123	0.1551	0.1767	0.1947

1

Log catchability residuals.

Fleet : SP-CORUTR7

Age	1982	1983	1984	1985	1986
0	No data for this fleet at this age				
1	No data for this fleet at this age				
2	No data for this fleet at this age				
3	99.99	99.99	99.99	99.99	99.99
4	99.99	99.99	99.99	99.99	99.99
5	99.99	99.99	99.99	99.99	99.99
6	99.99	99.99	99.99	99.99	99.99
7	99.99	99.99	99.99	99.99	99.99

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
0	No data for this fleet at this age									
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	-0.2	-0.67	-1.06	-1.4	-0.62	-0.18	-0.83	-0.51	0.98	-0.43
4	-0.17	-1.07	-0.81	-1.01	-1.02	0.22	-0.78	-0.32	0.29	-0.27
5	-0.46	-0.78	-0.73	-0.77	-1.21	-0.26	-0.46	-0.2	-0.13	0.07
6	-1.12	-0.43	-0.46	-0.58	-0.83	-0.81	-0.13	-0.25	-0.29	0.13
7	-1.4	-0.98	-0.51	-0.59	-0.7	-0.36	0.1	-0.09	-0.2	0.11

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	No data for this fleet at this age									
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	-0.74	-0.13	0.31	0.94	-0.31	-0.07	0.71	0.22	-0.18	-0.16
4	-0.87	-0.23	0.37	0.96	0.04	-0.51	0.52	0.31	-0.02	0.07
5	-0.41	0.35	-0.02	0.53	0.37	-0.73	0.15	0.2	0.23	0.09
6	-0.1	0.01	-0.13	0.33	0.51	-0.13	-0.04	0.02	0.25	0.03
7	-0.34	-0.44	-0.38	0.04	0.37	-0.2	-0.18	0.06	0.06	-0.21

Table 3.8. (Continued) Northern Hake. XSA tuning Diagnostics (""Update 2006"")

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	-12.4388	-11.7174	-11.5382	-11.6121	-11.6121
S.E(Log q)	0.5595	0.5184	0.4021	0.2888	0.2816

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	-75.47	-0.657	-78.48	0	20	43.35	-12.44
4	0.59	0.525	11.32	0.14	20	0.32	-11.72
5	0.83	0.258	11.31	0.18	20	0.35	-11.54
6	0.68	0.95	11.01	0.47	20	0.2	-11.61
7	0.68	1.207	10.89	0.59	20	0.17	-11.73
1							

Fleet : SP-VIGOTR7

Age	1982	1983	1984	1985	1986
0	No data for this fleet at this age				
1	No data for this fleet at this age				
2	99.99	99.99	99.99	99.99	99.99
3	99.99	99.99	99.99	99.99	99.99
4	99.99	99.99	99.99	99.99	99.99
5	99.99	99.99	99.99	99.99	99.99
6	99.99	99.99	99.99	99.99	99.99
7	99.99	99.99	99.99	99.99	99.99

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
0	No data for this fleet at this age									
1	No data for this fleet at this age									
2	0.47	0.64	0.13	0.83	0.72	0.65	-0.55	0.52	0.34	-0.75
3	-0.56	0.79	-0.56	-0.37	0.11	0.6	-0.33	0.5	0.31	0.01
4	0.33	0.47	-0.41	-0.05	-0.26	0.72	-0.11	0.09	0.28	0.29
5	0.25	0.82	-0.75	-0.3	-0.41	-0.21	-0.2	0.23	0.1	0.48
6	-0.19	0.86	-0.96	-0.58	-0.12	-1.23	-0.17	-0.05	-0.18	0.41
7	-0.26	0.05	-0.87	-0.6	-0.19	-0.88	-0.25	-0.13	-0.18	0.15

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	No data for this fleet at this age									
1	No data for this fleet at this age									
2	-0.35	-0.2	-0.13	0.16	-0.85	0.19	0.68	0.31	0.24	-0.38
3	-0.39	-0.13	0.4	0.34	-0.32	-0.06	0.32	0.15	-0.62	-0.2
4	0.02	0.01	0.57	0.34	-0.32	-0.41	-0.13	0.2	-0.43	-0.26
5	0.26	0.33	0.21	-0.15	0.02	-0.59	-0.2	0.02	0.08	-0.08
6	0.39	0.04	0.2	-0.03	0.07	0.08	-0.25	-0.09	0.14	-0.02
7	0.04	-0.19	-0.09	0.01	-0.23	-0.01	-0.27	0.02	-0.04	-0.21

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	2	3	4	5	6	7
Mean Log q	-15.7443	-14.8012	-15.1866	-15.434	-15.5475	-15.5475
S.E(Log q)	0.4882	0.3546	0.3368	0.285	0.291	0.2296

Table 3.8. (Continued) Northern Hake. XSA tuning Diagnostics (""Update 2006"")

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
2	1.23	-0.145	16.7	0.04	20	0.63	-15.74
3	3.73	-0.754	24.51	0.01	20	1.35	-14.8
4	2.86	-0.776	23.47	0.02	20	0.98	-15.19
5	2.62	-1.134	23.84	0.05	20	0.74	-15.43
6	1.7	-0.816	19.6	0.12	20	0.5	-15.55
7	0.8	0.821	14.37	0.63	20	0.16	-15.67
1							

Fleet : SP-PAIRT-ON8

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
0	No data for this fleet at this age									
1	No data for this fleet at this age									
2	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-1.15	0.84	-0.17
3	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-0.43	0.42	-0.43
4	99.99	99.99	99.99	99.99	99.99	99.99	99.99	0.01	0.61	0.32
5	99.99	99.99	99.99	99.99	99.99	99.99	99.99	0.07	0.05	0.42
6	99.99	99.99	99.99	99.99	99.99	99.99	99.99	0.6	-0.49	0.36
7	No data for this fleet at this age									

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	No data for this fleet at this age									
1	No data for this fleet at this age									
2	0.42	0.32	-0.49	0.08	-0.21	0.7	-1.22	-0.21	0.67	0.23
3	-0.16	-0.51	-0.3	-0.03	-0.05	0.78	0.01	0.15	-0.05	0.25
4	0.06	-0.8	-0.45	-0.06	-0.15	-0.01	0.48	-0.12	-0.07	0.35
5	0.48	-1.22	-0.53	-0.23	-0.18	-0.16	0.08	0.67	0.29	0.26
6	0.42	-1.06	-0.83	-0.23	-1.08	-0.72	0.52	0.72	1.15	0.59
7	No data for this fleet at this age									

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	2	3	4	5	6
Mean Log q	-11.1445	-9.7291	-10.3678	-11.6854	-12.2771
S.E(Log q)	0.6336	0.3632	0.371	0.4973	0.7847

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
2	0.34	1.203	11.46	0.27	13	0.21	-11.14
3	0.45	1.23	10.56	0.36	13	0.16	-9.73
4	0.9	0.116	10.4	0.13	13	0.35	-10.37
5	0.63	0.55	11.15	0.19	13	0.32	-11.69
6	0.29	2.02	10.47	0.47	13	0.2	-12.28
1							

Table 3.8. (Continued) Northern Hake. XSA tuning Diagnostics (""Update 2006"")

Fleet : SP-PAIRT-PA8

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
0	No data for this fleet at this age									
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-1.02	0.57	-0.23
4	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-0.61	0.36	0.18
5	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-0.45	-0.47	0.21
6	99.99	99.99	99.99	99.99	99.99	99.99	99.99	0.18	-0.97	-0.05
7	No data for this fleet at this age									

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	No data for this fleet at this age									
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	-0.05	-0.27	-0.02	0.01	-0.07	0.36	0.16	0.18	-0.18	0.14
4	-0.13	-0.63	0.23	-0.02	-0.17	0.39	0.09	-0.12	0.12	0.08
5	-0.06	-0.72	-0.02	-0.19	-0.17	0.63	0.47	0.37	0.31	-0.41
6	-0.39	-0.45	0.01	0.12	-0.61	0.85	0.62	0.35	0.24	-0.4
7	No data for this fleet at this age									

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
Mean Log q	-9.9665	-10.3366	-11.2592	-11.5236
S.E(Log q)	0.3197	0.2961	0.4183	0.5141

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	0.82	0.234	10.2	0.16	13	0.27	-9.97
4	1.28	-0.286	10.22	0.1	13	0.4	-10.34
5	0.58	0.824	10.83	0.3	13	0.25	-11.26
6	0.6	0.727	10.8	0.27	13	0.32	-11.52
1							

Fleet : FR-RESSGASCS

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
0	0.91	0.76	-0.49	0.02	-0.05	-0.35	0.03	0.26	0.13	0.49
1	0.56	0.18	0.85	0.33	0.22	-0.02	-0.22	0.34	0.7	-0.15
2	-0.27	-0.55	-0.06	0.51	-0.76	-0.6	0.4	0.69	0.27	-0.45
3	-0.54	0.46	0.23	0.26	0.23	-0.02	0.03	0.57	0.52	-0.39
4	0.12	0.54	0.86	0.47	-0.2	0.7	-0.11	0.16	0.41	-0.38
5	0.37	0.67	1.07	1.24	0.15	0.26	0.06	0.24	0.84	-0.09
6	No data for this fleet at this age									
7	No data for this fleet at this age									

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	-0.5	-0.69	0.08	-0.13	0.59	99.99	99.99	99.99	99.99	99.99
1	-0.07	-0.63	-0.03	-0.35	0.43	99.99	99.99	99.99	99.99	99.99
2	0.46	-0.32	-0.35	-0.23	0.38	99.99	99.99	99.99	99.99	99.99
3	0.11	-0.5	-0.41	0.18	0.11	99.99	99.99	99.99	99.99	99.99
4	0.11	-0.13	-0.32	-0.06	0.07	99.99	99.99	99.99	99.99	99.99
5	0.14	0.53	-0.67	-0.61	-0.29	99.99	99.99	99.99	99.99	99.99
6	No data for this fleet at this age									
7	No data for this fleet at this age									

Table 3.8. (Continued) Northern Hake. XSA tuning Diagnostics (""Update 2006"")

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	0	1	2	3	4	5
Mean Log q	-9.7769	-8.559	-8.4491	-9.424	-10.6574	-11.4084
S.E(Log q)	0.4443	0.4154	0.4526	0.3727	0.3002	0.5399

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
0	0.76	0.271	10.32	0.2	15	0.37	-9.78
1	0.77	0.275	9.32	0.22	15	0.35	-8.56
2	0.29	1.313	10.69	0.4	15	0.13	-8.45
3	0.5	0.537	10.32	0.18	15	0.2	-9.42
4	0.66	0.591	10.67	0.37	15	0.21	-10.66
5	0.94	0.044	11.34	0.11	15	0.56	-11.41
1							

Fleet : FR-EVHOES Total

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	-0.2	-0.22	-0.56	-0.39	0.24	0.73	-0.78	0.85	0.17	0
1	-0.25	-0.4	0.62	-1.27	0.12	0.17	0.08	0.38	0.52	-0.13
2	0.44	-0.38	0.57	-0.23	-0.2	0.24	0.01	-0.31	0.24	-0.29
3	0.08	0.06	0.35	0.02	0.22	0.67	-0.32	-0.27	-0.09	-0.62
4	0.07	0.3	0.14	0.73	0.48	-0.15	-0.63	-0.52	-0.38	0.1
5	0.56	0.09	0.08	0.13	0.36	0.12	-0.44	-0.64	-0.42	0.35
6	No data for this fleet at this age									
7	No data for this fleet at this age									

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	0	1	2	3	4	5
Mean Log q	-7.9094	-9.551	-9.6325	-10.2761	-11.4039	-12.2947
S.E(Log q)	0.5391	0.5456	0.3351	0.3763	0.4468	0.3984

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
0	1.14	-0.128	7.35	0.11	10	0.65	-7.91
1	0.68	0.484	10.27	0.24	10	0.39	-9.55
2	0.84	0.187	9.95	0.16	10	0.3	-9.63
3	-14.05	-0.859	25.05	0	10	5.37	-10.28
4	-8.11	-0.642	5.33	0	10	3.76	-11.4
5	-1.24	-2.448	7.71	0.14	10	0.39	-12.29
1							

Table 3.8. (Continued) Northern Hake. XSA tuning Diagnostics (""Update 2006"")

Fleet : UK-WCGFS

Age		1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
	0	No data for this fleet at this age									
	1	99.99	-0.94	-0.56	-0.72	0.65	-0.87	0.66	0.61	0.29	-0.49
	2	99.99	-0.69	0.11	0.6	0.23	0.29	-0.34	0.37	0.52	-0.08
	3	No data for this fleet at this age									
	4	No data for this fleet at this age									
	5	No data for this fleet at this age									
	6	No data for this fleet at this age									
	7	No data for this fleet at this age									

Age		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	0	No data for this fleet at this age									
	1	0.04	-0.08	0.91	-0.56	-1.38	0.43	0.76	-0.24	99.99	99.99
	2	-0.13	-0.24	0.54	0.36	-1.32	-0.09	0.27	0.09	99.99	99.99
	3	No data for this fleet at this age									
	4	No data for this fleet at this age									
	5	No data for this fleet at this age									
	6	No data for this fleet at this age									
	7	No data for this fleet at this age									

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	1	2
Mean Log q	-5.0012	-5.9104
S.E(Log q)	0.714	0.5301

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
1	0.96	0.024	5.25	0.05	17	0.73	-5
2	1.14	-0.06	5.11	0.02	17	0.64	-5.91

Fleet : SP-PGFS

Age		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	0	No data for this fleet at this age									
	1	No data for this fleet at this age									
	2	99.99	99.99	99.99	99.99	-0.8	0.8	-0.46	-0.35	1.81	-1.02
	3	99.99	99.99	99.99	99.99	-0.44	0.41	0.33	-0.79	0.67	-0.19
	4	99.99	99.99	99.99	99.99	-0.57	-0.84	0.34	-0.13	0.47	0.68
	5	99.99	99.99	99.99	99.99	-0.15	-0.56	0.75	0.32	-0.22	-0.16
	6	99.99	99.99	99.99	99.99	0.33	-0.28	0.52	0.21	-0.3	-0.47
	7	99.99	99.99	99.99	99.99	0.59	-0.15	0.48	0.73	-0.41	-0.5

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	2	3	4	5	6	7
Mean Log q	-11.6694	-10.4885	-9.7188	-8.9175	-8.5404	-8.5404
S.E(Log q)	1.0929	0.5657	0.6081	0.4639	0.4047	0.5576

Table 3.8. (Continued) Northern Hake. XSA tuning Diagnostics (""Update 2006"")

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
2	0.33	0.561	11.65	0.15	6	0.38	-11.67
3	0.66	0.245	10.76	0.12	6	0.41	-10.49
4	0.21	1.023	10.54	0.3	6	0.13	-9.72
5	0.26	1.6	9.93	0.55	6	0.11	-8.92
6	0.39	1.051	9.3	0.43	6	0.16	-8.54
7	2.01	-0.273	7.66	0.02	6	1.21	-8.42
1							

Fleet disaggregated estimates of survivors :

Age 0 Catchability constant w.r.t. time and dependent on age

Year class = 2006

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR7	1	0	0	0	0	0	0
SP-VIGOTR7	1	0	0	0	0	0	0
SP-PAIRT-ON8	1	0	0	0	0	0	0
SP-PAIRT-PA8	1	0	0	0	0	0	0
FR-RESSGASCS	1	0	0	0	0	0	0
FR-EVHOES Total	173704	0.567	0	0	1	1	0
UK-WCGFS	1	0	0	0	0	0	0
SP-PGFS	1	0	0	0	0	0	0
F shrinkage mean	0	1				0	0

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
173704	0.57	0	1	0	0

1

Age 1 Catchability constant w.r.t. time and dependent on age

Year class = 2005

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR7	1	0	0	0	0	0	0
SP-VIGOTR7	1	0	0	0	0	0	0
SP-PAIRT-ON8	1	0	0	0	0	0	0
SP-PAIRT-PA8	1	0	0	0	0	0	0
FR-RESSGASCS	1	0	0	0	0	0	0
FR-EVHOES Total	72617	0.404	0.149	0.37	2	0.859	0.006
UK-WCGFS	1	0	0	0	0	0	0
SP-PGFS	1	0	0	0	0	0	0
F shrinkage mean	61827	1				0.141	0.007

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
70990	0.37	0.11	3	0.285	0.006

Table 3.8. (Continued) Northern Hake. XSA tuning Diagnostics (""Update 2006"")

Age 2 Catchability constant w.r.t. time and dependent on age

Year class = 2004

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR7	1	0	0	0	0	0	0
SP-VIGOTR7	68519	0.508	0	0	1	0.176	0.135
SP-PAIRT-ON8	126725	0.662	0	0	1	0.103	0.075
SP-PAIRT-PA8	1	0	0	0	0	0	0
FR-RESSGASCS	1	0	0	0	0	0	0
FR-EVHOES Total	114129	0.266	0.349	1.31	3	0.639	0.083
UK-WCGFS	1	0	0	0	0	0	0
SP-PGFS	36186	1.182	0	0	1	0.032	0.241
F shrinkage mean	86133	1				0.05	0.109

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
100213	0.21	0.2	7	0.924	0.094

1

Age 3 Catchability constant w.r.t. time and dependent on age

Year class = 2003

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR7	57166	0.582	0	0	1	0.052	0.232
SP-VIGOTR7	63647	0.299	0.206	0.69	2	0.19	0.21
SP-PAIRT-ON8	95385	0.329	0.175	0.53	2	0.158	0.145
SP-PAIRT-PA8	77670	0.334	0	0	1	0.157	0.176
FR-RESSGASCS	1	0	0	0	0	0	0
FR-EVHOES Total	56729	0.221	0.276	1.25	4	0.335	0.233
UK-WCGFS	52954	0.75	0	0	1	0.028	0.248
SP-PGFS	82368	0.544	0.793	1.46	2	0.058	0.166
F shrinkage mean	53920	1				0.021	0.244

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
67409	0.13	0.11	14	0.865	0.2

1

Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 2002

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR7	34484	0.398	0.121	0.3	2	0.069	0.195
SP-VIGOTR7	26529	0.229	0.221	0.96	3	0.201	0.247
SP-PAIRT-ON8	40250	0.253	0.159	0.63	3	0.166	0.169
SP-PAIRT-PA8	34676	0.228	0.126	0.55	2	0.211	0.194
FR-RESSGASCS	1	0	0	0	0	0	0
FR-EVHOES Total	35436	0.202	0.151	0.75	5	0.236	0.19
UK-WCGFS	49369	0.447	0.32	0.71	2	0.043	0.14
SP-PGFS	62875	0.422	0.221	0.52	3	0.059	0.112
F shrinkage mean	31816	1				0.014	0.21

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
35551	0.1	0.07	21	0.72	0.19

Table 3.8. (Continued) Northern Hake. XSA tuning Diagnostics (""Update 2006"")

1
Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 2001

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR7	21452	0.292	0.055	0.19	3	0.099	0.222
SP-VIGOTR7	18487	0.185	0.179	0.97	4	0.234	0.254
SP-PAIRT-ON8	19228	0.23	0.228	0.99	4	0.141	0.245
SP-PAIRT-PA8	19513	0.205	0.174	0.85	3	0.185	0.242
FR-RESSGASCS	35600	0.486	0	0	1	0.023	0.14
FR-EVHOES Total	19922	0.186	0.125	0.67	6	0.204	0.238
UK-WCGFS	27217	0.45	0.08	0.18	2	0.027	0.179
SP-PGFS	16817	0.328	0.248	0.76	4	0.076	0.276
F shrinkage mean	16006	1				0.012	0.288

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
19674	0.09	0.06	28	0.7	0.24

1
Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 2000

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR7	11908	0.215	0.108	0.5	4	0.17	0.3
SP-VIGOTR7	11220	0.163	0.058	0.36	5	0.262	0.315
SP-PAIRT-ON8	11873	0.227	0.139	0.61	5	0.111	0.3
SP-PAIRT-PA8	10044	0.196	0.144	0.74	4	0.16	0.347
FR-RESSGASCS	12139	0.335	0.277	0.83	2	0.031	0.295
FR-EVHOES Total	7984	0.189	0.128	0.68	6	0.136	0.419
UK-WCGFS	5942	0.454	0.619	1.36	2	0.017	0.531
SP-PGFS	8010	0.271	0.148	0.55	5	0.1	0.418
F shrinkage mean	7592	1				0.013	0.437

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
10206	0.08	0.05	34	0.636	0.342

Table 3.8. (Continued) Northern Hake. XSA tuning Diagnostics (""Update 2006"")

Age 7 Catchability constant w.r.t. time and age (fixed at the value for age) 6

Year class = 1999

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR7	5695	0.184	0.122	0.66	5	0.243	0.343
SP-VIGOTR7	5106	0.154	0.087	0.57	6	0.307	0.376
SP-PAIRT-ON8	10528	0.229	0.159	0.69	5	0.078	0.2
SP-PAIRT-PA8	7131	0.199	0.07	0.35	4	0.112	0.283
FR-RESSGASCS	5677	0.281	0.216	0.77	3	0.033	0.344
FR-EVHOES Total	3921	0.19	0.245	1.29	6	0.097	0.466
UK-WCGFS	1936	0.46	0.363	0.79	2	0.012	0.79
SP-PGFS	4829	0.261	0.166	0.64	6	0.102	0.394
F shrinkage mean	8423	1				0.015	0.244

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
5577	0.08	0.06	38	0.806	0.349

Table 3.9 Northern Hake. Estimates of fishing mortality at age ("2006 Update")

Run title : Hake Northern stock (WGHMM 2007) At 3/05/2007 16:47
Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986
AGE									
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1	0.2023	0.1317	0.1563	0.1728	0.1994	0.2561	0.1122	0.0925	0.1624
2	0.2816	0.2686	0.1876	0.2422	0.4847	0.2474	0.1499	0.0766	0.2085
3	0.2215	0.1825	0.2068	0.1474	0.1676	0.2975	0.2051	0.1731	0.2601
4	0.1480	0.1412	0.2651	0.2045	0.1421	0.2887	0.4045	0.1172	0.1821
5	0.2539	0.1734	0.2717	0.2962	0.1687	0.1518	0.2700	0.1827	0.1273
6	0.1823	0.2349	0.1553	0.1910	0.2310	0.2262	0.2308	0.2632	0.2093
7	0.2023	0.1838	0.2258	0.2108	0.1781	0.2423	0.2791	0.1849	0.1956
+gp	0.2023	0.1838	0.2258	0.2108	0.1781	0.2423	0.2791	0.1849	0.1956
FBAR 2- 6	0.2174	0.2001	0.2173	0.2163	0.2388	0.2423	0.2521	0.1626	0.1975

YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
AGE										
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1	0.0662	0.0981	0.1092	0.1545	0.2623	0.1480	0.2263	0.2523	0.1804	0.0868
2	0.1971	0.1407	0.2337	0.3617	0.1811	0.1625	0.1799	0.3766	0.3734	0.1263
3	0.2066	0.3671	0.3153	0.2418	0.2843	0.3308	0.2235	0.3651	0.5566	0.3268
4	0.3507	0.2560	0.4201	0.3403	0.2900	0.5359	0.2537	0.2869	0.3998	0.3246
5	0.3378	0.3604	0.3913	0.4201	0.2654	0.4400	0.3371	0.3399	0.3532	0.4001
6	0.2305	0.5468	0.4794	0.5457	0.5071	0.4738	0.4760	0.5218	0.4413	0.5460
7	0.2929	0.4374	0.5822	0.7878	0.8708	1.2591	1.1672	0.9073	0.9405	0.7804
+gp	0.2929	0.4374	0.5822	0.7878	0.8708	1.2591	1.1672	0.9073	0.9405	0.7804
FBAR 2- 6	0.2646	0.3342	0.3680	0.3819	0.3056	0.3886	0.2941	0.3780	0.4249	0.3448

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	FBAR (04-06)
AGE											
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0
1	0.2032	0.0177	0.0093	0.0063	0.0017	0.0030	0.0062	0.0102	0.0118	(0.0058)*	(0.0093)*
2	0.2879	0.1597	0.1418	0.1202	0.0649	0.1711	0.0887	0.1176	0.0985	0.0940	0.1034
3	0.2525	0.2708	0.3485	0.3438	0.1883	0.2878	0.2723	0.2596	0.2066	0.1998	0.222
4	0.2406	0.2285	0.2980	0.3925	0.2026	0.1679	0.2632	0.2119	0.198	0.1896	0.1999
5	0.2818	0.3781	0.2877	0.3363	0.3166	0.1797	0.2969	0.3253	0.314	0.2403	0.2932
6	0.4262	0.3559	0.4986	0.4154	0.4286	0.4737	0.3980	0.4074	0.4617	0.3420	0.4037
7	0.4916	0.3707	0.5754	0.6135	0.5070	0.5432	0.5680	0.5354	0.5238	0.3491	0.4694
+gp	0.4916	0.3707	0.5754	0.6135	0.5070	0.5432	0.5680	0.5354	0.5238	0.3491	
FBAR 2- 6	0.2978	0.2786	0.3149	0.3216	0.2402	0.2561	0.2638	0.2644	0.2558	0.2131	

*replaced by AM04-05 : 0.0110

Table 3.10 Northern Hake. Estimates of stock numbers at age ("2006 Update")

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986
AGE									
0	297022	273326	347996	253634	206095	210132	190243	209891	194074
1	215718	243181	223781	284915	207658	168736	172041	155758	171844
2	141785	144274	174536	156699	196253	139286	106935	125912	116253
3	91141	87597	90297	118454	100699	98963	89048	75363	95486
4	66508	59794	59756	60118	83690	69726	60175	59387	51892
5	41416	46961	42509	37530	40118	59444	42770	32878	43244
6	35132	26306	32327	26524	22850	27748	41815	26730	22422
7	13935	23971	17028	22660	17940	14850	18118	27178	16821
+gp	26076	39010	34556	38144	39205	31080	33167	71329	58808
TOTAL	928732	944420	1022784	998676	914507	819965	754313	784426	770845

YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
AGE										
0	205599	213319	195169	253814	205771	242276	213249	180186	200404	202140
1	158895	168330	174651	159791	207805	168471	198359	174593	147524	164077
2	119601	121764	124938	128196	112095	130884	118959	129512	111072	100847
3	77265	80401	86607	80973	73106	76573	91090	81356	72760	62600
4	60270	51453	45602	51730	52057	45042	45037	59643	46236	34143
5	35414	34748	32611	24530	30138	31891	21579	28611	36654	25380
6	31175	20682	19840	18054	13194	18923	16816	12612	16675	21080
7	14890	20269	9800	10057	8565	6506	9647	8553	6128	8781
+gp	38471	24751	23015	16133	12377	9905	9583	7575	8178	9725
TOTAL	741579	735716	712234	743278	715108	730470	724317	682640	645630	628774

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	GMST 78-**	AMST 78-**
AGE													
0	160254	148806	160240	153827	143866	162551	204252	202969	(106513)*	(212157)*	0	204064	208559
1	165498	131205	121832	131194	125943	117788	133085	167227	166177	(87206)*	(173704)*	168696	172589
2	123164	110585	105541	98826	106739	102935	96148	108288	135521	134458	(70990)*	122308	124149
3	72770	75616	77174	74987	71751	81900	71022	72037	78821	100542	100213	81723	82483
4	36966	46284	47224	44594	43535	48663	50286	44288	45492	52487	67409	51776	52744
5	20205	23793	30152	28700	24657	29107	33682	31642	29335	30555	35551	32695	33717
6	13928	12481	13347	18514	16787	14709	19911	20494	18713	17546	19674	20417	21521
7	9997	7446	7159	6637	10005	8954	7499	10949	11165	9656	10206	11596	12753
+gp	15633	13525	6349	7873	10247	12482	6673	11216	10211	16394	15044		
TOTAL	618416	569740	569019	565153	553531	579088	622559	669110	601948	661001	492791		

Age 0 in 2005 replaced by:	186213
Age 0 in 2006 replaced by:	186213
Age 0 in 2007 replaced by:	186213
Age 1 in 2006 replaced by:	152458
Age 1 in 2007 replaced by:	152458
Age 2 in 2007 replaced by:	123457

Table 3.11. Northern Hake. Summary of catches and XSA results ("2006 Update")

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS Age 0	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 2- 6
1978	297022	290128	200662	49521	0.2468	0.2174
1979	273326	327022	236218	50637	0.2144	0.2001
1980	347996	319161	220063	56473	0.2566	0.2173
1981	253634	334699	234941	53920	0.2295	0.2163
1982	206095	328888	233911	54996	0.2351	0.2388
1983	210132	305763	221750	57508	0.2593	0.2423
1984	190243	305706	231285	63288	0.2736	0.2521
1985	209891	389774	309687	56100	0.1812	0.1626
1986	194074	360924	279314	57093	0.2044	0.1975
1987	205599	297437	224437	63368	0.2823	0.2646
1988	213319	240698	167724	64824	0.3865	0.3342
1989	195169	222975	143642	66472	0.4628	0.3680
1990	253814	190885	118450	64288	0.5427	0.3819
1991	205771	178248	104832	52373	0.4996	0.3056
1992	242276	163861	97382	56618	0.5814	0.3886
1993	213249	166949	97330	52146	0.5358	0.2941
1994	180186	161462	94788	51259	0.5408	0.3780
1995	200404	174074	100148	57619	0.5753	0.4249
1996	202140	154969	97505	47213	0.4842	0.3448
1997	160254	163965	102458	42600	0.4158	0.2978
1998	148806	168521	98585	35010	0.3551	0.2786
1999	160240	163233	95051	39814	0.4189	0.3149
2000	153827	161390	97065	42022	0.4329	0.3216
2001	143866	168995	106108	36675	0.3456	0.2402
2002	162551	183691	110474	40105	0.3630	0.2561
2003	204252	202902	113073	41877	0.3704	0.2638
2004	202969	216549	126886	47123	0.3714	0.2644
(2005)*	106513	210407	126432	46367	0.3667	0.2558
(2006)*	212157	242454	139855	41810	0.299	0.2131
Arith. Mean	205165	234336	156209	51349	0.37	0.2805
0 Units	(Thousand	(Tonnes)	(Tonnes)	(Tonnes)		

* Replaced by GM90-04 : 186213

Table 3.12 Hake - Northern stock (IIIa, IV, VI, VII, VIIIab) Prediction with management option table: Input data

"2006 UPDATE"

2006	Landings							
Age	Exploitation pattern	Weight in catch	Stock size	Natural Mortality	Maturity ogive	Prop. of F bef. spaw.	Prop. of M bef. spaw.	Weight in stock
0	0.0000	0.059	186213	0.2	0.00	0	0	0.059
1	0.0110	0.126	152458	0.2	0.00	0	0	0.126
2	0.1034	0.218	123457	0.2	0.00	0	0	0.218
3	0.2220	0.335	100213	0.2	0.23	0	0	0.335
4	0.1998	0.605	67409	0.2	0.60	0	0	0.605
5	0.2932	0.985	35551	0.2	0.90	0	0	0.985
6	0.4037	1.438	19674	0.2	1.00	0	0	1.438
7	0.4694	1.828	10206	0.2	1.00	0	0	1.828
8+	0.4694	2.677	15044	0.2	1.00	0	0	2.677
Unit	-	Kilograms	Thousands	-	-	-	-	Kilograms

2007	Landings							
Age	Exploitation pattern	Weight in catch	Stock size	Natural Mortality	Maturity ogive	Prop. of F bef. spaw.	Prop. of M bef. spaw.	Weight in stock
0	0.0000	0.059	186213	0.2	0.00	0	0	0.059
1	0.0110	0.126		0.2	0.00	0	0	0.126
2	0.1034	0.218		0.2	0.00	0	0	0.218
3	0.2220	0.335		0.2	0.23	0	0	0.335
4	0.1998	0.605		0.2	0.60	0	0	0.605
5	0.2932	0.985		0.2	0.90	0	0	0.985
6	0.4037	1.438		0.2	1.00	0	0	1.438
7	0.4694	1.828		0.2	1.00	0	0	1.828
8+	0.4694	2.677		0.2	1.00	0	0	2.677
Unit	-	Kilograms	Thousands	-	-	-	-	Kilograms

2008	Landings							
Age	Exploitation pattern	Weight in catch	Stock size	Natural Mortality	Maturity ogive	Prop. of F bef. spaw.	Prop. of M bef. spaw.	Weight in stock
0	0.0000	0.059	186213	0.2	0.00	0	0	0.059
1	0.0110	0.126		0.2	0.00	0	0	0.126
2	0.1034	0.218		0.2	0.00	0	0	0.218
3	0.2220	0.335		0.2	0.23	0	0	0.335
4	0.1998	0.605		0.2	0.60	0	0	0.605
5	0.2932	0.985		0.2	0.90	0	0	0.985
6	0.4037	1.438		0.2	1.00	0	0	1.438
7	0.4694	1.828		0.2	1.00	0	0	1.828
8+	0.4694	2.677		0.2	1.00	0	0	2.677
Unit	-	Kilograms	Thousands	-	-	-	-	Kilograms

Table 3.13. HAKE Northern stock - Catch predictions with management option table

"UPDATE 2006"

Year:	2007			
	Landings			
F Factor	Reference F	Catch in weight	Stock Biomass	Sp. Stock Biomass
1.0	0.2444	52234	253737	150921

Year:	2008				Year: 2009	
	Landings					
F Factor	Reference F	Catch in weight	Stock Biomass	Sp. Stock Biomass	Stock Biomass	Sp. Stock Biomass
0.0	0.0000	0	257443	156425	327054	220172
0.1	0.0244	6135			319433	213351
0.2	0.0489	12066			312062	206766
0.3	0.0733	17800			304933	200409
0.4	0.0978	23344			298036	194272
0.5	0.1222	28706			291364	188346
0.6	0.1466	33893			284907	182623
0.7	0.1711	38910			278657	177096
0.8	0.1955	43764			272609	171757
0.9	0.2200	48461			266753	166599
1.0	0.2444	53007			261084	161616
1.1	0.2688	57408			255594	156801
1.2	0.2933	61668			250277	152148
1.3	0.3177	65794			245127	147650
1.4	0.3422	69789			240138	143303
1.5	0.3666	73658			235304	139101
1.6	0.3910	77407			230620	135038
1.7	0.4155	81038			226080	131109
1.8	0.4399	84558			221680	127309
1.9	0.4644	87969			217414	123634
2.0	0.4888	91275			213278	120080

Table 3.14. NORTHERN HAKE stock (IIIa, IV, VI, VII, VIIIa,b). Detailed tables

"UPDATE 2006"

MFDP version 1a
Run: NorthernHakeUpdate2006
Time and date: 15:52 11/05/2007
Fbar age range: 2-6

Year: 2007 F multiplier: 1 Fbar: 0.2444

Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
0	0	0	0	186213	10987	0	0	0	0
1	0.011	1512	191	152458	19210	0	0	0	0
2	0.1034	11007	2403	123457	26955	0	0	0	0
3	0.222	18149	6080	100213	33571	23049	7721	23049	7721
4	0.1998	11103	6717	67409	40782	40445	24469	40445	24469
5	0.2932	8228	8105	35551	35018	31996	31516	31996	31516
6	0.4037	5963	8572	19674	28285	19674	28285	19674	28285
7	0.4694	3493	6384	10206	18657	10206	18657	10206	18657
8	0.4694	5148	13782	15044	40273	15044	40273	15044	40273
Total		64604	52234	710225	253737	140414	150921	140414	150921

Year: 2008 F multiplier: 1 Fbar: 0.2444

Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
0	0	0	0	186213	10987	0	0	0	0
1	0.011	1512	191	152458	19210	0	0	0	0
2	0.1034	11007	2403	123457	26955	0	0	0	0
3	0.222	16508	5530	91152	30536	20965	7023	20965	7023
4	0.1998	10824	6548	65713	39756	39428	23854	39428	23854
5	0.2932	10460	10303	45193	44515	40674	40064	40674	40064
6	0.4037	6580	9459	21710	31212	21710	31212	21710	31212
7	0.4694	3681	6729	10757	19665	10757	19665	10757	19665
8	0.4694	4424	11843	12928	34608	12928	34608	12928	34608
Total		64996	53007	709581	257443	146462	156425	146462	156425

Year: 2009 F multiplier: 1 Fbar: 0.2444

Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
0	0	0	0	186213	10987	0	0	0	0
1	0.011	1512	191	152458	19210	0	0	0	0
2	0.1034	11007	2403	123457	26955	0	0	0	0
3	0.222	16508	5530	91151	30536	20965	7023	20965	7023
4	0.1998	9845	5956	59771	36162	35863	21697	35863	21697
5	0.2932	10197	10044	44056	43395	39651	39056	39651	39056
6	0.4037	8364	12025	27598	39677	27598	39677	27598	39677
7	0.4694	4062	7426	11871	21700	11871	21700	11871	21700
8	0.4694	4150	11109	12127	32464	12127	32464	12127	32464
Total		65646	54684	708703	261084	148074	161616	148074	161616

Input units are thousands and kg - output in tonnes

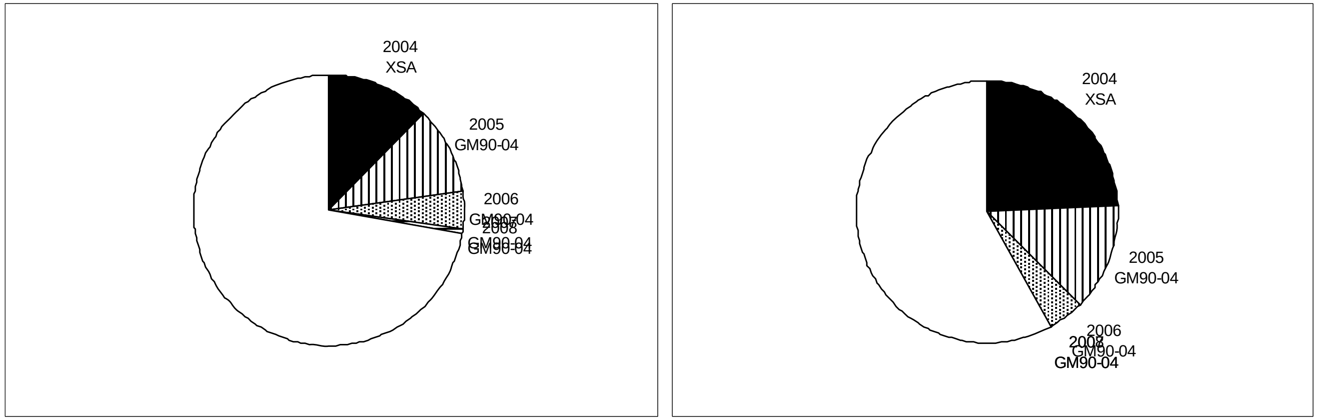
Table 3.15 **Northern Hake (IIIa - VIIIb) - "UPDATE 2006"**
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class	2004	2005	2006	2007	2008
Stock No. (thousands) of 0 year-olds	202969	186213	186213	186213	186213
Source	XSA	GM90-04	GM90-04	GM90-04	GM90-04
Status Quo F:					
% in 2007 landings	11.6	4.6	0.4	0.0	-
% in 2008	12.4	10.4	4.5	0.4	0.0
% in 2007 SSB	5.1	0.0	0.0	0.0	-
% in 2008 SSB	15.2	4.5	0.0	0.0	0.0
% in 2009 SSB	24.2	13.4	4.3	0.0	0.0

GM : geometric mean recruitment

Northern Hake (IIIa - VIIIb) - "UPDATE 2006" : Year-class % contribution to

a) 2008 landings **b) 2009 SSB**



XSA	GM90-04	GM90-04	GM90-04	GM90-04
2004	2005	2006	2007	2008

Table 3.16. Northern Hake (IIIa, IV, VI, VII, VIIIabd): Yield per recruit summary table

"2006 UPDATE"

MFYPR version 2a
MFYPR version 2a
Run: NorthernHakeUpdate2006
Time and date: 16:40 11/05/2007
Yield per results

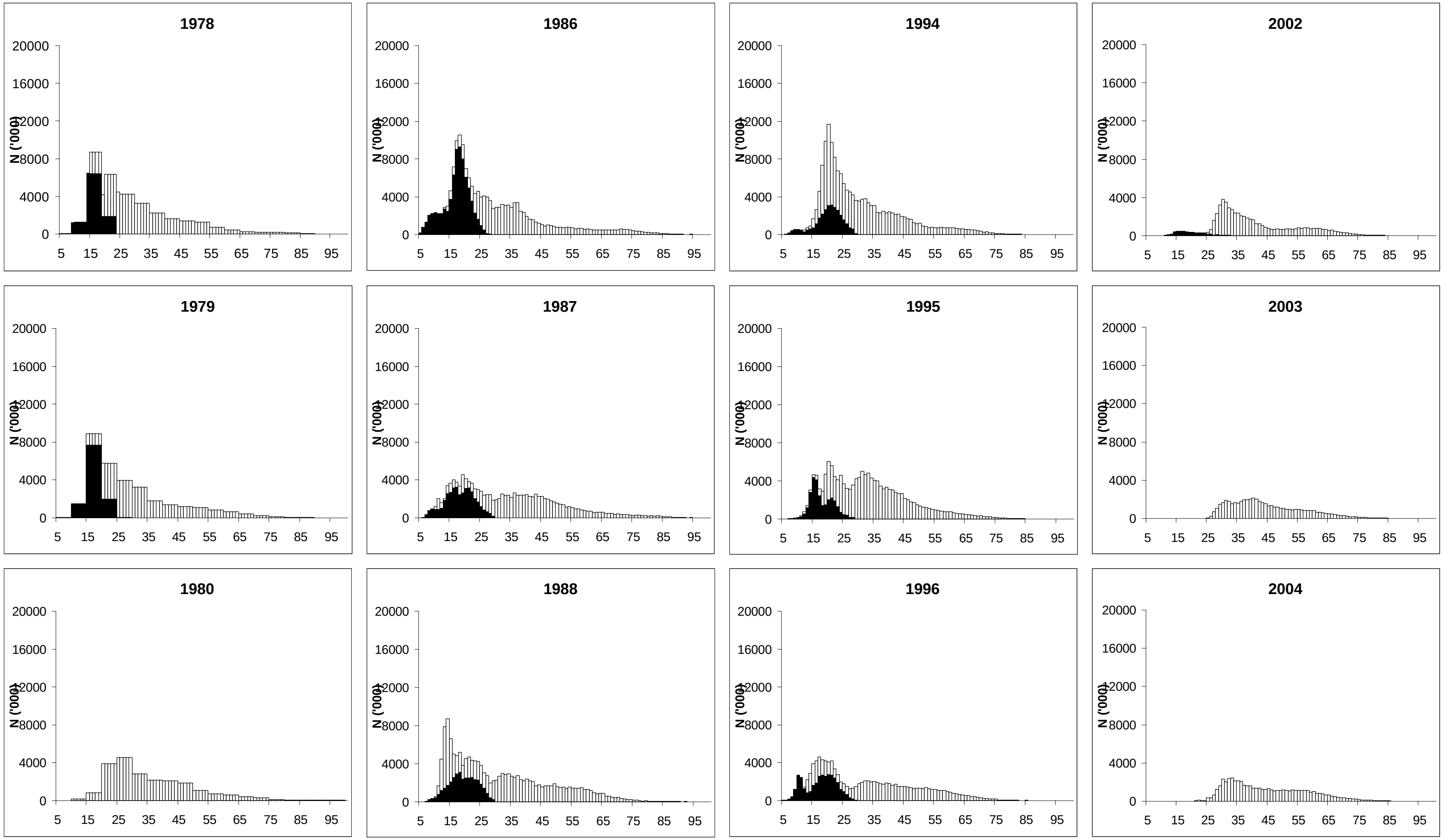
FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0	0	0	0	5.5167	4.992	2.3885	4.3969	2.3885	4.3969
0.1	0.0244	0.0862	0.1363	5.0875	3.9768	1.9727	3.389	1.9727	3.389
0.2	0.0489	0.1467	0.2132	4.7865	3.2966	1.6848	2.7159	1.6848	2.7159
0.3	0.0733	0.192	0.2574	4.5612	2.8118	1.4722	2.2379	1.4722	2.2379
0.4	0.0978	0.2276	0.2827	4.3846	2.4506	1.308	1.8832	1.308	1.8832
0.5	0.1222	0.2566	0.2963	4.2413	2.172	1.1768	1.611	1.1768	1.611
0.6	0.1467	0.2807	0.3027	4.1219	1.9515	1.0691	1.3966	1.0691	1.3966
0.7	0.1711	0.3013	0.3045	4.0202	1.7731	0.9789	1.2242	0.9789	1.2242
0.8	0.1955	0.3191	0.3033	3.9321	1.6261	0.902	1.083	0.902	1.083
0.9	0.22	0.3348	0.3002	3.8548	1.5033	0.8356	0.9658	0.8356	0.9658
1	0.2444	0.3488	0.2959	3.7861	1.3992	0.7775	0.8671	0.7775	0.8671
1.1	0.2689	0.3613	0.291	3.7244	1.31	0.7262	0.7832	0.7262	0.7832
1.2	0.2933	0.3727	0.2857	3.6686	1.2328	0.6806	0.7111	0.6806	0.7111
1.3	0.3177	0.383	0.2802	3.6178	1.1654	0.6397	0.6487	0.6397	0.6487
1.4	0.3422	0.3925	0.2746	3.5712	1.1061	0.6027	0.5942	0.6027	0.5942
1.5	0.3666	0.4013	0.2692	3.5282	1.0536	0.5692	0.5464	0.5692	0.5464
1.6	0.3911	0.4094	0.2639	3.4885	1.0068	0.5387	0.5041	0.5387	0.5041
1.7	0.4155	0.417	0.2587	3.4515	0.9648	0.5107	0.4665	0.5107	0.4665
1.8	0.44	0.4241	0.2538	3.417	0.9269	0.485	0.4329	0.485	0.4329
1.9	0.4644	0.4307	0.249	3.3847	0.8926	0.4613	0.4027	0.4613	0.4027
2	0.4888	0.4369	0.2445	3.3544	0.8614	0.4394	0.3756	0.4394	0.3756

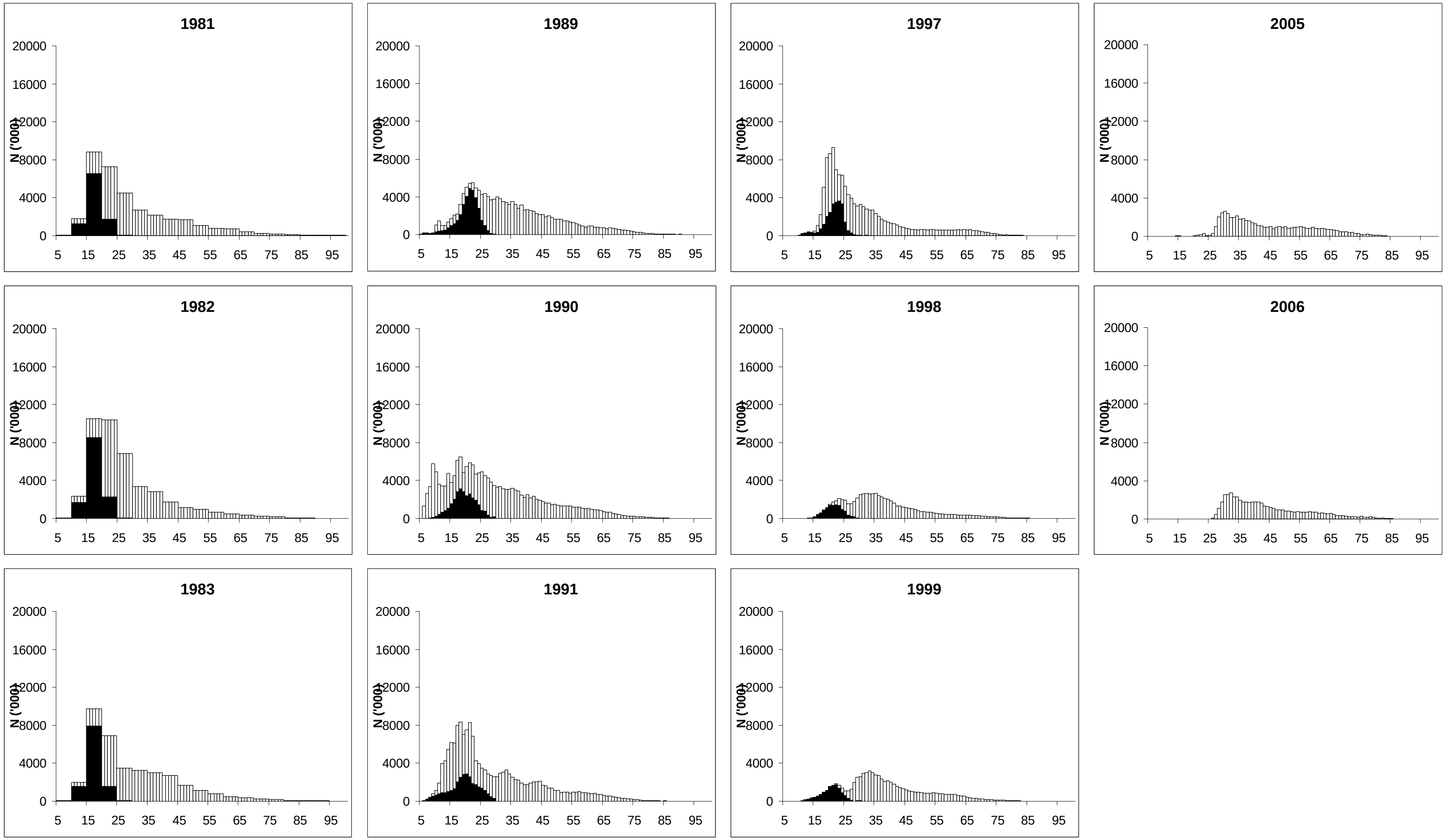
Reference point	F multiplier	Absolute F
Fbar(2-6)	1	0.2444
FMax	0.7021	0.1716
F0.1	0.4033	0.0986
F35%SPR	0.5311	0.1298
Flow	0.7225	0.1766
Fmed	1.2808	0.3131
Fhigh	1.6626	0.4064

Weights in kilograms

Table 3.17 Nothern Hake Recovery Plan Indicators.

	Recovery Plan Indicators											
	2007	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
p(SSB<Blim)	0.1	0.05	0	0	0	0	0	0	0	0	0	0
p(SSB<Bpa)	0.33	0.33	0.33	0.33	0.3	0.28	0.25	0.19	0.16	**0.2**	**0.1**	**0.07**
p(F>Flim)	0	0	0	0	0	0	0	0	0	0	0	0
p(F>Fpa)	0.33	0.24	0.35	0.22	0.77	0.68	0.36	**0.94**	**1**	0.56	0.95	**0.97**
Yield	47441	49427	54445	54783	61282	59936	57384	64718	**70981**	55039	63204	64978
TAC change (%)	0.08	0.04	0.1	0.01	0.12	-0.03	-0.04	0.13	0.1	**-0.22**	0.15	0.03
	Recovery Plan Indicators											
	2019	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
p(SSB<Blim)	0	0	0	0	0	0	0	0	0	0.01	0.02	0.01
p(SSB<Bpa)	**0.08**	**0.05**	**0.1**	0.28	0.06	0.06	0.45	0.6	0.72	**0.85**	**0.9**	**0.9**
p(F>Flim)	0	0	0	0	0	**0.46**	0	**0.97**	**0.97**	**0.95**	**0.76**	**1**
p(F>Fpa)	0.86	**0.99**	**0.99**	0.72	**0.95**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Yield	59979	68976	65750	55100	63206	**72486**	66209	**76090**	67212	59834	57215	62380
TAC change (%)	-0.08	0.15	-0.04	**-0.16**	0.15	0.15	-0.09	0.15	-0.11	-0.11	-0.05	0.09


1978
1986
1994
2002
1979
1987
1995
2003
1980
1988
1996
2004
N ('000)
20000
16000
12000
8000
4000
0
5 15 25 35 45 55 65 75 85 95


1981
1989
1997
2005
1982
1990
1998
2006
1983
1991
1999
N ('000)
20000
16000
12000
8000
4000
0
5 15 25 35 45 55 65 75 85 95

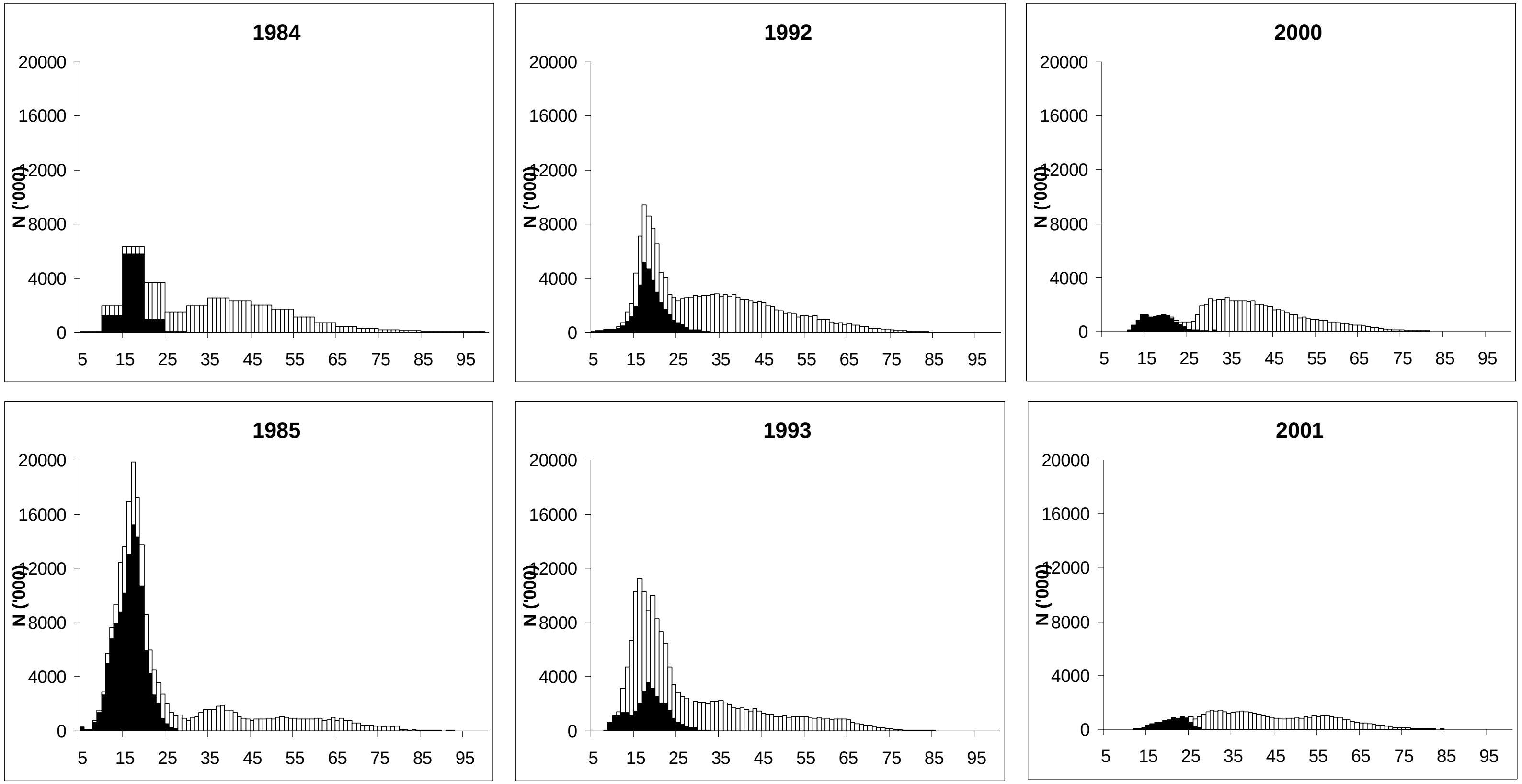


Figure 3.1. Northern Hake catches (landings in white and discards in black) length distributions in 1978-2006.
(Since 2002, only partial discard data are available, they are not presented on the graph)

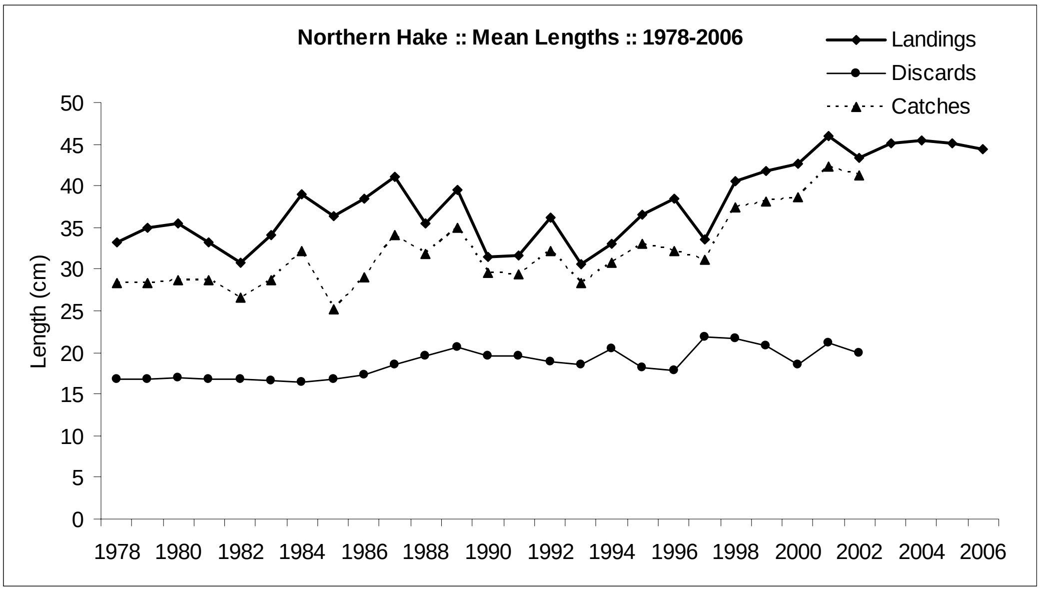
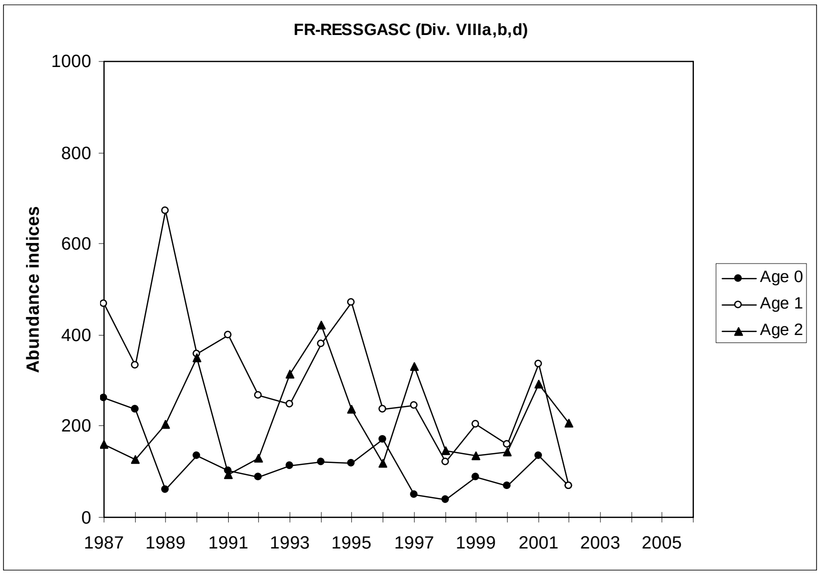
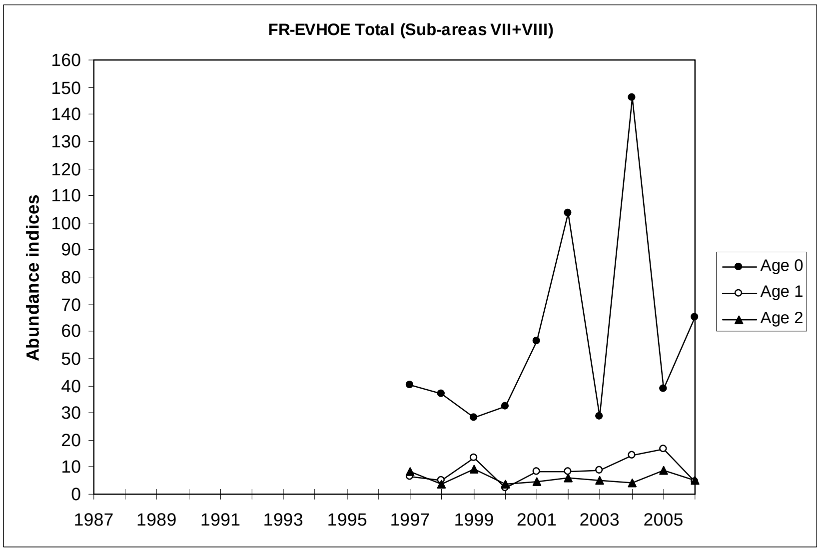


Figure 3.2. Northern Hake mean length of landings, discards and catches





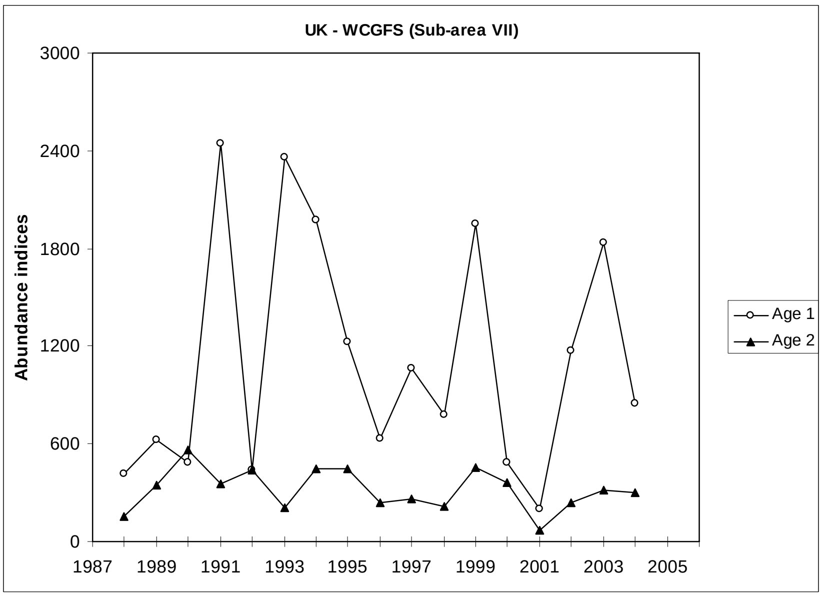
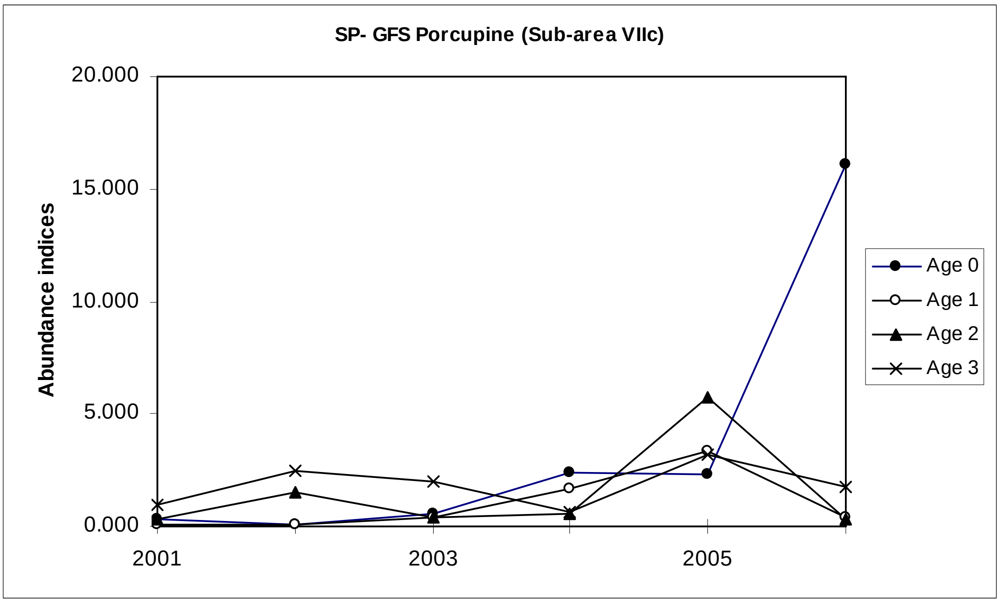


Figure 3.3a NORTHERN HAKE. Abundance indices at age from surveys



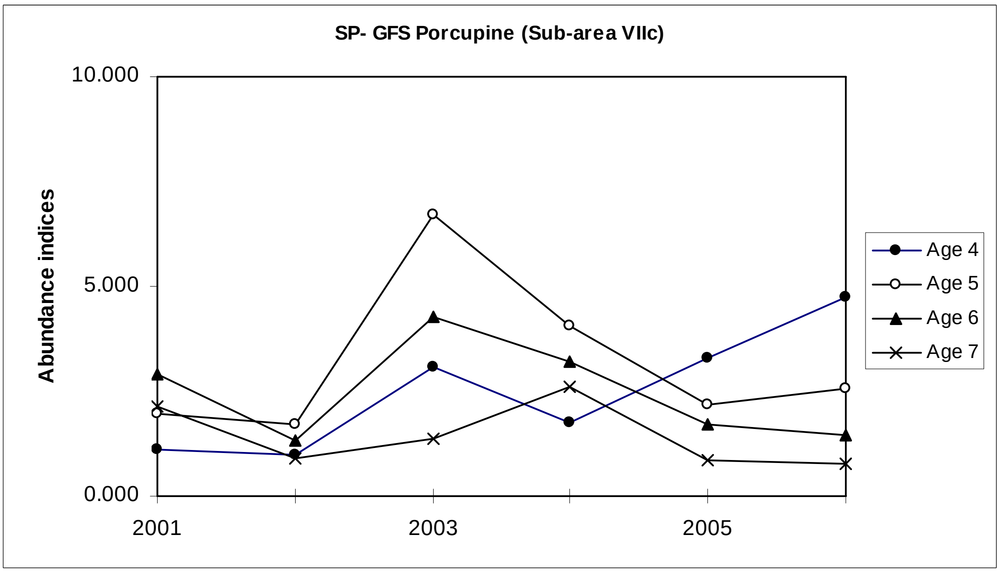


Figure 3.3b NORTHERN HAKE. Abundance indices at age from surveys

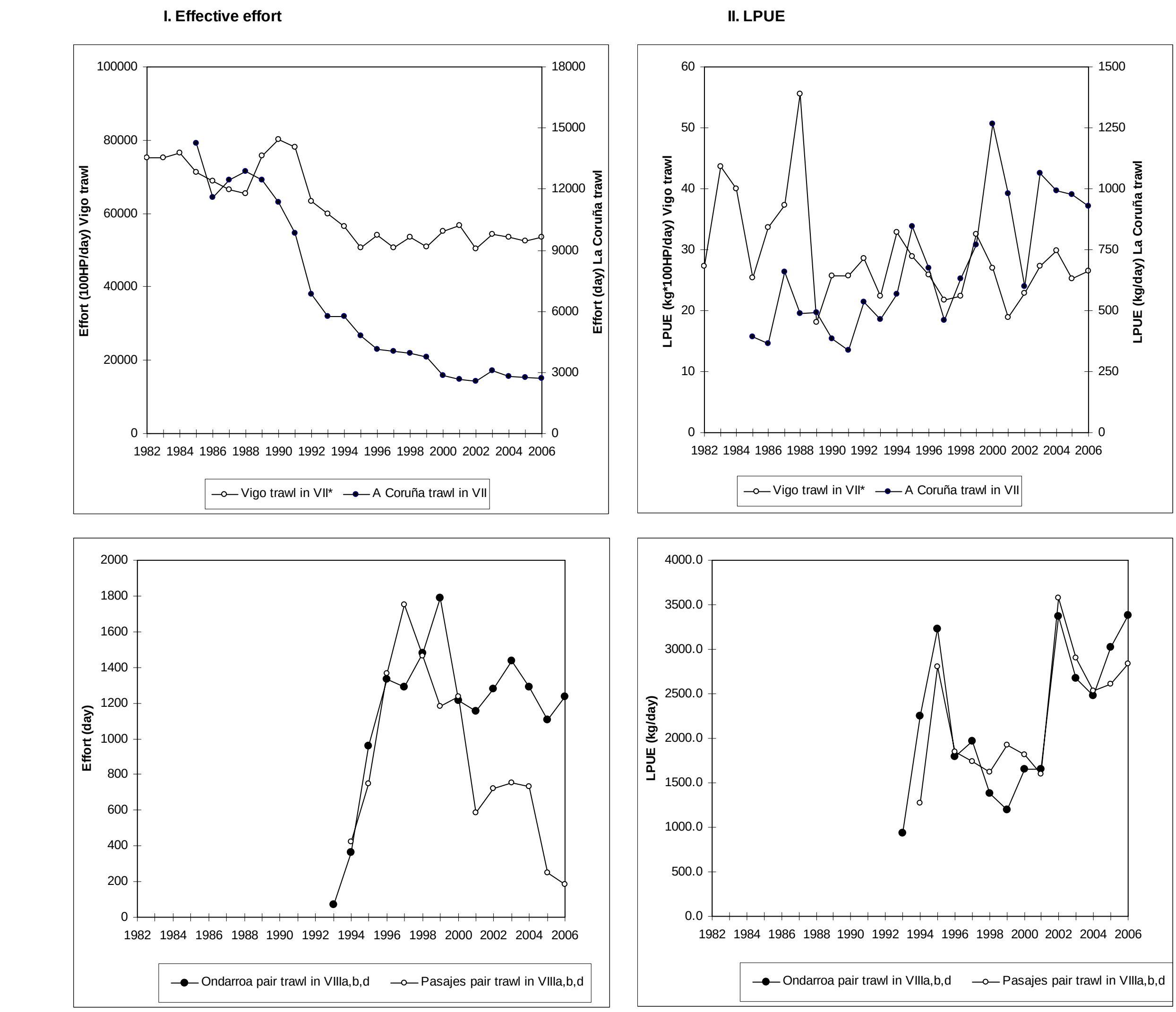


Figure 3.4.a. NORTHERN HAKE. Effective effort indices and LPUE values of commercial fleets used in the assessment to tune the model.

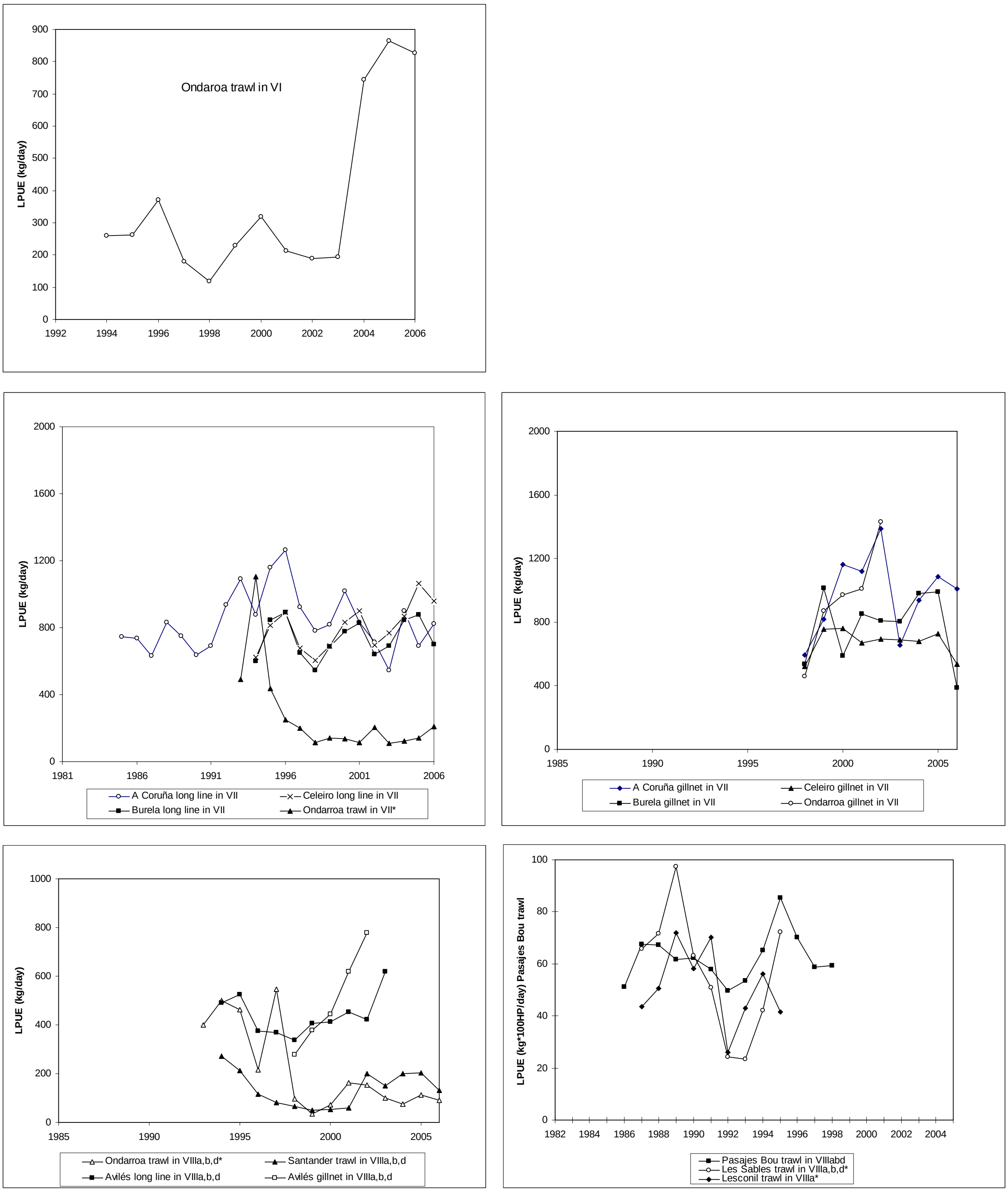


Figure 3.4b. NORTHERN HAKE. LPUE values of commercial fleets not used in the assessment to tune the model

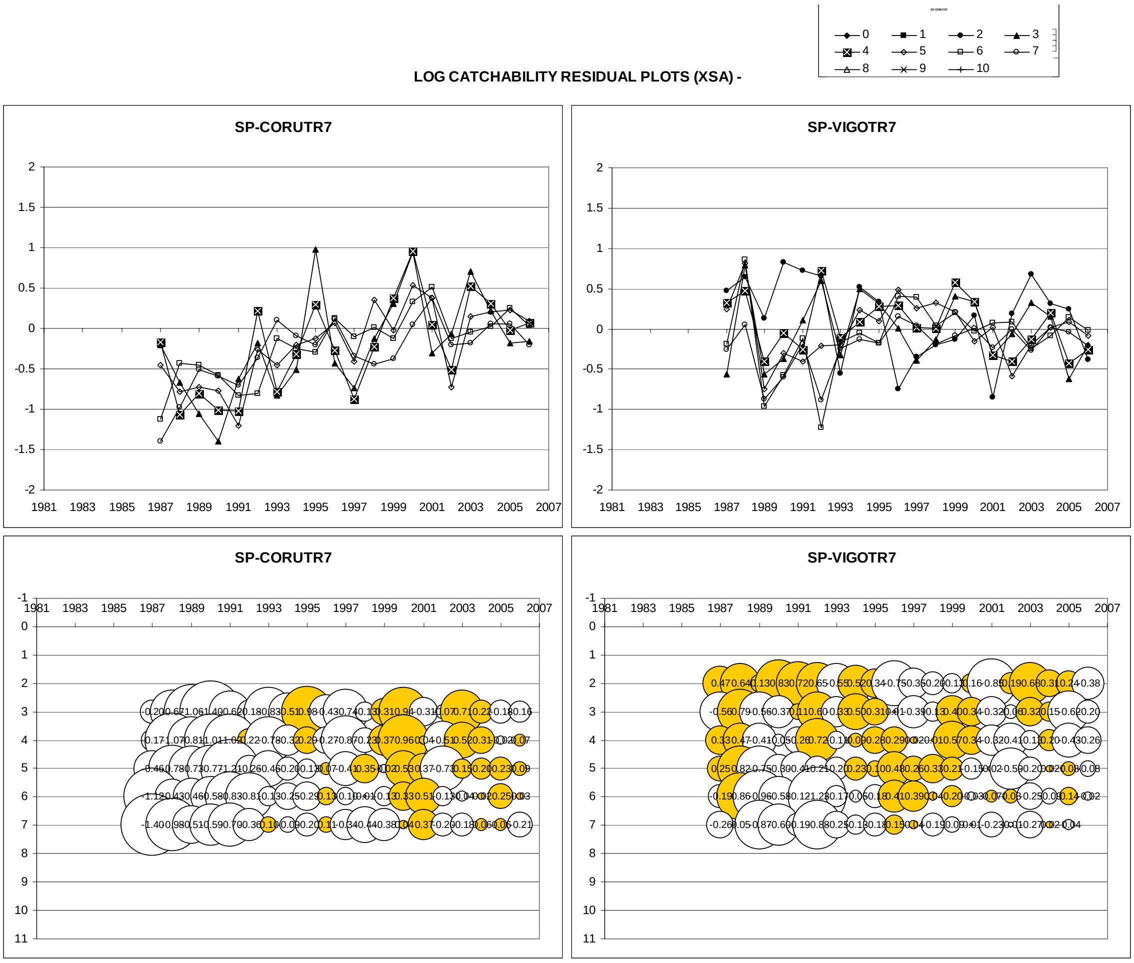


Figure 3.5a. Northern Hake **(2006 Update Run)**

LOG CATCHABILITY RESIDUAL PLOTS (XSA)

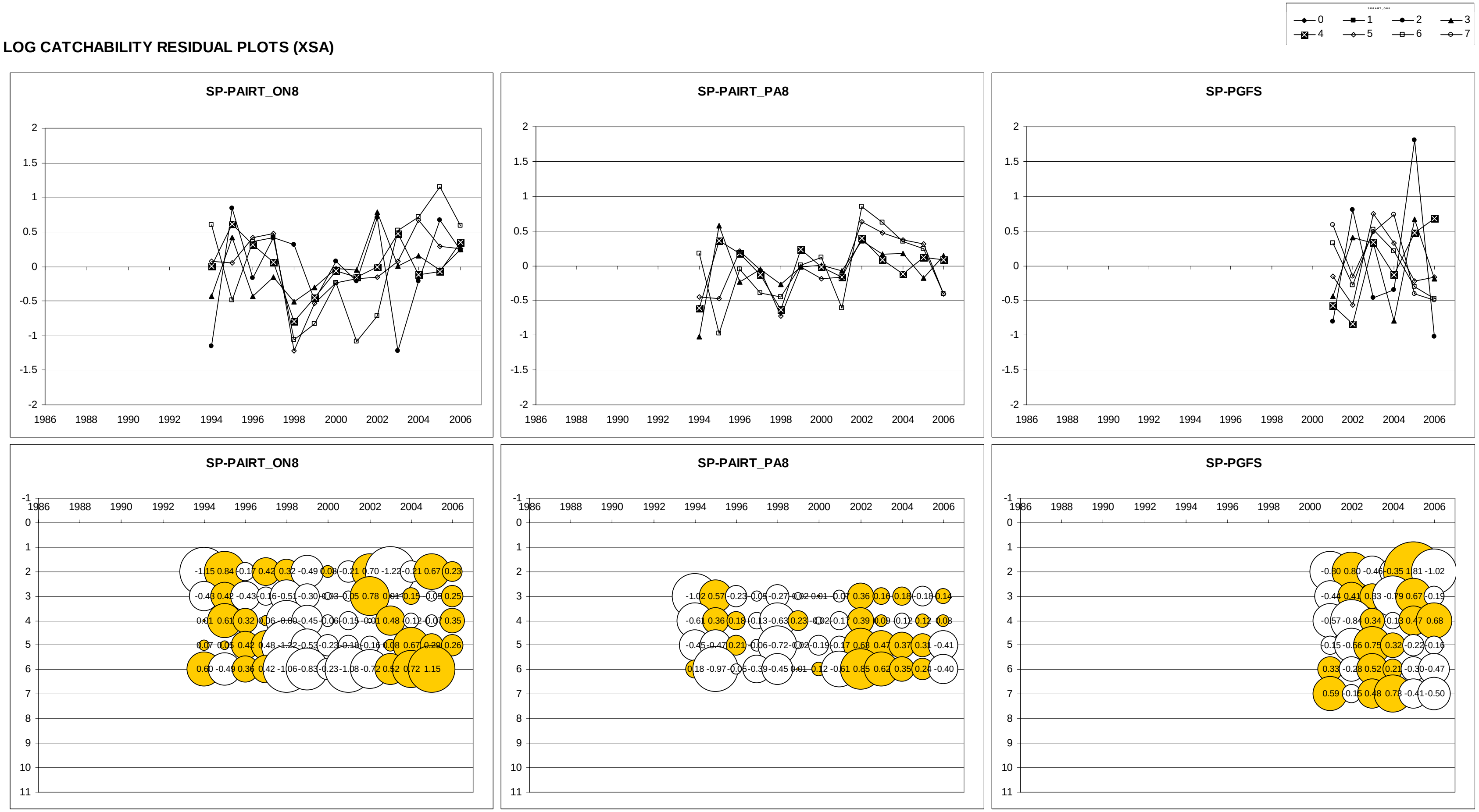
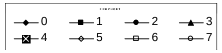


Figure 3.5. b Northern Hake 2006 Update



LOG CATCHABILITY RESIDUAL PLOTS (XSA)

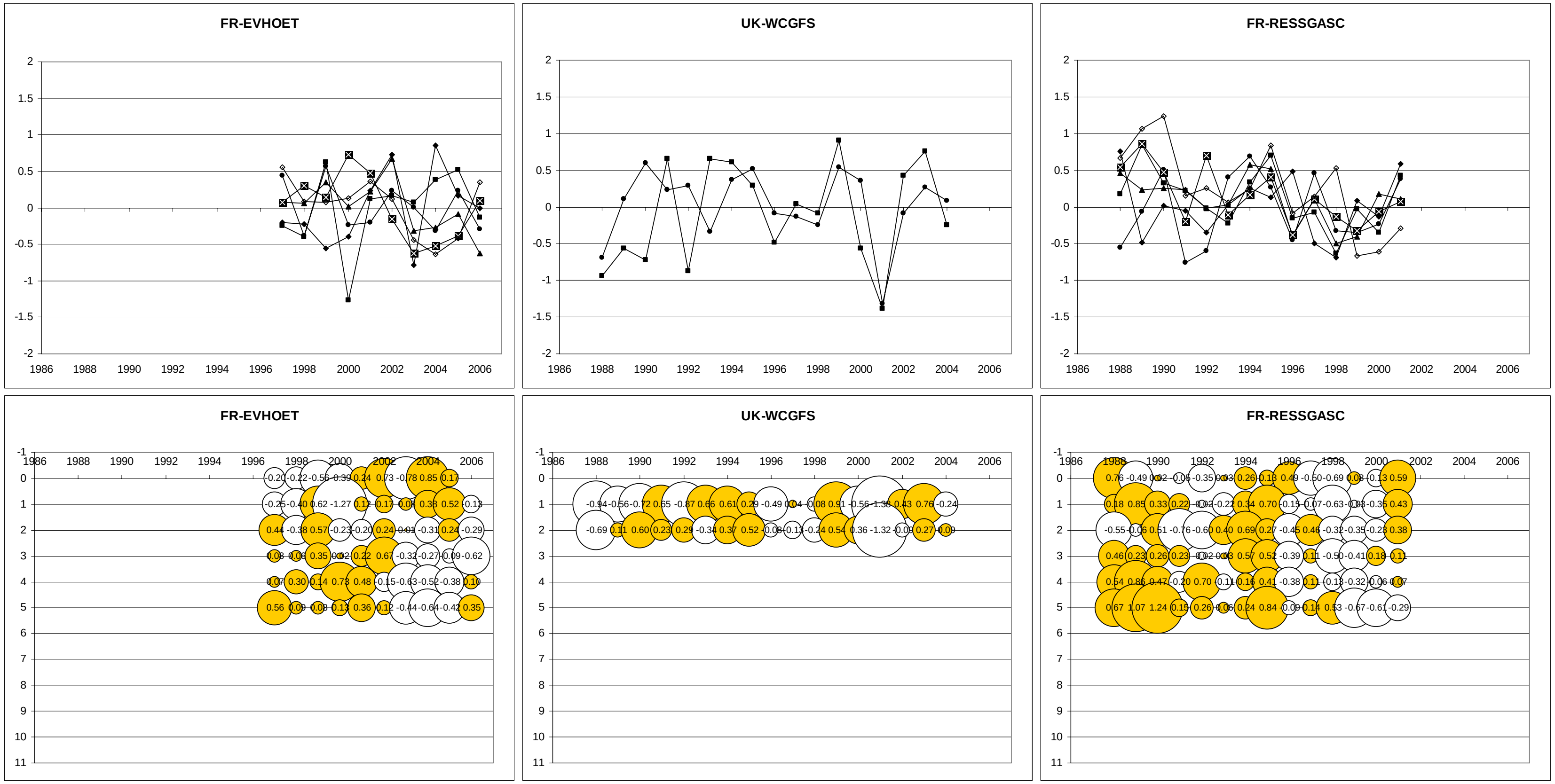


Figure 3.5c Northern Hake **2006 Update**

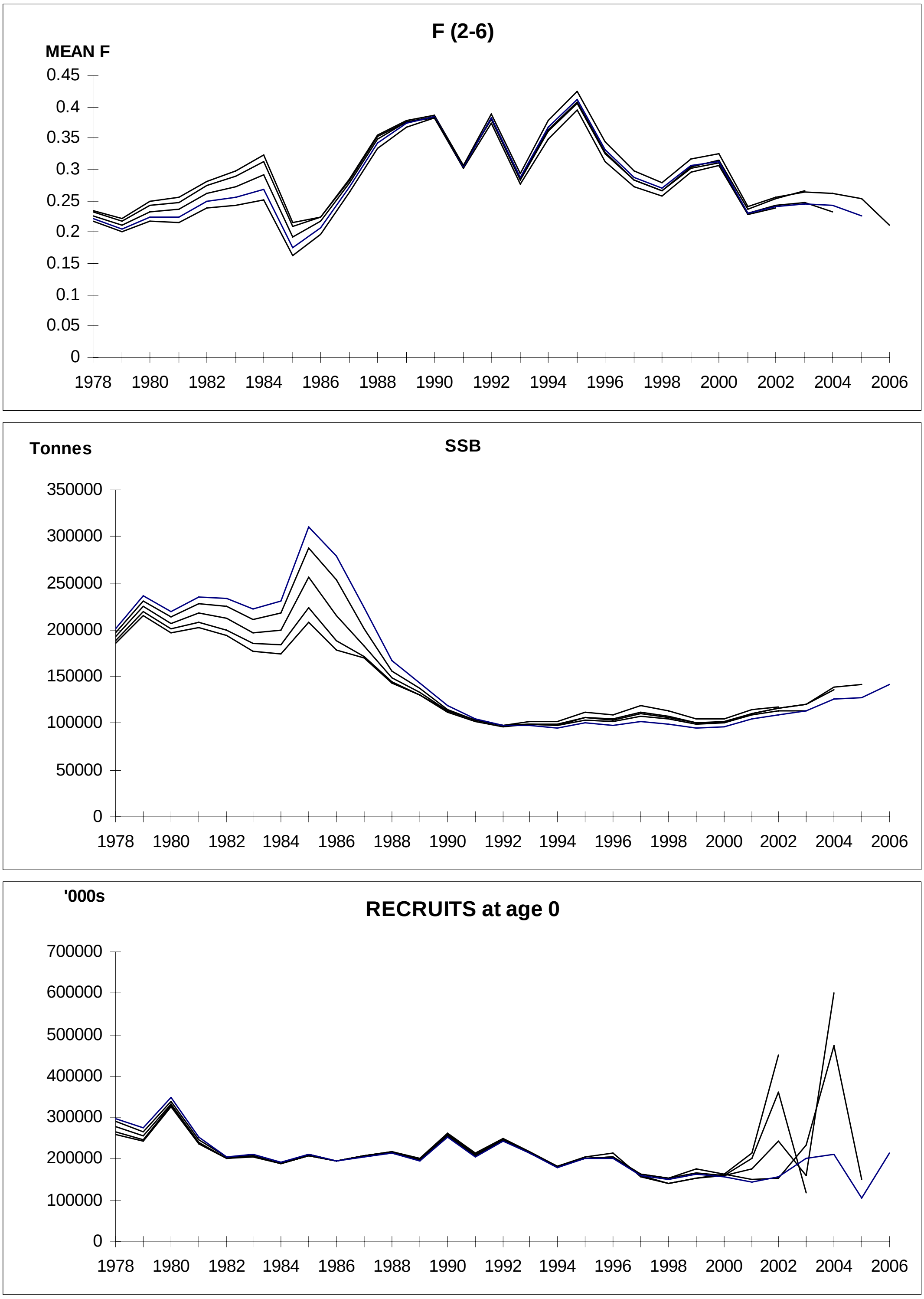


Figure 3.6. Northern Hake retrospective XSA ("2006 Update")

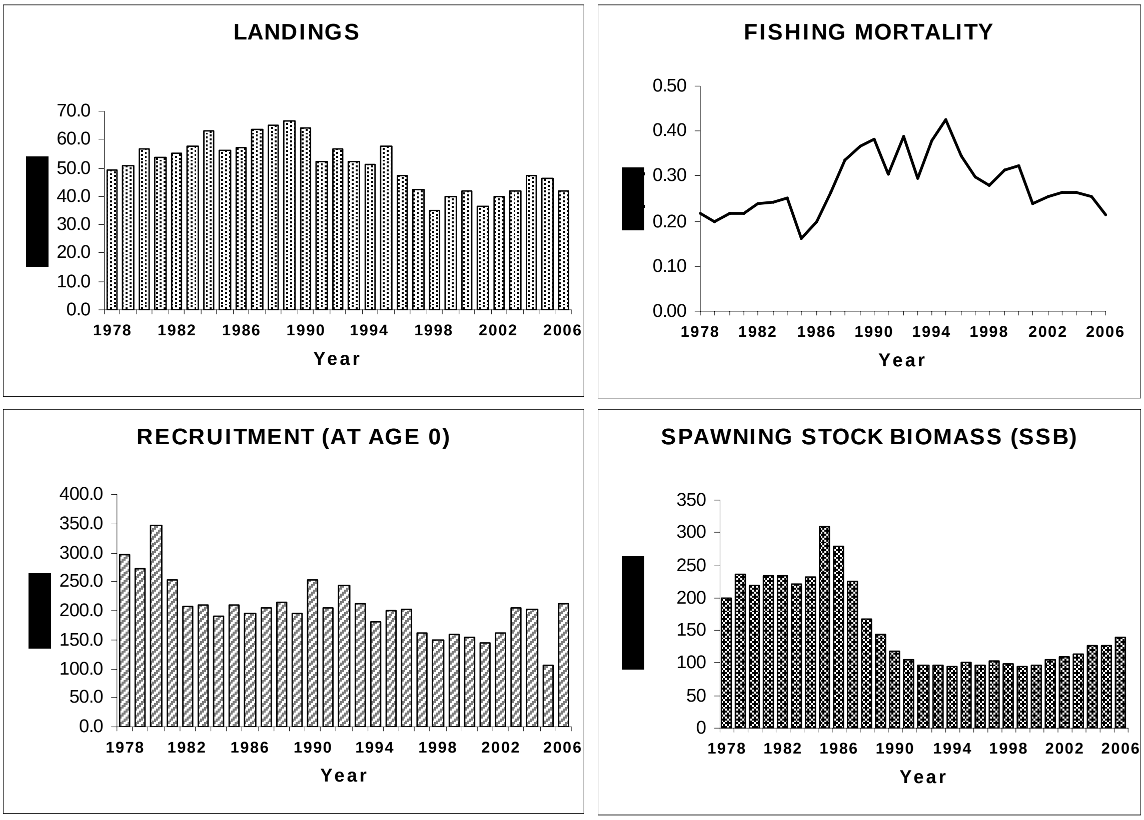


Figure 3.7 Northern Hake stock (IIIa, IV, VI, VII, VIIIab) (No Age 0, "2006 Update")

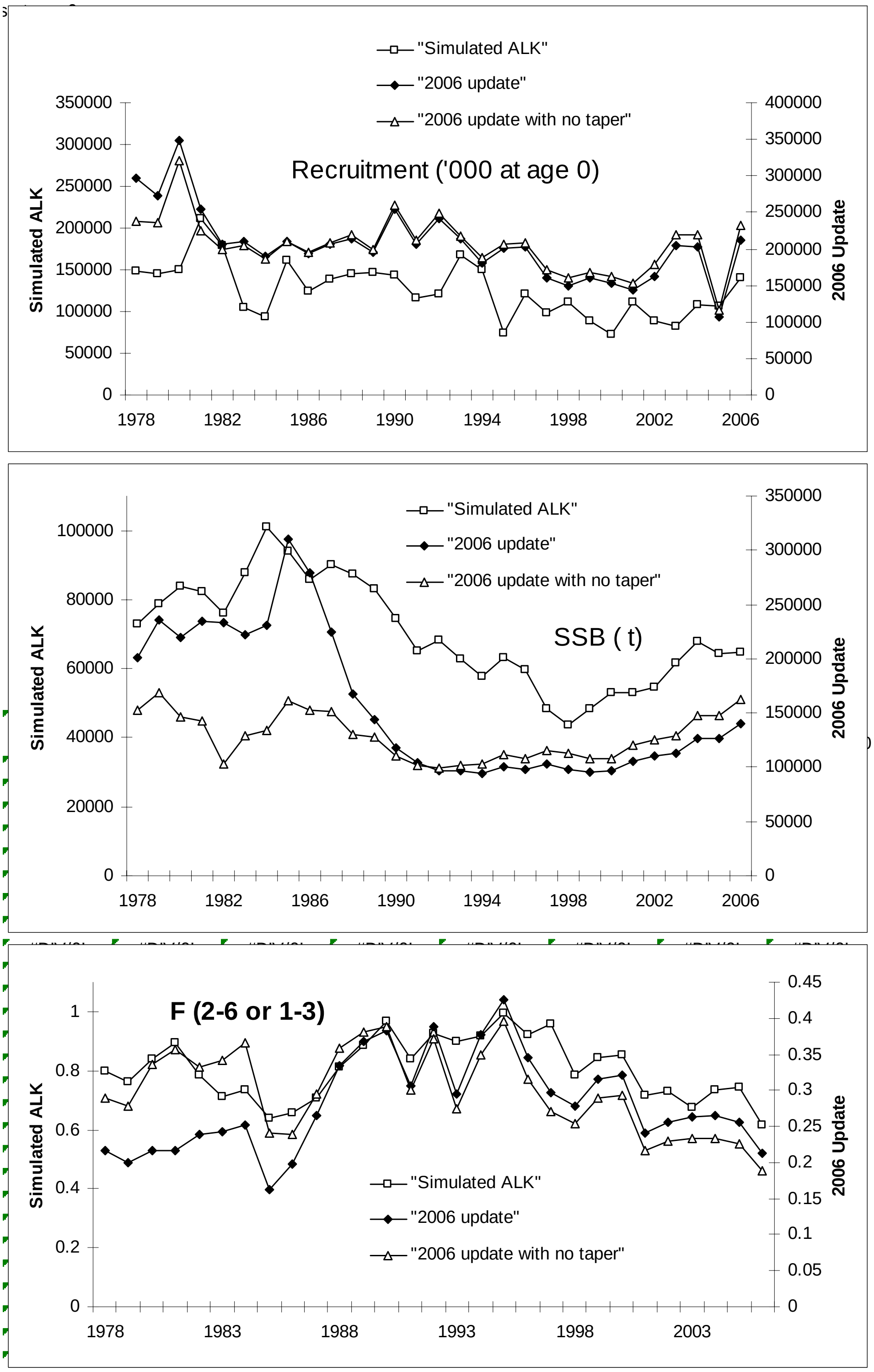


Figure 3.8a. Northern Hake . Comparison of alternative runs (Absloute values)

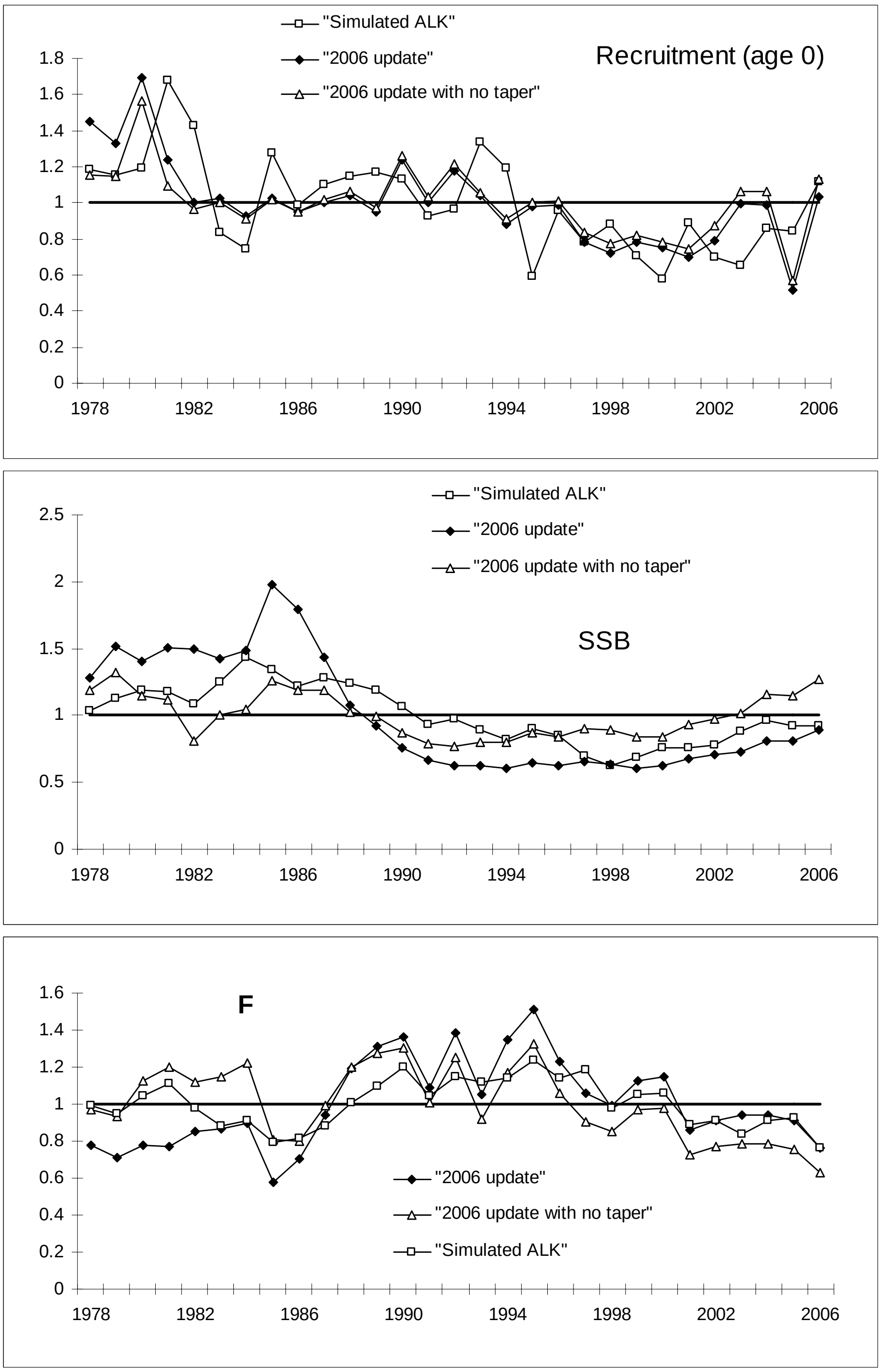
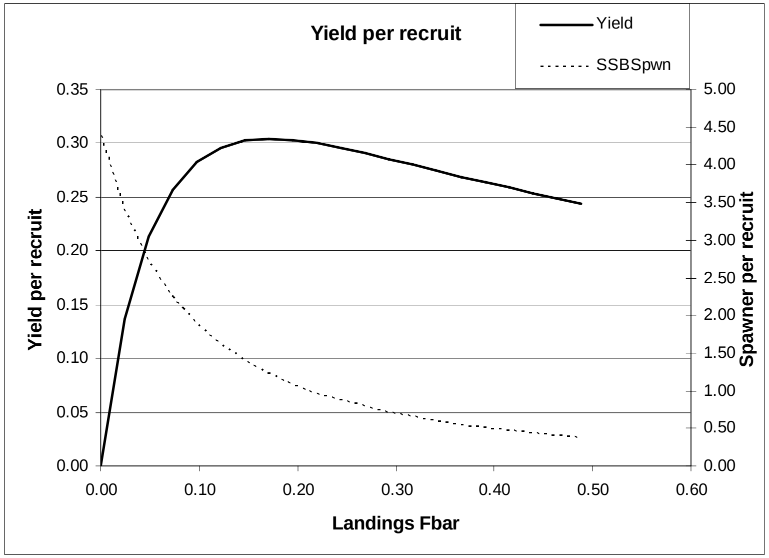
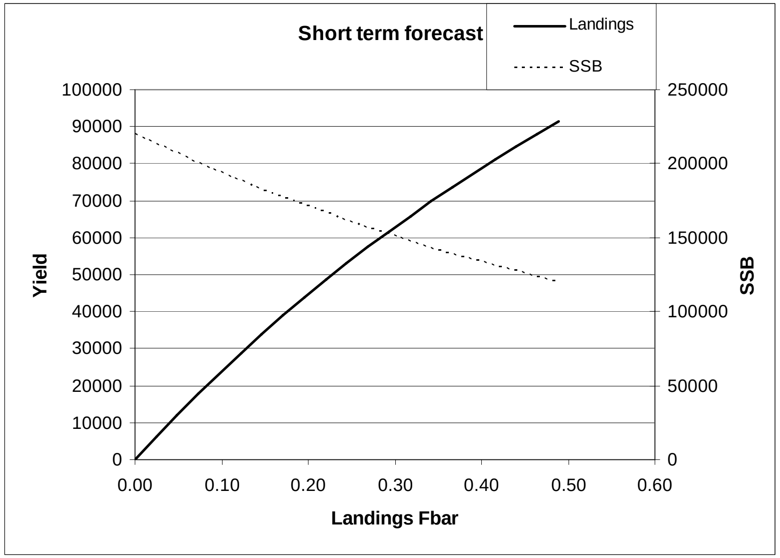


Figure 3.8b. Northern Hake . Comparison of alternative runs (relative values)





MFYPR version 2a
Run: NorthernHakeUpdate2006
Time and date: 16:40 11/05/2007

Reference point	F multiplier	Absolute F
Fbar(2-6)	1.0000	0.2444
FMax	0.7021	0.1716
F0.1	0.4033	0.0986
F35%SPR	0.5311	0.1298
Flow	0.7225	0.1766
Fmed	1.2808	0.3131
Fhigh	1.6626	0.4064

Weights in kilograms

MFDP version 1a
Run: NorthernHakeUpdate2006
Hake Northern stock (WGHMM 2007) Update WGHMM2007
Time and date: 15:52 11/05/2007
Fbar age range: 2-6

Input units are thousands and kg - output in tonnes

Figure 3.9 : Northern Hake. Short term and long term predictions (UPDATE 2006)

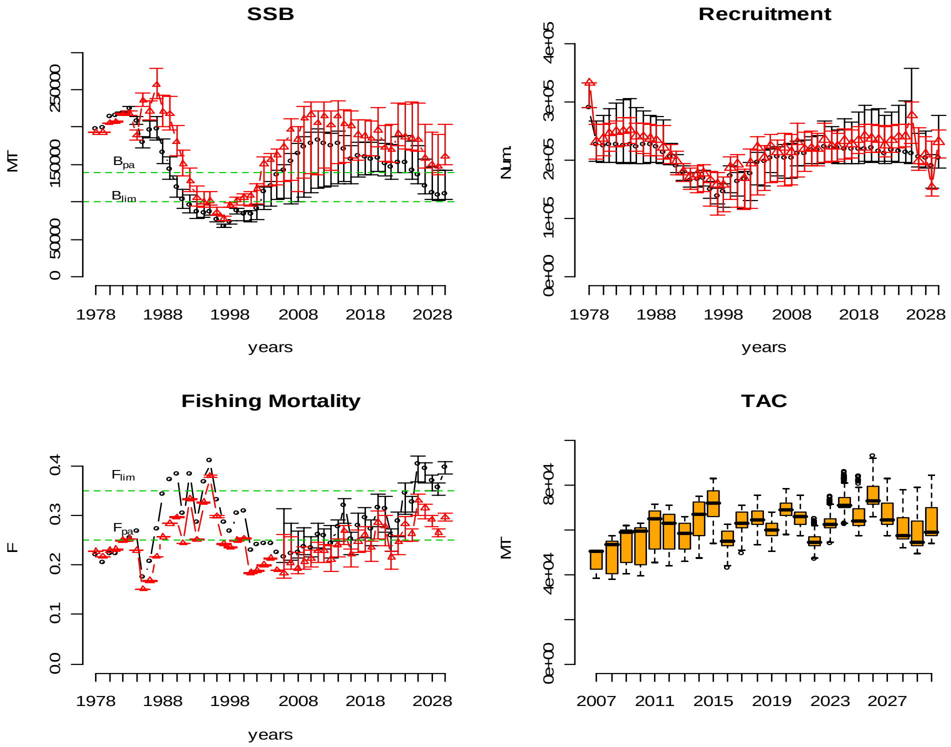


Figure 3.10 Northern Hake Recovery Plan Time series plots for SSB, Recruitment, Reference fishing mortality and TAC. In the first three plots the black line represents the true population and the red one the estimated one in 2030 using XSA. The dots are the median of the simulations for each year and the extremes are the 2.5 and 97.5 quantiles.

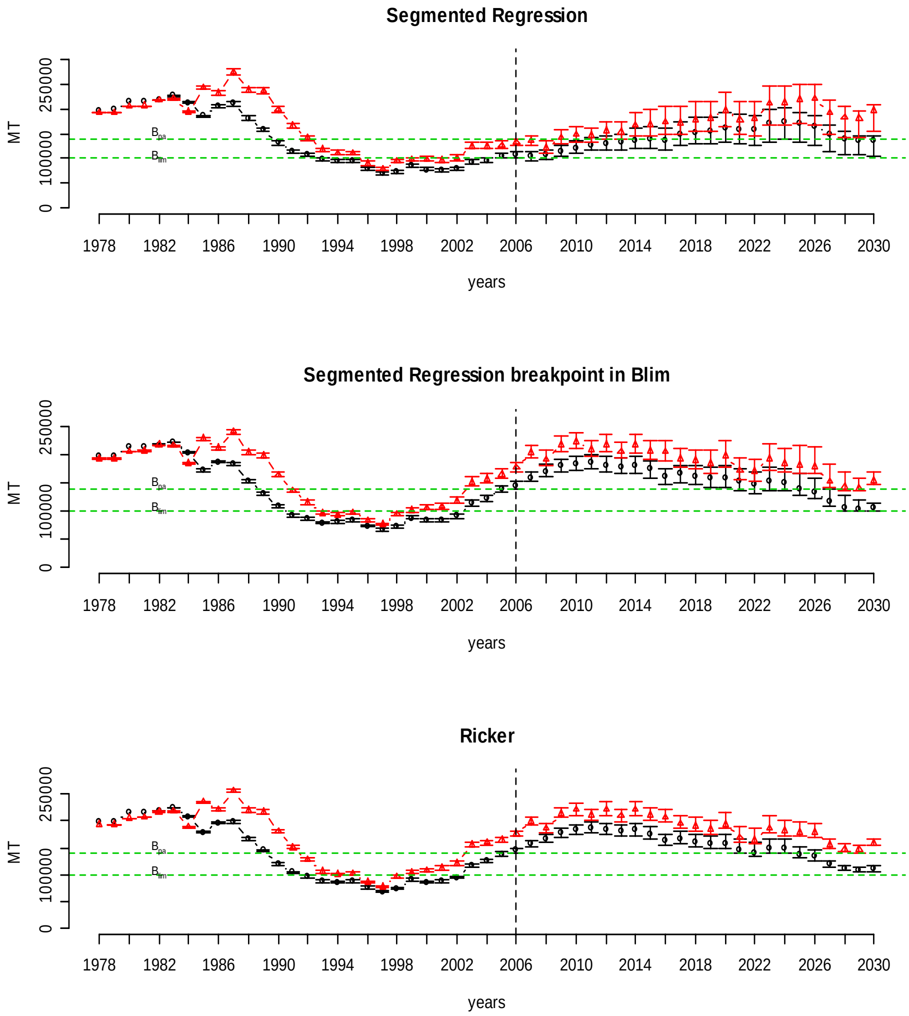


Figure 3.11 Northern Hake Recovery Plan Time series plots for SSB using Segmented Regression, Segmented Regression with changepoint in Blim and Ricker stock recruitment relationships. The black line represents the true population and the red one the estimated one in 2030 using XSA. The dots are the median of the simulations for each year and the extremes are the 2.5 and 97.5 quantiles.

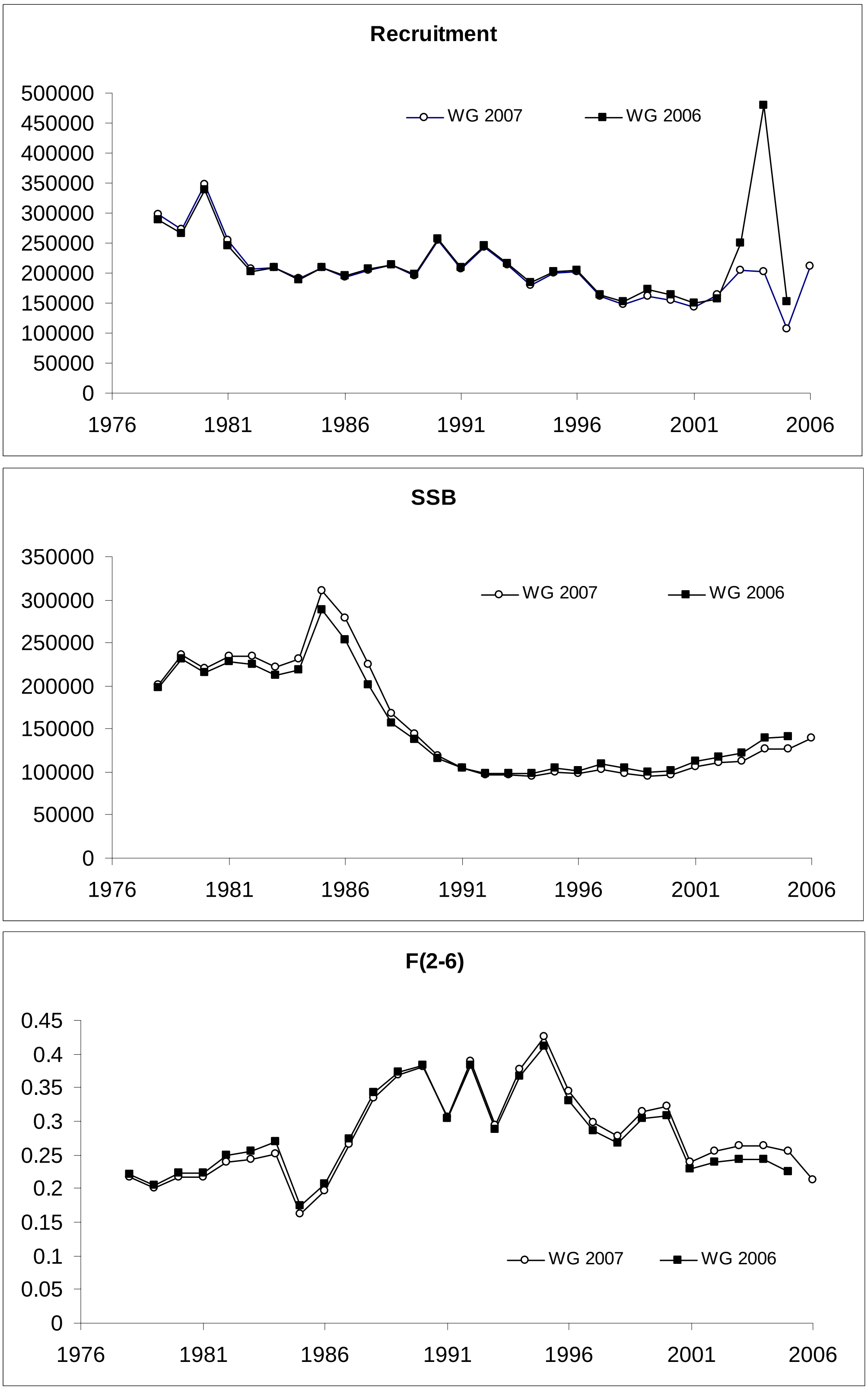


Figure 3.12. Northern Hake Comparative Runs for Updates

4 ANGLERFISH in Divisions VIIb-k and VIIIa,b,d,e

The type of analysis deployed is an update of last’s year assessment. No data revision has been carried out this year. A deterioration of the catch at age data quality has been observed in the last years.

Commercial CPUE series still present some problems. In 2006, French FR-FU04 trawlers showed a change in the selection pattern. Referring to survey information, French EVHOE data and Irish Groundfish survey are available.

The working group concluded that no changes of the current model formulation could result in a better assessment since the problems encountered are due to a recent deterioration of available catch data, especially discard estimates, and ageing problems.

For next year it is proposed an Experimental Assessment to try to assess the stock with different assessment method based on length distribution of data.

4.0 General

4.0.1 Ecosystem aspects

Lophius piscatorius is a North Eastern Atlantic species, with a distribution area from Norway (Barents Sea) to the Straits of Gibraltar (and including the Mediterranean and the Black Sea). *Lophius budegassa* has a more southern distribution from the British islands and Ireland to Senegal (including the Mediterranean and the Black Sea). Though the Working Group assessed two different stocks for each species (VIIIc, IXa stock and VIIb-k, VIIIabd), the boundaries are not based on biological criteria. Recent studies were carried out in genetic and morphometric analysis (GESSAN, 2002; Duarte et al., 2004; Fariña et al., 2004).

The spawning of the *Lophius* species is very particular, with eggs extruded in a buoyant, gelatinous ribbon that may measure more than 10 m (Afonso-Dias and Hislop, 1996; Hislop *et. al*., 2001; Quincoces *et. al*., 2002). This particular spawning results in a highly clumped distribution of eggs and newly emerged larvae (Hislop *et. al*., 2001) and favourable or unfavourable ecosystem conditions can therefore have important impacts on the recruitment.

4.0.2 Fishery

Anglerfish are an important component of mixed fisheries taking hake, megrim, sole, cod, plaice, and *Nephrops*. A trawl fishery by Spanish and French vessels developed in the Celtic Sea and Bay of Biscay in the 1970s, and overall annual landings may have attained 35 - 40 000 t by the early 1980s. Landings decreased between 1981 and 1993. and since 2000, landings show an increasing trend. France and Spain together still report more than 75% of the total landings of both species combined. The remainder is taken by the UK and Ireland (around 10% each) and Belgium (less than 5%). Otter-trawls (the main gear used by French, Spanish, and Irish vessels) currently take about 80% of the total landings of *L. piscatorius*, while around 60% of UK landings are by beam trawlers and gillnetters. Over 95% of total international landings of *L. budegassa* are taken by otter trawlers. There has been an expansion of the French gillnet fishery since the early 90’s in the Celtic Sea and in the north of the Bay of Biscay, mainly by vessels landing in Spain and fishing in medium to deep waters. Otter-trawling in medium and deep water in ICES Subarea VII appears to have declined, even though the increasing use of twin trawls by French vessels may have increased significantly the overall efficiency of the French fleet.

The TAC applied to both species and including Division VIIa was set at 36 000 t for 2007, a 9% increase from the 2006 TAC (33 918) and equivalent to the ACFM estimated *status quo* landings in 2006 (35 900).

The total catch of anglerfish was estimated at 31 500 t for 2006, this figure is most probably underestimated due to the unavailability of part of the French catch statistics in time for the WG (Table 4.0.1). Also, those statistics have been revised back to 1999 but the revisions were not made available ahead enough to be included in this year's assessment.

The Council Regulation (2406/96) laying down common marketing standards for certain fishery products fixes a minimum weight of 500 g for anglerfish. Therefore, if the species can be landed at any size, no commercialisation can occur for fish under that weight. As this regulation has become more and more implemented in practice, increased discarding practices in that fishery or misreporting that were suspected in previous years have become an evidence in the 2006 catch data. This has deteriorated the available data for the assessment as no reliable discard estimates exist.

Information from the Irish fishery indicates that underreporting of total landings is a problem in recent years due to restrictive individual vessel quotas. In 2005 specific anglerfish licences were introduced in Ireland aiming to improve compliance. There has been an increased enforcement on anglerfish quotas in 2006.

4.0.3 Summary of ICES advice for 2006 and management for 2005 and 2006

ICES advice for 2006

In order to harvest the stock within precautionary limits fishing mortality should be kept below $\mathbf{F}_{pa}$ and SSB should be above $\mathbf{B}_{pa}$ for both species. Fishing at $\mathbf{F}_{pa}$ for *L. budegassa* is equivalent to $\mathbf{F}_{sq}$ and is expected to result in landings of 7600 t, leading to an SSB of 26 800 t in 2008. Given the link between the two species, this corresponds to a fishing mortality of 0.21 for *L. piscatorius*, corresponding to landings of at most 28 400 t in 2007. The predicted SSBs are well above $\mathbf{B}_{pa}$ in all scenarios.

Management applicable for 2006 and 2007

The TAC applied to both species and including Division VIIa was set at 33 918 t in 2006 and 36 000 t for 2007.

Since February 1st 2006 a ban on gillnet at depth greater than 200m was set in Sub-areas VI a,b and VIIb,c,j,k.

4.0.4 Data

4.0.4.1 Data processing

Detailed information to species related aspects are given in the relevant sections. The particularity of the data gathering processes for anglerfish species is that, except in Spain, anglerfishes are sold without any species distinction. The overall catch per species is estimated from the species ratio observed in the biological sampling. Biological sampling is carried out by the countries contributing most catches, but assumptions about species proportion have to be made for countries reporting raw tonnages, for species combined. In some other countries, anglerfish are landed as tails only and conversion factors have to be used to estimate total length, which may introduce further errors.

The derivation of the age composition of both species is given in table 4.0.2. For all countries and fishery units where length distribution data are available, SOP corrections are made and numbers are raised to the total estimated catches by using the standard length-weight relations:

Lophius piscatorius: Wt(kg)= 0.00001362*Lt(cm)$^{2.984}$

Lophius budegassa: Wt(kg)= 0.00000762*Lt(cm)$^{3.131}$

All fishery units data within a country are summed and the species ratio and the distributions (age and length) are applied to the total (including unallocated) catch data.

The resulting species ratio, age and length distributions from the summation of data from countries where biological sampling is conducted are then applied to the total international catch.

As in previous years, the French catch statistics were not made available prior to the WG meeting and the estimates of catches were based on logbook data only. They are therefore under estimated. There has been a revision of the French catch and landings statistics down to 1999 but these were not made available in time for this year’s WG. There will therefore be major revisions of these before next year’s WG.

4.0.5 Combined species forecast

Due to increased discard practices, changes in exploitation pattern in major tuning fleets and obvious problems in ageing validation, the Working Group decided that analytical assessments presented for both species could not be accepted to provide reliable population estimates. Therefore no short term projections were carried.

4.0.6 Management considerations

No analytical assessment was carried out due to the bad quality of the data.

-An increasing discard is observed in the landings length distribution. It could be explained with the implementation of the minimum landing weight of 500 g for anglerfish.

-A change in the exploitation pattern of the French FR-FU04 tuning fleet has appeared in the last years.

-Survey indices may indicate the presence of a good incoming recruitment and no particular trend in the overall biomass over the period 1997-2006.

Table 4.0.1 Landings (tonnes) of both species of anglerfish in Divisions VIIb-k and VIIIa,b,d

Working group estimates

Year	VIIb-k	VIIIa,b,d	Total
1977			19895
1978			23445
1979			29738
1980			38880
1981			39450
1982			35285
1983			38280
1984	28847	7909	36756
1985	28491	7161	35652
1986	25987	5897	31883
1987	22295	7233	29528
1988	22494	5983	28477
1989	24731	5276	30007
1990	23434	5950	29384
1991	20385	4684	25069
1992	17554	3530	21084
1993	16633	3507	20140
1994	18093	3841	21934
1995	21922	4862	26784
1996	24132	6102	30233
1997	23928	5846	29774
1998	23295	4876	28171
1999	21288	3224	24512
2000	19250	2711	21962
2001	19357	2838	22195
2002	22990	3674	26664
2003	27408	4317	31725
2004	28983	5920	34903
2005	27038	5168	32206
2006**	26650	4857	31507

** preliminary

Table 4.0.2 **Derivation of the 2006 length compositions, by fishery unit, for *L. piscatorius* and *L. budegassa*, in Divisions VIIb-k and in VIIIa,b,d.**

ICES Division	Fishery unit	Country		2006
VIIb-k	FU 3 Fixed nets	FR	Q	FR.03.06
		EW	Y	total International length distribution species ratio available
	FU 4 Medium and deep waters non-Nephrops	IR	Q	IR.04.06
		FR	Q	FR.04.06
		SP	Q	SP.04.06
		EW	Q	total International LD
	FU 5 gadoid fleets	EW	Q	EW.05.06
		FR	Q	FR.05.06
	FU 6 beam-trawl	BEL	Q	total International LD
		EW	Q	EW.06.06
	FU 8 Nephrops	FR	Q	FR.08.06
VIIIa,b	FU 9 Nephrops	FR	Q	FR.09.06
	FU 10 artisanal bottom-trawl	FR	Q	FR.10.06
	FU 14 medium and deep waters non Nephrops	FR	Q	FR.14.06
		SP	Q	SP.14.06

No discards assumed

L. piscatorius : Spain 2006 + French 2006 Age Length Key (semestrial) applied to French, Spanish and English LDs. Irish ALKs applied to Irish LDs

L. budegassa :Spain 2006 + French 2006 Age Length Key (semestrial) applied to all LD

4.1 *Anglerfish (L. piscatorius)* in Divisions VIIb-k and VIIIa,b,d

The assessment of this stock has been implemented in FLR using FLEDA and FLXSA.

4.1.1 Data

4.1.1.1 Commercial Catch

The Working Group estimates of landings of *L. piscatorius* by fishery unit (defined in Section 3) are given in Table 4.1.1.

The landings have declined steadily from 23 700 t in 1986 to 12 800 t in 1992, then increased to 22 000 t in 1996 and declined to 14 900 t in 2000. The landings have increased since then reaching the maximum of the time series in 2004 (27 300 t). In 2006 landings remain stable with 25 700 t.

4.1.1.2 Biological Sampling

The sampling level is given in Table 1.3.

Figure 4.1.1 shows the evolution of the length composition of landings over the period 1993 to 2006.

The length composition of landings has showed a shift towards smaller individuals in 2002 and 2003, similar to that observed in 1993 and 1994, these cohorts are reaching larger lengths in 2004 and 2005 landings.

Partial information on discards is available for several countries and units. Even though they have not been computed, they provide indication that discards could be high in some cases.

The lack of available information on landings of smaller fish caused by the increasing discarding practices has not been compensated by an increase in discards sampling. Therefore the quality of data used for this assessment has decreased in recent years and it has been emphasized for 2006 data. The WG recommends to increase the sampling on the catches of smaller anglerfish and to increase the number of readings on younger ages.

The derivation of the 2006 length compositions is showed in Table 4.0.2.

The 1986 age compositions were obtained using mean quarterly ALKs from the years 1987-1991. France provided quarterly ALKs from 1987 to 2005, based on samples taken from the Celtic Sea. From 1987 to 1996, the French ALKs (available on a quarterly basis) were applied to the international length distributions. In 1997, combined French and Spanish quarterly ALKs were applied to the international length distributions. In 1998, combined French and Spanish semestrial ALKs were applied to the international length distributions.

In view of the data available and the fact that for years 1999 and 2000 there was a lack of age data for some lengths, it was decided to use a combined France 1999 + Spain 2000 ALK (sum of the readings) to the 1999 and 2000 international length compositions of the landings in each fishery unit, and to the length compositions of the tuning fleets.

ALKs were available for Spain in 1997-2001. In 1997 they were available for Quarters 1, 2, and 4, but since only a small number of illicia were read in the fourth quarter, only the two first quarters ALKs were used. In 1998, ALKs were available by semester for the Bay of Biscay, but only for the last semester for the Celtic Sea.

In 2006 as since 2001, quarterly French ALKs and Spanish semestrial ALKs were combined and applied to the semestrial international length distributions. Ireland provided an ALK for 2005 but due to large differences with the ones provided by France and Spain it was not used in the derivation of 2005. In 2006, differences were not so high, so the catch at age data was built using the Irish readings.

4.1.1.3 Surveys

Standardised biomass, abundance, and recruitment indices from the French EVHOE survey and Irish Groundfish survey are shown in Table 4.1.2.

The data shows the highest recruitment (age 0 individuals) indices in 2001 and the highest total abundance index in weight (the second higher in numbers) in 2004. In 2006 the index shows the second higher abundance index in weight and an increase in the recruitment indices.

The recent Irish Ground Fish Survey provides biomass and length distribution since 2003. This information is not included in the assessment as tuning fleet due to the short time series and the scarcely data available.

The length distribution of three available surveys is plotted in the Figure 4.1.2. In 2004, very small individuals are caught but this trend decreases in the next years.

4.1.1.4 Commercial LPUE

Effort and LPUE data were available in 2006 for four Spanish fleets (Table 4.1.3). Since French logbook data were only partially available since 1999, only the LPUE data can be considered.

Fishing effort (days fished corrected by HP) of the SP-VIGOTR7 and SP-CORUTR7 fleets has decreased since the late 1980's, about 25% and 70% respectively; but the SP-VIGOTR7 fleet seems to have stabilised since 1995, as SP-CORUTR7 which stabilises in the last five years. (Figure 4.1.3a). The time series of the two Spanish fleets (SP-BAKON7 and SP-BAKON8) start at 1993, SP-BAKON8 shows a clear decreasing trend until 1999 and a stable effort since then, SP-BAKON7 had a fluctuating effort pattern from 1993 to 2000 and a constant decrease since then.

FR-FU04 effort (hours fished) in the Celtic Sea presents a very similar trend as for the SP-VIGOTR7 fleet until 1994. Since then, an increase in the FR-FU04 effort devoted to benthic species was observed in 1995 and 1996, which is due to a change in target species rather than to an overall increase of effort. This increase in effort ceased in 1997. In the Bay of Biscay, the trend is similar, but the increase was relatively slight in 1995. It has to be noted again that these French benthic fleets effort are based on the number of hours fished by trawlers whatever trawl is used, not the trends of effective effort.

All the commercial LPUE series decreased steadily until 1992. Since then, they have increased, but different tendencies appeared in the last years (Figure 4.1.3.b. and Table 4.1.3).

4.1.2 Assessment

4.1.2.1 Input data

The input data for this assessment was from 1986 to 2006 and for ages ranging from 1 to 13 + for the catch at age in numbers, weight at age in the catch and in the stock are considered the same. The proportion of natural and fishing mortality before spawning was set at 0 for all ages and all years.

The estimated annual age compositions of the total international landings up to 2006 are shown in Table 4.1.4.

The weight-at-age data used in this assessment are given in Table 4.1.5. A steady decreasing trend in the mean weights at age for ages older than 3 is evident since 1996 and a high variability detected for older ages which are indicating problems with age composition.

A workshop was conducted in November 2004 in IPIMAR (Lisbon), according to the results of the workshop, the current Northern stock readers showed for *L. piscatorius* no bias between themselves but a possible change of the ageing criteria along the years was not studied.

Growth validation studies seem to be necessary in order to know if the bias in the data comes from ageing criteria changes or from natural events.

Natural mortality at all ages and in all years was assumed to be equal to 0.15.

The maturity ogive used was the same as last year (sexes combined) (Quincoces *et al*, 1998):

AGE	1	2	3	4	5	6	7	8	9	10	11	12	13+
Prop. mature	0.0	0.0	0.0	0.0	0.0	0.54	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Tuning data used in the analysis is presented on Table 4.1.6.

Exploratory analysis of catch at age matrix using FLEDA

In the standardized catch at age proportion plot, cohort could not be followed along years (Figure 4.1.4) but different cohorts behave as a unique age. This bias could be explained by a biased criterion on age readings.

The figure of trends in biomass for mature and immature (Figure 4.1.5) shows a decreasing trend in the mature component of landings until 1994, and after that a fluctuating increase with a peak in 2004 and decrease in the last two years.

4.1.2.2 Model

As in previous years, the model chosen by the Group to assess this stock was XSA. The assessment of this stock for this year is an update assessment.

Final XSA run

The final XSA run was performed using the settings which are detailed below with last year's configuration:

	TOTAL FLEETS	% IN THE LANDINGS	Tuning flets		2006 WG		2007 WG
Year range of catch data					86-05		86-06
Age range of catch data					1-13+		1-13+
Commercial fleets	EW-FU06	6.4%					
	SP-BAKON7	0.4%					
	FR-FU04	9.9%	FR-FU04	87-05	1-12	87-06	1-12
	SP-VIGOTR7	11.9%	SP-VIGOTR7	87-05	5-12	87-06	5-12
	SP-CORUTR7	3.4%	SP-CORUTR7	87-05	2-12	87-06	2-12
	SP-BAKON8	0.8%	SP-BAKON8	93-05	3-9	93-06	3-9
Surveys	FR-EVHOES		FR-EVHOES	97-05	1-7	97-06	0-7
	IR-GFS						
Taper					no		no
Tuning range					87-05		87-06
Ages catch dep. Stock size					no		no
q plateau					7		7
F shrinkage SE					10.0		10.0
year range					5		5
age range					3		3
Minimum SE per fleet					0.5		0.5

The diagnostics from the update XSA run are given in Table 4.1.7.

The retrospective analysis shows a bad estimate of recruitment and a tendency to overestimate F and underestimate the SSB (Figure 4.1.6).

The following information will be compiled in annex D:

The comparison between this year and last year assessment are in Figure D.1.1.

Plots of log-catchability residuals are shown in Figures D.1.2 and D.1.3.The log-catchability residuals show bigger residual in recent years than observed in last year assessment.

The patterns in the residuals (especially cohort effects) and in the standardised catch at age proportions, successive modes observed in the survey data, confirm the need of ageing validation studies.

The working group concluded that no changes in the model formulation could result in a better assessment since the problems encountered are due to a recent deterioration of available catch data, especially discard estimates, and ageing problems. The working group also agreed to reject the XSA results to serve as a basis for a diagnostics of the state of the resource.

Tables D.1.1 to D.1.3. show the outputs from the XSA.

4.1.2.3 Comments on the quality of the assessment

No analytical assessment was accepted and therefore precise estimate of recent development in the stock population structure and SSB are not available.

Table 4.1.1 **Anglerfish *(Lophius piscatorius)* in Divisions VIIb-k and VIIIa,b,d**
Landings in tonnes by Fishery Unit

	VIIb,c,e-k						VIIIa,b,d				TOTAL
Year	Gill-Net (Unit 3+13)	Medium/Deep Trawl (Unit 4)	Shallow Trawl (Unit 5)	Beam Trawl (Unit 6)	Shallow/medium Neph.Trawl (Unit 8)	Other (Unit 15)	Neph.Trawl (Unit 9)	Shallow Trawl (Unit 10)	Medium/Deep Trawl (Unit 14)	Unallocated (Unit 15)	VII +VIII
1986	429	13781	2877	1437	1021		746	720	2657		23666
1987	560	11414	2900	1520	787		1035	542	3152		21909
1988	643	9812	3105	1814	774		927	534	2487		20095
1989	781	8448	5259	2342	754		673	444	1772		20474
1990	1021	8787	3950	1736	880		410	391	2578		19753
1991	1752	7565	2806	1196	752		284	218	1657		16229
1992	1773	6254	1489	1052	887		254	166	942		12818
1993	1742	5776	2125	1281	969		360	278	950		13481
1994	1377	7344	2595	1523	1236		261	198	1586		16120
1995	1915	8461	3195	1805	1242		501	429	1954	228	19730
1996	2244	9796	2637	2189	1149	138	441	379	2229	938	22141
1997	2538	9225	2945	2031	964	39	429	376	2045	1068	21660
1998	3398	8714	2138	1722	812	3	397	149	1699	542	19572
1999	2912	8343	2257	1407	743	19	97	117	1292	0	17186
2000	2299	7340	1853	1457	838	5	100	84	949	0	14925
2001	1806	7978	2243	1982	866	17	136	75	1405	0	16508
2002	2731	9679	2644	1836	922	5	223	88	2002	0	20130
2003	3087	11957	2622	1978	925	81	377	124	2440	0	23591
2004	3982	12773	3055	2454	869	14	461	180	3523	0	27313
2005	4771	11192	2396	2385	571	7	322	152	2925	58	24778
2006**	3623	13341	2257	2418	701	3	433	217	2737	2	25733

* revised
** preliminary

Table 4.1.2. Anglerfish (*L. piscatorius*) in Divisions VIIb-k and VIIIa,b,d.
Abundance index from FR-EVHOES

	FR-EVHOES			IRISH GROUNDFISH SURVEY		
Year	Kg/30'	Nb/30'	Nb/30' age 0	tandardised to Kg/SqKm/1(	tandardised to No/SqKm/1(	andardised to No age 0/SqKm/10
1997	1.47	0.86	0.11			
1998	1.94	0.92	0.32			
1999	1.49	1.24	0.67			
2000	0.91	0.95	0.18			
2001	2.24	2.99	1.04			
2002	2.37	3.27	0.15			
2003	2.18	1.68	0.06	1.82	2.08	0.49
2004	3.36	3.17	0.16	2.30	3.65	1.83
2005	2.68	1.96	0.06	2.16	2.21	0.35
2006	3.17	1.94	0.12	1.23	1.31	0.17

Table 4.1.3. **Anglerfish (*L.piscatorius*) in Divisions VIIb-k and VIIIa,b,d.**
Effort and LPUE data

EFFORT	SP-VIGO7 in Sub-Area VII ('000 days*HP)	SP-CORUTR7 in Sub-Area VII ('000 days*HP)	French Benthic trawlers* Celtic Sea FU04 ('000 hrs)	French Benthic Twin Trawls Celtic Sea ('000 hrs)	French Benthic trawlers* Bay of Biscay FU14 ('000 hrs)	French Benthic Twin Trawls Bay of Biscay ('000 hrs)	EW FU06 Beam trawlers in VII ('00 days)	SP-BAKON7 (days)	SP-BAKON8 (days)
1986	6875	9527	418	N/A	123	N/A	N/A		
1987	6662	10453	349	N/A	199	N/A	N/A		
1988	6547	10886	334	N/A	150	N/A	N/A		
1989	7585	10483	378	N/A	187	N/A	N/A		
1990	8021	9630	380	N/A	208	N/A	N/A		
1991	7822	8522	380	N/A	210	N/A	N/A		
1992	6370	5852	331	N/A	186	N/A	100		
1993	5988	5001	274	N/A	159	N/A	114	1094	5590
1994	5655	4990	249	N/A	148	N/A	116	980	5619
1995	5070	4403	287	N/A	174	N/A	127	1214	4474
1996	5416	3746	196	121	144	19	126	1170	4378
1997	5058	3738	178	133	133	33	126	540	4286
1998	5360	3684	182	134	117	40	121	1196	3002
1999	5084	3512	108	110	83	59	115	1384	2337
2000	5519	2773	160	103	87	49	104	1850	2227
2001	5678	2356	127	133	60	66	186	1451	2118
2002	5041	2258	114	120	56	75	111	949	2107
2003	5437	2597	144	134	65	78	166	1022	2296
2004**	5347	2292	**155**	**129**	**75**	**88**	174	910	2159
2005**	5246	2120	137	135	81	118	109	544	2263
2006***	5392	2257	136	139	69	98	94	487	2398

LPUE	Vigo in Sub-Area VII (kg/days*HP)	La Coruna in Sub-Area VII (kg/days*HP)	French Benthic trawlers* Celtic Sea FU04 (kg/10 hrs)	French Benthic Twin Trawls Celtic Sea (kg/10 hrs)	French Benthic trawlers* Bay of Biscay FU14 (kg/10 hrs)	French Benthic Twin Trawls Bay of Biscay (kg/10 hrs)	EW (FU06) Beam trawlers in VII (kg/10 days)	SP-BAKON7 (kg/day)	SP-BAKON8 (kg/day)
1986	285.9	383.0	142.9		130.8				
1987	235.2	326.1	141.5		118.9				
1988	182.2	272.4	131.8		109.7				
1989	210.3	236.3	102.4		60.9				
1990	206.5	227.5	104.0		85.2				
1991	183.6	234.5	81.8		54.8				
1992	188.0	199.5	56.2		34.7		94.2		
1993	268.1	172.3	60.0		42.1		93.2	59.8	23.0
1994	288.8	186.6	111.3		74.6		81.2	73.3	44.1
1995	409.7	130.5	130.8		84.2		76.6	98.6	55.8
1996	520.0	212.1	116.6	159.1	81.1	113.5	110.2	130.4	69.6
1997	439.7	244.5	105.4	133.0	77.6	83.8	117.3	131.5	71.3
1998	450.7	192.7	95.5	113.1	60.3	66.4	110.9	133.9	66.3
1999	428.2	136.4	52.8	77.2	41.9	46.5	95.5	125.2	34.1
2000	202.9	182.1	89.4	72.0	34.2	43.6	109.0	185.5	31.2
2001	238.6	169.8	109.4	119.0	57.3	67.9	82.5	184.1	61.4
2002	468.8	218.1	140.8	149.7	70.1	56.6	123.0	218.3	71.7
2003	598.0	286.2	195.3	192.6	106.2	152.4	80.3	273.7	76.3
2004	562.9	249.3	**137.6**	**157.8**	**90.3**	**136.8**	**92.6**	249.0	118.7
2005	591.5	356.0	157.6	159.6	101.0	85.5	143.9	287.4	99.7
2006***	568.2	382.9	188.9	178.2	112.4	114.3	175.4	221.1	88.7

* Identified twin trawls excluded
**Revised
*** Preliminary
NB : data for France since 1999 are partial and from an unknown proportion of the total logbooks.
Therefore effort data since 1999 is used only for cpue computation and do not represent total effort. The effort data since 1999 is not plotted on the graph.

Table 4.1.4. - Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b,d: Catch number at age

Run title : I(L.piscatorius UNSEXED

At 7/05/2007 12:12

Table 1 Catch numbers at age Numbers*10**-3

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
AGE											
1	112	163	6	76	355	105	147	350	364	395	232
2	548	808	694	507	992	276	654	1617	1785	1506	1540
3	855	990	2214	1132	1137	499	941	2996	2780	2427	2475
4	999	963	1716	1908	1363	761	400	1268	2535	2222	2317
5	1001	609	1022	1898	1576	806	381	538	1354	1577	1945
6	1327	656	697	888	1370	991	544	447	776	1198	1299
7	1143	840	611	622	704	788	596	281	310	886	924
8	688	657	486	430	276	380	391	250	158	344	464
9	360	455	335	233	120	138	131	161	123	106	321
10	171	258	198	139	87	74	84	114	64	63	76
11	81	125	145	45	35	23	39	41	39	29	67
12	56	35	83	44	24	5	28	41	31	20	19
+gp	70	109	109	95	59	45	79	96	42	61	71
0 TOTALNU	7411	6668	8316	8017	8098	4891	4415	8200	10361	10834	11750
TONSLAN	23666	21909	20095	20474	19753	16229	12818	13481	16120	19730	22141
SOPCOF	100	100	100	100	100	100	100	100	100	100	100

Run title : I(L.piscatorius UNSEXED

At 7/05/2007 12:12

Table 1 Catch numbers at age Numbers*10**-3

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGE										
1	65	36	137	164	572	564	265	119	311	133
2	582	628	737	1855	797	1697	959	397	1386	447
3	997	1085	782	1985	1247	3169	2499	1069	1845	1062
4	1565	955	861	1796	1671	2199	3121	1775	1453	3303
5	1602	752	751	1025	1852	1417	2820	2337	1531	3080
6	1368	817	633	577	1370	1295	2451	2597	1368	2187
7	987	848	550	390	750	1045	1298	1954	1349	1027
8	603	657	298	178	464	671	680	1060	897	554
9	418	363	354	163	202	460	491	563	588	413
10	201	251	265	139	87	302	256	292	332	239
11	140	142	134	75	67	141	198	196	213	238
12	63	70	103	61	48	68	104	146	116	138
+gp	91	140	196	202	165	81	149	164	160	153
0 TOTALNU	8682	6744	5801	8610	9292	13109	15291	12669	11549	12974
TONSLAN	21660	19572	17186	14925	16508	20130	23591	27313	24778	25734
SOPCOF	100	100	100	101	98	100	100	100	100	100

Table 4.1.5. - Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b,d: Catch weight at age

Run title : (L.piscatorius UNSEXED

At 7/05/2007 12:12

Table 2 Catch weights at age (kg)

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
AGE											
1	0.1399	0.1559	0.1019	0.1478	0.1367	0.1486	0.1711	0.1469	0.1927	0.1718	0.1545
2	0.2675	0.2873	0.2557	0.3301	0.3427	0.3538	0.3513	0.3611	0.348	0.3762	0.2719
3	0.5703	0.558	0.5151	0.6026	0.6776	0.6935	0.5812	0.6209	0.6843	0.7021	0.6643
4	1.1165	1.1375	0.9309	1.1862	1.3253	1.3123	1.2295	1.1626	1.2335	1.1823	1.1427
5	2.077	2.1674	1.6483	1.7673	2.2205	2.2563	2.1254	1.9595	2.002	1.9424	1.8458
6	3.1293	3.376	2.7998	2.8076	3.3197	3.5169	3.3983	3.2549	3.2677	2.9475	2.8299
7	4.4019	4.6683	4.3878	4.4953	4.7393	4.9083	4.6087	4.4778	4.3843	3.8914	3.684
8	5.6331	5.814	5.5146	6.1189	6.2402	6.5358	6.1266	5.6738	6.0564	5.5363	5.1198
9	7.0077	6.9726	7.0481	7.9944	8.1398	8.7434	8.1026	7.0698	7.1158	7.0789	6.1407
10	8.7173	8.4378	8.2424	10.3839	10.5425	10.6985	9.4147	8.3517	8.3821	9.2293	7.4696
11	10.3548	9.5078	10.025	11.764	12.7765	12.298	10.5076	9.8546	10.526	10.3127	9.5255
12	11.5701	9.527	10.9097	12.7114	13.9876	15.07	10.6149	10.1586	12.166	10.4081	9.6731
+gp	18.1304	16.9412	16.7574	17.7224	17.0533	17.3877	14.7611	14.7056	15.0071	16.0631	13.7711
0 SOPCOF	0.9997	1.0004	1.0002	0.9999	0.9999	0.9986	0.9999	1.0002	1.0005	1	1.0005

Run title : (L.piscatorius UNSEXED

At 7/05/2007 12:12

Table 2 Catch weights at age (kg)

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGE										
1	0.1744	0.2111	0.1679	0.1793	0.117	0.1146	0.1239	0.1583	0.2831	0.304
2	0.296	0.2766	0.3096	0.2974	0.3068	0.2399	0.2183	0.2674	0.3185	0.429
3	0.5893	0.5305	0.5548	0.5234	0.5261	0.422	0.3818	0.4213	0.4628	0.6138
4	1.0233	0.9268	0.9902	0.931	0.878	0.7221	0.6629	0.7241	0.8342	0.8568
5	1.7691	1.6669	1.628	1.5202	1.4229	1.2198	1.0887	1.2302	1.3606	1.3104
6	2.5452	2.7927	2.5036	2.4417	2.0811	1.9959	1.6519	1.8059	2.1631	1.8662
7	3.6331	3.6951	3.7042	3.5483	2.986	2.8528	2.4151	2.77	3.0822	2.8897
8	4.4817	4.8595	5.1051	4.79	3.8695	3.8369	3.5774	3.5784	4.0144	4.0603
9	5.4459	6.1202	6.2318	5.9973	5.1383	4.7833	4.4073	4.6194	4.9921	5.0664
10	7.0105	7.4764	7.5001	7.2888	6.3277	5.8381	5.4924	5.5195	5.9165	6.4575
11	8.8473	9.1413	8.7337	8.7631	7.6055	7.2041	6.8975	6.75	6.7706	7.2993
12	8.9405	10.6568	11.4998	11.4282	8.6065	9.0238	7.9499	8.3746	8.6149	9.266
+gp	13.0517	13.7594	13.8889	14.6542	14.6158	15.7732	12.6404	11.7668	12.7118	13.2502
0 SOPCOF	1.0004	1	1.0007	1.0084	0.978	0.9997	0.9997	0.9998	1.0003	1.0002
1										

Table 4.1.6. Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b,d.
Tuning fleets

L.piscatorius	tuning	fleets	in	fishing	areas	VII	and	VIIIa				
106												
FR-FU04	Benthic	trawl	area	VII	(1000	Hrs	fished).	Twin	trawls	excluded		
1987	2006											
1	1	0	1									
1	12											
349	3	40	83	84	72	115	198	167	110	65	29	8
334	0	59	356	360	252	126	112	93	71	44	41	20
378	3	43	136	300	404	174	102	71	40	28	10	6
380	4	62	141	212	267	301	167	57	23	16	8	4
380	1	11	34	83	106	201	173	83	24	12	4	1
331	22	82	100	39	44	79	86	57	21	15	7	4
274	36	273	555	173	65	43	25	20	16	12	4	6
249	21	291	469	461	317	152	40	16	11	5	5	2
287	28	213	431	432	353	254	168	58	17	7	3	3
196	3	51	192	214	199	131	100	51	32	10	7	2
178	0	9	23	58	95	95	93	62	45	24	14	7
182	1	32	92	88	63	77	82	56	30	22	13	6
108	6	39	33	34	24	20	16	10	10	8	4	4
160	9	324	289	201	121	62	36	19	10	13	7	4
127	9	60	107	172	193	130	79	38	10	5	4	2
114	21	148	382	252	144	119	102	72	40	24	10	4
144	3	51	268	360	380	380	192	82	54	24	21	10
155	7	24	76	123	270	357	221	117	49	18	11	8
137	4	45	129	144	155	131	105	68	58	30	19	9
136	0	0	18	335	448	305	118	42	31	17	18	10
SP-VIGO7												
1987	2006											
1	1	0	1									
5	12											
6662	59	52	66	50	34	21	9	2				
6547	37	53	46	34	21	9	6	7				
7585	70	52	66	43	20	22	6	9				
8021	134	103	57	28	11	12	2	3				
7822	75	93	69	32	13	7	4	0				
6370	37	55	68	44	10	5	3	3				
5988	33	53	45	48	27	15	9	8				
5655	76	73	45	18	16	7	5	6				
5070	102	131	129	50	11	9	4	2				
5416	216	211	151	66	53	6	10	4				
5058	132	154	125	69	55	21	14	2				
5360	100	129	126	84	41	25	11	3				
5084	130	104	106	43	38	21	14	9				
5519	71	56	47	18	12	11	5	4				
5678	94	110	56	49	29	13	5	5				
5041	133	135	129	74	49	36	15	7				
5437	566	350	143	79	47	27	19	6				
5347	360	344	247	109	43	22	17	14				
5246	250	222	215	112	60	30	18	10				
5392	361	253	152	81	48	27	22	8				
SP-CORUTR7	Effort	in	days/1000	HP								
1987	2006											
1	1	0	1									
2	12											
10453	20	33	22	35	73	144	128	86	54	33	4	
10886	5	12	16	29	87	135	113	69	37	23	26	
10483	12	37	32	37	75	117	98	47	31	10	8	
9630	5	19	24	69	139	97	48	24	23	4	5	
8522	8	10	10	52	145	105	43	21	17	7	1	
5852	10	25	12	16	60	63	32	13	9	5	5	
5001	4	16	9	11	42	34	23	14	10	4	4	
4990	10	17	18	29	64	32	15	13	7	7	7	
4403	12	21	11	17	38	38	14	5	4	2	1	
3746	2	11	17	35	55	44	22	15	4	4	2	
3738	14	13	9	24	48	51	34	22	12	10	3	
3684	4	13	15	14	28	38	27	14	10	6	3	
3512	4	7	11	16	24	24	11	9	7	4	2	
2773	3	9	15	18	25	22	10	8	5	2	1	
2356	0	5	8	12	22	19	15	10	4	4	3	
2259	1	6	8	15	27	27	19	13	9	6	4	
2597	3	11	27	20	29	40	34	25	12	10	7	
2292	1	5	9	15	33	43	26	14	8	6	5	
2120	1	4	8	21	49	56	34	19	11	7	4	
2257	1	3	9	13	39	55	38	27	14	14	6	
FR-EVHOE	survey	(France)										
1997	2006											
1	1	0.8	0.88									
0	7											
0.500	0.106	0.047	0.173	0.138	0.097	0.133	0.032	0.094				
0.500	0.318	0.056	0.085	0.086	0.069	0.058	0.056	0.027				
0.500	0.675	0.110	0.060	0.107	0.085	0.059	0.006	0.035				
0.500	0.181	0.123	0.175	0.235	0.146	0.032	0.010	0.030				
0.500	1.037	1.119	0.072	0.082	0.090	0.101	0.257	0.110				
0.500	0.153	1.066	0.553	0.216	0.456	0.445	0.093	0.098				
0.500	0.060	0.370	0.074	0.294	0.225	0.272	0.158	0.112				
0.500	0.163	1.612	0.389	0.088	0.057	0.070	0.172	0.246				
0.500	0.063	0.238	0.076	0.256	0.411	0.333	0.161	0.142				
0.500	0.121	0.340	0.063	0.100	0.186	0.380	0.340	0.156				
SP-BAKON8	Effort/Age											
1993	2006											
1	1	0	1									
3	9											
5590.0	36.3	30.5	12.6	5.7	3.9	2.4	1.2					
5619.0	39.3	57.8	33.4	16.4	7.9	3.0	1.3					
4474.0	57.1	56.7	25.1	22.7	17.2	5.2	1.1					
4378.0	60.8	48.7	23.4	19.4	12.4	2.5	2.0					
4286.0	56.2	106.2	46.8	18.2	13.1	3.7	1.3					
3002.0	18.6	23.2	22.9	17.8	17.3	5.5	0.9					
2337.0	4.3	8.1	3.3	1.9	5.0	5.8	2.7					
2227.0	13.6	17.6	6.5	3.4	1.7	0.8	0.5					
2118.0	30.7	33.1	24.7	10.5	3.4	1.4	0.6					
2107.0	18.9	46.9	29.9	13.0	5.2	2.2	0.7					
2296.0	30.4	35.3	34.1	20.3	5.8	2.6	0.9					
2159.0	65.5	67.4	43.2	33.4	14.9	2.1	2.5					
2263.0	26.7	39.8	34.1	28.7	12.5	6.1	1.6					
2398.0	0.9	20.1	70.7	52.1	24.4	10.0	5.8					

Table 4.1.7. Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b,d.: XSA diagnostics
Lowestoft VPA Version 3.1

3/05/2007 10:14

Extended Survivors Analysis

MONK (L.piscatorius UNSEXED

CPUE data from file pistun.dat

Catch data for 21 years. 1986 to 2006. Ages 1 to 13.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
"FR-FU04" "Benthic"	1987	2006	1	12	0	1
"SP-VIGO7"	1987	2006	5	12	0	1
"SP-CORUTR7" "Effort	1987	2006	2	12	0	1
"FR-EVHOE" "survey"	1997	2006	0	7	0.8	0.88
"SP-BAKON8" "Effort/	1993	2006	3	9	0	1

Time series weights :

Tapered time weighting not applied

Catchability analysis :

Catchability independent of stock size for all ages

Catchability independent of age for ages >= 7

Terminal population estimation :

Survivor estimates shrunk towards the mean F
of the final 5 years or the 3 oldest ages.

S.E. of the mean to which the estimates are shrunk = 10.000

Minimum standard error for population
estimates derived from each fleet = .500

Prior weighting not applied

Tuning converged after 32 iterations

1

Regression weights

1	1	1	1	1	1	1	1	1	1

Fishing mortalities

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	0.003	0.001	0.004	0.005	0.016	0.019	0.01	0.01	0.044	0.005
2	0.036	0.033	0.03	0.069	0.028	0.059	0.038	0.018	0.149	0.079
3	0.096	0.083	0.049	0.101	0.058	0.14	0.11	0.051	0.105	0.155
4	0.221	0.119	0.083	0.145	0.11	0.13	0.188	0.1	0.087	0.262
5	0.308	0.149	0.123	0.128	0.207	0.122	0.231	0.199	0.112	0.253
6	0.404	0.241	0.17	0.124	0.238	0.207	0.301	0.325	0.162	0.219
7	0.394	0.443	0.239	0.143	0.222	0.272	0.312	0.393	0.264	0.166
8	0.414	0.467	0.259	0.107	0.238	0.299	0.269	0.427	0.297	0.156
9	0.463	0.445	0.467	0.208	0.161	0.371	0.352	0.353	0.42	0.204
10	0.37	0.528	0.644	0.317	0.154	0.363	0.344	0.344	0.342	0.283
11	0.608	0.458	0.565	0.353	0.234	0.378	0.405	0.454	0.428	0.416
12	0.559	0.665	0.673	0.514	0.378	0.372	0.5	0.559	0.502	0.514

1

XSA population numbers (Thousands)

YEAR \ AGE	1	2	3	4	5	6	7	8	9	10
1997	2.45E+04	1.77E+04	1.17E+04	8.50E+03	6.51E+03	4.44E+03	3.27E+03	1.92E+03	1.22E+03	7.01E+02
1998	3.10E+04	2.10E+04	1.47E+04	9.17E+03	5.87E+03	4.12E+03	2.55E+03	1.90E+03	1.09E+03	6.59E+02
1999	3.49E+04	2.66E+04	1.75E+04	1.16E+04	7.01E+03	4.35E+03	2.79E+03	1.41E+03	1.02E+03	6.01E+02
2000	3.65E+04	2.99E+04	2.22E+04	1.43E+04	9.21E+03	5.34E+03	3.16E+03	1.89E+03	9.37E+02	5.52E+02
2001	3.78E+04	3.13E+04	2.40E+04	1.73E+04	1.07E+04	6.98E+03	4.06E+03	2.36E+03	1.46E+03	6.55E+02
2002	3.29E+04	3.20E+04	2.62E+04	1.95E+04	1.33E+04	7.46E+03	4.73E+03	2.80E+03	1.60E+03	1.07E+03
2003	2.77E+04	2.78E+04	2.60E+04	1.96E+04	1.48E+04	1.02E+04	5.22E+03	3.10E+03	1.79E+03	9.49E+02
2004	1.26E+04	2.36E+04	2.30E+04	2.00E+04	1.40E+04	1.01E+04	6.48E+03	3.29E+03	2.04E+03	1.08E+03
2005	7.72E+03	1.08E+04	2.00E+04	1.88E+04	1.56E+04	9.86E+03	6.27E+03	3.76E+03	1.85E+03	1.23E+03
2006	3.04E+04	6.36E+03	7.98E+03	1.55E+04	1.49E+04	1.20E+04	7.22E+03	4.14E+03	2.41E+03	1.04E+03

Estimated population abundance at 1st Jan 2007

0.00E+00	2.60E+04	5.06E+03	5.88E+03	1.02E+04	9.94E+03	8.30E+03	5.26E+03	3.05E+03	1.69E+03

Taper weighted geometric mean of the VPA populations:

2.07E+04	1.71E+04	1.42E+04	1.07E+04	7.34E+03	4.86E+03	2.99E+03	1.71E+03	9.69E+02	5.44E+02

Standard error of the weighted Log(VPA populations) :

0.4408	0.4381	0.4095	0.4353	0.4772	0.4845	0.4774	0.4939	0.5278	0.5328

YEAR	AGE 11	12
1997	3.31E+02	1.59E+02
1998	4.17E+02	1.55E+02
1999	3.35E+02	2.27E+02
2000	2.72E+02	1.64E+02
2001	3.46E+02	1.64E+02
2002	4.83E+02	2.36E+02
2003	6.41E+02	2.85E+02
2004	5.79E+02	3.68E+02
2005	6.59E+02	3.17E+02
2006	7.55E+02	3.70E+02

Estimated population abundance at 1st Jan 2007

6.78E+02 4.29E+02

Taper weighted geometric mean of the VPA populations:

2.97E+02 1.67E+02

Standard error of the weighted Log(VPA populations) :

0.5913 0.5415

1

Log catchability residuals.

Fleet : "FR-FU04" "Benthic"

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	-0.63	99.99	-0.89	-0.87	-2.56	0.69	1.43	1.12	1.32	-0.67
2	-0.41	0.46	0.01	0.2	-1.82	0.02	1.46	1.69	1.37	0.39
3	-0.76	0.8	0.14	0.14	-1.47	-0.58	1.08	1.09	0.94	0.66
4	-0.65	0.53	0.38	0.45	-0.59	-1.51	-0.1	0.85	0.72	0.49
5	-0.59	0.51	0.63	0.41	-0.13	-1.15	-0.92	0.59	0.51	0.43
6	-0.09	0.11	0.17	0.62	0.38	-0.14	-1	0.02	0.33	0.03
7	0.6	0.25	0.15	0.53	0.57	0.1	-0.85	-0.84	0.23	0.09
8	0.94	0.58	0.33	0.17	0.51	0.33	-0.61	-0.82	-0.27	-0.09
9	0.94	1.01	0.34	-0.19	-0.16	-0.13	-0.06	-0.65	-0.56	-0.03
10	0.61	0.92	0.95	0.08	-0.38	0	0.07	-0.56	-0.85	-0.36
11	0.07	0.83	-0.01	0.62	-0.85	-0.37	-0.67	-0.14	-0.76	-0.05
12	0.49	0.2	-0.68	-0.48	-0.94	-0.33	0.13	-0.84	-0.35	-0.4

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	99.99	-2.09	0.1	0.07	0.27	1.36	-0.65	0.9	1.09	
2	-1.43	-0.36	0.12	1.75	0.23	1.23	0.06	-0.6	0.98	-5.33
3	-1.36	-0.23	-0.93	0.63	-0.22	1.11	0.52	-0.73	0.09	-0.9
4	-0.58	-0.31	-1	0.21	0.08	0.46	0.61	-0.61	-0.27	0.86
5	-0.12	-0.52	-1.16	-0.2	0.39	-0.06	0.63	0.24	-0.33	0.85
6	0.01	-0.23	-1.15	-0.63	0.13	0.07	0.73	0.61	-0.32	0.36
7	0.11	0.24	-1.07	-0.82	-0.01	0.22	0.54	0.43	-0.22	-0.28
8	0.25	0.16	-0.84	-0.96	-0.19	0.41	0.19	0.48	-0.13	-0.75
9	0.41	0.08	-0.43	-0.85	-1.08	0.42	0.37	0.05	0.49	-0.49
10	0.29	0.31	-0.04	-0.01	-0.98	0.31	0.18	-0.31	0.19	-0.24
11	0.6	0.21	-0.18	0.1	-0.52	0.23	0.47	-0.17	0.41	0.19
12	0.63	0.52	0.25	0.12	-0.41	0.03	0.58	0.11	0.46	0.38

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	1	2	3	4	5	6	7	8	9	10
Mean Log q	-13.3745	-11.2392	-9.9307	-9.4071	-9.0682	-8.7659	-8.5926	-8.5926	-8.5926	-8.5926
S.E(Log q)	1.2036	1.5779	0.8431	0.6662	0.6187	0.4938	0.5173	0.5447	0.5558	0.5078

Age	11	12
Mean Log q	-8.5926	-8.5926
S.E(Log q)	0.4719	0.4902

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
1	1.57	-0.533	15.32	0.06	17	1.93	-13.37
2	0.36	2.438	10.29	0.45	20	0.51	-11.24
3	0.58	1.543	9.79	0.43	20	0.47	-9.93
4	0.69	1.252	9.38	0.47	20	0.45	-9.41
5	0.67	1.75	9.02	0.61	20	0.39	-9.07
6	0.77	1.318	8.7	0.65	20	0.37	-8.77
7	0.94	0.266	8.56	0.51	20	0.5	-8.59
8	1.07	-0.264	8.69	0.43	20	0.6	-8.61
9	0.94	0.273	8.51	0.52	20	0.53	-8.62
10	0.96	0.188	8.49	0.55	20	0.5	-8.58
11	0.77	1.75	7.93	0.76	20	0.34	-8.59
12	0.66	3.035	7.43	0.82	20	0.27	-8.62

Fleet : "SP-VIGO7"

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	No data for this fleet at this age									
4	No data for this fleet at this age									
5	-0.1	-0.74	-0.48	0.31	0.14	-0.64	-1.04	-0.32	0.04	0.83
6	-0.36	-0.25	-0.55	-0.03	0.07	0.02	-0.39	-0.35	0.28	0.67
7	-0.11	-0.27	0.06	-0.25	-0.03	0.24	0	-0.51	0.44	0.52
8	0.13	-0.06	0.17	-0.25	-0.13	0.45	0.52	-0.49	0.05	0.19
9	0.16	0.15	-0.01	-0.63	-0.46	-0.49	0.72	-0.06	-0.52	0.49
10	-0.13	-0.3	1.05	0.08	-0.61	-0.72	0.55	0	-0.13	-0.85
11	-0.71	-0.73	-0.17	-0.48	-0.54	-0.83	0.39	0.08	0	0.32
12	-0.51	-0.49	0.07	-0.48	99.99	-0.24	0.67	0.48	-0.29	0.32

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	No data for this fleet at this age									
4	No data for this fleet at this age									
5	0.5	0.2	0.32	-0.64	-0.49	-0.29	1.03	0.64	0.14	0.59
6	0.62	0.39	0.14	-0.79	-0.36	-0.12	0.49	0.51	0.04	-0.03
7	0.4	0.62	0.32	-0.75	-0.81	0.01	-0.04	0.34	0.19	-0.37
8	0.35	0.52	0.11	-1.21	-0.4	-0.01	-0.14	0.21	0.07	-0.45
9	0.6	0.35	0.4	-0.87	-0.48	0.17	-0.06	-0.26	0.21	-0.41
10	0.15	0.39	0.42	-0.37	-0.48	0.26	0.01	-0.32	-0.11	-0.11
11	0.59	0	0.56	-0.44	-0.76	0.19	0.08	0.09	0.06	0.09
12	-0.64	-0.22	0.56	-0.08	0.05	0.14	-0.22	0.41	0.22	-0.14

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	5	6	7	8	9	10	11	12
Mean Log q	-12.7092	-12.2472	-11.9328	-11.9328	-11.9328	-11.9328	-11.9328	-11.9328
S.E(Log q)	0.5693	0.4065	0.4038	0.4094	0.4516	0.4625	0.4618	0.3896

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
5	0.7	1.663	11.56	0.62	20	0.38	-12.71
6	0.8	1.311	11.52	0.72	20	0.32	-12.25
7	1	0	11.93	0.6	20	0.41	-11.93
8	1.14	-0.646	12.57	0.55	20	0.47	-11.95
9	0.93	0.381	11.63	0.63	20	0.43	-11.98
10	1.08	-0.352	12.43	0.55	20	0.5	-11.99
11	0.88	0.778	11.29	0.71	20	0.4	-12.04
12	0.9	0.571	11.25	0.64	19	0.36	-11.95
1							

Fleet : "SP-CORUTR7" "Effort

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	No data for this fleet at this age									
2	0.8	-0.18	0.72	-0.23	0.06	0.35	-0.36	0.64	1.08	-0.49
3	0.38	-0.61	0.98	0.37	-0.34	0.62	0.09	0.24	0.65	0.32
4	0.14	-0.54	0.35	0.56	-0.29	-0.03	-0.43	0.14	-0.15	0.54
5	0.25	-0.17	-0.12	0.79	1.01	-0.07	-0.64	0.17	-0.29	0.7
6	0.09	0.29	0.05	0.65	0.99	0.75	0.11	0.2	-0.25	0.25
7	0.52	0.59	0.61	0.4	0.6	0.55	0.2	-0.42	-0.34	-0.04
8	0.92	0.93	0.97	0.41	0.38	0.52	0.27	-0.24	-0.78	-0.24
9	0.94	1.13	0.82	0.26	0.23	0.16	0.55	0.16	-0.87	-0.1
10	0.66	0.9	1.37	0.85	0.49	0.26	0.62	0.43	-0.5	-0.59
11	0.44	0.4	0.31	0.33	0.23	0.06	0.06	0.84	-0.26	0.07
12	0.03	0.62	-0.07	0.15	-0.41	0.66	0.46	1.06	-0.54	0.29

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	No data for this fleet at this age									
2	1.28	-0.14	-0.33	-0.48	99.99	-1.44	-0.35	-1.02	0.02	0.06
3	0.48	0.27	-0.49	-0.22	-0.74	-0.57	-0.11	-0.67	-0.59	-0.05
4	0.04	0.44	-0.08	0.29	-0.38	-0.45	0.65	-0.38	-0.37	-0.06
5	0.42	-0.07	-0.08	0	-0.35	-0.35	-0.25	-0.35	-0.09	-0.51
6	0.32	-0.21	-0.4	-0.35	-0.53	-0.36	-0.7	-0.43	0	-0.47
7	0.11	0.1	-0.5	-0.52	-0.72	-0.45	-0.28	-0.26	0.06	-0.21
8	0.24	0.06	-0.59	-0.81	-0.4	-0.27	0.06	-0.09	0.09	-0.04
9	0.28	-0.05	-0.37	-0.28	-0.36	-0.05	0.34	-0.24	0.29	0.2
10	0.19	0.15	-0.01	-0.17	-0.48	-0.02	0.24	-0.12	0.1	0.38
11	0.86	0.07	-0.02	-0.37	0.19	0.37	0.48	0.27	0.27	0.79
12	0.37	0.45	-0.28	-0.48	0.72	0.68	0.97	0.57	0.46	0.73

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	2	3	4	5	6	7	8	9	10	11
Mean Log q	-16.5518	-15.3957	-14.9379	-14.0317	-12.8069	-12.2329	-12.2329	-12.2329	-12.2329	-12.2329
S.E(Log q)	0.6888	0.5131	0.3768	0.4381	0.4575	0.4356	0.53	0.5031	0.5561	0.4267

Age	12
Mean Log q	-12.2329
S.E(Log q)	0.5791

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
2	2.7	-1.797	28.18	0.06	19	1.76	-16.55
3	3.92	-3.064	32.38	0.06	20	1.68	-15.4
4	1.3	-1.137	16.64	0.44	20	0.49	-14.94
5	2	-2.738	19.15	0.29	20	0.76	-14.03
6	3	-4.422	21.41	0.21	20	0.98	-12.81
7	2.22	-3.338	17.4	0.29	20	0.78	-12.23
8	1.68	-1.803	15.39	0.28	20	0.84	-12.16
9	1.28	-1.063	13.52	0.45	20	0.61	-12.08
10	1.6	-1.885	15.44	0.35	20	0.75	-12
11	0.88	1.15	11.19	0.83	20	0.28	-11.96
12	0.71	2.24	9.97	0.77	20	0.31	-11.91
1							

Fleet : "FR-EVHOE" "survey"

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	-1.74	-1.79	-1.24	-1.16	1.02	1.11	0.21	2.47	1.08	0.03
2	0.47	-0.41	-1.01	-0.02	-0.99	1.06	-0.84	0.97	0.24	0.53
3	0.4	-0.3	-0.28	0.3	-0.86	0.09	0.38	-0.75	0.5	0.51
4	0.23	-0.26	-0.32	0.06	-0.64	0.88	0.21	-1.25	0.77	0.32
5	0.6	-0.26	-0.45	-1.31	-0.26	0.93	0.42	-0.9	0.47	0.77
6	-0.23	0.26	-2.02	-1.8	1.26	0.15	0.45	0.56	0.38	0.98
7	0.48	-0.5	-0.48	-0.84	0.28	0.05	0.12	0.76	0.13	0
8	No data for this fleet at this age									
9	No data for this fleet at this age									
10	No data for this fleet at this age									
11	No data for this fleet at this age									
12	No data for this fleet at this age									

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	1	2	3	4	5	6	7
Mean Log q	-10.6112	-11.1547	-10.8574	-10.6113	-10.3147	-10.45	-9.7861
S.E(Log q)	1.4411	0.7799	0.5161	0.6413	0.7527	1.0902	0.4834

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
1	-2.55	-1.648	8.91	0.03	10	3.36	-10.61
2	1.89	-0.951	12.24	0.13	10	1.48	-11.15
3	1.96	-1.126	11.87	0.15	10	1	-10.86
4	0.9	0.15	10.51	0.23	10	0.61	-10.61
5	0.62	0.911	9.92	0.42	10	0.47	-10.31
6	0.38	2.225	9.45	0.61	10	0.34	-10.45
7	0.57	2.088	9.17	0.74	10	0.23	-9.79
1							

Fleet : "SP-BAKON8" "Effort/

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	99.99	99.99	99.99	99.99	99.99	99.99	-0.09	0.07	0.75	0.98
4	99.99	99.99	99.99	99.99	99.99	99.99	-0.47	0.04	0.32	0.29
5	99.99	99.99	99.99	99.99	99.99	99.99	-0.81	-0.01	-0.11	-0.05
6	99.99	99.99	99.99	99.99	99.99	99.99	-0.92	-0.19	0.3	0.14
7	99.99	99.99	99.99	99.99	99.99	99.99	-0.42	-0.28	0.52	0.21
8	99.99	99.99	99.99	99.99	99.99	99.99	-0.43	-0.29	-0.12	-0.89
9	99.99	99.99	99.99	99.99	99.99	99.99	-0.36	-0.58	-0.75	-0.61
10	No data for this fleet at this age									
11	No data for this fleet at this age									
12	No data for this fleet at this age									

Age		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	1	No data for this fleet at this age									
	2	No data for this fleet at this age									
	3	0.92	-0.06	-1.46	-0.47	0.29	-0.24	0.15	1.07	0.29	-2.21
	4	1.22	-0.07	-1.12	-0.48	0	0.24	-0.1	0.54	0.02	-0.44
	5	0.75	0.43	-1.45	-1	0.28	0.21	0.21	0.55	0.11	0.9
	6	0.3	0.63	-1.43	-1.05	-0.08	0.06	0.16	0.73	0.48	0.85
	7	0.27	1.18	0.01	-1.18	-0.67	-0.37	-0.42	0.4	0.16	0.58
	8	-0.43	0.35	0.84	-1.41	-0.99	-0.71	-0.71	-0.84	-0.04	0.24
	9	-1	-0.89	0.51	-1.11	-1.4	-1.22	-1.16	-0.23	-0.59	0.25
	10	No data for this fleet at this age									
	11	No data for this fleet at this age									
	12	No data for this fleet at this age									

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	8	9
Mean Log q	-14.5076	-13.7899	-13.833	-13.8951	-13.8997	-13.8997	-13.8997
S.E(Log q)	0.9196	0.5519	0.6681	0.6883	0.6018	0.7262	0.8758

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	0.57	1.022	12.46	0.32	14	0.52	-14.51
4	1.19	-0.316	14.61	0.18	14	0.68	-13.79
5	0.58	1.493	11.89	0.52	14	0.37	-13.83
6	0.51	2.408	11.37	0.67	14	0.3	-13.9
7	0.83	0.532	12.95	0.46	14	0.52	-13.9
8	1.15	-0.344	15.26	0.31	14	0.72	-14.29
9	0.99	0.029	14.48	0.45	14	0.57	-14.55
1							

Terminal year survivor and F summaries :

Age 1 Catchability constant w.r.t. time and dependent on age

Year class = 2005

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"FR-FU04" "Benthic"	1	0	0	0	0	0	0
"SP-VIGO7"	1	0	0	0	0	0	0
"SP-CORUTR7" "Effort	1	0	0	0	0	0	0
"FR-EVHOE" "survey"	26901	1.511	0	0	1	0.978	0.005
"SP-BAKON8" "Effort/	1	0	0	0	0	0	0
F shrinkage mean	6098	10				0.022	0.02

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
26019	1.49	0.22	2	0.149	0.005

1

Age 2 Catchability constant w.r.t. time and dependent on age

Year class = 2004

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"FR-FU04" "Benthic"	1305	0.983	3.114	3.17	2	0.204	0.276
"SP-VIGO7"	1	0	0	0	0	0	0
"SP-CORUTR7" "Effort	5373	0.707	0	0	1	0.406	0.074
"FR-EVHOE" "survey"	9651	0.72	0.23	0.32	2	0.388	0.042
"SP-BAKON8" "Effort/	1	0	0	0	0	0	0
F shrinkage mean	6877	10				0.002	0.059

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
5055	0.45	0.71	6	1.589	0.079

Age 3 Catchability constant w.r.t. time and dependent on age

Year class = 2003

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"FR-FU04" "Benthic"	4936	0.651	0.634	0.97	3	0.162	0.182
"SP-VIGO7"	1	0	0	0	0	0	0
"SP-CORUTR7" "Effort	5702	0.423	0.033	0.08	2	0.388	0.159
"FR-EVHOE" "survey"	10592	0.434	0.385	0.89	3	0.369	0.089
"SP-BAKON8" "Effort/	648	0.952	0	0	1	0.08	0.924
F shrinkage mean	10130	10				0.001	0.093

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
5882	0.26	0.29	10	1.104	0.155

Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 2002

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"FR-FU04" "Benthic"	14209	0.471	0.344	0.73	4	0.175	0.195
"SP-VIGO7"	1	0	0	0	0	0	0
"SP-CORUTR7" "Effort	6596	0.323	0.261	0.81	3	0.371	0.382
"FR-EVHOE" "survey"	17207	0.364	0.138	0.38	4	0.287	0.164
"SP-BAKON8" "Effort/	7909	0.49	0.313	0.64	2	0.167	0.327
F shrinkage mean	23358	10				0.001	0.123

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
10246	0.2	0.16	14	0.803	0.262

Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 2001

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"FR-FU04" "Benthic"	12516	0.379	0.352	0.93	5	0.18	0.206
"SP-VIGO7"	17997	0.583	0	0	1	0.082	0.147
"SP-CORUTR7" "Effort	6097	0.272	0.072	0.27	4	0.347	0.384
"FR-EVHOE" "survey"	9839	0.331	0.396	1.2	5	0.228	0.255
"SP-BAKON8" "Effort/	16464	0.4	0.331	0.83	3	0.163	0.16
F shrinkage mean	14985	10				0	0.175

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
9942	0.16	0.16	19	0.97	0.253

1

Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 2000

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"FR-FU04" "Benthic"	8803	0.305	0.208	0.68	6	0.208	0.207
"SP-VIGO7"	8636	0.38	0.08	0.21	2	0.144	0.211
"SP-CORUTR7" "Effort	5653	0.24	0.187	0.78	5	0.323	0.307
"FR-EVHOE" "survey"	10090	0.32	0.371	1.16	6	0.17	0.183
"SP-BAKON8" "Effort/	13279	0.351	0.171	0.49	4	0.155	0.142
F shrinkage mean	7226	10				0	0.247

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
8300	0.14	0.12	24	0.844	0.219

Age 7 Catchability constant w.r.t. time and dependent on age

Year class = 1999

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"FR-FU04" "Benthic"	5220	0.27	0.175	0.65	7	0.21	0.168
"SP-VIGO7"	5238	0.305	0.269	0.88	3	0.18	0.167
"SP-CORUTR7" "Effort	4782	0.233	0.185	0.8	5	0.273	0.182
"FR-EVHOE" "survey"	4594	0.281	0.182	0.65	7	0.183	0.188
"SP-BAKON8" "Effort/	7440	0.313	0.156	0.5	5	0.153	0.121
F shrinkage mean	2790	10				0	0.294

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
5259	0.12	0.08	28	0.657	0.166

1

Age 8 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1998

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"FR-FU04" "Benthic"	2918	0.254	0.222	0.87	8	0.219	0.162
"SP-VIGO7"	3440	0.27	0.294	1.09	4	0.213	0.139
"SP-CORUTR7" "Effort	2407	0.215	0.106	0.49	7	0.282	0.194
"FR-EVHOE" "survey"	3242	0.285	0.225	0.79	7	0.138	0.147
"SP-BAKON8" "Effort/	4085	0.301	0.085	0.28	6	0.148	0.119
F shrinkage mean	1428	10				0	0.307

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
3052	0.12	0.08	33	0.726	0.156

Age 9 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1997

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"FR-FU04" "Benthic"	1673	0.244	0.179	0.73	9	0.228	0.206
"SP-VIGO7"	1647	0.249	0.172	0.69	5	0.242	0.209
"SP-CORUTR7" "Effort	1473	0.21	0.112	0.53	8	0.291	0.231
"FR-EVHOE" "survey"	2241	0.28	0.285	1.02	7	0.102	0.158
"SP-BAKON8" "Effort/	1942	0.298	0.085	0.29	7	0.136	0.18
F shrinkage mean	970	10				0	0.333

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
1689	0.11	0.07	37	0.629	0.204

1

Age 10 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1996

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"FR-FU04" "Benthic"	782	0.244	0.132	0.54	9	0.257	0.25
"SP-VIGO7"	679	0.24	0.085	0.35	6	0.277	0.283
"SP-CORUTR7" "Effort	714	0.216	0.112	0.52	9	0.291	0.271
"FR-EVHOE" "survey"	619	0.28	0.134	0.48	7	0.075	0.306
"SP-BAKON8" "Effort/	430	0.298	0.168	0.56	7	0.1	0.416
F shrinkage mean	608	10				0	0.311

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
678	0.12	0.06	39	0.496	0.283

Age 11 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1995

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"FR-FU04" "Benthic"	472	0.222	0.082	0.37	11	0.273	0.384
"SP-VIGO7"	385	0.221	0.075	0.34	7	0.283	0.453
"SP-CORUTR7" "Effort	514	0.203	0.161	0.79	10	0.302	0.358
"FR-EVHOE" "survey"	380	0.281	0.257	0.91	6	0.062	0.458
"SP-BAKON8" "Effort/	248	0.287	0.155	0.54	7	0.079	0.637
F shrinkage mean	475	10				0	0.381

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
429	0.11	0.06	42	0.585	0.416

1

Age 12 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1994

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"FR-FU04" "Benthic"	218	0.219	0.135	0.61	12	0.298	0.462
"SP-VIGO7"	161	0.218	0.101	0.47	8	0.304	0.586
"SP-CORUTR7" "Effort	230	0.206	0.135	0.65	11	0.293	0.443
"FR-EVHOE" "survey"	186	0.295	0.29	0.98	5	0.044	0.525
"SP-BAKON8" "Effort/	93	0.282	0.233	0.83	7	0.061	0.866
F shrinkage mean	363	10				0	0.302

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
190	0.11	0.07	44	0.64	0.514

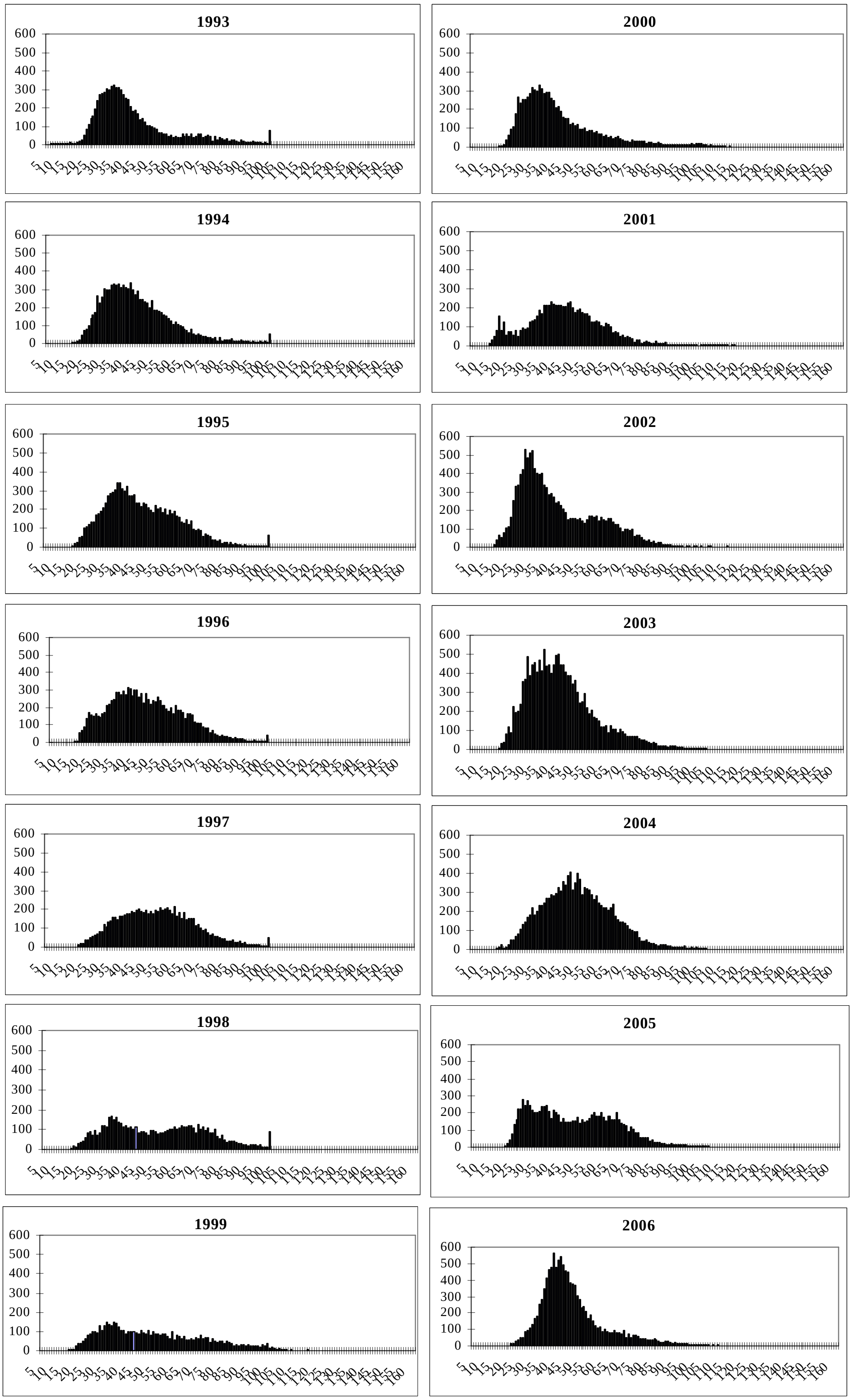


Figure 4.1.1. : **Anglerfish (*L. piscatorius*) in Divisions VIIb-k and VIIIa,b,d. Length distributions of landings from 1993 to 2006.**

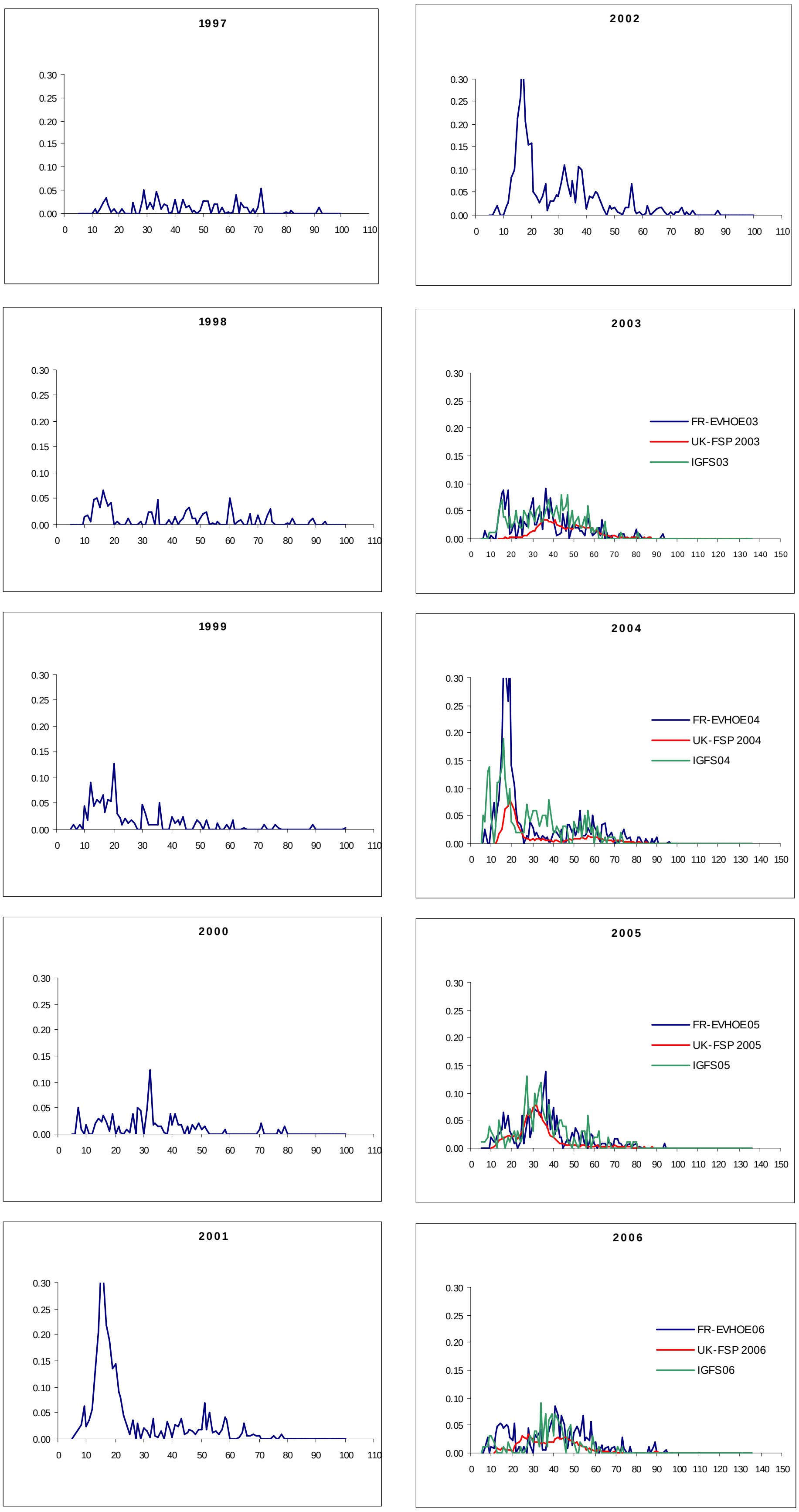


Figure 4.1.2. Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b,d. Abundance indices at length observed in the FR-EVHOE-S survey from 1997 to 2006 in Subarea VII and Divisions VIIIa,b,d. Irish Ground Fish Survey and UK-FSP Survey from 2003 to 2006 in Celtic Sea.

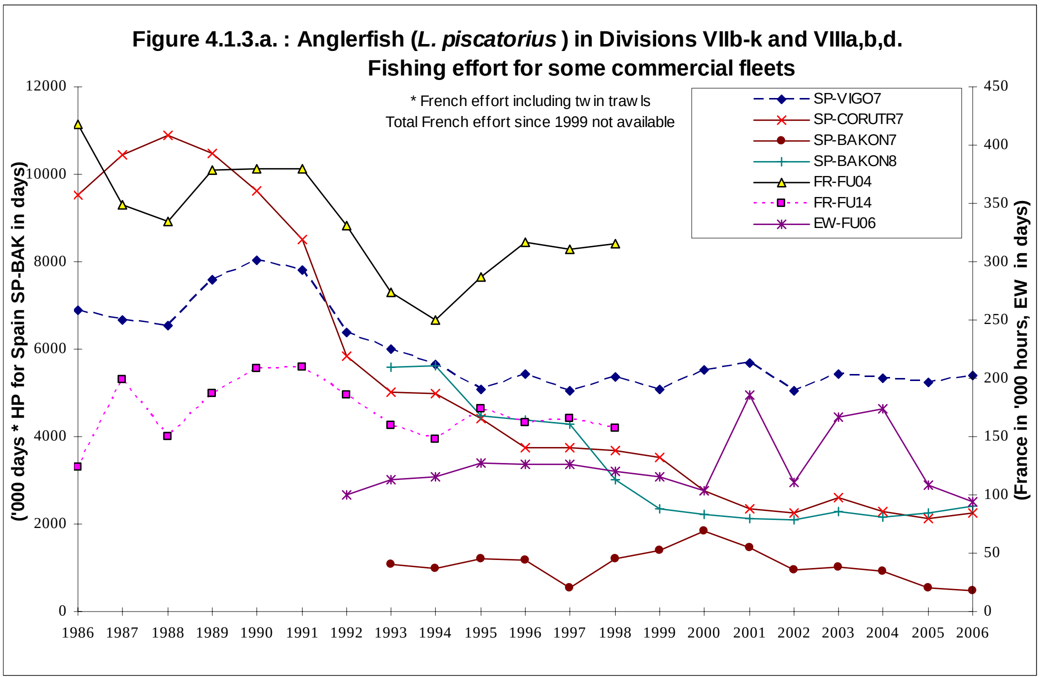


Figure 4.1.3.a. : Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b,d.
Fishing effort for some commercial fleets
* French effort including twin trawls
Total French effort since 1999 not available
SP-VIGO7
SP-CORUTR7
SP-BAKON7
SP-BAKON8
FR-FU04
FR-FU14
EW-FU06
('000 days * HP for Spain SP-BAK in days)
(France in '000 hours, EW in days)

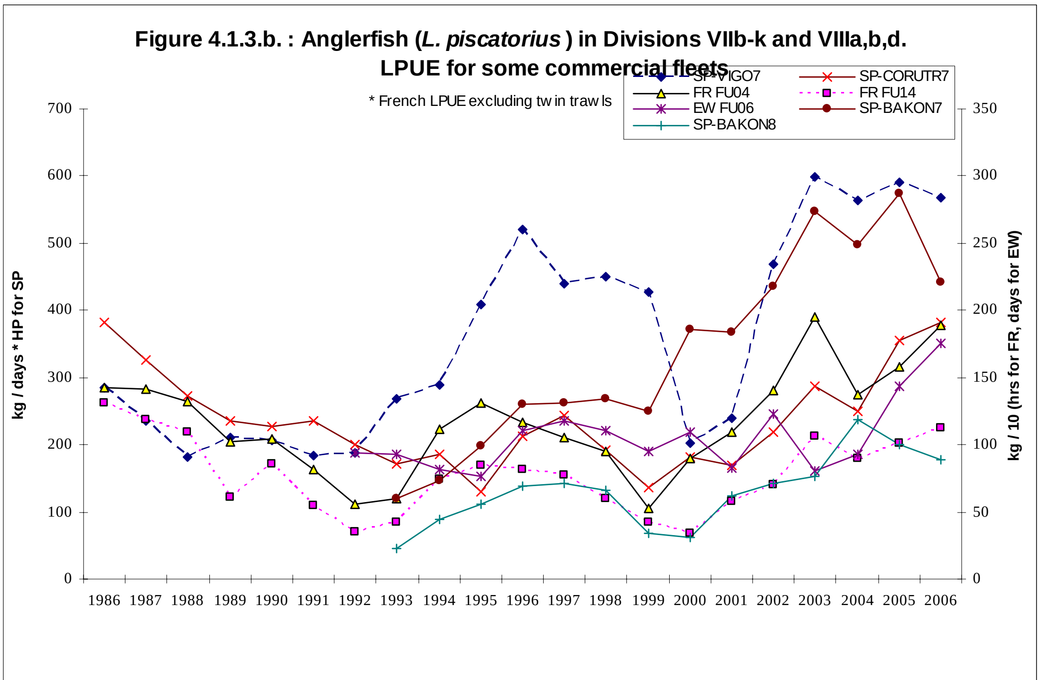


Figure 4.1.3.b. : Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b,d.
LPUE for some commercial fleets
* French LPUE excluding twin trawls
SP-VIGO7
SP-CORUTR7
FR FU04
FR FU14
EW FU06
SP-BAKON7
SP-BAKON8
kg / days * HP for SP
kg / 10 (hrs for FR, days for EW)

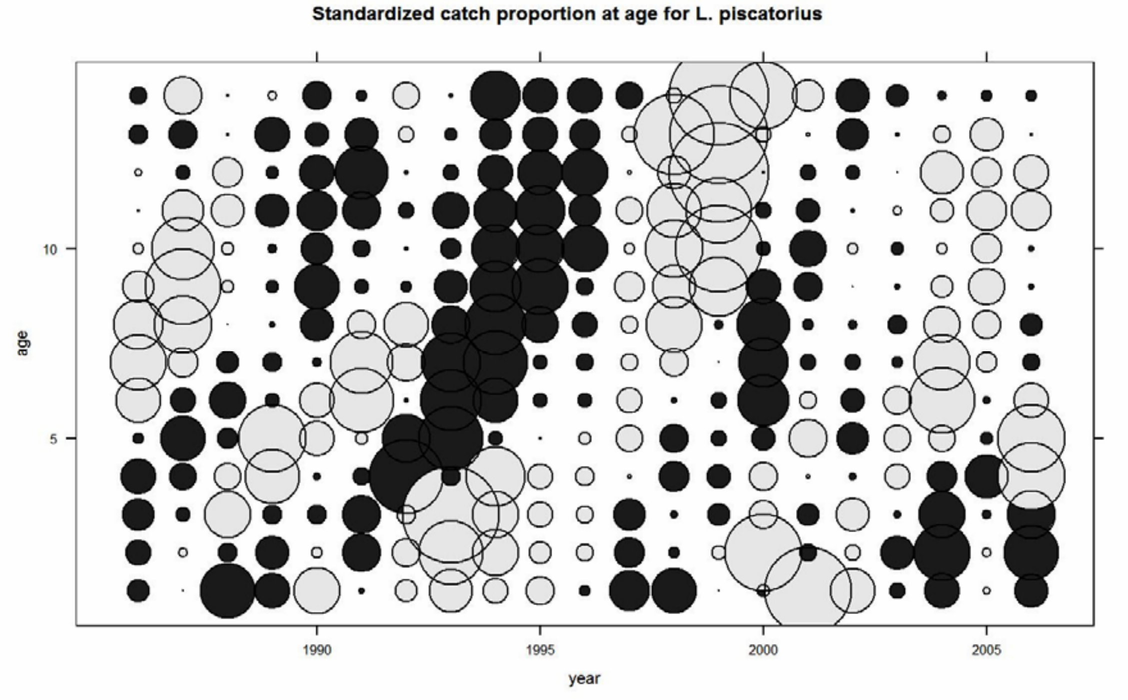


Figure 4.1.4. Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b,d. Grey values indicate positive values and black negative values.

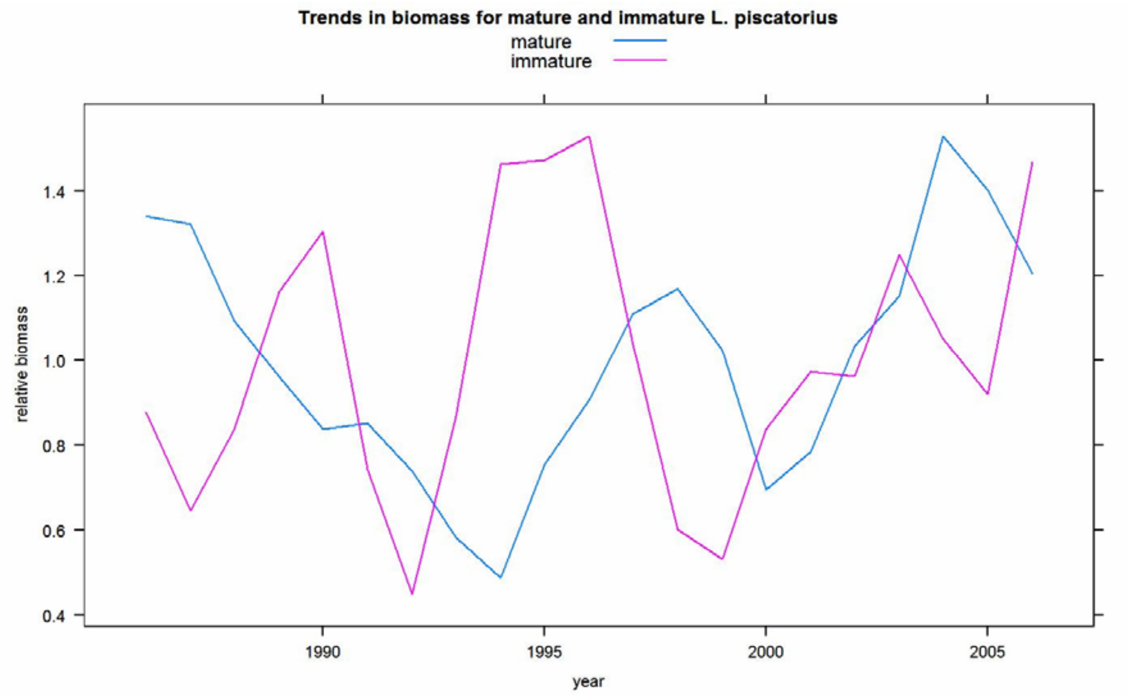


Figure 4.1.5. Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b,d.

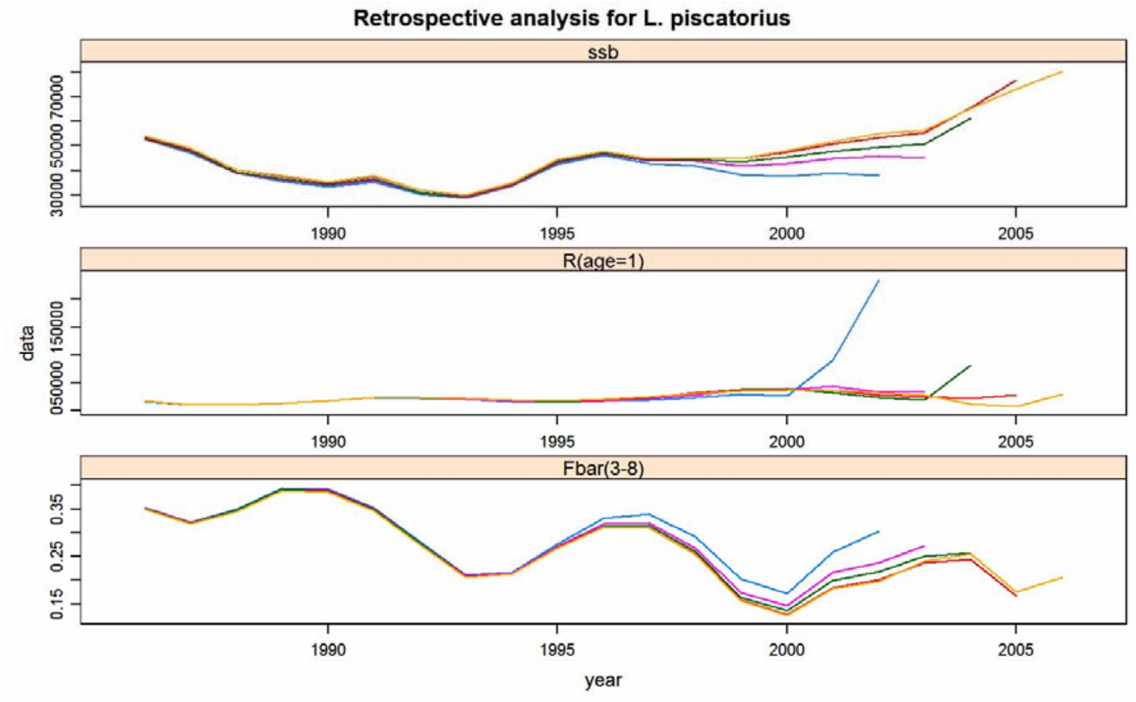


Figure 4.1.6. Anglerfish (*L. piscatorius*) in Divisions VIIb-k and VIIIa,b,d.

4.2 Anglerfish (*L. budegassa*) in Divisions VIIb-k and VIIIa,b,d,e

4.2.1 Data

4.2.1.1 Commercial Catch

The quantities of *L. budegassa* by fishery unit since 1986, as estimated by the WG, are given in Table 4.2.1. (a table by country and fishery unit is available in ICES stock files). As for *L. piscatorius* these figures are preliminary as the fisheries statistics for France were not made available prior to the meeting and the French data are based on logbooks only. As a consequence of this, catch data are likely to be under-estimated for both species in 2006.

The landings have fluctuated all over the studied period between 5 700 t to 9 600 t with a succession of high (1989-1992, 1998 and 2003) and low values (1987, 1994 and 2001). The total estimated landings for 2006 is 5 800 t, the second lowest value in the time series and a 22% drop from the 2005 landings.

4.2.1.2 Biological sampling

The sampling level is given in Table 1.3.

Figure 4.2.1 show the evolution of the length composition of landings for the last 10 years. The mean lengths in the international landings are provided below:

Year	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
mean length (cm)	41	38	39	40	42	43	42	43	43	36	37	40	44	45	39

The mean length in the landings has fluctuated all over the series from 36 to 45 cm. The mean length observed in 2006 has dropped to 39 cm following the highest of the series value observed in 2005.

In 2001, length compositions of both Spanish and French landings from the Celtic Sea showed an important component of the landings comprised of small individuals (20-30cm) which is reflected in the length distribution of total landings (Figure 4.2.1). In 2002 and 2003, this mode could be followed by an increase in the catches of individuals of 20-40 cm. However, in 2004, the mode is not yet apparent and the amount of fish greater than 45 cm in the landings is similar to those observed in previous years. Furthermore, the international length distribution shows a lack of fish of 25-30 cm. This could be caused by a low sampling level or by discarding practices of small fish (less than 500g, ie less than 30 cm (age 4) by French and Spanish fishermen to avoid quota closure and for market reason (high-grading) – as reported by the industry. The length composition in 2006 (figure 4.2.1) shows that a high proportion of the landings is comprised of small individuals of a modal length of 30cm. The length distribution of landings by country from 2001 to 2004 (figure 4.2.2) indicate that since 2004 there has been an increase in the implementation of the 500g regulation by the French bottom trawl fleets (by far contributing the most the total *L. budegassa* French landings) as no fish less than 35 cm were sampled in the 2006 landings. Since the increase of the proportion of these small fish in the total landings could reflect a strong incoming year-class not landed by some fleets, the results are reflected by the drop of total landings in 2006.

The lack of available information on landings of smaller fish caused by the increasing discarding practices has not been compensated by an increase in discards sampling. Therefore the quality of data used for this assessment has decreased in recent years and this is particularly true for the 2006 data. The WG recommends to increase the sampling on the catches of smaller anglerfish and to increase the number of readings on younger ages.

France provided quarterly ALKs from 1987 to 2005, based on samples taken from the Celtic Sea.

ALKs were also available for Spain in 1997 for Quarters 1, 2 and 4 and in 1998 by semester for the Bay of Biscay and for the second semester only for the Celtic Sea. Since 1999, Spain provided ALKs by semester for Celtic Sea and Bay of Biscay combined.

Since 2001, combined quarterly French and Spanish semestrial ALKs were applied to the international length distributions.

The 1986 age compositions were obtained using mean quarterly ALKs for the years 1987-1991.

As in previous years, very few readings are available for the small fish giving further uncertainties for the number at younger ages.

The estimated annual age compositions of the total international landings are shown in Table 4.2.2. The number of younger fish (ages 2-3) decreased in 1997 (-70% compared to 1996) and were even lower in 1998. Catches at these ages have increased since 1999 to a peak in 2001 and decreased since then. However, the estimated catches of young individuals since 2003 may be under-estimated due to increasing discarding practices at levels that could not be estimated and presented to the Working Group.

The figure 4.2.3 shows the standardized catch proportion at age. There are indications of drastic changes in exploitation patterns in recent years and of possible ageing problems (block of ages tracking).

As mentioned in section 4, SoP was calculated using the parameters of the length-weight relationship used by the ICES WG on fisheries units in sub-areas VII and VIII (ICES, 1991). Then correction of numbers was performed and the mean weight at age derived from the mean weight at length and the ALK was computed. The data from the full time series are given in Table 4.2.3; these are also used for mean weights in the stock.

An overall upward trend is noticeable for most of the ages over the whole period. In 2005 there is an unusual increase in mean weight at age for younger ages that are related to the few readings available for small fish already mentioned.

Natural mortality was assumed to be 0.15 for all ages and years.

The sex combined maturity ogive used was the same as last year (Quincoces et al, 1998).

Age	1	2	3	4	5	6	7	8	9	10	11	12	13	14+
Prop. mature	0.02	0.03	0.07	0.12	0.21	0.34	0.50	0.66	0.79	0.88	1.0	1.0	1.0	1.0

4.2.1.3 Surveys

The French FR-EVHOES survey provides biomass, abundance and recruitment indices for the period 1997 to 2006. The recent Irish GroundFish Survey provides biomass and abundance indices since 2003.

The FR-EVHOE-S survey biomass, abundance and recruitment indices are given in table 4.2.4 as well as abundance indices from the Irish Groundfish Survey from 2003 to 2006..

In figure 4.2.4, biomass and abundance indices indicate an increase in abundance of small individuals in the recent period as shown in the length distribution (fig.4.2.5). Biomass index indicate fluctuation over the period 1997 to 2006 but no particular trend. Since 2004, very small individuals (mode at 10 cm) are caught (especially in 2004) indicating good incoming recruitment. This is also shown in the Irish survey data.

4.2.1.4 Commercial catch and effort data

As for *L. piscatorius*, effort and LPUE data were available for four Spanish fleets, four French fleets and one UK English fleet (Table 4.2.5). Since French logbook data were only partially available since 1999, only the LPUE data can be considered.

Trends in fishing effort (Figure 4.2.6.a) are described in the *L.piscatorius* section 4.1.1.4.

Table 4.2.4. and Figure 4.2.6b shows LPUE from 7 fleets, SP-VIGOTR7 an SP-BAKON7 show the same increasing trend from 1993 to 2000. Since then LPUE for SP-VIGOTR7 have significantly increased while the SP-BAKON7 has decreased. The other fleets LPUEs have fluctuated over the same period.

4.2.2 Assessment

An updated XSA run was performed but in view of the increased bad fit of the model, stronger retrospective pattern, the Working Group decided not to accept the population estimates to carry projections and even the SSB trend as reflective of the recent development of the population biomass. The diagnostics and the results of this updated run are given in an annex to this section. In the following sections, input data and description of the model fit are given.

4.2.2.1 Input data

Catch at age data are available from 1986 to 2006 and ages 1 to 14+. However, due to the scarce data at age 1 in the catch, the analysis used only data from age 2-14+.

Commercial effort and catch at age data considered to meet the assumption of constant catchability at age necessary to be used as tuning fleets include one Spanish trawler fleet in the Celtic Sea (bakas from Vigo SP-VIGOTR7), two French trawler fleets targeting benthic species using single bottom trawl in the Celtic Sea (FR-FU04) and one in the Bay of Biscay (FR-FU14) and two Basque Baka fleets, one fishing in sub-area VII (SP-BAKON7) and the other in sub-area VIII (SP-BAKON8). However, as described in section 1.1.2, increasing discard practices associated with no reliable estimates of those discards lead to conclude that the constant catchability assumption is not met any more for younger ages groups in recent years.

Data from one survey (FR-EVHOES) was also available for ages 0 to 14.

Screening carried out in preceding assessments has lead the exclusion of some years and ages from some of the commercial fleets and all the tuning data used in the assessment are given in Table 4.2.6.

In 1996-2001, the numbers at age 2 in the FR-FU04 displayed as 0. It is not clear to the WG whether this is due to a lack of reading for this age or to a very low rate of catches for that age. In the first case, the 0 value could be interpreted as missing values, otherwise a more precise value is needed. The same problem occurred at age 3 in 2004 to 2006 for that fleet and in 2006 numbers at age 3 are almost absent. The WG recommended investigating this before the next full assessment of this stock. The WG recommended also as the FR-EVHOES time series was becoming longer, to exclude age 2 from the SP-VIGOTR7.

4.2.2.2 Model

Since the assessment of this stock is an update assessment this year, no exploratory runs were carried out.

Final XSA run

The final settings used this year are the same as last year as detailed below:

		% IN THE LANDINGS	WG	2006	WG	2007
Year range of catch data			1986-	2005	1986-	200**6**
Age range of catch data			2-14+		2-14+	
	FR-FU04 - Commercial	6.0%	88-05	2-13	88-0**6**	2-13
	FR-FU14 - Commercial	5.6%	86-05	8-13	86-0**6**	8-13
	SP-VIGOTR7 - Commercial	44.8%	86-05	2-13	86-0**6**	2-13
	FR-EVHOES - Survey		97-05	2-13	97-0**6**	2-13
	SP-BAKON7 Commercial	1.5%	97-05	5-10	97-0**6**	5-10
	SP-BAKON8 Commercial	2.9%	93-97	5-13	93-97	5-13
Taper				No		No
Tuning range				Full		Full
Ages catch dep. stock size				No		No
q plateau				10		10
F shrinkage se				No		No
year range				-		-
age range				-		-

The diagnostics and results from the updated XSA run are given in annex D, and the plots of log-catchability residuals are shown in Figures 4.2.7(a) and (b), and because of the short series of the survey, a 4 years retrospective analysis is presented in Figure 4.2.8.

4.2.2.3 Comments on the quality of the assessment

Residuals are higher in recent years than observed in the 2006 assessment. The retrospective is much worst than in previous assessments. Therefore and in view of recent changes in the exploitation pattern of the French FU04 fleet, a second run excluding ages 2 to 4 from this fleet has been attempted but with no significant changes in the retrospective pattern.

The patterns in the residuals (especially cohort effects) and in the standardised catch at age proportions, successive modes observed in the survey data confirm the need of ageing validation studies.

The working group concluded that no changes in the model formulation could result in a better assessment since the problems encountered are due to a recent deterioration of available catch data, especially discard estimates, and ageing problems. The working group also agreed to reject the XSA results to serve as a basis for a diagnostics of the state of the resource.

No analytical assessment was accepted and therefore precise estimate of recent development in the stock population structure and SSB are not available.

Table 4.2.1. ***Lophius budegassa in Divisions VIIb-k and VIIIa,b,d***

Landings in tonnes by Fishery Unit

	VIIb,c,e-k						VIIIa,b,d				
Year	Gill-Net (Unit 3+13)	Medium/Deep Trawl (Unit 4)	Shallow Trawl (Unit 5)	Beam Trawl (Unit 6)	Shallow/medium Neph.Trawl (Unit 8)	Other	Neph.Trawl (Unit 9)	Shallow Trawl (Unit 10)	Medium/Deep Trawl (Unit 14)	Unallocated	**TOTAL** VII +VIII
1986	23	5126	348	540	406	0	443	150	1181	0	8217
1987	30	3493	696	462	434	0	483	116	1904	0	7619
1988	34	4072	1095	751	394	0	435	102	1498	0	8382
1989	40	4398	976	1217	515	0	446	112	1829	0	9533
1990	53	4818	631	905	653	0	550	156	1865	0	9632
1991	88	4414	921	384	507	0	475	117	1933	0	8840
1992	90	4808	301	305	594	0	459	191	1518	0	8266
1993	93	3415	429	405	399	0	433	101	1385	0	6659
1994	70	2935	265	209	540	0	232	49	1515	0	5814
1995	110	3963	455	159	617	0	312	62	1286	90	7053
1996	118	4587	477	245	524	28	374	109	1239	392	8092
1997	134	4836	602	132	474	9	313	17	1128	471	8114
1998	179	5565	246	230	288	1	258	72	1454	305	8599
1999	16	4872	115	285	319	0	146	76	1496	0	7325
2000	68	4675	187	261	267	0	136	36	1407	0	7037
2001	36	3761	107	260	301	0	114	28	1080	0	5688
2002	31	4354	151	251	386	0	102	12	1247	0	6534
2003	79	5647	320	346	362	5	155	32	1189	0	8134
2004	107	4720	265	349	394	0	259	8	1489	0	7590
2005	68	4763	160	411	314	0	220	52	1426	14	7428
2006**	8	3658	147	276	218	0	294	1	1171	1	5774

** preliminary

Table 4.2.2. Anglerfish (budegassa) in Fishing areas VII and VIIIa,b,d,e - Catch numbers at age ('000)

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
AGE										
2	244	110	185	245	257	101	155	315	180	73
3	519	434	713	524	640	508	452	377	338	571
4	895	948	1000	517	815	660	915	602	697	586
5	1012	965	1234	745	788	975	774	905	772	878
6	1006	861	1256	1200	766	1059	947	1007	828	1204
7	779	925	984	1055	970	809	1292	757	853	1207
8	657	697	745	862	903	858	720	659	655	786
9	625	662	622	754	800	616	511	486	408	642
10	512	411	435	737	673	435	386	348	195	273
11	307	260	258	408	456	280	320	218	180	62
12	213	148	183	231	316	286	187	194	131	31
13	189	204	148	167	158	163	89	94	81	28
+gp	198	154	154	259	217	220	167	151	79	137
0 TOTALNU	7156	6779	7917	7704	7759	6970	6915	6113	5397	6478
TONSLAN	8217	7619	8382	9533	9632	8840	8266	6659	5814	7053
SOPCOF (	100	100	100	100	100	100	100	100	100	100

YEAR	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGE											
2	62	28	1	19	42	443	236	103	157	27	27
3	502	141	94	149	227	815	517	167	42	327	152
4	622	578	652	510	542	1238	1455	788	206	515	1412
5	754	814	1150	712	697	1093	1722	2523	819	508	1207
6	1086	825	1352	987	814	717	946	1875	642	476	600
7	1172	783	1069	766	521	705	904	1364	945	795	533
8	893	830	679	875	669	364	519	597	797	677	269
9	630	647	484	521	472	299	311	350	586	609	352
10	329	421	327	304	311	153	250	304	403	303	235
11	221	301	327	201	242	140	141	150	218	137	188
12	133	232	187	143	190	92	88	114	134	137	99
13	62	153	119	86	113	90	71	41	76	133	84
+gp	158	197	301	181	176	195	108	123	109	131	83
TOTALNUM	6624	5950	6742	5454	5016	6344	7268	8499	5134	4775	5241
TONSLAND	8092	8114	8599	7325	7037	5688	6534	8134	7590	7428	5773
SOPCOF %	100	100	100	100	101	100	100	100	100	100	100

Table 4.2.3. Anglerfish (budegassa) in Fishing areas VII and VIIIa,b,d,e - Catch weights at age (kg)

Table 2 Catch weights at age (kg)

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
AGE										
2	0.135	0.121	0.121	0.121	0.099	0.08	0.111	0.085	0.129	0.08
3	0.192	0.178	0.183	0.186	0.169	0.175	0.173	0.145	0.158	0.158
4	0.306	0.272	0.295	0.299	0.281	0.288	0.242	0.223	0.239	0.259
5	0.426	0.397	0.453	0.44	0.435	0.416	0.43	0.408	0.382	0.429
6	0.587	0.603	0.634	0.598	0.611	0.619	0.677	0.603	0.649	0.618
7	0.874	0.854	0.948	0.84	0.848	0.985	0.912	0.809	0.969	0.907
8	1.184	1.16	1.238	1.121	1.135	1.294	1.354	1.226	1.365	1.435
9	1.574	1.543	1.598	1.557	1.568	1.783	1.909	1.612	1.774	2.163
10	2.044	2.124	2.139	1.951	2.041	2.313	2.507	2.193	2.436	3.103
11	2.558	2.633	2.623	2.482	2.647	2.791	2.88	2.787	2.909	3.595
12	3.3	3.138	3.345	3.258	3.141	3.21	3.441	3.38	3.643	3.483
13	3.928	3.87	3.961	3.859	3.733	3.822	3.775	4.031	3.981	3.968
+gp	5.398	6.077	5.991	5.133	5.489	5.245	5.847	5.675	6.274	5.721

Table 2 Catch weights at age (kg)

YEAR	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGE											
2	0.076	0.12	0.053	0.078	0.077	0.087	0.104	0.103	0.178	0.2927	0.109
3	0.167	0.163	0.173	0.15	0.141	0.143	0.154	0.153	0.141	0.2049	0.151
4	0.304	0.238	0.247	0.237	0.227	0.239	0.242	0.243	0.331	0.3949	0.257
5	0.442	0.408	0.388	0.398	0.392	0.386	0.438	0.413	0.471	0.5801	0.444
6	0.662	0.622	0.6	0.642	0.64	0.628	0.666	0.685	0.801	0.7651	0.703
7	1.014	0.899	0.912	0.97	0.965	0.915	1.007	1.001	1.074	1.0967	1.006
8	1.441	1.34	1.35	1.36	1.367	1.363	1.445	1.454	1.412	1.5926	1.453
9	1.888	1.718	1.794	1.869	1.85	1.894	1.934	2.03	1.942	2.1961	2.186
10	2.393	2.294	2.297	2.429	2.427	2.476	2.502	2.451	2.443	2.661	2.828
11	3.09	2.926	2.66	3.05	3.063	3.099	3.21	3.217	3.42	3.3019	3.709
12	3.36	3.011	3.271	3.679	3.681	3.65	3.714	3.808	3.848	3.7866	4.337
13	4.208	3.704	3.689	4.311	4.292	4.203	4.762	4.394	4.193	4.4237	4.867
+gp	5.825	5.393	5.742	6.083	6.088	5.916	6.421	6.287	6.612	6.3906	6.47

**Table 4.2.4. Anglerfish (L. budegassa) in Divisions VIIb-k and VIIIa,b,d.
Abundance index from FR-EVHOES and IR-IGFS**

	FR-EVHOES				IR-IGFS	
Year	Kg/30'	Nb/30'	Nb/30' age 0	Nb/30' age 1	Nb/30'	Nb/30' age 0
1997	0.78	0.75	0.02	0		
1998	0.56	0.66	0.1	0.14		
1999	0.43	0.64	0.02	0.19		
2000	0.6	0.82	0.16	0.19		
2001	0.76	1.4	0.04	0.33		
2002	0.89	1.34	-	0.16		
2003	0.49	0.51	0.02	0.07	0.43	0.01
2004	0.58	1.1	0.47	0.27	1.16	0.83
2005	0.51	1.02	0.18	0.15	0.87	0.13
2006	0.8	1.6	0.05	0.22	0.66	0.09

Table 4.2.5.: L.budegassa in Divisions VIIb-k and VIIIa,b
Effort and LPUE data

EFFORT	SP-VIGO7 in Division VII	SP-CORUTR7 in Division VII	French Benthic trawlers* Celtic Sea FU04	French Benthic Twin Trawls Celtic Sea	French Benthic trawlers* Bay of Biscay FU14	French Benthic Twin Trawls Bay of Biscay	EW FU06 am trawlers in VII	SP-BAKON7	SP-BAKON8
	('000 days*HP)	('000 days*HP)	('000 hrs)	('000 hrs)	('000 hrs)	('000 hrs)	('00 days)	(days)	(days)
1986	6875	9527	418	N/A	123	N/A	N/A		
1987	6662	10453	349	N/A	199	N/A	N/A		
1988	6547	10886	334	N/A	150	N/A	N/A		
1989	7585	10483	378	N/A	187	N/A	N/A		
1990	8021	9630	380	N/A	208	N/A	N/A		
1991	7822	8522	380	N/A	210	N/A	N/A		
1992	6370	5852	331	N/A	186	N/A	100		
1993	5988	5001	274	N/A	159	N/A	114	1094	5590
1994	5655	4990	249	N/A	148	N/A	116	980	5619
1995	5070	4403	287	N/A	174	N/A	127	1214	4474
1996	5416	3746	196	121	144	19	126	1170	4378
1997	5058	3738	178	133	133	33	126	540	4286
1998	5360	3684	182	134	117	40	121	1196	3002
1999	5084	3512	108	110	83	59	115	1384	2337
2000	5519	2773	160	103	87	49	104	1850	2227
2001	5678	2356	127	133	60	66	186	1451	2118
2002	5041	2258	114	120	56	75	111	949	2107
2003	5437	2597	144	134	65	78	166	1022	2296
2004	5347	2292	155	129	75	88	174	910	2159
2005	5246	2120	137	135	81	118	109	544	2263
2006***	5392	2257	136	139	69	98	94	487	2398

LPUE	Vigo in Division VII	La Coruna in Division VII	French Benthic trawlers* Celtic Sea FU04	French Benthic Twin Trawls Celtic Sea	French Benthic trawlers* Bay of Biscay FU14	French Benthic Twin Trawls Bay of Biscay	EW (FU06) am trawlers in VII	SP-BAKON7	SP-BAKON8
	(kg/days*HP)	(kg/days*HP)	(kg/10 hrs)	(kg/10 hrs)	(kg/10 hrs)	(kg/10 hrs)	(kg/10days)	(kg/day)	(kg/day)
1986	339.3	37.4	37.6		50.6				
1987	294.3	15.6	25.4		47.6				
1988	264.9	42.2	38.7		52.8				
1989	272.0	25.1	47.2		65.2				
1990	250.4	29.2	51.6		62.0				
1991	231.2	29.9	43.7		53.8				
1992	248.1	13.9	48.2		52.8		27.6		
1993	194.4	15.4	42.9		49.7		29.7	51.0	55.3
1994	202.9	20.2	43.7		60.2		10.5	107.7	61.2
1995	285.9	8.4	51.3		47.1		7.1	120.0	48.7
1996	303.5	12.5	47.5	64.7	41.5	58.0	12.3	173.4	56.9
1997	383.4	12.0	49.8	62.8	44.2	47.7	7.4	272.9	41.9
1998	319.0	9.2	54.3	64.3	61.8	68.1	14.7	229.3	77.8
1999	369.4	8.8	37.9	55.4	57.2	63.4	12.3	329.0	84.6
2000	257.1	19.5	61.4	49.5	57.2	73.0	9.0	265.5	56.4
2001	304.3	3.4	37.4	40.7	49.3	71.0	5.2	198.2	37.2
2002	388.9	29.6	46.0	47.9	40.1	65.5	7.9	231.6	70.6
2003	599.6	16.4	57.2	53.4	44.5	63.9	6.9	241.7	64.9
2004	490.2	13.2	37.6	45.7	35.1	55.2	5.6	185.5	91.5
2005	522.5	17.6	59.2	55.6	43.1	57.6	13.1	139.6	72.0
2006***	479.4	13.3	25.7	27.8	46.5	58.5	8.5	179.2	70.4

* Identified twin trawls excluded
**Revised
*** Preliminary
NB : data for France since 1999 are partial and from an unknown proportion of the total logbooks. Therefore effort data since 1999 is used only for cpue computation and do not represent total effort. The effort data since 1999 is not plotted on the graph.

Table 4.2.6. Anglerfish (budegassa) in Fishing areas VII and VIIIa,b,d,e - Tuning fleets data

FR-FU04														
1986	2005													
1	1	0	1											
2	13													EFF
1000	7.18	16.76	43.09	83.79	129.27	165.18	225.03	294.45	277.69	189.12	153.21	131.66	1986	417.73
1000	2.87	25.82	131.97	192.22	218.04	180.74	146.32	160.66	152.05	94.68	68.85	109.02	1987	348.56
1000	5.99	65.86	152.67	299.36	365.22	332.29	269.42	305.35	224.52	116.75	104.78	86.81	1988	334.05
1000	23.80	68.75	95.20	171.88	280.30	312.03	335.83	351.69	359.63	227.41	145.44	105.77	1989	378.17
1000	13.18	57.97	113.31	187.09	231.88	403.16	424.24	405.80	345.19	268.77	208.17	102.77	1990	379.50
1000	7.90	71.14	137.00	274.01	287.18	295.09	368.86	310.89	255.57	181.79	165.99	81.68	1991	379.55
1000	18.13	75.55	229.69	317.33	408.00	565.15	335.46	259.91	241.78	214.58	117.87	54.40	1992	330.89
1000	3.65	21.88	105.73	266.16	360.95	342.72	346.37	284.39	255.22	160.42	153.13	69.27	1993	274.28
1000	20.04	76.15	140.28	152.31	248.50	424.86	436.88	312.63	188.38	200.40	124.25	72.15	1994	249.50
1000	6.96	93.92	142.62	264.37	629.62	754.85	487.00	483.52	271.33	52.18	34.79	24.35	1995	287.48
1000	0.00	40.91	127.84	301.71	562.50	516.48	501.14	470.46	214.77	132.96	81.82	35.80	1996	195.55
1000	0.00	11.27	78.86	146.46	230.96	332.35	461.91	383.05	276.02	191.52	163.36	112.66	1997	177.52
1000	0.00	16.53	203.83	429.69	539.86	501.30	380.11	291.97	214.84	253.41	137.72	99.16	1998	181.53
1000	0.00	27.66	101.43	73.77	101.43	147.53	285.85	258.19	184.42	129.09	73.77	64.55	1999	108.45
1000	0.00	37.47	181.09	287.25	355.94	256.03	374.67	368.43	218.56	212.31	237.29	156.11	2000	160.14
1000	0.00	78.87	378.57	457.44	331.25	347.02	252.38	189.28	110.42	94.64	63.09	70.98	2001	126.79
1000	26.33	280.83	754.72	956.57	552.88	605.53	386.14	272.05	245.72	131.64	87.76	87.76	2002	113.95
1000	13.92	34.79	132.21	438.39	688.89	786.31	452.30	320.09	306.17	173.96	125.25	48.71	2003	143.71
1000	1.13	0.00	11.10	39.52	85.63	239.70	326.69	303.91	283.51	240.55	139.51	56.96	2004	155.49
1000	0.00	0.00	22.27	34.26	101.77	327.07	427.23	487.31	276.96	95.31	148.49	174.77	2005	136.62
1000	0.00	0.00	0.64	54.54	166.87	178.92	88.68	113.18	82.90	91.35	55.99	73.73	2006	135.51
SP-VIGO7														
1986	2006													
1	1	0	1											
2	13													EFF
1000	17.75	40.58	67.78	72.00	65.75	42.04	29.67	25.31	18.47	9.60	6.55	8.73	1986	6875
1000	2.10	20.41	48.78	53.44	46.98	46.98	32.12	29.42	16.21	8.26	5.25	7.21	1987	6662
1000	16.19	58.04	64.30	68.58	58.81	37.73	25.97	17.11	10.08	5.96	3.67	4.43	1988	6547
1000	10.55	27.55	28.21	34.67	50.10	38.10	29.40	22.54	19.91	11.07	5.14	4.88	1989	7585
1000	4.11	20.45	31.04	27.80	29.55	32.79	30.42	25.06	19.45	11.10	6.36	2.74	1990	8021
1000	1.28	19.18	28.00	36.69	34.13	27.74	32.09	20.20	11.63	5.75	5.63	3.07	1991	7822
1000	3.45	11.93	28.26	36.42	37.99	45.05	26.53	18.21	12.72	10.20	5.34	2.51	1992	6370
1000	5.34	11.52	26.72	36.91	35.74	26.55	23.38	15.53	10.19	6.51	5.34	2.51	1993	5988
1000	18.21	26.70	52.34	52.70	42.62	35.72	21.57	13.79	6.90	3.89	3.36	1.77	1994	5655
1000	2.56	46.55	57.59	66.07	63.91	53.65	31.56	25.05	8.48	3.35	1.38	1.18	1995	5070
1000	1.29	44.13	55.02	54.10	69.05	71.64	38.59	15.51	7.75	3.88	2.40	1.29	1996	5416
1000	3.36	16.01	55.16	80.07	76.91	64.06	52.99	34.80	15.82	9.09	7.32	3.36	1997	5058
1000	0.00	10.63	66.98	75.56	60.26	50.37	35.82	23.32	13.81	11.94	5.41	2.43	1998	5360
1000	2.36	18.49	63.53	73.96	80.25	47.80	44.85	24.78	13.97	8.46	5.90	2.56	1999	5084
1000	4.17	24.82	55.26	57.08	54.36	30.44	34.79	15.58	10.69	6.52	3.62	1.45	2000	5519
1000	67.98	107.43	110.07	90.88	51.78	49.49	21.66	16.56	8.81	7.04	3.70	3.70	2001	5678
1000	38.29	70.82	188.45	150.37	70.03	58.32	31.74	17.06	12.30	6.15	3.57	2.78	2002	5041
1000	16.55	25.75	108.70	311.57	189.07	111.83	41.75	20.05	17.84	8.64	6.25	1.66	2003	5437
1000	28.01	7.52	32.50	122.40	72.97	84.68	59.08	39.48	22.16	7.05	4.41	2.68	2004	5347
1000	2.34	54.71	76.55	75.59	64.79	91.78	64.99	52.14	22.46	7.74	5.90	3.67	2005	5246
1000	4.91	27.48	246.98	185.61	62.61	52.69	25.28	31.41	19.14	13.07	5.58	3.63	2006.00	5392
FR-FU14														
1986	2006													
1	1	0	1											
8	13							EFF						
1000	470.00	429.49	397.07	259.31	121.55	72.93	1986	123.40						
1000	466.55	501.67	235.78	185.62	90.30	90.30	1987	199.34						
1000	421.38	341.11	274.23	207.34	153.84	93.64	1988	149.51						
1000	682.81	490.77	464.09	261.39	192.04	128.03	1989	187.46						
1000	604.65	427.09	307.12	249.54	196.75	119.97	1990	208.39						
1000	524.76	429.35	291.00	190.82	171.74	95.41	1991	209.62						
1000	554.65	312.33	215.40	199.24	107.70	37.69	1992	185.70						
1000	721.13	558.09	313.53	150.50	112.87	37.62	1993	159.47						
1000	813.00	521.67	189.70	196.47	149.05	88.07	1994	147.60						
1000	602.72	430.52	172.21	51.66	17.22	22.96	1995	174.21						
1000	536.44	473.74	174.17	97.53	90.57	69.67	1996	143.54						
1000	414.28	391.69	293.77	225.97	165.71	120.52	1997	132.76						
1000	410.62	307.97	256.64	222.42	128.32	68.44	1998	116.90						
1000	763.34	460.43	218.10	109.05	84.82	60.58	1999	82.53						
1000	494.66	540.68	356.62	287.59	172.56	103.53	2000	86.93						
1000	233.23	166.59	49.98	66.64	83.30	166.59	2001	60.03						
1000	395.62	269.74	197.81	125.88	71.93	71.93	2002	55.61						
1000	324.18	231.56	185.25	92.62	61.75	15.44	2003	64.78						
1000	486.43	263.46	167.65	95.01	48.83	49.01	2004	75.26						
1000	343.57	353.74	165.71	105.69	77.12	125.84	2005	80.72						
1000	112.931284	279.066396	238.431429	226.935344	129.124384	112.119455	2006	68.98						
FR-EVHOE-S														
1997	2006													
1	1	0.8	0.88											
2	13													
0.5	0.180	0.085	0.079	0.137	0.024	0.018	0.080	0.101	0.027	0.001	0.001	0.001	1997	
0.5	0.011	0.065	0.083	0.072	0.051	0.022	0.031	0.025	0.015	0.023	0.009	0.003	1998	
0.5	0.032	0.029	0.148	0.009	0.043	0.044	0.089	0.029	0.000	0.023	0.000	0.000	1999	
0.5	0.037	0.133	0.086	0.010	0.056	0.026	0.020	0.037	0.026	0.034	0.018	0.000	2000	
0.5	0.257	0.251	0.102	0.101	0.082	0.074	0.058	0.027	0.022	0.023	0.004	0.017	2001	
0.5	0.072	0.120	0.326	0.385	0.120	0.097	0.008	0.028	0.009	0.011	0.008	0.009	2002	
0.5	0.043	0.009	0.033	0.055	0.064	0.089	0.064	0.059	0.015	0.006	0.000	0.004	2003	
0.5	0.032	0.066	0.026	0.022	0.026	0.050	0.077	0.037	0.036	0.011	0.013	0.000	2004	
0.5	0.052	0.213	0.238	0.051	0.000	0.007	0.059	0.019	0.013	0.017	0.008	0.009	2005	
0.5	0.156	0.111	0.305	0.321	0.19	0.083	0.017	0.011	0.017	0.007	0.007	0.003	2006	
SP-BAKON7														
1997	2006													
1	1	0	1											
5	10							EFF						
1000	61.17	91.85	49.26	45.80	27.93	9.44	1997	540						
1000	37.06	58.49	28.49	21.36	19.92	14.25	1998	1196						
1000	42.82	86.66	39.56	31.56	19.83	12.36	1999	1384						
1000	34.84	49.64	53.92	22.52	18.23	7.78	2000	1850						
1000	34.42	53.58	43.72	19.70	14.67	10.57	2001	1451						
1000	45.52	60.08	42.88	30.35	17.42	10.02	2002	949						
1000	57.19	81.61	70.54	23.66	10.39	5.66	2003	1022						
1000	13.68	25.03	44.70	31.91	13.60	9.89	2004	910						
1000	22.06	24.43	20.33	14.41	11.56	10.59	2005	544						
1000	25.359	33.717	34.559	15.195	11.930	8.357	2006	487						
SP-BAKON8														
1993	1997													
1	1	0	1											
5	13											EFF		
1000	12.06	9.37	5.15	3.27	2.32	1.39	1.21	0.90	0.71	0.42	1993	5590		
1000	12.92	11.64	9.61	6.03	2.01	0.83	1.27	1.02	0.67	0.34	1994	5619		
1000	11.64	9.72	7.35	4.57	2.21	1.02	1.36	1.22	0.90	0.41	1995	4474		
1000	7.96	7.48	3.57	5.61	2.53	3.27	2.18	0.61	0.15	0.04	1996	4378		
1000	11.44	9.88	3.60	3.36	2.34	2.56	1.84	0.59	0.32	0.07	1997	4286		

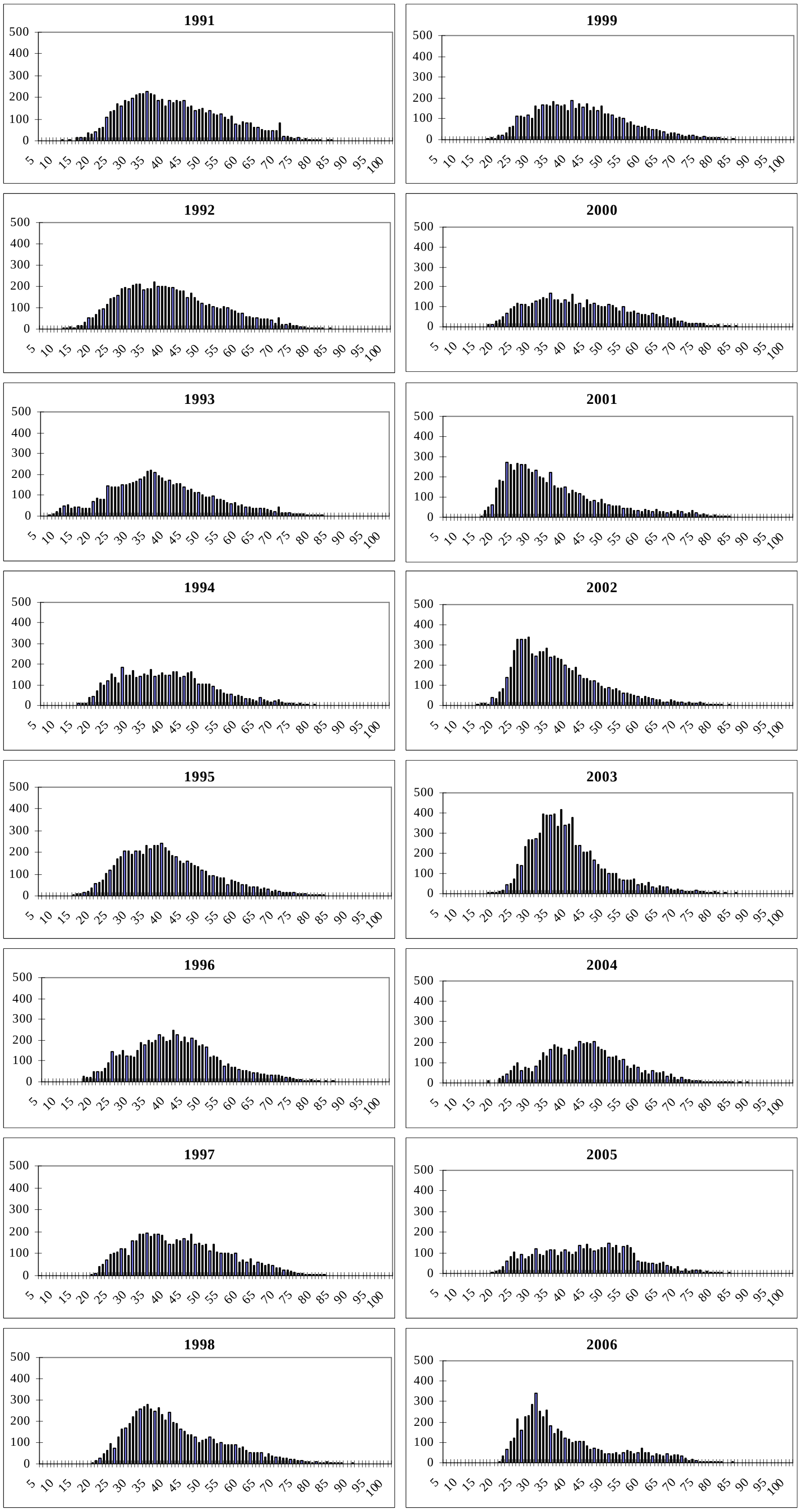


Figure 4.2.1. : **Anglerfish (Lophius budegassa in Divisions VIIb-k and VIIIa,b Length distributions of landings from 1991 to 2006**

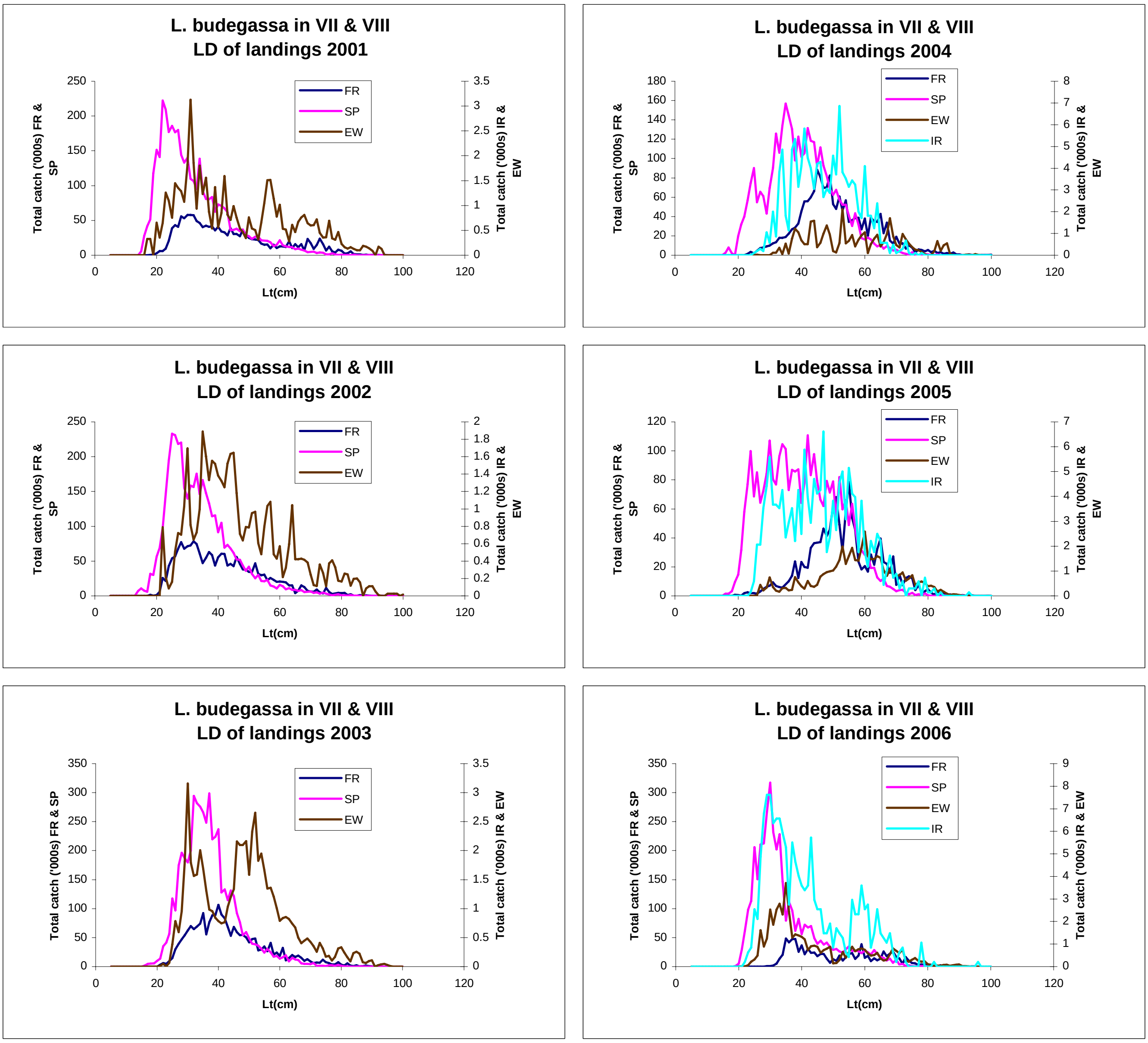


Figure 4.2.2. L. budegassa length distribution of landings by country from 2001 to 2006.

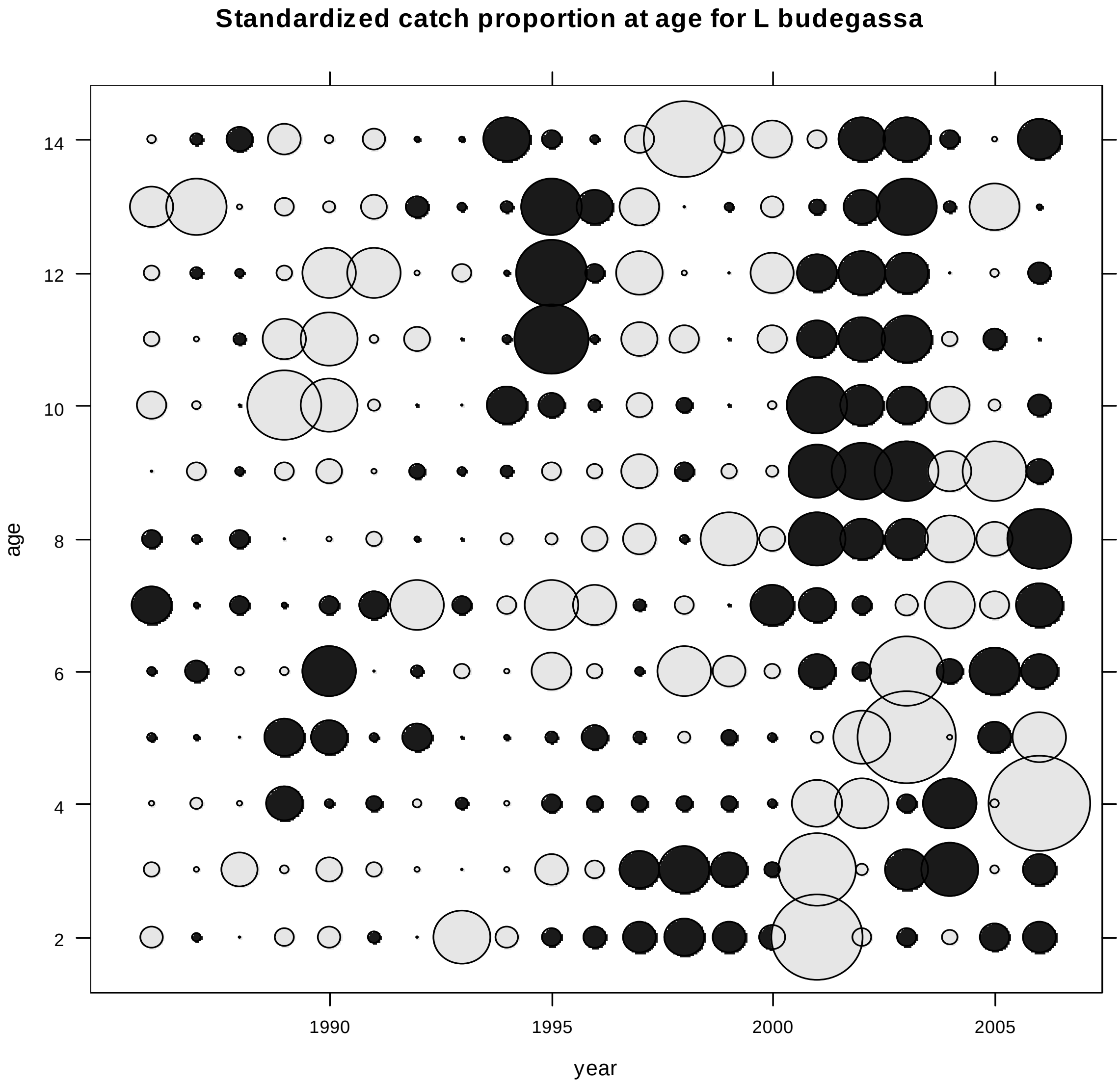
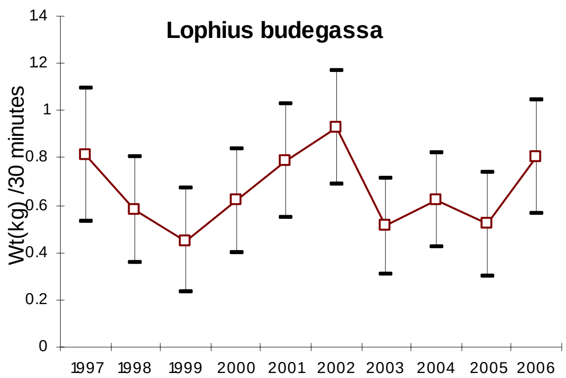


Figure 4.2.3. Standardized catch proportion at age for L. budegassa



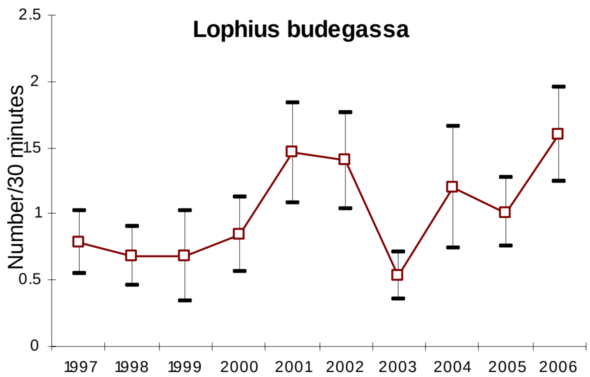


Figure 4.2.4. French EVHOE surveys biomass and total abundance indices from 1997 to 2006. Combined Bay of Biscay and Celtic Sea areas. Error bars indicate +/- 2SD.

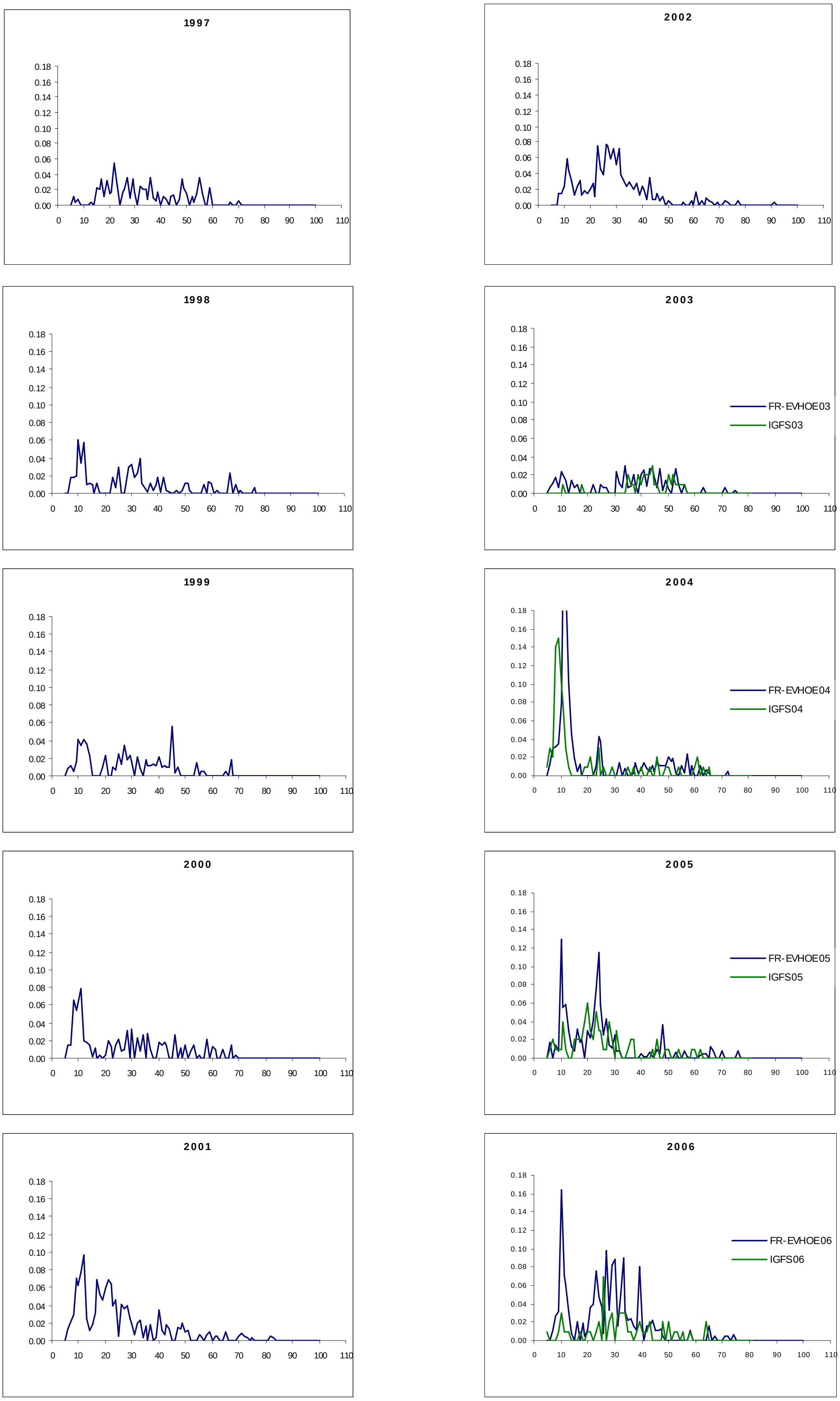


Figure 4.2.5. Abundance indices at length for L. budegassa observed in the FR-EVHOE-S survey from 1977 to 2006 in areas 7 & 8 and in the Irish IGFS from 2004 to 2006 in the Celtic Sea.

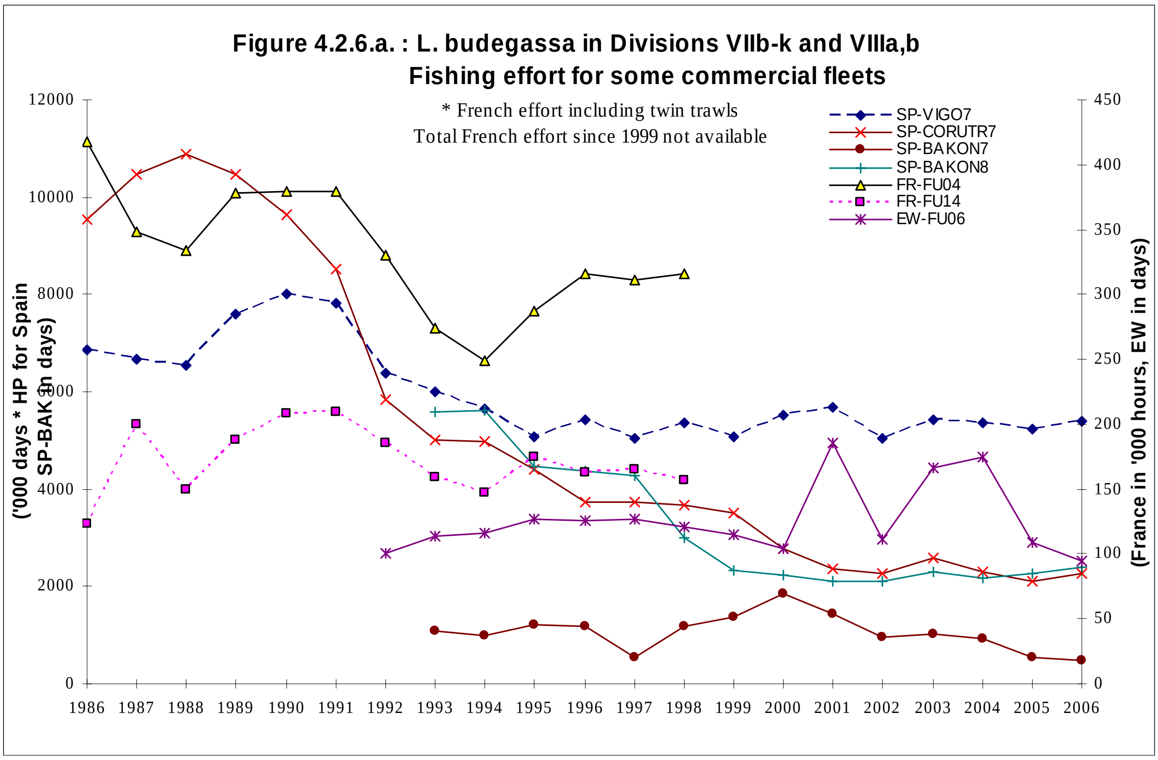


Figure 4.2.6.a. : L. budegassa in Divisions VIIb-k and VIIIa,b
Fishing effort for some commercial fleets
* French effort including twin trawls
Total French effort since 1999 not available
SP-VIGO7
SP-CORUTR7
SP-BAKON7
SP-BAKON8
FR-FU04
FR-FU14
EW-FU06
('000 days * HP for Spain
SP-BAK in days)
(France in '000 hours, EW in days)

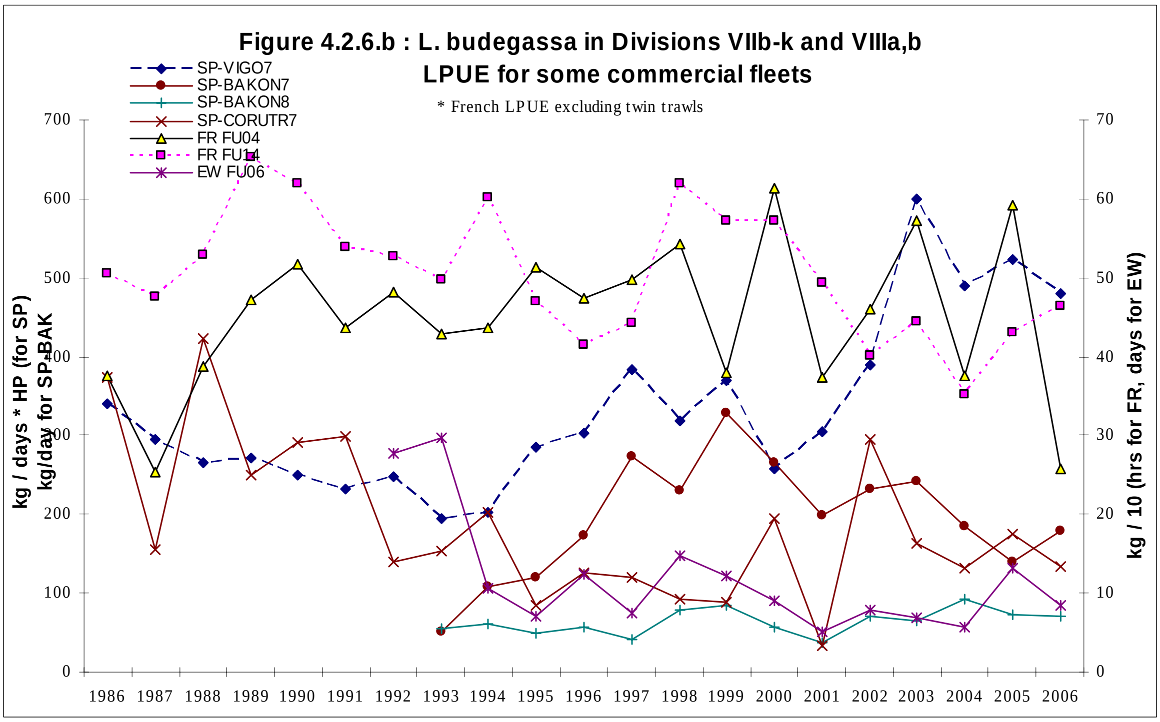
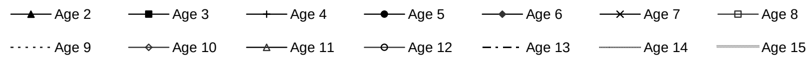


Figure 4.2.6.b : L. budegassa in Divisions VIIb-k and VIIIa,b
LPUE for some commercial fleets
* French LPUE excluding twin trawls
SP-VIGO7
SP-BAKON7
SP-BAKON8
SP-CORUTR7
FR FU04
FR FU14
EW FU06
kg / days * HP (for SP)
kg/day for SP-BAK
kg / 10 (hrs for FR, days for EW)

Figure 4.2.7 (a). Anglerfish (budegassa) VII-VIII LOG CATCHABILITY RESIDUAL PLOTS XSA



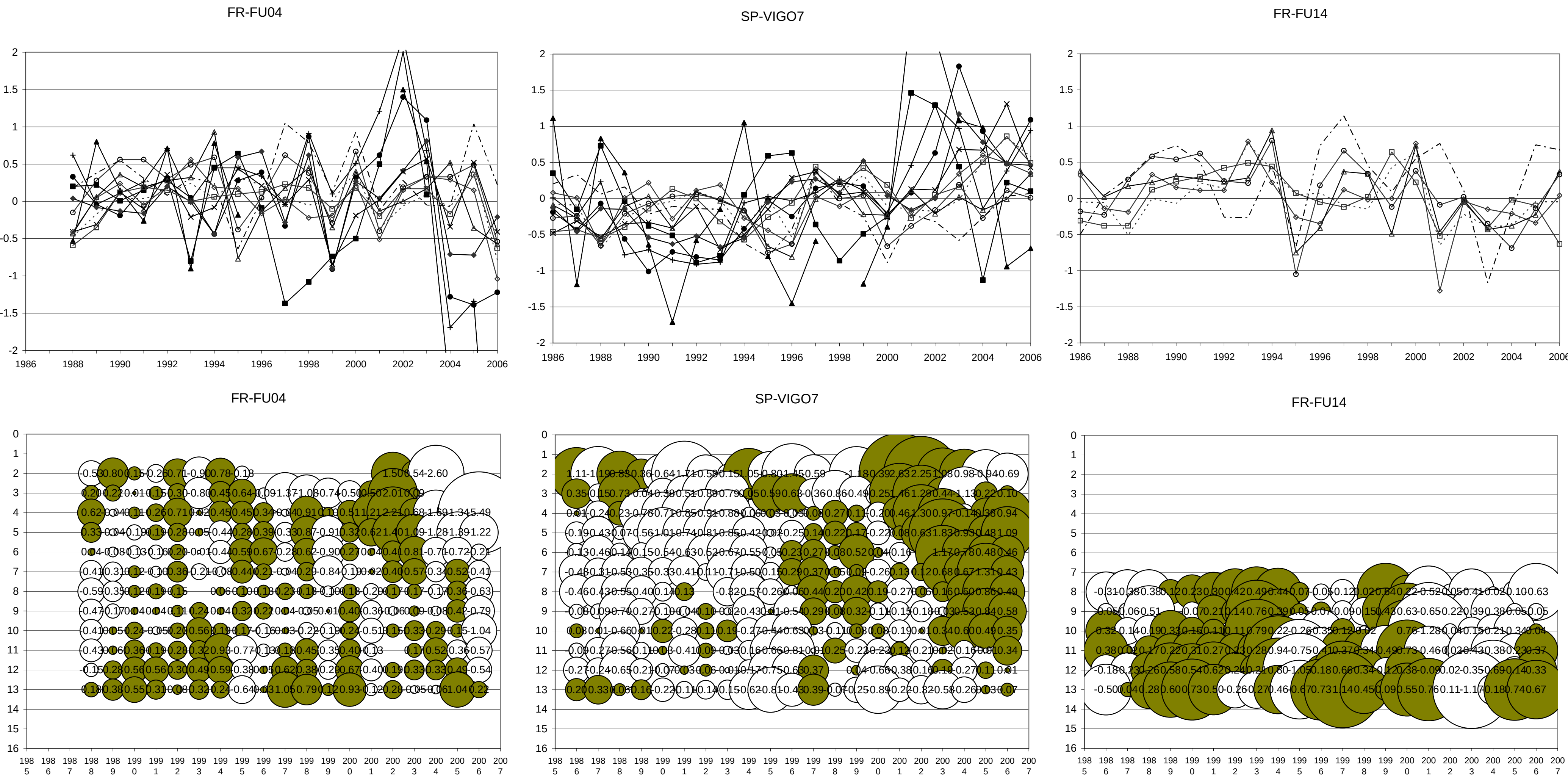
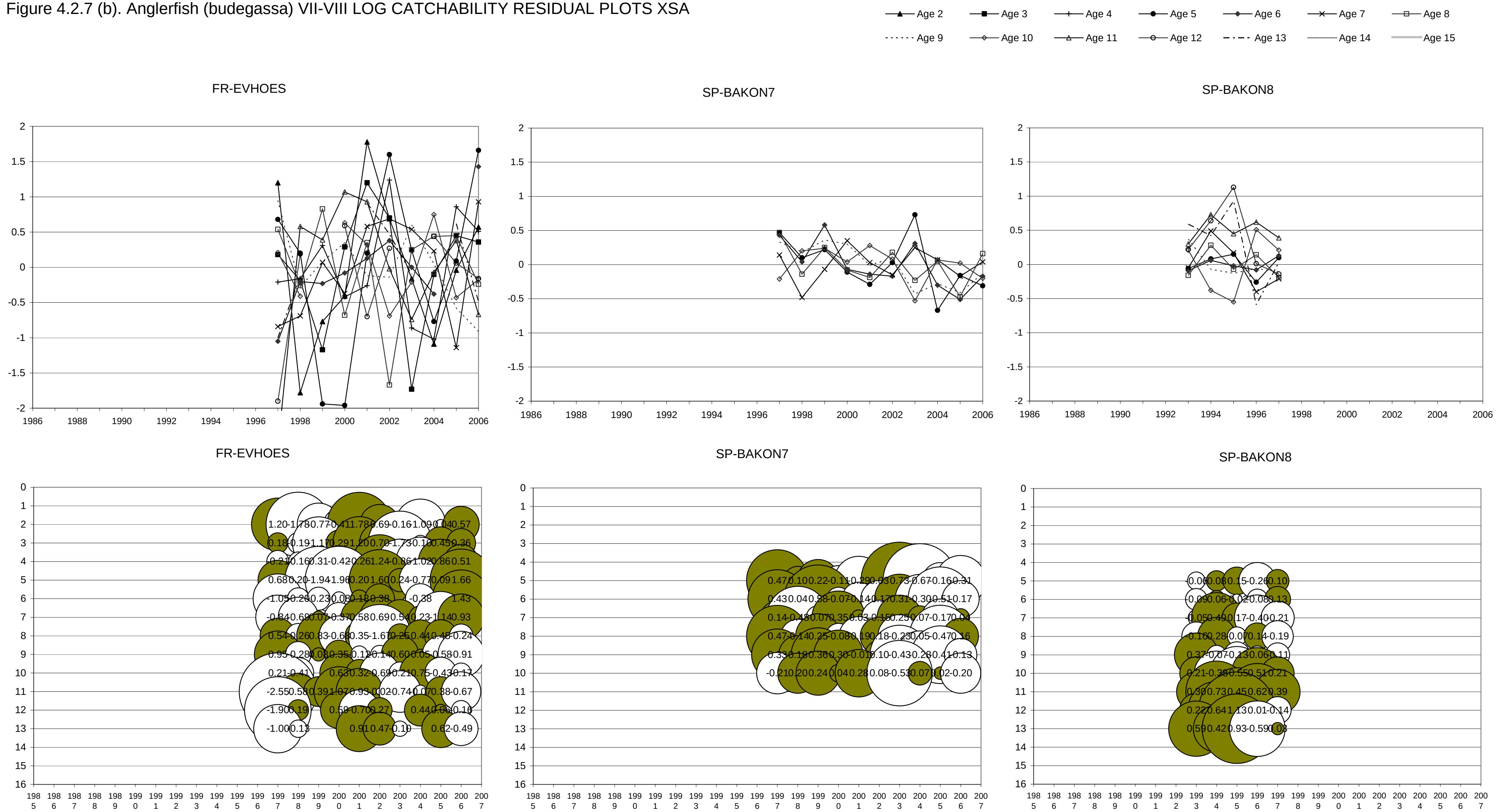


Figure 4.2.7 (b). Anglerfish (budegassa) VII-VIII LOG CATCHABILITY RESIDUAL PLOTS XSA



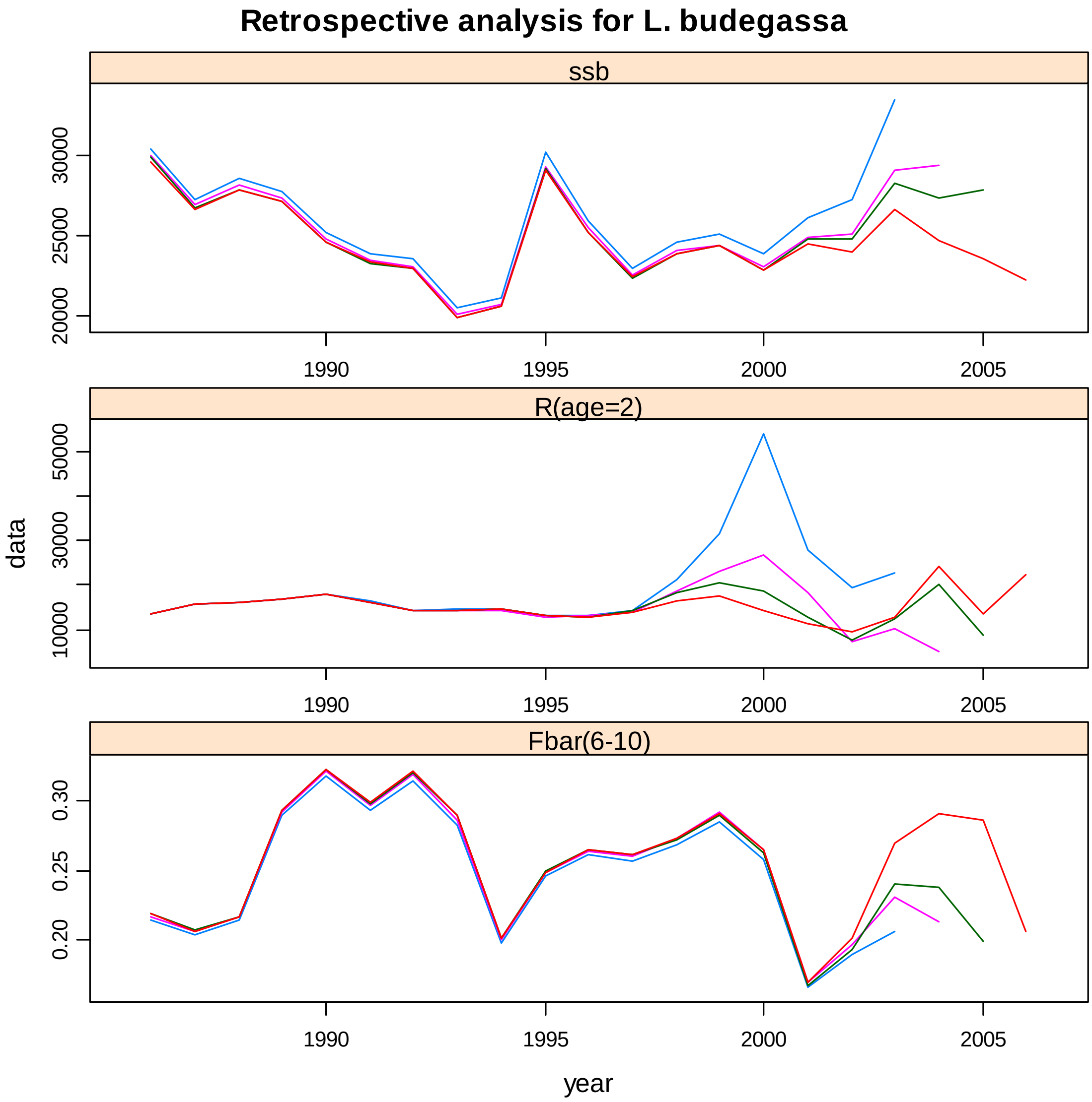


Figure 4.2.8. L. budegassa in VII and VIII, updated XSA retrospective analysis

5 Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d

Type of analysis deployed was an update of last´s year assessment. Proposal for next year´s assessment will be benchmark because a complete review of the commercial CPUEs from Spain and Ireland will be carried out. Discards from other countries than Spain will be attempted to be included in the assessment. In relation to new methods for assessment an attempt of adapting the Operating Model developed for Northern Hake to Northern Megrim will be examined.

Major data deficiencies were, as last year:

Limited discards data available in the time-series. Just Spanish discard data are used in the assessment. Some preliminary discard data has been supplied from other countries at sampling level.

Limited survey information, No EVHOE data is available this year, as no age reading was deployed.

Commercial CPUE series still present some problems. In 2006, Irish otter trawlers were removed from the analysis. No reviewed series have been included this year. Vigo trawl tuning series present, in the two time periods in which this tuning series appeared, to be divided with "apparently" different selectivity pattern.

No data revisions have been carried out this year.

Review group issues:

a) There are large retrospective revisions in stock trends. An exercise to see: a) how catchabilities of each index changes at a time when a year is removed in the retrospective analysis.and also

b) see of which magnitude is this change of catchability for each of the ages and fleets. Results of this exploratory analysis are included in the ICES files.b) Deficiencies in the data . See above.:

Limited discards: No other than Spanish data series have been provided for the assessment. Just sampling data from Ireland and United Kingdom were available.

Conflicting trends in commercial tuning data; which lead to large interannual changes in recent stock projections. No improvement or review of the commercial data series has been provided. Irish Otter trawl fleet was removed because of LPUE pattern in different areas and major changes in fleet structure over time. A better defined trawl fleets has been carried out but it has not been applied yet to the 1995-2002 data yet. Vigo trawl is still to be scrutinized from possible change of catchabilities since 1999.

Limited survey information influencing in the strength of the incoming year classes and there are considerable retrospective revisions of recruitment in the stock. This year the Irish Ground Fish Survey and the Spanish Porcupine Ground fish survey were attempted to be included in the analysis. IR-GFS was not finally included as the series was considered too short (2003-2006) and the SP-GFS was examined for residual, however questions in relation to the area swept ,objective of the survey and Age Length keys used were raised. The group decided not to include it this year as an updated assessment was to be deployed.

5.1 General

5.1.1 Ecosystem aspects

There are two megrim species in the Northeastern Atlantic: megrim (*Lepidorhombus whiffiagonis*) and four spot megrim (*Lepidorhombus boscii*).

In the absence on any data for *L.boscii*, no information on its status can be provided.

Megrim (*L.whiffiagonis*, Walbaum, 1792) is a pleuronectiform fish distributed from Faeroe Islands to Mauritania (from 70ºN to 26ºN) and the Mediterranean Sea, at depths ranging from 50 to 800 metres but more precisely around 100-300 metres (Aubin-Ottenheimer, 1986).

Four spot megrim (*L. boscii,* Risso 1810) is distributed from Faeroe Islands (63ºN) to Bojador Cape and all around the Mediterranean Sea. It is found between 150-650 m, but mostly between 200-600 m.

Although, it does not appear to be evidence of multiple populations in the northeast Atlantic, ICES assumes since the end of the 1970s three different stocks for assessment and management purposes: megrim in ICES Sub-area VI, megrim in Divisions VIIb,c,e-k and VIIIa,b,d and megrim in Divisions VIIIc and IXa.

Spawning period of these species goes from January to March. Megrim spawning peak occurs in February (VIIIa,b,d) and March (VII) along the shelf edge. Males reach the first maturity at a lower length and age than females. For both sexes combined, fifty percent of the individuals mature at about 20 cm and about 2.5 year old (BIOSDEF, 1998, Santurtún *et al*., 2000). Their eggs are spherical, pelagic, with a furrow (stria) in the internal part of the membrane and with a fat globule.

Megrim is a demersal species of small-medium size with a maximum size about 60 cm. It is believed that it has a medium-large lifespan, with a maximum age of about 14 - 15 years. It lives mostly between 50 and 800 m, mainly in muddy bottoms, showing a gradual expansion in bathymetric distribution throughout their lifetimes, where mature males and juveniles tend to occupy deep waters, immature females shallower waters and, during the very short period when females are mature, the dynamics remain unclear.

The Bay of Biscay and Iberian shelf are considered as a single biogeographic ecotone (a zone of transition between two different ecosystems) where southern species at the northern edge of their range meet northern species at the southern edge of their range as well as for some other Mediterranean species. Since species at the edge of their range may react faster to climate changes, this area is of particular interest in accounting for effects of climate change scenarios, for instance, in the food web models (BECAUSE; 2004)

Megrim belongs to very extended and diverse community of commercial species and it is caught in mixed fisheries by different gears and in different sea areas. Some of the commercial species that exist in the same ecosystem are hake and anglerfish, however many other species are also found. From the northern to southern areas of the extent of the stock these species include: Octopus, *Rajidae*, *Ommastrephidae*, *Nephrops norvergicus*, *Phycis blennoides*, *Molva molva*, *Pollachius virens*, *Trisopterus* spp (mainly *Trisopterus luscus*), *Trachurus* spp, *Sepia officinalis*, Loligidae, *Micromesistius poutassou*, *Merlangius merlangus*, *Scyliorhynus canicula* and *Pollachius pollachius*.

Demersal fish prey on megrim. Megrims are very voracious predators. Prey species include flatfish, sprat, sand eels, dragonets, gobies, haddock, whiting, pout and several squid species.

Adult megrim feed on small bottom dwelling fish, cephalopods and small benthic crustaceans; juvenile megrim feed on small fish and detritivore crustaceans inhabiting deep-lying muddy bottoms (Rodriguez-Marín & Olaso, 1993).

It is believed that megrim movements are more aggregation and desegregation movements in the same area instead of highly migratory movements between areas.

Although a comprehensive study on the role of megrim in the ecosystem of the complete sea area distribution has not been carried out, some general studies are available.

Fisheries modify ecosystems through more impacts on the target resource itself, the species associated to or dependent on it (predators or preys), on the tropic relationships within the ecosystem in which the fishery operates, and on the habitat.

At present, both the multi species aspect of the fishery and the ecological factors or environmental conditions affecting megrim population dynamics are not taken into account in assessment and management. This is due to the lack of knowledge on these issues.

5.1.2 Fishery description

Megrim in the Celtic Sea, west of Ireland, and in the Bay of Biscay are caught predominantly by Spanish and French vessels, which together have reported more than 65% of the total landings, and by Irish and UK demersal trawlers.

French benthic trawler operating in the Celtic Sea and targeting benthic and demersal species catch megrim as a by-catch.

Spanish fleets catch megrim targeting them and in mixed fisheries for hake, anglerfish, *Nephrops* and others. Otter trawlers account for the majority of Spanish landings from Subarea VII, the remainder, very low quantities, being taken by netters prosecuting a mixed fishery for anglerfish, hake and megrim on the shelf edge around the 200 m contour to the south and west of Ireland. The Vigo catches comprise around 50% of the total catches.

Most UK landings of megrim are made by beam trawlers fishing in ICES Divisions VIIe,f,g,h.

Irish megrim landings are largely made by multi-purpose vessels fishing in Divisions VIIb,c,g for gadoids as well as plaice, sole and anglerfish.

Estimates of total landings (including unreported or miss-reported landings) and catches (landings + discards) as used by the Working Group are shown in Table 5.1.

5.1.3 Summary of ICES advice for 2007 and management applicable for 2006 and 2007

ICES advice for 2006

It was not possible to fully quantify SSB, fishing mortality and recruitment for this stock. However, indications are that landings and SSB have been reasonably stable over the time-series. There are no indications of reduced recruitment..

The current stock status is uncertain, but all indicators point to the stock and catches being stable. Therefore ICES recommends that the landings of *L. whiffiagonis* in 2007 should not exceed the average landings of 2003 2005. This corresponds to 14 200 tonnes.

Management applicable for 2006 and 2007

The 2006 and 2007 TACs were set at 20 425 t, including a 5% contribution of *L. boscii* in the landings for which stock there is no assessment.

The minimum landing size of megrim was reduced from 25 to 20 cm length in 2000.

5.2 Data

5.2.1 Commercial catches and discards

Landings in 2006 (12 011 t) are slightly lower than that observed in 2005 (12 712 t) (Table 5.1)

Discard data available by country and the procedure to derivate them are summarised in Table 5.2a. In the last five years, an increasing trend in the discards has been observed in relation to year 2000 (1 000 t). The discards decrease in 2000 and 2001 can be partly explained by the reduction in the minimum legal size, thus allowing fish size-discarded in 1998 to be landed in 2000 and 2001. The increase in discards in the recent years could be explained by the MLS plus due to the large number of small fish caught until 2004. In 2005, the decrease in the number of small fish resulted in a large decrease of discards. In 2006 discards increased in around 30 %, specially in ages 2 & 3 (Table.5.1).

Since using the French discards from the 1991 survey to obtain estimates for 1999 and subsequent years was considered unreliable, only the Spanish data were used for these years, applied only to the Spanish fleets. This has led to an artificial decrease in the amount of total discards, since no estimates for French fleets were available. The group states the importance of incorporating annual estimates of discards to explain some of the recruitment processes detected in the analysis and no completely registered in the catch at age matrix and LPUE.

Some preliminary discards estimates from Ireland and United Kingdom were available to the group although were not incorporated to the assessment.

In the following table the discard ratio in weight of the most recent years is presented. Length distribution of 2002 has been derived from 2001 estimates.

	1999	2000	2001	2002	2003	2004	2005	2006
Discard ratio (%)	19	7	7	8	17	24	13	17

5.2.2 Biological sampling

France has provided quarterly length distribution by fishery unit and by sex since 1984. For 2003, 2004 and 2006 French data (length distributions, catch at age by FU and ALKs) were not available for the assessment. In 2005, length distributions, catch at age data by quarter and sex was available (Table 5.2b).

Annual length compositions of landings are available by country and fishery unit, for the period 1984-1990 by sex. Since 1991, annual length composition has been available for sexes combined for most countries except for France. In recent years, the length compositions have been available on a quarterly basis and sexes combined, except in 1993 for Spain, when data were presented for separate sexes and on an annual basis. As in previous years, derivations were used to provide length compositions where no data than weights of landings were available (Table 5.2b). Table 5.3a and Table 5.3b show the international length composition of landings and discards from 1990 to 2006 and the available length composition of landings by Fishing Unit in 2006.

The length compositions of the landings show an increase between 1990 and 1992 and, subsequently, a constant decrease until a rapid increase starting in 2000 (Table 5.3a & Figure 5.1).. Mean lengths stay relatively stable in the recent years. In 2004 there is a maximum in discard in number of the last 15 years, mainly for ages 3, 4 and 5. These discards increased in all lengths smaller than 20 cm. due to a big increase in the numbers of small fish caught. In

2005 discards decreased to levels similar to 2001 increasing again in 2006 for medium size fishes.

As mentioned in previous reports, no ALKs were available for the period 1984–1986, and age compositions for these years were derived from a combined-sex ALK based on age readings from 1987 to 1990 (Figure 5.2).

In 2006, quarterly ALKs for sexes combined were available for UK (E&W). Annual ALKs were applied to their length distributions. Annual age composition of discards and semestral for landings per fleet, based on semestral ALKs for both sexes combined, were available and applied from Spain in Subarea VII and in Divisions VIIIa,b,d. Quarterly age compositions were available for Irish catches for both sexes separated and combined for Divisions VIIb,c,e-k.

A fixed natural mortality of 0.2 is used for all age groups and all years both in the assessment and the forecast.

The maturity ogive, obtained by macroscopy, for sexes combined calculated for Subarea VII used by last year’s WG (BIOSDEF, 1998), has been also applied this year. It is as follows:

AGE	0	1	2	3	4	5	6+
Maturity	0.00	0.04	0.21	0.60	0.90	0.98	1.00

5.2.3 Abundance indices from surveys

UK survey Deep Waters (UK-WCGFS-D, Depth > 180 m) and UK Survey Shallow Waters (UK-WCGFS-S, Depth < 180 m) indices for the period 1987–2004 and French EVHOE survey (FR-EVHOES) results for the period 1997–2005 are summarised in Table 5.4a. Since 1998, the UK survey data were separated into two components according to depth range; waters shallower than 180 m and waters deeper than 180 m. This was because of the different population structures observed in deep and shallow waters on the continental shelf.

FR-EVHOES indices for age 1 showed high values in years 1998 and 2000 and lower values for 1997, 1999, and 2004; no general trend was evident. Since 2001 to 2004 and in 2006, no FR-EVHOES indices at age were available for this assessment.

The UK-WCGFS-D and UK-WCGFS-S show the same pattern in the indices for ages 2 and 3 since 1997; in agreement with the high values of FR-EVHOES age 1 indices for the years 1998 and 2000. These high indices in the Deep component of the UK Surveys are even more remarkable in 2003 for all ages and in 2004 for the younger ages.

An abundance index was provided for the Spanish Porcupine Ground Fish Survey from 2001 to 2006. However, data was not incorporated in this update assessment as commented in the general introduction.

When comparing Spanish, French and Irish abundance indices some contradictory signals are detected between them (Figure 5.3). Thus EVHOE survey decreased in abundance since 2001 until 2005 when increased slightly in 2006. The Spanish Porcupine Survey appears to fluctuate since 2002 with the lowest estimate abundance in 2006. Irish Ground Fish Survey gives the highest estimates with a decrease in 2006 in agreement with the Spanish one.

5.2.4 Commercial catch-effort data

Tuning series of fleet-disaggregated catch-at-age and associated effort data were available for three Spanish fleets in Subarea VII (A Coruña (SP-CORUTR7) and Cantábrico (SP-CANTAB7) from 1986 to 2006, and Vigo (SP-VIGOTR7) 1984–2006. One French fleet (FR-FU04) benthic trawlers in Celtic Sea, 1988–1998 (Table 5.4b and Figure 5.4a).

The general level of effort in SP-CORUTR7 and SP-VIGOTR7 has decreased since 1991, establishing the last three years of the series. SP-CANTAB7 remains quite stable since 1991 decreased slightly since 2000. The effort of the French benthic trawlers fleet in the Celtic Sea decreased from 1991 to 1994, then increased in 1995-1996 and remained relatively stable until 1998 (Figure 5.3a). Since French logbook data were only partially available since 1999, only the LPUE data can be considered.

Since 1985, the CPUE of SP-CORUTR7 has remained relatively stable at low levels and from 1990 onwards started decreasing (Figure 5.3b). Over the same period, SP-VIGOTR7 has remained relatively stable until 1999 when it started to increase reaching in 2004 the historical maximum.In 2006, a slight increase in the CPUE has occurred. SP-CANTAB7 has been fluctuating up to 1999 and then a sharp increased and after a decrease in 2003 until 2005. In 2006 a slight increase in the CPUE has been also detected for this fleet.

The LPUE of the French bottom trawlers fleets, targeting benthic and demersal species, decreased from 1988 to 1991 and remained relatively stable until 1994 (Figure 5.3c). Since then, both benthic fleets have shown increasing LPUE until 1997 and 1998. Benthic trawlers in VIIIa,b,d follow a decreasing trend while the Benthic Western Approaches remained at an increasing trend until 2002. From then onwards a sharp decreasing trend is observed. The *Nephrops* and demersal fleets LPUE remained relatively stable since 1992 until 1996 when the former stated decreasing steadily

5.3 Assessment

5.3.1 Input data

The input data used for this assessment was from 1984 to 2006 and for ages ranging from 1 to 10 + for the catch at age in numbers, weight at age in the commercial catch and in the stock (considered as the same). The age compositions of the international catch numbers and weights-at-age are given in Tables 5.5 and 5.6.

The age compositions of catches observed from 1993 to 1995 indicate the same shift in the pattern as the length compositions (Table 5.5 and Figure 5.2). The 1995, 1996 and 1997 age compositions show a shift towards older individuals and a substantial decrease in the numbers of ages 4 and 5. In 2004 age 3 was the most abundant of the catches resulting in the very abundant age group 4 in 2005. Age class, 5 and 6 show also high abundances in the last three years of the series. For 2005 age 3 has been the most represented in the discards. In 2006, age 4 was the most abundant in discards.

Tuning data available for assessment are presented in Table 5.7. For the SP-VIGOTR7, the Review Group recommended to explore the apparent change in catchability of this fleet from f 1999 onwards. The information that supports changes in catchability in the last years of the series was not yet available for this fleet and deeper analysis should be carried out in interseasonal work along this cirrent year. However, three proxies were commented: a) Data quality of the fleet has decreased in the last years b) a change of strategy of the fleet could occurred when change of MLS occurred (2000) being allow to land smaller fish than in the previous period and so a shift in the fishing area to look for this small ones could occurred, however no very remarkable increase of smaller than 25cm has been clearly detected in the landings as length distribution of landings do not support this increase (Figure 5.1).but is mostly detected in discards c) there has been a real increase in the abundances of small individuals (good recruitments in 2000, 2002, 2003 and 2004) and this increases actually reflects this increase in abundance.

Exploratory analysis of catch at age matrix using FLEDA

In the standardized catch at age proportion plot, a clear pattern of positive proportions were detected in the early years for the older ages while for the late years this proportion is reversed In the intermediate period, 1992, some cohorts could be followed. The same occurs with the enormous recruitment of 2004, age 1 and 2, which can be follow along 2005 in agreement with the high indices detected in 2003 and 2004 by the Deep component of the UK Survey (Figure 5.5). Apparently the total catch at age matrix appear to be driven mostly by the negative and positive pattern of catchability residuals observed in the higher contribution fleet to this catch which is the Vigo Trawl fleet which approximately contributes close to 55 % to the total catch.

The mature component of the catches (Figure 5.6) showed a steady declining trend along the all time series. Immature component is has fluctuated around the same level with very sharp peaks in 1993, 1998 and 2004.

5.3.2 Model

For this year this stock is subject to an update assessment.

XSA with a low shrinkage (s.e.=1.5) was carried out without taper for each individual fleet to screen the tuning data and check for catchability trends and high residuals, using the constant q model for all ages over the full time-series.

All years of tuning data were used with tapered time-series weighted by a 20-year tricubic function. This option was considered appropriate to reduce the influence of the oldest years when discards were derivated based on estimates from recent period.

The differences in the settings between this year and the final 2006 run are presented in the table below:

	TOTAL AVAILABLE FLEETS	**TUNNING FLEETS**	**2006 WG**		**2007 WG**		**%IN THE LANDINGS**
Fleets	SP-CORUTR7	-	-	-	-	-	0
	SP-CANTAB7	-	-	-	-	-	1
		SP – VIGOTR7	84-04	2-9	84-05	2-9	*42
		FR – FU04	88-01	4-9	88-01	4-9	11
	IR-7-OT	-	95-04	2-8	-	-	-
Surveys		UK-WCGFS-D	93-04	2-3	93-04	2-3	
		FR – EVHOES	97-01	1-9	97-05	1-9	
	UK-WCGFS-S	-	-	-	-	-	
	IR-7-GFS	-			-		
	SP-GFS	-	-		-		
Age recruitment			1		1		
Taper			Yes (tricubic) – 20		Yes (tricubic) - 20		
Plus group			10		10		
Tuning range			All		All		
Ages catch dep. Stock size			No		No		
Q plateau			8		8		
F shrinkage se			1.5		1.5		
year range			5		5		
age range			3		3		

*Percentage of Vigo fleet on the catches

The diagnostics of the final XSA run are given in Table E.1 The estimated fishing mortalities and stock numbers-at-age are given in Table E.2 and 3. The results are summarised in Table E.4. The comparison between this year assessment update and last year´s assessment is presented in Figure E.1. Plots of log-catchability residuals for each fleet are shown in Figure E.2.

Some year effects in the last years of SP-VIGOTR7 and FR-FU04 are observed. A slight increasing trend in log-catchability residuals is apparent for SP-VIGOTR7, however, in the individual fleet diagnostic this was not detected.

The estimate of age 1 was completely driven by F shrinkage in 2006. For age 2, FR-EVHOE has the highest contribution and from age 3 and older, SP-VIGOTR fleet takes increasing weight in the estimates reaching more than 60% of the weight in Age 8. For all ages other than 1, the shrinkage is very light. Estimates of survivors are quite inconsistent for all ages.

5.4 Comments on the quality of the assessment

Due to:

a) lack of reliable or complete discard data,

b) apparently changes in the catchability in the major tuning fleet,

c) lack of survey data already described in previous assessments in relation to surveys used for estimating discards (UK Survey ended on 2004 and FR-EVHOES series is discontinuous) and

d) conflicting signals of the new surveys intended to be included in the assessment, the Working Group decided that analytical assessment presented could not be accepted to provide reliable population estimatesA considerable underestimation of F and overestimation of SSB is detected retrospectively. (Figure E.3). The retrospective pattern also shows substantial down revisions of the recent recruitment estimates. As commented before, the lack of data recruitment signals from surveys for the period 2002-2004 and 2006 is influencing this retrospective pattern.

And thus, there are still large retrospective revisions in stock trends which cannot be fully explained.

Based on all the above, the Working Group also agreed to reject the XSA results to serve as a basis for a diagnostics of the state of the resource.

As a consequence of the lack of analytical assessment, no short term projections were carried out.

5.5 Management considerations

Precise estimates of recent development of the stock population structure and SSB are not available. However, discard data and surveys indices do not appear to indicate the presence of a decrease recruitment and no strong decreasing trend in the overall biomass.is either detected.

Table 5.1 Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. Nominal landings and catches (t) provided by the Working Group.

	Total landings	Total discards	Total catches	Agreed TAC (1)
1984	16659	2169	18828	
1985	17865	1732	19597	
1986	18927	2321	21248	
1987	17114	1705	18819	16460
1988	17577	1725	19302	18100
1989	19233	2582	21815	18100
1990	14371	3284	17655	18100
1991	15094	3282	18376	18100
1992	15600	2988	18588	18100
1993	14929	3108	18037	21460
1994	13685	2700	16385	20330
1995	15862	3206	19068	22590
1996	15109	3026	18135	21200
1997	14230	3066	17296	25000
1998	14345	5371	19716	25000
1999	13715	3135	16850	20000
2000	14485	1033	15517	20000
2001	15806	1275	17081	16800
2002	15988	1466	17454	14900
2003	15414	3147	18561	16000
2004	14300	4511	18811	20200
2005	12712	1831	14542	21500
2006	12011	2468	14479	20425

(1) for both megrim species and VIIa included

Table 5.2a Megrim (*L.whiffiagonis*) in VIIb,c,e-k and VIIIa,b,d. Discards information and derivation.

	FR	SP	IR	UK
1984	**FR84-85**	-	-	-
1985	**FR84-85**	-	-	-
1986	(FR84-85)	(SP87)	-	-
1987	(FR84-85)	**SP87**	-	-
1988	(FR84-85)	**SP88**	-	-
1989	(FR84-85)	(SP88)	-	-
1990	(FR84-85)	(SP88)	-	-
1991	**FR91**	(SP94)	-	-
1992	(FR91)	(SP94)	-	-
1993	(FR91)	(SP94)	-	-
1994	(FR91)	**SP94**	-	-
1995	(FR91)	(SP94)	-	-
1996	(FR91)	(SP94)	-	-
1997	(FR91)	(SP94)	-	-
1998	(FR91)	(SP94)	-	-
1999	-	**SP99**	-	-
2000	-	**SP00**	-	-
2001	-	**SP01**	-	-
2002	-	(SP01)	-	-
2003	-	**SP03**	**IR***	**UK***
2004	-	**SP04**	**IR***	-
2005	-	**SP05**	**IR***	-
2006	-	**SP06**	**IR***	**UK***

In bold: years where discards sampling programs provided information
In bold and *: years where discards sampling programs provided information but are not used in the derivation
In (): years for which the length distribution of discards has been derived

Table 5.2b **Megrim (*L.whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d.**
Derivations of length compositions and ALK's used for 2005and 2006 data

2005

Unit	Data	France	Ireland	Spain	UK
3	Landings	-			EW.03.05Q
	Discards	-			-
	ALK	-			EW.ALL FU.05Q
4	Landings	-		SP.04.05Q	EW.04.05Q
	Discards	-		SP.ALL FU.05Y	-
	ALK	-		SP.04.05Sm	EW.ALL FU.05Q
5	Landings	-			EW.05.05Q
	Discards	-			-
	ALK	-			EW.ALL FU.05Q
6	Landings	-			EW.06.05Q
	Discards	-			-
	ALK	-			EW.ALL FU.05Q
8	Landings	-			
	Discards	-			
	ALK	-			
9	Landings	-			
	Discards	-			
	ALK	-			
10	Landings	-			
	Discards	-			
	ALK	-			
14	Landings	-		SP.14.05Q	
	Discards	-		-	
	ALK	-		SP.14.05Sm	
All fisheries	Landings	FR.S.FU.05Q	IR.ALL FU.05Q		
Units	Discards	-	-		
	ALK	-	IR.ALL FU.05Q		
No of samples		56	110	92	69
No of fishes measured		10919	1272	11784	10698
No of fish aged		812	1707	866	1349

(-) : no discards assumed or available
ALL FU : all fishery units combined
Q : quarterly data
Sm : semestrial data
Y : annual data
S : by sex

2006

Unit	Data	France	Ireland	Spain	UK
3	Landings	-			EW.03.06Q
	Discards	-			-
	ALK	-			EW.ALL FU.06Q
4	Landings	-		SP.04.06Q	EW.04.06Q
	Discards	-		SP.ALL FU.06Y	-
	ALK	-		SP.04.05Sm	EW.ALL FU.06Q
5	Landings	-			EW.05.06Q
	Discards	-			-
	ALK	-			EW.ALL FU.06Q
6	Landings	-			EW.06.06Q
	Discards	-			-
	ALK	-			EW.ALL FU.06Q
8	Landings	-			
	Discards	-			
	ALK	-			
9	Landings	-			
	Discards	-			
	ALK	-			
10	Landings	-			
	Discards	-			
	ALK	-			
14	Landings	-		SP.14.06Q	
	Discards	-		-	
	ALK	-		SP.14.06Sm	
All fisheries	Landings	FR.S.FU.06Q	IR.ALL FU.06Q		
Units	Discards	-	-		
	ALK	-	IR.ALL FU.06Q		
No of samples		42	89	329	70
No of fishes measured		7520	14206	17242	9173
No of fish aged		-	1399	1862	1209

(-) : no discards assumed or available
ALL FU : all fishery units combined
Q : quarterly data
Sm : semestrial data
Y : annual data
S : by sex

Table 5.3a - Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. International length composition from 1990 to 2004. Numbers in thousands.

	1990			1991			1992			1993			1994		
Lt	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches
10	0	2	2	0	52	52	0	13	13	24	1	25	0	46	46
11	0	2	2	0	18	18	0	25	26	17	1	19	0	34	34
12	0	8	8	0	15	15	6	29	35	14	17	31	0	47	47
13	0	28	28	39	51	90	73	99	171	37	47	84	0	135	135
14	0	44	44	12	97	109	92	152	244	54	68	122	13	350	363
15	11	180	191	97	156	253	155	191	346	59	179	238	41	511	552
16	62	415	477	125	447	571	271	358	629	153	530	682	85	902	987
17	148	566	714	192	1051	1243	525	923	1448	230	1748	1978	119	1457	1576
18	293	1364	1657	258	1519	1777	981	1359	2340	583	3422	4006	437	2004	2441
19	431	2100	2531	813	2370	3183	1783	2311	4094	1444	2722	4166	1194	2170	3364
20	1101	3899	4999	2300	5681	7980	3304	7519	10823	2290	2833	5123	2302	1965	4268
21	2042	6324	8365	3889	3640	7529	5609	4506	10115	3950	1608	5558	3871	1427	5298
22	2833	3447	6281	5879	3375	9254	7408	3416	10824	4756	1182	5937	4371	1328	5699
23	3752	2963	6715	7097	2766	9863	7536	2141	9677	5405	1944	7349	4598	2074	6671
24	4573	2319	6893	7347	3176	10523	7387	2364	9751	5316	3829	9145	4325	3153	7478
25	5013	2063	7076	6475	2990	9465	7868	2443	10311	5255	4167	9422	4359	3279	7638
26	5154	2095	7249	5629	2798	8427	6233	2194	8427	4838	3148	7986	4483	2096	6579
27	4869	2187	7056	4579	1893	6472	5576	1441	7017	4277	1859	6136	3906	1651	5556
28	4540	1660	6200	4192	1223	5414	4481	1128	5609	4058	1220	5277	3695	1321	5016
29	4029	1532	5561	3705	991	4695	3542	1133	4675	3148	1254	4402	3389	1361	4751
30	3562	914	4476	3399	574	3973	2702	518	3220	3431	683	4115	3204	474	3678
31	3185	322	3507	2577	298	2875	2382	301	2683	2663	281	2943	2902	271	3174
32	2646	233	2880	2780	215	2995	2023	192	2215	2496	171	2667	2615	117	2733
33	2205	244	2450	2223	178	2401	1738	116	1855	2078	230	2308	2245	326	2571
34	2056	212	2269	2103	100	2203	1367	67	1434	2006	106	2112	1941	72	2013
35	1737	118	1854	1837	114	1952	1296	187	1483	1802	252	2054	1760	288	2048
36	1396	62	1457	1645	123	1768	1298	27	1325	1671	36	1707	1546	57	1602
37	1294	1	1295	1534	22	1556	1129	30	1159	1421	24	1444	1414	27	1441
38	1095	2	1097	1299	62	1361	991	13	1004	1370	9	1378	1199	2	1201
39	923	0	923	1040	48	1088	936	7	943	1194	4	1198	1030	1	1032
40	956	0	956	953	10	963	959	0	959	1032	0	1032	860	0	860
41	780	0	780	730	8	738	932	8	940	935	9	944	777	7	784
42	701	0	701	680	0	680	814	0	814	843	0	843	685	0	685
43	656	0	656	579	0	579	727	0	727	793	0	793	632	0	632
44	563	0	563	539	0	539	694	0	694	698	0	698	507	0	507
45	545	0	545	462	0	462	592	0	592	591	0	591	438	0	438
46	443	0	443	376	0	376	510	0	510	495	0	495	376	0	376
47	422	0	422	351	0	351	475	0	475	377	0	377	320	0	320
48	331	0	331	281	0	281	405	0	405	308	0	308	271	0	271
49	257	0	257	218	0	218	284	0	284	280	0	280	241	0	241
50	222	0	222	208	0	208	269	0	269	214	0	214	185	0	185
51	188	0	188	154	0	154	219	0	219	168	0	168	176	0	176
52	154	0	154	136	0	136	145	0	145	117	0	117	159	0	159
53	120	0	120	95	0	95	93	0	93	74	0	74	84	0	84
54	89	0	89	77	0	77	94	0	94	51	0	51	58	0	58
55	81	0	81	36	0	36	69	0	69	25	0	25	25	0	25
56	26	0	26	20	0	20	28	0	28	11	0	11	21	0	21
57	17	0	17	6	0	6	6	0	6	2	0	2	10	0	10
58	12	0	12	5	0	5	3	0	3	5	0	5	1	0	1
59	3	0	3	5	0	5	5	0	5	2	0	2	5	0	5
60	2	0	2	0	0	0	0	0	0	3	0	3	4	0	4
Total	65521	35307	100828	78977	36059	115036	86016	35212	121228	73063	33585	106649	66880	28952	95832
Wt	14371	3284	17655	15094	3283	18377	15600	2988	18588	14929	3108	18037	13685	2700	16385
Mean L	30.1	23.7	27.8	28.7	23.4	27.1	28.0	23.0	26.5	29.2	23.5	27.4	29.3	23.5	27.5
%<25cm	23	67	39	36	68	46	41	72	50	33	60	42	32	61	41
%<20cm	1	13	6	2	16	6	5	16	8	4	26	11	3	26	10

	1995			1996			1997			1998			1999		
Lt	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches
10	0	44	44	0	52	52	0	58	58	0	56	56	0	23	23
11	0	25	25	0	33	33	0	33	33	0	32	32	0	44	44
12	0	53	53	0	62	62	0	66	66	0	37	37	0	56	56
13	0	142	142	0	163	163	0	173	173	0	129	129	0	117	117
14	19	385	404	0	412	412	0	417	417	0	457	457	0	259	259
15	48	567	615	105	541	646	8	600	609	1	635	636	0	338	338
16	178	938	1116	325	840	1165	57	857	914	7	1132	1139	1	969	969
17	227	1758	1986	1047	1384	2431	314	1274	1588	37	2430	2466	11	2460	2471
18	966	2284	3250	1483	1825	3307	358	1717	2075	82	3231	3313	86	4432	4518
19	2055	2273	4328	2317	1992	4310	892	1839	2731	150	3043	3193	206	6737	6943
20	2011	1941	3952	2345	1793	4138	1699	1720	3419	448	2762	3210	429	8340	8769
21	2899	1328	4227	2220	1233	3453	1699	1176	2874	832	1736	2568	741	6734	7475
22	3230	1368	4597	1268	1087	2354	2153	1064	3217	1190	2052	3242	1138	5416	6554
23	3153	2807	5959	984	2201	3185	1728	2008	3736	1843	3720	5563	1524	4123	5647
24	3893	3634	7527	1728	3481	5209	2104	3042	5146	2316	6285	8602	2244	3058	5302
25	4172	3535	7707	2115	3789	5904	2848	3706	6554	3462	7038	10499	3703	1904	5607
26	4234	2620	6854	2823	2359	5182	3323	2810	6133	3928	5278	9206	4135	1596	5731
27	4049	1902	5951	3134	1812	4946	3457	2243	5700	4118	3568	7686	4562	717	5279
28	3902	1512	5414	3435	1667	5102	3497	1565	5061	3935	2672	6606	4217	344	4561
29	3680	1441	5122	3364	1546	4910	3226	1856	5081	3049	2496	5545	3929	165	4094
30	3590	759	4349	3087	561	3648	3245	665	3909	3398	1230	4629	3998	101	4100
31	3194	363	3557	2846	315	3162	2571	386	2957	2929	619	3548	3545	59	3604
32	3203	211	3414	2662	170	2832	2369	208	2577	3013	349	3362	3301	0	3301
33	2572	408	2981	2572	500	3072	2084	374	2458	2684	735	3419	2822	0	2822
34	2594	135	2729	2421	71	2492	2119	69	2188	2485	253	2738	2381	0	2381
35	1956	315	2272	2026	419	2445	1695	286	1980	2057	478	2535	2100	0	2100
36	1916	95	2011	2058	90	2148	1688	90	1778	2156	130	2287	1823	0	1823
37	1519	61	1581	1792	27	1819	1535	38	1572	1680	109	1790	1563	0	1563
38	1392	16	1408	1534	25	1559	1303	24	1327	1488	6	1494	1372	0	1372
39	1195	8	1203	1252	13	1265	1177	12	1189	1195	3	1198	1164	0	1164
40	1160	0	1160	1218	0	1218	1011	0	1011	1031	0	1031	973	0	973
41	923	31	953	1108	16	1124	919	19	938	872	12	884	911	0	911
42	892	0	892	964	0	964	848	0	848	770	0	770	713	0	713
43	717	0	717	843	0	843	725	0	725	620	0	620	566	0	566
44	576	0	576	759	0	759	721	0	721	574	0	574	443	0	443
45	509	0	509	673	0	673	597	0	597	528	0	528	365	0	365
46	423	0	423	644	0	644	529	0	529	425	0	425	384	0	384
47	363	0	363	446	0	446	476	0	476	386	0	386	294	0	294
48	347	0	347	385	0	385	480	0	480	342	0	342	236	0	236
49	268	0	268	279	0	279	338	0	338	223	0	223	214	0	214
50	275	0	275	272	0	272	296	0	296	196	0	196	189	0	189
51	215	0	215	201	0	201	267	0	267	165	0	165	113	0	113
52	173	0	173	172	0	172	199	0	199	116	0	116	91	0	91
53	126	0	126	119	0	119	183	0	183	111	0	111	72	0	72
54	87	0	87	78	0	78	103	0	103	106	0	106	62	0	62
55	32	0	32	35	0	35	76	0	76	51	0	51	38	0	38
56	36	0	36	35	0	35	38	0	38	24	0	24	38	0	38
57	19	0	19	10	0	10	25	0	25	19	0	19	9	0	9
58	8	0	8	4	0	4	10	0	10	1	0	1	6	0	6
59	6	0	6	4	0	4	2	0	2	1	0	1	1	0	1
60	0	0	0	0	0	0	11	0	11	1	0	1	8	0	8
Total	69003	32960	101963	59194	30479	89673	55001	30395	85395	55048	52711	107759	56720	47991	104711
Wt	15862	3206	19068	15109	3026	18135	14254	3066	17320	14346	5371	19717	13714	3135	16850
Mean L	30.0	23.7	28.0	31.0	23.9	28.6	31.4	24.0	28.8	31.8	24.2	28.1	31.5	21.3	26.8
%<25cm	27	59	37	23	56	34	20	53	32	13	53	32	11	90	47
%<20cm	5	26	12	9	24	14	3	23	10	1	21	11	1	32	15

Lt	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches
10	0	19	19	0	542	542	0	136	136	247	11	258	0	481	481	0	460	460	0	545	545	0	605	605	0	588	588	0	241	241
11	0	21	21	0	209	209	2	292	295	200	17	217	0	389	389	0	283	283	0	379	379	0	384	384	0	364	364	0	507	507
12	0	102	102	0	194	194	80	360	441	180	209	389	0	591	591	0	664	664	0	769	769	0	826	826	0	460	460	0	694	694
13	0	378	378	531	688	1219	984	1331	2315	498	635	1134	0	1821	1821	0	1920	1920	0	2202	2202	0	2338	2338	0	1747	1747	0	1580	1580
14	0	638	638	179	1401	1579	1340	2202	3542	779	991	1770	195	5070	5265	279	5583	5862	0	5977	5977	0	6048	6048	0	6624	6624	0	3757	3757
15	177	2791	2968	1506	2416	3922	2406	2958	5364	917	2775	3693	638	7914	8552	739	8792	9531	1623	8387	10010	131	9302	9433	16	9837	9853	0	5238	5238
16	1023	6855	7878	2055	7369	9424	4472	5912	10384	2517	8739	11257	1399	14888	16287	2935	15482	18417	5365	13859	19224	942	14142	15084	120	18671	18792	12	15982	15994
17	2590	9900	12490	3356	18395	21751	9193	16152	25345	4023	30598	34621	2078	25496	27574	3981	30770	34751	18319	24226	42544	5487	22294	27781	639	42521	43160	194	43049	43243
18	5422	25241	30663	4782	28095	32877	18150	25135	43285	10787	63316	74102	8093	37065	45158	17868	42261	60129	27429	33754	61184	6617	31763	38380	1524	59775	61299	1597	81995	83592
19	8413	40946	49359	15856	46213	62069	34763	45071	79834	28158	53074	81232	23276	42314	65590	40077	44314	84391	45190	38849	84039	17388	35860	53248	2926	59330	62255	4020	131376	135396
20	22561	79926	102487	47141	116458	163599	67728	154137	221865	46945	58083	105028	47195	40289	87485	41233	39792	81025	48080	36757	84837	34831	35258	70089	9186	56618	65804	8797	170963	179760
21	43897	135960	179857	83607	78270	161878	120590	96879	217469	84926	34573	119499	83230	30684	113914	62327	28557	90885	47730	26517	74247	36521	25275	61796	17885	37324	55209	15930	144775	160705
22	63752	77561	141312	132284	75930	208214	166682	76855	243537	107006	26587	133592	98352	29869	128221	72666	30776	103442	28519	24457	52976	48452	23941	72392	26780	46161	72942	25601	121861	147462
23	88176	69633	157809	166786	65001	231787	177096	50323	227419	127015	45694	172709	108041	48738	156780	74086	65962	140047	23122	51728	74850	40603	47195	87799	43314	87423	130737	35803	96894	132697
24	112049	56821	168869	180005	77809	257814	180977	57923	238901	130248	93807	224056	105972	77242	183214	95373	89036	184409	42326	85287	127613	51543	74539	126082	56751	153990	210740	54982	74911	129893
25	127820	52616	180436	165114	76245	241358	200639	62297	262935	134015	106253	240267	111151	83617	194767	106392	90139	196530	53923	96631	150554	72626	94504	167130	88269	179456	267726	94432	48552	142983
26	136579	55527	192106	149159	74157	223315	165175	58139	223314	128208	83411	211619	118799	55535	174334	112208	69433	181641	74808	62525	137333	88047	74467	162514	104100	139865	243965	109570	42304	151874
27	133891	60136	194027	125925	52058	177983	153344	39619	192963	117631	51120	168751	107404	45390	152794	111354	52293	163647	86172	49832	136005	95072	61671	156743	113244	98112	211356	125444	19730	145174
28	129397	47301	176698	119463	34846	154308	127698	32158	159856	115650	34756	150406	105311	37655	142966	111214	43098	154312	97891	47502	145393	99652	44591	144243	112135	76140	188274	120187	9793	129980
29	118855	45201	164057	109290	29223	138513	104475	33434	137909	92862	37000	129862	99979	40161	140140	108573	42520	151093	99230	45612	144842	95153	54739	149893	89944	73634	163578	115901	4868	120769
30	108627	27891	136518	103669	17499	121168	82422	15794	98215	104653	20847	125500	97710	14458	112168	109481	23152	132634	94146	17108	111254	98962	20270	119233	103649	37530	141179	121953	3095	125048
31	100334	10142	110476	81162	9395	90557	75038	9488	84526	83876	8842	92718	91423	8550	99974	100615	11440	112055	89658	9934	99592	80990	12167	93156	92257	19491	111749	111678	1848	113526
32	86009	7585	93595	90359	6983	97341	65738	6242	71980	81132	5556	86688	84990	3816	88807	104110	6849	110959	86530	5523	92054	76980	6768	83748	97929	11348	109277	107287	0	107287
33	73878	8186	82064	74472	5966	80438	58238	3899	62137	69596	7712	77309	75213	10922	86136	86173	13680	99852	86163	16738	102901	69816	12521	82337	89915	24614	114529	94549	0	94549
34	70945	7321	78266	72559	3458	76017	47160	2300	49459	69208	3667	72876	66959	2473	69432	89479	4670	94149	83539	2436	85975	73090	2388	75478	85742	8735	94477	82151	0	82151
35	61657	4172	65829	65231	4059	69290	46013	6642	52655	63971	8947	72918	62484	10234	72718	69452	11190	80643	71932	14882	86815	60163	10136	70300	73027	16969	89996	74538	0	74538
36	50937	2246	53183	60051	4480	64531	47365	1000	48365	60980	1316	62296	56427	2063	58490	69945	3455	73400	75109	3284	78393	61626	3267	64893	78709	4758	83467	66546	0	66546
37	48534	42	48575	57506	828	58334	42339	1108	43447	53277	888	54165	53034	1012	54047	56970	2304	59274	67199	1015	68214	57544	1425	58969	63016	4099	67115	58615	0	58615
38	42146	86	42231	50021	2374	52394	38138	518	38656	52727	336	53063	46148	85	46233	53588	605	54193	59068	956	60024	50162	936	51099	57282	237	57519	52809	0	52809
39	36468	0	36468	41082	1885	42967	36973	270	37243	47146	175	47321	40704	44	40748	47209	315	47524	49473	499	49972	46480	488	46969	47196	124	47320	45975	0	45975
40	38725	0	38725	38606	410	39016	38847	0	38847	41781	0	41781	34834	0	34834	46964	0	46964	49329	0	49329	40933	0	40933	41764	0	41764	39426	0	39426
41	32353	0	32353	30288	336	30624	38682	334	39016	38794	391	39184	32245	279	32524	38286	1267	39553	45992	652	46644	38133	797	38930	36207	497	36704	37798	0	37798
42	29776	0	29776	28907	0	28907	34614	0	34614	35844	0	35844	29133	0	29133	37899	0	37899	40971	0	40971	36032	0	36032	32737	0	32737	30293	0	30293
43	28537	0	28537	25188	0	25188	31610	0	31610	34506	0	34506	27495	0	27495	31193	0	31193	36684	0	36684	31553	0	31553	26984	0	26984	24605	0	24605
44	25075	0	25075	23995	0	23995	30901	0	30901	31040	0	31040	22554	0	22554	25630	0	25630	33770	0	33770	32094	0	32094	25563	0	25563	19733	0	19733
45	24796	0	24796	21017	0	21017	26949	0	26949	26886	0	26886	19921	0	19921	23161	0	23161	30633	0	30633	27161	0	27161	24014	0	24014	16608	0	16608
46	20598	0	20598	17488	0	17488	23700	0	23700	23003	0	23003	17464	0	17464	19684	0	19684	29923	0	29923	24618	0	24618	19740	0	19740	17836	0	17836
47	20057	0	20057	16662	0	16662	22571	0	22571	17896	0	17896	15183	0	15183	17240	0	17240	21180	0	21180	22616	0	22616	18330	0	18330	13974	0	13974
48	16062	0	16062	13640	0	13640	19632	0	19632	14924	0	14924	13142	0	13142	16809	0	16809	18673	0	18673	23273	0	23273	16584	0	16584	11462	0	11462
49	12715	0	12715	10796	0	10796	14074	0	14074	13842	0	13842	11947	0	11947	13275	0	13275	13832	0	13832	16728	0	16728	11022	0	11022	10593	0	10593
50	11224	0	11224	10490	0	10490	13572	0	13572	10821	0	10821	9357	0	9357	13908	0	13908	13757	0	13757	14964	0	14964	9917	0	9917	9526	0	9526
51	9681	0	9681	7923	0	7923	11283	0	11283	8649	0	8649	9072	0	9072	11073	0	11073	10346	0	10346	13774	0	13774	8491	0	8491	5813	0	5813
52	8096	0	8096	7162	0	7162	7630	0	7630	6158	0	6158	8368	0	8368	9057	0	9057	9055	0	9055	10436	0	10436	6103	0	6103	4803	0	4803
53	6446	0	6446	5094	0	5094	4958	0	4958	3951	0	3951	4493	0	4493	6718	0	6718	6389	0	6389	9796	0	9796	5923	0	5923	3844	0	3844
54	4861	0	4861	4213	0	4213	5136	0	5136	2804	0	2804	3139	0	3139	4762	0	4762	4267	0	4267	5640	0	5640	5795	0	5795	3366	0	3366
55	4504	0	4504	1976	0	1976	3808	0	3808	1410	0	1410	1364	0	1364	1792	0	1792	1961	0	1961	4237	0	4237	2807	0	2807	2106	0	2106
56	1459	0	1459	1132	0	1132	1573	0	1573	642	0	642	1205	0	1205	2037	0	2037	1997	0	1997	2148	0	2148	1363	0	1363	2144	0	2144
57	997	0	997	318	0	318	365	0	365	125	0	125	578	0	578	1078	0	1078	566	0	566	1442	0	1442	1071	0	1071	491	0	491
58	727	0	727	296	0	296	166	0	166	306	0	306	75	0	75	476	0	476	229	0	229	587	0	587	78	0	78	337	0	337
59	200	0	200	285	0	285	296	0	296	141	0	141	314	0	314	333	0	333	246	0	246	108	0	108	88	0	88	52	0	52
60	102	0	102	0	0	0	0	0	0	157	0	157	230	0	230	0	0	0	1	0	1	652	0	652	53	0	53	459	0	459
Total	1971126	835243	2806369	2268628	843187	3111815	2405584	808909	3214492	2133061	790327	2923388	1958318	679147	2637465	2069703	781064	2850767	1832348	728823	2561171	1725805	730907	2456713	1750191	1277042	3027233	1783841	1024013	2807854
Mean L	30.1	23.7	27.8	28.7	23.4	27.1	28.0	23.0	26.5	29.2	23.5	27.4	29.3	23.5	27.5	30.0	23.7	28.0	31.0	23.9	28.6	31.4	24.0	28.8	31.8	24.2	28.1	31.5	21.3	26.8

Table 5.3a - Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. International length composition from 1990 to 2006. Numbers in thousands.

	2000			2001			2002			2003			2004			2005			2006		
Lt	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discarc	Catches	Landin	Discarc	Catches	Landing	Discards	Catches	Landing	Discards	Catches
10	0	26	18	0	0	0	0	0	0	0	550	550	0	98	98	0	184	184	0	886	886
11	0	5	7	0	0	0	0	0	0	0	355	355	0	27	27	0	105	105	0	355	355
12	0	58	109	0	0	0	0	0	0	0	680	680	0	319	319	0	367	367	0	680	680
13	0	70	160	0	136	136	0	157	157	0	1312	1312	0	592	592	0	532	532	0	1312	1312
14	0	136	299	0	158	158	2	183	185	0	2739	2739	0	1420	1420	0	944	944	0	2739	2739
15	0	359	1284	0	531	531	6	614	620	0	3476	3476	1	3655	3656	0	1665	1665	0	3476	3476
16	0	498	1850	0	452	452	15	522	537	0	5301	5301	0	7203	7203	0	2905	2905	0	5301	5301
17	0	843	3274	0	1154	1155	9	1334	1343	43	6357	6400	2	10210	10212	0	3739	3739	43	6357	6400
18	27	1552	5070	32	2667	2699	93	3083	3177	229	8568	8797	149	11828	11977	59	5333	5392	229	8568	8797
19	51	2498	6583	135	3644	3779	427	4196	4623	702	8075	8776	450	13864	14314	510	5636	6145	702	8075	8777
20	98	3264	7856	640	5258	5899	1568	6072	7640	2394	9402	11796	3025	13939	16964	1765	5841	7605	2396	9402	11798
21	88	2851	8234	2487	4623	7109	5199	5332	10531	5437	7235	12672	7000	9431	16430	4780	3395	8176	5442	7235	12677
22	187	2056	8938	4832	1834	6667	8433	2097	10531	6540	4881	11421	8379	7106	15484	5436	2031	7467	6546	4881	11426
23	127	1248	8845	7116	1097	8213	8889	1240	10129	9046	3847	12892	9317	3294	12611	5360	998	6357	9052	3847	12899
24	256	770	7744	7049	510	7559	8988	562	9551	8185	1129	9314	10525	1941	12465	6240	701	6942	8187	1129	9316
25	246	378	6829	6631	313	6944	7314	360	7674	7530	601	8131	8212	1006	9217	5953	487	6440	7528	601	8128
26	314	281	5587	5580	240	5819	7343	274	7617	7638	562	8200	6755	788	7543	5280	683	5963	7625	562	8187
27	372	109	4889	4495	18	4513	6738	18	6756	6185	68	6253	5640	551	6191	4472	257	4729	6161	68	6229
28	234	62	3997	4403	41	4444	5861	47	5908	5687	92	5779	5054	713	5767	3449	262	3711	5655	92	5747
29	143	36	3651	4201	10	4210	5324	11	5335	4951	21	4971	4285	54	4339	3441	48	3488	4919	21	4939
30	165	6	3470	3558	26	3584	4392	30	4422	3935	8	3944	3490	27	3517	2901	82	2984	3906	8	3914
31	133	6	2833	3098	0	3098	4499	0	4499	4163	6	4169	3279	28	3307	2497	83	2580	4134	6	4139
32	134	8	2600	2730	0	2730	3172	0	3172	3611	0	3611	2527	19	2547	2071	12	2083	3584	0	3584
33	112	11	2340	2642	0	2642	2561	0	2561	2496	10	2506	2056	0	2056	2274	0	2274	2474	10	2485
34	94	4	2183	2218	11	2230	2553	13	2566	2222	0	2222	1991	0	1991	1924	5	1929	2202	0	2202
35	59	4	1929	1882	0	1882	1922	0	1922	1700	0	1700	1452	0	1452	1449	0	1449	1683	0	1683
36	85	0	1675	1722	0	1722	1725	0	1725	1635	0	1635	1144	0	1144	1216	0	1216	1620	0	1620
37	77	0	1599	1424	0	1424	1385	0	1385	1428	0	1428	927	0	927	1184	0	1184	1415	0	1415
38	39	0	1410	1146	0	1146	987	0	987	1060	0	1060	917	0	917	1050	0	1050	1049	0	1049
39	61	2	1324	1100	0	1100	896	0	896	811	0	811	796	0	796	1105	0	1105	802	0	802
40	47	0	1161	1068	0	1068	810	0	810	656	0	656	600	0	600	778	0	778	651	0	651
41	60	0	1017	1032	0	1032	568	0	568	606	0	606	542	0	542	630	0	630	602	0	602
42	25	0	797	912	0	912	515	0	515	438	0	438	491	0	491	571	0	571	436	0	436
43	28	0	661	833	0	833	417	0	417	325	0	325	365	0	365	424	0	424	323	0	323
44	26	0	587	608	0	608	376	0	376	316	0	316	361	0	361	386	0	386	315	0	315
45	20	0	456	496	0	496	324	0	324	249	0	249	254	0	254	291	0	291	249	0	249
46	13	0	372	375	0	375	220	0	220	269	0	269	217	0	217	229	0	229	269	0	269
47	13	0	293	286	0	286	175	0	175	168	0	168	159	0	159	227	0	227	168	0	168
48	9	0	310	280	0	280	117	0	117	145	0	145	156	0	156	151	0	151	145	0	145
49	3	0	228	179	0	179	141	0	141	117	0	117	97	0	97	113	0	113	117	0	117
50	2	0	151	160	0	160	76	0	76	74	0	74	61	0	61	102	0	102	74	0	74
51	1	0	121	134	0	134	57	0	57	68	0	68	35	0	35	69	0	69	68	0	68
52	0	0	104	93	0	93	48	0	48	63	0	63	23	0	23	57	0	57	63	0	63
53	0	0	62	81	0	81	19	0	19	40	0	40	18	0	18	67	0	67	40	0	40
54	0	0	75	43	0	43	19	0	19	28	0	28	12	0	12	34	0	34	28	0	28
55	0	0	25	30	0	30	12	0	12	10	0	10	7	0	7	27	0	27	10	0	10
56	0	0	20	30	0	30	6	0	6	8	0	8	2	0	2	20	0	20	8	0	8
57	0	0	7	16	0	16	9	0	9	1	0	1	2	0	2	8	0	8	1	0	1
58	0	0	18	4	0	4	3	0	3	0	0	0	1	0	1	1	0	1	0	0	0
59	0	0	2	7	0	7	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0
60	0	0	8	7	0	7	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
Total	3353	17139	113064	75795	22723	98518	94214	26147	120360	91209	65274	156483	90777	88112	178889	68602	36295	104897	90920	65611	156531
Wt	14485	1033	15517	15806	1275	17081	15937	1466	17402	15414	3147	18561	14300	4511	18811	12712	1831	14542	12011	2468	14479
Mean L	29.2	20.8	26.3	29.5	20.4	27.4	28.1	20.4	26.4	28.0	19.3	24.3	27.3	19.7	23.6	35			36		
%<25cm	25	95	53	29	97	45	36	97	49	36	98	62	43	96	69	35	95	56	36	98	62
%<20cm	2	35	16	0	38	9	1	39	9	1	57	25	1	56	28	1	59	21	1	58	25

Lt	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches	Landings	Discards	Catches	Landing	Discards	Catches	Landings	Discards	Catches
10	0	270	**186**	0	0	**0**	0	0	**0**	0	5771	**5771**	0	1030	**1030**	0	1837	1837	0	8863	8863
11	0	56	**86**	0	0	**0**	0	0	**0**	0	4086	**4086**	0	314	**314**	0	1159	1159	0	3909	3909
12	0	727	**1367**	0	0	**0**	0	0	**0**	0	8505	**8505**	0	3985	**3985**	0	4407	4407	0	8165	8165
13	0	940	**2156**	0	1830	**1830**	0	2116	**2116**	0	17713	**17713**	0	7994	**7994**	0	6922	6922	0	17057	17057
14	0	1966	**4341**	0	2295	**2295**	35	2653	**2687**	0	39708	**39708**	0	20585	**20585**	0	13213	13213	0	38339	38339
15	0	5560	**19898**	0	8236	**8236**	93	9521	**9614**	0	53871	**53871**	21	56654	**56675**	0	24971	24971	0	52133	52133
16	0	8223	**30525**	0	7453	**7453**	252	8615	**8868**	0	87461	**87461**	4	118845	**118850**	0	46481	46481	0	84811	84811
17	0	14759	**57302**	7	20202	**20209**	154	23353	**23507**	755	111250	**112005**	35	178683	**178717**	0	63571	63571	735	108072	108806
18	498	28713	**93793**	585	49348	**49933**	1724	57044	**58768**	4231	158506	**162736**	2759	218818	**221577**	1055	95996	97050	4121	154222	158342
19	996	48701	**128373**	2624	71063	**73687**	8334	81815	**90149**	13680	157459	**171139**	8766	270355	**279122**	9683	107077	116760	13343	153421	166764
20	2004	66910	**161047**	13128	107794	**120922**	32139	124483	**156622**	49077	192745	**241822**	62012	285750	**347762**	35295	116812	152107	47925	188044	235970
21	1882	61298	**177036**	53465	99386	**152851**	111781	114634	**226415**	116885	155558	**272443**	150498	202756	**353254**	100388	71303	171692	114272	151940	266212
22	4216	46252	**201104**	108728	41272	**150000**	189752	47190	**236942**	147152	109817	**256969**	188518	159876	**348394**	119596	44672	164268	144003	107376	251379
23	2978	29324	**207847**	167225	25770	**192995**	208888	29149	**238037**	212574	90396	**302971**	218952	77404	**296357**	123270	22945	146215	208207	88473	296680
24	6277	18858	**189721**	172704	12503	**185207**	220214	13777	**233991**	200525	27671	**228196**	257855	47544	**305399**	149761	16835	166596	196489	27106	223595
25	6275	9644	**174142**	169101	7973	**177074**	186508	9173	**195681**	192023	15313	**207337**	209397	25641	**235038**	148817	12177	160995	188195	15013	203208
26	8326	7453	**148053**	147867	6347	**154214**	194596	7257	**201852**	202394	14900	**217294**	178996	20881	**199877**	137288	17754	155042	198238	14619	212857
27	10243	2984	**134453**	123610	488	**124099**	185306	481	**185787**	170080	1879	**171959**	155111	15140	**170251**	120748	6937	127685	166342	1845	168187
28	6676	1779	**113908**	125486	1160	**126646**	167035	1341	**168377**	162080	2618	**164698**	144031	20330	**164361**	96580	7326	103906	158332	2572	160904
29	4223	1077	**107695**	123917	291	**124208**	157055	336	**157391**	146041	612	**146653**	126407	1601	**128008**	99783	1382	101165	142643	601	143245
30	5024	187	**105840**	108507	795	**109303**	133965	920	**134885**	120022	255	**120277**	106450	821	**107272**	87044	2471	89515	117176	251	117427
31	4197	192	**89249**	97583	0	**97583**	141725	0	**141725**	131139	175	**131314**	103283	887	**104170**	77421	2560	79981	128144	172	128317
32	4358	255	**84511**	88722	0	**88722**	103077	0	**103077**	117354	0	**117354**	82142	629	**82771**	66281	387	66668	114692	0	114692
33	3754	368	**78375**	88519	0	**88519**	85797	0	**85797**	83609	343	**83952**	68882	0	**68882**	75046	0	75046	81651	338	81989
34	3236	121	**75331**	76525	393	**76918**	88089	454	**88543**	76665	0	**76665**	68706	0	**68706**	65414	183	65597	74879	0	74879
35	2109	148	**68490**	66800	0	**66800**	68216	0	**68216**	60361	0	**60361**	51552	0	**51552**	50704	0	50704	58894	0	58894
36	3109	0	**61124**	62843	0	**62843**	62963	0	**62963**	59690	0	**59690**	41741	0	**41741**	43771	0	43771	58303	0	58303
37	2896	0	**59974**	53393	0	**53393**	51936	0	**51936**	53566	0	**53566**	34776	0	**34776**	43801	0	43801	52337	0	52337
38	1513	0	**54294**	44108	0	**44108**	37996	0	**37996**	40819	0	**40819**	35294	0	**35294**	39892	0	39892	39865	0	39865
39	2427	64	**52307**	43446	0	**43446**	35388	0	**35388**	32017	0	**32017**	31427	0	**31427**	43101	0	43101	31278	0	31278
40	1924	0	**47031**	43263	0	**43263**	32801	0	**32801**	26563	0	**26563**	24312	0	**24312**	31136	0	31136	26021	0	26021
41	2499	0	**42214**	42825	0	**42825**	23572	0	**23572**	25138	0	**25138**	22475	0	**22475**	25825	0	25825	24702	0	24702
42	1070	0	**33884**	38778	0	**38778**	21871	0	**21871**	18619	0	**18619**	20871	0	**20871**	24001	0	24001	18294	0	18294
43	1228	0	**28738**	36232	0	**36232**	18152	0	**18152**	14129	0	**14129**	15893	0	**15893**	18221	0	18221	13903	0	13903
44	1173	0	**26125**	27075	0	**27075**	16739	0	**16739**	14061	0	**14061**	16056	0	**16056**	16964	0	16964	13863	0	13863
45	888	0	**20739**	22551	0	**22551**	14740	0	**14740**	11346	0	**11346**	11541	0	**11541**	13105	0	13105	11201	0	11201
46	582	0	**17306**	17440	0	**17440**	10222	0	**10222**	12525	0	**12525**	10103	0	**10103**	10516	0	10516	12384	0	12384
47	635	0	**13913**	13577	0	**13577**	8296	0	**8296**	7978	0	**7978**	7571	0	**7571**	10646	0	10646	7885	0	7885
48	457	0	**15037**	13598	0	**13598**	5671	0	**5671**	7047	0	**7047**	7579	0	**7579**	7249	0	7249	6976	0	6976
49	138	0	**11272**	8844	0	**8844**	6981	0	**6981**	5791	0	**5791**	4799	0	**4799**	5524	0	5524	5737	0	5737
50	124	0	**7640**	8060	0	**8060**	3826	0	**3826**	3751	0	**3751**	3072	0	**3072**	5114	0	5114	3718	0	3718
51	48	0	**6240**	6924	0	**6924**	2941	0	**2941**	3492	0	**3492**	1828	0	**1828**	3522	0	3522	3462	0	3462
52	9	0	**5452**	4871	0	**4871**	2540	0	**2540**	3314	0	**3314**	1188	0	**1188**	2979	0	2979	3286	0	3286
53	0	0	**3324**	4360	0	**4360**	1028	0	**1028**	2135	0	**2135**	964	0	**964**	3535	0	3535	2118	0	2118
54	0	0	**4061**	2347	0	**2347**	1015	0	**1015**	1526	0	**1526**	648	0	**648**	1831	0	1831	1513	0	1513
55	0	0	**1395**	1676	0	**1676**	643	0	**643**	563	0	**563**	372	0	**372**	1478	0	1478	559	0	559
56	0	0	**1146**	1670	0	**1670**	317	0	**317**	439	0	**439**	127	0	**127**	1138	0	1138	436	0	436
57	0	0	**424**	923	0	**923**	519	0	**519**	76	0	**76**	91	0	**91**	461	0	461	75	0	75
58	0	0	**1056**	257	0	**257**	173	0	**173**	12	0	**12**	73	0	**73**	56	0	56	12	0	12
59	0	0	**142**	423	0	**423**	13	0	**13**	0	0	**0**	10	0	**10**	97	0	97	0	0	0
60	0	0	**471**	429	0	**431**	0	0	**0**	20	0	**20**	60	0	**60**	0	0	0	14	0	14
Total	97992	356829	**2970135**	2235016	464600	**2699618**	2645078	534314	**3179391**	2551268	1256613	**3807881**	2477249	1736523	**4213773**	1918138	689377	2607515	2496222	1227343	3723564
Mean L	29.2	20.8	**26.3**	29.5	20.4	**27.4**	28.1	20.4	**26.4**	28.0	19.3	**24.3**	27.3	19.7	**23.6**	68602	36295	104897	90920	65611	156531

Table 5.3b Megrim (*L.whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. Length composition by fleet for landings in 2006 (thousands). No length frequencies for Belgium are available.

Length	FRANCE	SPAIN		IRELAND	UNITED KINGDOM		
class (cm)	ALL FISHING UNITS	FU04:Otter trawl-med&deep	FU14:Otter trawl-med&deep VII	ALL FISHING UNITS	U03:Fixed net Otter trawl-med&deep	FU05:Otter trawl-sh	FU06:Beam trawl-all depths
10	0	0	0		0	0	0
11	0	0	0		0	0	0
12	0	0	0		0	0	0
13	0	0	0		0	0	0
14	0	0	0		0	0	0
15	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0
18	0	11	0	1	0	0	0
19	0	282	0	8	0	0	0
20	0	1248	3	13	0	0	0
21	0	3642	15	44	0	0	0
22	0	5722	18	70	0	0	0
23	0	6528	23	134	0	0	1
24	17	6383	33	228	0	0	8
25	51	5189	66	313	0	1	12
26	62	3959	111	389	0	1	26
27	138	3457	105	461	0	2	52
28	182	2757	100	443	0	4	78
29	335	1992	47	440	0	4	108
30	353	1387	67	430	0	7	130
31	394	1281	36	420	0	9	123
32	417	812	22	369	0	8	128
33	455	509	15	345	0	11	127
34	420	427	7	280	0	10	135
35	321	302	13	274	1	11	109
36	299	246	4	210	1	10	86
37	292	177	3	174	1	10	77
38	289	145	2	139	1	9	62
39	258	121	3	135	1	10	60
40	242	72	3	96	1	10	54
41	235	88	1	63	1	8	44
42	177	60	1	38	1	8	41
43	153	70	1	39	0	7	41
44	142	49	1	22	1	6	33
45	142	28	0	11	0	6	32
46	142	33	1	9	0	5	22
47	116	31	0	5	0	4	25
48	83	22	0	3	0	3	29
49	123	23	0	0	0	2	17
50	71	8	0	2	0	2	16
51	53	6	0	1	0	1	12
52	90	2	0	0	0	0	13
53	90	3	0	0	0	1	9
54	47	0	0	0	0	0	4
55	67	3	0	0	0	0	3
56	45	0	0	0	0	0	3
57	27	0	0	0	0	0	2
58	4	0	0	0	0	0	1
59	4	0	0	0	0	0	1
60	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0
TOTAL	6335	47073	702	5611	13	172	1719

Table 5.4a **Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d.**
Abundance Indices for UK-WCGFS-D, UK-WCGFS-S, IR-GFS, SP-PGFS and EVHOES

UK-WCGFS-D — **Effort in hours**

	Effort	Age 1	2	3	4	5	6	7	8	9
1987	100		863	5758	0	0	0	95	1753	151
1988	100	8	256	59	49	0	228	1008	1262	632
1989	100		70	188	471	2540	788	3067	680	1060
1990	100	8	526	1745	553	2584	1985	974	1154	974
1991	100		415	1375	1250	989	912	1677	593	731
1992	100	7	28	425	414	349	189	206	132	121
1993	100		122	382	1758	1505	728	739	666	718
1994	100		69	1593	1542	2663	1325	1278	825	595
1995	100	47	582	747	1755	1686	1303	548	281	421
1996	100	15	69	475	549	1580	1231	870	327	117
1997	100		329	751	1702	1518	541	149	47	17
1998	100		120	797	1432	1134	866	242	246	13
1999	100		237	270	734	760	302	94	33	17
2000	100		143	1004	619	681	395	67	35	13
2001	100	20	384	690	1426	581	460	376	226	45
2002	100		162	2680	1915	1349	761	690	315	104
2003	100		330	1705	3149	2662	1451	676	417	179
2004	100	168	1001	1382	1069	897	628	208	47	

UK-WCGFS-S — **Effort in hours**

	Effort	Age 1	2	3	4	5	6	7	8	9
1987	100		499	3082	641	891	180	794	264	587
1988	100		47	55	585	95	367	0	50	93
1989	100		616	574	547	1540	576	361	297	198
1990	100		375	1057	816	661	1220	195	454	176
1991	100	2	373	829	822	394	460	550	178	293
1992	100		149	278	323	193	109	164	93	36
1993	100		470	877	1140	601	327	321	143	233
1994	100		74	1000	1301	998	521	374	185	153
1995	100	28	435	878	1167	1054	805	488	359	130
1996	100	2	64	401	389	823	592	372	152	43
1997	100	3	284	1028	550	540	289	202	75	29
1998	100	4	30	438	665	381	209	97	48	21
1999	100		69	82	222	214	103	53	41	20
2000	100		72	377	249	313	169	81	52	20
2001	100	2	131	297	594	104	145	122	80	37
2002	100		134	808	506	757	339	326	181	82
2003	100	5	184	289	639	416	328	113	102	36
2004	100	50	343	467	270	394	303	124	49	21

FR-EVHOES

	Effort	Age 1	2	3	4	5	6	7	8	9
1997	100	0.466	3.851	2.711	1.551	1.403	1.110	0.619	0.354	0.185
1998	100	1.618	0.648	4.354	3.055	1.494	0.976	0.782	0.401	0.128
1999	100	0.531	3.346	0.679	2.064	3.303	1.612	0.669	0.288	0.250
2000	100	1.377	2.621	2.516	1.363	1.196	0.727	0.407	0.276	0.141
2001	100	0.619	5.556	3.668	3.028	0.605	1.556	1.408	0.320	0.175
2002										
2003										
2004										
2005	100	0.808	3.022	2.559	1.050	0.496	0.435	0.202	0.385	0.075

IR-7-GFS

	Effort	Age 0	1	2	3	4	5	6	7	8	9
2003	100	0	152	316	368	238	96	36	14	5	2
2004	100	0	153	461	595	454	162	57	30	12	3
2005	100	29	414	643	431	370	215	68	44	18	17
2006	100	44	505	548	481	215	154	68	10	7	5

SP-GFS

	Effort	Age 0	1	2	3	4	5	6	7	8
2001	100	43	1770	2208	2842	3434	1941	1357	487	132
2002	100	6	972	2064	3068	4265	2471	1209	340	118
2003	100	12	979	2292	3997	5653	3090	1393	417	144
2004	100	6	597	2841	4524	4616	2550	932	405	126
2005	100	65	541	532	1934	6987	4183	2193	407	100
2006	100	4	1426	1144	2592	3739	2619	713	161	88

Table 5.4a' EVHOE Abundance Indices by kilograms and numbers by 30 minutes haul duration

	kg/30'	Nb/30'
1997	2.00	11.99
1998	2.07	13.28
1999	1.71	12.61
2000	1.34	10.44
2001	2.11	16.73
2002	1.98	16.09
2003	1.74	13.06
2004	1.44	10.50
2005	1.42	10.3
2006	1.75	16,60

SP-GFS Abundance Indices by kilograms and numbers by 30 minutes haul duration

	kg/30'	Nb/30'
2001	6.80	143.34
2002	6.66	147.00
2003	8.15	180.79
2004	7.45	167.47
2005	8.28	170.17
2006	6.03	125.37

Table 5.4b **Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d.**
French and Spanish CPUEs for different bottom trawler fleets.

	French (single and twin bottom trawls combined) CPUE (kg/h)				Spanish CPUE (kg/(100day*100 hp))			Irish LPUE ('000 h)
	Benthic Bay of Biscay	Benhic Western Approaches	Gadoids Western Approaches	Nephrops Western Approaches	A Coruña -VII	Cantábrico- VII	Vigo-VII	Otter trawlers
1984					16.3	130.1	99.1	-
1985	3.0	5.3	4.7	4.7	9.8	39.5	108.9	-
1986	3.2	4.8	2.8	4.4	21.1	52.8	105.1	-
1987	3.3	5.1	2.7	4.5	8.3	80.7	96.2	-
1988	3.8	5.8	3.0	4.1	9.8	78.3	106.1	-
1989	3.6	5.5	2.6	4.2	14.6	48.1	92.1	-
1990	3.1	4.2	1.8	3.4	15.1	18.4	73.8	-
1991	2.6	4.0	1.3	2.8	12.9	25.9	85.4	-
1992	2.5	4.5	1.5	3.4	6.9	32.8	105.6	-
1993	1.9	4.6	1.2	3.5	5.1	33.5	92.3	-
1994	1.9	4.2	1.2	3.4	7.4	52.7	78.7	-
1995	2.3	4.9	1.4	3.4	7.8	61.3	94.3	8.4
1996	2.6	5.0	1.4	3.5	3.9	58.4	79.3	9.2
1997	3.3	5.6	1.2	3.0	3.0	46.9	96.0	7.0
1998	2.9	6.5	1.5	3.6	2.4	35.7	82.4	6.4
1999	2.4	6.3	0.9	3.4	1.1	32.5	137.0	5.9
2000	2.9	7.0	0.6	4.1	5.5	45.0	128.9	5.8
2001	2.2	7.0	0.7	4.3	1.3	75.6	131.2	7.1
2002	2.1	7.0	0.5	3.4	1.3	76.4	185.3	6.7
2003	1.8	5.9	0.6	3.3	11.2	54.0	192.1	5.3
2004	1.7	4.5	0.5	3.4	3.3	60.0	211.0	4.7
2005	1.8	4.8	0.4	4.3	1.7	61.97	135.3	4.3
2006	-	-	-	-	1.1	76.42	146.1	-

Table 5.5 Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. Catch numbers at age.

Run title : 7 and 8ab southern 04 index file

At 9/05/2007 16:31

Table 1	Catch numbers at age			Numbers*10**-3
YEAR	1984	1985	1986	
AGE				
1	103	3	420	
2	13902	1245	5393	
3	26005	11708	13719	
4	21178	18663	14467	
5	12205	16127	14693	
6	12735	17118	13983	
7	12410	15659	11366	
8	7749	8542	6419	
9	4592	4358	3775	
+gp	4014	3327	3780	
0 TOTALNU	114893	96750	88015	
TONSLAN	18828	19597	21248	
SOPCOF	100	100	111	

Table 1	Catch numbers at age			Numbers*10**-3						
YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
AGE										
1	494	408	1438	330	734	680	686	520	816	848
2	4956	7308	3701	10190	4797	10437	9467	6652	8530	9030
3	25076	24218	20188	18289	34752	49212	26269	22584	18066	16236
4	20024	16436	14282	18418	27438	30951	36077	31307	32023	16724
5	13382	16334	13626	15860	21765	11597	17184	17369	26253	20238
6	14094	11257	17297	17107	13235	5882	7305	7963	9062	13674
7	8382	8511	14311	9379	6588	5833	4030	3417	3814	5974
8	4637	6490	8806	5453	3406	3601	2758	1916	2317	3397
9	2236	3732	5135	2930	1180	1743	1581	1721	1207	1622
+gp	2107	4623	4237	2873	1142	1291	1292	2383	1508	1930
0 TOTALNU	95388	99317	103021	100829	115037	121227	106649	95832	103596	89673
TONSLAN	18819	19302	21815	17655	18376	18588	18037	16385	19068	18135
SOPCOF	100	98	103	100	100	100	100	100	100	100
1										

Run title : 7 and 8ab southern 04 index file

At 9/05/2007 16:31

Table 1	Catch numbers at age			Numbers*10**-3						
YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGE										
1	718	998	577	195	1520	629	9876	7449	1623	5106
2	7870	11599	14514	3592	10094	6461	24890	28506	11530	11462
3	17158	26465	20201	17699	10696	22363	24243	53499	24963	24037
4	21562	29154	24649	23016	26515	29271	47117	38449	28614	40759
5	17146	17617	20352	19639	15604	32721	24844	30556	14223	26634
6	8447	8344	10083	11229	17005	16700	14723	13487	13107	9289
7	5480	6340	6762	6378	9698	8858	5878	3935	5197	3155
8	3214	3979	4003	3616	4883	2328	2537	1949	3220	1306
9	1579	1814	1888	1736	1613	655	737	724	1175	462
+gp	2223	1452	1684	1295	1022	376	511	335	1245	370
0 TOTALNU	85397	107762	104713	88395	98650	120362	155356	178889	104897	122580
TONSLAN	17296	19716	16850	15517	17081	17454	18561	18811	14542	14479
SOPCOF	101	101	99	100	100	99	100	100	100	100
1										

Table 5.6. Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. Catch weights at age.

1

Run title : I 7 and 8ab southern 04 index file

At 9/05/2007 16:31

Table 2 Catch weights at age (kg)

YEAR	1984	1985	1986
AGE			
1	0.027	0.028	0.029
2	0.05	0.061	0.05
3	0.073	0.086	0.085
4	0.094	0.104	0.111
5	0.139	0.148	0.159
6	0.179	0.187	0.205
7	0.237	0.239	0.295
8	0.344	0.334	0.395
9	0.467	0.483	0.565
+gp	0.626	0.687	0.77
0 SOPCOF	1	1	1.1073

Table 2 Catch weights at age (kg)

YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
AGE										
1	0.026	0.023	0.024	0.028	0.029	0.021	0.022	0.02	0.021	0.021
2	0.06	0.049	0.046	0.053	0.048	0.053	0.043	0.048	0.046	0.045
3	0.099	0.088	0.073	0.074	0.082	0.082	0.079	0.097	0.094	0.08
4	0.125	0.118	0.103	0.105	0.108	0.122	0.127	0.122	0.137	0.137
5	0.188	0.168	0.141	0.14	0.158	0.18	0.193	0.175	0.18	0.183
6	0.24	0.225	0.205	0.19	0.239	0.254	0.334	0.272	0.298	0.267
7	0.305	0.285	0.261	0.267	0.353	0.386	0.402	0.369	0.45	0.399
8	0.427	0.365	0.349	0.358	0.45	0.52	0.494	0.456	0.572	0.517
9	0.588	0.52	0.497	0.541	0.634	0.726	0.687	0.512	0.684	0.661
+gp	0.813	0.687	0.752	0.797	0.931	0.937	0.882	0.763	0.812	0.79
0 SOPCOF	1.0032	0.9835	1.0308	1.0009	1.0022	1.0015	0.9996	1.0004	1.0029	1.0016

1

Run title : I 7 and 8ab southern 04 index file

At 9/05/2007 16:31

Table 2 Catch weights at age (kg)

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGE										
1	0.021	0.022	0.017	0.014	0.027	0.025	0.023	0.025	0.017	0.017
2	0.055	0.045	0.052	0.054	0.054	0.057	0.046	0.044	0.047	0.053
3	0.096	0.106	0.07	0.087	0.109	0.084	0.082	0.079	0.065	0.081
4	0.135	0.144	0.119	0.107	0.135	0.108	0.105	0.1	0.114	0.102
5	0.178	0.188	0.159	0.147	0.158	0.146	0.141	0.14	0.162	0.133
6	0.278	0.276	0.236	0.225	0.18	0.185	0.198	0.182	0.204	0.2
7	0.398	0.351	0.316	0.356	0.264	0.28	0.308	0.308	0.281	0.336
8	0.524	0.447	0.442	0.459	0.36	0.451	0.437	0.346	0.339	0.468
9	0.668	0.597	0.545	0.592	0.614	0.64	0.649	0.59	0.511	0.654
+gp	0.833	0.813	0.763	0.735	0.854	0.883	0.85	0.794	0.759	0.769
0 SOPCOF	1.0069	1.0147	0.9943	0.9996	1.0025	0.9933	1.0002	0.9993	1.0009	1.0015

1

Table 5.7 - Megrim *(L. whiffiagonis)* in Divisions VIIb,c,e-k and VIIIa,b,d tuning data. Catches in thousands.

1 SP-CORUTR7 (A Coruña trawlers VII) — **Efforts in Days by 10000 hp**

	Effort	Age 1	2	3	4	5	6	7	8	9
1986	100		174	195	224	121	121	111	76	44
1987	100		93	156	96	38	41	26	21	12
1988	100		107	100	133	86	51	30	26	20
1989	100		104	277	410	79	57	50	30	24
1990	100		325	629	409	69	40	28	18	12
1991	100		36	486	383	200	82	18	6	1
1992	100		115	628	322	70	17	18	3	3
1993	100		113	650	504	110	32	19	6	0
1994	100		44	176	251	117	46	14	4	2
1995	100		42	161	268	211	39	9	2	1
1996	100		34	98	120	61	33	11	3	1
1997	100		17	86	89	49	12	9	3	1
1998	100		23	42	136	18	6	4	2	0
1999	100		26	30	21	17	7	3	1	0
2000	100		28	181	340	252	128	30	8	1
2001	100		11	20	23	11	14	11	6	1
2002	100		4	10	17	33	19	7	0	0
2003	100		352	305	546	246	72	10	5	1
2004	100		63	79	78	37	18	5	3	1
2005	100		26	56	40	18	14	7	5	1
2006	100		7	21	51	39	14	4	2	0

2 SP-CANTAB7 (Cantábrico trawlers VII)

	Effort	Age 1	2	3	4	5	6	7	8	9
1986	100		83	151	285	406	380	262	179	118
1987	100		1	348	463	606	623	272	141	95
1988	100		1	111	805	1017	578	280	199	124
1989	100		47	315	1032	547	356	221	94	65
1990	100		22	166	239	111	101	121	66	36
1991	100		83	755	591	456	213	42	9	1
1992	100		361	1212	709	186	62	86	15	10
1993	100		145	1085	967	312	118	18	9	18
1994	100		107	1187	2106	854	279	70	31	9
1995	100		275	1646	2170	1322	358	96	27	10
1996	100		1062	2452	1177	1040	628	136	20	3
1997	100		520	2161	1917	769	158	68	12	1
1998	100		401	586	358	224	168	60	10	1
1999	100		0	10	312	666	390	156	57	13
2000	100		18	926	689	1022	564	92	36	10
2001	100		5	198	1174	847	1101	795	429	125
2002	100		0	389	763	1069	725	683	207	35
2003	100		43	489	1404	800	593	239	84	18
2004	100		316	2138	810	966	395	125	98	17
2005	100		13	451	2270	811	965	291	195	36
2006	100		124	607	1856	1838	1075	226	50	22

3 SP-VIGOTR7 (Vigo trawlers VII)

	Effort	Age 1	2	3	4	5	6	7	8	9
1984	100		392	1079	1924	943	698	585	368	158
1985	100		233	1143	2586	1318	877	610	300	123
1986	100		100	493	1712	1412	1021	611	269	120
1987	100		135	2292	1885	948	554	266	115	46
1988	100		137	801	2479	1627	765	311	174	106
1989	100		114	728	1796	886	646	472	277	202
1990	100		178	668	1277	890	650	350	151	60
1991	100		266	2500	1958	1480	733	133	32	5
1992	100		741	3791	2520	627	183	229	58	58
1993	100		517	2220	2740	934	341	199	52	5
1994	100		265	1273	2451	1213	538	161	63	30
1995	100		389	807	1865	2051	571	190	88	49
1996	100		378	464	487	1044	1036	339	136	58
1997	100		347	1042	1433	1240	622	459	155	49
1998	100		389	826	1851	844	394	304	141	48
1999	100		2659	3264	3155	2803	1026	317	112	30
2000	100		1965	6712	5937	5379	2456	453	189	51
2001	100		1690	1255	3027	1854	2170	1064	452	85
2002	100		1159	3283	4038	4409	2223	1098	210	28
2003	100		4199	3300	6122	2863	1724	656	255	50
2004	100		4988	7935	5534	4097	1751	403	190	48
2005	100		2059	4135	4100	1565	1536	567	378	96
2006	100		1792	3396	5703	3587	999	236	78	24

4 FR-FU04 (French bentic trawlers in the Celtic Sea) — **Effort in 1000h*1000kW**

	Effort	Age 1	2	3	4	5	6	7	8	9
1988	100		255	156	600	1057	713	518	485	345
1989	100		100	427	492	503	886	1215	803	503
1990	100		162	448	472	654	941	858	493	305
1991	100		158	683	850	759	757	685	462	180
1992	100		265	695	856	891	687	575	471	278
1993	100		253	747	817	589	376	442	386	243
1994	100		323	979	820	506	303	189	169	177
1995	100		537	1105	1878	1251	564	301	308	176
1996	100		250	700	804	919	735	511	376	223
1997	100		271	805	1002	863	558	399	386	263
1998	100		846	2954	2604	2189	1156	829	626	282
1999	100		0	70	658	819	591	727	571	364
2000	100		0	39	630	672	749	820	538	322
2001	100		67	401	1014	401	502	619	463	281

Figure 5.1. - Megrim (L.whiffiagonis) in Divisions VIIb,c,e-k and VIIIa,b,d. Length composition of catches for the years 1990 to 2006.

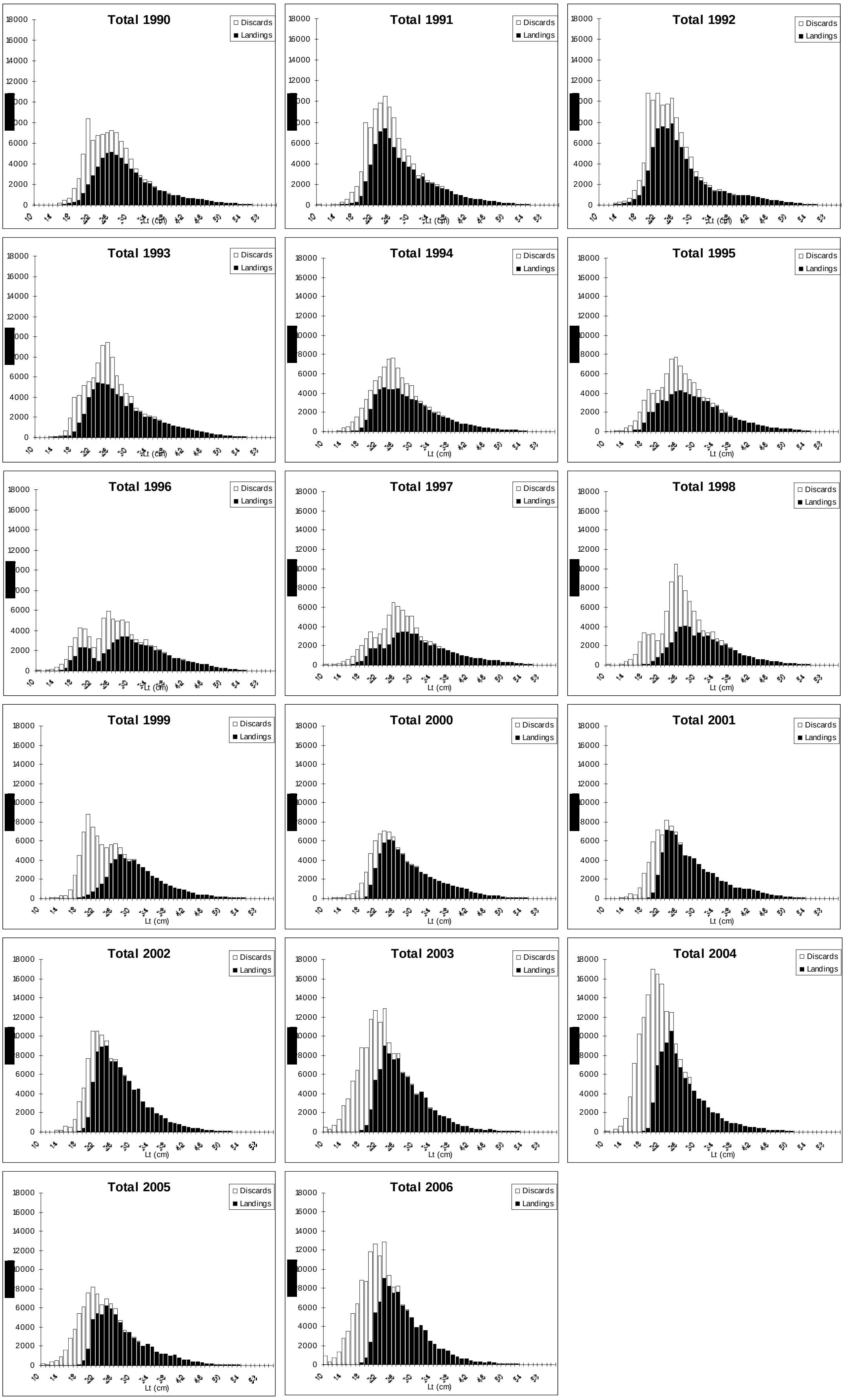


Figure 5.2. - Megrim (L.whiffiagonis) in Divisions VIIb,c,e-k and VIIIa,b,d. Age composition of catches for the years 1990 to 2006.

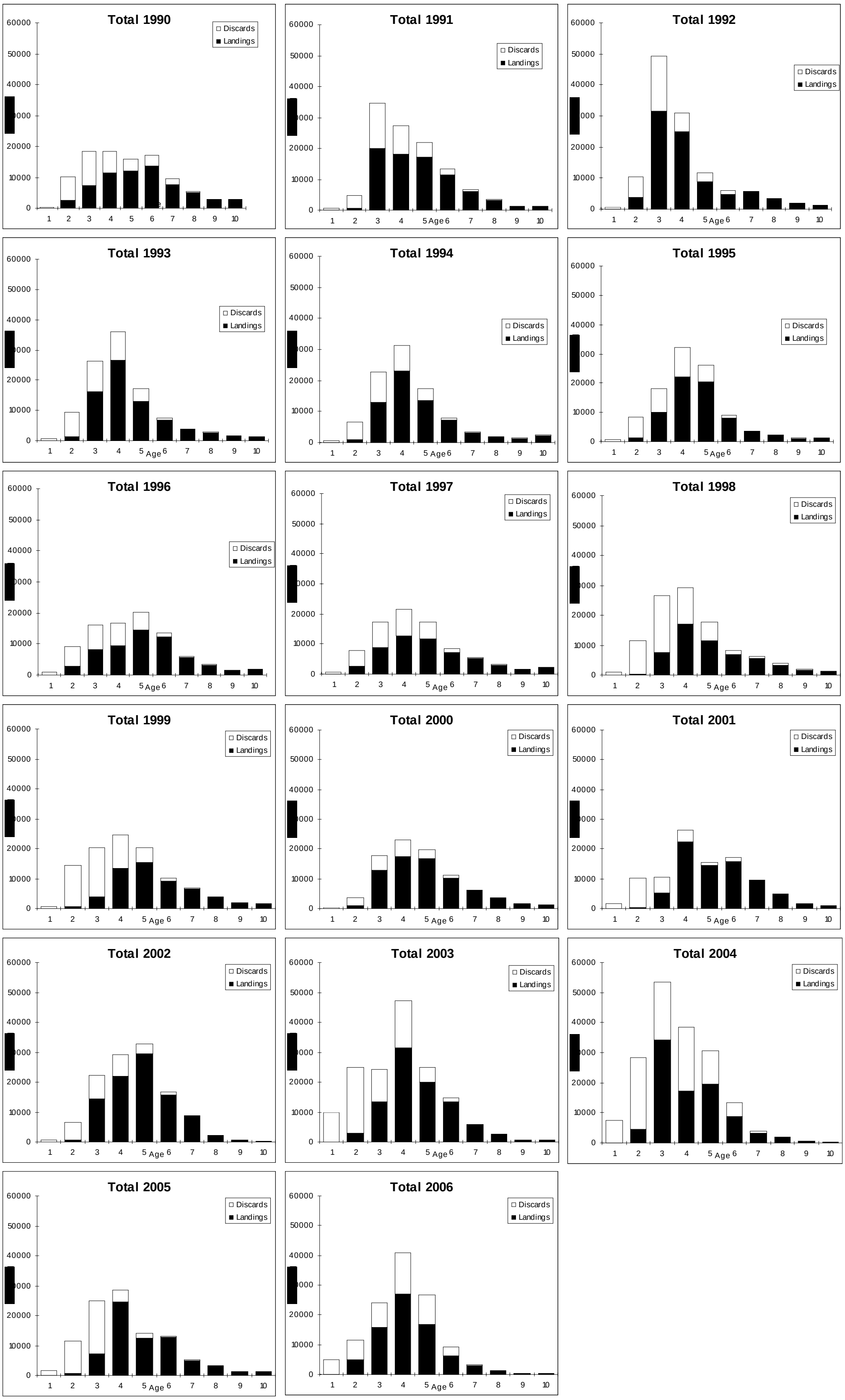


Figure 5.3 Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. Scaled Abundance Indices for FR-EVHOES, SP-PGFS and IR-GFS

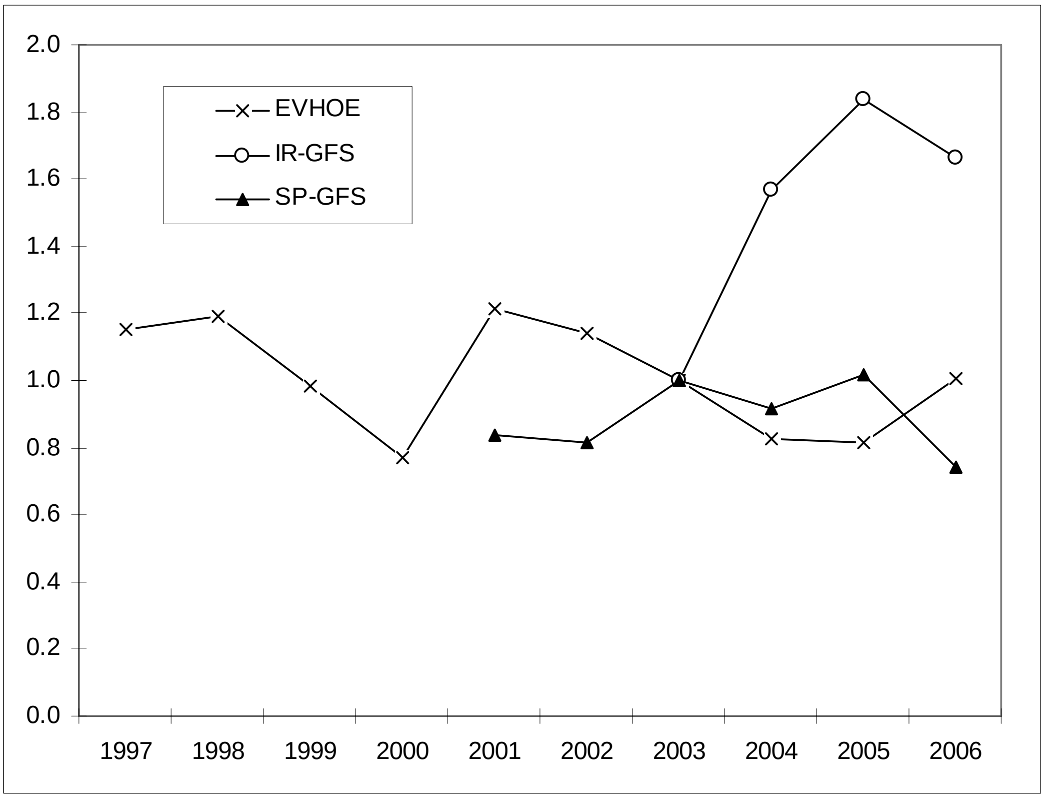


Figure 5.4a Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d.
Evolution of effort for different bottom trawler fleets.

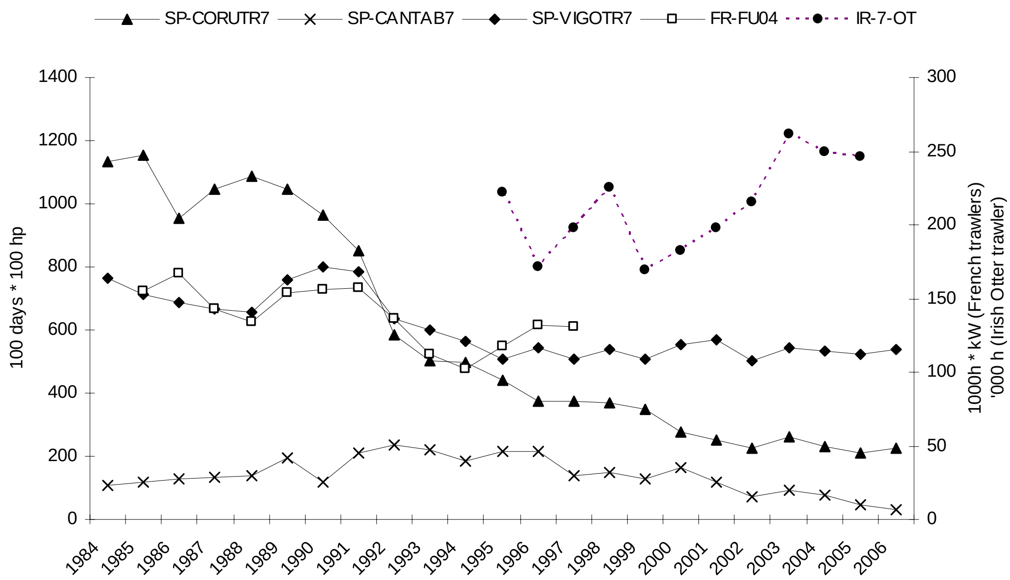


Figure 5.4b Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d.
Spanish CPUE for different bottom trawler fleets.

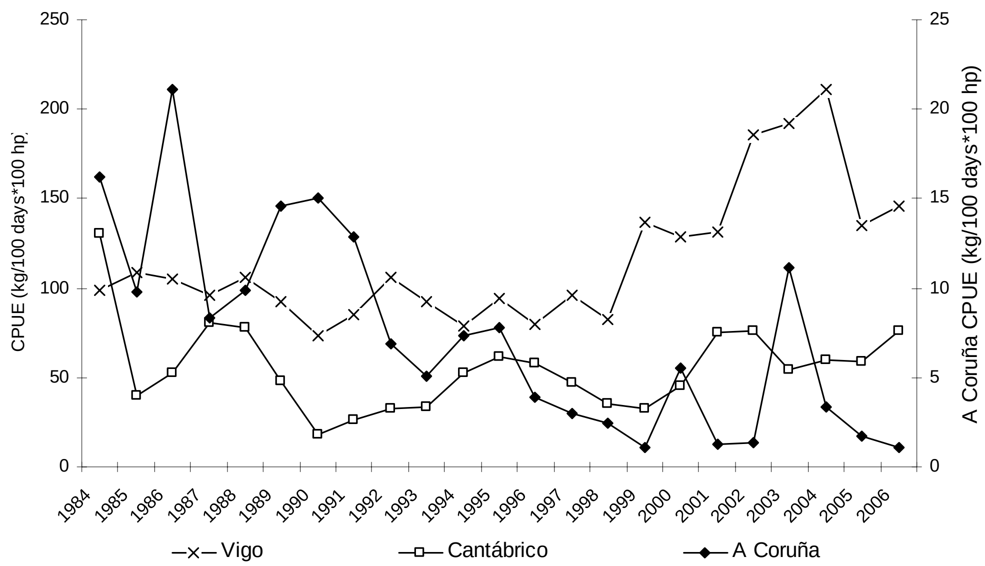


Figure 5.4c Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d.
French LPUE for different bottom trawler fleet.

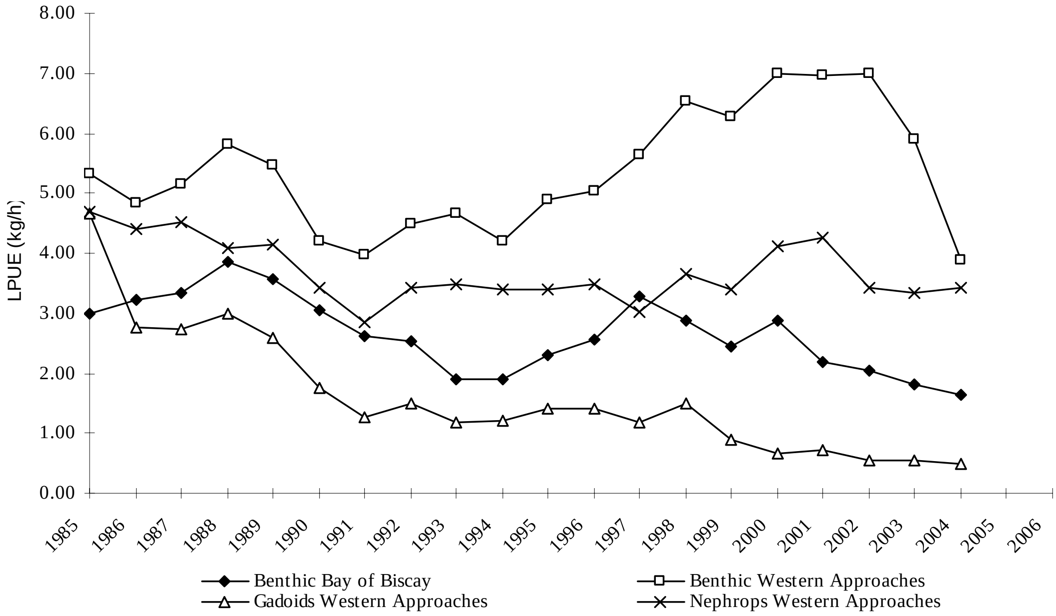
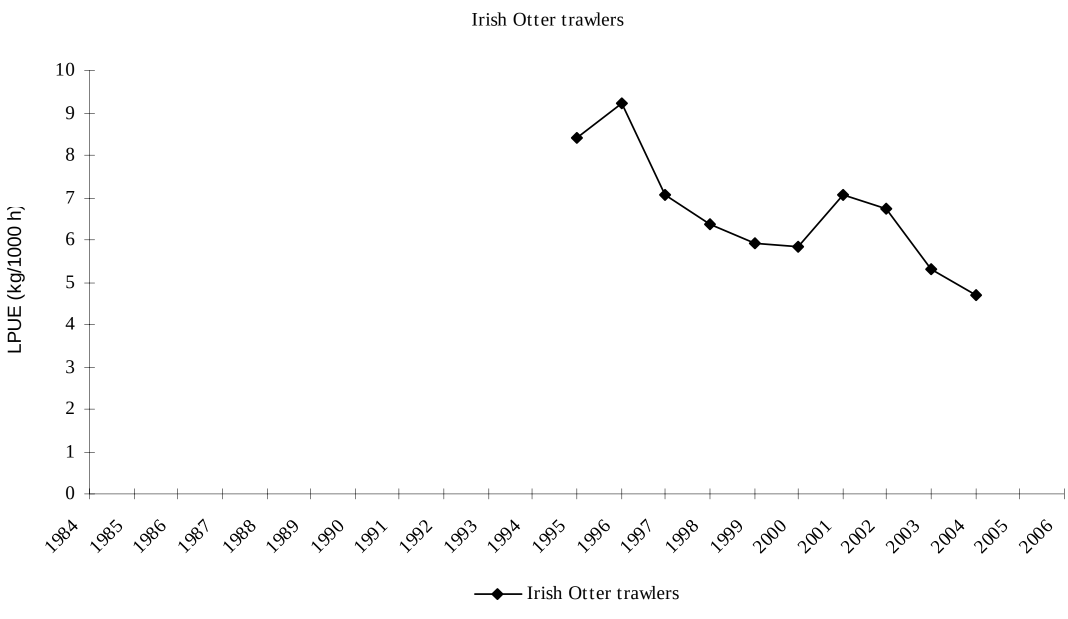


Figure 5.3d Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d.
Irish LPUE for otter trawler fleet.



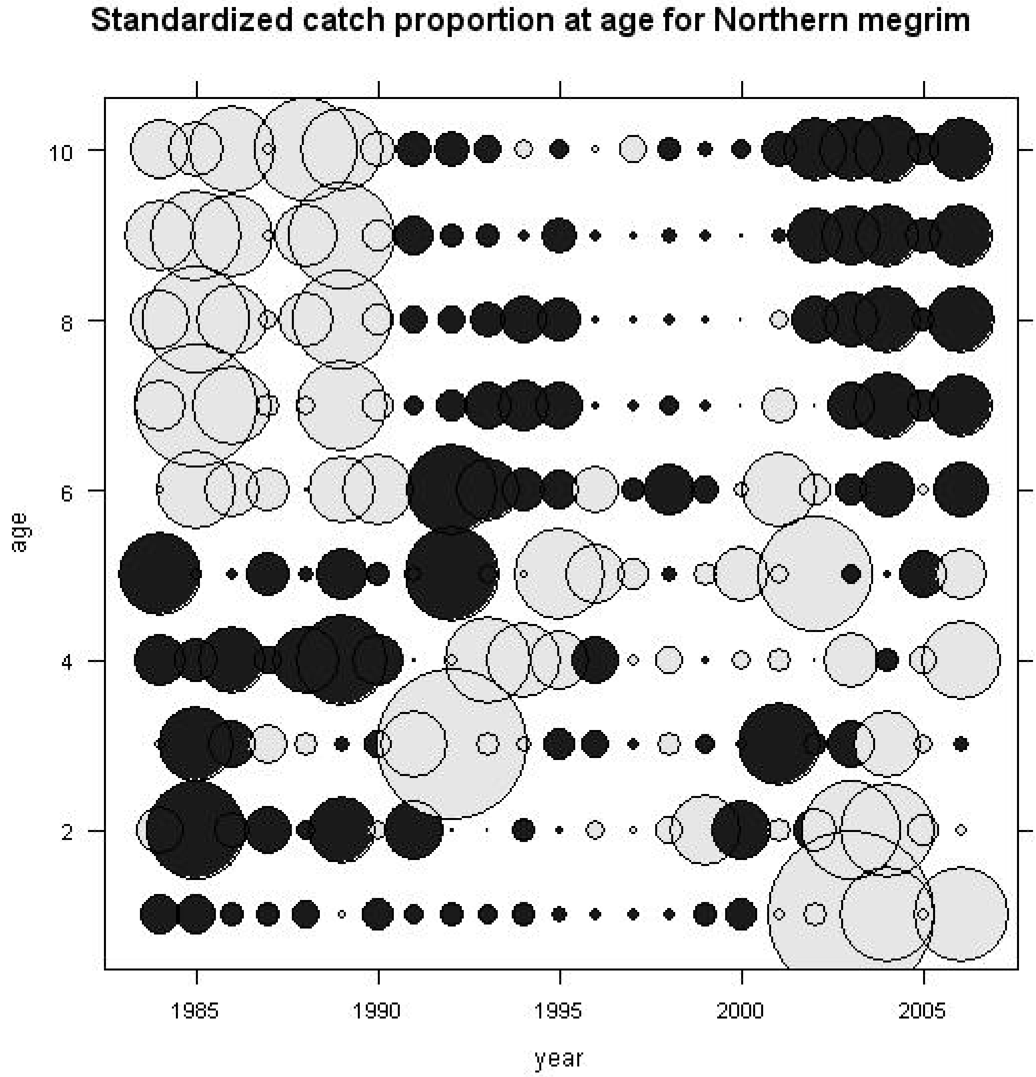


Figure 5.5 Megrim (L.whiffiagonis) in Divisions VIIb,c,e-k and VIIIa,b,d Grey bubbles are positive and black ones are negative.

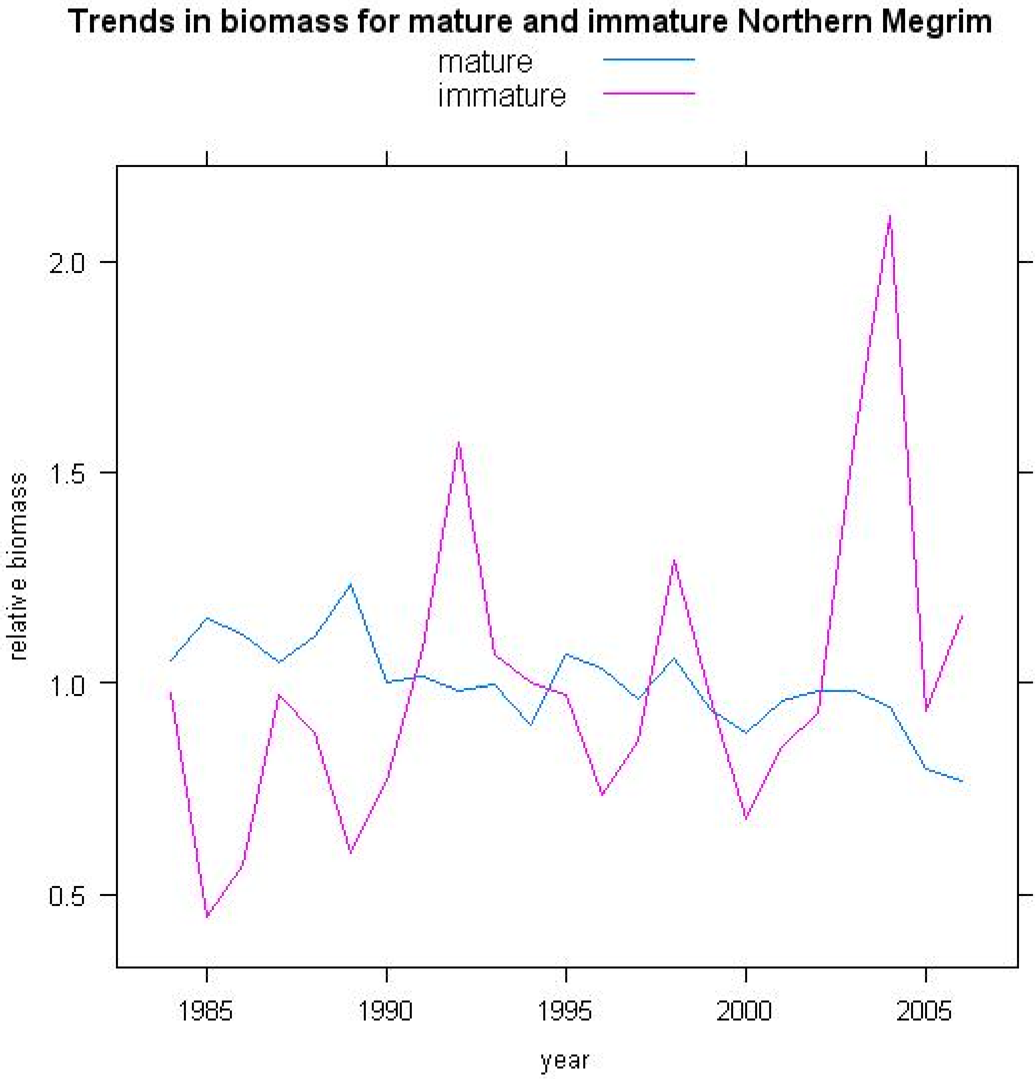


Figure 5.6 Megrim (L.whiffiagonis) in Divisions VIIb,c,e-k and VIIIa,b,d trends in biomass

6 Bay of Biscay Sole

Type of assessment in 2007 : update.

A benchmark assessment was performed in 2006. No major revision are foreseen before the 2008 WG meeting. Then the WG proposed to do again an updated assessment in 2008.

Changes in the assessment data compared to last year : slight revisions of commercial tuning files from 1999 because new data in the national French fishery data base.

Review Group issues :

- The impact of RESSGASC survey in the assessment remains difficult to explain.
- Even if there are three low recruitments observed in recent period, it is difficult to predict recruitment otherwise than using a geometric mean because the uncertainties on the factors that drive the recruitment.

6.1 General

6.1.1 Ecosystem aspects

The Bay of Biscay sole stock extends on shelf that lies along Atlantic French coast from the Spanish boarder to the West point of Brittany. Spawning grounds spread at depth from 30 to 100 m. Nursery grounds are located in the coastal waters, in bays and estuaries (map in Stock Annex in annex F).

Studies in Vilaine Bay (South Brittany) showed a significant positive relationship between the flow of Vilaine river in winter-spring and the size of the sole nursery in this area. This result led the WGSSDS to investigate if a relationship could be found between the river flows and the sole recruitment in the Bay of Biscay at its 2006 meeting, but without any success. The environmental effect on the sole recruitment is likely to be more complex at the Bay of Biscay scale. Its knowledge is the aim of two surveys series which are planed in 2007-2009 in the Charente sounds (La Rochelle area) and in the Loire estuary.

6.1.2 Fishery description

The Bay of Biscay sole fishery (a more detailed description is provided in the Stock Annex) has two main components : the major one is a French gill net fishery directed at sole (about two third of total catches) and the other one is a French and Belgian trawl fishery (French otter trawlers and Belgian beam trawlers). The otter trawlers have more mixed species catches than beam trawlers which are directed at sole. The French coastal boats of these two fisheries have a larger proportion of young fish in their catch than offshore boats.

6.1.3 Summary of ICES advice for 2007 and management applicable to 2006 and 2007

ICES advice for 2007 :

Although ICES has not evaluated the agreed management plan, it uses the exploitation boundaries in relation to the management plan as basis for the advice for 2007, as this plan is expected to give higher long-term gains in the present situation and is already implemented. ICES therefore recommends to limit landings in 2007 to 4540 t.

Management applicable to 2006 and 2007

The sole landings in the Bay of Biscay are subject to a TAC regulation. The 2006 TAC was set at 4060t. The 2007 TAC is set at 4540 t. The minimum landing size is 24 cm and the minimum mesh size is 70 mm for trawls and 100 mm for fixed nets, when directed on sole. Since 2002, the hake recovery plan has increased the minimum mesh size for trawl to 100mm in a large part of the Bay of Biscay but, in 2006, trawlers using a square mesh panel were allowed to use 70 mm mesh size in this area. This possibility was given them again for 2007.

The Belgian vessel owners get monthly non transferable individual quota for sole. The amount is related to the capacity of the vessel.

A regulation establishing a management plan has been adopted in February 2006. The objective is to bring the spawning stock biomass of Bay of Biscay sole above the precautionary level of 13 000 tonnes by gradually reducing the fishing mortality rate on the stock. After this date, the Council will decide on a long-term target fishing mortality and a rate of reduction in the fishing mortality for application until the target has been reached.

6.2 Data

6.2.1 Commercial catches and discards

The WG estimates of landings and catches are shown in Table 6.1a with official landings. The 2005 landings estimate was revised 2% higher to 4455t.

In 2002, landings were increased to 5467t by hydrodynamic conditions very favourable to the fixed nets' fishery (frequent strong swell periods in the first quarter). In the absence of such apparently rare conditions, the landings in 2003-2006 were ranging from between 4000t and 4500t, then well below the 2002 level and at the lowest level since 1985. The 2006 figure is 3 % below the landings predicted by the 2006 WG at *status quo* mortality (4726 t).

Discards estimates are available for the French offshore trawler fleet from 1984 to 2003. Given their low contribution to the total catch, their monitoring was not continued in 2004 and they are no longer used in the assessment.

Available discards estimates for a limited number of trips have shown that discards of beam trawlers and gillnetters are also generally low. However, they can be occasionally high in the inshore trawlers fleet.

6.2.2 Biological sampling

Length compositions are available on a quarterly basis from 1984 for the French fleets and from 1994 for the Belgian beam trawlers. The French length distributions are shown on Figures 6.2 a, b & c from 1984 onwards. The relative length distribution of landings in 2006 are shown by country in Table 6.3.

The quarterly French sampling for length compositions is by gear (trawl or fixed net) and boat length (below or over 12m long). The split of the French landings in these components is made as described in Stock Annex. The 2005 split was slightly revised because some late recording of logbooks in the database in 2006 (Table 6.1 b).

Age compositions are estimated using the same procedure as in previous years, as described in Stock Annex (Table 6.4 and Figures 6.3 a & b).

International mean weights at age are French-Belgian quarterly weighted mean weights (Table 6.5). A discrepancy between French and Belgian mean weight at age still exists (ICES files).

An investigation of this problem was carried out in 2005. It has shown that the discrepancy results from differences in age reading due to the reading methods and the age readers. This latter source of discrepancy has been quantified in 2006 by an otolith exchange organised by the Planning Group on Commercial Catch, Discards and Biological Sampling. This exercise has shown that the agreement in age reading is lower for the ICES area 8 (79%) compared to the other ones (4c, 7d, 7a, 7e and 7fg) for which it is 92%. The greater difficulty of age reading in area 8 is then confirmed as well as the need to have more frequent exchanges between French and Belgian age readers for this stock.

6.2.3 Abundance indices from surveys

Two quarterly CPUE FR-RESSGASC-S surveys are available for the tuning process from 1997, but they are both terminated after 2002. Indices of abundance, measured in number per 100 hours, are presented in Table 6.6.

6.2.4 Commercial catch- effort data

The French La Rochelle and Les Sables trawler series of commercial fishing effort data and LPUE indices were completely revised in 2005. A selection of fishing days (or trips before 1999) was made by a double threshold (sole landings >10% and nephrops landings <=10%) for a group of vessels. The process is described in the Stock Annex.

A third French commercial fleet LPUE series was added in 2005. It is formed by offshore trawlers landing sole in other harbours than Les Sables and La Rochelle fleets. It adds information on LPUE in the northern part of the Bay of Biscay, but the quality is lower because it was not possible to carry out the same selection process of vessels than for the two other fleets.

These three series were slightly revised from 1999 to 2005 because some corrections have been made in the French Fishery data base from 1999 onwards.

As each of these series are based on partial effort and landing data (recorded logbooks), no estimate of effort can be provided by fleet but only for the total effort of French offshore trawlers (using LPUE calculated for the whole trawler fleet). This estimate shows that, after a decrease until 1999, the effort of this fleet is stable in recent years (Table 6.2a and Figure 6.1).

The La Rochelle LPUE series (FR-ROCHELLE) shows a general decreasing trend over the time series but it is moderate from 1993 onwards (Figure 6.1). The Les Sables d'Olonne LPUE series (FR-SABLES) shows the same declining trend but this latter is more irregular in recent years. The other French trawlers series has remained relatively stable.

After a five years decrease, the effort of the Belgian beam trawl fleet has increased in 2005-2006. LPUE was relatively constant from 1990 to 1996, declined severely afterwards until 2002 but has increased in recent years to return to the 1998-2001 level (Table 6.2b).

6.3 Assessment

6.3.1 Input data

Stock weights are set to the catch weights.

As in previous assessments, natural mortality is assumed to be 0.1 for all age groups and all years.

The following observed maturity ogive (estimation described in Stock Annex) is used in all years :

AGE	≤ 1	2	3	4	≥ 5
Mature	0	0.32	0.83	0.97	1

Proportions of F and M before spawning were set to zero, as in previous years, to reflect SSB at 1st January.

6.3.2 Model

As in previous years, the model chosen by the Group to assess this stock was XSA.

The age range in the assessment is 2-8+, as last year assessment.

The year range used is 1984-2006.

Catch-at-age analysis and Data screening

The results of exploratory XSA runs, which are not included in this report, are available in ICES files.

A separable VPA was run to screen the catch-at-age data. The same settings as last year were used: terminal F of 0.6 on age 4 and terminal S of 0.9. There were no anomalous residuals apparent in recent years.

Three commercial fleets (FR-SABLES, FR-ROCHELLE French offshore trawlers and BEL-BT Belgian beam trawlers) and two quarterly FR-RESSGASC-S survey CPUE series (from 1987 to 2002) are available for tuning (Table 6.7). The table below summarizes the available information on the commercial tuning fleets.

FLEET TYPE	ACRONYMS	PERIOD	AGE RANGE	LANDING CONTRIBUTION
Offshore otter trawlers	FR-SABLES	1991 – 2006	0 – 8	2 %
Offshore otter trawlers	FR-ROCHELLE	1991 – 2006	0 – 8	1 %
Offshore beam trawlers	BEL-BT	1997 – 2006	0 – 8	8 %

XSA tuning runs (low shrinkage s.e. = 2.5, no taper, other settings as in last year tuning) were carried out on data from each fleet individually. The results showed small residuals for FR-SABLES and FR-ROCHELLE.

The Belgian beam trawlers fleets presents noisy residuals and was excluded because of the discrepancy in age reading between France and Belgium.

Exploratory run

These two RESSGASC fleets have no effect on recent years trends but, as notice by the 2006 WGSSDS, they lower the fishing mortalities before 1992 and, inversely, stabilize the historic SSB trend. In order to limit change in historical trends and to have some coherence with preceding assessments, the WG considers these two series must be kept in the tuning files. Furthermore, the recent adoption of a management plan including a biomass target largely based on the SSB trend reinforces this need.

Final XSA run

The final XSA was run using the same settings than in last year assessment.

			2006 XSA			2007 XSA
Catch data range			1984-2005			1984-2006
Age range in catch data			2-8+			2-8+
Fleets	FR – SABLES	91-05	2-7	FR – SABLES	91-**06**	2-7
	FR – ROCHELLE	95-05	2-7	FR – ROCHELLE	91-**06**	2-7
	FR – OTHER	95-04	2-7			
	FR – RESSGASC2	87-02	2-7	FR – RESSGASC2	87-02	2-7
	FR – RESSGASC4	87-02	2-7	FR – RESSGASC4	87-02	2-7
Taper			No			No
Ages catch dep. Stock size			No			No
Q plateau			6			6
F shrinkage se			1.5			1.5
Year range			5			5
age range			3			3
Fleet se threshold			0.2			0.2
F bar range			3-6			3-6

The results are given in Table 6.8. The log-catchability residuals are shown in Figure 6.4 a & b and retrospective results in Figure 6.5. As in last year assessment, the retrospective patterns shows some diverging trends prior to 1991. The missing commercial tuning data before 1995 is likely to be the cause of this problem.

The recruit estimates at age 2 are not consistent, Les Sables estimate being about than three times the La Rochelle one.

Estimates of survivors at age are mostly driven by the two commercial fleets FR-SABLES and FR-ROCHELLE. The Les Sables fleet has 10% to 30% more important weights than the La Rochelle ones.

The FR-RESSGASC-S surveys and the F shrinkage receive less than 3 % throughout. Except at age 2, commercial fleet estimates are in rather good agreement with each other and also with RESSGASC estimates at age 6 and 7.

Fishing mortalities and stock numbers at age are given in Tables 6.9 and 6.10 respectively. The results are summarised in Table 6.11. Trends in yield, F, SSB and recruitments are plotted in Figure 6.6. Fishing mortality in 2006 is estimated by XSA to have been at 0.52. Fishing mortality in 2005 remains estimated at 0.47 as by last year WG.

6.3.3 Assessment results

6.3.3.1 Estimating recruiting year class abundance

The 2003 year class is estimated to be 18.7 million 2 year olds. Last year’s WG XSA estimate (21.7 million) was not accepted by the WG which preferred to overwrite this year class with the GM (23 million) because the lack of reliability of the XSA estimate that showed the retrospective analysis. The present value indicate that this year class strength is below the average.

The 2004 year class is estimated to be at 27.7 million 2 year olds by XSA. The WG considered that this XSA recruitment estimate in terminal year could not be accepted because it is no more reliable than in the preceding year. It was overwritten by a short series GM from 1993 as in preceding assessments since there is observed fall in stock numbers at age 2 after 1993. This GM $_{93\text{-}05}$ is also used to estimate subsequent recruitments.

Recruitment at age 2

YEAR CLASS	THOUSANDS	BASIS	SURVEYS	COMMERCIAL	SHRINKAGE
2003	18731	XSA	0 %	99 %	1 %
2004	22716	GM(93-05)			
2005 & subsequent	22716	GM(93-05)			

6.3.3.2 Historic trends in biomass, fishing mortality and recruitment

A full summary of the time series of XSA results is given in Table 6.11 and illustrated in Figure 6.6.

Since 1984, fishing mortality gradually has increased, peaked in 2002 and decreased substantially the following two years, but it has increased again in 2005-2006. Fishing mortality in 2006 is estimated to be 0.52.

SSB trend in earlier years increases from 10700 t in 1984 to 16 600 t in 1993, afterwards it shows a continuous decrease to 9 500 t in 2003. Only a limited increase is observed from 2004 onwards, the SSB is then estimated to still have been close to 11000 t in 2006 as in the two preceding years.

The recruitment values are lower since 1993. Afterwards, the series was relatively stable from 1993 to 2001, but with two low values in 2004-2005 after a first one in 2001, a change in recruitment regime may be feared.

6.3.4 Catch options and prognosis

The exploitation pattern is the unscaled mean over the period 2004-2006 (over 2004-2005 at age 2) because the reliability of the last year F estimate is considered to be too low to do a correction for a light and short trend when, furthermore, no information are available on the 2006 landings at the time of the WG. This *status quo* F is estimated at 0.46.

The recruits at age 2 from 2007 to 2009 are assumed equal to GM $_{93\text{-}05}$. Stock number at age 3 in 2007 is derived from GM $_{93\text{-}05}$ reduced by total estimated mortality. Stock numbers at ages 4 and above in 2007 are the XSA estimates.

Weights at age in the landings are the 2003-2005 unweighted means corrected for a change in the fresh/gutted transformation coefficient which was changed from 1.11 to 1.04 for French landing in 2007. Weights at age in the stock remains the 2003-2005 unweighted means, the predicted spawning biomass are consequently still comparable to the biomass reference point of the management plan.

6.3.4.1 Short term predictions

Input values for the catch forecast are given in Table 6.12.

The landings forecasts is 4340 t in 2007 (TAC is set at 4540t), 3% lower than the 2006 landings. According to the agreed management plan, catches should be less than 4165 t in 2008 as they must be below those resulting in a 10% reduction in F as long SSB is below

13000t. The SSB is predicted to increase to 11900t in 2008 at status quo F and to 12600t in 2009 for a 10% decrease in F (Tables 6.1.13 and 6.1.14).

The proportional contribution of recent year classes to the landings in 2008 and to the SSB in 2009 are given in Table 6.15. Year classes for which GM recruitment has been assumed (2004 to 2006) contribute 80% of the 2008 landings and 63% of the 2009 SSB.

6.3.4.2 Yield and Biomass Per Recruit

Results for yield and SSB per recruit, conditional on *status quo* F, are given in Table 6.16 and in Figure 6.7. The landings $\mathbf{F}_{sq}$ (0.46) is about 2 times $\mathbf{F}_{max}$ (=0.24) and about 4 times $\mathbf{F}_{0.1}$ (=0.12). Long-term equilibrium landings and SSB (at F *status quo* and assuming GM recruitment) are estimated to be 4800 t and 12800t respectively.

6.3.5 Biological reference points

Because of the changes in Fbar age range, the F reference points were revised by ACFM in 2006. The rationale for setting theses reference points remains unchanged. The values and the basis of present and past reference points are given thereafter :

	ACFM 1998	ACFM 1999	WG & ACFM 2001	WG 2004	ACFM 2006
			Change in maturity ogive	Change in recruitment age and in Fbar age range	Change in Fbar age range
$\mathbf{F}_{lim}$	Not defined	Not defined	0.5 (potential collapse)	Not defined	$\mathbf{F}_{lim}$=0.58 (potential collapse)
$\mathbf{F}_{pa}$	0.40 (*prob*(SSB_{MT}<$\mathbf{B}_{pa}$)<.1)	0.45 (*prob* (SSB_{MT}<$\mathbf{B}_{pa}$)<.05)	$\mathbf{F}_{pa} = \mathbf{F}_{lim}\ e^{(-1.645 * .2)}$ = 0.36.	F proposal to promote SSB increase in the short- to medium-term	$\mathbf{F}_{pa} = \mathbf{F}_{lim}\ e^{(-1.645 * .2)}$ = 0.42
$\mathbf{B}_{lim}$	Not defined	Not defined	Not defined	Not defined	Not defined
$\mathbf{B}_{pa}$	11 300 t ($\mathbf{B}_{loss}$)	11 300 t ($\mathbf{B}_{loss}$)	13 000 t	Not relevant	13 000t

6.3.6 Comments on the assessment

Sampling

The sampling level (table 1.3) for this stock is considered to be satisfactory.

The Working Group considers that the lack of survey index, especially for estimating the incoming recruitment, is a deficiency in this assessment.

An age reading discrepancy cause a gap between the French and Belgian numbers at age distributions and the weights at age.

Discarding

Partial discards estimates are available for the French trawler fleet discards from 1984 to 2003. They were formerly included in the catch at age data but due to their low contribution to the total catch, their monitoring was not continued in 2004 and they are no longer used in the assessment as recommended by ACFM.

Sampling of other fleets discards was carried out in 2003 and 2004. They confirm the general low level of discards.

Consistency

The RESSGASC series has been kept in the tuning series in view to have consistency in historical trends in F and SSB. Even if they do not contribute to terminal year estimate, the removal of these series change rather substantially the earlier part of the trends. The WG preferred consequently to keep them in the tuning file to be consistent with preceding WGs. The implementation on a management plan aiming a SSB target reinforce this need of consistency in trend on which are based past reference points.

The XSA recruitment estimate in terminal year is very uncertain, it was consequently overwritten with a GM estimate which has a large contribution in predicted landings and SSB.

The definition of reference groups of vessels and the use of thresholds on species percentage to build the French series of commercial fishing effort data and LPUE indices is considered to provide LPUE which are more representative of change in stock abundance by taking into account the possibility of long term change in fishing power and recent change in fishing practises in the sole fishery.

Misreporting

No information on misreporting for this stock.

Industry input

A meeting with representatives of the fishing industry was held in France prior to the WG to present the data used by the present WG to assess the Bay of Biscay sole stock. The participants did not express reservations on these data which were estimated to fit with their knowledge of the fishery.

6.3.7 Management considerations

The assessment indicates that SSB has decreased continuously to 9900 t in 2003, since a peak in 1993 (16 600 t), has increased to 11000t in 2004 but stays at this level since then. As long the SSB is below 13000t, the management plan agreed in 2006 for this stock has set that the TAC should not exceed a level of catches which will result in a 10% reduction in F.

According to the deterministic prediction, the SSB is expected to increase to 12600t in 2009 by a 10% decrease in F. However, this forecast assumes mean recruitment, but three recent recruitments have been much lower than the historic mean. This uncertainty on future recruitments strengthen the need of strong management action to guarantee that SSB returns rapidly to an area where the recruitment dynamic is known.

Table **6.1 a** : Bay of Biscay sole (Division VIIIa,b). Internationnal landings and catches used by the Working Group (in tonnes).

	Official landings						Unallocated	WG	Discards[1]	WG
Years	Belgium	France	Nether.	Spain	Others	Total	landings	landings		catches
1979	5*	2376		62*		2443	176	2619	-	-
1980	33*	2549		107*		2689	297	2986	-	-
1981	4*	2581*	13*	96*		2694	242	2936	-	-
1982	19*	1618*	52*	57*		1746	2067	3813	-	-
1983	9*	2590	32*	38*		2669	959	3628	-	-
1984		2968	175*	40*		3183	855	4038	99	4137
1985	25*	3423	169*	308*		3925	326	4251	64	4315
1986	52*	4227	213*	75*		4567	238	4805	27	4832
1987	124*	4009	145*	101*		4379	707	5086	198	5284
1988	135*	4308				4443	939	5382	254	5636
1989	311*	5471*				5782	63	5845	356	6201
1990	301*	5231				5532	384	5916	303	6219
1991	389*	4315		3		4707	862	5569	198	5767
1992	440*	5919				6359	191	6550	123	6673
1993	400*	6083		13		6496	-76	6420	104	6524
1994	466*	6620		17***		7103	123	7226	184	7410
1995	546*	5325		6***		5877	328	6205	130	6335
1996	460*	3843		13***		4316	1537	5853	142	5995
1997	435*	4526		23***	1	4985	1274	6259	118	6377
1998	469*	3821	44	40***	1	4375	1607	5982	127	6109
1999	504*	3280		41***		3825	1424	5249	110	5359
2000	451	5293		95***	1	5840	-81	5759	51	5810
2001	361	4361	201	224***	1	5148	-320	4828	39	4867
2002	303	3680		27***	1	4011	1456	5467	21	5488
2003	296	3805		12***	3	4116	-10	4106	20	4126
2004	324	3739		54***	11	4128	-138	3990	-	-
2005	358	2139**		0	1	2498	1957	4455	-	-
2006	393	2336**		0	1	2730	1833	4563	-	-

* reported in VIII   *** reported as *Solea* spp (*Solea lascaris* and *solea solea*) in VIII

** Preliminary   [1] Discards = Partial estimates for the French offshore trawlers fleet

Table **6.1 b** : Bay of Biscay sole (Division VIIIa,b). Contribution (in %) to the total landings by differents fleets.

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Shrimp trawlers	7	7	8	11	6	5	4	3	3	2	2	2	1	1
Inshore trawlers	29	28	27	25	31	29	30	25	27	25	17	13	13	12
ffshore otter trawle	61	62	60	60	59	60	45	45	47	46	41	41	39	31
ffshore beam trawle	0	1	0	0	0	0	1	1	2	3	5	5	7	7
Fixed nets	3	3	5	4	4	6	20	26	20	24	35	39	40	49

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Shrimp trawlers	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Inshore trawlers	13	11	13	12	11	10	5	8	9	7	8	9	7	7
ffshore otter trawle	28	29	26	26	30	30	24	21	24	18	24	23	21	19
ffshore beam trawle	6	6	9	8	7	8	10	8	8	6	7	8	8	9
Fixed nets	52	52	53	54	52	52	61	63	59	70	60	60	63	65

Table 6.2 a : Bay of Biscay sole(Division VIIIa,b) LPUE and indices of fishing effort for French offshore trawlers.

Year	CPUE RESSGASC survey (kg/H) term		LPUE La Rochelle offshore trawlers of French sole fishery	LPUE Les Sables offshore trawlers of French sole fishery	LPUE Other harbours * offshore trawlers of French sole fishery	LPUE All offshore trawlers of French sole fishery	effort index All offshore trawlers of French sole fishery
	2	4	(kg/h)	(kg/h)	(kg/h)	(kg/h)	(1000 h)
1984	-	-	6.0	6.9	5.0	5.9	557
1985	-	-	5.6	6.5	4.3	4.9	454
1986	-	-	7.2	7.2	4.5	5.5	526
1987	0.7	1.1	6.6	5.9	4.6	5.4	816
1988	1.6	0.7	6.4	6.7	4.1	5.1	944
1989	1.2	0.9	5.5	6.1	4.5	5.1	996
1990	1.0	1.6	7.1	6.3	4.9	5.7	975
1991	1.1	2.2	6.5	6.5	4.7	5.4	954
1992	0.8	2.1	5.4	5.6	4.9	5.1	884
1993	1.0	1.5	4.6	6.4	4.9	5.2	791
1994	1.0	1.8	5.0	6.6	5.8	5.6	944
1995	1.0	1.8	4.6	5.4	5.0	5.2	742
1996	1.8	2.1	4.9	6.0	5.0	5.4	628
1997	1.2	1.4	4.1	5.3	4.6	4.7	774
1998	1.9	2.2	4.2	5.3	4.2	4.2	834
1999	1.1	0.9	3.7	5.9	4.2	4.5	524
2000	0.9	0.7	4.0	5.7	4.7	4.7	577
2001	1.0	1.0	3.4	4.0	5.2	4.7	454
2002	0.8	1.2	4.4	5.0	4.6	4.6	430
2003	-	-	4.1	3.9	4.8	4.6	447
2004	-	-	4.0	4.2	4.7	4.4	448
2005	-	-	3.9	5.2	4.3	4.2	495
2006			3.1	5.6	4.3	4.4	464

* French offshore trawlers in other harbours than in La Rochelle and Les Sables

Table 6.2 b : Bay of Biscay sole(Division VIIIa,b). Fishing effort and LPUE for Belgian beam trawlers.

Year	Landing (t)	Effort (1000 h)	LPUE (kg/h)
1976	26.3	1.7	15.5
1977	64.4	3.4	18.7
1978	29.8	1.7	17.7
1979			
1980	33.1	1.9	17.9
1981	4.1	0.3	16.4
1982	20.5	1.1	18.6
1983	10.2	0.6	17.3
1984			
1985	26.7	1.6	17.2
1986	52.0	2.8	18.4
1987	124.0	7.7	16.1
1988	134.7	5.6	24.1
1989	311.0	16.7	18.6
1990	309.4	9.0	34.3
1991	400.5	9.8	41.0
1992	452.9	14.8	30.6
1993	399.7	10.7	37.5
1994	467.6	13.5	34.6
1995	446.7	13.5	33.0
1996	459.8	13.6	33.9
1997	435.4	16.2	26.9
1998	463.1	17.8	26.1
1999	498.7	20.8	24.0
2000	459.2	19.2	23.9
2001	368.2	17.5	21.1
2002	310.6	16.5	18.8
2003	295.8	12.5	23.6
2004	318.7	12.2	26.2
2005	365.1	15.0	24.3
2006	392.9	16.7	23.5

Table 6.3 : Bay of Biscay Sole - 2006
French and Belgian relative length distribution of landings

Length(cm)	France	Belgium
15	0.00	0.00
16	0.00	0.00
17	0.00	0.00
18	0.00	0.00
19	0.00	0.00
20	0.00	0.00
21	0.00	0.00
22	0.07	0.06
23	1.42	1.33
24	4.60	3.48
25	7.76	4.88
26	9.18	6.35
27	10.48	8.72
28	9.97	13.60
29	9.83	13.92
30	9.82	14.22
31	8.62	8.39
32	5.88	9.16
33	4.49	4.82
34	3.31	3.72
35	2.59	2.08
36	2.29	1.64
37	2.04	1.29
38	1.50	0.94
39	1.40	0.57
40	1.05	0.47
41	0.86	0.26
42	0.70	0.00
43	0.59	0.10
44	0.48	0.00
45	0.30	0.00
46	0.25	0.00
47	0.12	0.00
48	0.13	0.00
49	0.09	0.00
50	0.07	0.00
51	0.02	0.00
52	0.04	0.00
53	0.01	0.00
54	0.00	0.00
55	0.03	0.00
Total	100.00	100.00

Table 6.4 : Bay of Biscay Sole, Catch number at age (in thousands)

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Age											
2	5901	8493	6126	3794	4962	4918	7122	4562	4640	1897	2603
3	3164	4606	4208	5634	5928	6551	6312	6302	7279	7816	5502
4	2786	2479	2673	3578	4191	3802	4423	4512	4920	6879	8803
5	2034	1962	2301	2005	2293	3147	2833	2083	2991	3661	5040
6	1164	906	1512	1482	1388	2046	972	1113	2236	1625	1968
7	880	708	1044	690	874	967	1018	1063	1124	566	970
+gp	1181	729	1235	714	766	499	870	981	951	708	696
TOTALNUM	17110	19883	19099	17897	20402	21930	23550	20616	24141	23152	25582
TONSLAND	4038	4251	4805	5086	5382	5845	5916	5569	6550	6420	7227
SOPCOF %	107	103	102	102	101	101	100	102	100	100	100

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Age												
2	3249	3027	3801	4096	2851	5677	3004	5192	4213	3396	4038	3159
3	5663	5180	9079	5550	5113	7015	6447	4770	6315	5391	3365	3917
4	6356	5409	5380	6351	4870	5143	4942	4945	2246	3300	3537	3583
5	3644	2343	3063	2306	2764	2542	1807	3095	1225	920	2183	1916
6	1795	1697	1578	1237	1314	955	929	1261	730	662	905	968
7	843	1366	692	785	902	421	522	613	377	272	478	597
+gp	986	1319	877	1188	977	444	489	437	251	333	494	1056
TOTALNUM	22536	20341	24470	21513	18791	22197	18140	20313	15357	14274	15000	15196
TONSLAND	6205	5854	6259	5982	5249	5760	4828	5485	4106	3990	4455	4463
SOPCOF %	100	100	100	100	100	101	101	101	101	101	102	99

Table 6.5 : Bay of Biscay Sole, Catch weight at age (in kg)

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Age											
2	0.121	0.106	0.102	0.141	0.134	0.136	0.131	0.143	0.146	0.145	0.147
3	0.168	0.174	0.173	0.201	0.190	0.188	0.179	0.192	0.196	0.197	0.195
4	0.213	0.252	0.245	0.285	0.272	0.258	0.241	0.260	0.262	0.267	0.251
5	0.269	0.313	0.328	0.376	0.357	0.354	0.348	0.325	0.341	0.341	0.324
6	0.329	0.390	0.409	0.467	0.495	0.437	0.436	0.437	0.404	0.439	0.421
7	0.368	0.457	0.498	0.497	0.503	0.543	0.601	0.535	0.490	0.569	0.569
+gp	0.573	0.698	0.657	0.682	0.604	0.799	0.854	0.715	0.715	0.677	0.774
SOPCOFAC	1.0712	1.0302	1.0197	1.0248	1.008	1.0055	1.0039	1.0183	1.0004	1.0008	1.0014

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Age												
2	0.160	0.159	0.142	0.161	0.177	0.171	0.153	0.171	0.180	0.190	0.191	0.192
3	0.206	0.204	0.193	0.212	0.219	0.207	0.220	0.209	0.226	0.228	0.231	0.238
4	0.252	0.268	0.256	0.257	0.246	0.276	0.266	0.263	0.307	0.291	0.301	0.272
5	0.308	0.319	0.319	0.335	0.305	0.343	0.344	0.319	0.362	0.391	0.369	0.341
6	0.403	0.399	0.406	0.410	0.404	0.452	0.429	0.465	0.487	0.493	0.428	0.444
7	0.484	0.453	0.502	0.501	0.533	0.573	0.520	0.592	0.657	0.643	0.468	0.436
+gp	0.658	0.625	0.678	0.700	0.582	0.755	0.620	0.686	0.643	0.810	0.677	0.609
SOPCOFAC	1.0023	0.9998	1.0048	1.0015	1.0006	1.0066	1.0085	1.0117	1.0056	1.0062	1.0208	0.9918

Table 6.6 : Ressgasc indices of sole VIIIa,b abundance (No/100h)

FR - RESSGASC 2

Year	Age 1	2	3	4	5	6
1987	9	106	85	51	18	15
1988	215	557	228	95	47	17
1989	21	279	200	64	32	14
1990	7	441	129	73	34	4
1991	7	189	181	128	45	19
1992	0	78	139	116	42	19
1993	0	43	150	146	97	28
1994	3	218	166	133	38	10
1995	30	155	165	80	44	28
1996	18	359	504	266	53	30
1997	24	180	385	130	41	16
1998	1	375	338	311	82	31
1999	5	220	226	94	41	30
2000	2	153	156	126	48	13
2001	11	179	181	106	34	25
2002	4	132	140	62	35	10

FR - RESSGASC 4

Year	Age 1	2	3	4	5	6
1987	503	160	109	54	24	10
1988	212	152	79	25	14	11
1989	87	137	93	48	35	29
1990	67	390	203	77	49	10
1991	397	553	298	88	20	9
1992	107	860	283	65	25	9
1993	87	218	234	111	46	24
1994	99	333	272	128	44	6
1995	201	463	230	105	47	12
1996	323	513	221	96	27	8
1997	76	177	272	103	44	19
1998	75	371	396	224	33	18
1999	15	174	114	88	21	14
2000	23	74	79	66	36	7
2001	26	132	143	92	33	11
2002	54	164	146	51	36	19

Table 6.7 : Sole 8ab, available tuning data (landings)

SOLE VIIIa,b commercial landings (N in 10**-3) and survey catch - Fishing effort in hours

Series, year and range used in tuning are shown in bold type

FR - SABLES

Year	Fishing effort	1	**2**	**3**	**4**	**5**	**6**	**7**	8
1991	33763	30.5	**242.1**	**332.8**	**194.7**	**73.8**	**32.4**	**23.6**	19.5
1992	30445	3.7	**236.8**	**285.8**	**130.2**	**59.5**	**32.1**	**15.0**	11.9
1993	34273	3.7	**152.0**	**441.3**	**224.0**	**75.7**	**27.0**	**8.0**	10.9
1994	20997	1.2	**94.1**	**157.4**	**184.3**	**77.3**	**24.2**	**13.4**	10.8
1995	31759	7.3	**173.4**	**228.1**	**177.1**	**69.1**	**34.1**	**15.9**	19.5
1996	31518	13.0	**193.0**	**222.6**	**169.8**	**55.6**	**37.8**	**29.4**	23.2
1997	27040	5.0	**140.9**	**290.9**	**114.2**	**49.0**	**26.7**	**10.6**	11.4
1998	16260	0.8	**86.9**	**112.1**	**113.6**	**31.4**	**13.8**	**8.1**	7.7
1999	12528	0.0	**64.9**	**53.2**	**39.7**	**26.8**	**15.0**	**15.2**	17.6
2000	11271	3.4	**81.3**	**121.3**	**45.0**	**15.7**	**8.4**	**4.7**	4.7
2001	9459	2.4	**35.2**	**67.8**	**35.8**	**8.7**	**5.1**	**2.9**	2.0
2002	10344	7.2	**76.9**	**60.5**	**37.7**	**19.4**	**8.3**	**3.8**	1.7
2003	7354	1.5	**39.1**	**49.3**	**14.3**	**7.8**	**4.0**	**1.7**	0.6
2004	6909	2.7	**38.7**	**36.4**	**23.0**	**5.7**	**3.9**	**1.7**	1.8
2005	6571	11.2	**46.4**	**23.5**	**23.4**	**14.8**	**6.4**	**3.5**	3.2
2006	5235	7.4	**54.2**	**27.7**	**13.4**	**5.4**	**3.0**	**2.0**	3.6

FR - ROCHEL

Year	Fishing effort	1	**2**	**3**	**4**	**5**	**6**	**7**	8
1991	15250	14.7	**134.8**	**157.4**	**88.9**	**30.3**	**11.6**	**6.7**	5.5
1992	12491	0.8	**99.4**	**130.1**	**58.7**	**21.2**	**9.1**	**4.5**	2.8
1993	12146	0.6	**53.3**	**126.5**	**51.8**	**17.2**	**6.4**	**2.1**	2.0
1994	8745	0.7	**42.4**	**56.5**	**52.9**	**19.4**	**6.4**	**2.7**	1.5
1995	4260	1.9	**25.9**	**31.3**	**20.7**	**7.2**	**2.4**	**1.1**	1.1
1996	10124	10.6	**113.1**	**74.6**	**34.3**	**8.8**	**5.0**	**3.1**	2.8
1997	12491	3.8	**74.1**	**117.6**	**35.8**	**12.6**	**7.3**	**2.6**	2.6
1998	10841	1.6	**77.7**	**65.4**	**57.9**	**11.3**	**4.7**	**2.9**	2.8
1999	8311	0.0	53.7	31.6	19.0	10.1	6.4	**4.3**	2.1
2000	8334	3.6	**63.3**	**45.1**	**19.3**	**6.5**	**2.7**	**1.4**	2.6
2001	7074	2.1	**22.4**	**38.1**	**23.9**	**6.2**	**3.8**	**2.0**	1.9
2002	6957	9.1	**90.1**	**36.2**	**11.8**	**5.4**	**2.3**	**1.2**	0.4
2003	5028	2.2	**37.4**	**40.0**	**9.1**	**3.7**	**1.8**	**0.5**	0.2
2004	1899	1.0	**12.1**	**11.8**	**4.4**	**1.0**	**0.7**	**0.3**	0.4
2005	3292	2.5	**18.2**	**10.5**	**8.5**	**5.0**	**2.2**	**1.2**	1.3
2006	2059	0.9	**7.7**	**6.8**	**5.3**	**2.2**	**1.1**	**0.6**	1.1

FR - RESSGASC 2

Year	Fishing effort	1	**2**	**3**	**4**	**5**	**6**	**7**	8
1987	80	7.0	**84.9**	**67.7**	**40.9**	**14.1**	**11.8**	**2.0**	11.7
1988	85	182.9	**473.2**	**193.6**	**81.1**	**39.9**	**14.5**	**3.8**	2.0
1989	82	17.3	**228.9**	**163.6**	**52.8**	**26.6**	**11.3**	**9.5**	5.0
1990	85	6.2	**375.2**	**110.0**	**61.7**	**29.0**	**3.8**	**5.0**	2.0
1991	87	6.0	**164.2**	**157.1**	**111.7**	**39.3**	**16.5**	**6.2**	11.0
1992	85	0.0	**66.5**	**118.1**	**98.6**	**35.6**	**16.5**	**2.7**	11.0
1993	76	0.0	**32.7**	**113.6**	**111.3**	**73.9**	**21.4**	**11.5**	9.5
1994	79	2.7	**172.4**	**130.9**	**104.7**	**30.3**	**8.0**	**6.0**	4.0
1995	82	24.3	**126.8**	**135.3**	**65.7**	**35.8**	**22.7**	**19.0**	8.4
1996	74	13.0	**265.9**	**372.7**	**196.6**	**39.0**	**22.4**	**8.9**	8.5
1997	98	23.4	**176.4**	**377.7**	**127.7**	**40.4**	**15.6**	**8.8**	13.0
1998	85	0.6	**318.5**	**287.2**	**264.4**	**69.8**	**26.3**	**15.6**	3.6
1999	82	4.0	**180.3**	**185.5**	**77.4**	**33.2**	**24.3**	**7.2**	2.0
2000	78	1.4	**119.4**	**121.4**	**98.3**	**37.7**	**10.3**	**5.4**	5.0
2001	84	9.4	**150.2**	**152.2**	**89.4**	**28.5**	**21.1**	**11.0**	4.2
2002	47	2.0	**61.9**	**66.0**	**29.2**	**16.4**	**4.8**	**3.2**	1.5

FR - RESSGASC 4

Year	Fishing effort	1	**2**	**3**	**4**	**5**	**6**	**7**	8
1987	79	397.7	**126.7**	**86.1**	**42.4**	**18.8**	**7.8**	**2.5**	2.0
1988	93	197.6	**141.2**	**73.7**	**23.3**	**13.4**	**10.0**	**5.6**	1.2
1989	65	56.5	**89.1**	**60.2**	**31.5**	**22.5**	**18.8**	**5.5**	3.0
1990	72	48.5	**280.9**	**146.1**	**55.6**	**35.5**	**7.5**	**7.5**	7.5
1991	74	293.5	**409.1**	**220.2**	**64.8**	**14.6**	**6.6**	**2.7**	2.5
1992	72	76.7	**619.4**	**203.8**	**46.5**	**17.9**	**6.2**	**2.5**	3.0
1993	71	62.1	**155.1**	**166.2**	**79.1**	**32.5**	**17.0**	**1.0**	0.0
1994	60	59.2	**199.9**	**162.9**	**76.8**	**26.4**	**3.8**	**3.0**	7.0
1995	90	180.8	**416.7**	**206.9**	**94.3**	**42.0**	**11.2**	**3.9**	3.3
1996	61	196.8	**312.8**	**135.1**	**58.6**	**16.6**	**5.0**	**6.5**	6.5
1997	67	50.8	**118.7**	**182.5**	**69.3**	**29.7**	**13.0**	**8.1**	8.8
1998	73	55.0	**270.7**	**288.7**	**163.7**	**24.1**	**12.9**	**6.3**	4.6
1999	78	12.0	**135.8**	**88.6**	**68.3**	**16.5**	**10.9**	**6.3**	1.5
2000	38	8.6	**28.0**	**30.2**	**25.2**	**13.6**	**2.8**	**1.6**	1.0
2001	77	20.0	**101.3**	**109.8**	**70.6**	**25.3**	**8.4**	**1.7**	1.8
2002	68	36.4	**111.7**	**99.4**	**34.5**	**24.6**	**12.9**	**3.6**	1.7

BEL-BT

Year	Fishing effort	1	2	3	4	5	6	7	8
1997	10740		179.5	390.3	192.1	148.7	61.5	49.0	83.3
1998	11162		48.3	176.1	216.1	99.1	91.6	59.8	196.8
1999	14668		19.0	367.4	420.6	293.2	159.0	118.2	316.0
2000	11566		433.3	656.7	208.8	68.8	25.2	15.3	21.2
2001	13278		144.7	313.3	298.6	184.8	77.7	57.7	81.7
2002	12851		0.0	85.8	309.0	272.0	131.3	56.9	137.4
2003	11198		113.3	599.1	183.0	78.3	44.0	29.7	106.8
2004	12175		393.1	801.0	190.5	67.4	46.9	17.3	42.6
2005	15017		336.5	565.7	318.2	145.3	90.3	31.3	70.0
2006	16699		141.0	605.6	385.0	255.4	127.3	71.4	69.0

Table 6.8

```
Lowestoft VPA Version 3.1

   5/05/2007  13:06

 Extended Survivors Analysis

 SOLE VIIIa,b

 CPUE data from file tunfilt2.dat

 Catch data for  23 years. 1984 to 2006. Ages  2 to   8.

      Fleet,            First, Last, First, Last, Alpha,  Beta
                     ,    year, year,  age ,  age
 FR-SABLES            ,   1991, 2006,   2,     7,   .000,  1.000
 FR-ROCHELLE          ,   1991, 2006,   2,     7,   .000,  1.000
 FR-RESSGASC-2        ,   1987, 2006,   2,     7,   .270,   .500
 FR-RESSGASC-4        ,   1987, 2006,   2,     7,   .830,   .960


 Time series weights :

      Tapered time weighting not applied


 Catchability analysis :

      Catchability independent of stock size for all ages

      Catchability independent of age for ages >=    6


 Terminal population estimation :

      Survivor estimates shrunk towards the mean F
      of the final   5 years or the   3 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 =    .200

      Prior weighting not applied


 Tuning had not converged after   30 iterations


 Total absolute residual between iterations
 29 and  30 =     .00034

 Final year F values
 Age         ,      2,      3,      4,      5,      6,      7
 Iteration 29,  .1275,  .3771,  .7101,  .5665,  .4190,  .5665
 Iteration 30,  .1275,  .3771,  .7100,  .5665,  .4189,  .5664


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,  1997,  1998,  1999,  2000,  2001,  2002,  2003,  2004,  2005,  2006

      2,  .184,  .211,  .130,  .271,  .210,  .251,  .230,  .243,  .257,  .127
      3,  .510,  .394,  .391,  .476,  .495,  .526,  .484,  .456,  .359,  .377
      4,  .653,  .721,  .631,  .759,  .645,  .782,  .447,  .446,  .544,  .710
      5,  .548,  .574,  .710,  .708,  .582,  .985,  .393,  .295,  .530,  .566
      6,  .630,  .394,  .670,  .502,  .538,  .940,  .575,  .339,  .466,  .419
      7,  .650,  .659,  .493,  .413,  .501,  .733,  .724,  .386,  .388,  .566
```

Table 6.8 continued

XSA population numbers (Thousands)

YEAR	AGE 2	3	4	5	6	7
1997	2.38E+04	2.39E+04	1.18E+04	7.63E+03	3.55E+03	1.52E+03
1998	2.27E+04	1.79E+04	1.30E+04	5.55E+03	3.99E+03	1.71E+03
1999	2.45E+04	1.66E+04	1.09E+04	5.72E+03	2.83E+03	2.44E+03
2000	2.52E+04	1.95E+04	1.02E+04	5.27E+03	2.54E+03	1.31E+03
2001	1.67E+04	1.74E+04	1.09E+04	4.30E+03	2.35E+03	1.39E+03
2002	2.46E+04	1.23E+04	9.58E+03	5.19E+03	2.18E+03	1.24E+03
2003	2.15E+04	1.73E+04	6.55E+03	3.97E+03	1.75E+03	7.69E+02
2004	1.65E+04	1.55E+04	9.64E+03	3.79E+03	2.42E+03	8.93E+02
2005	1.87E+04	1.17E+04	8.87E+03	5.58E+03	2.56E+03	1.56E+03
2006	2.78E+04	1.31E+04	7.41E+03	4.66E+03	2.97E+03	1.45E+03

Estimated population abundance at 1st Jan 2007

0.00E+00	2.21E+04	8.13E+03	3.30E+03	2.39E+03	1.77E+03

Taper weighted geometric mean of the VPA populations:

2.52E+04	1.82E+04	1.11E+04	6.00E+03	3.16E+03	1.63E+03

Standard error of the weighted Log(VPA populations) :

.1992	.2332	.2512	.2394	.2379	.3371

1

Log catchability residuals.

Fleet : FR-SABLES

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2	99.99	99.99	99.99	99.99	-.22	-.12	-.37	-.40	-.07	-.19
3	99.99	99.99	99.99	99.99	.11	-.19	.16	-.11	-.18	-.03
4	99.99	99.99	99.99	99.99	.11	-.29	-.12	.34	.11	-.02
5	99.99	99.99	99.99	99.99	.15	-.11	-.06	.27	.03	-.09
6	99.99	99.99	99.99	99.99	-.05	.26	-.32	.10	-.20	.27
7	99.99	99.99	99.99	99.99	.22	.03	-.19	.21	.09	.45

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
2	-.10	-.02	-.16	.21	-.07	.25	.04	.36	.47	.40
3	.20	-.01	-.42	.39	.11	.27	.04	-.10	-.26	.03
4	-.02	.42	-.24	.12	-.06	.10	-.30	-.15	.05	-.03
5	-.21	.18	.31	-.03	-.30	.40	-.16	-.41	.31	-.27
6	.01	-.36	.45	.01	-.22	.43	.10	-.29	.26	-.45
7	-.05	.07	.53	.05	-.28	.12	.13	-.11	.11	-.07

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	2	3	4	5	6	7
Mean Log q	-15.0923	-14.5262	-14.4683	-14.7353	-14.7660	-14.7660
S.E(Log q)	.2673	.2085	.2021	.2465	.2860	.2272

Table 6.8 continued

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
2,	2.12,	-1.835,	20.67,	.16,	16,	.53,	-15.09,
3,	.93,	.370,	14.19,	.65,	16,	.20,	-14.53,
4,	.81,	1.309,	13.50,	.77,	16,	.16,	-14.47,
5,	.75,	1.485,	13.25,	.72,	16,	.18,	-14.74,
6,	1.40,	-1.022,	17.46,	.32,	16,	.40,	-14.77,
7,	.72,	2.903,	12.62,	.88,	16,	.12,	-14.68,

1

Fleet : FR-ROCHELLE

Age	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
2	99.99,	99.99,	99.99,	99.99,	-.09,	-.18,	-.46,	-.40,	-.05,	.33
3	99.99,	99.99,	99.99,	99.99,	.27,	.03,	.06,	-.15,	-.05,	.12
4	99.99,	99.99,	99.99,	99.99,	.40,	.08,	-.26,	.25,	.25,	-.20
5	99.99,	99.99,	99.99,	99.99,	.46,	.16,	-.09,	.17,	.19,	-.38
6	99.99,	99.99,	99.99,	99.99,	.20,	.37,	-.25,	.12,	-.37,	-.14
7	99.99,	99.99,	99.99,	99.99,	.23,	.20,	-.01,	-.04,	-.10,	-.19

Age	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006
2	-.06,	.20,	-.02,	.18,	-.32,	.73,	.29,	.41,	.15,	-.70
3	.18,	-.03,	-.41,	-.18,	-.06,	.27,	.33,	.18,	-.25,	-.32
4	-.13,	.42,	-.29,	-.15,	.11,	-.39,	-.09,	-.23,	.00,	.25
5	-.39,	-.02,	.16,	-.20,	.06,	-.07,	-.12,	-.45,	.33,	.17
6	-.03,	-.56,	.49,	-.35,	.26,	.02,	.16,	-.24,	.36,	-.04
7	-.21,	-.07,	.16,	-.38,	.12,	-.16,	-.23,	-.07,	.21,	.14

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age ,	2,	3,	4,	5,	6,	7
Mean Log q,	-15.0111,	-14.6426,	-14.7466,	-15.1478,	-15.2437,	-15.2437,
S.E(Log q),	.3640,	.2215,	.2576,	.2637,	.3002,	.1853,

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
2,	1.66,	-.941,	18.26,	.13,	16,	.61,	-15.01,
3,	.83,	.940,	13.82,	.69,	16,	.18,	-14.64,
4,	.87,	.604,	14.07,	.62,	16,	.23,	-14.75,
5,	.83,	.825,	14.05,	.63,	16,	.22,	-15.15,
6,	1.64,	-1.376,	19.90,	.25,	16,	.48,	-15.24,
7,	.82,	1.651,	13.82,	.85,	16,	.14,	-15.27,

1

Table 6.8 continued

Fleet : FR-RESSGASC-2

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2	-.53	1.07	.31	.67	-.34	-1.21	-1.48	.10	-.12	.49
3	-.80	.24	.08	-.44	-.19	-.69	-.59	-.22	-.25	1.03
4	-.75	-.16	-.49	-.34	.08	-.12	-.14	-.10	-.37	.74
5	-.84	-.04	-.34	-.25	.06	-.17	.60	-.52	-.10	.19
6	-.14	-.06	-.41	-1.47	.01	.22	.32	-.68	.12	.55
7	-.67	-.49	.33	-.37	-.41	-1.07	1.03	-.26	.97	.05

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
2	.04	.84	.19	-.14	.40	-.28	99.99	99.99	99.99	99.99
3	.57	.68	.35	-.15	.13	.23	99.99	99.99	99.99	99.99
4	.26	1.06	.01	.42	.13	-.22	99.99	99.99	99.99	99.99
5	-.21	.80	.12	.38	.18	.17	99.99	99.99	99.99	99.99
6	-.15	.31	.72	-.05	.69	.02	99.99	99.99	99.99	99.99
7	.14	.74	-.42	-.06	.54	.09	99.99	99.99	99.99	99.99

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

Age	2	3	4	5	6	7
Mean Log q	-9.4230	-9.0669	-9.0838	-9.3642	-9.5855	-9.5855
S.E(Log q)	.6826	.5122	.4558	.4089	.5412	.5982

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
2	5.60	-.858	5.97	.00	16	3.85	-9.42
3	-4.12	-2.082	13.34	.01	16	1.91	-9.07
4	.87	.221	9.13	.18	16	.41	-9.08
5	3.24	-1.441	10.67	.03	16	1.28	-9.36
6	2.84	-.964	12.29	.02	16	1.54	-9.59
7	3.34	-1.150	14.64	.02	16	1.97	-9.58

1

Fleet : FR-RESSGASC-4

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2	-.38	-.47	-.65	.32	.45	.91	-.17	.22	.70	.55
3	-.49	-.74	-.59	.07	.36	.05	-.09	.31	.12	.26
4	-.47	-1.25	-.53	.01	-.05	-.46	-.14	.27	.26	.01
5	-.32	-1.02	.03	.41	-.55	-.42	.15	-.03	.31	-.23
6	-.18	-.22	.73	-.42	-.50	-.02	.47	-.75	-.39	-.37
7	.13	.30	.48	.69	-.68	-.48	-.92	-.28	-.32	.41

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
2	-.23	.58	-.33	-1.09	-.15	-.28	99.99	99.99	99.99	99.99
3	.35	.91	-.26	-.70	.01	.41	99.99	99.99	99.99	99.99
4	.39	1.13	.28	.19	.34	.00	99.99	99.99	99.99	99.99
5	.13	.18	-.18	.43	.43	.70	99.99	99.99	99.99	99.99
6	.40	-.03	.33	-.35	.15	1.14	99.99	99.99	99.99	99.99
7	.79	.34	-.22	-.33	-.96	.24	99.99	99.99	99.99	99.99

Table 6.8 continued

```
 Mean log catchability and standard error of ages with catchability
 independent of year class strength and constant w.r.t. time


    Age ,         2,         3,         4,         5,         6,         7
 Mean Log q,   -9.0197,   -8.8876,   -9.0582,   -9.3019,   -9.5577,   -9.5577,
 S.E(Log q),     .5528,     .4578,     .5214,     .4402,     .5050,     .5519,



 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

  2,     .48,    1.441,      9.62,     .36,     16,     .26,   -9.02,
  3,    1.12,    -.173,      8.77,     .13,     16,     .53,   -8.89,
  4,     .96,     .048,      9.07,     .12,     16,     .52,   -9.06,
  5,    2.32,   -1.071,      9.99,     .04,     16,    1.02,   -9.30,
  6,    5.39,   -1.336,     15.90,     .01,     16,    2.65,   -9.56,
  7,     .78,     .474,      9.13,     .26,     16,     .44,   -9.61,
1


 Terminal year survivor and F summaries :

 Age  2   Catchability constant w.r.t. time and dependent on age

 Year class = 2004

 Fleet,                Estimated,    Int,       Ext,    Var,    N, Scaled,
Estimated
      ,                Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 FR-SABLES          ,     33057.,   .276,       .000,    .00,   1,  .634,     .087
 FR-ROCHELLE        ,     11008.,   .375,       .000,    .00,   1,  .342,     .241
 FR-RESSGASC-2      ,         1.,   .000,       .000,    .00,   0,  .000,     .000
 FR-RESSGASC-4      ,         1.,   .000,       .000,    .00,   0,  .000,     .000

   F shrinkage mean  ,     11139.,   1.50,,,,                         .024,     .239

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
     22107.,       .22,      .37,    3,   1.704,   .127


 Age  3   Catchability constant w.r.t. time and dependent on age

 Year class = 2003

 Fleet,                Estimated,    Int,       Ext,    Var,    N, Scaled,
Estimated
      ,                Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 FR-SABLES          ,      9680.,   .171,       .206,   1.21,   2,  .557,     .326
 FR-ROCHELLE        ,      6544.,   .196,       .196,   1.00,   2,  .432,     .451
 FR-RESSGASC-2      ,         1.,   .000,       .000,    .00,   0,  .000,     .000
 FR-RESSGASC-4      ,         1.,   .000,       .000,    .00,   0,  .000,     .000

   F shrinkage mean  ,      6280.,   1.50,,,,                         .011,     .466

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      8135.,       .13,      .14,    5,   1.089,   .377


1
```

Table 6.8 continued

Age 4 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
FR-SABLES ,	3154.,	.135,	.143,	1.06,	3,	.584,	.733
FR-ROCHELLE ,	3485.,	.161,	.192,	1.19,	3,	.405,	.682
FR-RESSGASC-2 ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FR-RESSGASC-4 ,	1.,	.000,	.000,	.00,	0,	.000,	.000
F shrinkage mean ,	4386.,	1.50,,,,				.012,	.575

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
3296.,	.10,	.10,	7,	.941,	.710

Age 5 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
FR-SABLES ,	2153.,	.128,	.082,	.64,	4,	.562,	.613
FR-ROCHELLE ,	2746.,	.150,	.050,	.33,	4,	.427,	.509
FR-RESSGASC-2 ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FR-RESSGASC-4 ,	1.,	.000,	.000,	.00,	0,	.000,	.000
F shrinkage mean ,	2434.,	1.50,,,,				.011,	.559

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
2392.,	.10,	.06,	9,	.614,	.566

1

Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 2000

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FR-SABLES ,	1639.,	.127,	.150,	1.18,	5,	.541,	.446
FR-ROCHELLE ,	1983.,	.145,	.129,	.88,	5,	.435,	.381
FR-RESSGASC-2 ,	1343.,	.704,	.000,	.00,	1,	.005,	.522
FR-RESSGASC-4 ,	1339.,	.570,	.000,	.00,	1,	.008,	.523
F shrinkage mean ,	1188.,	1.50,,,,				.010,	.574

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
1770.,	.09,	.09,	13,	.909,	.419

Table 6.8 continued

Age 7 Catchability constant w.r.t. time and age (fixed at the value for age) 6

Year class = 1999

Fleet,	Estimated,	Int,	Ext,	Var,	N,	Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	,	Weights,	F
FR-SABLES ,	688.,	.119,	.103,	.87,	6,	.478,	.602
FR-ROCHELLE ,	797.,	.125,	.109,	.87,	6,	.491,	.538
FR-RESSGASC-2 ,	991.,	.424,	.077,	.18,	2,	.010,	.453
FR-RESSGASC-4 ,	921.,	.365,	.271,	.74,	2,	.013,	.480
F shrinkage mean ,	744.,	1.50,,,,				.008,	.567

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
745.,	.09,	.06,	17,	.734,	.566

1
1

Table 6.9 : Bay of Biscay Sole, Fishing mortality (F) at age

Terminal Fs derived using XSA (With F shrinkage)

YEAR	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
AGE											
2	0.3159	0.3864	0.2624	0.1756	0.2166	0.2015	0.264	0.1427	0.1473	0.0826	0.1087
3	0.2811	0.3863	0.2988	0.3639	0.4026	0.4353	0.3807	0.3502	0.3155	0.3503	0.3228
4	0.4135	0.3299	0.3601	0.3964	0.4476	0.4329	0.5225	0.4558	0.4491	0.49	0.7386
5	0.4166	0.5084	0.5124	0.4452	0.4224	0.632	0.5908	0.4419	0.5499	0.6277	0.7174
6	0.3844	0.2935	0.8308	0.647	0.5605	0.7304	0.3579	0.4303	1.0765	0.5802	0.7315
7	0.4061	0.3784	0.57	1.0591	0.8989	0.8644	0.8956	0.7343	0.9166	0.779	0.7315
+gp	0.4061	0.3784	0.57	1.0591	0.8989	0.8644	0.8956	0.7343	0.9166	0.779	0.7315
0 FBAR 3- 6	0.3739	0.3795	0.5005	0.4631	0.4583	0.5577	0.463	0.4195	0.5977	0.5121	0.6276

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	FBAR **-**
AGE													
2	0.1547	0.1137	0.1837	0.2108	0.1305	0.2708	0.2096	0.2513	0.2304	0.2433	0.257	0.1275	0.2093
3	0.3231	0.3492	0.5096	0.3938	0.3911	0.4764	0.4947	0.5263	0.4845	0.4564	0.3591	0.3771	0.3975
4	0.6663	0.5152	0.6535	0.7212	0.631	0.7592	0.6446	0.7822	0.4469	0.4463	0.5437	0.71	0.5667
5	0.6933	0.4874	0.5478	0.5742	0.71	0.708	0.5823	0.985	0.3927	0.2945	0.5297	0.5665	0.4635
6	0.5326	0.7232	0.6302	0.3939	0.6704	0.5023	0.5378	0.9399	0.5751	0.3386	0.4657	0.4189	0.4078
7	0.7141	0.8955	0.6503	0.6592	0.4928	0.4127	0.5012	0.7328	0.7243	0.3857	0.388	0.5664	0.4467
+gp	0.7141	0.8955	0.6503	0.6592	0.4928	0.4127	0.5012	0.7328	0.7243	0.3857	0.388	0.5664	
0 FBAR 3- 6	0.5538	0.5188	0.5853	0.5208	0.6006	0.6115	0.5649	0.8083	0.4748	0.384	0.4745	0.5181	
1													

Table 6.10 : Bay of Biscay Sole, Stock number at age (start of year) **Numbers*10**-3**

Terminal Fs derived using XSA (With F shrinkage)

	YEAR	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	AGE											
	2	22906	27857	27899	24770	26782	28331	32271	36055	35603	25166	26566
	3	13576	15113	17127	19417	18804	19514	20957	22425	28284	27801	20967
	4	8649	9274	9293	11494	12210	11375	11425	12958	14297	18669	17721
	5	6276	5176	6033	5866	6997	7062	6676	6131	7433	8256	10349
	6	3835	3744	2817	3270	3401	4150	3396	3346	3566	3881	3988
	7	2772	2363	2526	1110	1549	1757	1809	2148	1969	1100	1966
	+gp	3706	2424	2973	1139	1347	900	1534	1970	1653	1366	1401
0	TOTAL	61719	65950	68669	67067	71091	73088	78068	85033	92805	86238	82957

	YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	GMST 84-**	AMST 84-**
	AGE															
	2	23833	29601	23807	22660	24503	25161	16701	24566	21521	16530	18731	(27752)	0	25400	25861
	3	21562	18474	23904	17926	16607	19459	17366	12255	17290	15466	11726	13108	(22107)	18856	19252
	4	13738	14123	11789	12993	10941	10163	10935	9581	6551	9637	8866	7410	8135	11482	11801
	5	7661	6385	7634	5550	5716	5267	4304	5193	3965	3791	5581	4658	3296	6099	6272
	6	4570	3466	3548	3994	2828	2543	2348	2176	1755	2423	2555	2973	2392	3202	3288
	7	1736	2427	1522	1710	2437	1309	1392	1241	769	893	1562	1451	1770	1644	1738
	+gp	2018	2326	1917	2572	2628	1375	1298	879	509	1090	1609	2554	2057		
0	TOTAL	75118	76802	74121	67404	65660	65277	54344	55890	52360	49830	50631	59905	39757		

( ) age 2 replaced by GM 93-2005 = 22716

( ) age 3 replaced by GM e-(F04-05+M) = 16005

Table 6.11 : Bay of Biscay Sole, Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECI Age 2	TOTALBIO	TOTSPBIC	LANDINGS	YIELD/SSE	FBAR 3- 6
1984	22906	12988	10661	4038	0.3788	0.3739
1985	27857	13771	11246	4251	0.378	0.3795
1986	27899	14428	11921	4805	0.4031	0.5005
1987	24770	15733	12596	5086	0.4038	0.4631
1988	26782	16257	13110	5382	0.4105	0.4583
1989	28331	16443	13111	5845	0.4458	0.5577
1990	32271	16933	13338	5916	0.4435	0.463
1991	36055	18843	14504	5569	0.384	0.4195
1992	35603	20609	16020	6550	0.4089	0.5977
1993	25166	20180	16618	6420	0.3863	0.5121
1994	26566	19677	16193	7227	0.4463	0.6276
1995	23833	18086	14634	6205	0.424	0.5538
1996	29601	18233	14278	5854	0.41	0.5188
1997	23807	16952	13778	6259	0.4543	0.5853
1998	22660	16941	13714	5982	0.4362	0.5208
1999	24503	16380	12732	5249	0.4123	0.6006
2000	25161	15880	12185	5760	0.4727	0.6115
2001	16701	13301	10827	4828	0.4459	0.5649
2002	24566	13287	9920	5485	0.5529	0.8083
2003	21521	12915	9556	4106	0.4297	0.4748
2004	16530	13605	10786	3990	0.3699	0.384
2005	18731	13929	10955	4455	0.4067	0.4745
2006	27752	15560	11346	4463	0.3934	0.5181
Arith. Mean	25634	16127	12784	5379	0.4216	0.5204
0 Units	(Thousands	(Tonnes)	(Tonnes)	(Tonnes)		
1 GM 93-2005 :	22716					

Table 6.12 Multifleet prediction input data

Sole in Bay of Biscay
Multi fleet input data

MFDP version 1a
Run: Sole_8_stq_unsc
Time and date: 00:07 12/05/2007
Fbar age range (Total) : 3-6
Fbar age range Fleet 1 : 3-6

Input Fs are 2003-2004 means at age 2
Input Fs are 2003-2005 means at age 3 to 8
Catch and stock wts are 2003-2005 means
Recruits are 1993-2004 GM

2007

Age	N	M	Mat	PF	PM	Stock Wt	F Landings	Landing WT
2	22716	0.1	0.32	0	0	0.191	0.2502	0.179
3	16005	0.1	0.83	0	0	0.232	0.3975	0.218
4	8135	0.1	0.97	0	0	0.288	0.5667	0.270
5	3296	0.1	1	0	0	0.367	0.4636	0.344
6	2392	0.1	1	0	0	0.455	0.4077	0.426
7	1770	0.1	1	0	0	0.516	0.4467	0.483
8	2057	0.1	1	0	0	0.699	0.4467	0.655

2008

Age	N	M	Mat	PF	PM	Stock Wt	F Landings	Landing WT
2	22716	0.1	0.32	0	0	0.191	0.2502	0.179
3		0.1	0.83	0	0	0.232	0.3975	0.218
4		0.1	0.97	0	0	0.288	0.5667	0.270
5		0.1	1	0	0	0.367	0.4636	0.344
6		0.1	1	0	0	0.455	0.4077	0.426
7		0.1	1	0	0	0.516	0.4467	0.483
8		0.1	1	0	0	0.699	0.4467	0.655

2009

Age	N	M	Mat	PF	PM	Stock Wt	F Landings	Landing WT
2	22716	0.1	0.32	0	0	0.191	0.2502	0.179
3		0.1	0.83	0	0	0.232	0.3975	0.218
4		0.1	0.97	0	0	0.288	0.5667	0.270
5		0.1	1	0	0	0.367	0.4636	0.344
6		0.1	1	0	0	0.455	0.4077	0.426
7		0.1	1	0	0	0.516	0.4467	0.483
8		0.1	1	0	0	0.699	0.4467	0.655

Table 6.13 : Bay of Biscay Sole Multifleet prediction, management option table

MFDP version 1a
Run: Sole_8_stq_unsc
Time and date: 00:07 12/05/2007
Fbar age range (Total) : 3-6
Fbar age range Fleet 1 : 3-6

2007

Biomass	SSB	Landings FMult	Landings FBar	Yield
15048	11395	1.0000	0.4589	4343

2008

Biomass	SSB	Landings FMult	Landings FBar	Landing Yield	2009 Biomass	SSB
15536	11870	0.0000	0.0000	0	21422	17535
.	11870	0.1000	0.0459	544	20750	16887
.	11870	0.2000	0.0918	1066	20106	16267
.	11870	0.3000	0.1377	1566	19489	15674
.	11870	0.4000	0.1836	2046	18898	15106
.	11870	0.5000	0.2294	2506	18332	14562
.	11870	0.6000	0.2753	2947	17789	14041
.	11870	0.7000	0.3212	3370	17269	13543
.	11870	0.8000	0.3671	3776	16771	13065
.	11870	0.9000	0.4130	4165	16293	12607
.	11870	1.0000	0.4589	4539	15835	12169
.	11870	1.1000	0.5048	4897	15396	11749
.	11870	1.2000	0.5507	5242	14976	11346
.	11870	1.3000	0.5965	5572	14572	10961
.	11870	1.4000	0.6424	5889	14185	10591
.	11870	1.5000	0.6883	6194	13814	10236
.	11870	1.6000	0.7342	6486	13457	9897
.	11870	1.7000	0.7801	6767	13116	9571
.	11870	1.8000	0.8260	7037	12788	9259
.	11870	1.9000	0.8719	7296	12473	8959
.	11870	2.0000	0.9178	7545	12171	8672

Bpa = 13000 t
F<= 0.41 according to agreed management plan
Fpa = 0.42

Input units are thousands and kg - output in tonnes

Table 6.14 : Bay of Biscay sole

Detailed predictions

MFDP version 1a
Run: Sole_8_stq_unsc
Time and date: 00:07 12/05/2007
Fbar age range (Total) : 3-6
Fbar age range Fleet 1 : 3-6

Year: 2007 F multiplier: 1 Fleet1 HCFba 0.4589

Age	Landings F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
2	0.2502	4795	858	22716	4339	7269	1388	7269	1388
3	0.3975	5013	1091	16005	3718	13284	3086	13284	3086
4	0.5667	3365	908	8135	2343	7891	2273	7891	2273
5	0.4636	1168	401	3296	1210	3296	1210	3296	1210
6	0.4077	765	326	2392	1088	2392	1088	2392	1088
7	0.4467	609	294	1770	913	1770	913	1770	913
8	0.4467	708	463	2057	1437	2057	1437	2057	1437
Total		16422	4343	56371	15048	37959	11395	37959	11395

Year: 2008 F multiplier: 1 Fleet1 HCFba 0.4589

Age	Landings F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
2	0.2502	4795	858	22716	4339	7269	1388	7269	1388
3	0.3975	5012	1091	16004	3718	13284	3086	13284	3086
4	0.5667	4025	1087	9731	2803	9440	2719	9440	2719
5	0.4636	1480	509	4177	1533	4177	1533	4177	1533
6	0.4077	600	256	1876	854	1876	854	1876	854
7	0.4467	495	239	1440	742	1440	742	1440	742
8	0.4467	762	499	2215	1548	2215	1548	2215	1548
Total		17170	4539	58160	15536	39700	11870	39700	11870

Year: 2009 F multiplier: 1 Fleet1 HCFba 0.4589

Age	Landings F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
2	0.2502	4795	858	22716	4339	7269	1388	7269	1388
3	0.3975	5012	1091	16004	3718	13284	3086	13284	3086
4	0.5667	4025	1087	9731	2803	9439	2719	9439	2719
5	0.4636	1771	608	4996	1834	4996	1834	4996	1834
6	0.4077	760	324	2377	1082	2377	1082	2377	1082
7	0.4467	389	188	1129	582	1129	582	1129	582
8	0.4467	728	477	2116	1478	2116	1478	2116	1478
Total		17479	4633	59070	15835	40610	12169	40610	12169

Input units are thousands and kg - output in tonnes

Table 6.15 Sole in VIIIa,b

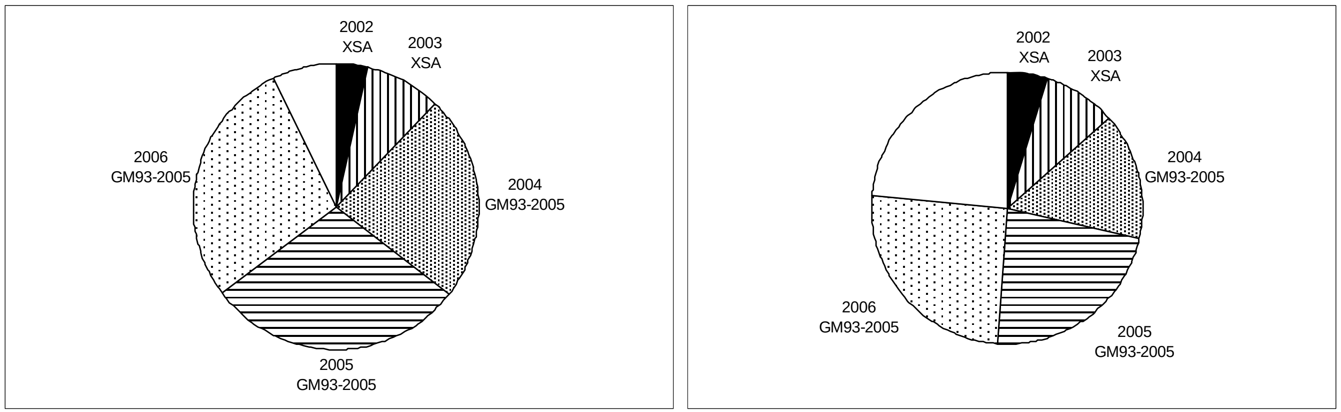
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class	2002	2003	2004	2005	2006
Stock No. (thousands) of 2 year-olds	16530	18731	22716	22716	22716
Source	XSA	XSA	GM93-2005	GM93-2005	GM93-2005
Status Quo F:					
% in 2007 landings	7.1	20.5	30.5	29.2	-
% in 2008	3.5	8.6	23.4	29.2	27.9
% in 2007 SSB	10.6	19.9	27.1	12.2	-
% in 2008 SSB	7.2	12.9	22.9	26.0	11.7
% in 2009 SSB	4.8	8.9	15.1	22.3	25.4

GM : geometric mean recruitment

Sole in VIIIa,b : Year-class % contribution to

a) 2008 landings **b) 2009 SSB**



XSA	XSA	GM93-2005	GM93-2005	GM93-2005
2002	2003	2004	2005	2006

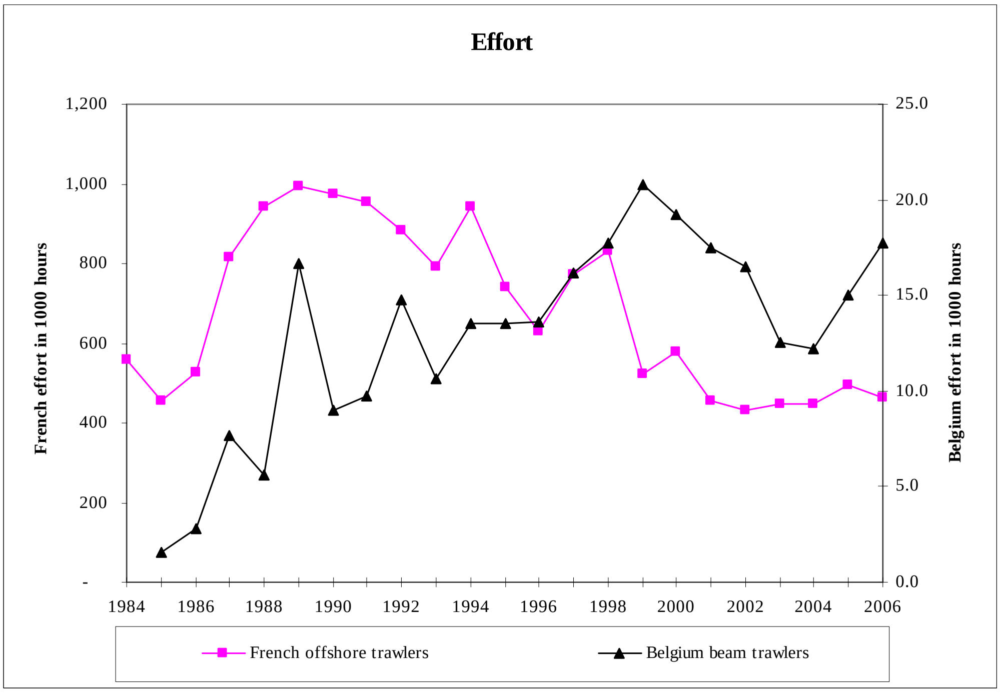
Table 6.16 : Bay of Biscay Sole Multifleet Yield per recruit

MFYPR version 2a
Run: Sole_8_stq_unsc_
Time and date: 10:20 12/05/2007
Yield per results

Landings FMult	Landings Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0.0000	0.0000	0.0000	0.0000	10.5083	5.5559	9.6499	5.3832	9.6499	5.3832
0.1000	0.0459	0.2984	0.1371	7.5281	3.5795	6.6750	3.4081	6.6750	3.4081
0.2000	0.0918	0.4558	0.1917	5.9572	2.5750	5.1093	2.4049	5.1093	2.4049
0.3000	0.1377	0.5531	0.2148	4.9883	1.9804	4.1453	1.8115	4.1453	1.8115
0.4000	0.1836	0.6191	0.2239	4.3317	1.5946	3.4935	1.4270	3.4935	1.4270
0.5000	0.2294	0.6668	0.2263	3.8577	1.3285	3.0242	1.1619	3.0242	1.1619
0.6000	0.2753	0.7029	0.2254	3.4998	1.1364	2.6708	0.9710	2.6708	0.9710
0.7000	0.3212	0.7312	0.2230	3.2200	0.9930	2.3953	0.8286	2.3953	0.8286
0.8000	0.3671	0.7540	0.2199	2.9954	0.8828	2.1748	0.7195	2.1748	0.7195
0.9000	0.4130	0.7727	0.2166	2.8110	0.7963	1.9945	0.6339	1.9945	0.6339
1.0000	0.4589	0.7884	0.2134	2.6570	0.7269	1.8443	0.5655	1.8443	0.5655
1.1000	0.5048	0.8018	0.2103	2.5263	0.6705	1.7174	0.5100	1.7174	0.5100
1.2000	0.5507	0.8133	0.2074	2.4140	0.6237	1.6088	0.4641	1.6088	0.4641
1.3000	0.5965	0.8234	0.2048	2.3164	0.5846	1.5147	0.4259	1.5147	0.4259
1.4000	0.6424	0.8322	0.2025	2.2308	0.5514	1.4325	0.3935	1.4325	0.3935
1.5000	0.6883	0.8400	0.2003	2.1550	0.5230	1.3600	0.3659	1.3600	0.3659
1.6000	0.7342	0.8471	0.1984	2.0873	0.4984	1.2955	0.3420	1.2955	0.3420
1.7000	0.7801	0.8534	0.1967	2.0266	0.4769	1.2379	0.3213	1.2379	0.3213
1.8000	0.8260	0.8591	0.1951	1.9717	0.4580	1.1860	0.3031	1.1860	0.3031
1.9000	0.8719	0.8643	0.1937	1.9218	0.4412	1.1390	0.2871	1.1390	0.2871
2.0000	0.9178	0.8691	0.1924	1.8763	0.4263	1.0963	0.2728	1.0963	0.2728

Reference point	F multiplier	Absolute F
Fleet1 Landings Fbar(3-6)	1.0000	0.4589
FMax	0.5125	0.2352
F0.1	0.2528	0.1160
F35%SPR	0.2850	0.1308

Weights in kilograms



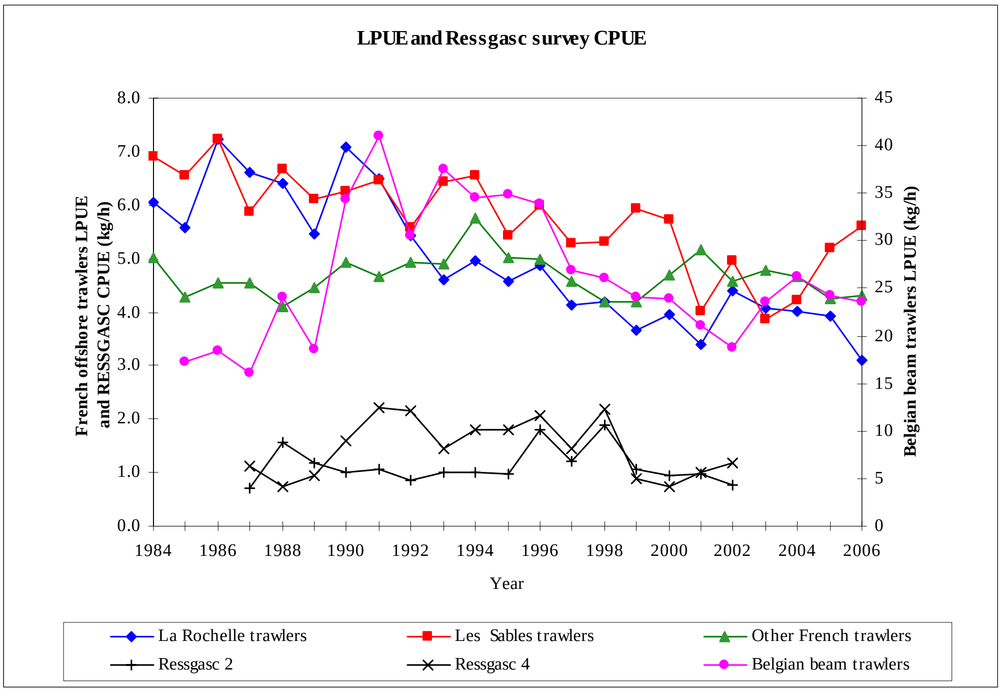


Figure 6.1 : Bay of Biscay sole (Division VIIIa,b)

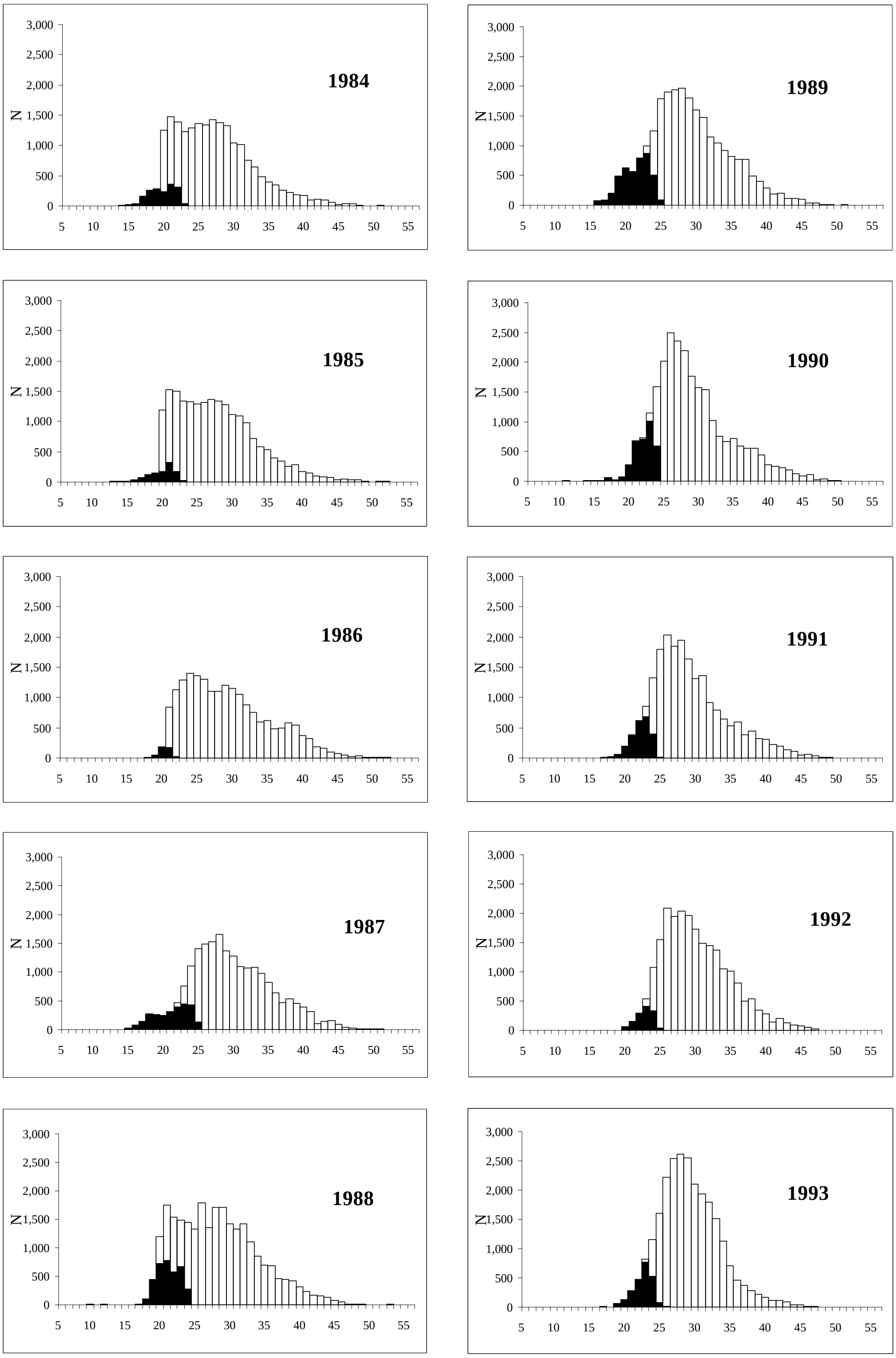


Figure 6.2 a : Bay of Biscay sole French length distribution from 1984 to 1993

Total French landings

Discard estimates of the French offshore trawlers fleet

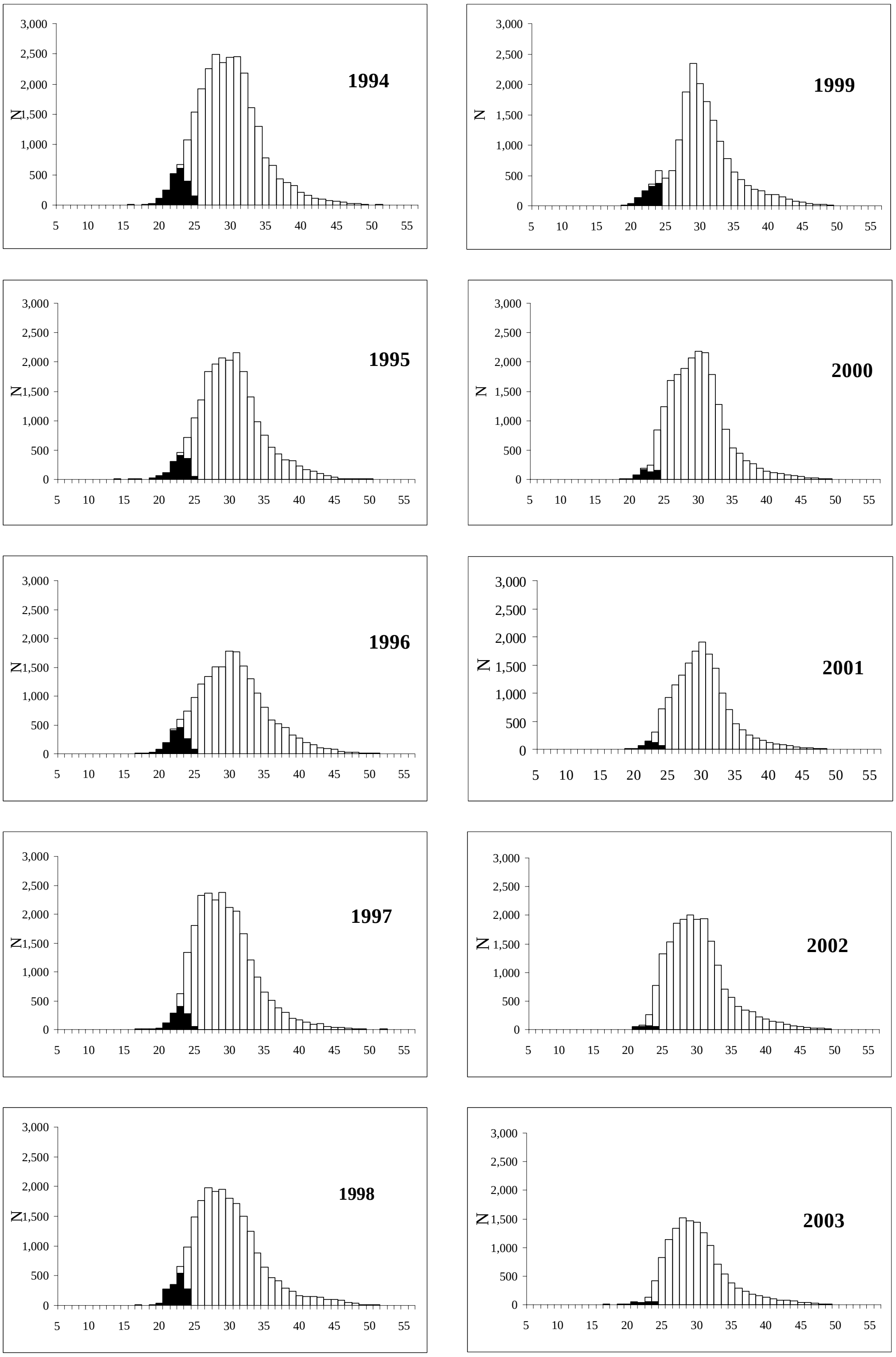


Figure 6.2 b : Bay of Biscay sole French length distribution from 1994 to 2003

Total French landings

Discard estimates of the French offshore trawler fleet (1994 to 2003)

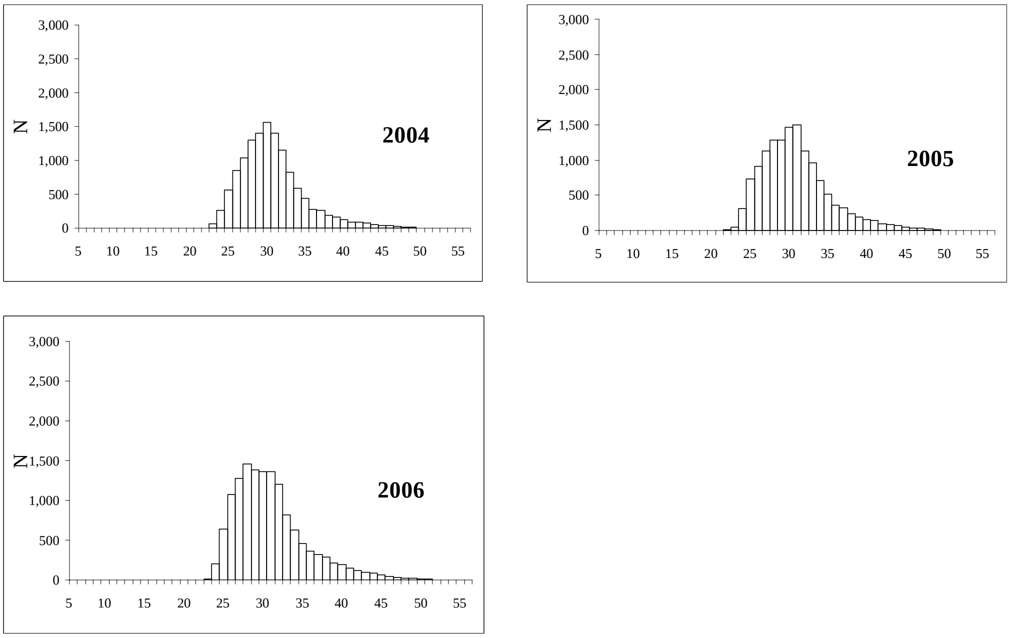


Figure 6.2 c : **Bay of Biscay sole French length distribution from 2004 to 2006**

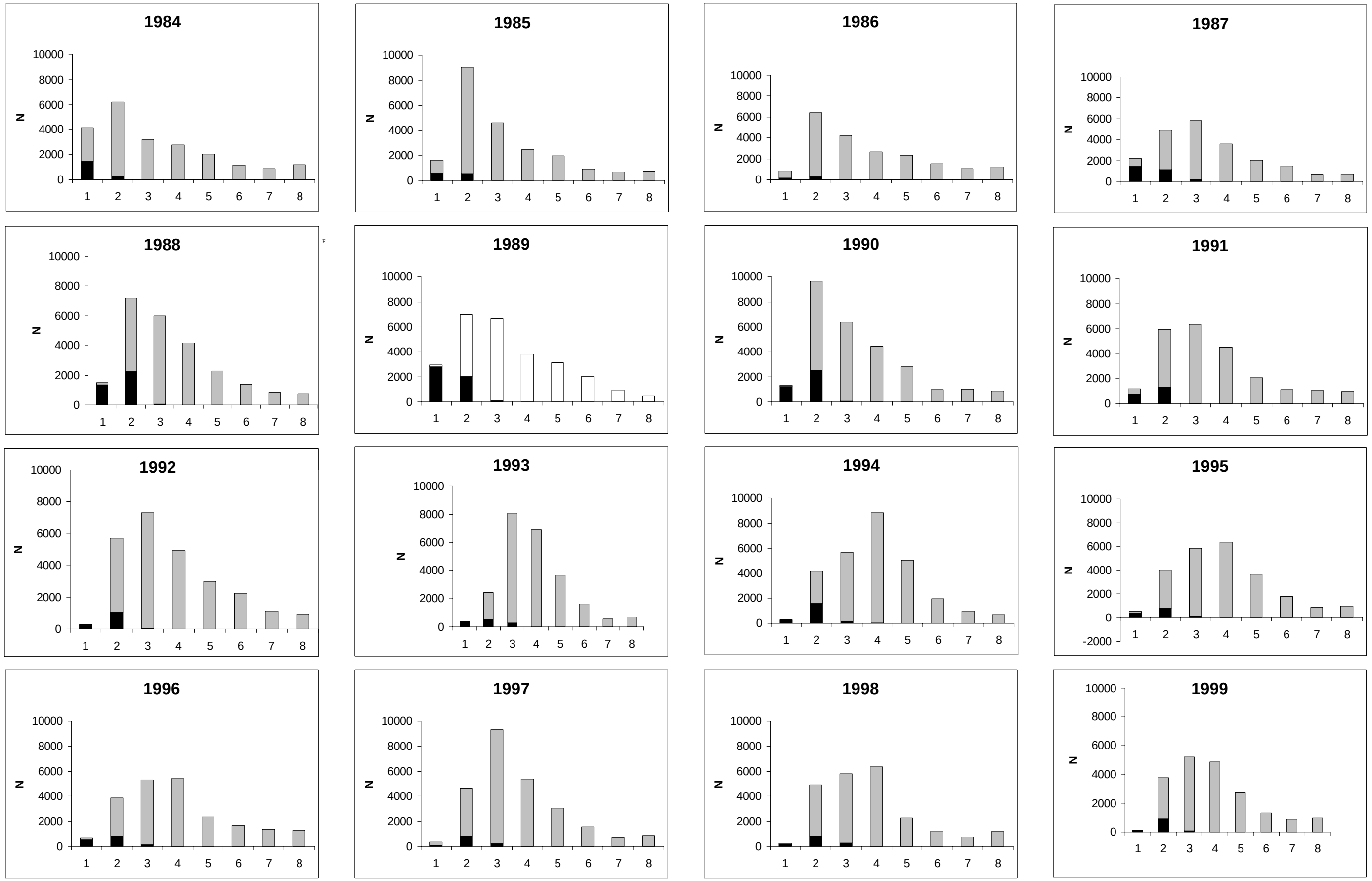


Figure 6.3 a : Bay of Biscay sole landings and discards age distributions from 1984 to 1999 (numbers in thousands)

Total landings

Discard estimates of the French offshore trawlers fleet

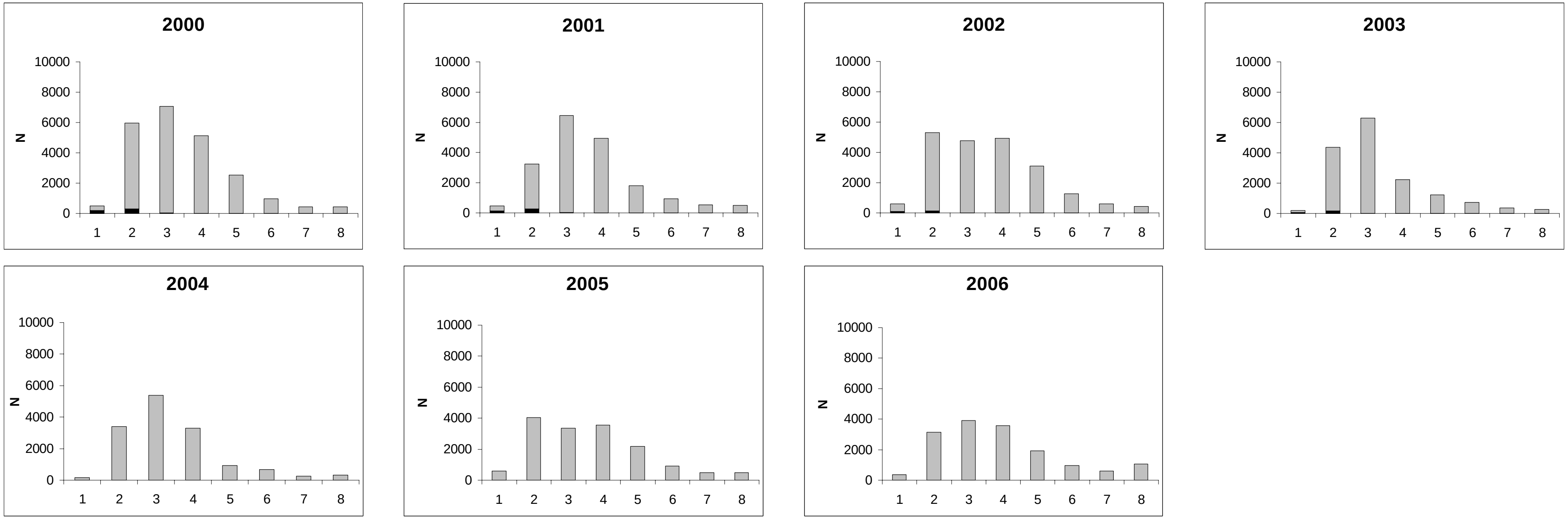


Figure 6.3 b : **Bay of Biscay sole landings and discards age distributions from 2000 to 2004 ; landings age distribtion since 2004 (numbers in thousands)**

Total landings

Discard estimates of the French offshore trawlers fleet

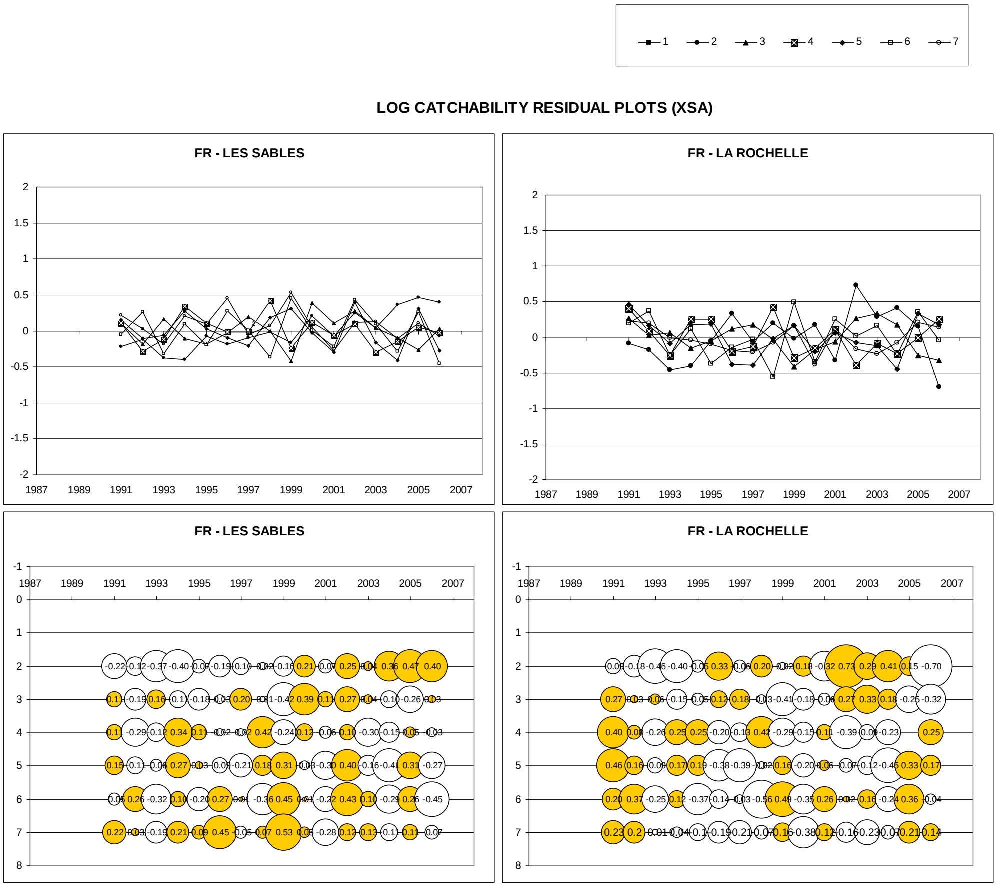


Figure 6.4 a : Bay of Biscay sole (Division VIIIa,b) - XSA (No Taper, mean q, s.e. shrink = 1.5, s.e. min =

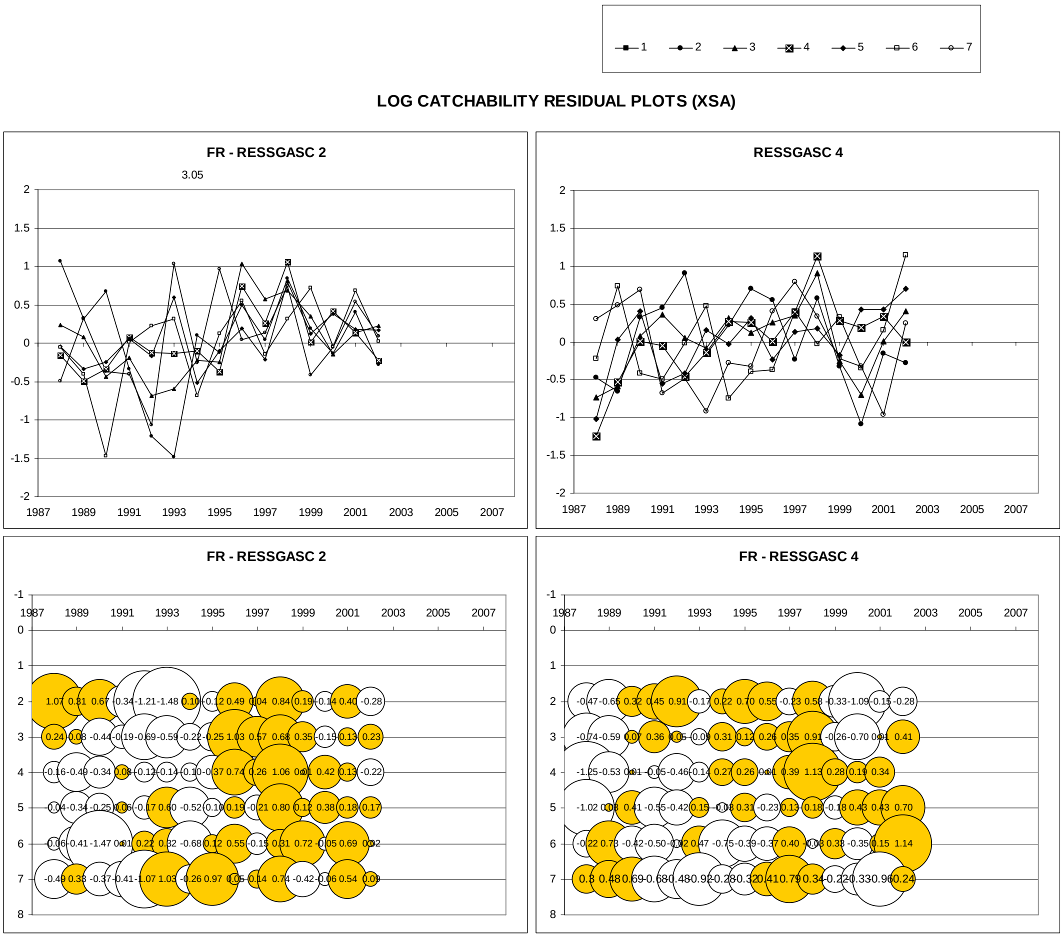
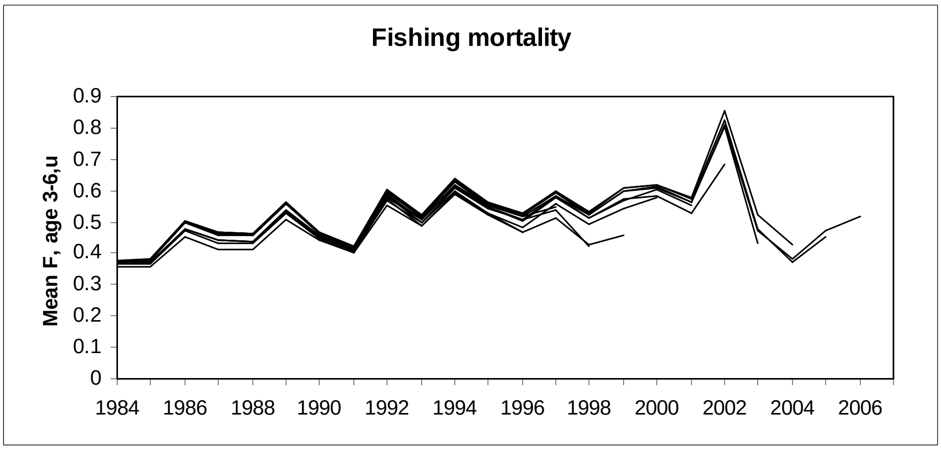
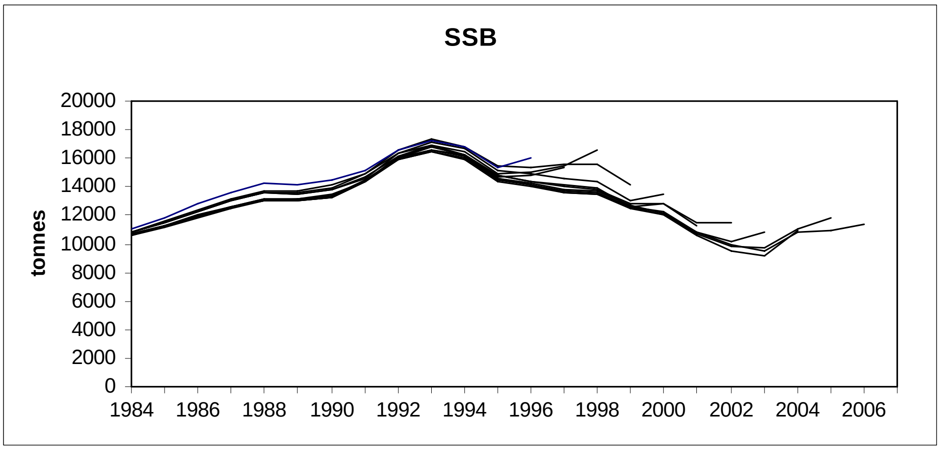


Figure 6.4 b : Bay of Biscay sole (Division VIIIa,b) - XSA (No Taper, mean q, s.e. shrink = 1.5, s.e. m





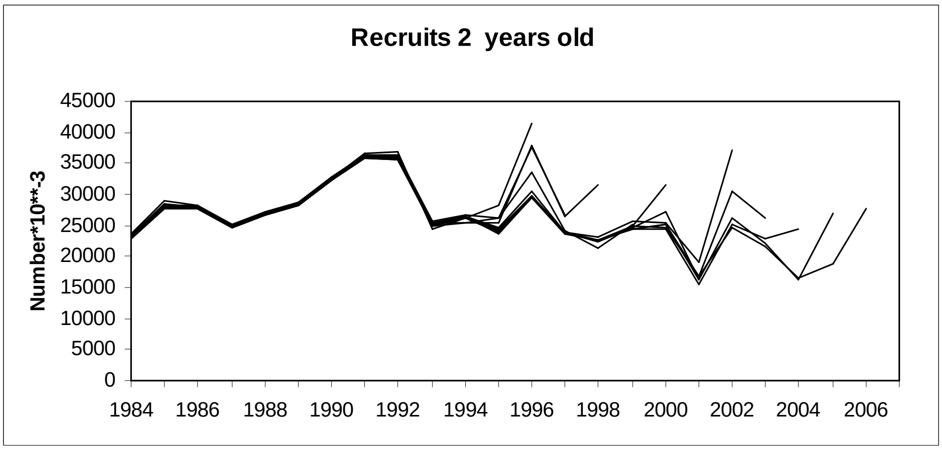
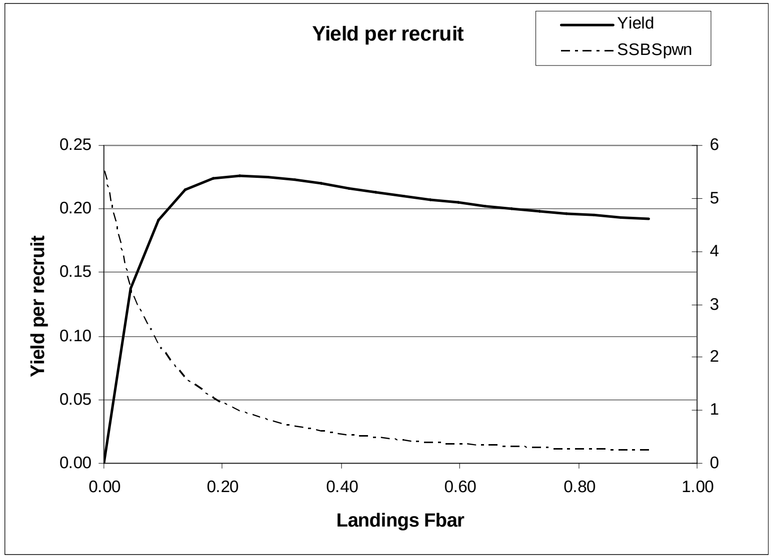
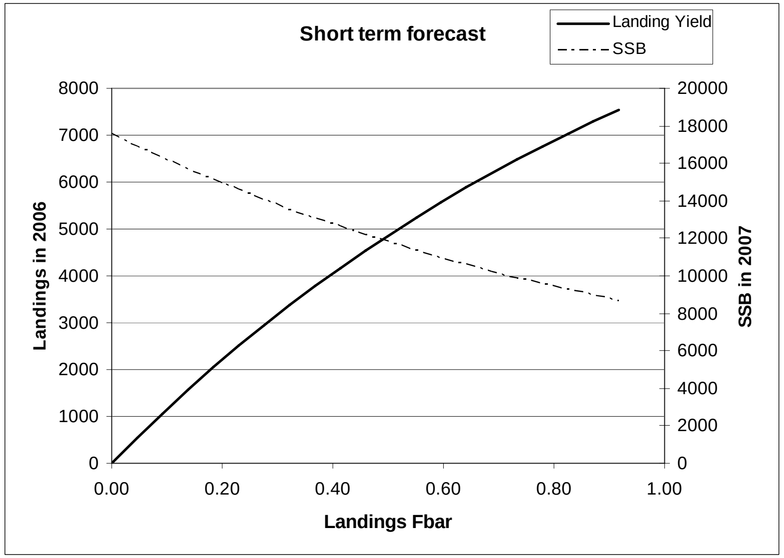


Figure 6.5 : Bay of Biscay sole (Division VIIIa,b) - Retrospective results
(No taper, q indep. stock size all ages, q indep. of age>=6, shr.=1.5)

Figure 6.6 **Sole in Division VIIIa,b (Bay of Biscay)**





MFYPR version 2a
Run: Sole_8_stq_unsc_
Time and date: 10:20 12/05/2007

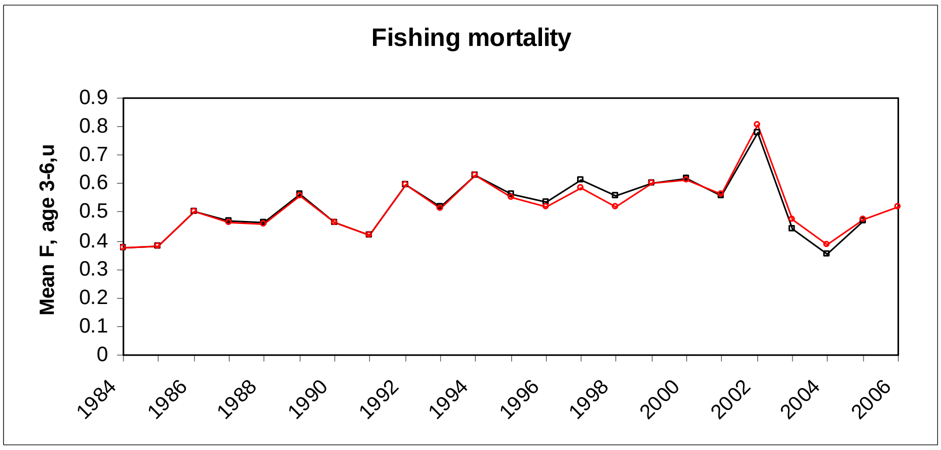
Reference point	F multiplier	Absolute F
Fleet1 Landings Fbar(3-6)	1.0000	0.4589
FMax	0.5125	0.2352
F0.1	0.2528	0.1160
F35%SPR	0.2850	0.1308

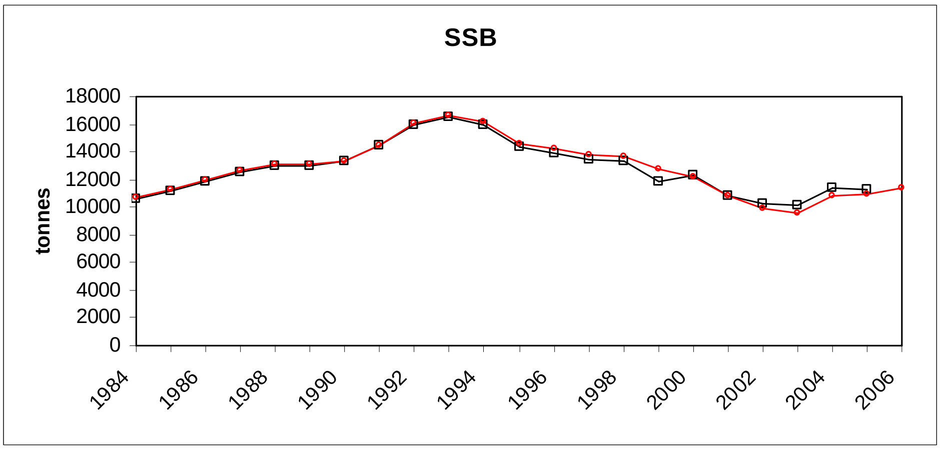
Weights in kilograms

MFDP version 1a
Run: Sole_8_stq_unsc
Time and date: 00:07 12/05/2007
Fbar age range (Total) : 3-6
Fbar age range Fleet 1 : 3-6

Input units are thousands and kg - output in tonnes

Figure 6.7 : Bay of Biscay sole





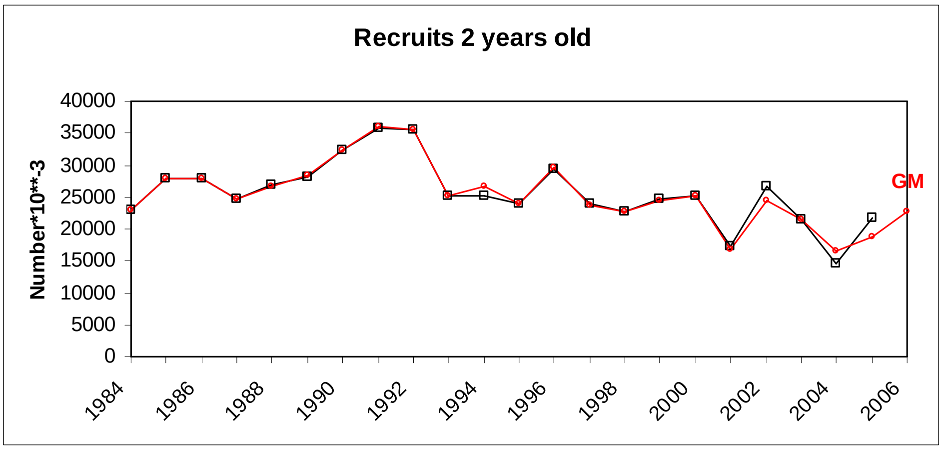


Figure 6.8 : Bay of Biscay sole (Division VIIIa,b) - WG07 / WG06 comparaison

7 Southern Stock of Hake

ICES ACFM Review Group of HMM (ICES, 2006) had some concerns about Hake growth, for the Southern as well as for the Northern stock. This year no further information about growth studies were presented to the WG and the available information at present do not let us present a clear conclusion.

The Review Group was discontent with the WG option of using the Cadiz survey to tune Southern hake assessment. Also, the RGHMM asked the WG to demonstrate the differences between the WGHMM06 Southern hake assessment and the same assessment without the Cadiz Autumn Groundfish survey. Morgado *et al.* (2007, WD11) shows the F, SSB and recruitment estimates obtained with and without the Cadiz Autumn Groundfish Survey as tuning fleet. The two assessments have very similar results (see Annex H). The decision to include the Cadiz Autumn Groundfish survey last year was based on the reduction of errors in the survivors and in the fact that as it is managed at present as a stock unit there is no reason to split it. The RG suggested the possibility of performing a full assessment with the Cadiz catch data, but an historic series of catch data is not available at the same level than the rest of the stock so it was not possible to combined catch data for the whole time series.

The RG suggested that the WG presents a revision of the full time series of Portuguese survey taking into account the calibration of RV *Capricórnio* for 4 years. This work was not ready at the WG time and it is expected to be next year.

The RG noted an inconsistency between the exclusion and acceptance of year classes for the recruit index (Northern hake: 2004 excluded, Southern hake: 2004 included). This decision was based on abundance indices and models results for each stock, particularly in the consistency of these values at age 1 the following year. This year the South hake recruitment for 2005 was also accepted.

Regarding the question about a shift of 1 year in strong year class: in section 1.2 the two hake stock recruitment estimates are plotted together and it can be see that after 1992 the two stocks have the same recruitment trend except for 2004. In 2004 an otolith workshop (Piñeiro and Sainza, 2005) was carried out and Northern and Southern stock age readers showed an acceptable precision level for ages younger than 3 year old. No differences between the two stock otoliths pattern were detected till now.

The RG suggested a PA reference points review on the basis of the inconsistencies among F and Biomass reference points. This year the uncertainty in stock estimates was considered for the first time. The WG considers the reference points, particularly the Biomass reference points, may need revision. The WG proposes to examine this in detailed next year.

Two major data revisions were considered this year: (i) a different ALK were applied to 1983-86 Spanish Groundfish survey data; (ii) a new maturity ogive. These revisions are detailed in section 7.2 and these effects in the assessment were analysed by Morgado *et al.* (2007, WD 11).

This year, the assessment was carried out with FLR. Also a Bayesian VPA was performed. As last year's assessment deterministic and stochastic short term forecasts were performed.

One of the major deficiencies of Southern Hake assessment is the lack of information on discards (see 7.2.1).

Type of assessment: updates, stock on observation list. The proposal for next year assessment will be also on observation, once the stock is under a recovery plan.

7.1 General

7.1.1 Ecosystem aspects

European hake is distributed in the North-eastern Atlantic. It is occasionally fished in the Lofoten islands in the north, and is common from Norway (61ºN) to the coast of Mauritania (21ºN) in the south. Regarding longitude, it is distributed from Iceland in the west to the Black Sea, through the Mediterranean Sea, and the Skagerrak or Kattegat in the North Sea (Casey and Pereiro, 1995; Inada, 1981). Hake became an important fishing resource mainly after the decrease of the cod fishery during the 1950s and the 1960s (Alheit and Pritcher, 1995), although reports of decreases in the catches, related to pair trawl catches in the Mediterranean Sea, can be found even in the XIXth century (Cisternas, 1867).

Atlantic and Mediterranean European hake are usually considered as different stocks due to the differences in biology (i.e. growth rate or spawning season) of the populations in both areas. In the North Eastern Atlantic, there is no clear evidence of the existence of multiple hake populations, although Roldán *et al.* (1998) based on genetic studies states that "*the data (…) indicate that the population structure within the Atlantic is more complex than the discrete northern and southern stocks proposed by ICES*". Castillo *et al.* (2005) also identified a more complex genetic structure where Cádiz hake was found genetically closer to Atlantic hake than Mediterranean Hake.

The Southern Stock of Hake is distributed along the Atlantic coast of the Iberian Peninsula. The northern boundary of the stock, on the Spanish – French border, was decided mainly on management considerations and is not clearly based on a biological basis for stock separation

In the south, the Gibraltar strait is the boundary splitting the Southern Stock from the Mediterranean hake. The high abundance of small hake present in the Gulf of Cadiz is not found elsewhere when they become older. This raises the problem of how to handle the Gulf of Cadiz catches within the framework of the southern stock management.

Southern hake spawns mainly from December to June, with a maximum between February and March, and the adults concentrate mainly in canyons and rocky bottoms of the shelf break area (Alcázar *et al.*, 1983; Pérez and Pereiro, 1985; Piñeiro and Sainza, 2003).

According to Sánchez and Gil (1999) hake recruitment leads to well-defined patches of juveniles, found in localized areas of the continental shelf. These concentrations vary in density according to the strength of the year-class, although they remain generally stable in size and spatial location. These authors have related the year-on-year repetition of the spatial patterns to environmental conditions. In the eastern, progressively narrowing, shelf of the Cantabrian Sea, years during which there is massive inflow of the eastward shelf-edge current produce low recruitment indices, due to larvae and pre-recruits being transported away from spawning areas to the open ocean.

Hake recruitment indices can be related to environmental factors. High recruitments occur during intermediate oceanographic scenarios and decreasing recruitment is observed in extreme situations (Sanchez *et al.*, 2003). In Galicia and the Cantabrian Sea, generally moderate environmental factors such as weak Poleward Currents, moderate upwelling and good mesoscale activity close to the shelf lead to strong recruitments (Sanchez and Gil, 1999).

In Portuguese continental waters the abundance of small individuals is higher between autumn and early spring. In the Southwest main concentrations occur at 200-300 m depth, while in the South they are mainly distributed at coastal waters. In the North of Portugal recruits are more abundant between 100-200 m water depths (Cardador, 1995). These different depth-areas associations may be related with the feeding habits of the recruits, since the zooplankton biomass is relatively higher at those areas (Cunha, 1993).

Hake is a highly ichthyophagous species with euphausiids although decapod prawns are an important part of its diet for smaller hake (> 20 cm). In Galicia and the Cantabrian Sea hake is one of the apex predators in the demersal community, occupying together with anglerfish one of the highest trophic levels (Velasco *et al.*, 2003). Its diet at >30 cm is mainly composed of blue whiting, while other species such as horse mackerel and clupeids are only important in shallow waters and in smaller individuals that also feed on other small fishes. Cannibalism is not as important as in other areas such as VIIIab. This may be due to the steeper shelf in VIIIc (Velasco & Olaso, 1998). Along the Portuguese coast the diet of hake is mainly composed of crustaceans (particularly decapods) and fish. The main food items include blue whiting, sardine, snipefish, decapods and mysids. Cannibalism in the diet of hake was relatively rare.

7.1.2 Fishery description

Hake in divisions VIIIc and IXa is caught in a mixed fishery by the Spanish and Portuguese trawl and by the artisanal fleets.

A review of fleet segmentation was presented this year (Castro *et al.*, 2007, WD1; Abad *et al.*, 2007, WD2; Silva & Murta, 2007, WD3; Duarte *et al.*, 2007, WD4; Silva *et al.*, 2997 WD5; Castro *et al.*, 2007, WD6;).

Spanish fishery

The Spanish trawl fleet is quite homogeneous and uses mainly two gears, pair trawl and bottom trawl. The percentage of hake present in the landings is small as there are other important target species (i.e. anglerfishes, megrims, Norway lobster, blue whiting, horse mackerel and mackerel). In recent years hake contributed around 6% of the total landings of the trawl fishery, this percentage used to be higher in the years prior to the 1980s. During recent years there has been an increase in Spanish trawlers using a new High Vertical Opening gear towed by single vessels and targeting the pelagic species listed above.

In contrast, the artisanal fleet is very heterogeneous and uses a wide variety of gears; traps, large and small gillnets, long lines, etc. Hake landings in 2006 of the trawl fleets made up a 65% of the total Spanish hake landings (without Gulf of Cadiz). Previously the landings of the artisanal fleet were larger in relative terms, peaking at 43% of the total Hake landings in 1987.

The trawl fleet landings length composition, since the implementation of the minimum landing size in 1991, has a mode around 29-31 cm depending on the year. Artisanal fleets target different components of the stock depending on the gear used. Small gillnets catch smaller fish than gillnets and long lines, which target mainly large spawning fish and have length composition with a mode above 50 cm. Hake is an important component of the catch for these fleets mainly due to the high prices this species reaches in the Iberian markets.

Portuguese fishery

Hake is caught by the Portuguese fleet in the trawl and artisanal mixed fisheries together with other fish species and crustaceans. These include horse mackerel, anglerfish, megrim, mackerel, Spanish mackerel, blue whiting, red shrimp (*Aristeus antennatus*), rose shrimp (*Parapenaeus longirostris*) and Norway lobster.

The trawl fleet comprises two distinct components - the trawl fleet catching demersal fish (70 mm mesh size) and the trawl fleet targeting crustaceans (55 mm mesh size). The fleet targeting fish species operates along the entire Portuguese coast at depths between 100 and 200 m. The trawl fleet targeting crustaceans operates mainly in the southwest and south in deeper waters, from 100 to 750 m.

In 2004 the number of trawlers was 108 (of which 35 targeted crustaceans), with an average of 180 GRT and 500 Kwatts of engine power. The number of >12m vessels in the artisanal fleet using fixed nets was 458, with average GRT of 45.6 and 170 Kwatts. The number of small boats (< 12 m) using fixed nets was around 7350 vessels, with a mean GRT of 1.4 and 15.6 Kwatts engine power.

In 2004, hake caught by Portuguese trawlers was mainly landed in the fishing harbours of central Portugal, representing 56% of the total trawl hake catches. The most important fishing harbours from Northern Portugal are: Matosinhos, Aveiro and Figueira Foz, from Central Portugal are: Nazaré, Lisboa and Sines and Southern Portugal are: Portimão and Vila Real Santo António. The artisanal fleet lands hake mainly in the fishing harbours of the Centre (42%). The main fishing harbours are Póvoa do Varzim (North), Sesimbra (Centre) and Olhão (South). Landings recorded by month show that the majority of the hake landings occur from May until October for both fleets.)

7.1.3 ICES advice and Management applicable to 2006 and 2007

ICES Advice for 2007

Zero catches or a recovery plan.

Management Applicable

Hake is managed by TAC and technical measures. The agreed TAC for Southern Hake, including Cadiz, in 2006 was 6 661 t and in 2007 was 6 128t. Landings in 2006 including Cadiz were estimated to be 10 733 t, 75% above the TAC for Southern Stock.

A Recovery Plan for southern hake was enacted in 2006 (CE 2166/2005). This plan aims to rebuild the stock to within safe biological limits, i.e. 35 000 t of spawning stock biomass, and drive fishing mortality to 0.27. To achieve these objectives the regulation entangles a mixed TAC and effort control system.Technical measures applied to this stock include: (i) minimum landing size of 27 cm, (ii) protected areas, and (iii) minimum mesh size. These measures are set depending on areas and gears by several regulations.

7.2 Data

Data Revisions

The Spanish groundfish survey abundance index of 1983 to 1986 of was revised. In previous assessments, the ALK used to obtain age data for those years was based on a Kimura-Chikuni method. To be consistent with the procedure applied to other years with no age readings, the ALK applied to survey data between 1983 and 1986 is the combine ALK of 1994-1998. The main impact of this revision is a shift of fish from age 1 to age 0, mainly in 1983 and 1985 (Morgado *et al.*, 2007, WD11).

Annual maturity ogives were revised (Morgado *et al.*, 2007, WD11). Following the recommendations of the ICES Workshop on Sexual Maturity Sampling -WKMAT (ICES, 2007) the maturity ogives used in the Southern hake assessment are weighted by the annual total stock length composition.

Golf of Cadiz trawl fleet effort was revised after inconsistencies in the time series were detected.

7.2.1 Commercial Catch and discards

The landings data used in the Southern Hake assessment are based on: (i) Portuguese sales notes compiled by the National Fisheries and Aquaculture Directorate; (ii) Spanish sales notes and Owners Associations data compiled by IEO; and (iii) Basque Country sales notes and Ship Owners data compiled by AZTI.

Landings

Total landings from the Southern Hake Stock (with and without the Gulf of Cadiz) by country and gear for the period 1972-2006, as estimated by the WG, are given in Table 7.1.

In 2006, the total landings estimates, excluding the Gulf of Cadiz, were 10 075 t, which are 35% higher than the landings in 2005. Spanish landings increased by 39 % and Portuguese landings remained stable. Since 1983 there has been a declining trend in the landings to 2002, the lowest in the series. Including the Gulf of Cadiz, the landings in 2006 were 10 733 t, almost 75% above the TAC.

Discards

A Spanish discard sampling programme has been carried out in divisions VIIIc and IXa since 1993. This series provides information on discarded and retained catch by weight and numbers and length distributions for Southern Hake, among other species. Spanish sampling was carried out for 1993, 1994, 1997, 1999 (second semester), 2000, 2001, 2003, 2004, 2005 and 2006. The discards sampling programme is based on stratified random sampling per Fishery Unit (fleet by ICES Division) and landings are used to raise the results. However, doubt about the accuracy of the total landings for the fleet leads to similar doubt about the estimated total discards. Independent estimates of landings and discards by the fleet may be preferred. However, Spanish effort information is not always available or accurate and can give conflicting results. Only landings information is available for all metiers, till now, for some of the Spanish fishery. It is therefore impossible to obtain different estimates and compare their results and precision. Also, Spanish landing and effort information is available from logbooks (which are different to the sales notes available until now) from 2003. This information needs to be analysed and compared with available landing and effort information, and a decision must be made on which dataset should be used in future workings groups. At the end of this year a comparison will be finished and decision will be taken on which data base on landing and effort will be assumed for assessment. This decision could change the Spanish discard estimates obtained since 2003 (Pérez Contreras, 2007, WD7). Therefore it should be noted that Spanish discards estimates should be considered only as indicative.

The Portuguese Discard Sampling Programme started in 2003 (second semester) and is based on a quasi-random sampling of co-operative commercial vessels. Two trawl fleets are sampled in this programme: Crustacean Trawl and Fish Trawl fleets. The total number of trips, performed by each fleet is used to estimate discards. This seems to be the best sampling variable to use, as there is no correlation between landings and discards. The method applied is one of the methods suggested during the ICES Workshop on Discard Raising Procedures (ICES 2007a). As it is the first time this method is being used, it will still be validated during 2007 (Fernandes *et al.*, 2007, WD 8)

Hake discards for the Spanish fleet were estimated to vary between 200 t and 3400 t. The 2006 estimate is the maximum value of the time series (3 398 t, CV = 29.5%). The Portuguese fleet discards were estimated to be around 1 000 t (2004 and 2006) (CV=23,9 % and 26,6%) and 1 700 t (2005) (17,4%) (Fernandes *et al.*, 2007, WD 8).

Discard data represent an opportunity to better understand the fleets' behaviour and get more information about the population, in particular on the discards of age 0 or age 1 fish that are discarded because of the minimum landings size. These data also present more complexity and technical problems, such as how to rebuild the catch matrix to include it. Some exploratory data analyses were carried out with the available data, trying to find correlations with other information, namely the survey indices and the Cadiz landings, which are also focused on younger ages (Jardim, 2007, WD9). The raising procedure used to estimate Spanish discard data and the short time series of the Portuguese discard data do not allow final conclusions to be drawn. Further work is needed to increase sampling and standardize methodologies. The impact of discards on stock perception can be high and it is necessary to be confident on the estimates before using them.

The annual discard sampling levels and observation effort on board for the Spanish and Portuguese discard sampling programmes are summarized in the table below.

	SPAIN						PORTUGAL			
	Baca trawl		Pair trawl		VHVO		Crustacean trawl		Fish trawl	
	Trips	Sampling Hauls	Trips	Sampling Hauls	Trips	Sampling Hauls	Trips	Sampling Hauls	Trips	Sampling Hauls
1993	3	8	1	1	-	-	-	-	-	-
1994	53	447	8	7	7	14	-	-	-	-
1995	-	-	-	-	-	-	-	-	-	-
1996	-	-	-	-	-	-	-	-	-	-
1997	67	439	31	39	1	2	-	-	-	-
1998		-	-	-	-	-	-	-	-	-
1999*	44	250	20	18	-	-	-	-	-	-
2000	70	367	42	42	14	35	-	-	-	-
2001	11	43	7	7	3	6	-	-	-	-
2002	-	-	-	-	-	-	-	-	-	-
2003	23	100	11	11	18	56	-	-	-	-
2004	26	121	10	11	17	46	17	111	24	126
2005	49	159	30	31	34	78	15	74	39	160
2006	24	113	23	27	30	73	7	30	42	194

*** Data from 1999 are only from the second semester.**

7.2.2 Biological Sampling

The sampling of commercial landings is carried out by the Fisheries Institutes involved in the fishery assessment. The length composition sampling design follows a multistage stratified random scheme by quarter, harbour and gear. The age sampling scheme follows a stratified random sampling design by length class of 1 cm. The sampling levels in 2006 are summarized in Table 1.3.

Length Composition

Table 7.2 presents the length compositions of landings by country and gear and mean length for 2006.

Figure 7.1 shows the length distributions of landings for 1982-2006 with a vertical line to mark the minimum landing size (27 cm). In general there has been a decrease in numbers of individuals until 1996 and since then it has remained stable at a low level. In 1989 the minimum landing size of 27 cm was enforced and since then the proportion of these fish in the landings has decreased.

Age composition

Commercial and survey ALKs are available from 1993, with the exception of the Spanish survey which has ALKs from 1994. Catches at age for the years without ALK were estimated using combined ALKs from recent years. Table 7.3 summarises the ALKs used. An annual Iberian ALK has been used since 2001 combining IEO, AZTI and IPIMAR age readings.

Four otolith exchanges between readers involved in the assessment have been carried out. In 2003 an exchange program followed by a workshop in 2004 was carried out (Piñeiro and Sainza, 2005) mainly focused in older fishes. Up to 2003, the exchanges and workshops conducted indicated an acceptable level of precision between age readers for ages younger than 5 years old. However, the 2003 exchange and the 2004 workshop results revealed a decrease in the precision for ages older than 3. However the age readers involved in Southern Hake showed a high level of agreement among them.

Length-weight relationship, weights-at-age and M

An international length-weight relationship for the whole period has been used since 1999. Landed numbers and weights at age for 1982-2006 are given in Tables 7.4 and 7.5, respectively. Weights at age in the catch have been used as stock weights.

Natural mortality was assumed to be 0.2 year^{-1} for all age groups in all years.

Maturity ogive

Since WGHMM 2005, this stock is assessed with annual maturity ogives. This year the proportion of mature estimates are weighted by the length composition of the stock as recommended by ICES WKMAT (ICES, 2007b) (Morgado *et al.*, 2007, WD 11). The proportion mature used in this year's assessment are shown in Table 7.6.

A new Portuguese Groundfish survey carried out during the spawning season, started in 2005. SSB estimates for 2005 higher than those from 2006. This might be a useful survey to track SSB trends, but a longer time series is needed (Chaves *et al.*, 2007, WD 18).

7.2.3 Abundance indices from surveys

The Spanish Groundfish survey uses a stratified random sampling design with half hour hauls and covers the northwest area of Spain during September/October. The Portuguese October survey has used a fixed sampling design since 1989, covering the whole Portuguese continental shelf (ICES, 2002). Since 2002 haul duration has been 30 minutes. Prior to this, haul duration was 1 hour. In 1996, 1999, 2003 and 2004 the R/V *Capricórnio* with a CAR gear was used instead of the R/V *Noruega* with a NCT gear. Recent work on calibration of these vessels showed a higher catchability of *Capricórnio*, in particular at lower sizes. (Azevedo and Cardador, 2006). The Portuguese July survey has not been conducted since 2002 and has been replaced with a new groundfish survey that is carried out during the hake spawning season and which started in 2005 (Pestana & Cardador, 2007, WD 17).

Two ground fish surveys are carried out annually in the Gulf of Cadiz - in March (from 1994) and in November (from 1997). A stratified random sampling design with 5 bathymetric strata, covering depths between 15 and 700 m, is used in this area, with one hour hauls (ICES, 2002d). Hake otoliths have been collected since 2000 and some ALKs are available. This year the Golf of Cadiz Autumn Groundfish survey was not use to tune the XSA.

Biomass, abundance and recruitment indices for the Portuguese and Spanish surveys respectively are presented in Table 7.7 and Table 7.8.

Since 1989 the Portuguese Autumn survey has shown variable abundance indices with a minimum in 1987. The 2006 observed abundance is below the mean of the series.

The Spanish survey shows a sharp increase from 1992 to 1997, a sudden decrease in 1998 and since then has remained at low levels, reaching the minimum of the series in 2001. In 2005 the largest indices since 1997 were estimated.

The recruitment index of the Spanish and Portuguese autumn surveys (Figure 7.2) are inconsistent. However the Portuguese autumn and the Spanish ground fish surveys show that in 2006 the recruitment is lower than in 2005. The Spanish survey has the lowest values of the series between 1998 and 2003 with an increase in 2004. The Portuguese autumn survey had a minimum in 1995 and has fluctuated from 1996 to 2003, showing the maximum of the series in 2005. The Cadiz Autumn survey showed a maximum in 2006.

The Spanish and the Portuguese October groundfish survey are used to tune XSA.

Commercial catch-effort data

Effort series is collected from Portuguese logbooks and compiled by IPIMAR, and from Spanish sales notes and Owners Associations data and compiled by IEO.

Landings, LPUE and effort are available for Coruña trawl (SP-CORUTR), Coruña pair trawl (SP-CORUTRP), Vigo/Marin trawl (SP-VIMATR), Santander trawl (SP-SANTR), Cadiz Trawl and Portuguese trawl (P-TR) fleets. These data are given in Table 7.9 and shown in Figure 7.3. Table 1.2 summarizes the acronyms for the fleets used in the assessment.

The Spanish trawl fleets, except the SP-VIMATR, show a general downward trend in their effort since the 1990's until the early 2000's, after which SP-CORUTR and the SP-CORUTRP fleets remain stable. P-TR effort shows a downward trend from 1992 to 1995. Effort has been relatively low and variable since then.

The SP-CORUTRP shows a downward trend until 1998 and since then has increased to a maximum in 2006. The SP-SANTR LPUE series is also stable in recent years with peaks in 1995, 1996 and 2001 and low values between 2002 and 2005, with a sight increase in 2006. The SP-CORUTR shows a decreasing trend since the maximum in 1998 until 2004 and since then has been increasing to a value close to the 1998 maximum. The P-TR LPUE is fairly stable through the whole series, with a maximum in 1995.

7.2.4 Other relevant data

The Fishery in the Gulf of Cadiz.

See Annex G.

7.3 Assessment

This year two differences assessment models were performed: XSA and a Bayesian VPA (Azevedo, 2006). The codes of the two assessments are available in stock files.

A preliminary length based assessment with GADGET (Begley and Howell, 2004) was attempted (see Cerviño *et al*., 2007, WD 22). Summary results are presented in Annex H).

Due to doubts about the south-east boundaries of the stock and methodological difficulties with reconstructing the catch matrix backwards using the Golf of Cadiz information, and following the review group concerns, the Gulf of Cadiz was not included in the assessment.

One of the main problems yet to be addressed is reconstructing catch at age data to include discards.

7.3.1 Input data for assessment

As in previous years, age plus was set at 8 and the data for age 0 in the catch at age matrix was replaced by zeroes due to the low landings in this age for recent years. The catch at age matrix is presented in Table 7.4.

7.3.2 Model

Data screening

Several exploratory analyses were carried with the FLEDA package. The results are presented in Annex H and Morgado *et al.* (2007, WD 11).

The table below summarizes the available information of the tuning fleets.

FLEET	ACRONYMS	PERIOD	AGE RANGE	LANDINGS %
Portuguese Trawl	P-TR-89	1989 – 1994	0 – 7	-
	P-TR-95	1995 – 2004	0 – 7	8.5
Spanish A Coruña Trawl VIIIc	SP-CORUTR8c-85	1985 – 1993	0 – 7	-
	SP-CORUTR8c-94	1994 – 2004	0 – 7	4.8
Spanish A Coruña Pair Trawl VIIIc	SP-CORUTRP8c-85	1985 – 1993	0 – 7	-
	SP-CORUTRP8c-94	1994 – 2004	0 – 7	4.6
Santander Trawl	SP-SANTR	1986 – 2004	0 – 7	0.2
Vigo/Marin Trawl	SP-VIMATR	1990 – 2004	0 – 7	3.4
Spanish GFS	SP-GFS	1983 – 2004	0 – 7	
Portuguese GFS July	P-GFS-jul	1989 – 2001	0 – 7	
Portuguese GFS October	P-GFS-oct	1989 – 2004	0 – 7	
Cadiz GFS - Autumn	SP-GFS- caut	2000-2006	0 – 7	

SP-SANTR was not included in the assessment in previous years due to the low and variable hake catches since 1997. These fleets have a very low weight in the landings (0.2 %). As explained SP-GFS- caut was not considered for tuning the XSA this year.

XSA tuning data were available for eight fleets, five commercial and three surveys (Table 7.10). Three commercial fleets were segmented in two periods (P-TR, SP-CORUTR8c and SP-CORUTRP8c). The initial series were discarded for P-TR and SP-CORUTRP8c. Trends in catchability were examined by carrying out single fleet XSA runs without shrinkage (in ICES files).

The analysis of the residuals of log catchabilities revealed high residuals and year trends for some fleets which were also excluded from further analysis (P-GFS-jul, SP-VIMATR, and SP-CORUTRP8c). The P-GFS-jul was terminated in 2001 and for SP-VIMATR there was a change in the effort estimation since 2004.

Two general rules were applied for age selection in the tuning: (i) due to the minimum landing size (27 cm) ages 0 and 1 of the commercial fleets were discarded; and (ii) due to the low catches of large hakes in the surveys ages after 5 were removed.

Exploratory XSA Runs

A first XSA run was performed with the same options and tuning fleets as in last year’s assessment. The log-catchability residuals and the consistency among the fleets estimating survivors were very similar to last year's assessment. The main difference with the 2006 assessment was the downwards revision of recruitment in 2005.

Age 0 and 1 of the P-GFS-oct in 1996, 1999, 2003 and 2004 were removed, as it was considered that the two vessels that have been used have different catchabilities on these ages (Azevedo & Cardador, 2006). In this case, for ages older than 1, the original values were considered. This is the same procedure as last year.

Final XSA Run

Final settings used this year and last year's configuration is detailed below:

XSA parameters		2006 WG		2007 WG	
Fleets	P-TR-95	95-05	2-7	95-**06**	2-7
	SP-CORUTR8c-85	85-93	2-7	85-93	2-7
	SP-CORUTR8c-94	94-05	3-7	94-**06**	3-7
	SP-GFS	83-05	0-4	83-**06***	0-4
	SP-GFS-caut	00-05	0-4	**-**	**-**
	P-GFS-oct	89-05	0-4	89-**06**	0-4
Age recruitment		0		0	
Catch data		Age 0 = 0		Age 0 = 0	
Taper		No		No	
Taper range		-		-	
Ages catch dep.st.size		No		No	
q plateau		6		6	
F shrinkage se		0.8		0.8	
year range:		5		5	
Age range:		4		4	

- : not used

***: some age/years not included on the assessment (see above)**

The log catchability residuals from the final XSA run are presented in Figure 7.5 and Table 7.11 gives the diagnostics from the final XSA. Commercial fleets showed some weak trends in log q but do not show in general high residuals. As in the last assessment, the SP-GFS survey presents a slightly downwards trend from 1996 until 2002. The P-GFS-oct shows an upwards trend between 1994 and 2001 and year effects in 1989, 1993 and 1997. Also in 1995 this fleet shows a high residual for age 0.

Usually the two recruitment surveys have an inconsistent age 0 estimation. This year the SP-GFS estimated a higher recruitment (71 million) than the P-GFS-oct (58 millions). The scaled weights to estimate survivors at age 0 given by the model are 68% and 32%, respectively.

At age 1, survivors' estimates are mainly given by the surveys, with 47% of the weight from the SP-GFS and 37% from the P-GFS-oct. For this age the estimates are very consistent between the two surveys. The F shrinkage has a low weight (16%) in age 1 estimate.

The Portuguese trawl fleet (P-TR-95) estimates survivors after age 1. It's contribution is ≈35%, except for age 7 (≈50%). For the 2003 year-class survivors this fleet is constrained by the minimum threshold on standard error. The A Coruña commercial fleet (SP-CORUTRc-94) estimates survivors after age 2, and its contribution increases with age from ≈10% at age 3 to ≈35% at ages 5 and 6, at age 7. This fleet has 30% of the weight estimates.

The F shrinkage contribution is low in all ages.

The retrospective analysis carried out is shown in Figure 7.6. The fishing mortality showed some overestimation bias in previous assessments. The retrospective pattern for recruitment is reasonably consistent with the exception of the terminal years, which show greater variation. There is a tendency to underestimates SSB.

Bayesian VPA

As last year a Bayesian stock assessment was performed (Morgado *et al.*, 2007, WD11). The data used are the same used for the XSA, with the following exceptions: (i) the catch-at–age matrix starts in 1983, instead of 1982; (ii) the catch-at–age matrix is tuned only with the surveys (SP-GFS; PT-GFS-oct. and PT-GFS-jul) and LPUE series were not used; (ii) the PT-GFS-jul is included; (iv) the age 0 and 1 of PT-GFS-oct. for the year carried out with R/V *Capricornio* were converted based on (Azevedo and Cardador, 2006).

Natural mortality of M=0.2 year-1, age and time invariant, was the same as adopted by the WG (ICES, 2006). To estimate the spawning stock biomass it was adopted the mean weight-at-age and proportion mature-at-age used by the working group to perform the assessment with XSA. The mean fishing mortality-at-age, Fbar, was computed for the age range 2-5, as usual.

As in the last year Bayesian assessment it was adopted the population survivor model currently used for the assessment with XSA, though assuming separable fishing mortality, two relative exploitation, from 1983-1994 and from 1995-2005, with fixed value at age 6 (1.0) and it was assumed a linear relationship between the indices of abundance and true stock size, with time invariant catchability. For the likelihood it was assumed that the log of the reported catch and abundance indices are independently and identically normally distributed. Priors were assigned to the parameters as presented in the text table below. Gamma prior distributions with hyperparameters were specified for the inverse of variance (precision) of the log of the reported catches and survey abundance indices. The hyperparameters were set such that the 2.5% and 97.5% percentiles of the coefficients of variance of the catches were 40 and 60% (Jardim et al., 2004), were 10 and 20% for the Portuguese surveys and were 10 and 15% for the Spanish surveys (Azevedo, 2006). Therefore, for example, the shape parameter of the gamma distribution for the reported catch, α_c, is modelled as a normal distribution with μ=4.25 and $1/\sigma^2$=1.28. To avoid negative values for the hyperparameter, the normal distributions were left truncated. Computations were performed using WinBugs (version 1.4). The posterior distributions of the parameters, estimated via MCMC with Gibbs sampling, were summarized by median and 95% credible intervals, drawn from the posteriors of 5000 samples. These samples were obtained from a burn-in of 1000 and thinning of 10 for a chain of 51000 iterations.

Parameter	Prior
$N_{0,1983}, N_{0,1984}, ..., N_{0,2006}$	$U(0, 10^6)$
$N_{1,1983}, N_{2,1983}, ..., N_{8+,1983}$	$U(0, 10^6)$
$f_{1984}, f_{1985}, \ldots, f_{2006}$	U(0,2)
$r_0,\ldots,r_5, r_7, r_{8+}$ (1984-1994) $r_0,\ldots,r_5, r_7, r_{8+}$ (1995-2006)	U(0,1)
$q^{PS}{}_0, q^{PS}{}_1, ..., q^{PS}{}_{8+}$ $q^{PF}{}_0, q^{PF}{}_1, ..., q^{PF}{}_{8+}$ $q^{SF}{}_0, q^{SF}{}_1, ..., q^{SF}{}_{8+}$	U(0, 1)
$1/\sigma^2_c$	$G(\alpha_c, \beta)$
α_c	N(4.51, 1.28)
$1/\sigma^2_{PS}$; $1/\sigma^2_{PF}$	$G(\alpha_P, \beta)$
α_P	N(62.5, 0.003)
$1/\sigma^2_{SF}$	$G(\alpha_S, \beta)$
α_S	N(72.22, 0.005)
β	G(0.1, 0.1)

(f - annual fishing level; r - relative exploitation pattern; q - catchability, PS - Portuguese Summer survey; PF – Portuguese fall survey; SF – Spanish fall survey; subscripts c – catch, s-survey; U-uniform, N-gaussian and G-gamma probability distributions).

7.3.3 Assessment results

XSA

Fishing mortalities and stock numbers from the final XSA are given in Tables 7.12 and 7.13. The XSA summary is presented in Table 7.14 and Figure 7.7.

Estimating recruiting year class abundance

The 2004 year class is estimated to be 69 million, 12% less than last year's estimate (78 millions. The 2005 year class estimate was revised downwards from 152 millions to 67 millions. This high reduction is driven by the two surveys estimates from 2006 that do not show such a strong 2005 year class. Discards are a key factor to understanding this retrospective underestimation.

The 2006 recruitments estimate was 81 millions but, this needs to be verified when these fish recruit to the fishery. Recruitment estimates have a period of low and stable recruitment that starts in 1989. After 2002 recruitment starts increasing. The 2005 year class is estimated mainly by the two surveys with high consistency. Taking these into account, the 2006 recruitment estimate was replaced by the GM of the period 1989-2005, 47 millions.

The WG estimates of year-class strength used for prediction can be summarised as follows:

Recruitment at age 0

YEAR CLASS	THOUSANDS	BASIS	SURVEYS	COMMERCIAL	SHRINKAGE
2004	68829	XSA	56%	36%	8%
2005	67231	XSA	84%	-	16%
2006	46840	GM_{89-05}	-	-	-
2007	46840	GM_{89-05}	-	-	-

Historic trends in biomass, fishing mortality and recruitment

The SSB decreased sharply between 1982 (48 300 t) and 1986 (22 600 t) and then slowly until 1998, the minimum of the series (6 400 t). Since 1998 it has been stable at a low level with a slight increase after 2003. The SSB estimate for 2006 was 15 300 t.

Fishing mortality reached its maximum value in 1995 (0.78 $year^{-1}$) and has declined slowly until 2004 (0.45 $year^{-1}$) showing a peak in 2000 (0.65 $year^{-1}$). The 2006 estimate is again quite high (0.61 $year^{-1}$) although very uncertain.

Recruitment (age 0) declined continuously between 1984 (117 millions) and 1991 (41 millions); since than it has fluctuated around 40 millions, reaching the lowest level in 2000 (31 millions). From 2002 onwards there are signals of an increased recruitment, which will have to be confirmed later.

Bayesian VPA

Inspection of standardized residuals (Figure 7.8) revealed no major discrepancies between observed and predicted values and the posterior predictive model check indicated that the model is reasonably accurate.

The overall perspective of the stock is similar to the XSA results but this method provides extremely valuable information on the precision of the estimates. Bayesian estimates for fishing mortality, recruitment and SSB are presented in Table 7.15.

Comparatives results of XSA and Bayesian VPA are presented in Figure 7.7. XSA estimates are inside the 2.5 and 97.5 Bayesian percentiles, although the 2005 and 2006 F estimates from XSA are close to the 97.5 percentile of the Bayesian VPA. XSA estimates are inside credibility intervals. However, median SSB values for the beginning of the times series are lower, compared with XSA estimates. Also, median F estimates are lower than the 2005 and 2006 XSA estimates. F Bayesian estimates for 2005 and 2006 are 25% and 18% lower, respectively. Despite these differences both models indicate an increasing trend in the last two years.

Bayesian estimates are used to stochastic short-term forecasts.

7.4 Catch options and prognosis

7.4.1 Short-term projections

Taking into account the relevance of the short term projections (STP) for management, in particular in Southern Hake (which has been under a recovery plan since 2005) it was decided to carry out the deterministic STP as in previous years, but also to include stochastic STP using the outputs of the Bayesian VPA. The methodology used is the same as last year. The same assumptions for deterministic and stochastic short term forecast were considered, to allow comparisons.

Input data for deterministic predictions are given in Table 7.16a. Note that the minor differences in starting population numbers in 2007 are due to rounding differences. Selection pattern and number of at age assumed for stochastic prediction are given in Table 16b.Catch and stock weights, and proportion mature at age were set as the mean for the period 2004-2006, for both deterministic and stochastic predictions.

Fishing mortality at age was calculated as the mean of the F values at age for 2004-2006, unscaled. Although there is a tendency of increasing F in the last two years, it was not scaled because the reliability of F estimates is considered to be low to do a correction. The XSA estimated values for those years are inside the 95% credibility intervals from Bayesian assessment, but far from the median value (Figure 7.7).

The $GM_{89\text{-}05}$ (47 millions) was assumed for 2006 to 2009 recruitment estimates. The 2007 population numbers for ages 1 were estimated from $GM_{89\text{-}05}$ decreased by natural mortality. The 2007 population numbers for ages 2 and older were those given by XSA, considering the high consistent estimates from the two surveys.

This year the STF is based on status quo F for the following reasons: (i) landings have increased in 2006 and are above the TAC; (ii) fishing mortality has increased despite a 10% effort reduction. Another forecast implying a 10% F reduction is presented in annex H. Annex H presents several short-term options (GM89-05; GM89-04; Fsq04-06 scaled; Fsq 04-06 not scaled).

The deterministic STP for landings in 2008 and SSB in 2009, are given in Table 7.17 and Figure 7.9, assuming various levels of fishing mortality. Assuming *status quo* F (0.55), the deterministic forecast of landings in 2007 are 9 600 t and 9 800 t in 2008 (Table 7.18). The agreed TAC for 2007 is 6126 t. The 2007 landings forecast are 57% above TAC_{2007}. The SSB is predicted to be 16 000 t in 2008 and 16 100 t in 2009. The relative contributions to the landings and SSB of recent year classes are presented in Table 7.19. These indicate that $GM_{89\text{-}05}$ contributes 2% and 17% to yield in 2007 and 2008, respectively. With regard to SSB in 2008 and 2009 the $GM_{89\text{-}05}$ is contributes 18% and 35%, respectively.

Stochastic STP are presented in Figure 7.10 and summarized in Table 7.20. Deterministic SSB forecasts in 2009 (16 100 t) are outside the prediction interval of the stochastic projections ([16 400t, 29 400t]) and very close to the 2.5 percentile. Deterministic projected landings in 2007 (9 600 t) are below 2.5 percentile of the stochastic STP (9 800 t). In 2008 the deterministic yield STP (9 800 t) is also outside the stochastic STP 95%CI ([10 100 t, 14 800 t]) but close to the lowest limit. The differences between the Fsq (0.55 for deterministic and

0.45 [0.35,0.57] for stochastic) of the two projections together with the lower starting population number in 2006 (see Table 7.13 and Table 7.16b) drive the predictions to different status (Figure 7.10).

The weights of recruitments assumed to be GM89-05, and of year class 2006 on the stochastic predictions of yield in 2008 and SSB in 2009, are shown in Figure 7.11. The year class of 2005 has a higher influence on these predictions but with a high variability.

7.4.2 Yield and biomass per recruit analysis

Results for yield and SSB per recruit analysis are shown in Table 7.21 and Figure 7.9. The $\mathbf{F}_{sq}$ was 0.55, $\mathbf{F}_{max}$ is estimated to be 0.23, 42% of the *statu quo* $F_{(04-06)}$; and $\mathbf{F}_{0.1}$ is 0.14, 26% of $\mathbf{F}_{sq}$.

F_{max} is estimated to be close to natural mortality (0.2 year^{-1}).

Assuming *statu quo* F, the current exploitation pattern and the assumed recruitment (GM_{89-05}), long-term yield and SSB are estimated to be 8 300 t and 14 200 t, respectively.

7.4.3 Medium term projections

This year an evaluation of the recovery plan was carried out where medium term projections were performed (see Cardador *et al.*, 2007, WD 26; Garcia, 2007; WD 24).

7.5 Biological reference points

The present reference points are presented in the Table below together with the previous ones:

BRPs	ACFM 2000	ACFM 2003	ACFM 2004
FLim	0.45 = Floss	Not defined	0.55 = Floss
Fpa	0.27 = Flim*e(-1.645*0.3)	Not defined	0.40 = Flim*0.72
Blim	20 500 t = Bloss	25 000 t (level impaired recruitment)	Not changed
Bpa	33 600 t = Blim*e(1.645*0.3)	35000 t = Bpa ~ Blim * 1.4.	Not changed

Results from the PA software Excel add-in were not produced due to software problems. The WG thinks that is due to the problems in readings a maturity ogive matrix.

There are doubts about the present levels of BRP, and the new information presented this year support these uncertainties. This new information includes: a revision of the 1983-86 Spanish groundfish survey ALK that brings the SSB estimated for that time period to values close to Blim low (Morgado *et al.*, 2007, WD 11). Also a sensitivity analysis of the effects of “shrinkage” on abundance at the beginning of the time series (Cerviño and Jardim, 2007, WD 21) show an overestimation of SSB in years 1982-84. This overestimation is also supported by the Bayesian VPA results (Figure 7.7), where SSB XSA estimates are at the level of the 97.5 percentile. This evidence, together with the confirmation of good recruitments in 2004 and 2005 at low SSB levels, show a different perception about the relation between the historic stock status and the present BRP (Figure7.12) where there are only four years (with signals of SSB overestimation) above Blim (25 000t).

This year the uncertainty in stock estimates was considered for the first time. The WG considers the reference points, particularly the Biomass reference points, may need revision. The WG proposes to examine this in detailed next year.

7.6 Comments on the assessment

The Gulf of Cadiz landings have not been included in the assessment since 2002 (ICES, 2004a) and these represent a large part of the landings by number from the stock mainly at young ages (Annex G).

Age 0 is included in the assessment with catch numbers at age set to zero, so that survivors could be estimated by the recruitment surveys at age 0.

Discards were not considered due to the short and discontinuous time series available and the doubts about the estimation procedure. However the discard rate is considered to be high particularly in age 0 and 1. There are indications that the Spanish discards increased in 2006 although the precision of the estimates are poor. The Portuguese discard estimates for 2006 is lower than last year.

It was noted that in absence of abundance indices, the "shrinkage" settings in XSA may result in an over estimate of SSB at the beginning of the time series (Cerviño *et al.*, 2007, WD 21). Bayesian assessment results for SSB (Figure 7.7) support this possible overestimation at the beginning of the time series.

The 2007 assessment shows a slight downwards revision of F in 2005. A comparison between the 2006 and 2007 assessments is shown on the text table below and Figure 7.13.

BRP	YEAR	WG06	WG07	% CHANGE	COMMENTS
Fbar	2005	0.62	0.58	-6%	
	2006		0.61		
SSB	2005	12.9	13.4	4%	
	2006		15.3		
R	2005	151678	67231	-56%	
	2006		46840*		*GM(1989-05)
Fbar		0.54	0.55	2%	Average of last 3 year

A combination of deterministic and stochastic short-term projections was examined, and the results show that deterministic values for SSB and yield are outside the 95% credibility intervals. At F status quo SSB is expected to increase slightly and landings show a high probability of overcoming the TAC for 2007 and increase in the following years.

In spite of some problems with discards estimates and the validation of the age reading criteria, the quality of the data available for the assessment has improved in recent years. It is now possible to build annual ALKs and estimate annual maturity ogives. The sampling of commercial landings covers all the fleets.

Further work must be carried out to investigate: (i) the spatial distribution of the stock; (ii) the Gulf of Cadiz fishery; (iii) the S-R relationship; (iv) inclusion of discards; (v) validation of the ageing process with tagging experiments; (vi) standardisation of effort for the tuning fleets; (vii) alternative models for the assessment; (viii) short-term and medium-term forecast. The Working Group members support a project to conduct a large scale tagging experiment covering as much as possible of hake distribution area in the North Eastern Atlantic.

A first implementation of a length-age model was presented (Cerviño *et al.*, 2007, WD 22). Catch data covers 1990 to 2005 and was set by quarters. The model assumes constant selectivity. Although the results may be considered as preliminary they show a similar trend as the XSA for F, recruitment and SSB (see Appendix H).

7.7 Evaluation of the recovery plan

The analysis of the recovery plan was carried out using two different approaches: A stochastic projection method described by Cardador *et al.* (2007, WD 26) and using Management Strategy Evaluation with the implementation of an operating model (Garcia, 2007, WD 24). The difficulties in forecasting the behaviour of the stock still exist and are mainly related to the poorly known stock recruitment relationship and discards patterns. The former has a strong impact on the forecasts.

Comparing these results with the analysis made in 2006 (section 6.7 in ICES CM 2006/ACFM:26) it's safe to say that the perspective we had did not change. The fact that the TAC was overshot by an high percentage, the confirmation that discards may have increased , and the increasing trend in F in the last 3 years, raise concerns about the implementation of the recovery plan. On the other hand the confirmation of the high recruitments in 2004 and the increasing trend in SSB in the last years show that the stock may have a higher productivity than perceived before.

However, it is clear that if the upward trend in F does not stop, SSB and yield will decrease in the next years. On the other hand, the opportunity to rebuild the stock protecting recent recruitments will be lost, if it has not been already.

7.8 Management considerations

Landings in 2006 (10 700 t) were estimated to be 4 000 t above TAC (6 661 t).

The landings forecasts for 2007 were performed without considering the Gulf of Cadiz. To be fully comparable with the TAC proposal the forecasted landings must be corrected by a factor of 1.10, as defined by the recovery plan regulation. In that case the landings forecast for 2007 is 11 275 t, above the TAC of 6 128 t, and 11 489 t in 2008.

Discards were not considered in the assessment but the discard rate is high and mainly on ages 0 and 1. A number of technical measures have been implemented to protect juvenile hake in the area (e.g. minimum landing and minimum mesh sizes and protected areas). The expected benefit of this measure has not been realised, giving the continuing high discards observed.

SSB in 2006 is estimated by XSA to be 15 287 t is lower than the 2.5 percentile (15 370 t) estimates by the Bayesian VPA. Although SSB estimates are lower compared to the beginning of the time series the 2006 value is more than double Bloss (6 400 t). SSB in 2009 is predicted to be 16 100 t by deterministic projections, lower than the median 24 000 t (95%CI [17 300, 32 000]) by stochastic projections.

The enforcement of the minimum landing size of 27 cm in 1991 led to a change in the estimates of the exploitation patterns in ages 0 and 1, which makes direct comparisons of recruitment between the two periods of the times series difficult.

Hake is taken in a mixed species trawl fishery, and the management of other stocks such as blue whiting, horse mackerel, mackerel, megrim, anglerfish, and *Nephrops* needs to be taken into account when considering the requirements of the hake stock.

Effort control measures will be subject to approval by qualified majority at the Council of Ministers, which could lead to modifications in the way in which the plan is implemented.

The Group considers that a complete evaluation of the recovery plan requires more information and /or more explicit modelling regarding the major sources of uncertainty including: stock recruitment relationships, discarding, TAC overshoot and growth rates. The Group recommends further work to be carried out to obtain information in these areas and that more in-depth analyses should be carried out to evaluate the potential effects on assessment and management.

Table 7.1 HAKE SOUTHERN STOCK - Landings estimates (´000 t) by country and gear, 1972-2006

YEAR	Spain										Portugal			France	Total Stock Without Cadiz	TOTAL STOCK
	Gillnet	Small Gillnet	Longline	Artisanal Unallocated	Artisanal Cadiz	**Total Artisanal**	Trawl North	Trawl Cadiz	**Total Trawl**	**Total**	Artisanal	Trawl	**Total**			
1972	-	-	-	-	-	7.1	10.20	-	10.2	17.3	4.70	4.10	8.8		26.1	26.1
1973	-	-	-	-	-	8.5	12.30	-	12.3	20.8	6.50	7.30	13.8	0.20	34.8	34.8
1974	2.60	1.00	2.20	-	-	5.8	8.30	-	8.3	14.1	5.10	3.50	8.6	0.10	22.8	22.8
1975	3.50	1.30	3.00	-	-	7.8	11.20	-	11.2	19.0	6.10	4.30	10.4	0.10	29.5	29.5
1976	3.10	1.20	2.60	-	-	6.9	10.00	-	10.0	16.9	6.00	3.10	9.1	0.10	26.1	26.1
1977	1.50	0.60	1.30	-	-	3.4	5.80	-	5.8	9.2	4.50	1.60	6.1	0.20	15.5	15.5
1978	1.40	0.10	2.10	-	-	3.6	4.90	-	4.9	8.5	3.40	1.40	4.8	0.10	13.4	13.4
1979	1.70	0.20	2.10	-	-	4.0	7.20	-	7.2	11.2	3.90	1.90	5.8		17.0	17.0
1980	2.20	0.20	5.00	-	-	7.4	5.30	-	5.3	12.7	4.50	2.30	6.8		19.5	19.5
1981	1.50	0.30	4.60	-	-	6.4	4.10	-	4.1	10.5	4.10	1.90	6.0		16.5	16.5
1982	1.25	0.27	4.18	-	-	5.7	3.92	0.49	4.4	10.1	5.01	2.49	7.5		17.1	17.6
1983	2.10	0.37	6.57	-	-	9.0	5.29	0.57	5.9	14.9	5.19	2.86	8.0		22.4	22.9
1984	2.27	0.33	7.52	-	-	10.1	5.84	0.69	6.5	16.7	4.30	1.22	5.5		21.5	22.2
1985	1.81	0.77	4.42	-	-	7.0	5.33	0.79	6.1	13.1	3.77	2.05	5.8		18.2	18.9
1986	2.07	0.83	3.46	-	-	6.4	4.86	0.98	5.8	12.2	3.16	1.79	4.9	0.01	16.2	17.2
1987	1.97	0.53	4.41	-	-	6.9	3.50	0.95	4.5	11.4	3.47	1.33	4.8	0.03	15.2	16.2
1988	1.99	0.70	2.97	-	-	5.6	3.98	0.99	5.0	10.6	4.30	1.71	6.0	0.02	15.7	16.7
1989	1.86	0.56	1.95	-	-	4.4	3.92	0.90	4.8	9.2	2.74	1.85	4.6	0.02	12.9	13.8
1990	1.72	0.59	2.13	-	-	4.4	4.13	1.20	5.3	9.8	2.26	1.14	3.4	0.03	12.0	13.2
1991	1.41	0.42	2.20	-	-	4.0	3.63	1.21	4.8	8.9	2.71	1.25	4.0	0.01	11.6	12.8
1992	1.48	0.40	2.05	-	-	3.9	3.79	0.98	4.8	8.7	3.77	1.33	5.1		12.8	13.8
1993	1.26	0.36	2.74	-	0.01	4.4	2.67	0.54	3.2	7.6	3.04	0.87	3.9		10.9	11.5
1994	1.90	0.37	1.47	-	0.00	3.7	2.72	0.33	3.0	6.8	2.30	0.79	3.1		9.5	9.9
1995	1.59	0.37	0.96	-	0.00	2.9	5.27	0.46	5.7	8.7	2.57	1.03	3.6		11.8	12.2
1996	1.15	0.21	0.98	-	0.03	2.4	3.64	0.98	4.6	7.0	2.01	0.89	2.9		8.9	9.9
1997	1.04	0.30	0.77	-	0.04	2.2	3.10	0.88	4.0	6.1	1.51	0.91	2.4		7.6	8.5
1998	0.75	0.32	0.63	-	0.04	1.7	2.83	0.52	3.4	5.1	1.67	0.91	2.6		7.1	7.7
1999	0.60	0.17	0.25	0.22	0.02	1.3	2.45	0.57	3.0	4.3	2.12	1.09	3.2		6.9	7.5
2000	0.85	0.13	0.15	0.13	0.01	1.3	2.81	0.58	3.4	4.7	2.09	1.16	3.3		7.3	7.9
2001	0.58	0.18	0.11	0.14	0.04	1.0	2.18	1.20	3.4	4.4	2.00	1.20	3.2		6.4	7.6
2002	0.60	0.12	0.14	0.05	0.02	.9	2.13	0.88	3.0	3.9	1.80	0.97	2.8		5.8	6.7
2003	0.43	0.25	0.17	0.23	0.02	1.1	2.43	1.25	3.7	4.8	1.15	0.96	2.1		5.6	6.9
2004	0.42	0.25	0.13	0.19	0.03	1.0	2.79	1.06	3.9	4.9	1.31	0.80	2.1		5.9	7.0
2005	0.63	0.17	0.23	0.40	0.02	1.5	3.91	.89	4.8	6.3	1.12	0.96	2.1		7.4	8.3
2006	0.71	0.27	0.35	0.20	0.02	1.5	6.51	0.63	7.1	8.7	1.14	0.91	2.0		10.1	10.7

Table 7.2 HAKE SOUTHERN STOCK - length compositions (thousands) by gear in 2006 (without Cadiz)

Length class (cm)	PORTUGAL		SPAIN					STOCK TOTAL
	Trawl	Hooks gillnets	Trawl	Small gillnets	Gillnets	Artisanal	Longline	
10								
11								
12								
13								
14								
15								
16	1	0						1
17	2	0						2
18	3	2	3	0		0		8
19	1	3	30	16		18		67
20	3	6	38	36		41		124
21	1	10	55	44		50		161
22	1	17	86	58		66		228
23	3	23	139	78		89		331
24	3	38	349	102		116		609
25	28	53	631	131	0	145	0	988
26	89	73	1053	133		142		1491
27	255	100	1598	128		112		2194
28	368	145	1791	115	0	90	0	2509
29	497	186	1947	136	0	87	0	2852
30	517	216	1622	132	0	84	0	2571
31	311	239	1643	119	1	74	0	2385
32	234	218	1670	94	0	56	0	2273
33	209	180	1204	72	1	42	0	1708
34	186	181	1321	43	1	26	1	1759
35	191	161	1172	37	1	19	1	1582
36	119	123	956	21	1	12	1	1232
37	86	103	689	16	2	10	3	910
38	64	99	475	12	2	6	4	662
39	53	81	499	10	5	5	8	660
40	46	68	367	6	7	3	10	506
41	41	71	388	4	5	2	13	523
42	31	72	344	1	8	1	14	472
43	28	66	246	1	12	0	19	372
44	29	60	213	1	12	0	19	334
45	24	63	199	0	18	0	23	327
46	16	67	150	0	21	0	24	279
47	15	58	136	1	24	0	24	257
48	10	57	104	0	28	0	23	223
49	9	56	111		28		22	227
50	8	32	105		33		21	199
51	5	43	95	0	37	0	20	200
52	4	42	83	0	39	0	19	188
53	5	33	83	0	38	0	15	174
54	4	27	77		43		13	164
55	3	16	47		37		11	114
56	2	17	46		36		10	110
57	1	10	34	0	31	0	8	84
58	1	6	24		26		6	63
59	1	6	25		22		6	60
60	0	3	20	0	18	0	4	46
61	1	2	16		15		4	37
62	0	3	11		13		3	30
63	0	3	11		11		3	28
64	0	0	9		8		2	20
65	0	2	8		7		2	19
66	0	1	5		5		2	14
67	0	1	3		3		1	9
68	0	1	3		4		1	10
69	0	0	3		2		1	6
70	0	1	2		2		1	6
71	0	0	2		3		1	7
72	0	0	1		1		1	4
73	0	0	1		1		1	3
74	0	0	0		1		1	2
75	0	0	1		1		0	2
76	0	0	1		0		0	2
77			0		0		0	1
78		0	0		1		0	2
79	0	0	0		0		0	1
80		0	0				0	0
81	0	0	0		0		0	0
82	0	0	0				0	0
83		0	0		0		0	1
84		0	0				0	0
85	0	0	0				0	0
86		0	0		0		0	1
87					0		0	0
88			0		0		0	0
89			0				0	0
90	0		0				0	0
TOTAL	3509	3147	21951	1547	617	1298	369	32438
Nominal Weight (tons)	907.9	1249.4	6507	270.1	706.2	200.9	347.0	10188.1
Mean length (cm)	32.5	36.5	33.4	28.5	53.6	27.4	49.9	33.7

Table 7.3 HAKE SOUTHERN STOCK - ALKs used in the assessment

<table>
<tr><th rowspan="2">Year</th><th>Landings + Commercial</th><th colspan="2">Portuguese surveys</th><th>7.8.1 Spanish surveys</th></tr>
<tr><th>tuning fleets</th><th>July</th><th>October</th><th>September</th></tr>
<tr><td>1982</td><td rowspan="5">Combined IEO 1994-98</td><td rowspan="7"></td><td rowspan="3"></td><td></td></tr>
<tr><td>1983</td><td rowspan="4">Combined September IEO 1994-98</td></tr>
<tr><td>1984</td></tr>
<tr><td>1985</td><td rowspan="8">Combined IPIMAR 93-98</td></tr>
<tr><td>1986</td></tr>
<tr><td>1987</td><td rowspan="3">Combined AZTI 87-89</td><td>no survey</td></tr>
<tr><td>1988</td><td rowspan="6">Combined September IEO 1994-98</td></tr>
<tr><td>1989</td><td rowspan="4">Combined IPIMAR 93+95+97+98</td></tr>
<tr><td>1990</td><td rowspan="3">Combined IEO 1994-98</td></tr>
<tr><td>1991</td></tr>
<tr><td>1992</td></tr>
<tr><td>1993</td><td>Annual IEO 93*</td><td>July IPIMAR 93</td><td>October IPIMAR 93</td></tr>
<tr><td>1994</td><td>Annual IEO 94</td><td>no survey</td><td>October IPIMAR 94</td><td>September IEO 94</td></tr>
<tr><td>1995</td><td>Annual IEO 95</td><td>July IPIMAR 95</td><td>October IPIMAR 95</td><td>September IEO 95</td></tr>
<tr><td>1996</td><td>Annual IEO 96</td><td>no survey</td><td>October IPIMAR 96</td><td>September IEO 96</td></tr>
<tr><td>1997</td><td>Annual IEO 97</td><td>July IPIMAR 97</td><td>October IPIMAR 97</td><td>September IEO 97</td></tr>
<tr><td>1998</td><td>Annual IEO 98</td><td>July IPIMAR 98</td><td>October IPIMAR 98</td><td>September IEO 98</td></tr>
<tr><td>1999</td><td>Annual IEO +AZTI 99</td><td>July IPIMAR 99</td><td>October IPIMAR 99</td><td>September IEO 99</td></tr>
<tr><td>2000</td><td>Annual IEO +AZTI 00</td><td>July IPIMAR 00</td><td>October IPIMAR 00</td><td>September IEO 00</td></tr>
<tr><td>2001</td><td>Annual Iberian 01</td><td>July IPIMAR 01</td><td>October IPIMAR 01</td><td>September IEO 01</td></tr>
<tr><td>2002</td><td>Annual Iberian 02</td><td>No survey</td><td>October IPIMAR 02</td><td>September IEO 02</td></tr>
<tr><td>2003</td><td>Annual Iberian 03</td><td>No survey</td><td>October IPIMAR 03</td><td>September IEO 03</td></tr>
<tr><td>2004</td><td>Annual Iberian** 04</td><td>No survey</td><td>October IPIMAR 04</td><td>September IEO 04</td></tr>
<tr><td>2005</td><td>Annual Iberian 05</td><td>No survey</td><td>October IPIMAR 05</td><td>September IEO 05</td></tr>
<tr><td>2006</td><td>Annual Iberian 06</td><td>No survey</td><td>October IPIMAR 06</td><td>September IEO 06</td></tr>
</table>

* - Just one reader

** - IEO and IPIMAR

Table 7.4. Southern Hake Stock. Landings numbers at age (thousands)

Year	1982	1983	1984	1985	1986	1987	1988	1989
Age								
0	18606.4	9701.4	4831	18292	5334.4	1075.2	4294.7	1056.8
1	24785.5	19256.8	8220	26320.7	16519.5	8306.6	14352.6	6333
2	22533.4	21901.7	11850.7	24904	21128.1	16543.7	20964.5	18222.6
3	7540.5	9752.8	7273.4	7214	7956.8	9996.2	8546.9	10983.7
4	3299	5523.3	5885.4	3231.2	4967.6	5097.9	3274.4	2720.7
5	2193	3693.5	4576.1	2422.6	2940.4	3123.4	2836.6	1847.8
6	1831.3	2824.9	3361.9	2097.5	1739.9	1610.6	1816.5	1114.8
7	1249	1873.3	2080.4	1421.4	885.1	806.7	1022.9	647.9
8+	989.6	1383.6	1436.6	902.1	408.2	420.9	657	507.4

Year	1990	1991	1992	1993	1994	1995	1996	1997
Age								
0	698.9	1675	944.4	1297.7	2060.3	326.4	776.9	299
1	5114	3058.3	2060.9	3319.4	2934.6	2019.4	1162.1	1290.9
2	14988.2	9816.3	8875	6758.7	6414	15967.6	8074.2	11019.6
3	6325.7	6670.7	7422	3613.9	4190.7	9493.2	6443.9	6940.8
4	3294.1	3535.6	3807.6	2476.4	3577.7	4207.8	2882.4	1434.3
5	1958.7	2031	2027.9	1881.5	1979.9	1900.9	1060.8	1090.8
6	1352.9	1399.8	1357.1	1684.7	990.2	1062	906.6	757.4
7	832.1	859.6	909.3	997.9	630.4	697.8	524.7	410.8
8+	557.4	586.6	810.4	962.8	681.1	415.6	386.4	210.8

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006
Age									
0	21.2	0.9	15.4	0	9.3	0	0.1	0.19	12.2
1	2861.9	1242.3	1491.5	656.7	406.8	1401.1	1856.6	742.98	3041.8
2	12047.5	6421.2	6499.5	7223.6	3933.2	7871.1	8286	7421.85	13608.1
3	5172.3	9603.8	8439.7	6982.9	6896	5976.1	4570.9	10184.69	11072.3
4	1706.5	2736.1	3045.2	2060.1	1952.5	1749.3	1777	2741.44	2575.2
5	704.8	891.3	1294.9	1055.1	917	695.3	870.4	962.48	1184.9
6	463.3	424.7	363.8	567.8	582.8	300	363.6	541.27	582.4
7	266.4	208.8	208.2	340.1	206.6	105.9	134.4	186.18	225.2
8+	179	89.3	135.8	151.5	140.7	73.2	55.2	114.91	135.5

Table 7.5. Southern Hake Stock. Landinds mean weight at age (kilograms)

Year	1982	1983	1984	1985	1986	1987	1988	1989
Age								
0	0.026	0.031	0.024	0.029	0.029	0.027	0.023	0.026
1	0.071	0.072	0.078	0.07	0.079	0.06	0.054	0.063
2	0.156	0.167	0.171	0.154	0.157	0.133	0.127	0.14
3	0.306	0.313	0.334	0.3	0.32	0.296	0.283	0.284
4	0.552	0.565	0.584	0.566	0.558	0.604	0.634	0.598
5	0.84	0.82	0.826	0.847	0.788	0.858	0.949	0.917
6	1.117	1.098	1.084	1.12	1.019	1.054	1.131	1.13
7	1.332	1.322	1.298	1.312	1.21	1.206	1.267	1.31
8+	1.93	1.906	1.931	1.804	1.817	1.894	1.916	1.954

Year	1990	1991	1992	1993	1994	1995	1996	1997
Age								
0	0.028	0.031	0.029	0.033	0.026	0.03	0.031	0.038
1	0.1	0.088	0.1	0.105	0.129	0.066	0.068	0.074
2	0.168	0.193	0.197	0.209	0.205	0.169	0.195	0.184
3	0.31	0.315	0.325	0.344	0.317	0.293	0.358	0.304
4	0.556	0.553	0.543	0.59	0.506	0.501	0.59	0.567
5	0.8	0.798	0.789	0.815	0.774	0.734	0.815	0.858
6	1.083	1.077	1.099	1.035	1.091	1.007	1.068	1.075
7	1.302	1.299	1.364	1.287	1.303	1.281	1.266	1.287
8+	1.856	1.885	1.955	1.944	1.895	1.868	2.006	2.095

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006
Age									
0	0.034	0.039	0.033	0.037	0.039	0.044	0.046	0.016	0.053
1	0.127	0.125	0.128	0.103	0.12	0.122	0.127	0.104	0.135
2	0.202	0.179	0.18	0.17	0.184	0.188	0.205	0.185	0.191
3	0.33	0.268	0.266	0.277	0.292	0.303	0.33	0.27	0.303
4	0.544	0.494	0.54	0.5	0.569	0.55	0.58	0.515	0.594
5	0.79	0.86	0.87	0.828	0.846	0.826	0.841	0.861	0.865
6	1.096	1.071	1.131	1.012	1.077	1.069	1.102	1.069	1.215
7	1.276	1.294	1.387	1.227	1.3	1.486	1.294	1.372	1.276
8+	1.905	1.98	1.776	1.644	1.793	1.981	2.09	1.887	1.932

Table 7.6. Southern Hake Stock. Prop. of mature at age (combined sexes).

Year	1982	1983	1984	1985	1986	1987	1988	1989
Age								
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.01
2	0.02	0.02	0.09	0.02	0.02	0.02	0.02	0.03
3	0.13	0.28	0.31	0.21	0.17	0.16	0.12	0.18
4	0.62	0.90	0.68	0.83	0.67	0.59	0.54	0.67
5	0.87	0.97	0.83	0.96	0.86	0.79	0.78	0.88
6	0.95	0.99	0.90	0.99	0.94	0.90	0.88	0.95
7	0.97	1.00	0.93	0.99	0.97	0.94	0.92	0.97
8+	1.00	1.00	0.98	1.00	1.00	0.99	0.98	1.00

Year	1990	1991	1992	1993	1994	1995	1996	1997
Age								
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.02	0.06	0.04	0.02	0.08	0.02	0.02	0.03
2	0.05	0.23	0.17	0.13	0.17	0.14	0.26	0.18
3	0.24	0.48	0.40	0.33	0.33	0.35	0.68	0.45
4	0.66	0.80	0.71	0.72	0.57	0.68	0.94	0.86
5	0.87	0.92	0.88	0.88	0.79	0.85	0.98	0.95
6	0.96	0.97	0.96	0.93	0.92	0.94	0.99	0.98
7	0.99	0.99	0.98	0.97	0.96	0.97	1.00	0.99
8+	1.00	1.00	1.00	1.00	0.99	0.99	1.00	1.00

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006
Age									
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
1	0.04	0.21	0.20	0.03	0.13	0.07	0.13	0.27	0.17
2	0.09	0.28	0.28	0.09	0.22	0.15	0.25	0.45	0.31
3	0.21	0.39	0.41	0.26	0.39	0.32	0.46	0.53	0.54
4	0.46	0.60	0.69	0.64	0.70	0.63	0.74	0.62	0.77
5	0.69	0.80	0.85	0.90	0.86	0.83	0.89	0.81	0.89
6	0.84	0.86	0.90	0.95	0.92	0.90	0.94	0.89	0.96
7	0.90	0.91	0.95	0.98	0.95	0.97	0.96	0.96	0.98
8+	0.97	0.96	0.96	0.99	0.97	0.99	0.99	1.00	0.99

Table 7.7 HAKE SOUTHERN STOCK - Portuguese groundfish surveys; biomass, abundance and recruitment indices

Year	Spring					Summer					Autumn					
	Biomass (kg/h)		Abundance (N/h)			Biomass (kg/h)		Abundance (N/h)			Biomass (kg/h)		Abundance (N/h)			
	Mean	s.e.	Mean	s.e.	hauls	Mean	s.e.	Mean	s.e.	hauls	Mean	s.e.	Mean	s.e.	Age 0 - n/hour	hauls
1979 *						11.7		80.4		55	9.5		na			55
1980 * (**)	11.3		178.1		36	15.4		153.0		63	12.5		108.7			62
1981 (Autumn **)	10.7	0.7	122.4	15.5	67	9.9	1.3	87.8	15.5	69	24.4	0.5	734.8	29.3		111
1982	18.1	2.5	265.6	37.5	69	11.0	2.7	93.0	32.8	70	10.6	1.8	119.5	34.7		190
1983 (Autumn **)	27.0	6.0	530.5	151.0	69	15.1	2.3	120.5	20.8	98	13.4	0.5	121.8	4.8		117
1984																
1985						14.3	0.8	170.7	15.6	101	11.0	0.7	128.7	8.4	60.1	150
1986						27.4	1.8	249.4	15.1	118	17.7	1.2	165.6	28.4	73.0	117
1987											8.6	0.9	37.4	3.7	3.1	81
1988											15.3	1.7	177.8	30.8	77.7	98
1989						11.9	0.9	80.8	8.6	114	8.4	0.5	59.6	4.6	12.9	130
1990						9.8	1.0	95.6	13.5	98	11.8	1.0	157.2	26.3	82.0	107
1991						14.2	1.2	104.2	11.3	119	20.9	4.3	195.3	41.5	56.6	80
1992	14.5	1.2	176.4	32.3	88	10.9	1.1	74.1	11.4	81	11.7	1.7	65.2	11.1	12.1	51
1993	9.0	0.7	78.7	16.8	75	11.3	1.7	105.0	34.7	66	5.5	0.8	54.4	12.9	23.2	58
1994											9.9	1.0	98.9	12.1	18.3	77
1995						15.0	1.4	129.3	16.3	81	14.8	1.7	85.8	10.7	2.1	80
1996***											9.2	1.1	109.9	17.8	56.4	63
1997						19.0	1.4	206.5	16.9	86	24.6	9.3	208.0	92.5	40.4	51
1998						10.5	0.8	71.6	8.6	87	15.6	2.0	140.6	21.7	54.0	64
1999***						11.8	0.7	116.2	10.1	65	11.6	1.5	118.3	17.1	43.2	71
2000						16.4	1.6	123.0	15.2	88	11.8	1.8	102.7	19.9	29.9	66
2001						16.6	1.7	132.5	14.2	83	15.6	2.8	164.2	38.5	50.9	58
2002 +++											13.0	2.1	117.6	26.9	43.5	66
2003 *** +++											9.8	1.0	94.2	8.0	30.7	71
2004 *** +++											18.4	3.3	402.3	85.2	250.2	79
2005 (Autumn ++	17.3	2.5	379.2	52.1	68						18.9	1.9	213.7	23.5	105.7	87
2006 (Autumn ++	15.9	2.0	374.4	55.1	67						16.5	1.8	126.2	11.0	44.7	88

all data concerns 20 mm cod end mesh size except data marked with * which concerns 40 mm
(**) all area not covered
*** R/V Capricornio, other years R/V Noruega
Strata depth:
from 1979 to 1988 covers 20-500 m depth
from 1989 to 2004 covers 20-750 m depth
since 2005 covers 20-500 m depth
+++ 30 minutes tow

Table 7.8 HAKE SOUTHERN STOCK - Spanish groundfish surveys; abundances and recruitment indices for total area (Mino - Bidasoa). Biomass for Cadiz surveys.

	Spanish Survey (Sp-GFS)						Cadiz Survey (Sp-GFS-caut)				Cadiz Survey (Sp-GFS-cspr)			
	Biomass index (Kg/30min)			Abundance Index (nº/30min)		Age 0 (n/30 min)	Biomass index (Kg/h)		n/h		Biomass index (Kg/h)		n/h	
Year	Mean	s.e.	Hauls	Mean	s.e.	Mean	Mean	s.e.	hauls	age 0	Mean	s.e.	hauls	age 0
1983	7.04	0.65	107	192.4	25.0	172.6								
1984	6.33	0.60	94	410.4	53.5	394.8								
1985	3.83	0.39	97	108.5	14.0	93.6								
1986	4.16	0.50	92	247.8	46.5	236.2								
1987														
1988	5.59	0.69	101	390.0	67.4	378.4								
1989	7.14	0.75	91	487.9	73.1	469.9								
1990	3.34	0.32	120	85.9	9.1	72.4								
1991	3.37	0.39	107	166.8	15.8	157.4								
1992	2.14	0.19	116	59.3	5.4	49.8								
1993	2.49	0.21	109	80.0	8.0	67.4					30	3.04	0.10	
1994	3.98	0.33	118	245.0	24.9	233.8					30	2.68	0.06	
1995	4.58	0.44	116	80.9	8.4	66.6					30	4.66	0.23	
1996	6.54	0.59	114	345.2	40.5	329.4					31	7.66	0.20	
1997	7.27	0.78	119	421.4	56.5	398.1	5.28	0.53	27		30	3.34	0.09	
1998	3.36	0.28	114	75.9	8.7	60.3	2.66	0.07	34		31	2.93	0.12	
1999	3.35	0.25	116	95.3	10.6	75.9	2.71	0.07	38		38	3.03	0.06	
2000	3.01	0.43	113	66.9	7.4	56.6	2.03	0.11	30	17.8	41	3.02	0.07	NA
2001	1.73	0.29	113	42.0	7.6	35.7	2.57	0.07	39	22.5	40	6.01	0.13	NA
2002	1.91	0.23	110	57.1	8.8	50.9	3.39	0.13	39	116.2	41	2.74	0.04	NA
2003	2.61	0.27	112	92.8	11.6	80.3	1.61	0.04	41	15.8				
2004	3.94	0.40	114	177.0	23.5	156.6	2.72	0.11	40	83.6	40	3.65	0.07	NA
2005	6.46	0.53	116	344.8	32.2	325.2	6.68	0.20	42	88.7	40	10.77	0.89	NA
2006	5.50	0.39	115	224.5	21.9	209.7	4.99	0.31	41	210.0	41	2.15	0.06	NA

Since 1997 new depth stratification: 70-120m, 121-200m and 201-500 m

Before 1997: 30-100m, 101-200m and 201-500 m

Table 7.9 HAKE SOUTHERN STOCK. Landings (tonnes), Catch per unit effort and effort for trawl fleets

	A Coruña Trawl			A Coruña Pair Trawl			Vigo and Marín trawl [1]			Santander trawl			Cadiz trawl			Portugal trawl		
YEAR	Landings	lpue *	Effort	Landings	lpue *	Effort	Landings	lpue *	Effort	Landings	lpue *	Effort	Landings	lpue ***	Effort	Landings	lpue **	Effort
1985	945	20.6	45920	1016	42.9	23700												
1986	842	21.1	39810	1009	39.4	25630				218	12.0	18153						
1987	695	20.0	34680	752	25.2	29820				455	30.3	14995						
1988	698	16.5	42180	410	31.6	12980				219	13.1	16660				1714		
1989	715	16.1	44440	480	31.5	15240				245	13.9	17607				1847	9.8	187553
1990	749	16.9	44430	429	23.5	18250	438	17.5	25063	392	19.2	20469				1138	11.2	101552
1991	501	12.4	40440	609	19.9	30530	368	12.6	29260	340	15.2	22391				1245	9.4	132126
1992	589	15.1	38910	730	27.4	26670	666	21.4	31146	311	13.6	22833				1325	8.1	163825
1993	514	11.5	44504	350	16.4	21349	290	13.1	22198	390	18.2	21370				871	6.8	128011
1994	473	11.9	39589	319	15.4	20732	556	21.3	26115	296	13.0	22772	326	11.7	27823	789	6.2	128033
1995	831	20.1	41452	691	23.9	28988	1018	35.5	28677	336	23.9	14046	458	14.2	32194	1026	12.4	82450
1996	722	20.2	35728	249	14.2	17555	647	21.9	29480	274	22.7	12071	975	30.5	31951	894	7.6	118257
1997	732	20.8	35211	295	18.1	16307	347	9.2	37578	127	10.8	11776	880	27.0	32573	906	8.0	112583
1998	895	27.5	32563	198	11.7	16966	284	6.7	42371	122	11.4	10646	523	15.9	32824	913	8.9	102919
1999	691	22.8	30232	139	14.9	9322	402	10.1	39738	92	8.9	10349	570	17.4	32731	1092	11.3	97000
2000	590	19.6	30102	92	28.7	3190	371	11.0	33771	52	5.9	8779	584	19.5	29875	1162	8.6	134681
2001	597	20.0	29923	91	18.6	4873	293	8.7	33802	47	15.5	3053	1203	39.6	30416	1210	9.6	126478
2002	232	10.6	21823	266	37.2	7147	256	10.6	24288	30	7.6	3975	883	28.9	30526	970	12.2	79443
2003	274	14.8	18493	121	30.2	3988	397	17.2	23151	22	5.8	3837	1251	39.5	31643	962	8.0	120419
2004	259	12.3	21112	249	29.0	8582	259	23.2	11139	17	4.6	3776	1062	35.4	30029	728	10.3	71013
2005	330	16.0	20663	428	47.5	9025	286	28.7	9981	7	4.9	1404	885	27.3	32419	965	10.0	96849
2006	518	26.9	19264	489	78.2	6245	360	32.3	11128	24	9.0	2718	634	24.1	26248	908	10.2	88788

* - Kg/fishind day x100 HP

** - Kg/hour (new lpue serie)

***- Kg/fishing day

[1] 2004 and 2005 Vigo-Marin fleet change in sampling design

2003 - Pt lpue - revised

Trawl cadiz effort revised in 2007 WG

Table 7.10

SOUTHERN HAKE. TUNNING FLEETS. WG2007. Without Cadiz

111										
P-Tr-89			**NOT USED**							
1989	1994									
1	1	0	1							
0	8									
187.55	1022.10	4347.20	5302.40	1857.30	363.80	73.60	13.30	5.40	1.90	1989
101.55	63.30	1009.90	3169.40	1183.30	244.80	57.00	21.50	9.60	2.10	1990
132.13	2.70	302.30	2788.80	1583.00	331.90	61.50	18.00	8.90	3.80	1991
163.82	0.00	234.80	2509.10	1673.60	365.30	75.40	24.70	11.60	4.70	1992
128.01	0.30	199.80	1460.70	805.30	224.70	77.40	49.40	18.50	6.90	1993
128.03	3.20	400.10	1279.00	800.70	358.00	84.60	17.40	6.40	4.00	1994
P-Tr-95										
1995	2006									
1	1	0	1							
0	8									
82.45	0.90	38.00	2947.30	1297.60	215.20	51.20	14.10	5.60	2.00	1995
118.26	0.10	31.30	1998.50	1023.40	188.00	50.50	26.10	9.90	3.80	1996
112.58	1.00	35.40	2667.60	1103.60	116.60	56.20	28.70	11.30	3.00	1997
102.92	7.60	348.70	2229.90	827.90	165.40	41.30	15.10	6.30	1.90	1998
97.00	0.00	323.80	2171.70	2027.80	262.70	41.90	18.50	8.00	1.50	1999
134.68	0.00	332.70	1700.70	2143.10	344.10	73.00	17.70	7.80	3.80	2000
126.48	0.00	93.00	2044.10	1953.40	348.80	107.90	47.00	24.70	8.80	2001 IBE01 ALK
79.44	0.00	93.90	1307.80	1863.50	244.60	66.40	33.00	10.00	5.40	2002 IBE02ALK
120.42	0.00	195.10	1944.00	1210.30	220.30	75.70	30.40	8.30	4.60	2003 IBE03ALK
78.11	0.00	176.78	1573.87	728.33	203.18	81.76	25.54	7.99	2.31	2004 IBE04ALK
96.85	0.00	39.80	1698.50	1955.20	233.30	57.90	25.30	6.80	3.30	2005 IBE05ALK
88.79	1.40	286.40	1643.40	1311.10	189.40	55.00	15.50	4.90	2.30	2006 IBE06ALK
SP-CORUTR8c-85										
1985	1993									
1	1	0	1							
0	8									
45.92	0.85	380.13	1763.25	662.97	229.86	90.33	51.64	27.00	10.32	1985
39.81	12.72	768.48	1397.08	473.85	234.57	111.45	53.02	24.53	10.67	1986
34.68	5.12	451.14	1322.29	366.79	181.08	87.46	41.62	21.60	8.75	1987
42.18	4.38	382.37	1172.86	411.59	183.65	96.79	47.03	25.05	9.01	1988
44.44	0.42	152.99	1117.28	607.24	209.69	81.32	31.58	14.26	6.40	1989
44.43	0.02	146.53	1108.80	539.90	249.17	95.34	38.07	16.08	7.24	1990
40.44	0.00	47.32	466.25	308.83	186.11	85.06	41.39	19.44	8.81	1991
38.91	0.00	105.08	845.37	372.64	161.88	77.18	42.50	22.05	11.52	1992
44.50	0.40	135.05	610.06	277.18	136.24	64.80	43.62	19.22	13.07	1993
SP-CORUTR8c-94										
1994	2006									
1	1	0	1							
0	8									
39.59	0.00	257.27	736.18	461.95	269.04	89.86	25.25	13.06	8.94	1994
41.45	0.00	23.60	2591.82	900.05	355.13	100.04	29.46	14.85	8.19	1995
35.73	0.06	99.76	860.43	719.62	272.42	66.94	47.80	25.31	11.73	1996
35.21	0.50	60.17	935.31	725.25	175.18	101.99	57.25	25.36	4.30	1997
32.56	0.00	289.50	1867.37	849.80	228.46	58.49	25.79	12.40	6.38	1998
30.23	0.00	63.80	305.70	889.80	457.20	95.30	35.30	14.90	5.50	1999
30.10	0.00	48.21	392.50	818.52	317.31	92.40	19.98	9.06	5.11	2000
29.92	0.00	6.34	388.37	673.80	256.99	98.70	47.38	29.58	16.70	2001 IBE01 ALK
21.82	0.00	0.90	24.47	122.36	77.16	44.12	31.85	15.28	18.61	2002 IBE02 ALK
18.49	0.00	49.26	351.68	351.31	96.97	27.52	10.41	2.78	1.37	2003 IBE03 ALK
21.11	0.01	40.63	302.72	231.05	94.75	38.47	13.57	4.44	1.77	2004 IBE04ALK
20.66	0.00	5.22	129.07	325.33	163.18	63.15	33.14	10.12	5.03	2005 IBE05ALK
19.26	0.00	48.10	457.20	704.40	159.20	53.50	23.30	8.60	4.70	2006 IBE06ALK

Table 7.10 (Continued)

SP-CORUTRP8c-85				**NOT USED**						
1985	1993									
1	1	0	1							
0	8									
23.70	0.06	89.96	748.56	635.32	323.14	152.46	97.69	59.24	30.57	1985
25.63	1.76	208.07	965.55	597.00	392.64	187.16	83.61	34.66	11.02	1986
29.82	0.24	58.67	362.43	383.26	379.21	167.81	62.63	27.32	11.13	1987
12.98	0.14	41.62	363.90	286.74	161.39	71.65	29.74	13.24	4.17	1988
15.24	0.00	23.22	255.19	296.21	222.66	99.19	37.10	15.43	6.76	1989
18.25	0.01	33.17	339.82	333.73	175.58	68.38	28.41	12.28	4.75	1990
30.53	0.00	13.97	243.00	355.97	283.67	129.68	56.31	23.98	9.94	1991
26.67	0.00	24.23	366.44	513.92	285.78	138.82	66.42	29.75	11.10	1992
21.35	0.00	8.32	99.10	123.47	110.40	70.90	51.55	25.63	17.34	1993
SP-CORUTRP8c-94										
1994	2006			**NOT USED**						
1	1	0	1							
0	8									
20.73	0.00	42.70	207.28	227.93	188.59	68.10	23.25	12.25	7.61	1994
28.99	0.00	5.17	868.23	847.01	358.32	105.60	31.38	12.64	4.90	1995
17.56	0.00	1.23	279.99	265.15	112.16	25.22	12.21	4.04	1.26	1996
16.31	0.00	3.88	352.23	362.18	68.32	45.54	25.74	10.53	2.06	1997
16.97	0.00	31.02	329.18	207.05	60.63	16.21	6.67	3.11	1.47	1998
9.32	0.00	8.90	92.80	215.20	80.40	17.70	5.80	1.90	0.50	1999
3.19	0.00	9.63	86.44	161.64	40.11	8.61	1.96	0.99	0.66	2000
4.87	0.00	0.81	75.78	156.51	41.39	7.58	3.16	1.19	0.35	2001 IBE01 ALK
7.15	0.00	1.14	87.24	395.65	107.57	33.48	17.72	5.17	4.74	2002 IBE02 ALK
3.99	0.00	9.73	124.70	181.04	47.32	9.36	3.13	0.77	0.42	2003 IBE03 ALK
8.58	0.00	65.57	490.06	268.47	59.35	14.60	4.98	1.80	0.79	2004 IBE04ALK
9.03	0.00	5.61	183.17	445.29	230.45	74.06	35.49	10.87	7.05	2005 IBE05ALK
6.25	0.00	24.60	138.30	220.90	176.70	120.10	64.90	25.10	14.40	2006 IBE06ALK
SP-SANTR				**NOT USED**						
1986	2006									
1	1	0	1							
0	8									
18.15	0.00	0.37	10.00	70.04	114.58	58.99	26.20	11.09	5.76	1986
15.00	0.00	0.91	21.25	75.30	183.42	141.44	67.42	29.36	12.10	1987
16.66	0.00	0.07	3.54	33.46	98.88	64.47	31.69	14.48	6.17	1988
17.61	0.00	0.48	12.53	70.98	135.76	69.99	28.00	10.84	4.44	1989
20.47	0.00	0.34	26.22	151.74	231.10	107.86	41.40	15.21	5.56	1990
22.39	0.00	0.20	8.28	55.73	162.81	104.93	51.52	22.00	8.77	1991
22.83	0.00	0.04	6.08	70.84	168.82	88.11	38.11	16.97	10.02	1992
21.37	0.00	0.21	42.43	93.52	140.92	100.99	69.64	31.83	14.92	1993
22.77	0.00	4.12	51.05	113.85	195.38	112.17	31.78	12.05	5.92	1994
14.05	0.00	0.00	39.58	161.63	280.32	122.89	37.65	11.62	2.49	1995
12.07	0.00	0.00	25.88	204.82	187.26	51.38	25.64	8.04	2.63	1996
11.78	0.00	0.00	12.03	84.29	77.11	34.63	15.01	4.85	1.78	1997
10.65	0.00	0.55	27.73	75.00	83.25	29.26	10.87	4.51	1.84	1998
10.35	0.00	0.10	6.20	57.80	85.90	21.30	6.00	1.70	0.60	1999
8.78	0.00	0.72	7.34	29.13	50.78	13.35	2.03	0.48	0.25	2000
3.05	0.00	0.06	11.05	43.28	33.81	10.41	3.14	1.29	0.43	2001 IBE01 ALK
3.98	0.00	0.28	12.34	48.28	15.44	3.49	1.17	0.26	0.08	2002 IBE02 ALK
3.84	0.00	0.02	4.97	23.41	15.89	4.04	1.04	0.07	0.01	2003 IBE03 ALK
3.78	0.00	0.05	7.77	20.16	10.11	2.13	0.41	0.09	0.01	2004 IBE04ALK
1.40	0.00	0.00	1.16	6.26	5.17	1.35	0.47	0.07	0.01	2005 IBE05ALK
2.72	0.00	0.00	4.20	23.50	15.60	4.60	0.80	0.20	0.00	2006 IBE06ALK

Table 7.10 (Cont'd)

SP-VIMATR				**NOT USED**						
1990	2006									
1	1	0	1							
0	8									
25.06	2.10	107.30	540.20	322.20	133.70	56.80	30.80	15.10	4.90	1990
29.26	0.00	40.10	415.30	325.70	116.30	39.90	18.70	9.20	5.60	1991
31.15	0.60	63.50	461.20	728.70	398.00	119.70	44.20	19.70	6.50	1992
22.20	0.90	121.90	452.60	219.40	78.50	30.60	25.60	10.90	5.40	1993
26.12	0.00	141.80	607.10	467.30	294.70	84.30	30.30	18.00	7.60	1994
28.68	0.00	72.70	2352.30	1079.30	340.10	111.90	55.70	29.40	6.90	1995
29.48	0.80	75.10	875.00	753.60	201.90	43.60	35.90	19.20	4.50	1996
37.58	0.10	84.00	768.40	426.80	69.20	28.90	14.30	6.30	1.20	1997
42.37	0.00	123.51	697.31	250.53	49.44	15.81	8.59	4.42	1.29	1998
39.74	0.00	78.50	495.90	871.90	134.00	17.30	6.80	2.40	0.10	1999
33.77	0.12	136.19	593.68	625.64	139.89	32.06	6.19	2.19	1.21	2000
33.80	0.00	56.22	585.77	449.21	89.31	19.61	7.92	4.83	2.44	2001 IBE01 ALK
24.29	0.09	65.77	413.91	413.60	80.25	22.31	9.30	2.62	1.18	2002 IBE02 ALK
23.15	0.00	191.25	973.19	462.56	79.14	27.27	9.44	1.90	0.84	2003 IBE03 ALK
11.14	0.01	256.82	589.77	192.24	59.93	22.90	7.48	2.55	0.91	2004 IBE04ALK
9.98	0.00	57.33	498.38	466.33	72.19	23.35	14.11	4.85	3.20	2005 IBE05ALK
11.13	0.00	157.40	786.10	533.30	50.10	12.70	4.50	1.80	1.30	2006 IBE06ALK
SP-GFS										
1983	2006									
1	1	0.75	0.83							
0	8									
1	172.63	7.34	6.34	2.63	1.96	0.94	0.28	0.13	0.12	1983 ALK Combined 94-98
1	394.75	6.13	5.55	1.78	1.12	0.70	0.24	0.08	0.03	1984 ALK Combined 94-98
1	93.56	6.79	5.47	1.78	0.84	0.34	0.10	0.03	0.01	1985 ALK Combined 94-98
1	236.24	4.65	3.59	1.81	0.83	0.44	0.16	0.04	0.02	1986 ALK Combined 94-98
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1987
1	378.42	4.98	3.57	1.52	0.89	0.39	0.13	0.08	0.03	1988 ALK Combined 94-98
1	469.86	11.01	4.89	1.22	0.50	0.28	0.13	0.05	0.03	1989 ALK Combined 94-98
1	72.37	7.56	3.23	1.46	0.80	0.34	0.10	0.04	0.04	1990 ALK Combined 94-98
1	157.44	5.47	1.97	0.95	0.58	0.32	0.11	0.05	0.02	1991 ALK Combined 94-98
1	49.78	4.47	3.10	1.29	0.44	0.15	0.06	0.03	0.03	1992 ALK Combined 94-98
1	67.38	8.69	2.31	0.86	0.42	0.18	0.08	0.05	0.03	1993 ALK Combined 94-98
1	233.83	7.12	2.06	1.04	0.79	0.17	0.05	0.06	0.01	1994
1	66.57	2.71	6.21	3.70	1.06	0.45	0.10	0.04	0.02	1995
1	329.39	10.11	2.85	1.47	0.86	0.27	0.13	0.10	0.03	1996
1	398.15	17.44	3.46	1.82	0.46	0.12	0.03	0.01	0.00	1997
1	60.31	9.28	4.33	1.17	0.60	0.27	0.03	0.00	0.00	1998
1	75.86	15.07	1.17	2.19	0.51	0.29	0.05	0.01	0.00	1999
1	56.55	5.26	3.11	1.02	0.48	0.26	0.10	0.05	0.03	2000
1	35.72	3.01	1.56	1.03	0.51	0.10	0.05	0.04	0.02	2001
1	50.87	3.37	1.14	1.09	0.35	0.19	0.11	0.03	0.01	2002
1	80.28	9.41	1.93	0.59	0.33	0.15	0.05	0.03	0.03	2003
1	156.65	17.65	1.76	0.62	0.21	0.12	0.03	0.01	0.02	2004
1	325.17	13.94	2.99	1.84	0.71	0.13	0.02	0.03	0.00	2005
1	209.67	4.31	8.06	1.73	0.37	0.21	0.06	0.05	0.01	2006

Table 7.10 (Continued)

P-GFS-jul			**NOT USED**							
1989	2001									
1	1	0.58	0.67							
0	8									
1	1.32	41.43	30.02	10.69	2.45	1.00	0.41	0.21	0.03	1989
1	5.33	66.06	13.49	7.84	2.23	1.01	0.42	0.27	0.08	1990
1	3.61	58.23	27.08	9.40	2.77	1.60	0.90	0.58	0.07	1991
1	1.40	34.95	23.93	9.16	2.34	1.19	0.65	0.35	0.03	1992
1	4.24	76.33	11.97	6.71	2.48	1.94	0.84	0.45	0.25	1993
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1994
1	1.70	63.10	50.69	9.63	2.47	1.25	0.27	0.12	0.01	1995 alkrev
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1996
1	0.51	169.17	27.65	4.83	2.78	0.91	0.39	0.28	0.02	1997 alkrev
1	3.09	38.59	15.09	9.90	2.81	1.43	0.44	0.14	0.07	1998
1	10.70	62.36	37.29	4.25	1.43	0.72	0.24	0.11	0.13	1999 alkrev
1	5.26	73.89	25.48	10.68	4.52	1.87	0.75	0.26	0.17	2000 alkrev
1	13.08	67.72	30.42	15.45	4.07	0.78	0.54	0.28	0.15	2001
P-GFS-oct										
1989	2006									
1	1	0.83	0.92							
0	8									
1	12.89	20.12	16.89	7.39	1.53	0.37	0.16	0.05	0.04	1989
1	82.01	45.38	19.31	7.41	2.36	0.41	0.11	0.08	0.08	1990
1	56.60	82.40	36.69	14.60	3.13	0.65	0.31	0.17	0.19	1991
1	12.09	20.17	19.11	10.18	2.65	0.61	0.42	0.20	0.13	1992
1	23.24	17.13	8.56	3.56	1.35	0.27	0.26	0.11	0.08	1993
1	18.28	50.94	18.26	5.88	1.52	0.31	0.08	0.05	0.11	1994 alkrev
1	2.10	34.58	37.15	8.12	2.88	0.39	0.30	0.15	0.08	1995 alkrev
1	56.43	33.59	10.07	6.91	1.94	0.85	0.28	0.11	0.02	1996 alkrev
1	40.40	70.39	83.74	8.74	2.34	1.60	0.61	0.01	0.00	1997 alkrev
1	54.02	46.52	22.75	12.33	3.01	1.14	0.56	0.17	0.09	1998 alkrev
1	43.18	43.37	21.21	7.82	2.03	0.39	0.15	0.05	0.07	1999
1	29.90	39.32	21.41	8.88	1.71	1.01	0.29	0.09	0.05	2000 alkrev
1	50.90	73.92	22.21	14.26	2.12	0.62	0.13	0.02	0.02	2001 alkrev
1	43.54	37.13	26.78	7.52	2.11	0.41	0.12	0.01	0.00	2002
1	30.73	44.73	10.93	6.10	1.28	0.25	0.11	0.03	0.00	2003
1	250.16	118.61	22.81	7.94	1.71	0.79	0.17	0.15	0.01	2004
1	105.68	67.42	30.10	7.68	1.99	0.68	0.10	0.09	0.00	2005
1	44.69	35.41	32.58	10.03	2.53	0.62	0.32	0.02	0.03	2006
Cd_Surv_Aut										
2000	2006									
0	1	0.83	0.875							
0	8									
1	17.771	2.264	1.856	1.256	1.412	0.329	0.185	0.068	0.000	2000
1	22.498	2.852	3.302	1.118	0.579	0.179	0.084	0.107	0.022	2001
1	116.242	7.163	2.681	0.648	0.316	0.180	0.120	0.083	0.085	2002
1	15.779	2.596	1.393	1.136	0.677	0.212	0.198	0.000	0.073	2003
1	83.598	7.310	2.412	0.992	0.190	0.061	0.000	0.000	0.000	2004
1	88.661	27.379	2.419	1.128	0.290	0.084	0.039	0.000	0.000	2005
1	209.966	6.968	3.152	1.374	0.578	0.231	0.000	0.000	0.000	2006

Table 7.11a. Southern Hake Stock. FLXSA diagnostics.

```
> diagnostics(hke07.xsa)
FLR XSA Diagnostics 2007-05-04 14:04:05

CPUE data from hke07.ind00

Catch data for 25 years. 1982 to 2006. Ages 0 to 8.

           fleet first age last age first year last year alpha beta
1        P-Tr-95         2        7       1995      2006     0    1
2 SP-CORUTR8c-85         2        7       1985      1993     0    1
3 SP-CORUTR8c-94         3        7       1994      2006     0    1
4         SP-GFS         0        4       1983      2006  0.75 0.83
5      P-GFS-oct         0        4       1989      2006  0.83 0.92


 Time series weights :

   Tapered time weighting not applied

Catchability analysis :

    Catchability independent of size for all ages

    Catchability independent of age for ages >   6

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 =   0.8

    Minimum standard error for population
    estimates derived from each fleet =  0.3

   prior weighting not applied

Regression weights
     year
age   1997 1998 1999 2000 2001 2002 2003 2004 2005 2006
  all    1    1    1    1    1    1    1    1    1    1


 Fishing mortalities
   year
age  1997  1998  1999  2000  2001  2002  2003  2004  2005  2006
  0 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
  1 0.032 0.095 0.047 0.054 0.029 0.015 0.038 0.048 0.015 0.063
  2 0.530 0.464 0.320 0.365 0.394 0.242 0.436 0.333 0.273 0.402
  3 0.782 0.512 0.854 0.932 0.865 0.828 0.712 0.490 0.899 0.846
  4 0.501 0.441 0.566 0.740 0.614 0.634 0.509 0.473 0.622 0.597
  5 0.627 0.495 0.436 0.579 0.623 0.619 0.486 0.517 0.511 0.607
  6 0.868 0.603 0.637 0.318 0.546 0.875 0.419 0.511 0.721 0.679
  7 1.019 0.900 0.607 0.763 0.557 0.389 0.372 0.335 0.539 0.770
  8 1.019 0.900 0.607 0.763 0.557 0.389 0.372 0.335 0.539 0.770
```

Table 7.11b. Southern Hake Stock. FLXSA diagnostics.

XSA population number (thousands)

year \ age	0	1	2	3	4	5	6	7	8
1997	42483	45253	29600	14135	4022	2587	1443	711	358
1998	36682	34782	35882	14264	5292	1995	1131	496	328
1999	38593	30033	25888	18477	6998	2789	996	507	214
2000	31003	31598	23465	15385	6437	3254	1477	431	277
2001	37298	25383	24520	13330	4960	2515	1492	880	388
2002	50147	30537	20188	13539	4595	2197	1105	708	478
2003	53792	41057	24634	12970	4845	1996	969	377	259
2004	68829	44041	32347	13046	5211	2384	1005	522	213
2005	67231	56352	34378	18986	6545	2659	1164	494	302
2006	81480	55044	45465	21431	6329	2878	1306	464	275

Estimated population abundance at 1st Jan 2007

year \ age	0	1	2	3	4	5	6	7	8
2007	0	66710	42314	24910	7527	2851	1285	542	176

Fleet: P-Tr-95

Log catchability residuals.

age \ year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
2	0.673	-0.026	0.240	-0.071	0.223	-0.231	-0.015	0.129	-0.002	-0.099
3	0.003	-0.163	-0.246	-0.569	0.273	0.215	0.301	0.688	-0.165	-0.342
4	-0.076	-0.368	-0.426	-0.288	0.010	0.110	0.394	0.589	-0.039	0.224
5	-0.425	-0.460	-0.127	-0.143	-0.431	-0.295	0.435	0.549	0.301	0.647
6	-0.722	-0.346	0.100	-0.322	0.083	-0.825	0.306	0.858	0.295	0.556
7	-0.538	-0.228	-0.063	-0.246	-0.093	-0.218	0.195	-0.101	-0.081	-0.026

age \ year	2005	2006
2	-0.327	-0.493
3	0.230	-0.226
4	-0.016	-0.114
5	-0.025	-0.027
6	0.277	-0.259
7	-0.257	-0.336

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

	2	3	4	5	6	7
Mean_Logq	-7.0272	-6.5763	-7.5087	-8.0409	-8.2538	-8.2538
S.E_Logq	0.3010	0.3497	0.2991	0.3935	0.5056	0.1824

Table 7.11c. Southern Hake Stock. FLXSA diagnostics.

Fleet: SP-CORUTR8c-85

Log catchability residuals.

age \ year	1985	1986	1987	1988	1989	1990	1991	1992	1993
2	0.149	0.128	0.325	-0.150	-0.026	0.063	-0.580	0.233	-0.143
3	0.097	-0.053	-0.062	-0.092	0.144	0.193	-0.176	0.153	-0.204
4	-0.160	0.001	-0.021	-0.061	0.008	0.151	0.041	0.126	-0.084
5	-0.255	0.062	0.079	0.127	-0.121	-0.007	-0.021	0.070	0.065
6	-0.150	0.103	-0.024	0.178	-0.229	-0.163	-0.031	0.044	0.272
7	-0.215	0.017	0.064	0.030	-0.195	-0.117	0.034	0.154	-0.068

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

	2	3	4	5	6	7
Mean_Logq	-7.1204	-7.3668	-7.5785	-7.822	-7.9179	-7.9179
S.E_Logq	0.2699	0.1495	0.0982	0.120	0.1664	0.1241

Fleet: SP-CORUTR8c-94

Log catchability residuals.

age \ year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
3	-0.600	0.011	0.368	0.183	0.294	0.302	0.438	0.365	-1.057	0.158	-0.496
4	-0.514	-0.041	0.047	-0.009	0.033	0.577	0.374	0.377	-0.426	-0.139	-0.384
5	-0.574	-0.403	-0.317	0.296	0.020	0.221	0.104	0.452	0.096	-0.172	-0.134
6	-0.958	-0.729	0.025	0.521	-0.067	0.463	-0.637	0.324	0.683	-0.334	-0.198
7	-0.848	-0.306	0.476	0.476	0.151	0.263	-0.002	0.386	0.184	-0.732	-0.738

age \ year	2005	2006
3	-0.333	0.367
4	0.018	0.087
5	0.272	0.138
6	0.660	0.246
7	0.254	0.323

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

	3	4	5	6	7
Mean_Logq	-6.2626	-6.3556	-6.7055	-6.8226	-6.8226
S.E_Logq	0.4711	0.3215	0.3020	0.5451	0.4821

Table 7.11d. Southern Hake Stock. FLXSA diagnostics.

Fleet: SP-GFS

Log catchability residuals.

age	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
0	-0.334	0.341	-0.867	0.032	NA	0.821	1.230	-0.440	0.476	-0.847	-0.622
1	-0.316	-0.716	-0.572	-0.787	NA	-0.686	0.252	0.066	-0.085	-0.165	0.349
2	0.347	0.217	0.162	-0.210	NA	-0.271	0.285	-0.053	-0.464	0.179	-0.055
3	-0.043	-0.279	-0.345	-0.267	NA	-0.246	-0.537	-0.257	-0.570	-0.122	-0.549
4	0.183	-0.094	-0.404	-0.366	NA	-0.080	-0.690	-0.233	-0.445	-0.494	-0.496

age	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0	0.845	-0.501	0.908	1.361	-0.380	-0.201	-0.276	-0.920	-0.863	-0.476	-0.054
1	0.057	-0.695	0.506	0.859	0.541	1.135	0.037	-0.322	-0.405	0.345	0.911
2	-0.371	1.041	0.179	0.340	0.320	-0.775	0.336	-0.375	-0.614	-0.134	-0.580
3	-0.253	1.177	0.701	0.664	0.000	0.638	0.118	0.219	0.230	-0.432	-0.564
4	0.190	0.827	0.772	0.447	0.391	0.048	0.208	0.431	0.146	-0.064	-0.618

age	2005	2006
0	0.699	0.068
1	0.402	-0.710
2	-0.159	0.655
3	0.472	0.248
4	0.490	-0.148

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

	0	1	2	3	4
Mean_Logq	-5.8729	-8.5371	-8.8180	-8.8457	-8.9699
S.E_Logq	0.7041	0.5720	0.4348	0.4776	0.4335

Fleet: P-GFS-oct

Log catchability residuals.

age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
0	-1.034	1.017	0.786	-0.929	-0.354	-0.371	-2.625	NA	0.405	0.843	NA
1	-1.017	-0.015	0.751	-0.536	-0.848	0.148	-0.027	NA	0.373	0.278	NA
2	-0.549	-0.342	0.372	-0.088	-0.837	-0.287	0.775	-0.645	1.450	-0.104	0.027
3	-0.681	-0.594	0.207	-0.003	-1.098	-0.484	0.040	0.329	0.304	0.403	-0.012
4	-1.015	-0.589	-0.193	-0.121	-0.764	-0.577	0.429	0.177	0.649	0.573	0.009

age	2000	2001	2002	2003	2004	2005	2006
0	0.419	0.766	0.314	NA	NA	0.908	-0.145
1	0.169	0.998	0.112	NA	NA	0.096	-0.482
2	0.175	0.192	0.441	-0.485	-0.112	0.052	-0.035
3	0.366	0.924	0.236	-0.031	0.032	-0.019	0.081
4	0.073	0.440	0.528	-0.134	0.051	0.105	0.358

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

	0	1	2	3	4
Mean_Logq	-7.1883	-6.6364	-6.6792	-6.8333	-7.4848
S.E_Logq	1.0123	0.5632	0.5418	0.4677	0.4818

Terminal year survivor and F summaries:

Age 0 Year class = 2006

source	survivors	N	scaledWts
SP_GFS	71429	1	0.68
P_GFS_oct	57703	1	0.32

Table 7.11e. Southern Hake Stock. FLXSA diagnostics.

Age 1 Year class = 2005

source

	survivors	N	scaledWts
SP_GFS	36431	2	0.468
P_GFS_oct	36282	2	0.371
fshk	93551	1	0.160

Age 2 Year class = 2004

source

	survivors	N	scaledWts
P_Tr_95	15208	1	0.357
SP_GFS	38840	3	0.346
P_GFS_oct	25583	2	0.215
fshk	30667	1	0.082

Age 3 Year class = 2003

source

	survivors	N	scaledWts
P_Tr_95	5706	2	0.369
SP_CORUTR8c_94	10866	1	0.101
SP_GFS	8713	4	0.279
P_GFS_oct	8079	2	0.164
fshk	8702	1	0.088

Age 4 Year class = 2002

source

	survivors	N	scaledWts
P_Tr_95	2720	3	0.351
SP_CORUTR8c_94	2909	2	0.229
SP_GFS	2574	5	0.207
P_GFS_oct	3479	4	0.151
fshk	2997	1	0.061

Age 5 Year class = 2001

source

	survivors	N	scaledWts
P_Tr_95	1200	4	0.346
SP_CORUTR8c_94	1350	3	0.351
SP_GFS	1243	5	0.133
P_GFS_oct	1325	5	0.109
fshk	1443	1	0.061

Age 6 Year class = 2000

source

	survivors	N	scaledWts
P_Tr_95	534	5	0.368
SP_CORUTR8c_94	596	4	0.354
SP_GFS	319	5	0.108
P_GFS_oct	674	5	0.088
fshk	614	1	0.082

Age 7 Year class = 1999

source

	survivors	N	scaledWts
P_Tr_95	158	6	0.510
SP_CORUTR8c_94	200	5	0.302
SP_GFS	166	5	0.050
P_GFS_oct	181	4	0.039
fshk	206	1	0.098

>

Table 7.12. Southern Hake Stock. Terminal Fs.

hke07.xsa@harvest

An object of class FLQuant:

year age	1982	1983	1984	1985	1986	1987	1988
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	0.339	0.321	0.117	0.362	0.275	0.125	0.249
2	0.503	0.571	0.335	0.616	0.559	0.490	0.530
3	0.293	0.424	0.375	0.350	0.404	0.567	0.510
4	0.204	0.364	0.493	0.283	0.435	0.494	0.365
5	0.184	0.370	0.586	0.386	0.452	0.543	0.569
6	0.229	0.381	0.690	0.592	0.533	0.482	0.718
7	0.228	0.387	0.540	0.719	0.538	0.508	0.654
8	0.228	0.387	0.540	0.719	0.538	0.508	0.654

year age	1989	1990	1991	1992	1993	1994	1995
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	0.132	0.129	0.092	0.071	0.097	0.079	0.067
2	0.577	0.523	0.389	0.420	0.348	0.276	0.789
3	0.593	0.402	0.467	0.577	0.301	0.379	0.856
4	0.299	0.352	0.413	0.536	0.383	0.553	0.832
5	0.361	0.366	0.382	0.443	0.559	0.609	0.652
6	0.458	0.493	0.488	0.478	0.835	0.657	0.797
7	0.612	0.755	0.683	0.691	0.798	0.906	1.605
8	0.612	0.755	0.683	0.691	0.798	0.906	1.605

year age	1996	1997	1998	1999	2000	2001
0	0.000	0.000	0.000	0.000	0.000	0.000
1	0.035	0.032	0.095	0.047	0.054	0.029
2	0.417	0.530	0.464	0.320	0.365	0.394
3	0.896	0.782	0.512	0.854	0.932	0.865
4	0.697	0.501	0.441	0.566	0.740	0.614
5	0.510	0.627	0.495	0.436	0.579	0.623
6	0.768	0.868	0.603	0.637	0.318	0.546
7	1.328	1.019	0.900	0.607	0.763	0.557
8	1.328	1.019	0.900	0.607	0.763	0.557

year age	2002	2003	2004	2005	2006
0	0.000	0.000	0.000	0.000	0.000
1	0.015	0.038	0.048	0.015	0.063
2	0.242	0.436	0.333	0.273	0.402
3	0.828	0.712	0.490	0.899	0.846
4	0.634	0.509	0.473	0.622	0.597
5	0.619	0.486	0.517	0.511	0.607
6	0.875	0.419	0.511	0.721	0.679
7	0.389	0.372	0.335	0.539	0.770
8	0.389	0.372	0.335	0.539	0.770

Table 7.13. Southern Hake Stock. Stock numbers at age (start of year) (thousands)

hke07.xsa@stock.n

year								
age		1982	1983	1984	1985	1986	1987	1988
	0	94668.06	100363.9	116849.8	92669.32	95213.31	87866.76	69257.58
	1	95342.81	77507.65	82171.03	95668.51	75871.23	77954.06	71939.22
	2	63013.09	55633.24	46033.63	59838.19	54510.8	47170.64	56307.27
	3	32793.48	31201.69	25731.17	26966.19	26457.29	25512.17	23650.7
	4	19754.17	20026.1	16721.08	14485.65	15550.55	14461.79	11842.66
	5	14454.77	13188.29	11398.3	8364.736	8936.14	8236.844	7227.54
	6	9898.802	9850.255	7455.639	5191.511	4656.407	4655.708	3917.588
	7	6758.03	6447.425	5508.632	3062.188	2352.553	2238.017	2354.441
	8	5325.304	4723.64	3763.837	1917.365	1073.587	1155.996	1493.526

year								
age		1989	1990	1991	1992	1993	1994	1995
	0	57168.14	46756.75	40690.87	48294.66	52215.87	41793.59	45727.12
	1	56703.31	46805.31	38281.19	33314.86	39540.33	42750.74	34217.7
	2	45912.08	40694.41	33693.61	28574.72	25411.12	29369.36	32346.01
	3	27131.03	21101.14	19755.88	18703.84	15364.57	14689.34	18241.97
	4	11630	12274.54	11552.42	10138.85	8597.704	9309.456	8234.715
	5	6733.152	7060.046	7068.921	6259.18	4855.727	4798.465	4384.701
	6	3350.748	3840.68	4007.972	3949.818	3289.663	2273.082	2137.164
	7	1563.813	1734.647	1920.328	2014.859	2005.883	1168.969	965.072
	8	1210.363	1145.742	1293.642	1772.448	1906.957	1242.324	559.4025

year							
age		1996	1997	1998	1999	2000	2001
	0	55272.07	42483.24	36682.01	38593.3	31003.28	37298.15
	1	37438.2	45252.94	34782.33	30032.69	31597.53	25383.34
	2	26187.85	29600.29	35881.92	25887.81	23464.61	24520.3
	3	12034.59	14134.96	14263.72	18476.6	15385.01	13330.21
	4	6345.462	4022.409	5292.434	6998.059	6437.486	4959.621
	5	2934.64	2587.122	1995.461	2788.973	3253.8	2515.156
	6	1869.884	1442.828	1131.16	996.0162	1476.937	1492.312
	7	788.8242	710.6062	495.9641	506.9039	431.1846	880.0335
	8	567.6797	358.0451	327.8283	214.2739	277.2773	387.7786

year						
age		2002	2003	2004	2005	2006
	0	50146.64	53791.77	68828.69	67230.52	81479.7
	1	30537.14	41056.6	44040.98	56352.16	55043.69
	2	20187.91	24633.61	32346.53	34377.78	45464.97
	3	13539.34	12969.56	13046.23	18985.62	21430.58
	4	4595.46	4845.316	5211.177	6545.425	6328.62
	5	2196.538	1995.749	2384.177	2658.655	2878.383
	6	1104.542	968.6375	1004.848	1164.429	1305.835
	7	708.0353	376.9832	521.6021	493.7009	463.5921
	8	478.2902	258.5448	212.6865	301.5047	274.9734

units:
thousands

Table 7.14. Southern hake Stock. Summary Table

	hke07.summary			
	Yield	Fbar	R	SSB
	(tonnes)	(ages2-5,year-1)	(age=0,thousands)	(thousands)
1982	17108	0.2959	94668	48316
1983	22376	0.4322	100364	51913
1984	21485	0.4471	116850	39025
1985	18152	0.4089	92669	28676
1986	16185	0.4627	95213	22614
1987	15232	0.5236	87867	21204
1988	15667	0.4933	69258	19845
1989	12887	0.4578	57168	19683
1990	11994	0.4108	46757	19812
1991	11618	0.4126	40691	24073
1992	12824	0.4943	48295	22097
1993	10944	0.3978	52216	19002
1994	9542	0.4542	41794	14680
1995	11782	0.7822	45727	12471
1996	8875	0.6299	55272	14266
1997	7619	0.6102	42483	10286
1998	7100	0.4778	36682	6401
1999	6911	0.5441	38593	9928
2000	7318	0.6542	31003	11029
2001	6365	0.6241	37298	8009
2002	5817	0.5807	50147	9088
2003	5617	0.5357	53792	7361
2004	5890	0.4530	68829	10556
2005	7437	0.5759	67231	13398
2006	10188	0.6130	(81479.7)	15287

R_{2006} replaced by $GM_{89\text{-}05}$ = 46840 thousands

Table 7.15. Southern Hake Stock. Bayesian estimates and uncertainty

	Fbar(2-5)				R (thousands)				SSB (tonnes)			
Year	P 2.5%	median	P 97.5%	CV	P 2.5%	median	P 97.5%	CV	P 2.5%	median	P 97.5%	CV
1983	0.4344	0.5040	0.5822	0.07	71370	88690	111100	0.12	35020	41300	49440	0.09
1984	0.4041	0.5126	0.6459	0.12	72640	90720	113000	0.11	27540	31670	36950	0.08
1985	0.4305	0.5373	0.6629	0.11	60500	74770	92940	0.11	23460	27690	32640	0.08
1986	0.3808	0.4737	0.5819	0.11	63180	78210	96890	0.11	17150	20250	24060	0.09
1987	0.3522	0.4396	0.5441	0.11	54790	67580	83480	0.11	15600	18370	21800	0.09
1988	0.4125	0.5137	0.6374	0.11	45210	55100	67370	0.10	15520	18240	21560	0.09
1989	0.3860	0.4785	0.5923	0.11	44580	54510	66330	0.10	15750	18370	21620	0.08
1990	0.3451	0.4277	0.5251	0.11	41090	50150	61740	0.10	14400	16750	19520	0.08
1991	0.3365	0.4180	0.5144	0.11	38460	47040	57600	0.10	17270	19830	22790	0.07
1992	0.3703	0.4635	0.5703	0.11	42360	52200	64670	0.11	15490	17800	20600	0.07
1993	0.3706	0.4624	0.5702	0.11	44830	55220	68340	0.11	13670	15760	18230	0.07
1994	0.3427	0.4278	0.5308	0.11	39570	48830	60410	0.11	11770	13500	15650	0.07
1995	0.4988	0.6128	0.7357	0.10	36320	44500	54490	0.10	11010	12740	14870	0.08
1996	0.4886	0.6002	0.7299	0.10	40760	50200	62080	0.11	14350	16380	18900	0.07
1997	0.4609	0.5728	0.6983	0.11	36900	45330	56210	0.11	10990	12680	14850	0.08
1998	0.4297	0.5326	0.6547	0.11	36860	45680	56550	0.11	6976	8098	9648	0.08
1999	0.4119	0.5176	0.6416	0.11	33930	42040	52390	0.11	10280	11700	13580	0.07
2000	0.4560	0.5767	0.7132	0.11	26770	33640	42320	0.12	10850	12390	14300	0.07
2001	0.5683	0.7127	0.8765	0.11	27620	34980	43910	0.12	8112	9466	11150	0.08
2002	0.4997	0.6257	0.7791	0.11	35880	46390	59840	0.13	8099	9337	11010	0.08
2003	0.3965	0.5029	0.6301	0.12	42920	57350	75410	0.15	7091	8182	9660	0.08
2004	0.3302	0.4217	0.5331	0.12	49680	69430	97640	0.17	9114	10480	12210	0.08
2005	0.3270	0.4263	0.5479	0.13	56240	85170	130800	0.22	12310	14340	16810	0.08
2006	0.3616	0.4982	0.6694	0.16	40120	72380	131600	0.31	15370	18420	22280	0.10

Table 7.16a - Hake Southern Stock - Single option prediction input data

Year: 2007								
Age	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. spaw.	Prop. of M bef. spaw.	Weight in stock	Exploit. pattern	Weight in catch
0	46840	0.2	0.01	0	0	0.038	0.000	0.038
1	38350	0.2	0.19	0	0	0.122	0.042	0.122
2	42312	0.2	0.34	0	0	0.194	0.336	0.194
3	24902	0.2	0.51	0	0	0.301	0.745	0.301
4	7527	0.2	0.71	0	0	0.563	0.564	0.563
5	2851	0.2	0.86	0	0	0.856	0.545	0.856
6	1284	0.2	0.93	0	0	1.129	0.637	1.129
7	542	0.2	0.97	0	0	1.314	0.548	1.314
8	280	0.2	0.99	0	0	1.970	0.548	1.970
Units	thousands					kg		kg

Year: 2008								
Age	Recruit. (age 0)	Natural mortality	Maturity ogive	Prop. of F bef. spaw.	Prop. of M bef. spaw.	Weight in stock	Exploit. pattern	Weight in catch
0	46840	0.2	0.01	0	0	0.038	0.000	0.038
1	.	0.2	0.19	0	0	0.122	0.042	0.122
2	.	0.2	0.34	0	0	0.194	0.336	0.194
3	.	0.2	0.51	0	0	0.301	0.745	0.301
4	.	0.2	0.71	0	0	0.563	0.564	0.563
5	.	0.2	0.86	0	0	0.856	0.545	0.856
6	.	0.2	0.93	0	0	1.129	0.637	1.129
7	.	0.2	0.97	0	0	1.314	0.548	1.314
8	.	0.2	0.99	0	0	1.970	0.548	1.970
Units	thousands					kg		kg

Year: 2009								
Age	Recruit. (age 0)	Natural mortality	Maturity ogive	Prop. of F bef. spaw.	Prop. of M bef. spaw.	Weight in stock	Exploit. pattern	Weight in catch
0	46840	0.2	0.01	0	0	0.038	0.000	0.038
1	.	0.2	0.19	0	0	0.122	0.042	0.122
2	.	0.2	0.34	0	0	0.194	0.336	0.194
3	.	0.2	0.51	0	0	0.301	0.745	0.301
4	.	0.2	0.71	0	0	0.563	0.564	0.563
5	.	0.2	0.86	0	0	0.856	0.545	0.856
6	.	0.2	0.93	0	0	1.129	0.637	1.129
7	.	0.2	0.97	0	0	1.314	0.548	1.314
8	.	0.2	0.99	0	0	1.970	0.548	1.970
Units	thousands					kg		kg

Input units are thousands and kg - output in tonnes

MFDP version 1a
Run: hke8c9a
Time and date: 13:06 14/05/2007
Fbar age range: 2-5

Table 7.16b. Input data for stochastic prediction.

Age	selection pattern			Stock size in 2006		
	2.50%	50%	97.50%	2.50%	50%	97.50%
0	0.000	0.000	0.000	39860	49497	60315
1	0.024	0.031	0.041	46039	69730	107003
2	0.255	0.332	0.424	32210	45185	63690
3	0.449	0.564	0.699	16320	22240	29911
4	0.353	0.455	0.580	6364	8559	11580
5	0.343	0.447	0.572	2417	3217	4263
6	0.497	0.624	0.774	1020	1363	1819
7	0.425	0.561	0.707	428	578	785
8	0.152	0.321	0.558	349	534	926
Units				thousands		

Table 7.17 - Hake Southern Stock - Prediction with management option table

2007 Biomass	SSB	FMult	FBar	Landings
31554	15189	1.0000	0.5473	9637

2008 Biomass	SSB	FMult	FBar	Landings	2009 Biomass	SSB
31235	16019	0.0000	0.0000	0	44392	26636
.	16019	0.1000	0.0547	1251	42588	25272
.	16019	0.2000	0.1095	2432	40890	23989
.	16019	0.3000	0.1642	3548	39291	22783
.	16019	0.4000	0.2189	4602	37786	21649
.	16019	0.5000	0.2737	5597	36369	20582
.	16019	0.6000	0.3284	6539	35034	19578
.	16019	0.7000	0.3831	7428	33776	18634
.	16019	0.8000	0.4379	8270	32591	17745
.	16019	0.9000	0.4926	9066	31473	16908
.	16019	1.0000	0.5473	9820	30419	16120
.	16019	1.1000	0.6021	10533	29425	15378
.	16019	1.2000	0.6568	11208	28487	14679
.	16019	1.3000	0.7115	11848	27602	14021
.	16019	1.4000	0.7663	12454	26766	13400
.	16019	1.5000	0.8210	13029	25976	12816
.	16019	1.6000	0.8757	13574	25231	12264
.	16019	1.7000	0.9305	14091	24526	11744
.	16019	1.8000	0.9852	14582	23860	11254
.	16019	1.9000	1.0399	15047	23230	10791
.	16019	2.0000	1.0947	15489	22634	10355

Input units are thousands and kg - output in tonnes

MFDP version 1a
Run: hke8c9a
SOUTHERN HAKE. WG2007
Time and date: 13:06 14/05/2007
Fbar age range: 2-5

Table 7.18 - Hake Southern Stock - Single option prediction: detailed tables

Year: 2007		F multiplier: 1		Fbar: 0.5473		1 January		Spawning time	
Age	Absolut F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp. Stock size	Sp. Stock biomass	Sp. Stock size	Sp. Stock biomass
0	0.000	0	0	46840	1796	312	12	312	12
1	0.042	1424	174	38350	4679	7224	881	7224	881
2	0.336	10998	2130	42312	8194	14290	2767	14290	2767
3	0.745	12000	3612	24902	7496	12710	3826	12710	3826
4	0.564	2968	1671	7527	4238	5350	3012	5350	3012
5	0.545	1095	937	2851	2440	2458	2103	2458	2103
6	0.637	554	625	1284	1449	1196	1350	1196	1350
7	0.548	209	275	542	712	525	690	525	690
8	0.548	108	213	280	552	278	547	278	547
Total		29356	9637	164888	31554	44343	15189	44343	15189
Unit		thousands	tonnes	thousands	tonnes	thousands	tonnes	thousands	tonnes

Year: 2008		F multiplier: 1		Fbar: 0.5473		1 January		Spawning time	
Age	Absolut F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp. Stock size	Sp. Stock biomass	Sp. Stock size	Sp. Stock biomass
0	0.000	0	0	46840	1796	312	12	312	12
1	0.042	1424	174	38349	4679	7224	881	7224	881
2	0.336	7827	1516	30113	5832	10170	1970	10170	1970
3	0.745	11933	3592	24763	7454	12639	3804	12639	3804
4	0.564	3817	2149	9680	5450	6880	3874	6880	3874
5	0.545	1347	1153	3506	3000	3023	2586	3023	2586
6	0.637	584	659	1354	1528	1261	1424	1261	1424
7	0.548	215	282	556	731	539	708	539	708
8	0.548	150	296	389	766	386	761	386	761
Total		27296	9820	155550	31235	42434	16019	42434	16019
Unit		thousands	tonnes	thousands	tonnes	thousands	tonnes	thousands	tonnes

Year: 2009		F multiplier: 1		Fbar: 0.5473		1 January		Spawning time	
Age	Absolut F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp. Stock size	Sp. Stock biomass	Sp. Stock size	Sp. Stock biomass
0	0.000	0	0	46840	1796	312	12	312	12
1	0.042	1424	174	38349	4679	7224	881	7224	881
2	0.336	7827	1516	30112	5832	10169	1969	10169	1969
3	0.745	8492	2556	17623	5305	8995	2707	8995	2707
4	0.564	3796	2137	9626	5419	6842	3852	6842	3852
5	0.545	1732	1482	4509	3858	3887	3326	3887	3326
6	0.637	718	811	1665	1879	1551	1751	1551	1751
7	0.548	226	297	586	770	568	746	568	746
8	0.548	173	340	447	881	444	875	444	875
Total		24388	9313	149759	30419	39993	16120	39993	16120
Unit		thousands	tonnes	thousands	tonnes	thousands	tonnes	thousands	tonnes

Input units are thousands and kg - output in tonnes

MFDP version 1a
Run: hke8c9a
Time and date: 13:06 14/05/2007
Fbar age range: 2-5

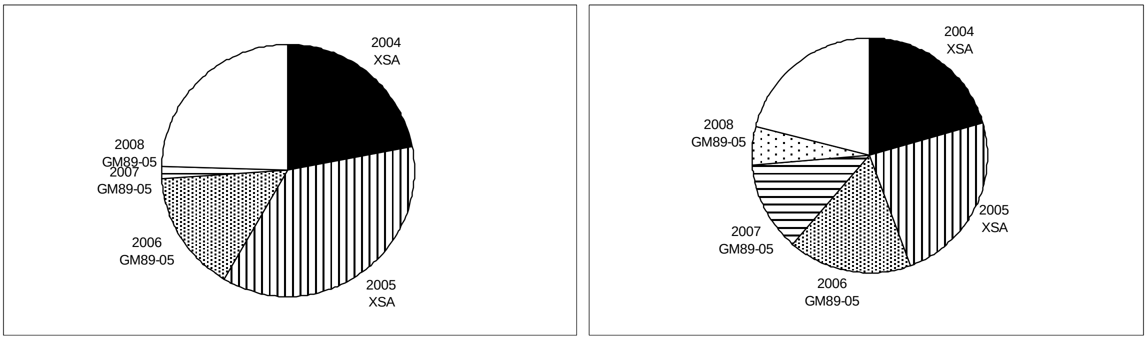
Table 7.19 **HAKE SOUTHERN STOCK**
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class			2004	2005	2006	2007	2008
Stock No. (thousands) of 0 year-olds			68828.69	67230.52	46840	46840	46840
Source			XSA	XSA	GM89-05	GM89-05	GM89-05
Status Quo F:							
% in	2007	landings	37.5	22.1	1.8	0.0	-
% in	2008		21.9	36.6	15.4	1.8	0.0
% in	2007	SSB	25.2	18.2	5.8	0.1	-
% in	2008	SSB	24.2	23.7	12.3	5.5	0.1
% in	2009	SSB	20.6	23.9	16.8	12.2	5.5

GM : geometric mean recruitment

HAKE SOUTHERN STOCK : Year-class % contribution to

a) 2008 landings **b) 2009 SSB**



XSA	XSA	GM89-05	GM89-05	GM89-05
2004	2005	2006	2007	2008

Table 7.20 – Percentiles of SSB and Landings stochastic forecast

	Year	Percentile 2.5	50	97.5
SSB	2006	14360	17194	20098
	2007	15866	19962	24241
	2008	16496	21724	27439
	2009	16434	22519	29442
Yield	2006	8326	9776	11217
	2007	9828	11766	13751
	2008	10089	12383	14840
	2009	9660	11939	14332

Table - 7.21 - Hake Southern Stock - Yield per recruit: summary table

						1 January		Spawning time	
F factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp. Stock size	Sp. Stock biomass	Sp. Stock size	Sp. Stock biomass
0.000	0.000	0.000	0.000	5.517	3.859	2.929	3.407	2.929	3.407
0.100	0.055	0.146	0.126	4.791	2.690	2.247	2.270	2.247	2.270
0.200	0.110	0.239	0.180	4.329	2.001	1.821	1.606	1.821	1.606
0.300	0.164	0.303	0.202	4.009	1.563	1.534	1.189	1.534	1.189
0.400	0.219	0.351	0.208	3.776	1.268	1.330	0.911	1.330	0.911
0.500	0.274	0.387	0.206	3.599	1.062	1.178	0.719	1.178	0.719
0.600	0.328	0.415	0.202	3.459	0.912	1.062	0.582	1.062	0.582
0.700	0.383	0.438	0.196	3.347	0.800	0.971	0.482	0.971	0.482
0.800	0.438	0.457	0.190	3.255	0.715	0.898	0.407	0.898	0.407
0.900	0.493	0.473	0.184	3.177	0.649	0.838	0.349	0.838	0.349
1.000	0.547	0.487	0.178	3.111	0.596	0.789	0.304	0.789	0.304
1.100	0.602	0.499	0.173	3.054	0.554	0.747	0.269	0.747	0.269
1.200	0.657	0.509	0.168	3.005	0.519	0.712	0.240	0.712	0.240
1.300	0.712	0.518	0.164	2.962	0.491	0.682	0.217	0.682	0.217
1.400	0.766	0.526	0.160	2.923	0.467	0.655	0.198	0.655	0.198
1.500	0.821	0.534	0.156	2.888	0.446	0.632	0.182	0.632	0.182
1.600	0.876	0.540	0.153	2.857	0.429	0.612	0.169	0.612	0.169
1.700	0.931	0.546	0.150	2.829	0.413	0.594	0.158	0.594	0.158
1.800	0.985	0.552	0.148	2.803	0.400	0.578	0.148	0.578	0.148
1.900	1.040	0.557	0.146	2.780	0.389	0.563	0.140	0.563	0.140
2.000	1.095	0.562	0.144	2.758	0.378	0.550	0.133	0.550	0.133
		numbers	Kilograms	numbers	Kilograms	numbers	Kilograms	numbers	Kilograms

Reference point	F multiplier	Absolute F
Fbar(2-5)	1.000	0.547
FMax	0.425	0.232
F0.1	0.259	0.142
F35%SPR	0.299	0.164

MFYPR version 2a
Run: hke8c9a
Time and date: 13:14 14/05/2007
Yield per results

Weights in kilograms

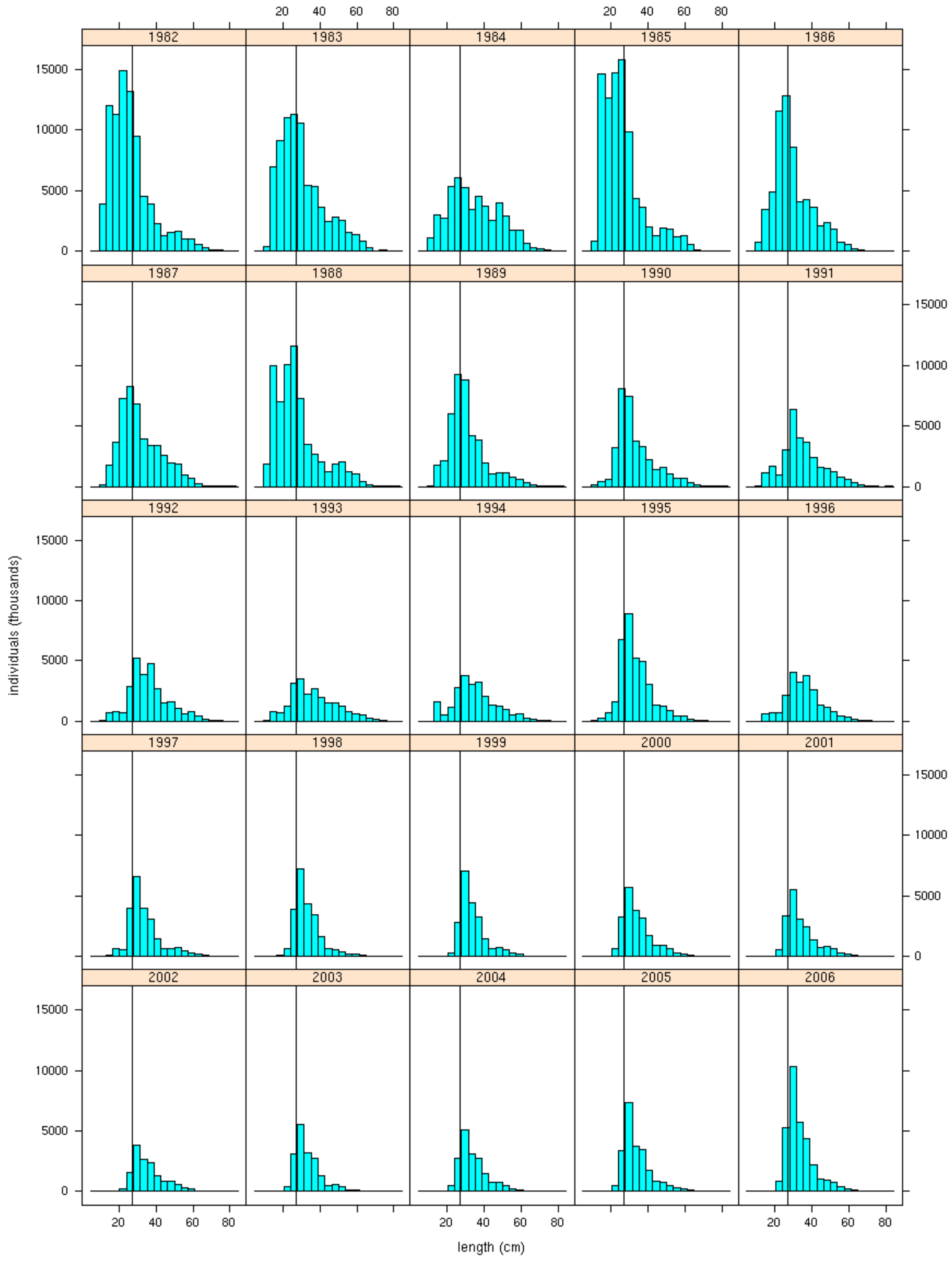


Figure 7.1. Southern Hake Stock. Length distribution of landings from 1982 to 2006 (without Golfo f Cadiz)

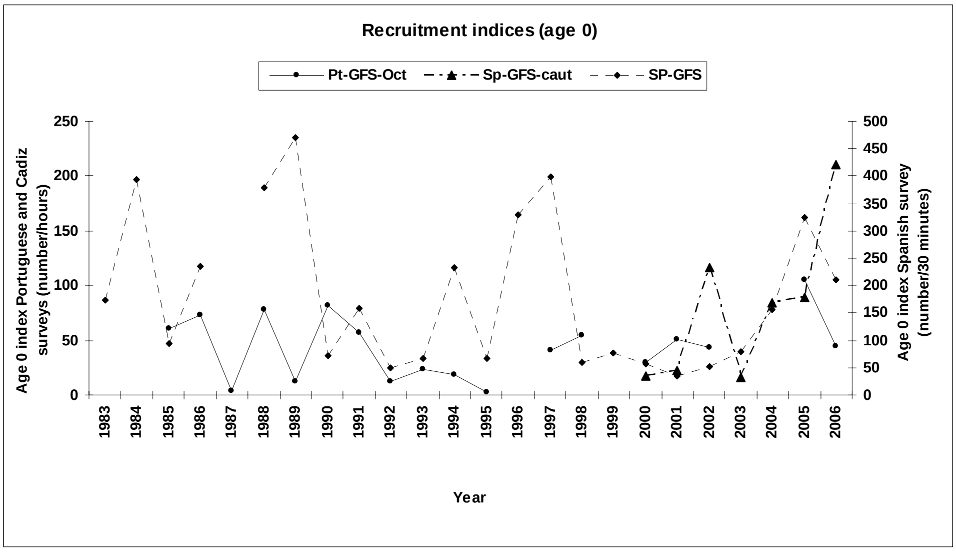


FIGURE 7.2 HAKE SOUTHERN STOCK - Recruitment Indices from groundfish surveys

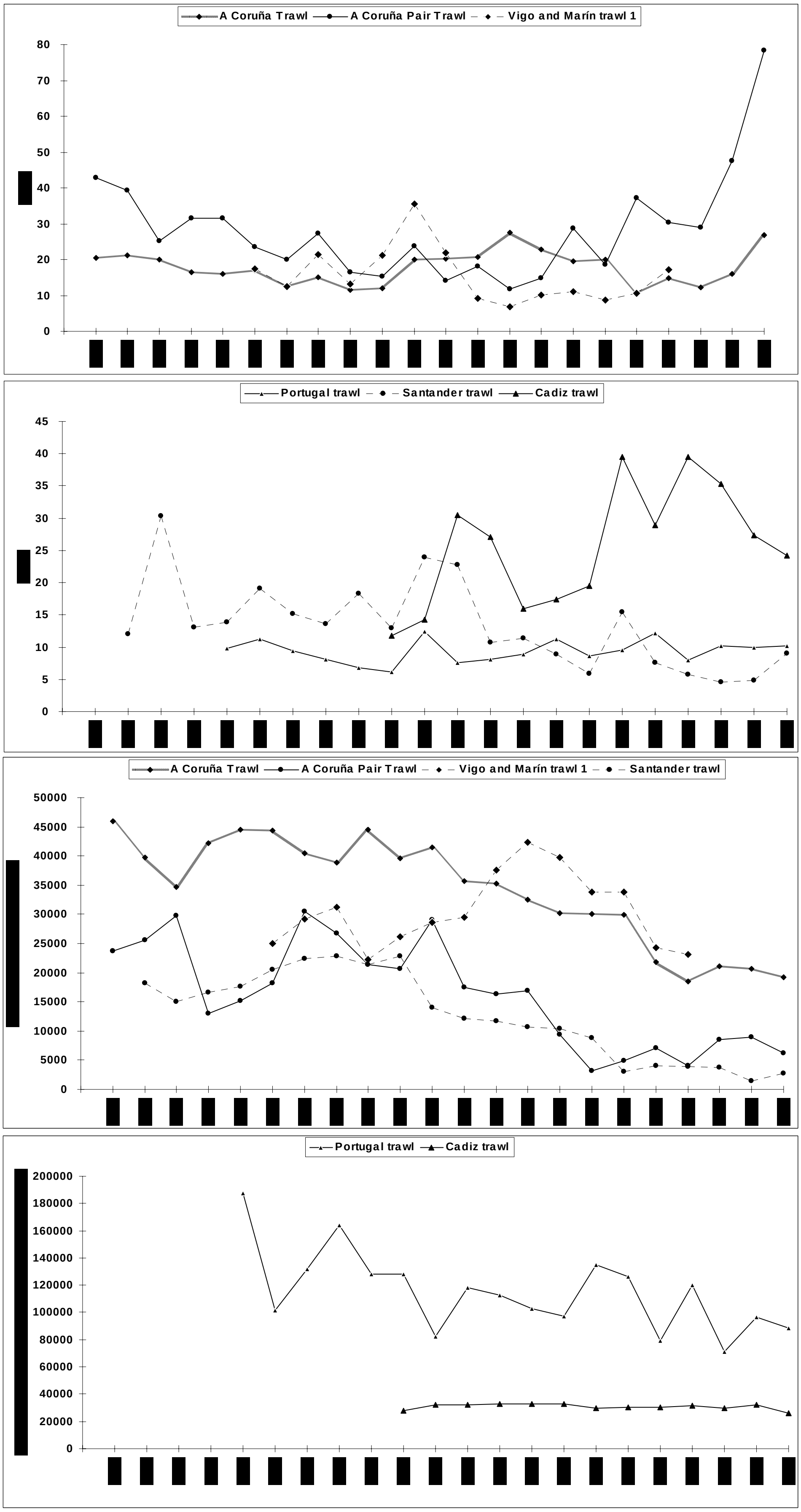


FIGURE 7.3 HAKE SOUTHERN STOCK - LPUE and fishing effort trends for trawl fleets

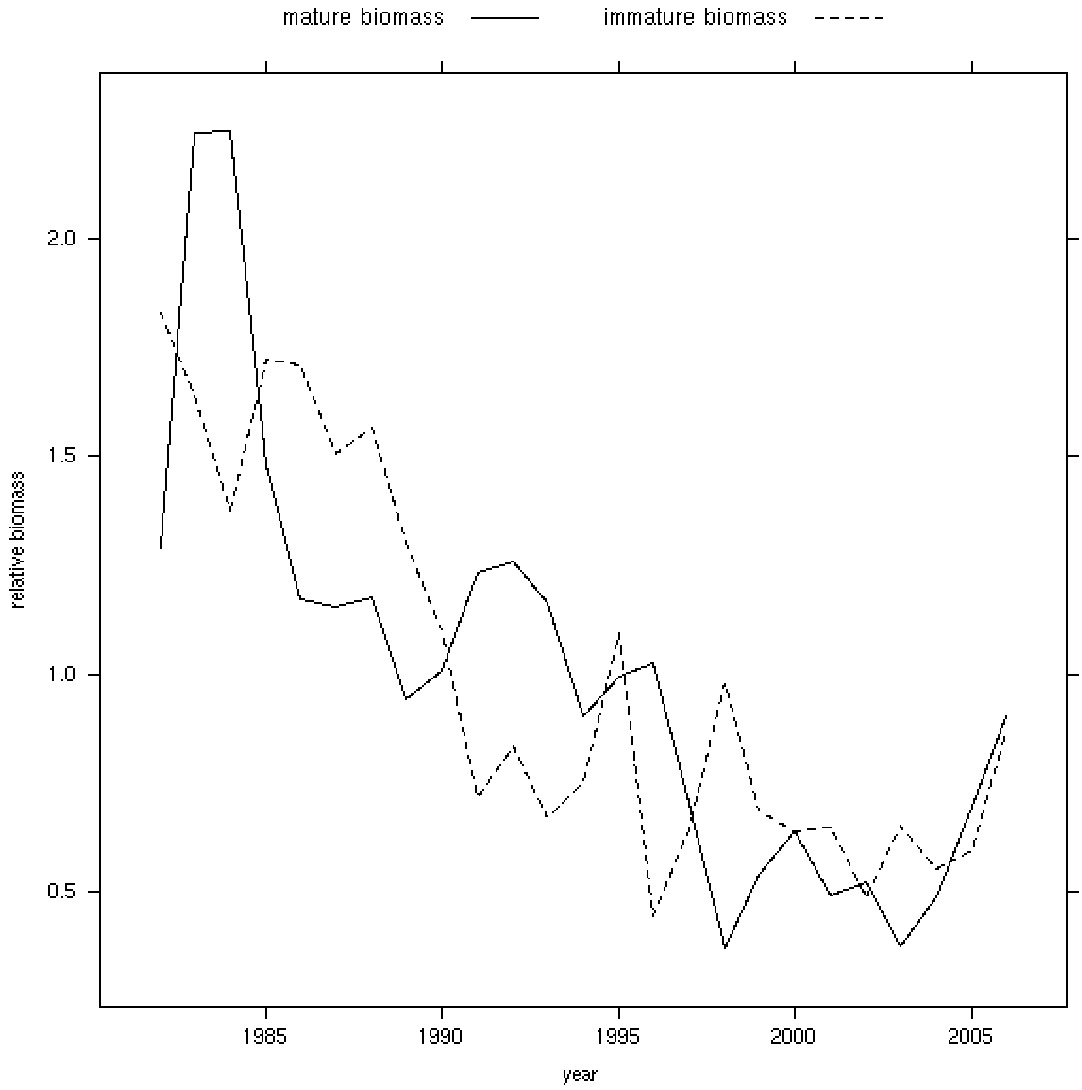
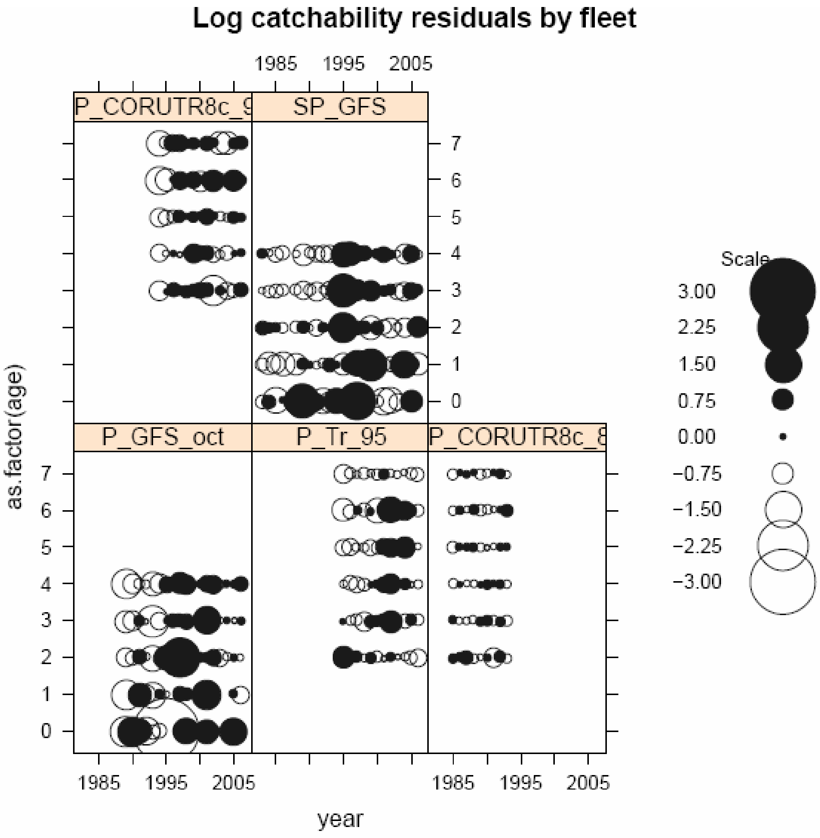


Figure 7.4. Southern Hake Stock. Trends in biomass for mature and immature.



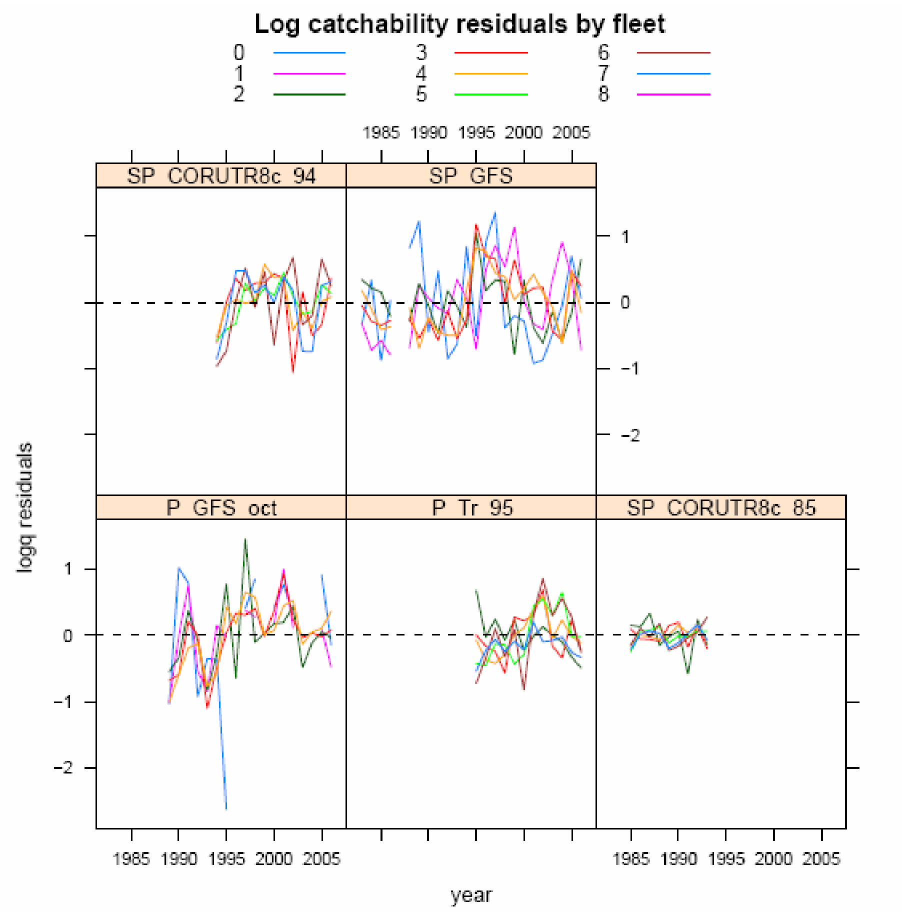


Figure 7.5. Southern Hake Stock. Log Catchability residual plots from FLxsa.

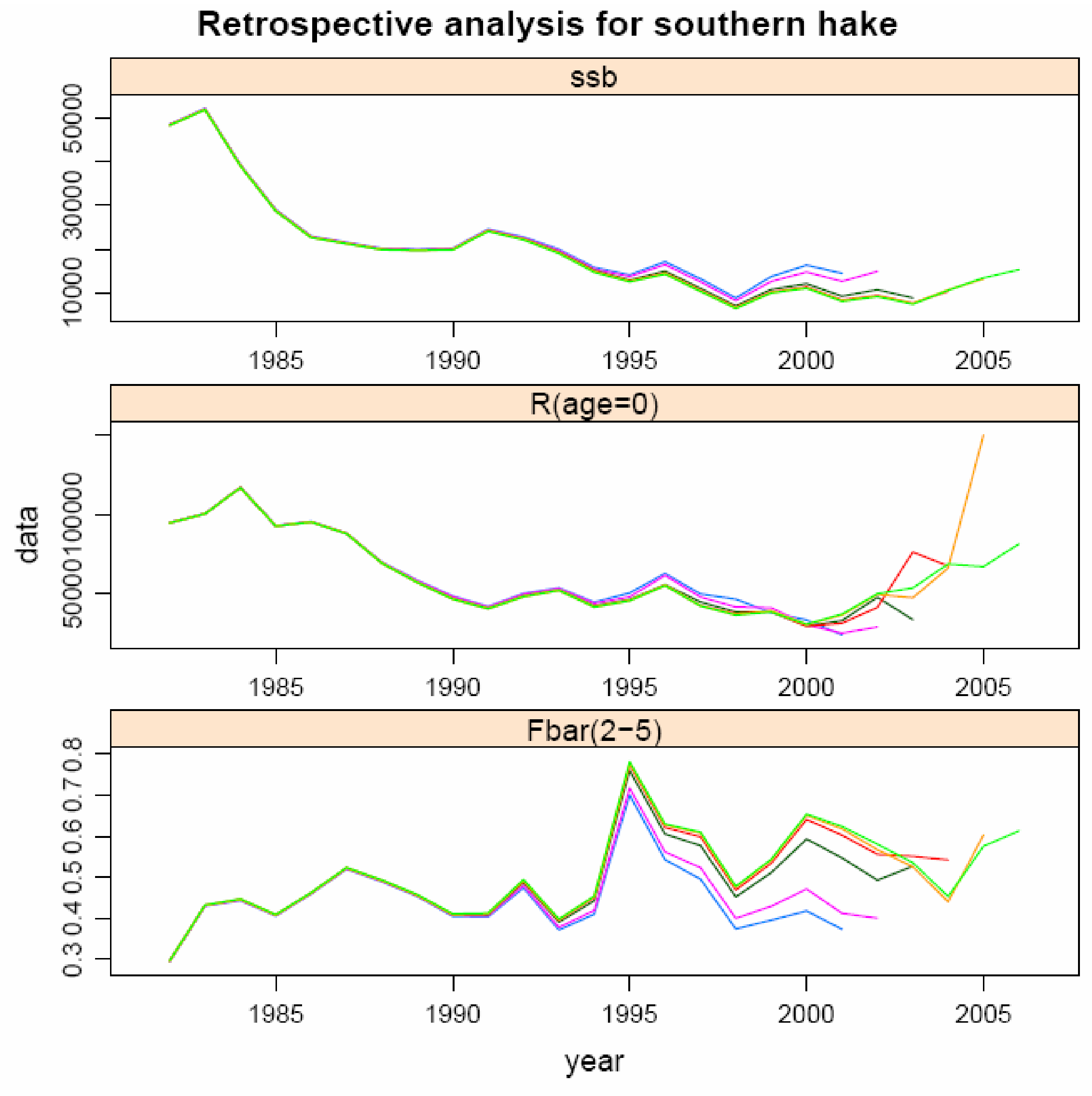


Figure 7.6. Southern Hake Stock. Retrospective analysis of SSb (tones), recruitment (thousands) and F ($year^{-1}$).

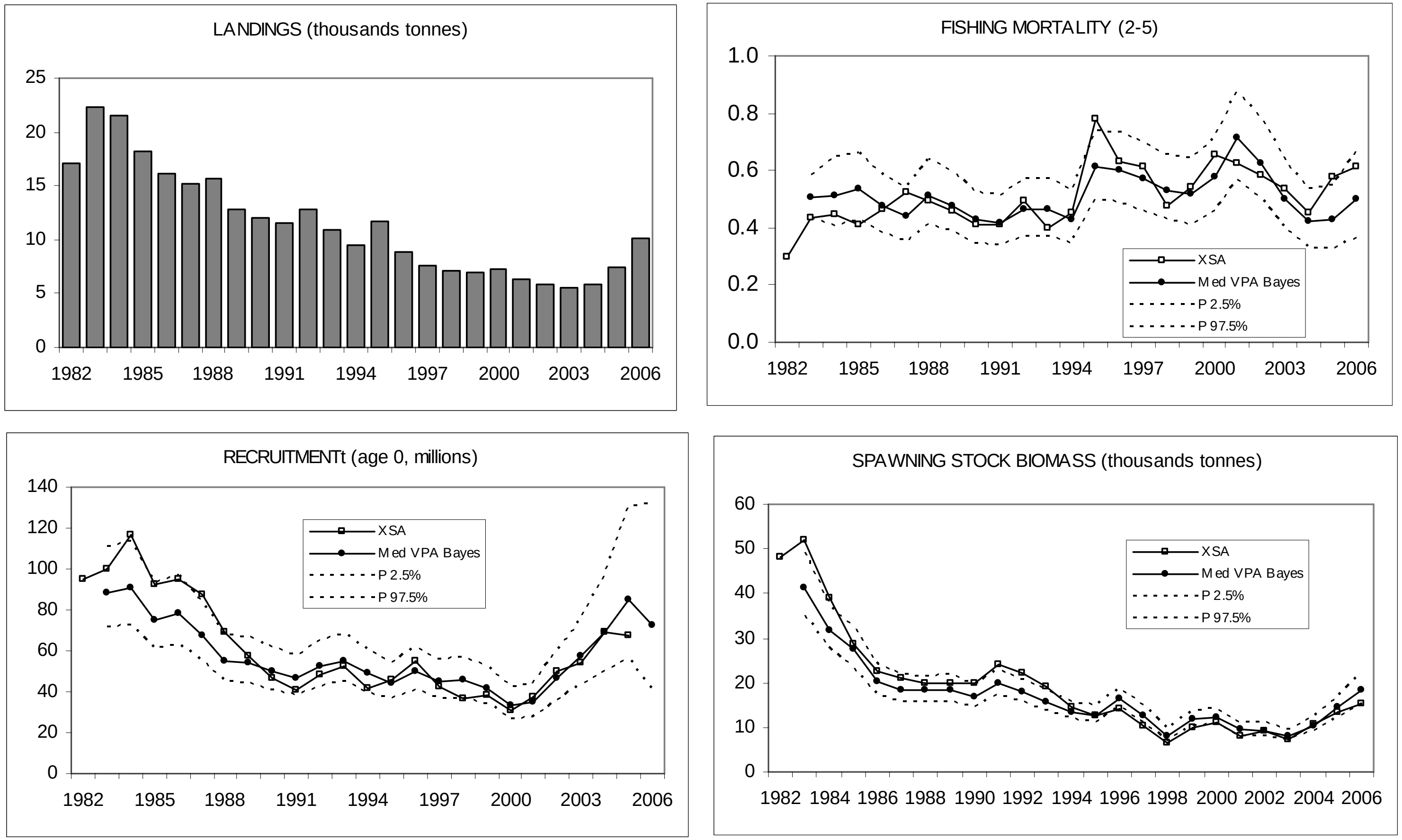


Figure 7.7. Southern Hake Stock. XSA and Bayesian VPA estimates

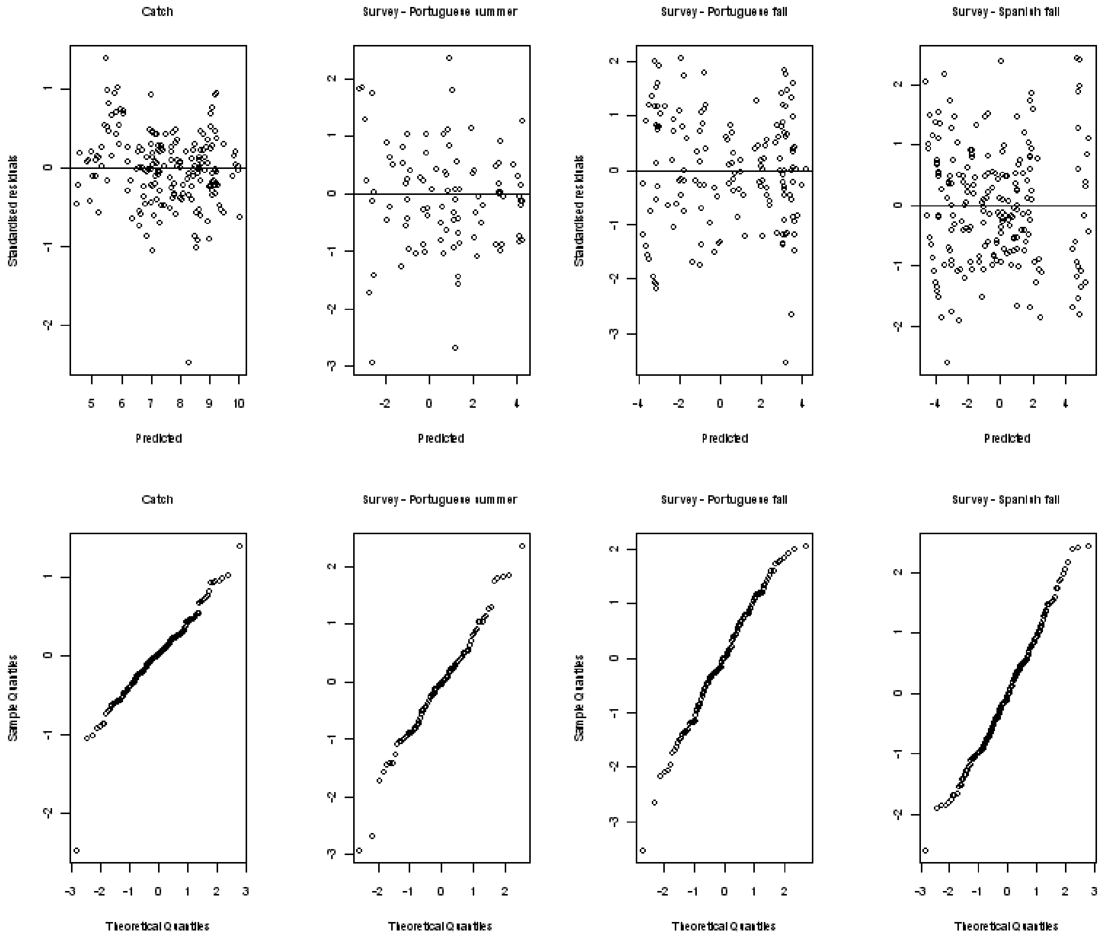
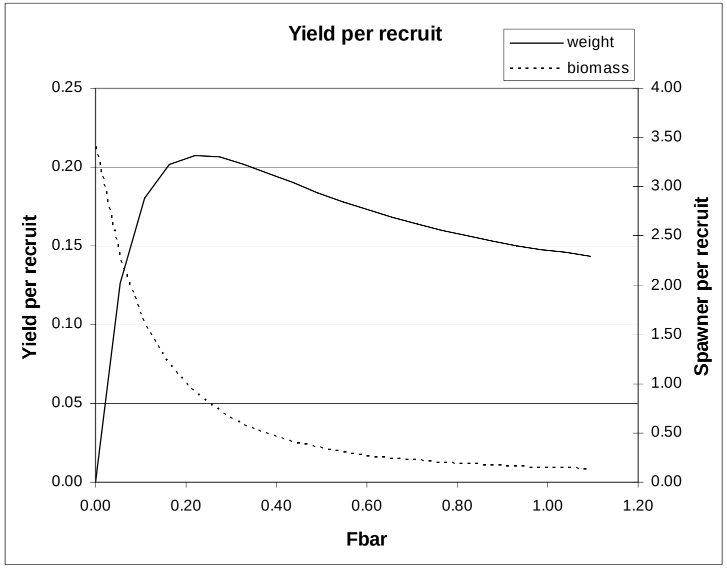
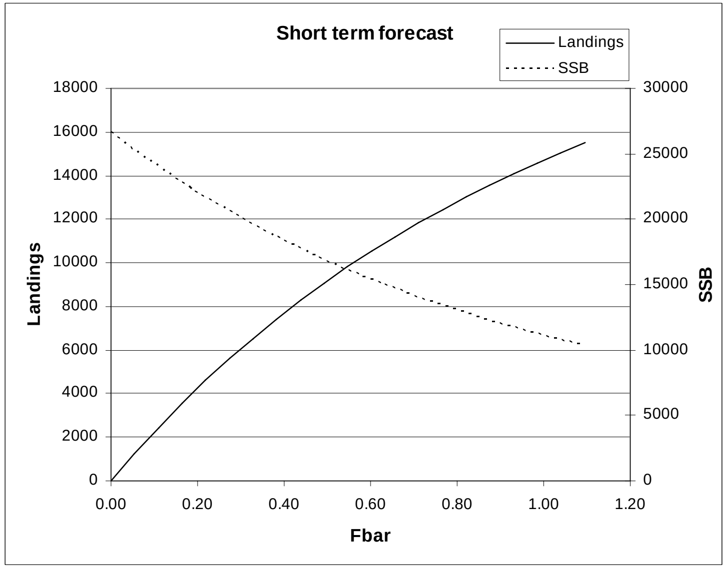


Figure 7.8. Southern Hake Stock. Residuals from Bayesian VPA.





MFYPR version 2a
Run: hke8c9a
Time and date: 13:14 14/05/2007

Reference point	F multiplier	Absolute F
Fbar(2-5)	1.0000	0.5473
FMax	0.4246	0.2324
F0.1	0.2589	0.1417
F35%SPR	0.2989	0.1636

Weights in kilograms

MFDP version 1a
Run: hke8c9a
SOUTHERN HAKE. WG2007
Time and date: 13:06 14/05/2007
Fbar age range: 2-5

Input units are thousands and kg - output in tonnes

Figure 7.9 - Hake Southern Stock. Yield per recruit

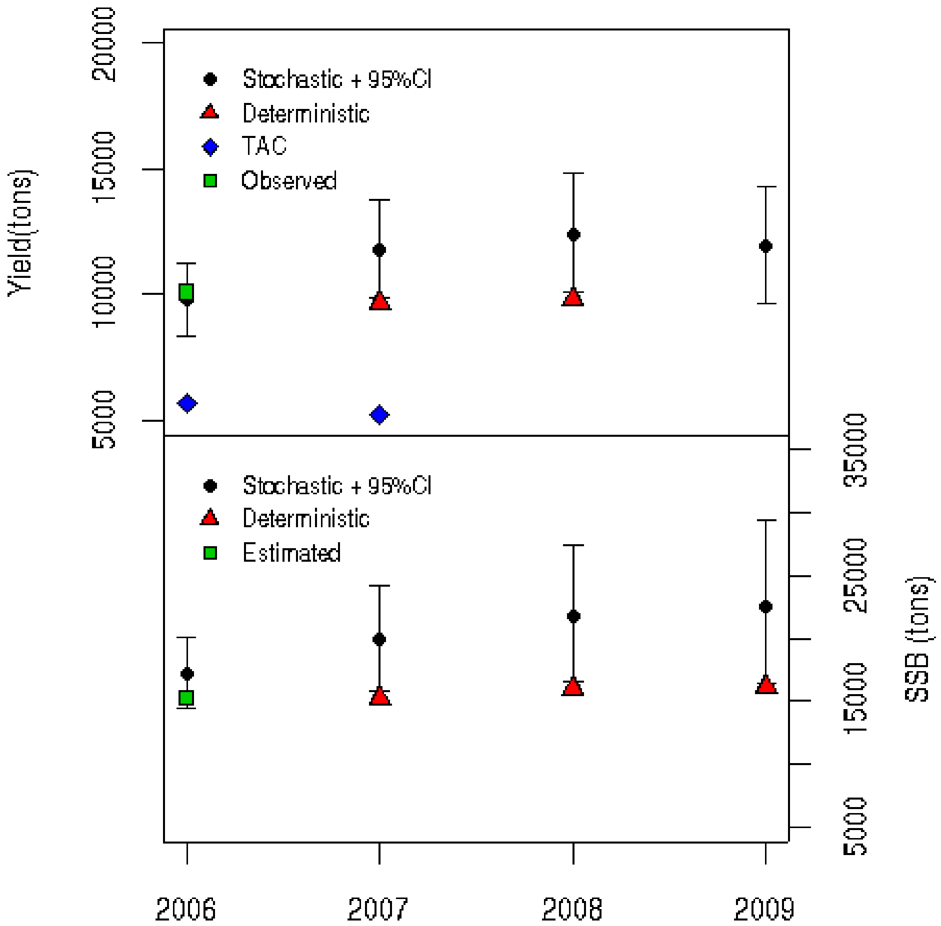


Figure 7.10. Southern Hake Stock. Yield and SSB projections for 2007 onwards.

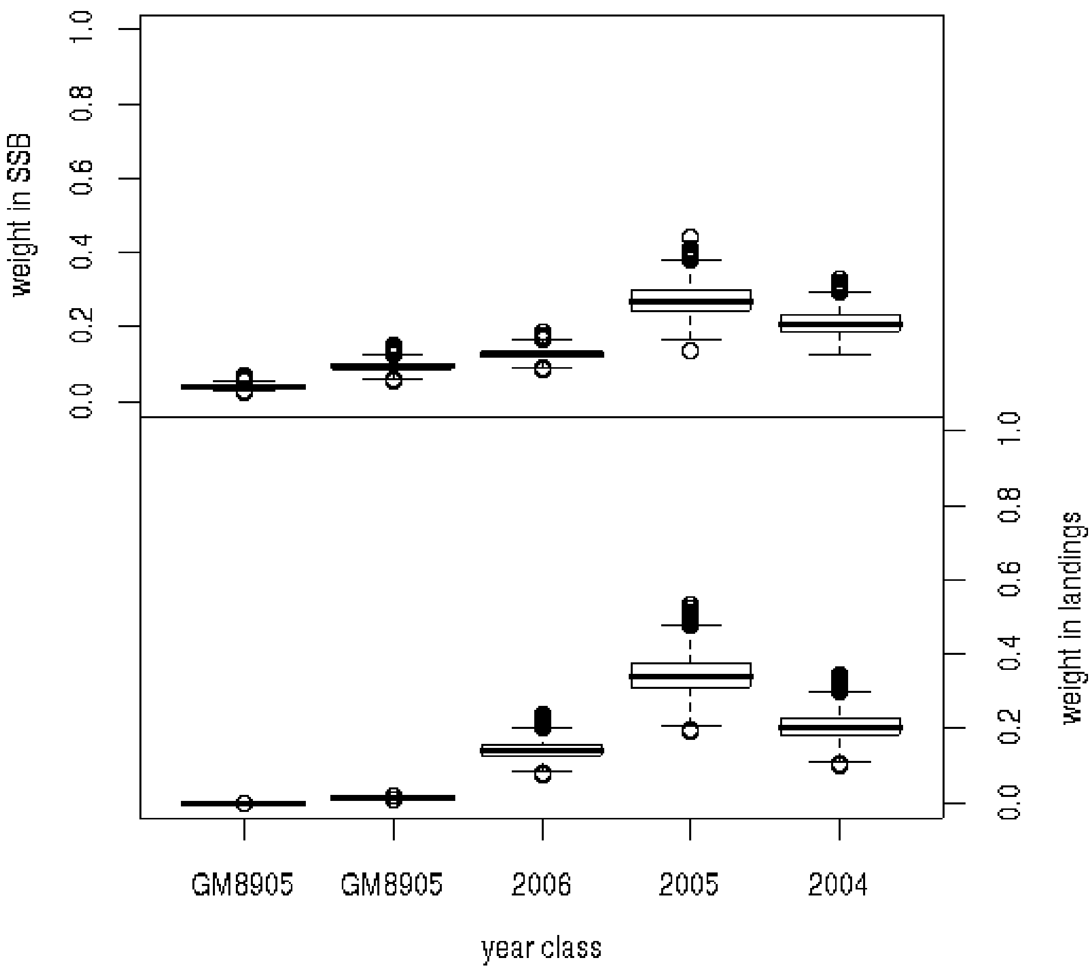


Figure 7. 11. Southern Hake Stock. Year class weight in 2009 SSB and 2008 landings.

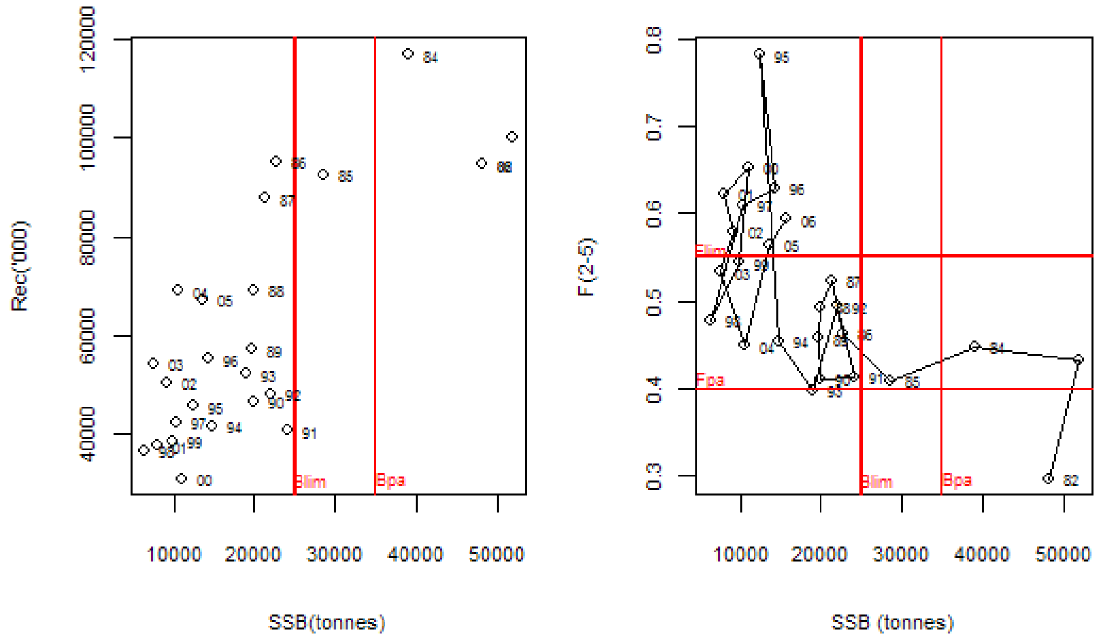
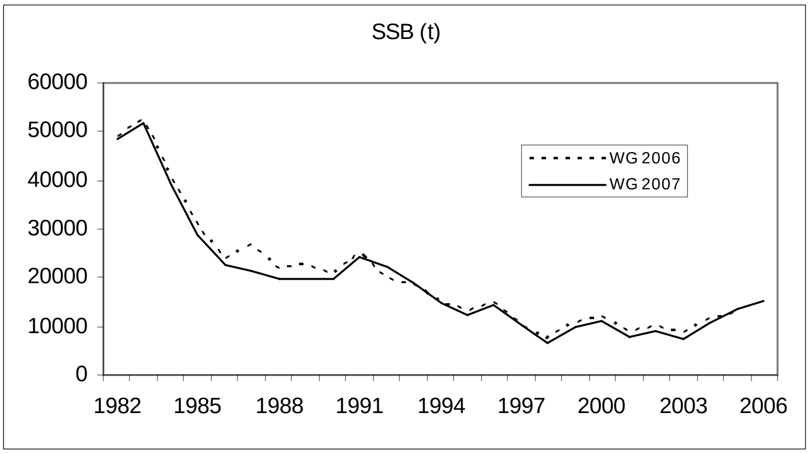
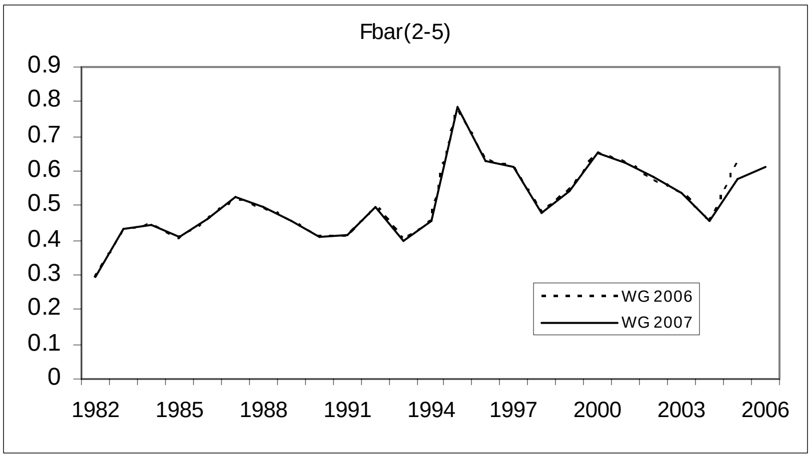


Figure 7.12. Southern Hake Stock. Stock recruitment relationship SSB – F trajectory.





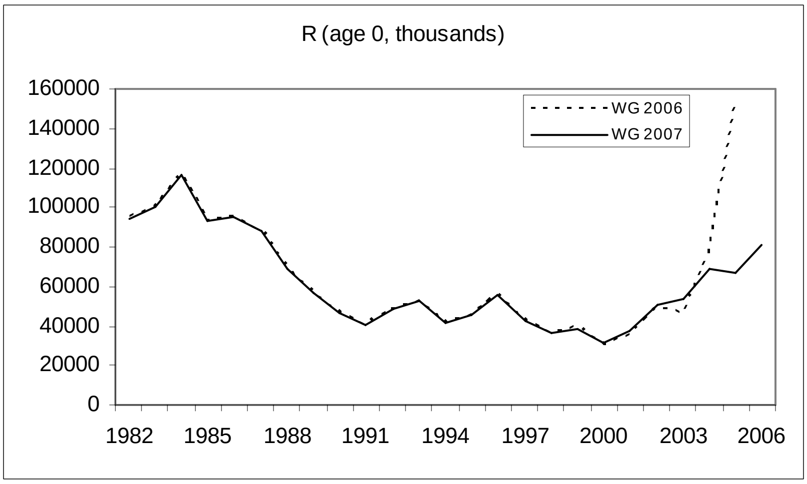


Figure 7.13. Southern Hake . Comparative final runs.

8 Anglerfish in Divisions VIIIc and IXa

Two species of anglerfish, *Lophius piscatorius* and *L. budegassa*, are found in ICES Divisions VIIIc and IXa. Both species are caught in mixed bottom trawl fisheries and in artisanal fisheries using mainly fixed nets.

The two species are not usually landed separately, for the majority of the commercial categories, and they are recorded together in the ports' statistics. Therefore, estimates of each species in Spanish landings from Divisions VIIIc and IXa and Portuguese landings of Division IXa are derived from their relative proportions in market samples.

In this year's Working Group a benchmark assessment was performed. Catch and CPUE-at-age data were available for years 1996-2006. Since last year's Working Group age readings were revised and extra age readings were performed and basic data were revised. Also, commercial effort/cpue data were enhanced by splitting the Portuguese trawl fleet into two sub-components and by including a new standardized series for the gillnet fishery of the Spanish port of Cedeira (WD19, Costas *et al.*, 2007) in ICES Division VIIIc. Detailed information on the available data and on the performed revisions are given in WD12 (Duarte *et al.*, 2007). Data and effort/CPUE revisions were supported by an EU co-financed project (ABA-FISH/2004/03-22).

RG comments focused essentially on the enormous fluctuation in F that is not apparent in effort. These fluctuations are linked to the catchability residuals and might be consequence of changes in the population structure like stronger year classes that a stock production model can not depict. Moreover, by combining species with different growth rates might also cause apparent changes in population structure when relative abundance between species changes.

Therefore, RG comments were addressed by considering the age-structured approach and also by performing the separated species assessment with the Schaefer model.

Summary of ICES advice for 2007 and management for 2006 and 2007

ICES advice for 2007

The assessment is only considered indicative of stock trends and cannot be used as an absolute measure of stock status. The stock size of the combined stocks (*Lophius piscatorius* and *L. budegassa*) is considered to be well below the level associated with harvesting at maximum sustainable yield. The fishing mortality is estimated to be well above $\mathbf{F}_{MSY}$. The fishing mortality in 2004 was around 2.0 times $\mathbf{F}_{MSY}$ and increased in 2005 to be 2.4 times higher than $\mathbf{F}_{MSY}$.

Fishing mortality equal to zero in 2007 is required to bring SSB back to B_{MSY} in the medium term. If this is not possible then a recovery plan should be established that will ensure rapid and safe recovery of the SSB towards B_{MSY}. Landings in 2001 and 2002 might have reduced fishing mortality to $F_{MSY.}$ Catches in that order could be considered as a preliminary guidance for maximum landings in a recovery plan.

Management for 2006 and 2007

The two species are managed under a common TAC that was set at 1955 t for 2006 and 2007. There is no minimal landing size for anglerfish but an EU Council Regulation (2406/96) laying down common marketing standards for certain fishery products fixes a minimum weight of 500 g for anglerfish. In Spain this minimum weight was put into effect in year 2000.

Assessment methodology

As benchmark assessment, catch and CPUE-at-age-data were anaylsed by species. As a first step an Exploratory Data Analysis was performed with FLEDA (Jardim and Azevedo, 2006) a package available for the R language (R Development Core Team, 2006). This analysis was followed by a separable analysis and by exploratory runs using the XSA model. Independent fleet catchability residuals were analysed. A final XSA assessment is presented for each species. However, the Working Group considered the XSA assessments only as exploratory due to inconsistencies with model assumptions.

In parallel with the age structured data analysis and assessments the Schaefer stock production model was fitted by species. Two approaches were undertaken: the ASPIC (Prager, 1994 and Prager, 2004) approach with estimation of bootstrap CI and a Bayesian approach (WD25, Azevedo and Duarte, 2007) with a reparametrization in order to improve the MCMC chain mixing and convergence (Punt and Hilborn, 2001).

8.1 Anglerfish (*Lophius piscatorius*) in Divisions VIIIc and IXa

8.1.1 General

8.1.1.1 Ecosystem aspects

L. piscatorius is a North Eastern Atlantic species, with a distribution area from Norway (Barents Sea) to the Straits of Gibraltar (and including the Mediterranean and the Black Sea). The Southern stock comprises ICES divisions VIIIc and IXa and its boundaries were not based on biological criteria. Recent studies were carried out in genetic and morphometric analysis (GESSAN, 2002; Duarte *et al*. 2004; Fariña *et al.*, 2004).

L. piscatorius is a slow growing species, with a late maturation. In the Southern stock, ages of first maturity are estimated around 7 years for males and higher for females (Duarte *et al*., 2001). The spawning of *Lophius* species is very particular, with eggs extruded in a buoyant, gelatinous ribbon that may measure more than 10 m (Afonso-Dias and Hislop, 1996; Hislop *et al*., 2001 and Quincoces, 2002). This particular spawning may lead to highly clumped distributions of eggs and newly emerged larvae (Hislop *et al*., 2001) and favorable or unfavorable ecosystem conditions may have important impacts in recruitment.

Due to the particular reproduction aspects, slow growth and late maturation, the population dynamics of this species is expected to be highly sensitive to external biological/ecosystem factors. From what is known of the life history of this species, it is a typical K strategist, and therefore adapted for long-term population sustainability in predictable long-lasting environments and is unlikely to persist in unstable environments

8.1.1.2 Fishery description

L. piscatorius is caught by Spanish and Portuguese bottom trawlers and gillnet fisheries. For some gillnet fishery, it is an important target species, while it is also a by catch of the trawl fishery targeting hake or crustaceans. In the Portuguese trawl fleet, the combined weight of both *Lophius* species represented less than 1% of the total landings in weight and in the artisanal fleet this value reached 2% between 2000 and 2002. Since 1997 Spanish landings represented on average 83% of the total *L. piscatorius* stock landings.

The length distribution of the landings are considerably different between both fisheries, with the gillnet landings showing higher mean lengths compared to the trawl landings. Since 1997, the Spanish landings were on average 46% from the trawl fleet (with mean lengths in 2006 of 54 cm and 49 cm in Division VIIIc and IXa, respectively) and 54% from the gillnet fishery (mean length of 78 cm in Division VIIIc in 2006). Portuguese landings were since 1997 on average 8% from bottom trawlers (mean length of 57 cm in 2006) and 92% from gillnets (mean length of 62 cm in 2006).

For the Spanish trawl fleets it should be noted that since 2003 the alternative use of a trawl gear with HVO (High Vertical Opening) has taken place in higher proportions relative to previous years. This gear targets horse mackerel with very few anglerfish catches.

8.1.2 Data

8.1.2.1 Commercial catches and discards

Total landings of *L. piscatorius* by country and gear for the period 1978–2006, as estimated by the Working Group, are given in Table 8.1.1. There were unrecorded landings in Division VIIIc between 1978 and 1979, and it is not possible to obtain the total landings in those years. The maximum landing of the available series was recorded in 1986 with 6870 t. After that, a general decline to 788 t in 2001 was observed, reaching the minimum of the available series. From 2002 to 2005 landings increased. In 2006 landings decreased 15% relative to 2005.

Portuguese landings were TAC constrained in 2005 and 2006. Very low landings were registered during the 4^{th} quarters of these years. The Portuguese landings were therefore relatively stable during these two years having however decreased from 2004 to 2005 by 27% in the artisanal fleet. The landings in 2006 of only *L. piscatorius* are higher than the TAC of 1995 t for both species together.

Although discard data are not available for the whole time series, a discard sampling program was carried out by Spain (Pérez *et al*., 1996 and ICES, 2001), indicating that discards in Spanish trawl fleets are very low and mainly in small length classes (below 25 cm).

An exploratory analysis of the proportion of landings by quarter relative to the annual value for each fleet between 1996 and 2006 showed variations by quarter for *L. piscatorius* (Annex I, Figure I1). The Spanish trawl fleet in Division VIIIc had lower proportions during the first quarter of the year, the Spanish trawl fleet in Division IXa showed higher values in the second quarter and the Portuguese trawl fleet showed lower values in the fourth quarter. These shifts in the trawl fleets could be related to different fishing behavior of the trawl fleet or to different vulnerability of the species along the year.

The Spanish artisanal fleet showed higher proportions during the first quarter and the Portuguese artisanal fleet showed the same feature with additional high values during the second quarter (Annex I, Figure I1). The artisanal fleets have anglerfish as the target species and these shifts could be related with the higher vulnerability of the species in the fishing area.

8.1.2.2 Biological sampling

Both Spain and Portugal carry out biological sampling at markets. Length data from sampled vessels are summed and the resulting length composition is applied to the quarterly landings of the corresponding port, gear and ICES Divisions. Although all the fish of each sampled boat are measured, it is difficult to cover the whole length range in the landings.

The sampling levels for 2006 are shown in Table 1.3. Spanish and Portuguese market sampling effort has increased considerably since 1995 and is expected to be maintained in future.

Length composition

The sampled length compositions were raised for each country and SOP corrected to total landings on a quarterly or half yearly basis (when the sampling levels by quarter were low). Table 8.1.2 gives the annual length compositions by country and gear for 2006. The average lengths of trawl caught anglerfish are lower compared to the artisanal fleets. The annual length compositions for all fleets combined for the period 1986–2006 are presented in Figure 8.1.1. In 2002 an increase of smaller individuals is apparent (around 35 cm), that is confirmed in the 2003 length distribution. The 2004 and 2005 length distributions show higher proportions of larger fish compared to years 2002-2003.

The landings in number, the mean length and mean weight in the landings between 1986 and 2006 are in the following table:

	1986	1987	1988	1989	1990	1991	1992	1993	1994
Total (thousands)	1872	2806	2853	1821	1677	1657	1256	857	704
Mean Weight (g)	3670	1832	2216	2744	2261	2197	2692	2719	2850
Mean Length (cm)	61	44	50	54	49	50	54	54	54
	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total (thousands)	876	1153	1043	583	289	190	127	381	784
Mean Weight (g)	2093	2564	3560	5113	6682	6885	6189	2766	2907
Mean Length (cm)	48	52	60	68	72	72	64	50	54
				2004		2005		2006	
Total (thousands)				793		856		923	
Mean Weight (g)				3881		4259		3211	
Mean Length (cm)				61		63		58	

The lowest total number in landings (year 2001) is 4 % of the maximum value (year 1988). Since 2001 increases were verified and values of 2003-2006 are around the same level. Mean lengths and mean weights in the landings have increased sharply between 1995 and 2000. In 2002 low values of mean lengths and mean weights were observed, around the minimum of the time series, due to the increase in smaller individuals. After that, increases were observed reaching 63 cm in 2005.

Exploratory analyses of the length distributions by ICES Division, country, gear, year and quarter were updated with the 2006 data (Annex I). This spatial and quarterly disaggregated analysis of the length distributions may examine the consistency of modal lengths and its progress with time and between areas and can therefore highlight possible changes in the population structure not apparent in the annual length distribution.

From Figures I2, I4 and I5 higher modal lengths can be observed around 30 cm in the first quarter of 2002 in the three trawl fleets (Spanish in Division VIIIc and IXa and Portuguese in IXa) and again in the first quarter of 2003 in the Portuguese trawl fleet (Figure I5). These modal lengths can be traced in the following quarters in the trawl fleets and apparently in the following years with higher lengths in the artisanal fleet (Figure I3 and I6), that targets larger anglerfish. The present analysis suggests that in recent year’s changes to the population structure may have been occurred, and possibly higher age classes may have entered into the fishery.

Age-length-keys

Age readings are available for *L. piscatorius* since 1996 based on *illicia*. The following table shows the number of *illicia* readings available, by year and quarter:

	Quarter				
Year	1	2	3	4	Total
1996	0	0	163	228	391
1997	223	197	206	242	868
1998	253	181	197	236	867
1999	152	139	120	177	588
2000	198	170	197	216	781
2001	142	135	139	181	597
2002	165	161	145	170	641
2003	144	180	191	179	694
2004	157	194	187	171	709
2005	167	172	108	95	542
2006	186	210	233	221	850

The consistency of age readings was analysed by Duarte et al., 2007 (WD12). Ages from previous years were revised and mean lengths at age do not show inconsistent patterns between years. In order to perform an age structured assessment age-length-keys were used to obtain catch-at-age data and mean weights at age.

8.1.2.3 Abundance indices from surveys

Spanish and Portuguese survey results for the period 1983–2006 are summarized in Table 8.1.3. Considering the very small amount of caught anglerfish in the two surveys, these indices were not considered to reflect the change in the abundance of this species.

8.1.2.4 Commercial catch-effort data

Landings, effort and LPUE data are given in Table 8.1.4 and Figure 8.1.2 for Spanish trawlers (Division VIIIc) from the ports of Santander, Aviles and A Coruña since 1986 and for the Portuguese trawlers (Division IXa) since 1989. For each fleet the proportion of the landings in the stock is given. The Portuguese trawl fleet was split into fish trawlers and crustacean trawlers (WD12, Duarte et al., 2007) according to the fleet segmentation proposed by the IBERMIX project (WD06, Castro *et al*., 2007). Additionally, for Spain an artisanal fleet was available for *L. piscatorius* from the port of Cedeira in Division VIIIc (WD19, Costas *et al*., 2007). Effort unit for this fleet is soaking days and effort standardization was performed (see WD).

All fleets show a general decrease in landings during the late eighties and early nineties. A slight landings increase in 1996 and 1997 can be observed in all fleets. In recent years, Spanish fleets of Corunha, Aviles and Cedeira show an increase in landings while the Portuguese fleets are stabilized at low levels. Proportion in total landings is higher for the Cedeira and Corunha fleets. The Corunha fleet decreased its importance since 1991.

Effort trends show a general decline since the mid nineties in all trawl fleets. The artisanal fleet of Cedeira shows a fluctuation. The Portuguese Crustacean fleet shows high effort values in 2001 and 2002 that might be related to a change in the target species due to very high abundance of rose shrimp during that period. LPUE's from all available fleets show a general decline during the eighties and early nineties followed by a slight increase. In recent years LPUE's increased for all fleets. This general LPUE trend is consistent between fleets including the artisanal fleet. In 2006 a slight decrease is observed for Spanish fleets.

8.1.3 Assessment

Catch and LPUE at-age matrices were obtained using the available ages (annual ALK were applied to annual length distributions of landings). A benchmark assessment was performed for *L. piscatorius* with the following methods:

- Age structured exploratory analysis were performed using FLEDA,
- XSA exploratory runs were carry out and diagnostics of a final XSA exploratory assessment is presented,
- ASPIC assessment is presented by using the Coruña trawl fleet and the Cedeira artisanal fleet,
- A Bayesian approach to the Schaefer production model was carried out.

The available age structured data are summarized in the following table:

	Years	Age	Age plus
Catch-at.age data	1996-2006	2-15	15
Tunning:			
SP-AVILESTR	1996-2003	2-15	15
SP-CORUTR8c	1996-2006	2-15	15
SP-SANTR	1996-2006	2-15	15
SP-CEDGNS8c	1999-2006	5-15	15
P-TRF	1996-2006	-	-
P-TRC	1996-2006	-	-

The catch-at-age matrix, mean weight-at-age and tuning fleet information are presented in tables 8.1.5, 8.1.6 and 8.1.7. The age range for the exploratory analysis and assessment was 2-14, and the plus group was set at age 15. Six tuning fleets were available. In Division VIIIc: SP-AVILESTR, SP-CORUTR8c and SP-SANTR, and the artisanal fleet of SP-CEDGNS8c. In Division IXa two Portuguese trawler fleets were available but due the low catches of *L. piscatorius* (Table 8.1.2) in this area and very noisy catch-at-age information, they were not employed in the analysis.

It was assumed a natural mortality of 0.15 year^{-1} for all ages and in all years. The maturity ogive used was (for combined sexed) (Quincoces *et al*., 1998):

Age	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15+**
Prop. mature	0	0	0	0	0.54	1	1	1	1	1	1	1	1	1

Exploratory analysis of catch-at-age matrix using FLEDA

Catch proportion at age (Figure 8.1.3) by year showed high values for younger ages in 1996 and 2002. No age could be identified as having throughout the time series the most important proportion in the landings.

In the standardized catch-at-age proportion plot (Figure. 8.1.4), cohorts could not be followed along years but groups of consecutive cohorts seemed to have the expected behaviour of a unique age. This effect may be due to a biased criterion of age reading that reads more than one age per year-class.

The mature component of landings (Figure 8.1.5) showed a decreasing trend until 2002 followed by an increment until 2005. In 2006 there was a slight decrease. Both mature and immature components of landings show similar trends with a year lag.

All tuning fleets considered in the analysis showed good correlations between consecutive cohorts for the main ages (Figure 8.1.6). The analysis of standardized CPUEs showed consistency between tuning series especially until age 10 (Figure 8.1.7).

No important changes were observed in the mean weight-at-age along the years (Figure 8.1.8).

XSA Exploratory assessment

XSA exploratory runs were performed for each fleet independently with the following settings:

1) Catchability independent of N for all ages,
2) No q plateau (catchability estimated for all ages),
3) F shrinkage with s.e. of 0.5,
4) No tapered time weighting.
5) Catch-at-age data for 1996-2006 and ages 2-15 (age 15 as plus group).

High log-catchability residuals and year effects were detected generally for all fleets (ICES files). In relative terms the SP-CEDGNS8c and SP-CORUTR8c fleets showed the lowest residual levels. Exploitation patterns are different between trawl and artisanal fleets with the latter showing higher proportions in the landings of older individuals. The SP-CEDGNS8c shows lower log-catchability residuals in older individuals. This fleet is an artisanal fleet using gillnets and is therefore more consistent with the catch-at-age matrix in this age range. Since the SP-CEDGNS8c and SP-CORUTR8c fleets showed the highest consistencies and are the most important in landings proportion, these fleets were used to explore further the XSA assessment.

The q plateau was investigated between fleets and age 10 was selected to be the most consistent age for the q-plateau.

A final XSA exploratory assessment was performed with the following options:

1) Catchability independent of N for all ages,
2) q- plateau for ages > 10,
3) F shrinkage with s.e. of 0.5,
4) No tapered time weighting,
5) Catch-at-age data for 1996-2006 and ages 2-15 (age 15 as plus group),
6) Tunning fleets: SP-CORUTR8c; year: 1996-2006; ages: 2-14
SP-CEDGNS8c; year: 1999-2006; ages: 5-14

In Table 8.1.8 are the XSA diagnostics and in Figure 8.1.9 the log-catchability residuals are plotted. Annual patterns of log-catchability residuals are apparent. Survivors estimates show consistency between fleets after age 4. F shrinkage has the highest weights in estimates until age 7. Due to these inconsistencies results of the XSA assessment were not used to analyse fishing mortality and biomass trends.

ASPIC assessment

An ASPIC assessment for *L. piscatorius* was performed with the SP-CORUTR8c and SP-CEDGNS8c fleets. Input data and model options are given in Table 8.1.9.

Bootstrap confidence intervals for estimated parameters are presented in table 8.1.10 and residuals in log-scale are presented in Figure 8.1.10. B/B_{MSY} and F/F_{MSY} have respectively 18% and 1% of bias and 50% and 45% of inter-quartile range. Biomass is estimated to be 36% of B_{MSY} with a probability of 80% of being between 17% and 51%. Fishing mortality is estimated to be 1.6 times F_{MSY} with 80% probability of being between 1.1 and 2.4 times F_{MSY}. MSY is estimated to be 5402 t with 80% CI of 5042 t and 6354 t.

Trends in relative biomass (Figure 8.1.11) indicate a decrease since the beginning of the time series with slight recoveries in the late nineties and in recent years. Fishing mortality increased from the beginning of the time series and showed sharp decreases in mid nineties and early two thousands that allowed the slight biomass increases in the following years. In 2006, biomass is estimated to be well below B_{MSY} and fishing mortality decreased from 2005 but is estimated to be above F_{MSY}.

Bayesian assessment

The Bayesian assessment is described in WD25 (Azevedo and Duarte, 2007). Despite the high uncertainty associated with B and F estimates, the biomass decreased between 1986 and 1991 and F fluctuated, without trend, around 0.5 year-1. Biomass has recovered since 2000 (lowest level) and is estimated to be around 8 th t in 2006 (Figure 8.1.12).

8.1.4 Assessment results

Due to the inconsistencies with the age-structured assessment, the Working Group decided to base the assessment on the ASPIC model and to compare the trends in biomass and fishing mortality with the Bayesian assessment and with the information given by the basic data. Figure 8.1.12 shows the trends in biomass and fishing mortality from the ASPIC and the Bayesian approach with the respective CI. In spite of the large uncertainty intervals obtained by the Bayesian approach, trends seem to be consistent between both approaches (this can also be observed in Figure 8.1.13 where the scaled trends are plotted with the scaled trend of the mature biomass). Also, both models show a slight recovery in late nineties as a consequence of the reduction in fishing mortality estimated for that period. In recent years both approaches are consistent in showing a slight reduction in F and a slight biomass increase. Uncertainty on absolute values is however higher in recent years.

8.1.5 Projections

Projections were performed based on the ASPIC estimates. The projected B/B_{MSY} and yield are presented in Table 8.1.11. Projections were performed for F *status quo* and for reductions in F in the first year from 10% to 50% and to F_{MSY} level and with zero catches. With F *status quo* and with all scenarios of decreasing F, the biomass is expected to increase. F status quo is expected to bring biomass to 43% of B_{MSY} in the next ten years. By reducing F to F_{MSY} levels or for reductions of 40% or higher in F, the biomass is expected to reach B_{MSY} levels in the next ten years. For all scenarios landings are expected to increase in medium term.

8.1.6 Biological Reference Points

Relative to biological reference points, the WG noted that:

- Although within ICES B_{MSY} has been considered as a candidate for a limit reference point, in another regional fisheries organisation and for a stock assessed with the same model, scientists have adopted a value of 30% B_{MSY} as a limit under the rational that it corresponds to 50% MSY (NAFO SCS 4/12, N4980, 2004, NAFO Scientific Council Report, June 2004).
- WG considers that the B_{MSY} value estimated for *L. piscatorius* by the ASPIC model should not be used as a limit reference point.

8.1.7 Comments on the assessment

Comments on the assessment are in section 8.3.

8.1.8 Management considerations

Management considerations are in section 8.3.

Table 8.1.1 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Tonnes landed by the main fishing fleets for 1978-2006 as determined by the Working Group.

	Div. VIIIc			Div. IXa				Div. VIIIc+IXa
	SPAIN			SPAIN	PORTUGAL			
Year	Trawl	Gillnet	TOTAL	Trawl	Trawl	Artisanal	TOTAL	TOTAL
1978	n/a	n/a	n/a	258		115	373	
1979	n/a	n/a	n/a	319		225	544	
1980	2806	1270	4076	401		339	740	4816
1981	2750	1931	4681	535		352	887	5568
1982	1915	2682	4597	875		310	1185	5782
1983	3205	1723	4928	726		460	1186	6114
1984	3086	1690	4776	578	186	492	1256	6032
1985	2313	2372	4685	540	212	702	1454	6139
1986	2499	2624	5123	670	167	910	1747	6870
1987	2080	1683	3763	320	194	864	1378	5141
1988	2525	2253	4778	570	157	817	1543	6321
1989	1643	2147	3790	347	259	600	1206	4996
1990	1439	985	2424	435	326	606	1366	3790
1991	1490	778	2268	319	224	829	1372	3640
1992	1217	1011	2228	301	76	778	1154	3382
1993	844	666	1510	72	111	636	819	2329
1994	690	827	1517	154	70	266	490	2007
1995	830	572	1403	199	66	166	431	1834
1996	1306	745	2050	407	133	365	905	2955
1997	1449	1191	2640	315	110	650	1075	3714
1998	912	1359	2271	184	28	497	710	2981
1999	545	1013	1558	79	9	285	374	1932
2000	269	538	808	107	4	340	451	1259
2001	231	294	525	57	16	190	263	788
2002	385	341	726	110	29	168	307	1032
2003	911	722	1633	312	29	305	645	2278
2004	1262	1269	2531	264	27	335	626	3157
2005	1378	1622	3000	371	29	244	643	3644
2006	1166	1247	2413	260	29	260	549	2963

n/a: not available

Table 8.1.2 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Length composition by fleet for landings in 2006 (thousands).

	Div. VIIIc			Div. IXa				Div. VIIIc+IXa
	SPAIN			SPAIN	PORTUGAL			
Length (cm)	Trawl	Gillnet	TOTAL	Trawl	Trawl	Artisanal	TOTAL	TOTAL
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21	0.172	0.000	0.172	0.000	0.000	0.000	0.000	0.172
22	0.209	0.000	0.209	0.052	0.000	0.000	0.052	0.261
23	0.279	0.000	0.279	0.225	0.000	0.000	0.225	0.504
24	0.216	0.000	0.216	0.270	0.000	0.000	0.270	0.486
25	0.343	0.000	0.343	0.298	0.000	0.000	0.298	0.641
26	0.859	0.000	0.859	0.705	0.000	0.000	0.705	1.564
27	1.010	0.000	1.010	1.459	0.014	0.000	1.473	2.482
28	2.402	0.000	2.402	2.227	0.018	0.000	2.245	4.647
29	3.027	0.000	3.027	1.749	0.044	0.186	1.980	5.007
30	4.266	0.000	4.266	4.263	0.046	1.024	5.332	9.598
31	4.498	0.000	4.498	3.531	0.048	1.988	5.567	10.065
32	7.551	0.000	7.551	2.340	0.097	1.456	3.893	11.444
33	8.934	0.000	8.934	3.132	0.082	0.295	3.509	12.443
34	14.624	0.000	14.624	2.848	0.111	0.480	3.438	18.062
35	13.112	0.000	13.112	1.991	0.105	0.576	2.673	15.785
36	16.044	0.000	16.044	2.374	0.041	0.164	2.579	18.623
37	18.217	0.000	18.217	3.875	0.241	0.123	4.240	22.457
38	17.729	0.000	17.729	3.168	0.438	0.155	3.760	21.489
39	19.165	0.000	19.165	3.203	0.108	0.289	3.600	22.765
40	16.873	0.087	16.960	3.443	0.180	0.292	3.915	20.875
41	17.277	0.000	17.277	2.643	0.383	0.430	3.456	20.733
42	15.381	0.000	15.381	4.667	0.315	0.518	5.500	20.881
43	14.776	0.000	14.776	3.259	0.190	0.560	4.009	18.785
44	14.445	0.000	14.445	3.137	0.189	0.850	4.176	18.621
45	14.875	0.087	14.962	2.069	0.247	0.985	3.301	18.263
46	16.304	0.000	16.304	2.580	0.288	0.783	3.651	19.955
47	15.685	0.061	15.746	1.365	0.158	1.008	2.531	18.277
48	15.277	0.000	15.277	2.764	0.152	1.168	4.084	19.361
49	12.296	0.118	12.414	2.668	0.257	1.331	4.256	16.670
50	11.669	0.151	11.820	2.145	0.297	1.398	3.841	15.661
51	7.156	0.428	7.584	1.608	0.146	1.437	3.190	10.774
52	9.701	0.305	10.006	1.673	0.107	1.672	3.453	13.459
53	10.335	0.295	10.630	1.128	0.066	1.485	2.679	13.309
54	7.629	0.491	8.121	1.398	0.063	1.251	2.711	10.832
55	8.253	0.300	8.554	0.735	0.071	1.182	1.989	10.542
56	7.460	0.688	8.148	2.329	0.074	1.378	3.781	11.929
57	9.593	0.623	10.216	1.931	0.021	1.028	2.980	13.196
58	8.572	1.348	9.920	2.258	0.169	1.081	3.508	13.429
59	7.075	0.675	7.750	1.878	0.141	1.108	3.128	10.878
60	8.342	1.647	9.988	1.658	0.055	0.631	2.344	12.332
61	9.503	1.312	10.815	1.318	0.068	0.765	2.151	12.965
62	12.009	2.296	14.305	2.046	0.061	0.898	3.004	17.309
63	10.069	2.932	13.002	1.013	0.038	0.590	1.642	14.643
64	9.253	3.060	12.313	0.955	0.032	0.586	1.572	13.886
65	8.946	3.048	11.995	1.277	0.034	0.820	2.131	14.126
66	9.047	4.602	13.649	0.647	0.065	0.650	1.362	15.011
67	8.513	5.298	13.811	0.691	0.018	0.455	1.164	14.975
68	9.153	5.778	14.931	0.589	0.018	0.547	1.154	16.085
69	8.506	5.949	14.455	0.305	0.136	0.808	1.249	15.704
70	7.233	7.321	14.554	1.478	0.010	0.616	2.104	16.657
71	7.517	5.523	13.040	0.593	0.013	0.604	1.210	14.249
72	8.018	7.695	15.713	1.204	0.000	0.675	1.878	17.591
73	5.127	8.042	13.169	0.416	0.081	0.673	1.169	14.338
74	5.657	6.592	12.248	1.340	0.126	0.539	2.005	14.254
75	5.008	7.557	12.565	0.859	0.211	0.524	1.593	14.159
76	6.006	5.884	11.890	1.253	0.308	0.746	2.307	14.197
77	4.629	4.051	8.679	0.118	0.029	0.856	1.003	9.682
78	3.946	6.629	10.576	0.287	0.010	0.519	0.816	11.392
79	4.283	5.104	9.387	0.598	0.054	0.449	1.101	10.488
80	2.696	4.848	7.543	0.869	0.044	0.631	1.544	9.088
81	3.127	3.626	6.753	0.598	0.064	0.656	1.318	8.071
82	4.313	4.117	8.431	0.928	0.107	0.519	1.554	9.984
83	4.030	4.607	8.636	0.810	0.103	0.733	1.646	10.283
84	4.442	5.983	10.425	0.110	0.349	0.601	1.060	11.485
85	2.723	2.655	5.378	0.771	0.050	0.434	1.254	6.633
86	3.587	3.969	7.557	0.938	0.147	0.511	1.596	9.153
87	2.284	2.395	4.679	0.324	0.164	0.487	0.974	5.653
88	2.770	4.214	6.983	0.183	0.094	0.650	0.926	7.910
89	3.036	2.377	5.413	0.454	0.035	0.478	0.968	6.381
90	2.368	4.030	6.398	0.598	0.019	0.441	1.059	7.457
91	2.419	2.348	4.766	0.215	0.082	0.466	0.763	5.529
92	1.070	3.017	4.087	0.101	0.023	0.502	0.626	4.713
93	2.194	1.759	3.953	0.261	0.038	0.303	0.602	4.555
94	0.825	2.003	2.828	0.000	0.016	0.443	0.459	3.287
95	1.439	2.113	3.552	0.032	0.000	0.362	0.394	3.946
96	0.830	2.886	3.716	0.446	0.000	0.335	0.781	4.497
97	0.529	1.847	2.376	0.474	0.000	0.373	0.847	3.223
98	1.096	1.105	2.201	0.000	0.040	0.277	0.317	2.518
99	0.998	1.528	2.527	0.046	0.000	0.182	0.227	2.754
100+	3.358	10.440	13.798	0.364	0.136	2.186	2.686	16.484
TOTAL	574	178	752	111	8	52	171	923
Tonnes	1166	1247	2413	260	29	260	549	2963
Mean Weight (g)	2031	7013	3209	2354	3711	4985	3221	3211
Mean length (cm)	53.8	78.1	59.5	49.3	57.2	61.8	53.5	58.4
Measured weight (t)	3.0	0.7	3.7	2.5			2.5	6.2

Table 8.1.3 ANGLERFISH (*L. piscatorius*). Divisions VIIIc and IXa.
Abundance indices from Spanish and Portuguese surveys.

	Spanish surveys September-October (total area Miño-Bidasoa)					Portuguese Surveys October		
Year	Hauls	Kg/30 min		N/30 min.		Hauls	N/60 min.	Kg/60 min
		Yst	Sst	Yst	Sst			
1983	145	2.03	0.29	3.50	0.46	117	na	na
1984	111	2.60	0.47	2.90	0.55	na	na	na
1985	97	1.33	0.36	1.90	0.26	150	na	na
1986	92	4.28	0.80	10.70	1.40	117	na	na
1987	ns	ns	ns	ns	ns	81	na	na
1988	101	3.33	0.70	1.50	0.25	98	na	na
1989	91	0.44	0.08	2.40	0.30	138	0.07	0.09
1990	120	1.19	0.22	1.20	0.22	123	0.05	0.46
1991	107	0.71	0.22	0.50	0.09	99	+	+
1992	116	0.76	0.15	1.18	0.16	59	0.01	0.09
1993	109	0.88	0.16	1.20	0.14	65	0.01	0.08
1994	118	1.66	0.62	3.70	0.49	94	0.02	+
1995	116	2.19	0.32	5.70	0.69	88	0.03	0.05
1996*	114	1.54	0.26	1.40	0.16	71	0.18	0.27
1997	116	1.69	0.39	0.67	0.11	58	0.03	0.49
1998	114	1.40	0.37	0.39	0.08	96	0	0
1999*	116	0.75	0.23	0.36	0.06	79	0	0
2000	113	0.57	0.19	0.88	0.18	78	0	0
2001	113	1.09	0.24	2.88	0.28	58	0	0
2002	110	1.34	0.21	2.76	0.29	67	0.04	0.06
2003*	112	1.67	0.40	1.41	0.16	80	0.15	0.29
2004*	114	2.09	0.32	2.71	0.32	79	0.12	0.16
2005	116	3.05	0.54	2.04	0.19	87	0.04	0.12
2006	115	1.88	0.40	2.86	0.30	88	0	0

Yst = stratified mean
Sst = mean standar error
ns = no survey
na = not available
+ = less than 0.01
* For Portuguese Surveys - R/V Capricornio, other years R/V Noruega

Table 8.1.4 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Landings, landings per unit effort and effort for trawl and gillnet fleets. For landings the percentage relative to total annual stock landings is given.

Landings (t)

	Div. VIIIc								Div. IXa			
Year	Avilés	%	Santander	%	A Coruña	%	Cedeira	%	Portugal Crustacean	%	Portugal Fish	%
1986	500	7	516	8	1070	16						
1987	500	10	529	10	949	18						
1988	401	6	387	6	1565	25						
1989	214	4	305	6	961	19			85	2	175	3
1990	260	7	278	7	781	21			106	3	219	6
1991	245	7	281	8	865	24			73	2	151	4
1992	198	6	222	7	694	21			25	1	51	2
1993	76	3	186	8	386	17			36	2	75	3
1994	116	6	188	9	245	12			23	1	47	2
1995	192	10	186	10	260	14			22	1	45	2
1996	322	11	270	9	413	14			45	2	88	3
1997	345	9	381	10	411	11			51	1	59	2
1998	286	10	316	11	138	5			11	<1	17	1
1999	108	6	182	9	162	8	342	18	3	<1	6	<1
2000	28	2	75	6	85	7	140	11	2	<1	2	<1
2001	23	3	54	7	84	11	87	11	9	1	7	1
2002	75	7	57	6	130	13	130	13	18	2	11	1
2003	111	5	85	4	228	10	159	7	13	1	16	1
2004	216	7	106	3	279	9	382	12	12	<1	14	<1
2005	278	8	59	2	391	11	434	12	12	<1	17	<1
2006	148	5	89	3	242	8	415	14	12	<1	17	1

Fishing effort

	Div. VIIIc				Div. IXa	
Year	*Avilés	*Santander	*A Coruña	**Cedeira	Portugal ***Crustacean	Portugal ***Fish
1986	10845	18153	39810			
1987	8309	14995	34680			
1988	9047	16660	42180			
1989	8063	17607	44440		76	52
1990	8497	20469	44430		90	61
1991	7681	22391	40440		83	57
1992	n/a	22833	38910		71	49
1993	7635	21370	44504		75	56
1994	9620	22772	39589		41	36
1995	6146	14046	41452		38	41
1996	4525	12071	35728		64	54
1997	5061	11776	35211		43	27
1998	5929	10646	32563		48	35
1999	6829	10349	30232	4607	24	18
2000	4453	8779	30072	3361	42	19
2001	1838	3053	29923	2226	85	19
2002	2748	3975	21823	2605	62	14
2003	2526	3837	18493	2576	42	17
2004	n/a	3776	21112	5086	21	14
2005	n/a	1404	20663	4032	20	13
2006	n/a	2718	19264	4584	20	14

* Fishing days per 100 HP
** Soaking days
*** 1000 Hours trawling with occurrence of anglerfish
n/a - not available

LPUE

	Div. VIIIc				Div. IXa	
Year	*Avilés	*Santander	*A Coruña	**Cedeira	Portugal ***Crustacean	Portugal ***Fish
1986	46.1	28.4	26.9			
1987	60.2	35.3	27.4			
1988	44.3	23.3	37.1			
1989	26.5	17.3	21.6		1.12	3.35
1990	30.6	13.6	17.6		1.18	3.61
1991	31.9	12.6	21.4		0.89	2.64
1992	n/a	9.7	17.8		0.35	1.05
1993	9.9	8.7	8.7		0.48	1.34
1994	12.0	8.2	6.2		0.57	1.33
1995	31.2	13.2	6.3		0.57	1.08
1996	71.1	22.4	11.6		0.70	1.62
1997	68.1	32.3	11.7		1.19	2.18
1998	48.3	29.7	4.2		0.23	0.49
1999	15.8	17.6	5.4	74.1	0.15	0.33
2000	6.3	8.6	2.8	41.5	0.04	0.11
2001	12.5	17.6	2.8	38.9	0.11	0.37
2002	27.5	14.3	6.0	50.0	0.29	0.78
2003	44.0	22.1	12.3	61.9	0.30	0.92
2004	n/a	28.1	13.2	75.0	0.57	1.00
2005	n/a	41.9	18.9	107.5	0.59	1.28
2006	n/a	32.7	12.6	90.6	0.59	1.27

* kg/days*100HP
** kg/soaking day
*** kg/hour trawl

Table 8.1.5. ANGLERFISH (L. piscatorius) – Divisions VIIIc and Ixa.

Landings number at age (thousands).

Table 1 Catch numbers at age Numbers*10**-3

YEAR,	1996,
AGE	
2,	61,
3,	161,
4,	221,
5,	121,
6,	111,
7,	93,
8,	89,
9,	74,
10,	51,
11,	29,
12,	31,
13,	13,
14,	6,
+gp,	12,
TOTALNUM,	1071,
TONSLAND,	2955,
SOPCOF %,	100,

Table 1 Catch numbers at age Numbers*10**-3

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
AGE										
2,	25,	7,	14,	8,	5,	39,	35,	9,	49,	8,
3,	60,	31,	13,	18,	18,	120,	129,	60,	64,	73,
4,	102,	25,	14,	10,	13,	46,	84,	69,	33,	111,
5,	108,	33,	7,	5,	12,	33,	87,	68,	31,	81,
6,	117,	49,	14,	7,	17,	22,	113,	90,	54,	74,
7,	125,	59,	17,	13,	11,	19,	91,	109,	80,	52,
8,	132,	89,	37,	16,	16,	24,	84,	126,	134,	68,
9,	104,	80,	50,	21,	12,	20,	53,	109,	127,	66,
10,	75,	58,	45,	14,	10,	19,	29,	59,	135,	77,
11,	47,	43,	37,	16,	10,	13,	27,	45,	47,	64,
12,	34,	35,	28,	20,	5,	4,	20,	24,	30,	41,
13,	22,	24,	12,	14,	5,	4,	11,	13,	24,	20,
14,	9,	11,	13,	9,	5,	4,	4,	12,	10,	8,
+gp,	12,	25,	16,	19,	13,	11,	10,	13,	12,	13,
TOTALNUM,	971,	569,	317,	189,	152,	378,	775,	807,	830,	756,
TONSLAND,	3715,	2981,	1932,	1259,	788,	1032,	2278,	3157,	3644,	2932,
SOPCOF %,	100,	100,	100,	100,	100,	100,	100,	100,	100,	100,

Table 8.1.6. ANGLERFISH (L. piscatorius) – Divisions VIIIc and Ixa.

Landings mean weight at age (kilograms).

Table 2 Catch weights at age (kg)

YEAR,	1996,
AGE	
2,	.4100,
3,	.6250,
4,	.9620,
5,	1.4380,
6,	2.1160,
7,	2.9820,
8,	4.1050,
9,	5.0630,
10,	6.3940,
11,	7.8750,
12,	8.2350,
13,	9.8210,
14,	12.0390,
+gp,	15.4660,
SOPCOFAC,	1.0000,

Table 2 Catch weights at age (kg)

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
AGE										
2,	.4070,	.5810,	.6000,	.4580,	.4590,	.4550,	.3910,	.4320,	.4430,	.3770,
3,	.6690,	.6320,	.8440,	.6490,	.6130,	.7350,	.6830,	.7470,	.6690,	.6360,
4,	1.0080,	1.0180,	1.0870,	.9070,	1.0210,	1.0630,	1.0220,	1.0560,	.9120,	.9420,
5,	1.6340,	1.6180,	1.6570,	1.3530,	1.5440,	1.4880,	1.5810,	1.5470,	1.5080,	1.4530,
6,	2.3220,	2.3810,	2.2620,	2.1390,	2.2270,	2.1240,	2.2310,	2.2720,	2.2800,	2.0440,
7,	3.1000,	3.3880,	3.1300,	3.1100,	3.3100,	3.0520,	2.9220,	3.1750,	3.1520,	2.8520,
8,	3.9980,	4.1800,	4.1070,	3.8510,	4.1300,	3.8050,	3.9020,	3.9680,	3.9260,	3.6530,
9,	5.0000,	5.3760,	5.1740,	5.0950,	5.1680,	5.0030,	4.8560,	4.7230,	4.8800,	4.7480,
10,	6.6010,	6.4250,	6.6870,	6.0840,	6.3340,	6.2110,	5.9710,	5.8660,	6.2360,	6.1690,
11,	7.8200,	7.8720,	7.7890,	7.9130,	7.7880,	7.3080,	7.4470,	7.3700,	7.3110,	7.0660,
12,	9.0100,	8.5380,	8.9900,	9.6900,	9.2580,	8.7520,	8.4990,	8.2810,	8.4940,	8.6960,
13,	10.3210,	10.6690,	10.9780,	10.7930,	10.3930,	11.2720,	9.7950,	10.6540,	9.8410,	10.4380,
14,	11.1940,	12.0170,	12.3330,	13.1110,	12.4720,	11.5290,	11.4600,	11.6910,	12.2790,	12.4530,
+gp,	16.0290,	14.9120,	17.0560,	17.1740,	18.2520,	17.5780,	16.4120,	15.5600,	15.2780,	16.2460,
SOPCOFAC,	.9990,	.9989,	.9986,	.9995,	.9992,	1.0000,	1.0005,	.9994,	1.0006,	.9988,

Table 8.1.7. ANGLERFISH (L. piscatorius) – Divisions VIIIc and Ixa.

Tunning fleets.

SOUTHERN STOCK MONKFISH: EFFORT 1000 FISHING DAYS PER HP

104														
SPAVI														
1996	2003													
1	1	0	1											
2	15													
4.52	3.412	16.42	30.891	18.012	10.73	9.172	10.184	9.134	6.195	3.052	3.196	1.264	0.423	0.69
5.06	1.494	6.551	18.625	15.149	11.961	11.606	11.673	9.77	7.081	4.238	2.969	1.738	0.62	0.519
5.93	0.34	1.963	3.608	7.077	10.696	9.321	11.242	7.644	4.795	3.477	2.797	2.035	0.867	1.33
6.83	0.198	0.352	0.93	0.669	1.519	1.316	3.292	3.106	2.395	2.146	1.616	0.666	0.646	0.402
4.45	0.182	0.638	0.648	0.338	0.337	0.599	0.52	0.47	0.251	0.278	0.526	0.418	0.195	0.261
1.84	0.112	0.897	0.855	0.801	1.404	0.531	0.572	0.268	0.128	0.193	0.137	0.107	0.112	0.356
2.75	3.244	15.368	4.493	3.162	2.542	2.615	2.406	1.703	1.152	0.514	0.161	0.048	0.176	0.415
2.53	1.682	10.166	7.719	6.255	6.001	4.473	4.227	2.438	1.096	0.938	0.697	0.364	0.152	0.517
SPSAN														
1996	2006													
1	1	0	1											
2	15													
12.07	7.464	10.83	8.322	4.406	4.946	7.767	11.185	10.117	6.416	3.067	2.859	1.1	0.421	0.745
11.78	3.708	7.259	10.307	8.518	9.514	12.03	14.12	12.48	7.969	4.607	3.13	2.239	1.178	1.18
10.65	0.635	2.373	2.749	5.266	9.042	10.378	13.686	9.829	6.235	4.037	2.975	1.677	0.639	1.398
10.35	0.363	0.349	0.87	0.931	3.011	4.159	6.849	6.597	4.71	3.7	2.174	0.757	0.691	0.407
8.78	0.286	1.283	1.469	1.027	1.242	1.393	1.198	1.092	0.805	1.087	1.467	0.93	0.513	0.708
3.05	0.408	2.426	1.99	2.435	4.269	1.826	1.847	0.679	0.421	0.465	0.225	0.298	0.304	0.373
3.98	2.02	4.889	2.27	2.63	3.558	2.55	2.638	1.375	0.936	0.479	0.112	0.209	0.059	0.122
3.84	0.118	2.436	3.184	3.642	4.224	3.787	4.275	2.394	1.307	1.084	0.703	0.274	0.081	0.072
3.78	0.362	4.89	7.471	5.652	6.218	6.136	4.831	3.451	1.431	0.663	0.382	0.179	0.15	0.103
1.4	0.009	0.246	0.345	0.748	2.946	4.264	4.064	2.007	1.354	0.396	0.232	0.119	0.033	0.034
2.72	0	3.998	7.399	3.499	3.014	2.263	3.965	3.238	2.113	1.205	0.527	0.214	0.105	0.147
SPCOR														
1996	2006													
1	1	0	1											
2	15													
35.73	19.613	48.419	59.73	31.838	29.857	16.611	9.598	6.687	4.771	2.447	3.066	1.067	0.538	0.23
35.21	3.613	13.286	25.983	26.61	23.703	20.502	15.328	8.705	5.474	3.748	2.459	1.786	0.456	0.515
32.56	0.51	2.481	2.218	3.273	4.141	4.495	5.854	4.334	2.715	1.833	1.471	0.68	0.244	0.422
30.23	2.042	2.114	1.17	1.126	1.838	2.371	3.381	4.645	4.109	3.557	2.702	1.054	0.719	0.441
30.07	1.052	2.009	0.58	0.44	1.356	1.336	1.484	2.092	1.344	1.384	1.651	1.252	0.45	0.424
29.92	2.329	7.823	4.645	3.577	3.647	1.864	2.262	1.758	1.129	1.248	0.485	0.439	0.269	0.537
21.82	8.032	26.996	10.596	8.135	4.975	3.817	3.489	2.423	2.418	1.3	0.533	0.083	0.42	0.238
18.49	3.592	16.373	12.129	16.539	19.718	11.408	6.491	4.206	2.181	1.865	1.668	0.739	0.223	0.257
21.11	2.553	7.878	7.103	9.097	12.357	13.504	13.584	9.199	4.509	2.955	1.678	0.684	0.635	0.45
20.66	4.514	7.827	4.261	3.915	8.182	11.707	17.379	14.891	13.928	4.145	2.692	2.305	0.442	0.584
19.26	1.465	13.441	20.356	15.223	14.08	7.732	6.842	4.276	4.651	3.427	2.385	1.101	0.293	0.429
SPCED														
1999	2006													
1	1	0	1											
5	15													
4430.707907		0.034	0.209	1.261	6.392	10.771	9.597	7.526	5.226	2.214	2.268	2.203		
3268.083044		0.044	0.246	1.006	1.83	3.291	2.263	2.073	2.035	1.306	1.065	1.951		
2087.175934		0.027	0.239	0.548	1.192	1.125	1.128	1.277	0.694	0.653	0.94	1.87		
2469.795422		0.127	0.282	0.892	2.335	3.531	3.826	2.684	0.766	0.997	0.531	1.753		
2535.938714		0.534	1.976	2.42	3.657	3.476	2.726	3.104	2.844	1.586	0.624	1.439		
5018.451077		0.597	2.709	7.469	13.293	14.136	8.938	6.794	3.936	2.49	2.093	2.297		
4011.214022		0.13	1.036	4.434	11.423	13.741	15.844	8.461	5.58	5.377	1.739	1.839		
4538.9909		0.19	0.624	1.717	5.705	9.627	12.764	11.08	8.034	4.119	1.657	2.488		

Table 8.1.8. ANGLERFISH (L. piscatorius) – Divisions VIIIc and Ixa.

FLXSA diagnostics.

FLR XSA Diagnostics 2007-05-12 10:48:55

CPUE data from mon06.ind.sel

Catch data for 11 years. 1996 to 2006. Ages 2 to 15.

	fleet	first age	last age	first year	last year	alpha	beta
1	SPCOR	2	14	1996	2006	0	1
2	SPCED	5	14	1999	2006	0	1

Time series weights :

Tapered time weighting not applied

Catchability analysis :

Catchability independent of size for all ages

Catchability independent of age for ages > 10

Terminal population estimation :

Survivor estimates shrunk towards the mean F
of the final 5 years or the 5 oldest ages.

S.E. of the mean to which the estimates are shrunk = 0.5

Minimum standard error for population
estimates derived from each fleet = 0.3

prior weighting not applied

Regression weights

age \ year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
all	1	1	1	1	1	1	1	1	1	1

Fishing mortalities

age \ year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
2	0.008	0.002	0.003	0.002	0.001	0.008	0.006	0.001	0.010	0.005
3	0.034	0.012	0.004	0.005	0.005	0.040	0.033	0.012	0.009	0.017
4	0.089	0.017	0.007	0.004	0.004	0.016	0.034	0.021	0.008	0.019
5	0.138	0.036	0.005	0.003	0.005	0.013	0.035	0.033	0.011	0.022
6	0.187	0.082	0.018	0.006	0.011	0.012	0.052	0.044	0.031	0.031
7	0.240	0.128	0.035	0.020	0.012	0.014	0.060	0.062	0.048	0.036
8	0.341	0.255	0.106	0.039	0.029	0.031	0.076	0.104	0.096	0.049
9	0.285	0.335	0.208	0.075	0.035	0.045	0.084	0.127	0.138	0.059
10	0.249	0.242	0.301	0.082	0.045	0.070	0.078	0.121	0.218	0.110
11	0.238	0.210	0.227	0.162	0.072	0.069	0.125	0.159	0.126	0.143
12	0.218	0.264	0.191	0.176	0.070	0.033	0.138	0.149	0.145	0.145
13	0.320	0.222	0.128	0.130	0.054	0.065	0.116	0.125	0.211	0.126
14	0.261	0.242	0.168	0.130	0.065	0.058	0.076	0.177	0.118	0.096
15	0.261	0.242	0.168	0.130	0.065	0.058	0.076	0.177	0.118	0.096

XSA population number (thousands)

year \ age	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1997	3204	1936	1284	903	740	630	492	452	366	238	186	87	43	56
1998	3687	2734	1610	1011	676	528	426	301	293	245	161	129	54	124
1999	4475	3167	2324	1363	840	537	400	284	185	198	171	107	89	109
2000	4361	3838	2714	1987	1166	710	446	310	199	118	136	122	81	167
2001	3828	3746	3287	2327	1706	998	599	369	247	158	86	98	92	219
2002	5064	3290	3207	2817	1992	1453	848	501	307	204	126	69	80	209
2003	6452	4322	2721	2718	2394	1694	1233	707	412	246	164	105	56	148
2004	8562	5521	3601	2264	2259	1956	1373	984	560	328	187	123	81	88
2005	5408	7361	4696	3035	1885	1861	1582	1065	746	427	241	139	93	112
2006	1821	4609	6276	4011	2584	1573	1527	1237	799	516	324	180	97	156

Table 8.1.8 (continued)

Estimated population abundance at 1st Jan 2007

year	age 2	3	4	5	6	7	8	9	10	11	12	13	14	15
2007	0	1571	3927	5336	3402	2170	1315	1262	1012	621	388	243	138	77

Fleet: SPCOR

Log catchability residuals.

age \ year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
2	2.210	0.198	-1.825	-0.556	-1.189	-0.260	1.018	0.135	-0.624	0.431	0.462
3	2.203	0.738	-1.218	-1.454	-1.692	-0.303	1.398	0.787	-0.332	-0.606	0.477
4	2.717	1.847	-0.797	-1.734	-2.587	-0.693	0.477	0.952	-0.003	-0.764	0.586
5	2.058	1.984	-0.196	-1.502	-2.815	-0.871	0.079	1.001	0.453	-0.673	0.482
6	1.613	1.554	-0.073	-1.058	-1.691	-1.075	-0.603	0.776	0.230	0.014	0.312
7	1.134	1.460	0.143	-0.482	-1.338	-1.344	-0.686	0.443	0.336	0.258	0.076
8	0.381	1.178	0.397	-0.085	-1.044	-0.917	-0.515	-0.081	0.431	0.553	-0.296
9	0.106	0.548	0.358	0.500	-0.442	-0.805	-0.469	-0.078	0.263	0.692	-0.674
10	0.127	0.210	-0.193	0.780	-0.505	-0.912	-0.037	-0.266	0.042	0.950	-0.196
11	-0.271	0.258	-0.425	0.536	0.083	-0.347	-0.248	0.115	0.171	0.253	-0.049
12	0.638	0.073	-0.199	0.388	0.127	-0.692	-0.679	0.419	0.163	0.402	0.056
13	0.307	0.563	-0.764	-0.108	-0.064	-0.925	-1.925	0.036	-0.323	0.830	-0.137
14	0.123	-0.119	-0.916	-0.287	-0.675	-1.348	-0.448	-0.550	0.047	-0.466	-0.856

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

	2	3	4	5	6	7	8	9	10	11	12	13	14
Mean_Logq	-10.4689	-9.1903	-9.1913	-8.9289	-8.3927	-8.2575	-7.9720	-7.8494	-7.7807	-7.7807	-7.7807	-7.7807	-7.7807
S.E_Logq	1.0904	1.2341	1.5385	1.4507	1.0616	0.9009	0.6692	0.5253	0.5299	0.3010	0.4338	0.7623	0.4397

Fleet: SPCED

Log catchability residuals.

age \ year	1999	2000	2001	2002	2003	2004	2005	2006
5	-0.937	-0.754	-0.950	0.242	1.698	1.309	-0.295	-0.313
6	-0.551	-0.418	-0.377	-0.534	1.222	0.909	0.347	-0.599
7	0.239	0.030	-0.473	-0.529	0.311	0.613	0.358	-0.551
8	0.954	-0.133	-0.413	-0.255	-0.186	0.328	0.255	-0.550
9	1.178	0.147	-0.672	0.003	-0.366	0.045	0.167	-0.501
10	1.146	-0.167	-0.652	0.198	-0.459	-0.239	0.316	-0.143
11	0.804	0.304	-0.064	0.253	0.209	0.038	0.203	0.167
12	0.566	0.153	-0.073	-0.540	0.537	0.050	0.367	0.313
13	0.152	-0.205	-0.267	0.338	0.385	0.003	0.914	0.226
14	0.379	0.003	0.163	-0.437	0.063	0.274	0.140	-0.080

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

	5	6	7	8	9	10	11	12	13	14
Mean_Logq	-17.9806	-16.0609	-14.5977	-13.3621	-12.6732	-12.2862	-12.2862	-12.2862	-12.2862	-12.2862
S.E_Logq	1.0137	0.7275	0.4577	0.4890	0.5701	0.5599	0.2571	0.3642	0.3754	0.2492

Terminal year survivor and F summaries:

Age 2 Year class = 2004

source	survivors	N	scaledWts
SPCOR	2476	1	0.161
fshk	1440	1	0.839

Age 3 Year class = 2003

source	survivors	N	scaledWts
SPCOR	6124	2	0.251
fshk	3383	1	0.749

Table 8.1.8 (continued)

Age 4 Year class = 2002

source

	survivors	N	scaledWts
SPCOR	3736	3	0.3
fshk	6216	1	0.7

Age 5 Year class = 2001

source

	survivors	N	scaledWts
SPCOR	3110	4	0.304
SPCED	2471	1	0.122
fshk	3816	1	0.575

Age 6 Year class = 2000

source

	survivors	N	scaledWts
SPCOR	3189	5	0.303
SPCED	1312	2	0.265
fshk	2256	1	0.432

Age 7 Year class = 1999

source

	survivors	N	scaledWts
SPCOR	1768	6	0.263
SPCED	1174	3	0.455
fshk	1197	1	0.282

Age 8 Year class = 1998

source

	survivors	N	scaledWts
SPCOR	1136	7	0.288
SPCED	1541	4	0.502
fshk	903	1	0.210

Age 9 Year class = 1997

source

	survivors	N	scaledWts
SPCOR	822	8	0.348
SPCED	1356	5	0.480
fshk	684	1	0.173

Age 10 Year class = 1996

source

	survivors	N	scaledWts
SPCOR	584	9	0.380
SPCED	648	6	0.463
fshk	636	1	0.157

Age 11 Year class = 1995

source

	survivors	N	scaledWts
SPCOR	382	10	0.460
SPCED	368	7	0.429
fshk	509	1	0.111

Age 12 Year class = 1994

source

	survivors	N	scaledWts
SPCOR	246	11	0.455
SPCED	226	8	0.453
fshk	333	1	0.092

Table 8.1.8 (continued)

Age 13 Year class = 1993

source

	survivors	N	scaledWts
SPCOR	133	11	0.418
SPCED	140	8	0.490
fshk	151	1	0.092

Age 14 Year class = 1992

source

	survivors	N	scaledWts
SPCOR	69	11	0.351
SPCED	84	8	0.566
fshk	61	1	0.082

Table 8.1.9 ANGLERFISH (*L. piscatorius*) – Divisions VIIIc and IXa.

ASPIC input settings and data.

Input	Value
Error type	YLD – Condition on yield
Number of bootstrap trials	500
Maximum F when estimating effort	8.0d0 (y^{-1})
Statistical weight for B1 > K	1
Statistical weights for fisheries	F1: 1, F2: 1
B1-ratio (starting guess)	0.5
MSY (starting guess)	5000 (t)
K (starting guess)	50000 (t)
q (starting guess)	F1: 1d-5, F2: 1d-6
Estimated parameters	All: B1-Ratio, MSY, K, qF1, qF2
Min and max allowable MSY	2 000 (t) – 10 000 (t)
Min and max K	5000 (t) – 500 000 (t)
Random number seed	1964185

F1:	SP-CORUTR8c	
Type:	CC (CPUE and Catch)	
Year	CPUE (t/effort)	Catch (t)
1980	-1	4816
1981	-1	5568
1982	-1	5782
1983	-1	6114
1984	-1	6032
1985	-1	6139
1986	0.02690	6870
1987	0.02740	5141
1988	0.03710	6321
1989	0.02160	4996
1990	0.01760	3790
1991	0.02140	3640
1992	0.01780	3381
1993	0.00870	2329
1994	0.00620	2007
1995	0.00630	1834
1996	0.01160	2955
1997	0.01170	3715
1998	0.00420	2981
1999	0.00540	1932
2000	0.00280	1259
2001	0.00280	788
2002	0.00600	1032
2003	0.01230	2278
2004	0.01320	3157
2005	0.01890	3644
2006	0.01260	2932

F2:	SP-CEDGNS8c
Type:	I1 (Index of biomass – annual average)
Year	CPUE (t/effort)
1980	-1
1981	-1
1982	-1
1983	-1
1984	-1
1985	-1
1986	-1
1987	-1
1988	-1
1989	-1
1990	-1
1991	-1
1992	-1
1993	-1
1994	-1
1995	-1
1996	-1
1997	-1
1998	-1
1999	0.0741
2000	0.0415
2001	0.0389
2002	0.0500
2003	0.0619
2004	0.0750
2005	0.1075
2006	0.0906

Table 8.1.10. ANGLERFISH (L. piscatorius) – Divisions VIIIc and IXa. ASPIC results: parameter estimates, bootstrap relative bias and confidence interval, and interquartil (IQ) range.

	WG2007							
			Bootstrap Confidence Interval					
Parameter	Point estimates	Relative bias	Lower 80%	Higher 80%	Lower 50%	Higher 50%	IQ-Range	Relative IQ-Range
B1/K	1.03	-17.10%	0.32	0.64	0.40	0.51	0.10	20.70%
K	25520	12.79%	21440	28070	23210	25850	2647	10.40%
q(1)	2.80E-06	-15.98%	2.75E-06	3.26E-06	2.88E-06	3.23E-06	3.53E-07	12.60%
q(2)	2.00E-05	-13.70%	1.77E-05	4.92E-05	2.01E-05	2.81E-05	7.99E-06	40.00%
MSY	5402	-3.96%	5042	6354	5367	5747	380	7.00%
Ye(2006)	3174	3.61%	2012	4149	2493	3651	1158	36.50%
Y(Fmsy)	1932	12.29%	1086	2772	1387	2315	928	48.00%
Bmsy	12760	12.79%	10720	14040	11600	12930	1323	10.40%
Fmsy	0.423	-12.46%	0.411	0.577	0.431	0.484	0.053	12.50%
fmsy(1)	151300	5.43%	129400	162600	138000	153200	15220	10.10%
fmsy(2)	21190	6.60%	14930	24750	17570	22340	4776	22.50%
B./Bmsy	0.36	17.89%	0.17	0.51	0.24	0.42	0.18	49.40%
F./Fmsy	1.55	0.91%	1.14	2.42	1.34	2.03	0.69	44.60%
Ye./MSY	0.59	8.58%	0.30	0.76	0.43	0.66	0.24	40.30%
q2/q1	7.1	3.33%	5.91	9.51	6.62	8.37	1.75	24.60%

Table 8.1.11. Anglerfish (*L. piscatorius*) – Divisions VIIIc and IXa. Point estimates of B/B_{MSY}(from 2007 to 2016) and Yield (from 2007 to 2016) for projections with F status quo (Fsq), $F_{MSY,}$ zero cathes and first year reduction in F of 10, 20, 30, 40 and 50%. Values for F/FMSY are also given.

Fishing mortality trends in relation to F_{MSY}

			Decrease in first year					
year	Fsq	FMSY	zero catches	reduction 50 %	reduction 40 %	reduction 30 %	reduction 20 %	reduction 10 %
2007	1.549	1.55	1.549	1.55	1.55	1.55	1.55	1.55
2008	1.549	1.01	0	0.77	0.93	1.08	1.24	1.39
2009	1.549	1.01	0	0.77	0.93	1.08	1.24	1.39
2010	1.549	1.01	0	0.77	0.93	1.08	1.24	1.39
2011	1.549	1.01	0	0.77	0.93	1.08	1.24	1.39
2012	1.549	1.01	0	0.77	0.93	1.08	1.24	1.39
2013	1.549	1.01	0	0.77	0.93	1.08	1.24	1.39
2014	1.549	1.01	0	0.77	0.93	1.08	1.24	1.39
2015	1.549	1.01	0	0.77	0.93	1.08	1.24	1.39
2016	1.549	1.01	0	0.77	0.93	1.08	1.24	1.39

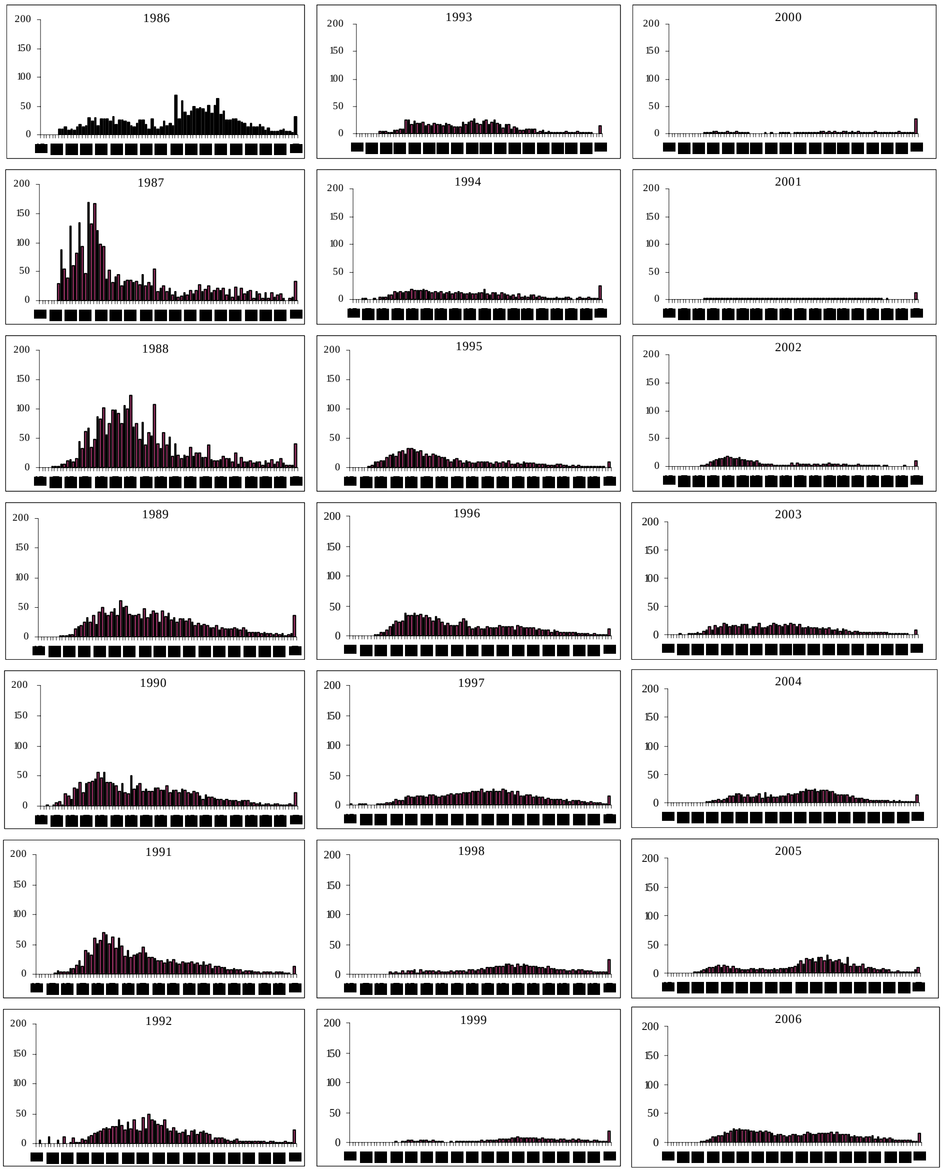
Biomass trends in relation to B_{MSY}

year	Fsq	FMSY	zero catches	reduction 50 %	reduction 40 %	reduction 30 %	reduction 20 %	reduction 10 %
2007	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
2008	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
2009	0.38	0.47	0.69	0.52	0.49	0.46	0.43	0.41
2010	0.39	0.58	1.11	0.67	0.61	0.55	0.49	0.44
2011	0.40	0.67	1.49	0.83	0.72	0.63	0.54	0.47
2012	0.41	0.76	1.74	0.95	0.82	0.70	0.59	0.49
2013	0.42	0.82	1.88	1.05	0.90	0.76	0.63	0.52
2014	0.42	0.88	1.95	1.11	0.95	0.80	0.66	0.53
2015	0.43	0.91	1.98	1.16	0.99	0.83	0.69	0.55
2016	0.43	0.94	1.99	1.18	1.02	0.86	0.70	0.56

Yield

year	Fsq	FMSY	zero catches	reduction 50 %	reduction 40 %	reduction 30 %	reduction 20 %	reduction 10 %
2007	3050	3050	3050	3050	3050	3050	3050	3050
2008	3155	2292	0	1850	2150	2429	2689	2930
2009	3248	2854	0	2493	2749	2945	3090	3188
2010	3329	3404	0	3144	3342	3443	3464	3421
2011	3398	3897	0	3725	3875	3890	3798	3627
2012	3458	4309	0	4188	4313	4266	4084	3803
2013	3509	4630	0	4522	4647	4566	4319	3952
2014	3552	4868	0	4749	4888	4795	4508	4075
2015	3589	5039	0	4895	5055	4964	4655	4176
2016	3620	5158	0	4987	5167	5086	4768	4258

Figure 8.1.1 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Length distributions of landings (thousands) for 1986 to 2006.



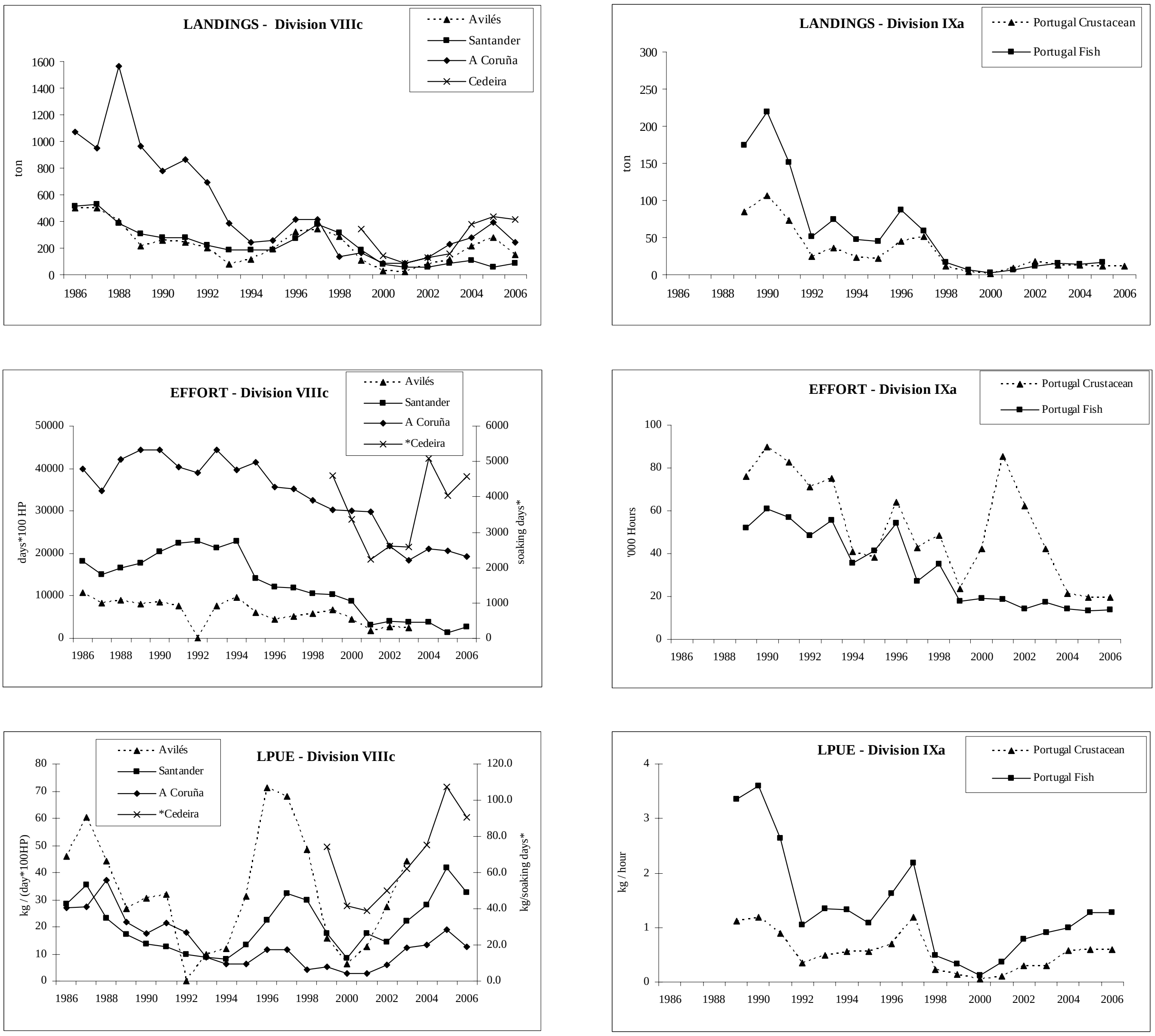


Figure 8.1.2 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Trawl and gillnet landings, effort and LPUE data between 1986-2006.

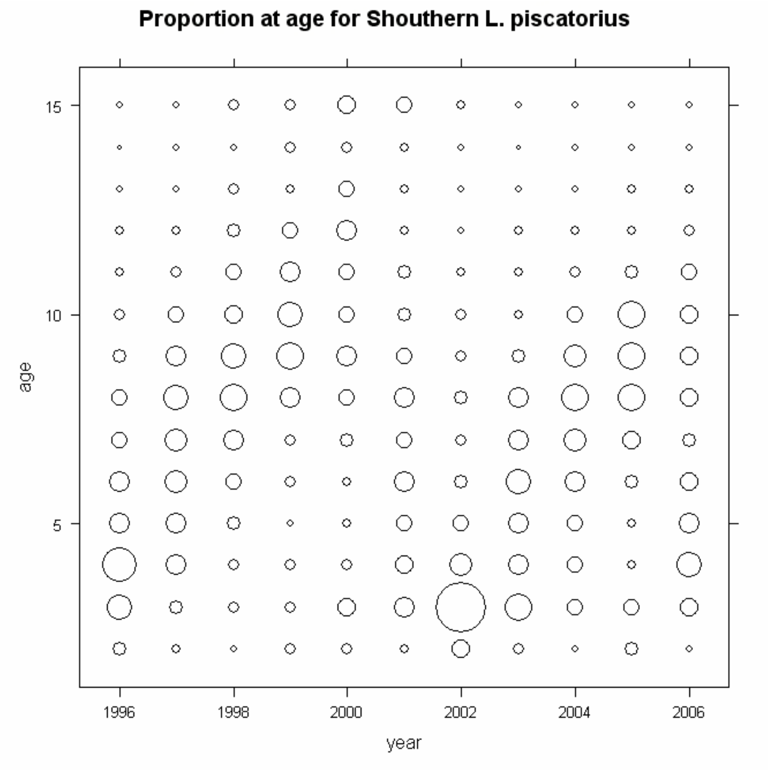


Figure 8.1.3. ANGLERFISH (L. piscatorius) – Divisions VIIIc and IXa. Catch proportions at age.

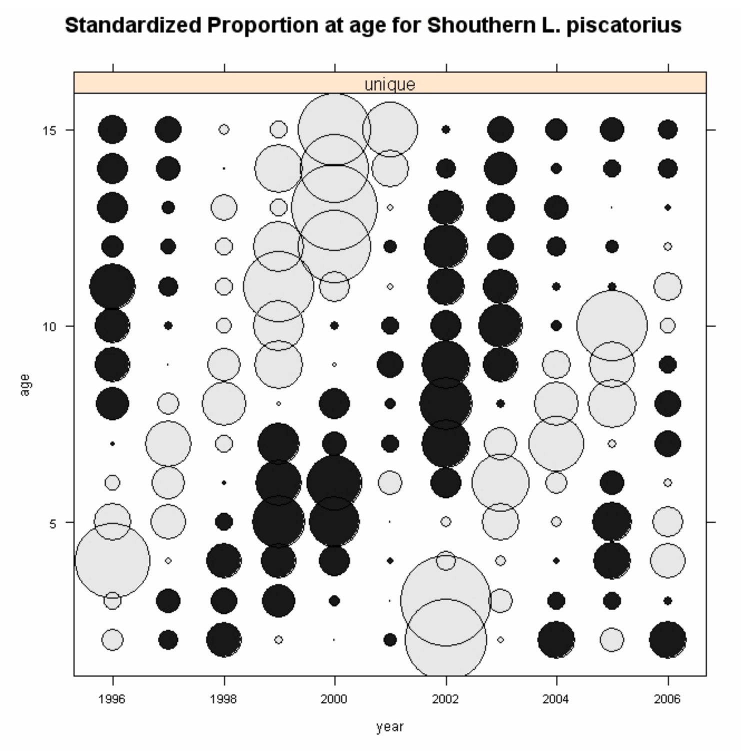


Figure 8.1.4. ANGLERFISH (L. piscatorius) – Divisions VIIIc and IXa. Standardized catch proportions at age.

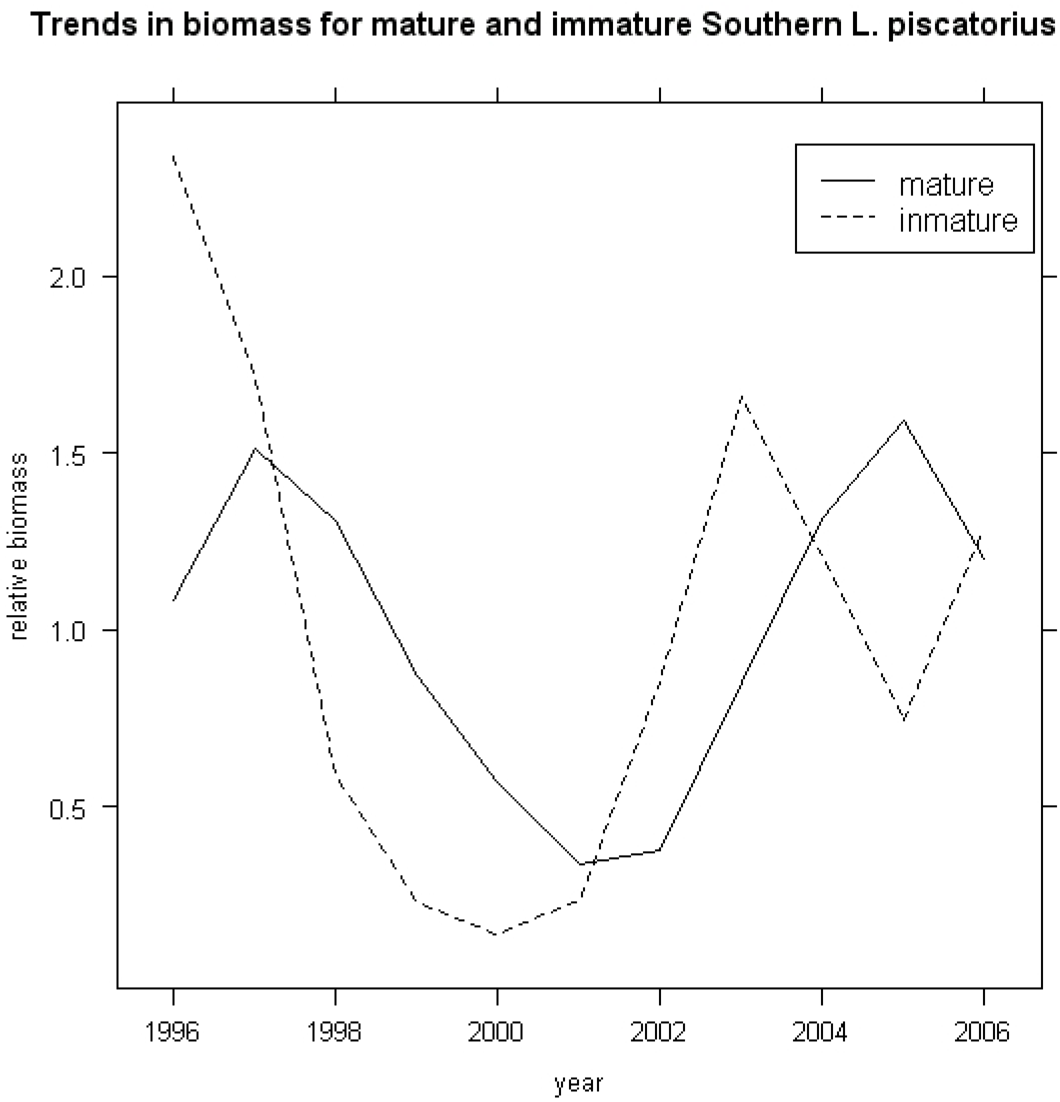


Figure 8.1.5. ANGLERFISH (L. piscatorius) – Divisions VIIIc and IXa. Landings mature and immature biomass trends.

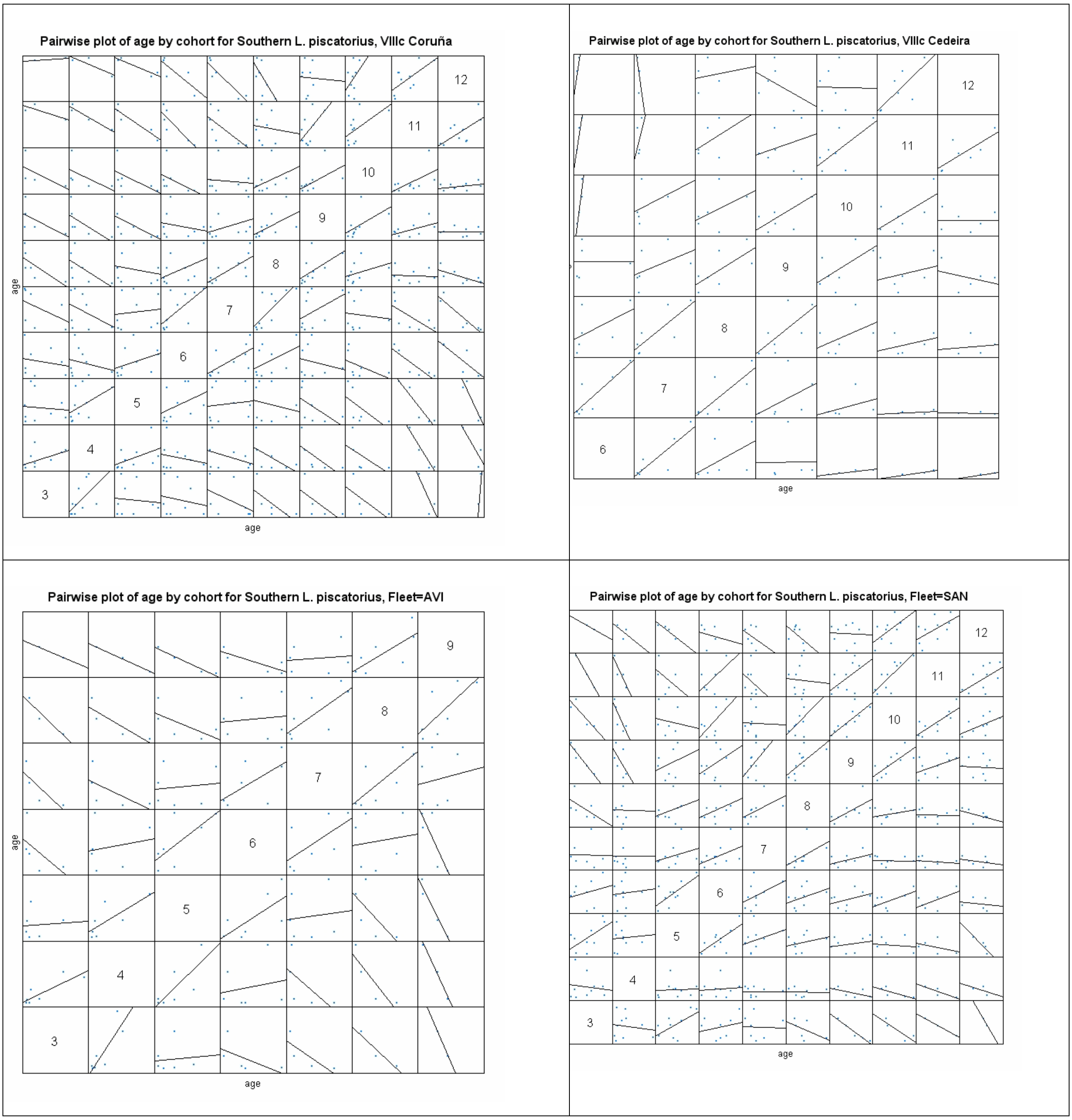


Figure 8.1.6. ANGLERFISH (L. piscatorius) – Divisions VIIIc and IXa. Pairwise plot of age by cohort.

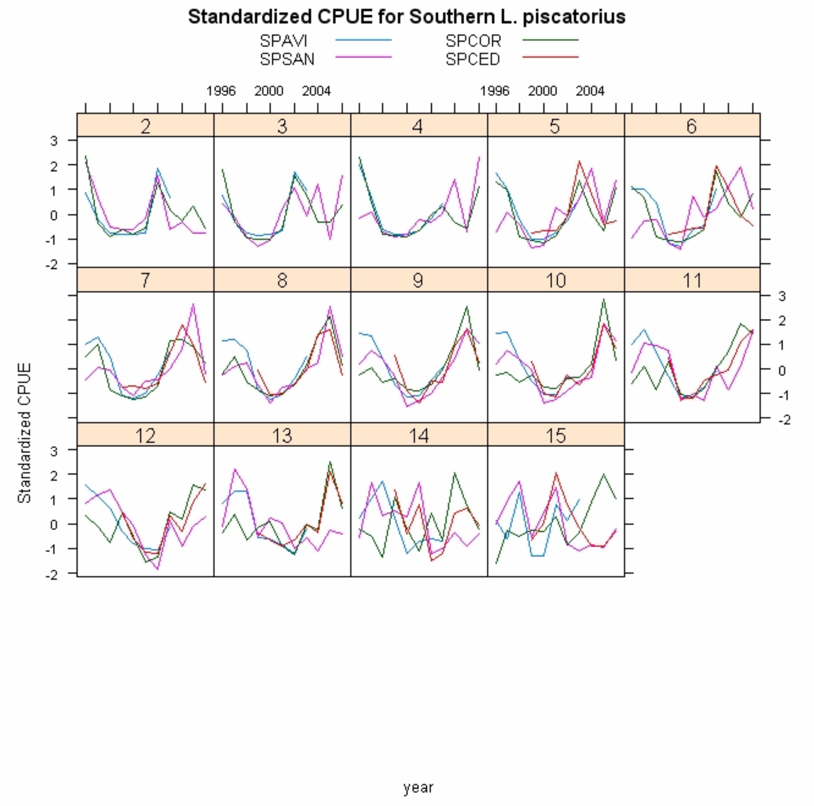


Figure 8.1.7. ANGLERFISH (L. piscatorius) – Divisions VIIIc and IXa. Standardized CPUE at age.

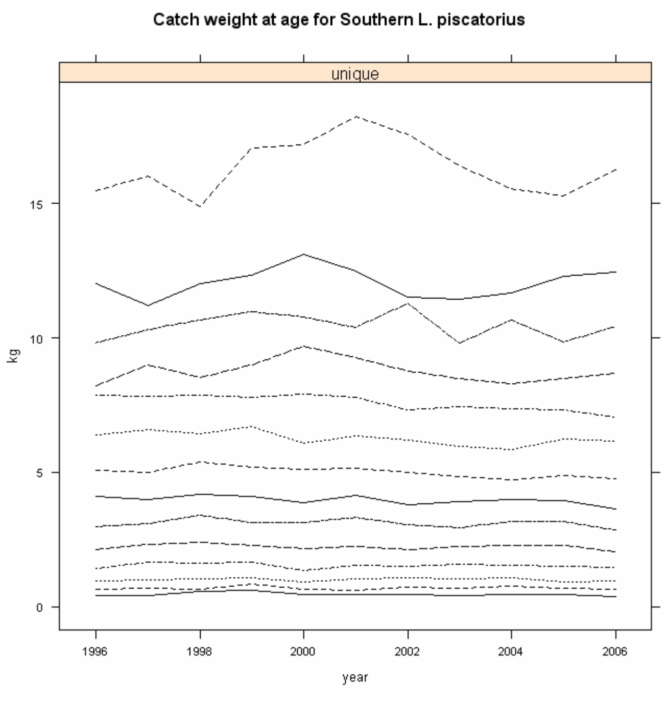


Figure 8.1.8. ANGLERFISH (L. piscatorius) – Divisions VIIIc and IXa.

Catch mean weights at age.

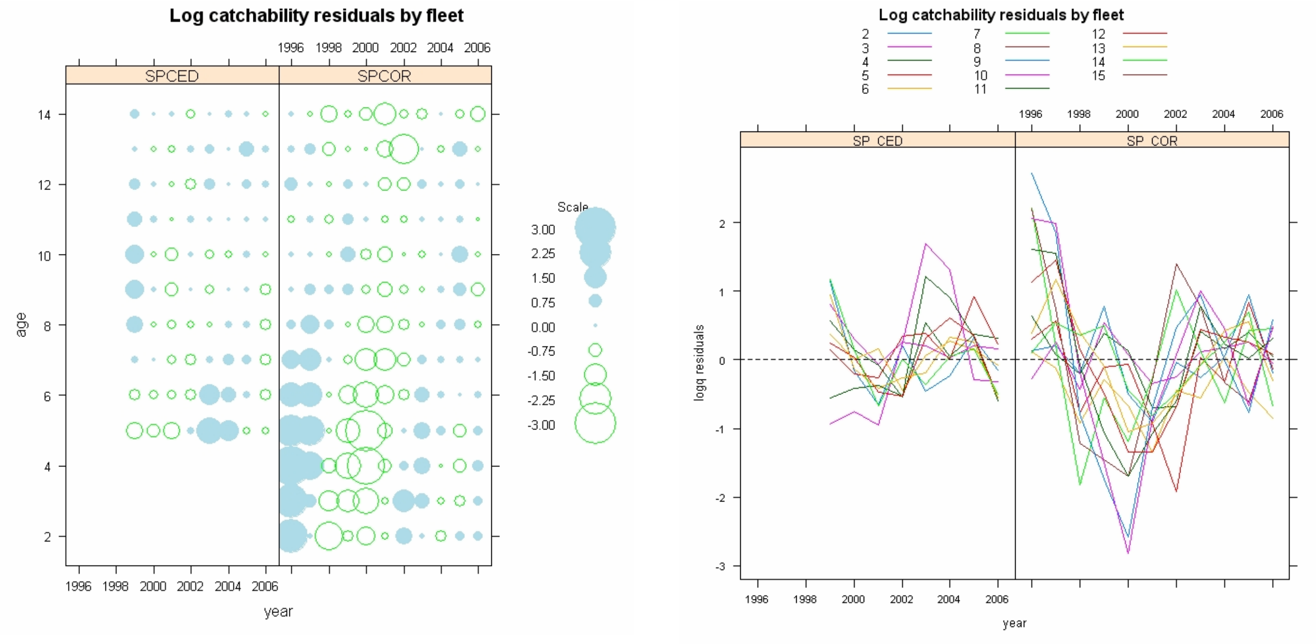


Figure 8.1.9. ANGLERFISH (L. piscatorius) – Divisions VIIIc and IXa. Log catchability residuals by fleet.

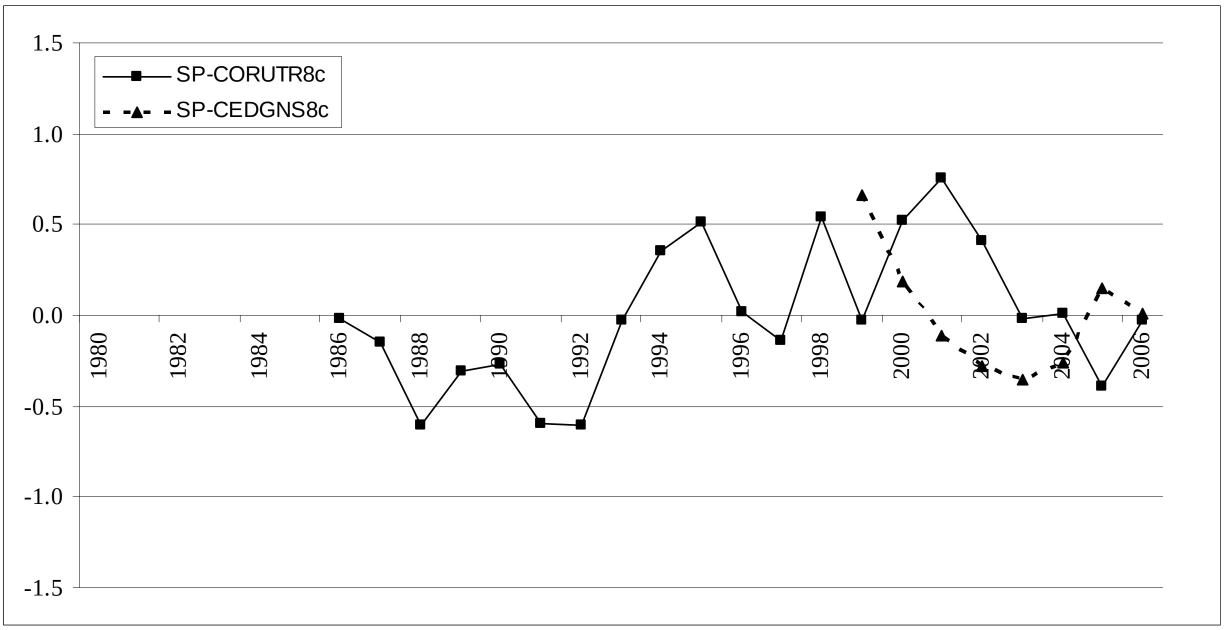


Figure 8.1.10. ANGLERFISH (*L. piscatorius*)– Divisions VIIIc and IXa. ASPIC residuals in Log scale for the A Coruña trawler fleet and the artisanal fleet of Cedeira.

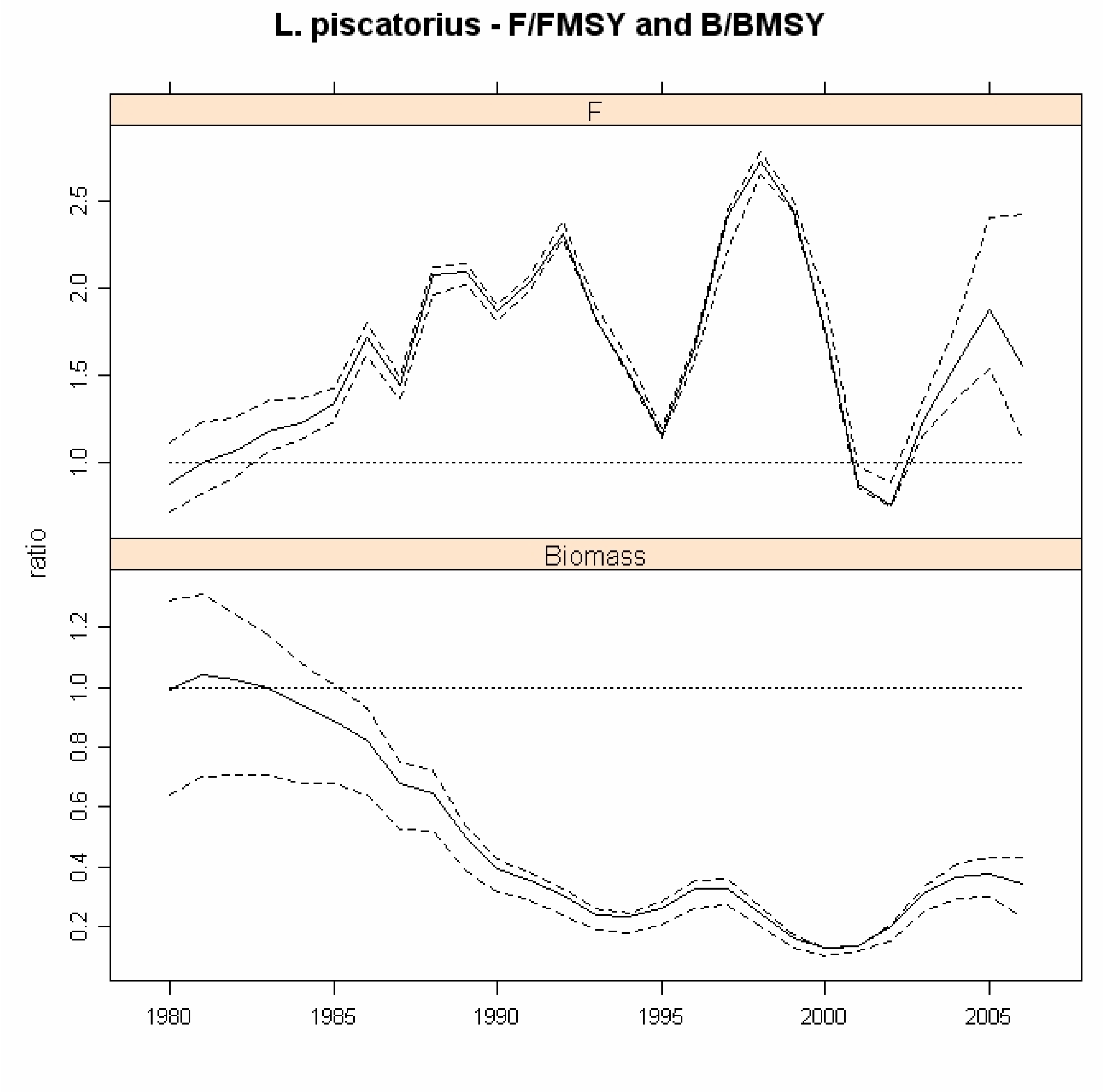


Figure 8.1.11. ANGLERFISH (L. piscatorius) – Divisions VIIIc and IXa. Confidence intervals (80%) of the F/F_{MSY} and B/B_{MSY} ratios.

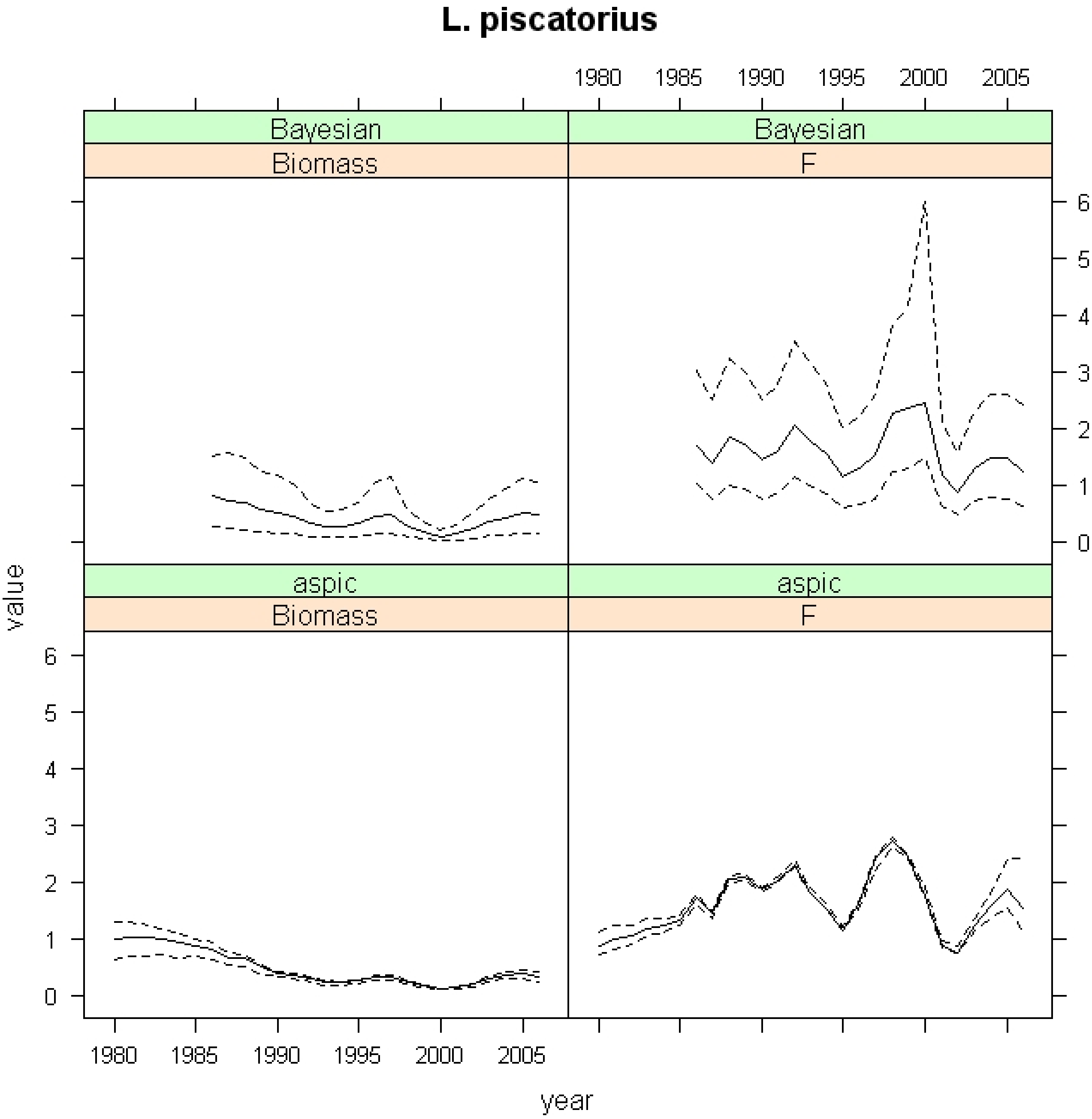


Figure 8.1.12. ANGLERFISH (L. piscatorius) – Divisions VIIIc and IXa. Trends in biomass and F from Bayesian approach and frequentist approach (ASPIC).

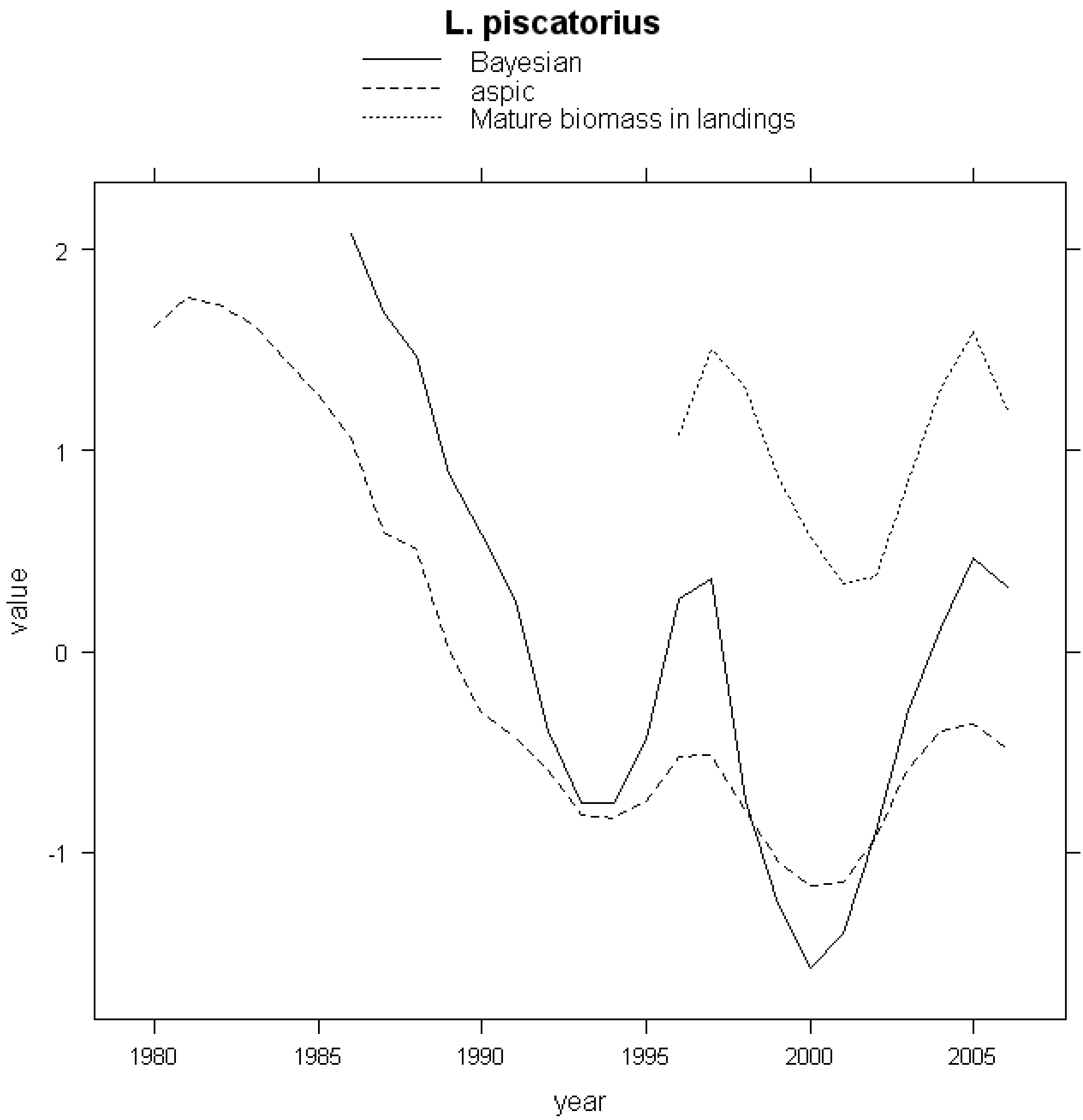


Figure 8.1.13. ANGLERFISH (L. piscatorius) – Divisions VIIIc and Ixa. Scaled comparison of estimated biomass from Bayesian approach, frequentist approach (ASPIC) and the mature component of landings.

8.2 Anglerfish (*Lophius budegassa*) in Divisions VIIIc and IXa

8.2.1 General

8.2.1.1 Ecosystem aspects

L. budegassa is a North Eastern Atlantic species, with a distribution area from the British Isles to Senegal (including the Mediterranean and the Black Sea). The Southern stock comprises ICES divisions VIIIc and IXa and its boundaries were not based on biological criteria. Recent studies were carried out in genetic and morphometric analysis (GESSAN, 2002; Duarte *et al*. 2004; Fariña *et al.*, 2004).

As *L. piscatorius*, this species is slow growing, with a late maturation. In the Southern stock, ages of first maturity are estimated around 7 years for males and around 9-10 for females (Duarte et al., 2001).

Other particular biological/ecosystem aspects are common with *L. piscatorius* (section 8.1.1.1).

8.2.1.2 Fishery description

L. budegassa is caught by Spanish and Portuguese bottom trawlers and gillnet fisheries. As with *L. piscatorius*, it is an important target species for the artisanal fleet, while it is a by catch for the trawl fleet targeting hake or crustaceans. The importance of *Lophius* species in the fisheries is referred in section 8.1.1.2. Since 1997 Spanish landings represented on average 72% of the total *L. budegassa* stock landings.

The length distribution of the landings are considerably different between both fisheries, with the gillnet landings showing higher mean lengths compared to the trawl landings. Since 1997, the Spanish landings were on average 90% from the trawl fleet (mean lengths in 2006 of 44 cm and 33 cm for Divisions VIIIc and IXa, respectively) and 13% from the artisanal fleet (mean length of 65 cm in 2006 in Division VIIIc). Portuguese landings were on average for the same period, 24 % from the trawl fleet (43 cm mean length) and 76% from the artisanal fleet (60 cm mean length).

For the Spanish trawl fleets it is necessary to take into account that since 2003 the alternative use of a trawl gear with HVO (High Vertical Opening) has taken place in higher proportion relative to previous years. This gear targets horse mackerel with very few anglerfish catches.

8.2.2 Data

8.2.2.1 Commercial catches and discards

Total landings of *L. budegassa* by country and gear for the period 1978–2006, as estimated by the Working Group, are given in Table 8.2.1. There were unrecorded landings in Division VIIIc between 1978 and 1979, and it is not possible to obtain the total landings in those years. After 1980, landings increased and reached a peak of 3 832 t in 1987. Since then, landings decreased and reached a minimum in 2002 with 770 t. From 2002 to 2005 landings remained, in low values, under 1000 t.

In 2006 landings increased reaching 1148 t. This increase was observed in all fleets except for the Portuguese artisanal fleet (decreased from 214 to 121 t). Comments on discard data are the same as for *L. piscatorius* in Section 8.1.2.1.

In 2005 and 2006, Portuguese combined species landings were TAC constrained and very low landings were registered during the 4th quarter.

As for *L. piscatorius*, an exploratory analysis of landings proportion by quarter was updated (Annex I, Figure I1). The Spanish trawl fleet in Division VIIIc obtained higher landings during the first semester of the year and the Portuguese trawl fleet also showed higher values in the first quarter. The reasons for these shifts along the year could be the same as in *L. piscatorius* (section 8.1.2.1). The Spanish artisanal fleet showed higher proportion during the second quarter while the Portuguese artisanal fleet showed the highest in the first quarter (Annex I, Figure I1). The artisanal fleets have anglerfish as the target species and these shifts can be related with the higher vulnerability of the species.

8.2.2.2 Biological sampling

The procedure for sampling of this species is the same as for *L. piscatorius*. The sampling levels for 2006 are shown in Table 1.3. Spanish and Portuguese market sampling effort has increased since 1995 and is expected to be maintained in future.

Length composition

The sampled length compositions were raised for each country and SOP corrected to total landings on a quarterly basis or half yearly basis (when the sampling levels by quarter were low). Table 8.2.2 gives the length compositions by country and gear for 2006.

The annual length composition between 1986 and 2006 are presented in Figure 8.2.1. In 2002 an increase of smaller individuals is apparent (around 35 cm), that is confirmed in the 2003 length distribution. In 2006 there was an increase in the number of smaller individuals that was confirmed by the lowest annual mean length (37 cm) observed since 1987. The total annual landings in numbers and the annual mean length and mean weight are in the following table:

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Total (thousands)	1704	4673	2653	1815	1590	1672	1497	1238	1063	1583	1146	1452
Mean Weight (g)	1504	820	1395	1420	1468	1294	1410	1799	1486	1157	1422	1248
Mean Length (cm)	43	34	43	44	44	42	45	48	44	40	44	41

	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total (thousands)	1554	1268	680	435	514	507	468	408	1030
Mean Weight (g)	1380	1487	2010	2329	1497	1826	1974	2198	1115
Mean Length (cm)	42	42	47	49	41	46	47	49	37

In 2005 the lowest total number in landings was observed, being 9 % of the maximum value (year 1987) and the mean weight and length are of the same level of the maximum values observed in 2001. In 2006 the number in landings more than doubled the previous year.

As for *L. piscatorius*, the exploratory analysis of the length distributions was updated with the 2006 data (Annex I). This spatial and quarterly disaggregated analysis may examine the consistency of modal lengths and highlight possible changes in the population structure not as apparent in the annual length distribution.

Modal length classes of around 30 cm, are shown in the first quarter of 2002 in the Spanish trawl fleet in Division IXa (Figure I9) and in the first quarters of 2001 and 2002 in the Portuguese trawl fleet (Figure I10). These modal lengths can be traced in the following quarters of the same fleets. For the artisanal fleets (Figures I8 and I11) these model lengths are less evident since these fleets target anglerfish of higher lengths. In 2006 higher modes in smaller lengths are apparent in the second, third and fourth quarters in the Spanish trawler fleet in Division IXa and in the third and fourth quarter in the Spanish trawler fleet in Division VIIIc.

Age-length-keys

Age readings are available for *L. budegassa* from 1996 based on *illicia*. The following table shows the number of *illicia* readings available, by year and quarter:

	Quarter				
Year	1	2	3	4	Total
1996	0	0	166	221	387
1997	329	322	191	179	1021
1998	182	138	172	151	643
1999	218	147	173	175	713
2000	383	299	206	235	1123
2001	274	250	182	229	935
2002	251	189	283	252	975
2003	445	283	250	292	1270
2004	343	301	251	136	1031
2005	305	256	48	26	635
2006	349	221	0	0	570

Age readings of the last two quarters in 2005 and 2006 are low due to the TAC constraint of the fishery in Portugal, with low landings during that period.

As for *L. piscatorius*, the consistency of the age readings since 1996 was investigated by Duarte *et al.*, 2007 (WD12). Ages for previous years were revised and mean lengths-at-age do not show inconsistent patterns between years. In order to perform an age structured assessment age-length keys were used to obtain catch-at-age and mean weights at age.

8.2.2.3 Abundance indices from surveys

Spanish and Portuguese survey results for the period 1983–2006 are summarized in Table 8.2.3. Considering the very small amount of caught anglerfish in the two surveys, these indices were not considered to reflect the change in the abundance of this species.

8.2.2.4 Commercial catch-effort data

Landings, effort and LPUE data are given in Table 8.2.4 and Figure 8.2.2 for Spanish trawlers from ports of Santander, Aviles and A Coruña since 1986 and for Portuguese trawlers (Division IXa) since 1989. For each fleet the proportion of the landings in the stock is given. As explained in Section 8.1.2.4, the Portuguese fleet was split into fish trawlers and crustacean trawlers and a Spanish artisanal fleet was available for the port of Cedeira in Division VIIIc.

From late eighties to mid-nineties the overall trend in landings for all fleets was decreasing. A slight increase was observed from 1996 to 1998 in all fleets. Coruña trawler fleet showed in 2002 the most important drop in landings and in relative proportion of total landings. The lowest observed landings for both trawlers and gillnets was in 2005, except for Avilés.

Effort trends are analysed in section 8.1.

LPUEs of all Spanish fleets show high values during the second half of the 90's, while the Portuguese fleets have fluctuated. In recent years LPUE's have remained relatively stable at low values for all fleets. In 2006 a slight increase was observed in trawler and gillnet fleets.

8.2.3 Assessment

Catch and LPUE-at-age matrices were obtained using the available ages (annual ALK were applied to annual length distributions of landings). As for *L. piscatorius* a benchmark assessment was performed with the following methods:

- Age structured exploratory analysis performed using FLEDA.
- XSA exploratory runs were carried out and diagnostics of a final XSA exploratory assessment is presented.
- ASPIC assessment is presented using the Portuguese fish and crustacean trawler fleets.
- A Bayesian approach to the Schaefer production model was carried out.

The available age structured data are summarized in the following table:

	Years	Age	Age plus
Catch-at-age data	1996-2006	2-15	15
Tuning Fleets:			
SP-AVILESTR	1996-2003	2-15	15
SP-CORUTR8c	1996-2006	2-15	15
SP-SANTR	1996-2006	2-15	15
SP-CEDGNS8c	1999-2006	-	-
P-TRF	1996-2006	2-15	15
P-TRC	1996-2006	2-15	15

The catch-at-age, mean weight-at-age and tuning fleet information are presented in Tables 8.2.5, 8.2.6 and 8.2.7. The age range for the exploratory analysis and assessment was 2-14 and the plus group was set at age 15. Six tuning fleets were available. In Division VIIIc: SP-AVILESTR, SP-CORUTR8c and SPSANTR, and the artisanal fleet of SP-CEDGNS8c. In ICES Division IXa two Portguese trawler fleets were available.

It was assumed a natural mortality of 0.15 year^{-1} for all ages and in all years.

The used maturity ogive was (Duarte et al., 2001):

Age	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15+**
Prop. mature	0	0.02	0.05	0.1	0.2	0.35	0.53	0.71	0.84	0.92	0.96	0.98	1	1

Exploratory analysis of catch-at-age matrix using FLEDA

The catch proportion at age (Figure 8.2.3) shows that ages from 4 to 7 are the most abundant. In the standardized catch proportions at age (Figure 8.2.4) the cohorts can not be followed along the years. Groups of consecutive cohorts seemed to have the expected behaviour of a unique age. This effect may be due to a biased criterion of age reading that reads more than one age per year-class.

The relative biomass of mature and immature components of the stock have dropped from 1999 to 2001 (Figure 8.2.5). In recent years they have shown low fluctuating values.

Pairwise plots of age by cohorts (Figure 8.2.6) showed for all fleets acceptable level of internal consistency. The consistency between tuning fleets was satisfactory in all ages but age 8 and age 9 (Figure 8.2.7). Mean weights at age remained without changes along years (Figure 8.2.8).

XSA Exploratory assessment

XSA exploratory runs were performed with the following settings:

1) Catchability independent of N for all ages,
2) No q plateau (catchability estimated for all ages),
3) F shrinkage with s.e. of 0.8,
4) No tapered time weighting.
5) Catch-at-age data for 1996-2006 and ages 2-15 (age 15 as plus group).

High log-catchability residuals and year effects were detected generally for all fleets (ICES files). Since the P-TRF and SP-CORUTR8c fleets showed the lowest residuals and are the most important in landings proportion, they were used to explore further the XSA assessment.

The q plateau was investigated between fleets and age 10 was selected to be the most consistent age for the q-plateau.

A final XSA exploratory assessment was performed with the following options:

1) Catchability independent of N for all ages,
2) q- plateau for ages > 10,
3) F shrinkage with s.e. of 0.8,
4) No tapered time weighting,
5) Catch-at-age data for 1996-2006 and ages 2-15 (age 15 as plus group),
6) Tuning fleets: SP-CORUTR8c; year: 1996-2006; ages: 2-14

P-TRF; year: 1996-2006; ages: 2-14

In Table 8.2.8 are the XSA diagnostics and in Figure 8.2.9 the log-catchability residuals are plotted. Annual patterns of log-catchability residuals are apparent. Survivors estimates show consistency between fleets after age 6. F shrinkage has the lowest weights in estimates after age 3. Due to these inconsistencies, results of the XSA assessment were not used to analyse fishing mortality and biomass trends.

ASPIC assessment

An ASPIC assessment for *L. budegassa* was performed with the P-TRF and P-TRC fleets. Input data and model options are given in Table 8.2.9.

Bootstrap confidence intervals for estimated parameters are presented in table 8.2.10 and residuals in log-scale are in Figure 8.2.10. B/B_{MSY} and F/F_{MSY} have respectively 2% and 8% of bias and 52% and 42% of inter-quartile range. Biomass is estimated to be 35% of B_{MSY} with a probability of 80% of being between 22% and 55%. Fishing mortality is estimated to be 1.4 times F_{MSY} with 80% probability of being between 0.9 and 2.0 times F_{MSY}. MSY is estimated to be 2500 t with 80% CI of 2494 t and 2504 t. This parameter shows no bias and a small inter-quartile range (1%).

Trends in relative biomass (Figure 8.2.11) indicate a decrease since the late eighties with a slight recovery in the late nineties and in recent years. Fishing mortality remained at high levels between late eighties and late nineties, dropping after that. In 2006, biomass is estimated to be well below B_{MSY} and fishing mortality is estimated to be above F_{MSY}. However, the F_{MSY} 80% CI include the probability of F being at F_{MSY} levels.

Bayesian assessment

The Bayesian assessment is described in WD25 (Azevedo and Duarte, 2007). Despite the high uncertainty associated with B and F estimates, the biomass decreased between 1986 and mid nineties. F increased during that period. A slight biomass recovery is apparent in the following years that dropped again after, due to the fishing mortality increase (Figure 8.2.12).

8.2.4 Assessment results

Due to the inconsistencies with the age-structured assessment, the Working Group decided to base the assessment on the ASPIC model and to compare the trends in biomass and fishing mortality with the Bayesian assessment and with the information given by the basic data. Figure 8.2.12 shows the trends in biomass and fishing mortality from the ASPIC and the Bayesian approach with the respective CI. In spite of the large uncertainty intervals obtained by the Bayesian approach, trends in biomass seem to be consistent between both approaches until the mid nineties (this can also be observed in Figure 8.2.13 where the scaled trends are plotted with the scaled trend of the mature biomass). After that, the Bayesian estimates indicate an important increase in biomass that the ASPIC results estimate as a stable period in low levels. However, in recent years both approaches estimate a slight increase in biomass. Fishing mortality trends show also differences in recent years, with Bayesian estimates showing a drop in F in the late nineties while the ASPIC estimates indicate an increase during that period to highest historical F levels. The uncertainty on absolute values in fishing mortality and biomass is however higher in recent years for both approaches.

8.2.5 Projections

Projections were performed based on the ASPIC estimates. The projected B/B_{MSY} and yield are presented in Table 8.2.11. Projections were performed for F *status quo* and for reductions in F in the first year from 10% to 50% and to F_{MSY} level and with zero catches. With F *status quo* and with all scenarios of decreasing F, the biomass is expected to increase. F status quo is expected to bring biomass to 58% of B_{MSY} in the next ten years. Reducing F to F_{MSY} levels or by reducing F by 30% or more, the biomass is expected to reach B_{MSY} levels within the next ten years. For all scenarios landings are expected to increase in medium term.

8.2.6 Biological Reference Points

Relative to biological reference points, the WG noted that:

- Although within ICES B_{MSY} has been considered as a candidate for a limit reference point, in another regional fisheries organisation and for a stock assessed with the same model, scientists have adopted a value of 30% B_{MSY} as a limit under the rational that it corresponds to 50% MSY (NAFO SCS 4/12, N4980, 2004, NAFO Scientific Council Report, June 2004).
- Therefore the WG considers that the B_{MSY} value estimated for *L. budegassa* by the ASPIC model should not be used as a limit reference point.

8.2.7 Comments on the assessment

Comments on the assessment are in section 8.3.

8.2.8 Management considerations

Management considerations are in section 8.3.

Table 8.2.1. ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Tonnes landed by the main fishing fleets for 1978-2006 as determined by the Working Group.

	Div. VIIIc			Div. IXa				Div. VIIIc+IXa
	SPAIN			SPAIN	PORTUGAL			
Year	Trawl	Gillnet	TOTAL	Trawl	Trawl	Artisanal	TOTAL	TOTAL
1978	n/a	n/a	n/a	248		107	355	
1979	n/a	n/a	n/a	306		210	516	
1980	1203	207	1409	385		315	700	2110
1981	1159	309	1468	505		327	832	2300
1982	827	413	1240	841		288	1129	2369
1983	1064	188	1252	699		428	1127	2379
1984	514	176	690	558	223	458	1239	1929
1985	366	123	489	437	254	653	1344	1833
1986	553	585	1138	379	200	847	1425	2563
1987	1094	888	1982	813	232	804	1849	3832
1988	1058	1010	2068	684	188	760	1632	3700
1989	648	351	999	764	272	542	1579	2578
1990	491	142	633	689	387	625	1701	2334
1991	503	76	579	559	309	716	1584	2163
1992	451	57	508	485	287	832	1603	2111
1993	516	292	809	627	196	596	1418	2227
1994	542	201	743	475	79	283	837	1580
1995	913	104	1017	615	68	131	814	1831
1996	840	105	945	342	133	210	684	1629
1997	800	198	998	524	81	210	815	1813
1998	748	148	896	681	181	332	1194	2089
1999	571	127	698	671	110	406	1187	1885
2000	441	73	514	377	142	336	855	1369
2001	383	69	452	190	101	269	560	1013
2002	173	74	248	234	75	213	522	770
2003	279	49	329	305	68	224	597	926
2004	251	120	371	285	50	267	603	973
2005	273	97	370	283	31	214	527	897
2006	323	124	447	541	39	121	701	1148

n/a: not available

Table 8.2.2 ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Length composition by fleet for landings in 2006 (thousands).

	Div. VIIIc			Div. IXa				Div. VIIIc+IXa
	SPAIN			SPAIN	PORTUGAL			
Length (cm)	Trawl	Gillnet	TOTAL	Trawl	Trawl	Artisanal	TOTAL	TOTAL
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.629	0.000	0.000	0.629	0.629
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	1.546	0.000	0.000	1.546	1.546
21	0.000	0.000	0.000	2.736	0.000	0.000	2.736	2.736
22	0.000	0.000	0.000	2.836	0.000	0.000	2.836	2.836
23	0.000	0.000	0.000	4.497	0.003	0.000	4.500	4.500
24	0.206	0.000	0.206	5.316	0.024	0.000	5.339	5.546
25	0.380	0.000	0.380	7.055	0.060	0.000	7.115	7.495
26	1.361	0.000	1.361	25.569	0.040	0.000	25.608	26.970
27	2.244	0.000	2.244	39.065	0.610	0.000	39.675	41.919
28	5.694	0.000	5.694	66.367	0.400	0.085	66.853	72.547
29	3.856	0.000	3.856	62.393	0.835	0.061	63.289	67.145
30	6.352	0.000	6.352	48.557	1.177	0.084	49.818	56.170
31	4.045	0.000	4.045	71.639	1.513	0.053	73.204	77.249
32	4.724	0.000	4.724	76.708	1.197	0.151	78.056	82.781
33	7.076	0.000	7.076	66.829	0.982	0.131	67.943	75.019
34	8.293	0.036	8.329	54.907	1.253	0.137	56.297	64.626
35	8.745	0.000	8.745	43.727	0.900	0.122	44.749	53.493
36	6.809	0.000	6.809	38.149	1.264	0.160	39.572	46.381
37	8.342	0.000	8.342	28.536	0.642	0.105	29.283	37.626
38	7.051	0.000	7.051	23.239	0.821	0.130	24.189	31.241
39	4.819	0.000	4.819	9.109	0.649	0.152	9.910	14.729
40	4.695	0.000	4.695	7.146	0.691	0.296	8.133	12.829
41	5.852	0.047	5.899	8.297	0.822	0.426	9.545	15.444
42	4.763	0.000	4.763	4.638	0.302	0.194	5.134	9.897
43	4.682	0.000	4.682	5.685	0.892	0.349	6.926	11.608
44	5.902	0.000	5.902	5.865	0.607	0.309	6.781	12.683
45	4.322	0.044	4.366	2.904	0.565	0.475	3.944	8.310
46	5.530	0.124	5.653	3.499	0.224	0.880	4.602	10.256
47	5.595	0.000	5.595	2.396	0.331	0.887	3.613	9.208
48	7.687	0.092	7.779	3.815	0.064	1.240	5.119	12.898
49	5.626	0.117	5.744	2.322	0.226	1.335	3.884	9.628
50	5.306	0.211	5.517	2.195	0.394	1.230	3.819	9.336
51	4.823	0.207	5.029	2.731	0.177	1.006	3.913	8.943
52	4.585	0.471	5.056	1.524	0.130	0.781	2.435	7.491
53	4.042	0.648	4.690	1.233	0.105	0.817	2.156	6.846
54	3.758	0.241	3.999	1.528	0.098	1.105	2.731	6.730
55	2.948	0.232	3.180	2.226	0.298	0.665	3.189	6.369
56	2.035	1.136	3.170	1.537	0.005	0.716	2.258	5.428
57	2.180	0.161	2.341	1.153	0.139	0.463	1.754	4.096
58	1.603	1.439	3.043	0.946	0.074	0.570	1.590	4.632
59	1.545	0.550	2.094	0.936	0.184	0.606	1.726	3.820
60	1.785	1.842	3.627	1.402	0.095	0.587	2.083	5.710
61	1.759	1.550	3.310	0.830	0.059	0.484	1.374	4.683
62	2.907	1.478	4.385	1.181	0.022	0.423	1.626	6.011
63	1.210	0.730	1.940	0.482	0.130	0.589	1.201	3.141
64	0.921	1.241	2.162	0.559	0.046	0.664	1.268	3.430
65	2.928	1.403	4.331	1.104	0.070	0.701	1.875	6.206
66	1.531	2.285	3.815	0.431	0.222	0.771	1.424	5.240
67	1.591	1.406	2.997	1.064	0.157	0.834	2.055	5.052
68	1.458	1.095	2.553	0.788	0.117	0.722	1.627	4.180
69	1.138	1.668	2.806	0.796	0.189	0.748	1.733	4.539
70	0.721	1.980	2.702	0.417	0.118	1.064	1.598	4.300
71	1.743	0.956	2.699	0.544	0.251	1.092	1.887	4.586
72	1.256	1.572	2.828	0.965	0.125	0.966	2.057	4.884
73	1.370	0.577	1.947	1.021	0.457	0.889	2.367	4.314
74	0.391	0.927	1.319	0.550	0.069	0.674	1.294	2.612
75	0.695	0.867	1.562	0.530	0.143	0.744	1.417	2.979
76	0.328	0.482	0.810	0.228	0.196	0.525	0.949	1.759
77	0.045	0.198	0.243	0.385	0.106	0.485	0.976	1.220
78	0.053	0.145	0.198	0.188	0.170	0.392	0.749	0.947
79	0.061	0.022	0.083	0.196	0.132	0.368	0.696	0.779
80	0.064	0.000	0.064	0.000	0.053	0.311	0.364	0.428
81	0.217	0.000	0.217	0.237	0.032	0.203	0.472	0.688
82	0.062	0.000	0.062	0.192	0.004	0.137	0.333	0.395
83	0.046	0.100	0.146	0.295	0.053	0.174	0.522	0.668
84	0.016	0.000	0.016	0.000	0.012	0.149	0.161	0.177
85	0.000	0.078	0.078	0.000	0.059	0.147	0.205	0.283
86	0.016	0.000	0.016	0.043	0.066	0.170	0.279	0.295
87	0.000	0.072	0.072	0.000	0.011	0.141	0.152	0.224
88	0.016	0.000	0.016	0.000	0.003	0.064	0.067	0.083
89	0.000	0.000	0.000	0.000	0.042	0.042	0.084	0.084
90	0.000	0.000	0.000	0.000	0.042	0.039	0.081	0.081
91	0.000	0.000	0.000	0.000	0.010	0.072	0.081	0.081
92	0.000	0.000	0.000	0.000	0.000	0.039	0.039	0.039
93	0.000	0.000	0.000	0.000	0.009	0.025	0.034	0.034
94	0.000	0.000	0.000	0.000	0.000	0.015	0.015	0.015
95	0.000	0.000	0.000	0.000	0.004	0.003	0.007	0.007
96	0.000	0.000	0.000	0.000	0.000	0.017	0.017	0.017
97	0.000	0.000	0.000	0.000	0.000	0.003	0.003	0.003
98	0.000	0.000	0.000	0.000	0.000	0.119	0.119	0.119
99	0.000	0.000	0.000	0.000	0.000	0.007	0.007	0.007
100+	0.000	0.000	0.000	0.000	0.000	0.036	0.036	0.036
TOTAL	192	28	220	756	22	31	810	1030
Tonnes	323	124	447	541	39	121	701	1148
Mean Weight (g)	1684	4362	2030	715	1775	3859	866	1115
Mean Length	44.3	64.9	47.0	33.4	42.6	60.2	34.6	37.3
Measured weight (t)	3.0	1	3.7	2.5			2.5	6.2

Table 8.2.3 ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Abundance indices from Spanish and Portuguese surveys.

	Spanish surveys September-October (total area Miño-Bidasoa)					Portuguese Surveys October		
Year	Hauls	Kg/30 min		N/30 min.		Hauls	N/60 min.	Kg/60 min
		Yst	Sst	Yst	Sst			
1983	145	0.68	0.17	0.50	0.09	117	na	na
1984	111	0.60	0.17	0.60	0.11	na	na	na
1985	97	0.46	0.11	0.50	0.07	150	na	na
1986	92	1.42	0.32	2.50	0.33	117	na	na
1987	ns	ns	ns	ns	ns	81	na	na
1988	101	2.27	0.38	1.50	0.21	98	na	na
1989	91	0.45	0.10	0.90	0.21	138	0.23	0.19
1990	120	1.52	0.47	1.50	0.22	123	0.11	0.17
1991	107	0.83	0.14	0.60	0.10	99	+	0.02
1992	116	1.16	0.19	0.80	0.11	59	0	0
1993	109	0.90	0.20	0.90	0.13	65	0.02	0.04
1994	118	0.75	0.17	1.00	0.12	94	0.06	0.09
1995	116	0.72	0.12	1.00	0.11	88	0.02	0.08
1996*	114	0.95	0.17	1.30	0.18	71	0.27	0.50
1997	116	1.16	0.20	0.97	0.11	58	0.03	0.01
1998	114	0.88	0.18	0.57	0.09	96	0.02	0.12
1999*	116	0.43	0.12	0.26	0.06	79	0.08	0.07
2000	113	0.66	0.18	0.40	0.08	78	0.13	0.13
2001	113	0.19	0.06	0.52	0.10	58	+	+
2002	110	0.26	0.09	0.33	0.07	67	0	0
2003*	112	0.36	0.11	0.35	0.10	80	0.22	0.21
2004*	114	0.76	0.23	0.44	0.12	79	0.14	0.21
2005	116	0.64	0.20	1.62	0.30	87	0.01	+
2006	115	1.08	0.22	1.16	0.19	88	0.02	0.46

Yst = stratified mean
Sst = mean standar error
ns = no survey
na = not available
+ = less than 0.01
* For Portuguese Surveys - R/V Capricornio, other years R/V Noruega

Table 8.2.4 ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Landings, fishing effort and landings per unit effort for trawl and gillnet fleets.

Landings (t)

Year	Div. VIIIc Avilés	%	Div. VIIIc Santander	%	Div. VIIIc A Coruña	%	Div. VIIIc Cedeira	%	Div. IXa Portugal Crustacean	%	Div. IXa Portugal Fish	%
1986	64	3	21	1	353	14						
1987	85	2	16	< 1	636	17						
1988	125	3	30	1	435	12						
1989	119	5	32	1	280	11			89	3	183	7
1990	58	2	40	2	258	11			127	5	261	11
1991	52	2	62	3	182	8			101	5	208	10
1992	33	2	107	5	180	9			94	4	193	9
1993	53	2	143	6	201	9			64	3	132	6
1994	65	4	196	12	166	11			26	2	53	3
1995	141	8	126	7	341	19			22	1	46	3
1996	162	10	89	5	334	21			45	3	88	5
1997	143	8	122	7	298	16			38	2	43	2
1998	91	4	114	5	323	15			70	3	111	5
1999	41	2	67	4	380	20	14	1	41	2	69	4
2000	23	2	44	3	287	21	4	< 1	66	5	76	6
2001	12	1	28	3	281	28	6	1	59	6	42	4
2002	11	1	16	2	76	10	7	1	47	6	28	4
2003	9	1	15	2	85	9	3	< 1	30	3	38	4
2004	32	3	23	2	68	7	5	1	23	2	27	3
2005	54	6	7	1	54	6	2	< 1	12	1	19	2
2006	16	1	18	2	70	6	4	< 1	16	1	24	2

Fishing effort

Year	Div. VIIIc *Avilés	Div. VIIIc *Santander	Div. VIIIc *A Coruña	Div. VIIIc **Cedeira	Div. IXa Portugal ***Crustacean	Div. IXa Portugal ***Fish
1986	10845	18153	39810			
1987	8309	14995	34680			
1988	9047	16660	42180			
1989	8063	17607	44440		76	52
1990	8497	20469	44430		90	61
1991	7681	22391	40440		83	57
1992	n/a	22833	38910		71	49
1993	7635	21370	44504		75	56
1994	9620	22772	39589		41	36
1995	6146	14046	41452		38	41
1996	4525	12071	35728		64	54
1997	5061	11776	35211		43	27
1998	5929	10646	32563		48	35
1999	6829	10349	30232	4607	24	18
2000	4453	8779	30073	3361	42	19
2001	1838	3053	29923	2226	85	19
2002	2748	3975	21823	2605	62	14
2003	2526	3837	18493	2576	42	17
2004	n/a	3776	21112	5086	21	14
2005	n/a	1404	20663	4032	20	13
2006	n/a	2718	19264	4584	20	14

* Fishing days per 100 HP

** Soaking days

*** 1000 Hours trawling with occurrence of anglerfish

n/a - not available

LPUE

Year	Div. VIIIc *Avilés	Div. VIIIc *Santander	Div. VIIIc *A Coruña	**Cedeira	Div. IXa Portugal ***Crustacean	Div. IXa Portugal ***Fish
1986	5.9	1.1	8.9			
1987	10.3	1.1	18.3			
1988	13.9	1.8	10.3			
1989	14.7	1.8	6.3		1.170	3.5
1990	6.8	1.9	5.8		1.409	4.3
1991	6.7	2.8	4.5		1.222	3.6
1992	n/a	4.7	4.6		1.315	4.0
1993	7.0	6.7	4.5		0.853	2.4
1994	6.7	8.6	4.2		0.637	1.5
1995	23.0	9.0	8.2		0.582	1.1
1996	35.8	7.4	9.4		0.703	1.6
1997	28.3	10.4	8.5		0.879	1.6
1998	15.3	10.7	9.9		1.450	3.2
1999	5.9	6.5	12.6	2.9	1.721	3.9
2000	5.1	5.0	9.6	1.2	1.559	4.0
2001	6.7	9.3	9.4	2.6	0.686	2.3
2002	4.1	4.1	3.5	2.7	0.754	2.0
2003	3.6	4.0	4.6	1.0	0.714	2.2
2004	n/a	6.0	3.2	1.0	1.074	1.9
2005	n/a	4.9	2.6	0.6	0.634	1.4
2006	n/a	6.8	3.6	0.9	0.801	1.7

* kg/fishing effort

** kg/soaking days

*** kg/hour

Table 8.2.5. ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa.

Landings number at age (thousands).

Table 1 Catch numbers at age Numbers*10**-3

	YEAR,	1996,
	AGE	
	2,	4,
	3,	35,
	4,	76,
	5,	128,
	6,	147,
	7,	215,
	8,	123,
	9,	125,
	10,	69,
	11,	30,
	12,	24,
	13,	10,
	14,	5,
	+gp,	8,
0	TOTALNUM,	999,
	TONSLAND,	1629,
	SOPCOF %,	100,

Table 1 Catch numbers at age Numbers*10**-3

	YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
	AGE										
	2,	1,	7,	1,	0,	0,	3,	1,	0,	0,	3,
	3,	43,	103,	21,	8,	5,	44,	0,	5,	1,	53,
	4,	190,	203,	143,	15,	20,	83,	35,	38,	22,	297,
	5,	253,	311,	255,	44,	35,	75,	75,	53,	53,	307,
	6,	238,	235,	255,	107,	45,	73,	119,	46,	48,	112,
	7,	205,	165,	187,	143,	85,	65,	90,	78,	49,	51,
	8,	91,	68,	128,	118,	70,	35,	68,	80,	55,	49,
	9,	96,	74,	86,	92,	63,	37,	41,	66,	55,	46,
	10,	61,	74,	64,	40,	37,	27,	22,	47,	37,	35,
	11,	53,	65,	60,	39,	28,	28,	18,	34,	35,	27,
	12,	34,	44,	32,	32,	29,	20,	11,	17,	23,	21,
	13,	9,	16,	11,	21,	18,	12,	9,	9,	19,	16,
	14,	5,	9,	10,	8,	12,	5,	5,	4,	6,	7,
	+gp,	7,	15,	11,	11,	10,	5,	11,	6,	6,	7,
0	TOTALNUM,	1284,	1388,	1264,	679,	458,	510,	507,	484,	408,	1030,
	TONSLAND,	1813,	2089,	1885,	1369,	1013,	770,	926,	973,	897,	1148,
	SOPCOF %,	100,	100,	100,	100,	100,	100,	100,	100,	100,	100,

1

Table 8.2.6. ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa.

Landings mean weight at age (kilograms).

Table 2 Catch weights at age (kg)

YEAR,	1996,
AGE	
2,	.1440,
3,	.2200,
4,	.4020,
5,	.6720,
6,	.9220,
7,	1.2690,
8,	1.8730,
9,	2.3240,
10,	2.9190,
11,	3.7660,
12,	4.3520,
13,	5.3690,
14,	6.3040,
+gp,	8.4740,
0 SOPCOFAC,	.9996,

Table 2 Catch weights at age (kg)

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
AGE										
2,	.1050,	.2020,	.2250,	.1760,	.1890,	.1460,	.0920,	.1330,	.0000,	.1470,
3,	.2300,	.3430,	.3170,	.3420,	.3410,	.3160,	.2390,	.2690,	.3020,	.2840,
4,	.4370,	.6170,	.4970,	.4450,	.5260,	.4370,	.7210,	.4880,	.5360,	.4540,
5,	.6180,	.7830,	.6490,	.6240,	.6560,	.6020,	.8310,	.6600,	.7800,	.6160,
6,	.8800,	1.0910,	.9300,	.8990,	.9590,	.8300,	1.0790,	.9360,	1.0130,	.8450,
7,	1.3280,	1.4700,	1.2220,	1.1950,	1.2210,	1.1010,	1.3440,	1.2190,	1.3170,	1.1430,
8,	1.9160,	1.9580,	1.7380,	1.6240,	1.5900,	1.6530,	1.8220,	1.7440,	1.6520,	1.6220,
9,	2.4950,	2.3160,	2.5000,	2.1900,	2.2030,	2.0460,	2.3950,	2.4960,	2.1400,	2.1810,
10,	3.1200,	2.7450,	3.1020,	3.1120,	2.8520,	2.7320,	3.0490,	3.1490,	2.8990,	2.7260,
11,	3.7070,	3.6350,	3.4590,	3.8870,	3.6830,	3.8420,	3.8600,	3.7290,	3.6730,	3.7320,
12,	4.3960,	4.3220,	3.9320,	4.5120,	4.3720,	4.8130,	4.7800,	4.4340,	4.5180,	4.6520,
13,	5.4640,	5.0690,	5.0070,	5.1580,	5.0840,	5.3660,	5.3260,	5.3920,	5.1370,	5.4520,
14,	6.5640,	5.9560,	6.1860,	5.7530,	5.8600,	6.1140,	6.6070,	6.5130,	6.0590,	6.0780,
+gp,	8.5590,	8.0000,	8.5750,	8.4430,	7.8930,	8.1580,	8.1760,	8.1340,	8.0410,	7.6480,
0 SOPCOFAC,	.9982,	.9989,	.9985,	.9986,	.9993,	.9997,	1.0000,	.9988,	1.0000,	.9993,

Table 8.2.7. ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa.

Tunning fleets.

Black anglerfish VIIIc and IXa

105

VIIIc Corunha

1994 2006

1 1 0 1

3 15

39.589	16.524	56.396	58.17	46.495	46.761	24.317	25.602	18.307	14.044	8.359	2.267	0.616	0.229
41.452	4.039	36.512	101.256	150.582	173.466	67.151	54.945	28.887	13.842	8.188	2.779	1.243	1.215
35.728	2.717	21.923	39.06	47.869	72.42	65.209	83.265	51.7	16.789	11.577	3.134	1.288	1.624
35.184	0.876	22.827	44.279	48.875	39.538	20.393	26.701	18.386	16.665	9.648	1.567	0.534	0.524
32.563	25.593	34.758	48.864	46.177	41.854	20.059	23.052	23.484	17.889	10.099	2.842	1.16	0.502
30.137	3.81	24.826	65.887	87.483	71.413	49.266	29.9	20.29	18.032	8.91	2.545	1.687	1.059
30.072	3.121	6.482	19.129	37.826	47.667	41.85	30.201	9.645	6.945	4.459	2.656	0.981	1.036
29.923	1.558	7.98	14.837	18.168	35.134	33.398	28.048	14.091	7.946	7.282	3.849	2.133	1.179
21.823	0.829	3.717	6.222	8.484	7.516	4.346	4.382	2.967	2.728	1.835	1.303	0.488	0.272
18.493	NA	3.561	8.589	16.513	10.83	6.471	3.425	1.972	1.631	0.905	0.667	0.243	0.338
21.112	2.701	15.655	11.196	3.742	5.82	5.976	4.204	3.025	2.115	0.991	0.429	0.225	0.385
20.663	0.422	11.601	16.895	9.44	4.246	3.352	3.311	1.837	1.699	1.214	0.996	0.259	0.193
19.264	0.965	17.653	31.531	20.016	10.52	11.019	9.169	6.158	3.343	1.968	1.308	0.485	0.285

VIIIc Aviles

1994 2006

1 1 0 1

3 15

9.620	8.028	8.554	15.632	13.603	16.712	10.824	10.618	6.796	5.234	4.19	1.793	0.841	0.574
6.146	4.067	30.178	60.578	67.1	68.927	23.647	16.941	7.419	3.92	3.659	1.653	1.024	0.632
4.525	0.221	6.756	22.427	33.06	67.591	39.701	33.591	13.415	3.882	2.98	1.068	0.69	0.842
5.061	0.018	3.54	9.973	16.252	24.799	16.388	18.839	10.395	6.541	3.107	0.419	0.13	0.06
5.929	0.459	2.348	4.945	9.95	14.191	8.225	9.941	9.538	6.243	3.167	0.818	0.308	0.224
6.829	0.021	0.732	2.7	4.84	4.781	4.18	3.257	2.659	2.494	1.197	0.567	0.382	0.349
4.453	0.023	0.076	0.449	1.641	3.189	3.709	2.876	0.872	0.614	0.363	0.268	0.119	0.072
1.838	0.099	0.307	0.331	0.36	0.763	0.915	1.163	0.647	0.456	0.413	0.22	0.11	0.106
2.748	0.146	0.648	1.098	1.816	1.544	0.79	0.873	0.609	0.365	0.164	0.069	0.021	0.017
2.526	NA	1.065	2.04	2.017	1.236	0.682	0.378	0.132	0.08	0.044	0.031	0.011	0.017
NA	NA	0.666	1.558	2.012	4.364	5.015	3.086	1.441	0.817	0.254	0.063	0.01	0.002
NA	NA	0.049	0.484	1.333	3.147	5.158	5.446	3.956	2.721	1.253	0.858	0.202	0.082
NA	0.016	0.556	0.894	0.828	1.011	2.38	2.941	1.909	1.252	0.859	0.517	0.231	0.154

VIIIc Santander

1994 2006

1 1 0 1

3 15

22.772	10.644	46.55	75.074	77.411	69.047	29.57	26.731	16.945	11.005	7.414	2.54	1.296	2.064
14.046	3.919	20.796	48.656	69.831	69.662	19.249	13.534	6.707	3.681	2.633	0.845	0.5	0.399
12.071	4.198	23.642	29.515	23.654	34.493	15.073	14.326	7.141	2.446	1.893	0.675	0.32	0.378
11.776	3.763	11.962	12.975	16.781	24.049	12.211	11.736	6.214	4.321	2.66	0.856	0.395	0.332
10.646	6.675	10.49	17.002	20.875	20.402	9.343	9.806	8.464	5.382	2.72	0.683	0.252	0.329
10.349	0.346	1.309	4.373	10.739	11.617	10.061	6.545	4.338	3.885	1.872	0.564	0.385	0.306
8.779	0.055	0.111	0.44	2.1	5.126	5.792	4.562	1.651	1.499	1.12	0.682	0.261	0.313
3.053	0.127	1.058	1.504	1.143	2.279	3.068	2.947	1.437	0.77	0.776	0.485	0.29	0.234
3.975	0.273	1.715	1.953	2.54	2.187	0.848	0.999	0.643	0.553	0.299	0.147	0.065	0.055
3.837	NA	1.323	2.443	2.967	2.206	1.255	0.602	0.242	0.192	0.123	0.092	0.046	0.053
3.776	0.168	4.534	5.194	3.391	3.744	2.953	1.524	0.591	0.32	0.101	0.02	0.006	0.046
1.404	NA	NA	0.066	0.209	0.489	0.793	0.776	0.545	0.316	0.119	0.085	0.019	0.014
2.718	NA	0.044	0.32	0.502	0.887	1.793	2.09	2.11	1.956	1.394	0.908	0.237	0.134

IXa Crust

1992 2006

1 1 0 1

3 15

71.275	NA	1.246	8.21	27.35	68.375	28.958	21.58	8.889	2.893	1.287	0.113	0.04	0.309
74.995	NA	1.427	4.443	7.855	26.729	24.342	22.265	10.504	3.549	1.411	0.144	NA	NA
40.701	0.177	0.093	0.581	1.851	5.389	7.31	9.15	5.986	2.577	1.129	0.141	0.013	0.004
38.258	0.624	4.356	6.541	8.94	9.209	4.781	4.714	2.857	1.127	0.407	0.05	NA	NA
64.043	1.319	2.329	8.78	15.727	18.52	6.476	5.854	2.774	1.249	1.505	0.803	0.58	0.776
42.768	8.237	11.999	7.532	5.882	4.072	1.736	2.017	1.409	1.245	1.09	0.377	0.286	0.339
48.312	0.485	5.184	11.131	15.95	16.651	5.594	4.916	4.31	1.856	0.852	0.3	0.183	0.795
23.735	1.118	5.18	8.116	6.184	4.73	2.984	2.361	2.016	1.791	0.992	0.38	0.518	0.781
42.350	1.06	1.967	4.422	9.029	10.86	7.014	3.794	0.828	0.949	0.985	0.729	0.516	3.22
85.477	1.35	3.99	5.737	7.231	12.272	8.732	4.541	2.26	0.889	0.659	0.388	0.266	0.454
62.292	3.272	2.012	2.634	4.765	6.505	3.765	3.527	2.051	1.58	0.825	0.348	0.126	0.226
42.288	0.167	1.753	2.96	4.042	3.169	2.075	1.158	0.684	0.575	0.331	0.263	0.154	0.378
21.462	0.547	0.46	0.601	1.217	2.512	2.396	1.345	0.722	0.696	0.447	0.26	0.131	0.246
19.526	0.069	0.371	0.227	0.233	0.414	0.583	0.574	0.445	0.495	0.447	0.541	0.262	0.459
19.702	0.034	2.774	4.991	2.76	1.606	1.644	1.109	0.783	0.513	0.611	0.628	0.377	0.609

IXa Fish

1992 2006

1 1 0 1

3 15

48.518	NA	2.563	16.892	56.269	140.676	59.579	44.399	18.288	5.953	2.647	0.233	0.083	0.636
55.507	NA	2.936	9.14	16.161	54.992	50.082	45.809	21.612	7.302	2.902	0.295	NA	NA
35.616	0.365	0.191	1.196	3.808	11.088	15.04	18.826	12.316	5.302	2.324	0.291	0.026	0.009
41.218	1.285	8.962	13.457	18.393	18.946	9.836	9.699	5.877	2.318	0.837	0.102	NA	NA
54.047	2.567	4.533	17.09	30.613	36.049	12.605	11.395	5.399	2.431	2.93	1.563	1.129	1.511
26.975	9.477	13.806	8.666	6.768	4.686	1.997	2.321	1.621	1.432	1.255	0.434	0.329	0.39
35.063	0.766	8.192	17.592	25.207	26.315	8.841	7.769	6.811	2.934	1.347	0.475	0.29	1.256
17.965	1.894	8.774	13.748	10.476	8.011	5.054	3.999	3.416	3.033	1.68	0.644	0.877	1.323
18.891	1.224	2.273	5.11	10.433	12.55	8.105	4.385	0.957	1.097	1.138	0.842	0.597	3.721
18.510	0.966	2.855	4.105	5.174	8.781	6.248	3.249	1.617	0.636	0.471	0.277	0.191	0.325
14.009	1.952	1.2	1.571	2.843	3.88	2.246	2.104	1.224	0.943	0.492	0.207	0.075	0.135
17.271	0.208	2.182	3.684	5.031	3.944	2.583	1.442	0.851	0.715	0.411	0.327	0.191	0.471
14.370	0.646	0.544	0.71	1.439	2.971	2.833	1.591	0.853	0.823	0.528	0.307	0.154	0.291
13.456	0.103	0.555	0.34	0.35	0.62	0.874	0.86	0.667	0.743	0.671	0.811	0.392	0.688
13.653	0.051	4.158	7.48	4.137	2.407	2.465	1.662	1.174	0.769	0.916	0.941	0.565	0.913

Table 8.2.8. ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa.

FLXSA diagnostics.

```
> diagnostics(ank07.xsa.ind2)

FLR XSA Diagnostics 2007-05-09 19:42:28

CPUE data from ank07.ind2

Catch data for 11 years. 1996 to 2006. Ages 2 to 15.

          fleet first age last age first year last year alpha beta
1 VIIIc Corunha         4       14       1996      2006     0    1
2      IXa Fish         4       14       1996      2006     0    1

 Time series weights :

   Tapered time weighting not applied

Catchability analysis :

    Catchability independent of size for all ages

    Catchability independent of age for ages >   10

Terminal population estimation :

    Survivor estimates shrunk towards the mean F
    of the final   5 years or the  5 oldest ages.

    S.E. of the mean to which the estimates are shrunk =   0.8

    Minimum standard error for population
    estimates derived from each fleet =  0.3

   prior weighting not applied

Regression weights
     year
age   1997 1998 1999 2000 2001 2002 2003 2004 2005 2006
  all    1    1    1    1    1    1    1    1    1    1

 Fishing mortalities
    year
age   1997  1998  1999  2000  2001  2002  2003  2004  2005  2006
  2  0.001 0.006 0.001 0.001 0.000 0.003 0.000 0.000    NA 0.001
  3  0.027 0.091 0.022 0.009 0.007 0.075 0.000 0.003 0.000 0.017
  4  0.118 0.162 0.168 0.019 0.027 0.167 0.076 0.041 0.014 0.121
  5  0.206 0.271 0.298 0.067 0.054 0.127 0.214 0.147 0.071 0.252
  6  0.283 0.283 0.351 0.184 0.086 0.145 0.287 0.186 0.182 0.201
  7  0.414 0.306 0.361 0.322 0.207 0.165 0.252 0.295 0.288 0.283
  8  0.236 0.218 0.389 0.385 0.244 0.116 0.247 0.350 0.328 0.497
  9  0.293 0.290 0.451 0.509 0.346 0.182 0.185 0.374 0.410 0.474
  10 0.247 0.366 0.415 0.367 0.375 0.228 0.154 0.318 0.357 0.477
  11 0.416 0.426 0.535 0.450 0.452 0.494 0.228 0.353 0.381 0.437
  12 0.454 0.704 0.364 0.573 0.675 0.616 0.356 0.332 0.394 0.405
  13 0.314 0.386 0.356 0.410 0.703 0.637 0.602 0.523 0.675 0.506
  14 0.485 0.508 0.394 0.465 0.403 0.373 0.605 0.631 0.753 0.549
  15 0.485 0.508 0.394 0.465 0.403 0.373 0.605 0.631 0.753 0.549

 XSA population number ( thousands )
      age
year      2    3    4    5    6   7   8   9  10  11  12 13 14 15
  1997 1476 1743 1846 1464 1041 652 467 406 300 166 100 37 13 19
  1998 1176 1270 1461 1412 1025 675 371 318 261 201  94 55 23 40
  1999 1099 1006  998 1069  927 665 428 257 205 156 113 40 32 35
  2000  789  945  847  726  683 561 399 249 141 116  78 68 24 32
  2001  760  679  806  715  584 489 350 234 129  84  64 38 39 34
  2002 1359  654  580  675  583 461 342 236 142  76  46 28 16 18
  2003 2371 1167  522  422  512 434 337 262 169  97  40 21 13 26
  2004 3794 2041 1004  417  294 330 290 226 188 125  67 24 10 13
  2005   NA 3266 1752  829  310 210 212 176 134 117  76 41 12 13
  2006 3756 3349 2810 1488  664 222 136 131 101  81  69 44 18 17
```

Table 8.2.8 (Continued)

Estimated population abundance at 1st Jan 2007

year \ age	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2007	17	3231	2834	2143	996	468	144	71	70	54	45	40	23	9

Fleet: VIIIc Corunha

Log catchability residuals.

age \ year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
4	-0.188	-0.133	0.620	0.745	-0.503	-0.237	-0.289	-0.106	0.573	-0.276	-0.207
5	-0.188	-0.083	0.159	0.826	-0.131	-0.371	-0.832	0.166	0.281	-0.011	0.184
6	0.072	0.023	0.059	0.908	0.298	-0.320	-0.735	0.293	-0.816	0.077	0.143
7	0.440	0.050	0.100	0.752	0.501	0.286	-0.902	-0.269	-0.730	-0.574	0.346
8	0.516	-0.378	-0.094	0.818	0.725	0.569	-1.192	-0.550	-0.565	-0.817	0.966
9	0.865	-0.100	0.075	0.700	0.767	0.690	-0.939	-1.123	-0.816	-0.765	0.646
10	1.092	-0.076	0.439	0.636	0.247	0.721	-0.686	-1.139	-0.869	-0.993	0.629
11	0.522	0.492	0.453	0.845	0.147	0.613	-0.027	-0.741	-0.805	-0.927	0.219
12	1.019	0.474	0.762	0.381	0.152	0.899	0.138	-0.383	-0.946	-0.817	-0.168
13	0.706	-0.412	-0.097	0.160	-0.292	0.789	0.303	0.051	-0.681	-0.284	-0.077
14	-0.016	-0.383	-0.084	-0.002	-0.236	0.051	-0.254	-0.438	-0.404	-0.391	-0.164

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

	4	5	6	7	8	9	10	11	12	13	14
Mean_Logq	-7.6894	-6.8025	-6.4335	-6.1446	-6.1279	-5.9700	-6.0834	-6.0834	-6.0834	-6.0834	-6.0834
S.E_Logq	0.4292	0.4167	0.4841	0.5453	0.7471	0.7827	0.7925	0.6229	0.6609	0.4532	0.1794

Fleet: IXa Fish

Log catchability residuals.

age \ year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
4	-0.978	0.829	0.300	1.422	0.114	0.415	0.223	0.673	-1.202	-1.687	-0.108
5	-0.059	-0.079	0.433	1.146	0.384	0.194	-0.395	0.758	-0.723	-2.118	0.460
6	0.383	-0.516	0.552	0.475	0.648	0.076	-0.213	0.345	-0.215	-1.617	0.083
7	0.332	-0.814	0.565	0.085	0.635	0.383	-0.117	-0.208	-0.015	-1.065	0.218
8	-0.392	-1.287	0.161	0.207	0.698	0.522	-0.260	-0.251	0.222	-0.583	0.962
9	-0.235	-0.974	0.217	0.508	0.605	0.318	0.074	-0.617	-0.100	-0.381	0.585
10	-0.224	-0.882	0.485	0.729	-0.241	0.394	0.229	-0.554	-0.393	-0.219	0.674
11	-0.466	-0.339	-0.071	0.937	0.124	-0.074	0.712	-0.140	-0.006	0.032	0.452
12	0.589	0.058	0.031	0.588	0.609	-0.001	0.623	0.253	0.167	0.377	0.769
13	0.954	-0.073	-0.603	0.661	0.382	-0.005	0.264	0.764	0.727	1.297	1.295
14	0.796	0.757	-0.186	1.219	1.090	-0.524	-0.326	0.747	0.960	1.810	1.691

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

	4	5	6	7	8	9	10	11	12	13	14
Mean_Logq	-8.8890	-8.1722	-7.6057	-7.1479	-7.2768	-7.2730	-7.4411	-7.4411	-7.4411	-7.4411	-7.4411
S.E_Logq	0.9353	0.8743	0.6481	0.5375	0.6390	0.5156	0.5313	0.4296	0.2794	0.5905	0.7774

Terminal year survivor and F summaries:

Age 2 Year class = 2004

source survivors	N	scaledWts
3231	1	1

Age 3 Year class = 2003

source survivors	N	scaledWts
2834	1	1

Table 8.2.8 (Continued)

Age 4 Year class = 2002

source

	survivors	N	scaledWts
VIIIc.Corunha	1744	1	0.639
IXa.Fish	1923	1	0.135
fshk	4095	1	0.226

Age 5 Year class = 2001

source

	survivors	N	scaledWts
VIIIc.Corunha	959	2	0.706
IXa.Fish	584	2	0.155
fshk	2176	1	0.139

Age 6 Year class = 2000

source

	survivors	N	scaledWts
VIIIc.Corunha	589	3	0.684
IXa.Fish	214	3	0.218
fshk	535	1	0.098

Age 7 Year class = 1999

source

	survivors	N	scaledWts
VIIIc.Corunha	167	4	0.609
IXa.Fish	100	4	0.297
fshk	172	1	0.094

Age 8 Year class = 1998

source

	survivors	N	scaledWts
VIIIc.Corunha	60	5	0.538
IXa.Fish	70	5	0.339
fshk	155	1	0.124

Age 9 Year class = 1997

source

	survivors	N	scaledWts
VIIIc.Corunha	53	6	0.465
IXa.Fish	82	6	0.413
fshk	122	1	0.123

Age 10 Year class = 1996

source

	survivors	N	scaledWts
VIIIc.Corunha	39	7	0.426
IXa.Fish	62	7	0.450
fshk	99	1	0.125

Age 11 Year class = 1995

source

	survivors	N	scaledWts
VIIIc.Corunha	36	8	0.401
IXa.Fish	52	8	0.496
fshk	53	1	0.103

Age 12 Year class = 1994

source

	survivors	N	scaledWts
VIIIc.Corunha	32	9	0.376
IXa.Fish	48	9	0.529
fshk	32	1	0.096

Table 8.2.8 (Continued)

Age 13 Year class = 1993

source

	survivors	N	scaledWts
VIIIc.Corunha	18	10	0.446
IXa.Fish	31	10	0.445
fshk	17	1	0.109

Age 14 Year class = 1992

source

	survivors	N	scaledWts
VIIIc.Corunha	7	11	0.645
IXa.Fish	14	11	0.249
fshk	11	1	0.106

Table 8.2.9 ANGLERFISH (*L. budegassa*) – Divisions VIIIc and IXa.

ASPIC input settings and data.

Input	Value
Error type	YLD – Condition on yield
Number of bootstrap trials	500
Maximum F when estimating effort	8.0d0 (y^{-1})
Statistical weight for B1 > K	1
Statistical weights for fisheries	F1: 1, F2: 1
B1-ratio (starting guess)	0.5
MSY (starting guess)	3000 (t)
K (starting guess)	20000 (t)
q (starting guess)	F1: 1d-5, F2: 1d-4
Estimated parameters	All: B1-Ratio, MSY, K, qF1, qF2
Min and max allowable MSY	2 000 (t) – 10 000 (t)
Min and max K	5000 (t) – 100 000 (t)
Random number seed	1964185

F1:	P-TRF	
Type:	CC (CPUE and Catch)	
Year	CPUE (t/effort)	Catch (t)
1980	-1	2110
1981	-1	2300
1982	-1	2369
1983	-1	2379
1984	-1	1929
1985	-1	1833
1986	-1	2563
1987	-1	3832
1988	-1	3700
1989	0.00117	2578
1990	0.00141	2334
1991	0.00122	2163
1992	0.00132	2111
1993	0.00085	2227
1994	0.00064	1580
1995	0.00058	1831
1996	0.00070	1629
1997	0.00088	1813
1998	0.00145	2089
1999	0.00172	1885
2000	0.00156	1369
2001	0.00069	1013
2002	0.00075	770
2003	0.00071	926
2004	0.00107	973
2005	0.00063	897
2006	0.00080	1148

F2:	P-TRC
Type:	I1 (Index of biomass – annual average)
Year	CPUE (t/effort)
1980	-1
1981	-1
1982	-1
1983	-1
1984	-1
1985	-1
1986	-1
1987	-1
1988	-1
1989	0.00351
1990	0.00429
1991	0.00365
1992	0.00397
1993	0.00237
1994	0.00150
1995	0.00111
1996	0.00162
1997	0.00160
1998	0.00316
1999	0.00385
2000	0.00404
2001	0.00227
2002	0.00200
2003	0.00217
2004	0.00190
2005	0.00138
2006	0.00173

Table 8.2.10. ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa. ASPIC results: parameter estimates, bootstrap relative bias and confidence interval, and interquartil (IQ) range.

	WG2007							
			Bootstrap Confidence Interval					
Parameter	Point estimates	Relative bias	Lower 80%	Higher 80%	Lower 50%	Higher 50%	IQ-Range	Relative IQ-Range
B1/K	0.42	-0.02%	0.42	0.42	0.42	0.42	0.00	0.10%
K	11370	-0.10%	11180	11570	11350	11410	58	0.50%
q(1)	4.60E-07	0.80%	3.90E-07	5.41E-07	4.21E-07	5.02E-07	8.11E-08	17.60%
q(2)	1.13E-06	4.08%	1.03E-06	1.26E-06	1.06E-06	1.18E-06	1.23E-07	10.90%
MSY	2499	0.01%	2494	2504	2498	2500	1	0.10%
Ye(2006)	1449	-1.40%	962	1994	1200	1777	577	39.80%
Y(Fmsy)	879	2.07%	539	1376	697	1155	458	52.10%
Bmsy	5687	-0.10%	5590	5787	5674	5703	28.9	0.50%
Fmsy	0.439	0.15%	0.431	0.447	0.438	0.441	0.002	0.60%
fmsy(1)	956000	0.99%	811500	1111000	873600	1032000	158100	16.50%
fmsy(2)	388900	-2.95%	347700	428700	371300	414500	43130	11.10%
B./Bmsy	0.35	2.06%	0.22	0.55	0.28	0.46	0.18	52.10%
F./Fmsy	1.39	8.18%	0.94	2.02	1.10	1.67	0.58	41.50%
Ye./MSY	0.58	-1.41%	0.38	0.80	0.48	0.71	0.23	39.80%
q2/q1	2.5	4.92%	1.91	2.82	2.10	2.59	0.49	19.90%

Table 8.2.11. Anglerfish (*L. budegassa*) – Divisions VIIIc and IXa. Point estimates of B/B_{MSY}(from 2007 to 2016) and Yield (from 2007 to 2016) for projections with F status quo (Fsq), $F_{MSY,}$ zero catches and first year reduction in F of 10, 20, 30, 40 and 50% of B_{MSY}. Values for F/F_{MSY} a

Fishing mortality trends in relation to F_{MSY}

			Decrease in first year					
year	Fsq	FMSY	zero catches	reduction 50 %	reduction 40 %	reduction 30 %	reduction 20 %	reduction 10 %
2007	1.386	1.39	1.39	1.39	1.39	1.39	1.39	1.39
2008	1.386	1	0.00	0.69	0.83	0.97	1.11	1.25
2009	1.386	1	0.00	0.69	0.83	0.97	1.11	1.25
2010	1.386	1	0.00	0.69	0.83	0.97	1.11	1.25
2011	1.386	1	0.00	0.69	0.83	0.97	1.11	1.25
2012	1.386	1	0.00	0.69	0.83	0.97	1.11	1.25
2013	1.386	1	0.00	0.69	0.83	0.97	1.11	1.25
2014	1.386	1	0.00	0.69	0.83	0.97	1.11	1.25
2015	1.386	1	0.00	0.69	0.83	0.97	1.11	1.25
2016	1.386	1	0.00	0.69	0.83	0.97	1.11	1.25

Biomass trends in relation to B_{MSY}

year	Fsq	FMSY	zero catches	reduction 50 %	reduction 40 %	reduction 30 %	reduction 20 %	reduction 10 %
2007	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
2008	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
2009	0.43	0.50	0.74	0.56	0.53	0.51	0.48	0.45
2010	0.46	0.61	1.17	0.75	0.68	0.62	0.56	0.51
2011	0.49	0.71	1.55	0.92	0.82	0.73	0.64	0.56
2012	0.51	0.79	1.78	1.06	0.93	0.81	0.70	0.60
2013	0.53	0.85	1.90	1.15	1.01	0.88	0.76	0.64
2014	0.55	0.90	1.96	1.22	1.07	0.93	0.79	0.67
2015	0.57	0.94	1.98	1.25	1.11	0.96	0.82	0.69
2016	0.58	0.96	1.99	1.28	1.13	0.99	0.84	0.71

Yield

year	Fsq	FMSY	zero catches	reduction 50 %	reduction 40 %	reduction 30 %	reduction 20 %	reduction 10 %
2007	1288	1288	1288	1288	1288	1288	1288	1288
2008	1420	1110	0	823	959	1086	1205	1316
2009	1541	1383	0	1138	1265	1366	1444	1501
2010	1648	1644	0	1452	1565	1634	1667	1670
2011	1740	1871	0	1720	1824	1868	1863	1817
2012	1818	2054	0	1921	2026	2056	2024	1940
2013	1883	2193	0	2057	2170	2197	2149	2039
2014	1935	2293	0	2142	2266	2297	2243	2117
2015	1977	2362	0	2193	2329	2366	2312	2177
2016	2010	2409	0	2223	2367	2412	2360	2222

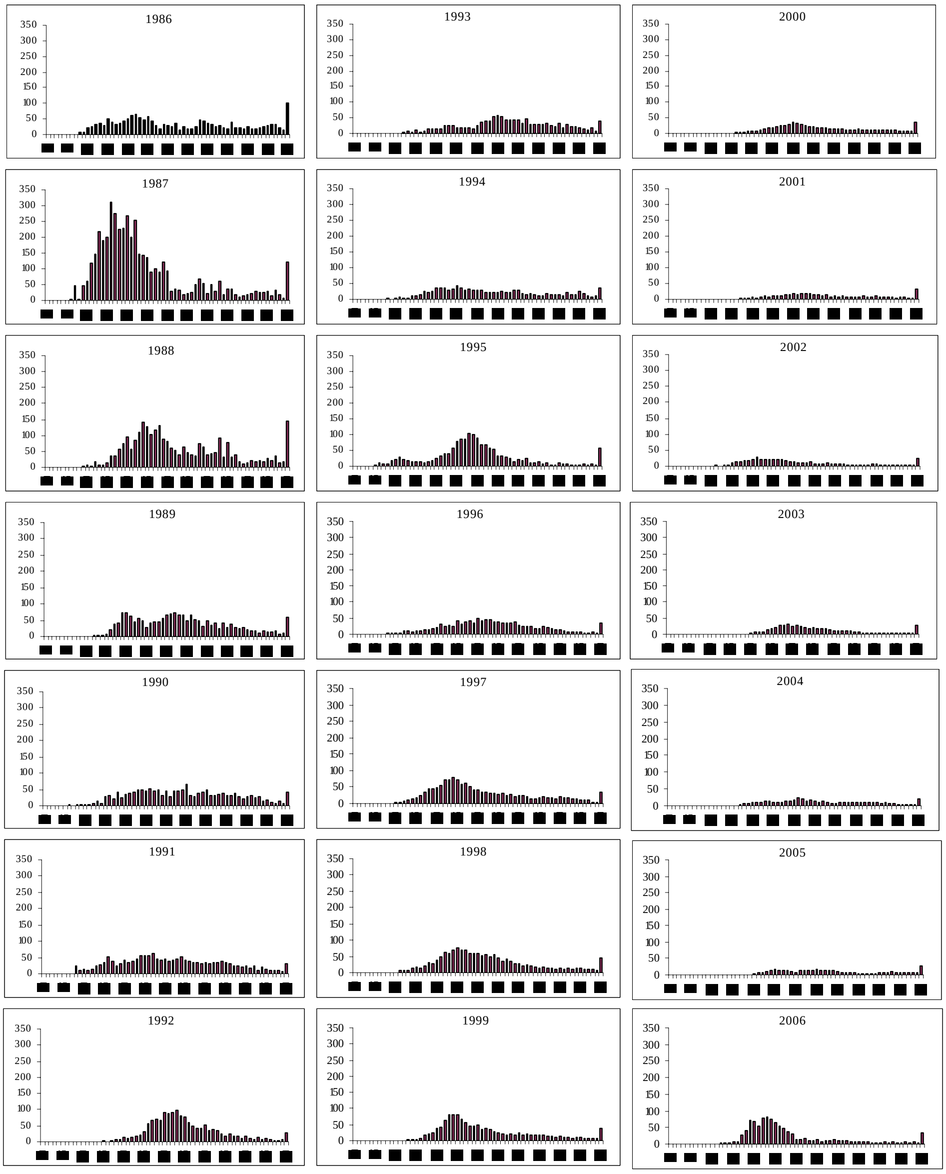


Figure 8.2.1 ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Length distributions of landings (thousands for 1986 to 2006).

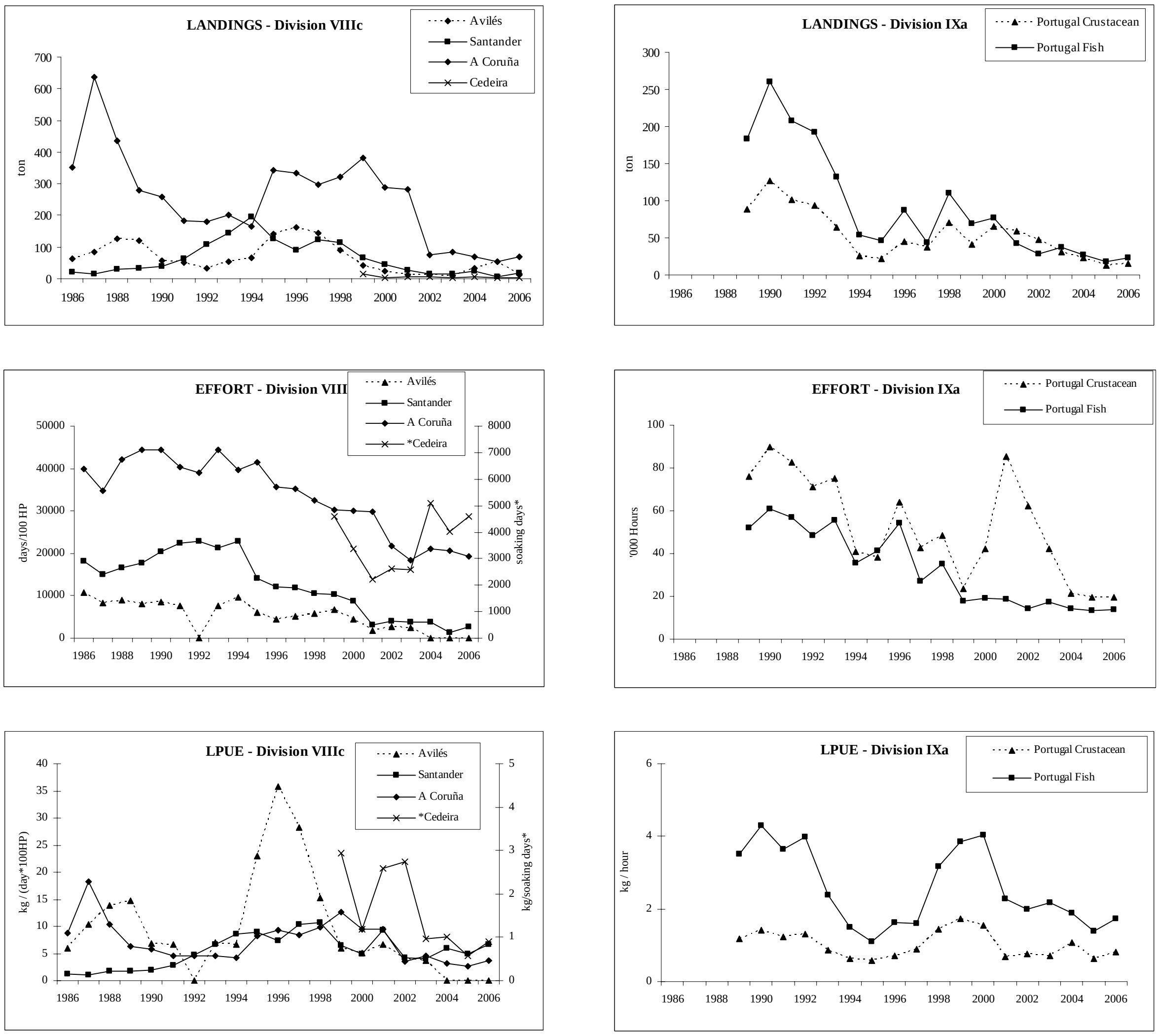


Figure 8.2.2 ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Trawl and gillnet landings, effort and LPUE data between 1986-2006.

Figure 8.2.3. ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa. Catch proportions at age.

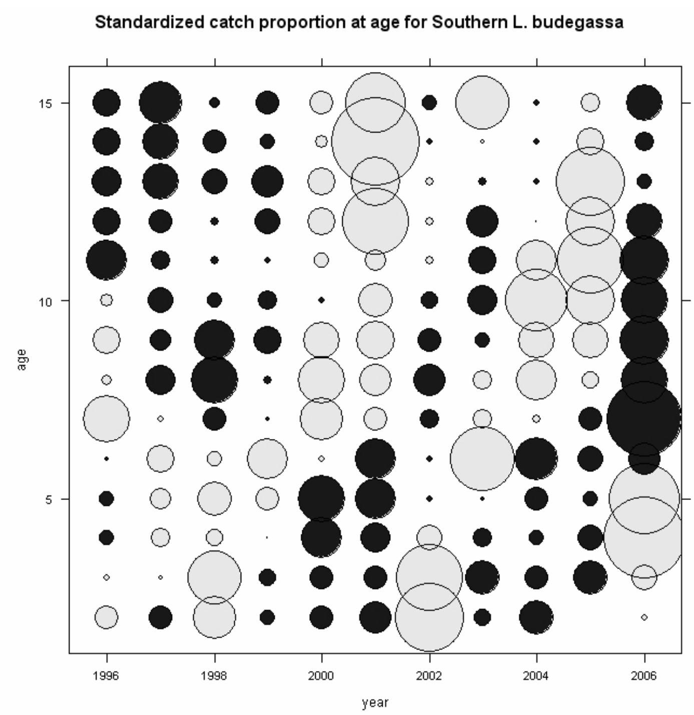


Figure 8.2.4. ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa. Standardized catch proportions at age.

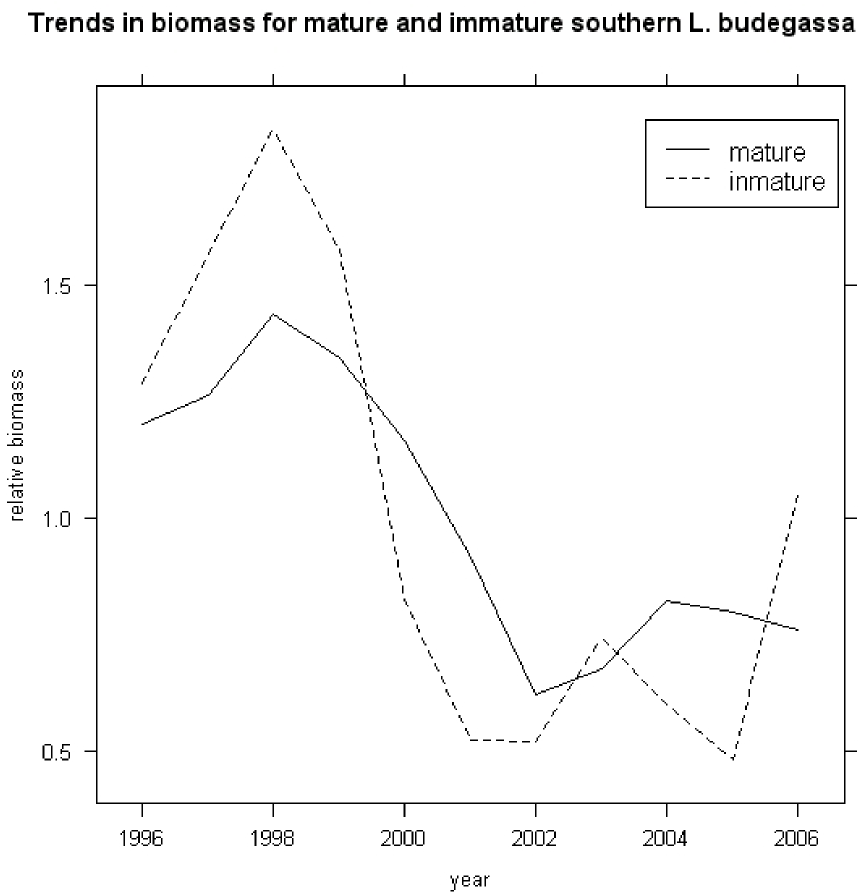


Figure 8.2.5. ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa. Landings mature and immature biomass trends.

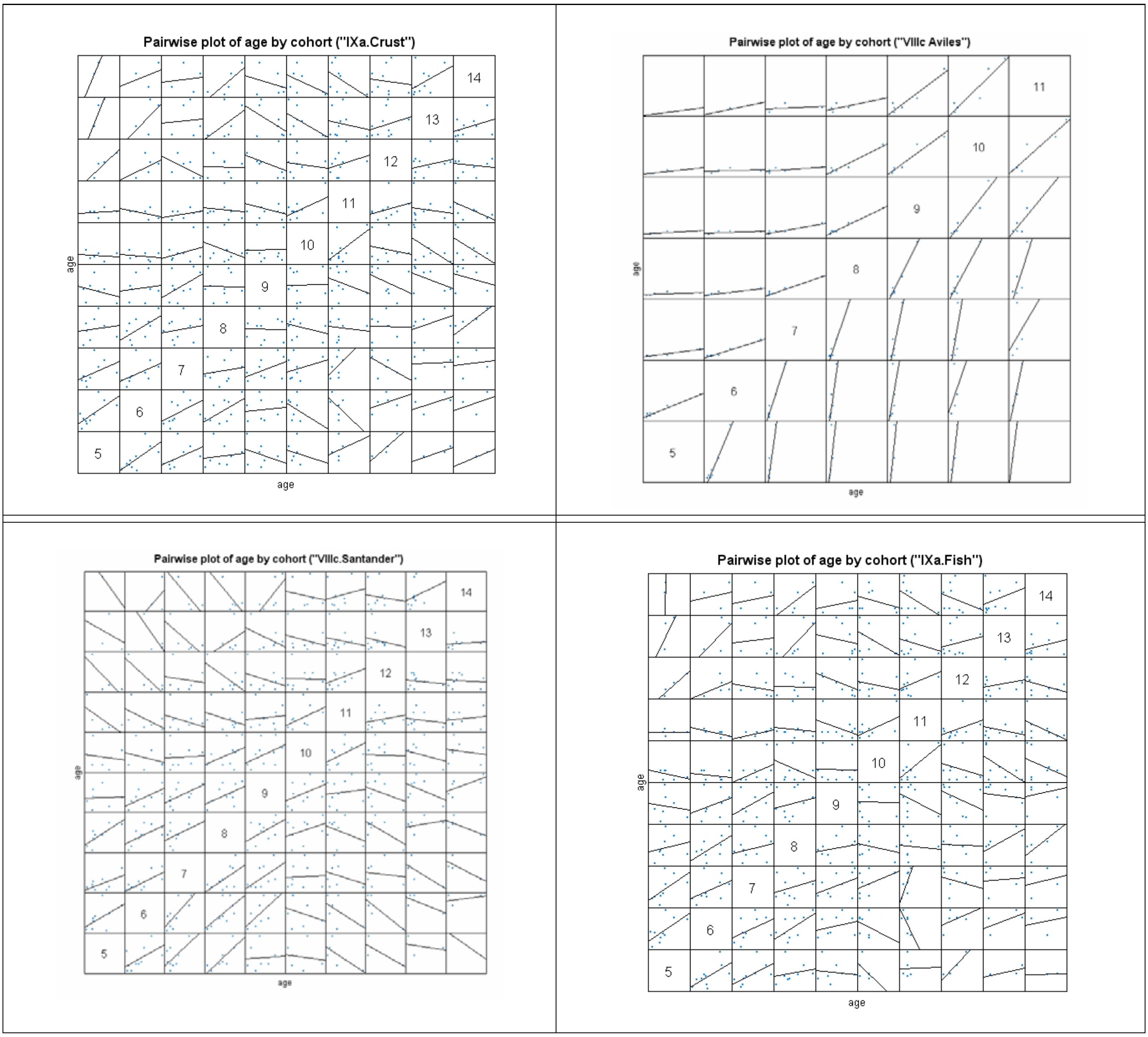


Figure 8.2.6. ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa. Pairwise plot of age by cohort.

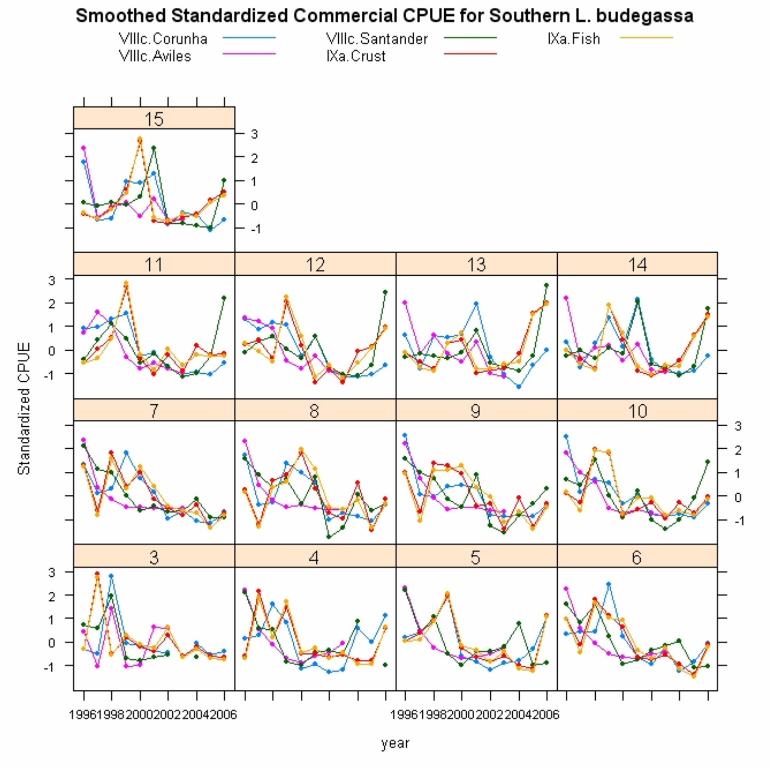


Figure 8.2.7. ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa. Standardized CPUE at age.

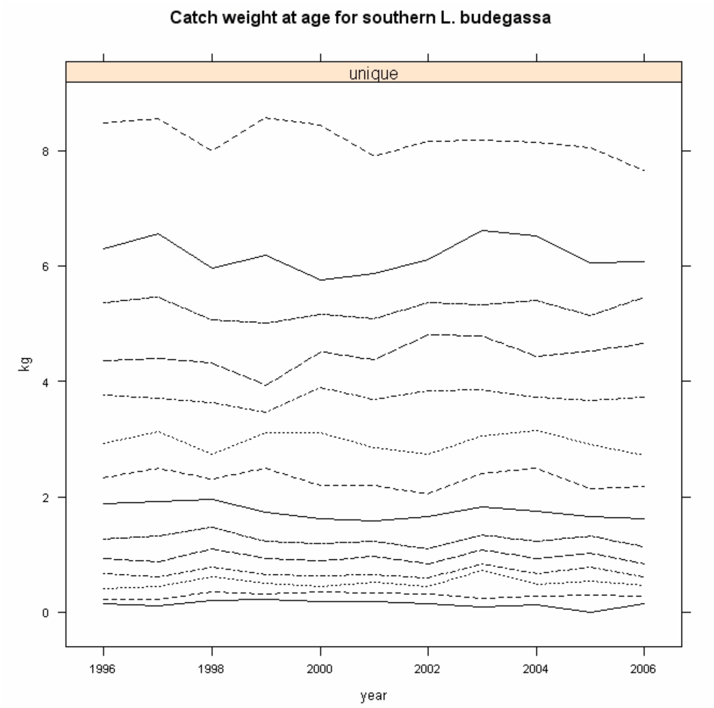


Figure 8.2.8. ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa. Catch mean weights at age.

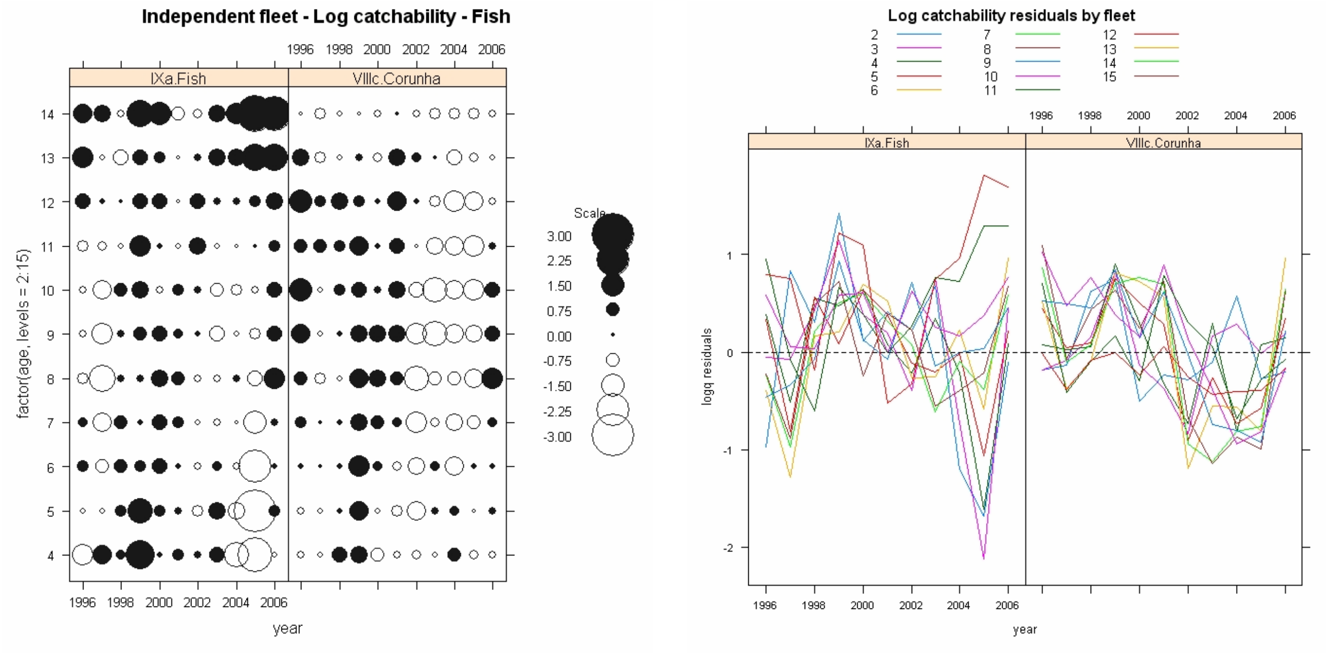


Figure 8.2.9. ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa. Log catchability residuals by fleet.

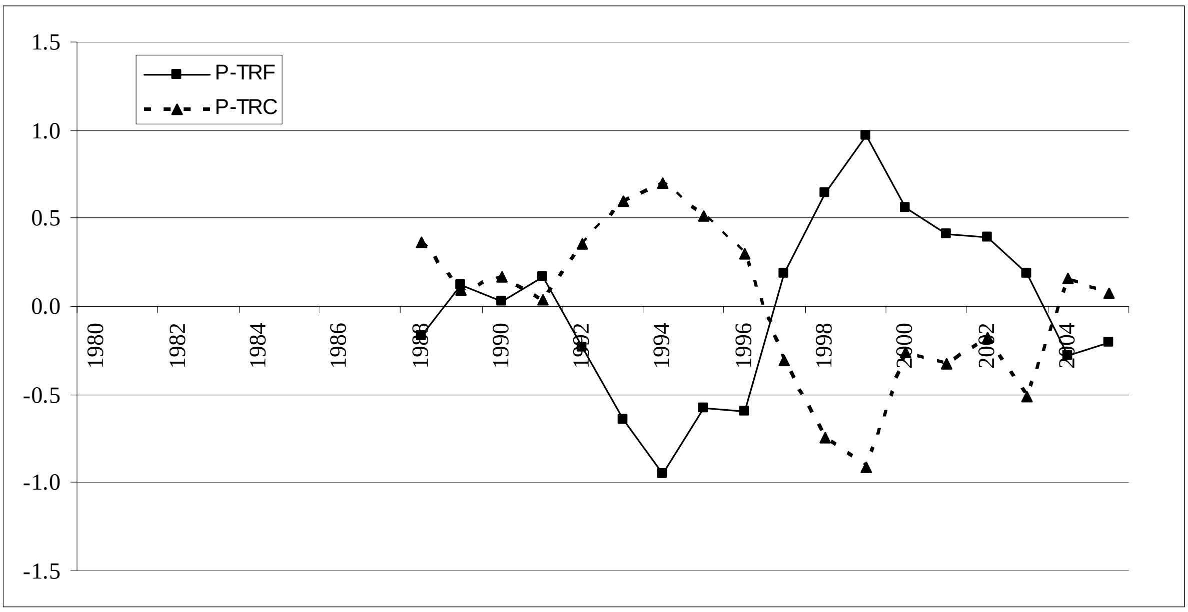


Figure 8.2.10. ANGLERFISH (*L. budegassa*)– Divisions VIIIc and IXa. ASPIC residuals in Log scale for Portuguese crustacean and fish trawler fleets.

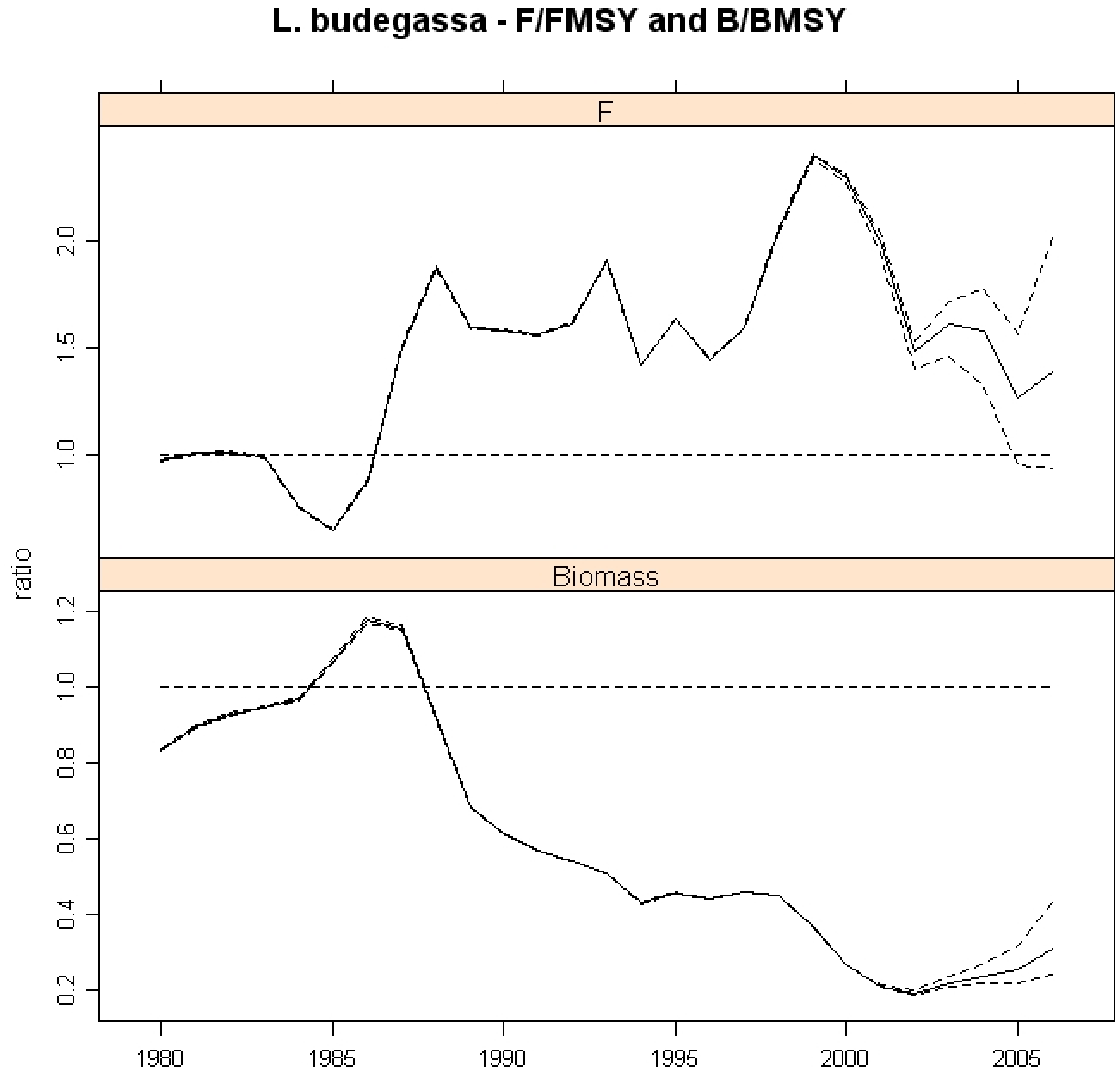


Figure 8.2.11. ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa. Confidence intervals (80%) of the F/F_{MSY} and B/B_{MSY} ratios.

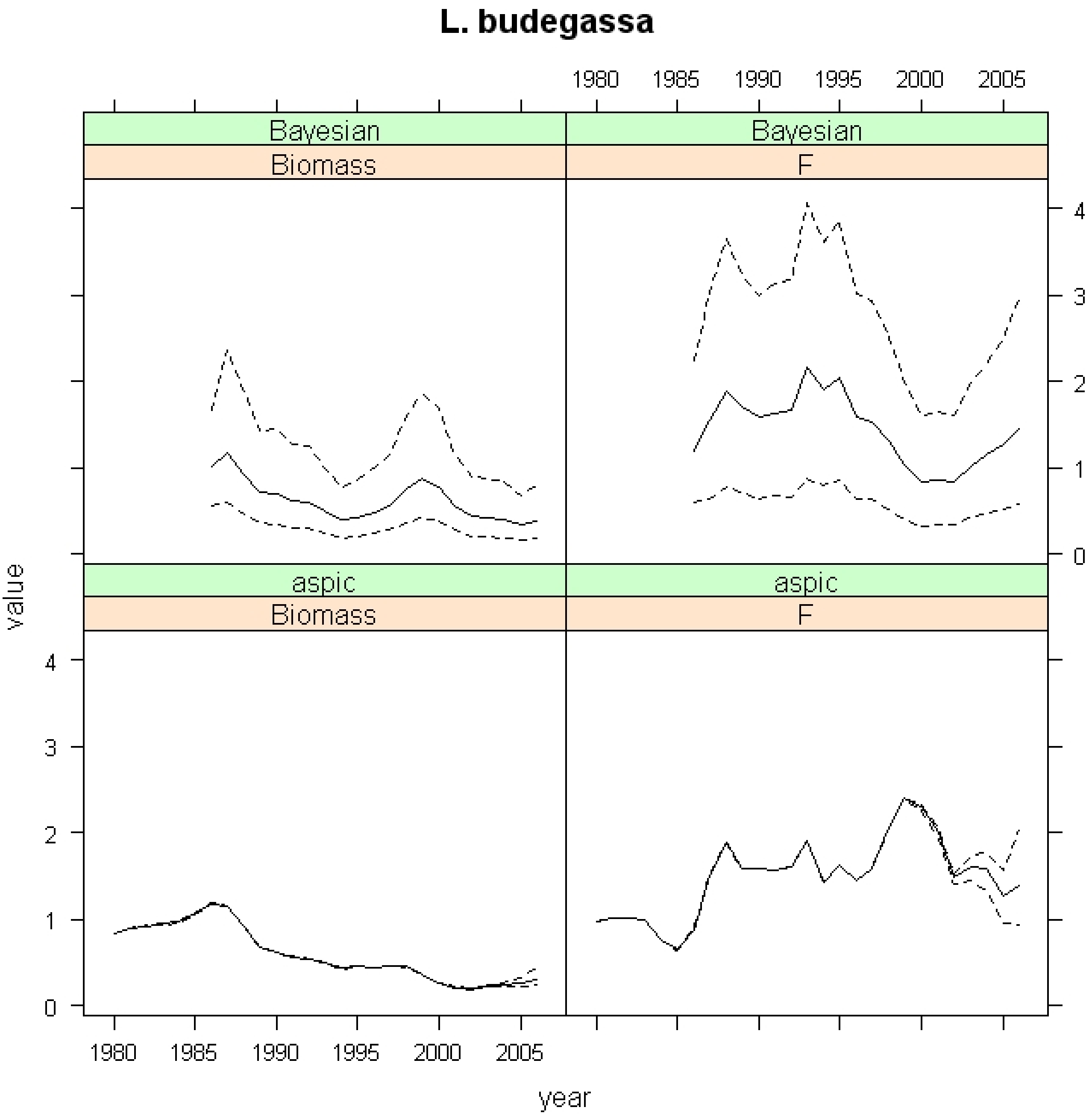


Figure 8.2.12. ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa. Trends in biomass and F from Bayesian and frequentist (ASPIC) approaches.

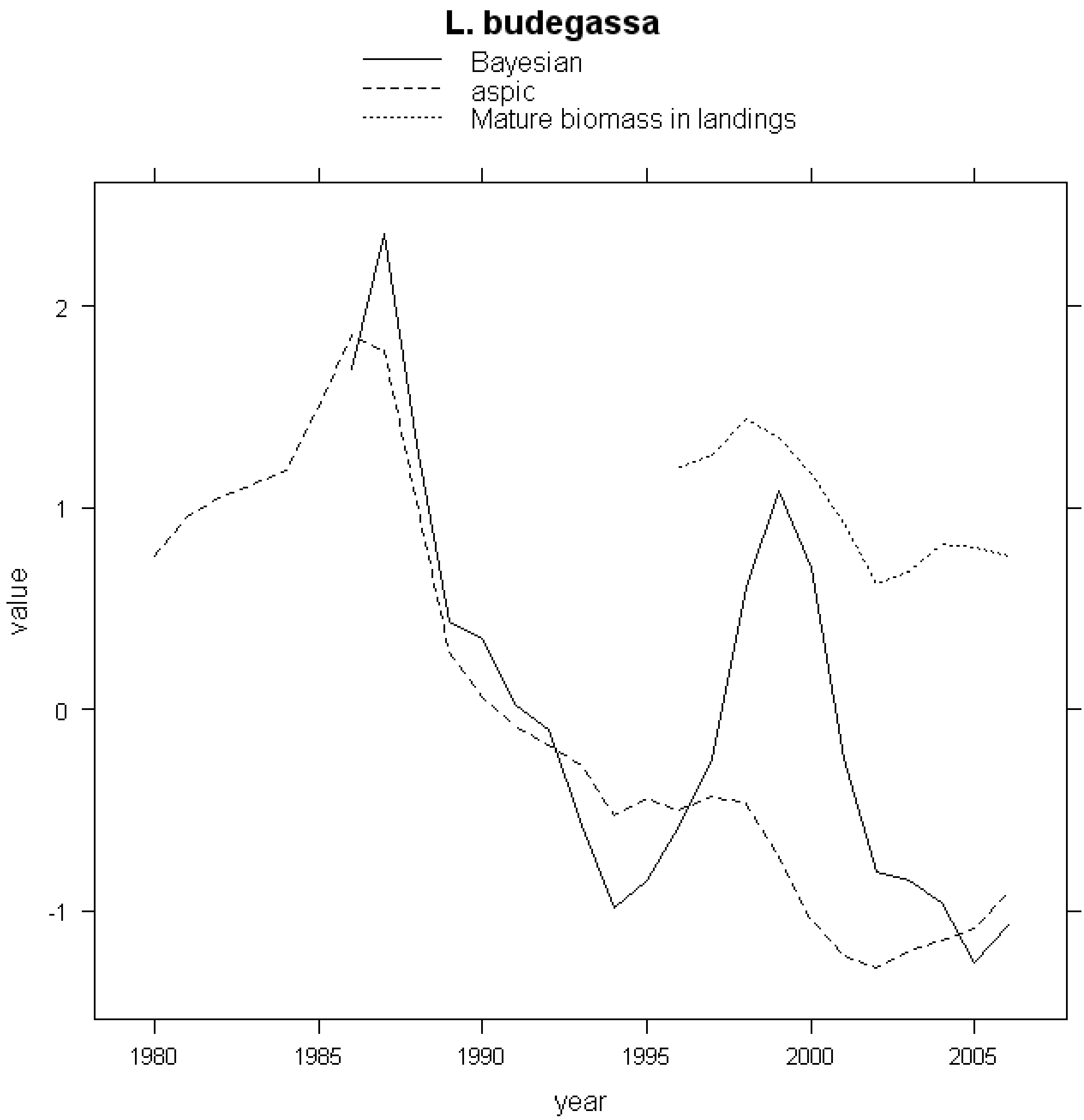


Figure 8.2.13. ANGLERFISH (L.budegassa). Division VIIIc and IXa. Scaled comparison of estimated biomass by Bayesian and frequentist (ASPIC) approaches and the mature component of landings.

8.3 Anglerfish (*L. piscatorius* and *L. budegassa*) in Divisions VIIIc and IXa

The total anglerfish (*Lophius*) landings are given in Table 8.3.1 by ICES division, country and fishing gear. The general trend reflects the trends described for each species, with landings increasing in the early eighties and reaching maximum in 1986 (9 433 t) and 1988 (10 021 t), and decreasing after to the minimum of the time series in 2001 (1 801 t) and 2002 (1 802 t). During the last years, landings increased reaching 4 111 t (2 963 t *L. piscatorius* and 1148 t *L. budegassa*) in 2006.

The species proportion in the landings has changed since 1986. In the beginning of the time series (1980-1986) *L. piscatorius* represented more than 70% of the total anglerfish landings. After 1986 the proportion of *L. piscatorius* decreased and since 1999 both species had approximately the same weight in the annual landings. Since 2002, *L. piscatorius* gained again more importance and represents 72 % of the 2006 landings.

The TAC (1 955 t in 2006 and 2007) is set for both species of anglerfish combined. Landings in 2006 exceeded by 110% (2 156 t) the established TAC.

Four LPUE series are presented in Table 8.3.2 and Figure 8.3.1, the Portuguese Fish and Crustacean (P-TRF and P-TRC) fleets and the two Spanish A Coruña and Cedeira (SP-CORUTR8c and SP-CEDGNS8c) fleets.

8.3.1 Assessment

Working Group has performed assessments for each species separated (sections 8.1 and 8.2).

8.3.2 Comments on the assessment

Due to important improvements in the basic data of anglerfish, a separated assessment for both species was presented. A commercial standardized effort/CPUE series for the artisanal fleet was possible to include in the assessment of *L. piscatorius*. Also, the revision of the Portuguese trawl fleet by separating the two segments (Fish and Crustacean) as proposed by the IBERMIX project, seemed to improve the indices.

Trends in estimated biomass and fishing mortality are consistent between the different models approach that were performed. The age structured exploratory assessment did not perform well with XSA, showing possible inconsistencies with model assumptions (e.g. exact catch-at-age, same selection pattern, constant catchability) and possible age reading problems or other deficiencies.

The working group considers that a separated assessment for both anglerfish stocks has the advantage of tracking and detecting different biomass and exploitations levels that each species might have and that is not possible to analyse with a combined assessment. Also, these species have different biological parameters of growth and reproduction that a combined assessment does not account.

A great effort has been made to improve the quality of the basic data for the assessment of these stocks. New age readings were available and age readings from previous years were revised. Age readings are considered precise concerning the ageing criteria and the between reader variability. However, inconsistencies were observed in the catch at age matrix. Also, recent information coming from different sources (tagging, tracking higher year classes from other areas) seems to indicate a faster growth compared with the growth rate of the *illicia* readings.

8.3.3 Management considerations

Both species of anglerfish are subject to a common TAC (1 955 t in 2006 and 2007), so the joint status of these species should be taken into account when formulating management advice. Landings in 2006 (4 187 t) were more than double the TAC.

Trends in biomass estimates have shown a relative decline over the time series for both species. Both stocks are therefore considered to be at a low level at present. For *L. budegassa* there are indications of an incoming higher year class (information from commercial markets, 2006 length distribution and lowest mean length in the landings in 2006). If confirmed management measures could be taken to take the biomass of this stock to higher levels.

It should be noted that both anglerfish are essentially caught in mixed fisheries, and management measures applied to these species may have implications for other stocks. It is necessary to take into account that a recovery plan for hake and *Nephrop*s is taking place in the same area.

Table 8.3.1 ANGLERFISH (*L. piscatorius* and *L. budegassa*) - Divisions VIIIc and IXa.
Tonnes landed by the main fishing fleets for 1978-2006 as determined by the Working Group.

	Div. VIIIc			Div. IXa				Div. VIIIc+IXa
	SPAIN			SPAIN	PORTUGAL			
Year	Trawl	Gillnet	TOTAL	Trawl	Trawl	Artisanal	TOTAL	TOTAL
1978	n/a	n/a	n/a	506	0	222	728	
1979	n/a	n/a	n/a	625	0	435	1060	
1980	4008	1477	5485	786	0	654	1440	6926
1981	3909	2240	6149	1040	0	679	1719	7867
1982	2742	3095	5837	1716	0	598	2314	8151
1983	4269	1911	6180	1426	0	888	2314	8494
1984	3600	1866	5466	1136	409	950	2495	7961
1985	2679	2495	5174	977	466	1355	2798	7972
1986	3052	3209	6261	1049	367	1757	3172	9433
1987	3174	2571	5745	1133	426	1668	3227	8973
1988	3583	3263	6846	1254	344	1577	3175	10021
1989	2291	2498	4789	1111	531	1142	2785	7574
1990	1930	1127	3057	1124	713	1231	3068	6125
1991	1993	854	2847	878	533	1545	2956	5803
1992	1668	1068	2736	786	363	1610	2758	5494
1993	1360	959	2319	699	306	1231	2237	4556
1994	1232	1028	2260	629	149	549	1327	3587
1995	1743	677	2420	814	134	297	1245	3665
1996	2146	850	2995	749	265	574	1589	4584
1997	2249	1389	3638	838	191	860	1889	5527
1998	1660	1507	3167	865	209	829	1903	5070
1999	1116	1140	2256	750	119	692	1561	3817
2000	710	612	1322	485	146	675	1306	2628
2001	614	364	978	247	117	459	823	1801
2002	559	415	974	344	104	380	828	1802
2003	1190	771	1961	617	96	529	1242	3203
2004	1513	1389	2901	549	77	602	1229	4130
2005	1651	1719	3370	653	60	458	1171	4541
2006	1489	1371	2860	801	68	458	1327	4187

n/a: not available

Table 8.3.2 ANGLERFISH (*L. piscatorius* and *L. budegassa*) - Divisions VIIIc and IXa.
Landings, landings per unit effort and effort for trawl and gillnet fisheries. For landings the percentage relative to total annual stock landings is given.

Landings (t)

	Div. VIIIc								Div. IXa			
Year	Avilés	%	Santander	%	A Coruña	%	Cedeira	%	Portugal Crustacean	%	Portugal Fish	%
1986	564	6	537	6	1423	15						
1987	585	7	545	6	1585	18						
1988	526	5	418	4	2000	20						
1989	333	4	338	4	1241	16			174	2	358	5
1990	317	5	318	5	1038	17			233	4	480	8
1991	297	5	344	6	1047	18			174	3	359	6
1992	232	4	329	6	874	16			118	2	244	4
1993	129	3	329	7	587	13			100	2	206	5
1994	181	5	384	11	412	11			49	1	101	3
1995	333	9	312	9	601	16			44	1	90	2
1996	484	11	359	8	748	16			90	2	175	4
1997	488	9	503	9	709	13			89	2	102	2
1998	377	7	430	8	461	9			81	2	128	3
1999	148	4	249	7	542	14	355	9	44	1	75	2
2000	51	2	119	5	373	14	143	5	68	3	78	3
2001	35	2	82	5	366	20	92	5	68	4	49	3
2002	87	5	73	4	206	11	137	8	65	4	39	2
2003	120	4	100	3	312	10	162	5	43	1	53	2
2004	248	6	129	3	347	8	387	9	35	1	42	1
2005	332	8	66	2	445	11	436	11	24	1	36	1
2006	164	4	107	2	312	7	419	9	27	1	41	1

Fishing effort

	Div. VIIIc				Div. IXa	
Year	*Avilés	*Santander	*A Coruña	**Cedeira	Portugal ***Crustacean	Portugal ***Fish
1986	10845	18153	39810			
1987	8309	14995	34680			
1988	9047	16660	42180			
1989	8063	17607	44440		76	52
1990	8497	20469	44430		90	61
1991	7681	22391	40440		83	57
1992	n/a	22833	38910		71	49
1993	7635	21370	44504		75	56
1994	9620	22772	39589		41	36
1995	6146	14046	41452		38	41
1996	4525	12071	35728		64	54
1997	5061	11776	35211		43	27
1998	5929	10646	32563		48	35
1999	6829	10349	30232	4607	24	18
2000	4453	8779	30072	3361	42	19
2001	1838	3053	29923	2226	85	19
2002	2748	3975	21823	2605	62	14
2003	2526	3837	18493	2576	42	17
2004	n/a	3776	21112	5086	21	14
2005	n/a	1404	20663	4032	20	13
2006	n/a	2718	19264	4584	20	14

* Fishing days per 100 HP

** Soaking days

*** 1000 Hours trawling with occurrence of anglerfish

n/a - not available

LPUE

	Div. VIIIc				Div. IXa	
Year	*Avilés	*Santander	*A Coruña	**Cedeira	Portugal ***Crustacean	Portugal ***Fish
1986	52.0	29.6	35.7			
1987	70.4	36.3	45.7			
1988	58.1	25.1	47.4			
1989	41.3	19.2	27.9		2.3	6.9
1990	37.4	15.5	23.4		2.6	7.9
1991	38.6	15.3	25.9		2.1	6.3
1992	n/a	14.4	22.5		1.7	5.0
1993	16.9	15.4	13.2		1.3	3.7
1994	18.8	16.8	10.4		1.2	2.8
1995	54.1	22.2	14.5		1.1	2.2
1996	106.9	29.7	20.9		1.4	3.2
1997	96.4	42.7	20.1		2.1	3.8
1998	63.6	40.4	14.2		1.7	3.6
1999	21.7	24.1	17.9	77.1	1.9	4.2
2000	11.4	13.6	12.4	42.7	1.6	4.2
2001	19.1	26.9	12.2	41.5	0.8	2.6
2002	31.6	18.4	9.4	52.7	1.0	2.8
2003	47.6	26.1	16.9	62.9	1.0	3.1
2004	n/a	34.1	16.4	76.0	1.6	2.9
2005	n/a	46.9	21.5	108.1	1.2	2.7
2006	n/a	39.4	16.2	91.5	1.4	3.0

* kg/days*100HP

** kg/soaking days

*** kg/hour

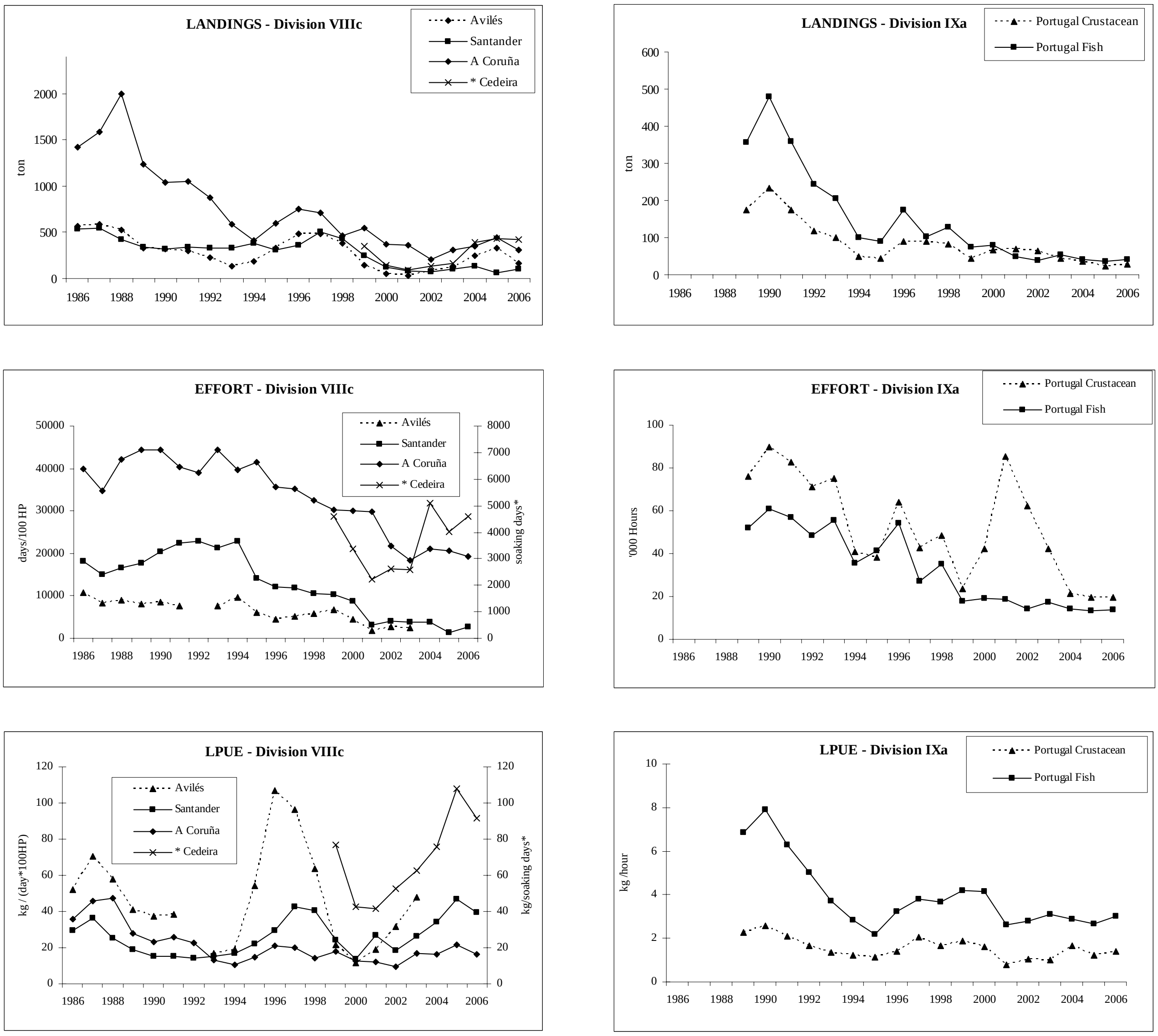


Figure 8.3.1 ANGLERFISH (*L. budegassa and L. piscatorius*) - Divisions VIIIc and IXa. Trawl and gillnet landings, effort and LPUE data between 1986-2006.

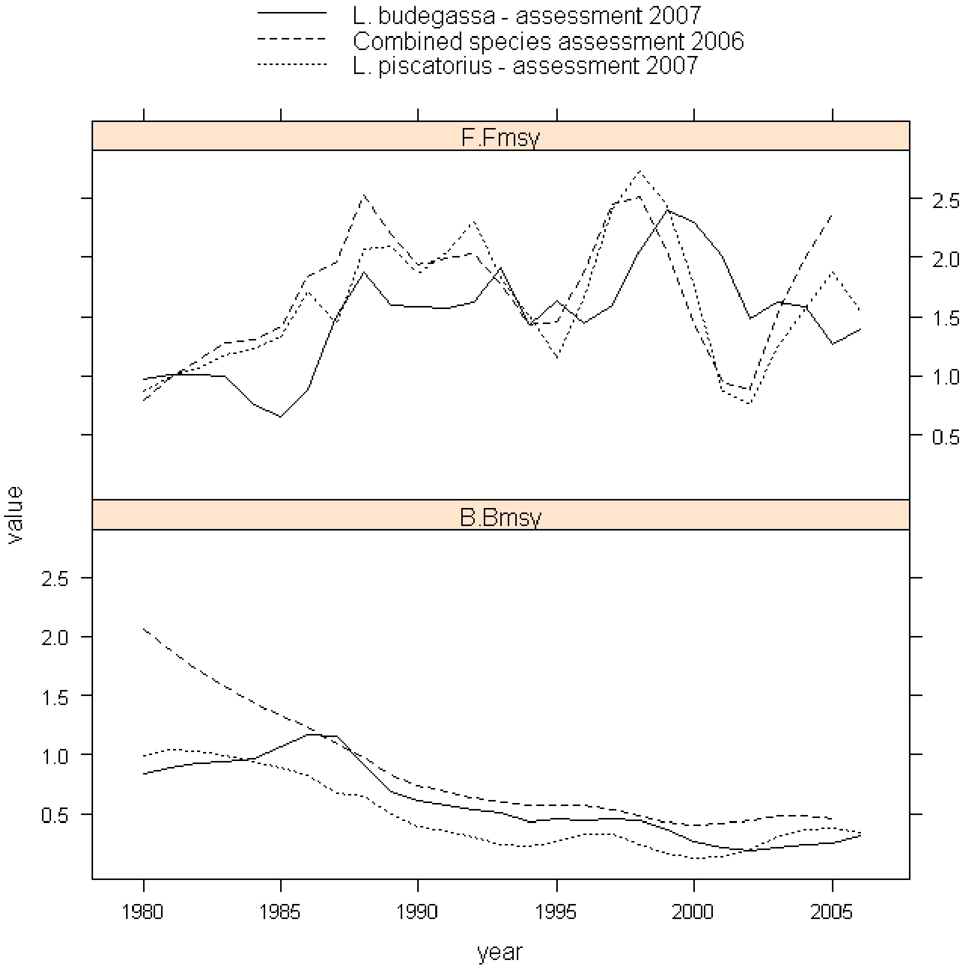


Figure 8.3.2. ANGLERFISH (*L. piscatorius and L. budegassa).* Divisions VIIIc and IXa. Comparison between last year's assessment and this year's assessment.

9 Megrims in Divisions VIIIc and IXa

L. whiffiagonis:

Type of assessment in 2007: update

Software used: FLR (FLEDA and FLXSA) for assessment, MFDP, MFYPR and PASoft for further calculations.

No data revisions were conducted this year.

Review Group issues: RG suggested that reference points were proposed for this stock. However, the WG felt this was not appropriate this year. More details given in Section 9.1.4.

Proposed assessment for 2008: No assessment to be conducted for this stock in 2008. The WG is overloaded and proposes that the species L.whiffiagonis and L.boscii be evaluated in alternated years. The WG proposes to conduct a benchmark assessment for L.boscii in 2008, in which methodological issues will be explored that can be applied to this stock in 2009.

L. boscii:

Type of assessment in 2007: update

Software used: FLR (FLEDA and FLXSA) for assessment, MFDP, MFYPR and PASoft for further calculations.

No data revisions were conducted this year.

Review Group issues: RG suggested that differences between assessments conducted in 2006 and 2005 be investigated. They indicated that removing the 2005 survey index values might bring results closer together. This year an additional XSA run was made removing the 2005 survey index values (results included in ICES files). This did not alter significantly the results obtained without excluding the 2005 index value.

Proposed assessment for 2008: Benchmark. At present, the tuning data used in the assessment for this stock only comes from Spain and there are Portuguese survey and commercial data that should be explored. In addition, models that incorporate uncertainty in estimations and projections (Bayesian models in particular) will be developed and results compared with those obtained under XSA.

Ecosystem aspects

The Iberian Region along the eastern Atlantic shelf (Divisions VIIIc and IXa) is an upwelling area with high productivity, especially along the Portuguese and Galician coasts; upwelling takes place during late spring and summer. The region is characterized by a large number of commercial and non-commercial fish species caught for human consumption.

The genus *Lepidorhombus* is represented in eastern Atlantic waters by two species, Megrim (*L. whiffiagonis*) and four-spot megrim (*L. boscii*). Some general ecosystem studies on megrim have been carried out in the distribution area of these stocks (Rodriguez-Marín and Olaso, 1993; Sánchez and Gil, 1995; Sanchez et al, 1998 and 2001 and Rodriguez-Marín, 2002).

Megrim (*L. whiffiagonis*) is distributed in shallow waters of both ICES Divisions (VIIIc and IXa), with its highest abundance in Division VIIIc. Four-spot megrim (*L. boscii*) is distributed in both ICES Divisions (VIIIc and IXa). Both species of megrims disappear at the mouth of the most important rivers, probably associated with the occurrence of continental run-off, which acts mainly by modifying the composition of the grounds on which megrim depend for food, and creating grounds which are more appropriate for other flatfish, such as sole, plaice or thickback sole (*Dicologoglossa cuneata)*, adapted to estuarine conditions (Sánchez et al., 2001).

The dependence on sediment is probably related both to the distribution of suitable prey and to the ability of flatfish to bury themselves. Burying provides some protection from predators and reduces the use of energy. The juvenile habitat is often a small and generally shallower part of the total habitat occupied by the species. For certain species nursery areas play an important role, whereas for other species no specific nursery areas are known. In general for North Atlantic flatfish the magnitude of recruitment is mainly an effect of transport to and quality of areas for larval development (van der Veer *et al*., 1990, 2000, Beverton and Iles 1992; Bailey 1994; Wennhage and Pihl 2001).

Many flatfish species show a gradual offshore movement of juveniles as they grow. This might indicate that habitat quality for flatfish is size-dependent. Another common pattern is the annual micro- and macroscale movements and migrations between spawning, feeding, and wintering areas (e.g., Molander 1925; Gibson 1994).

There is a certain bathymetric segregation between the two species of megrims. *L. boscii* has a preferential depth range of 100 to 450 m and *L. whiffiagoni*s of 50 to 300 m (Sanchez et al, 1998). Previous studies on megrim species show that they generally occurred outside zones with hydrographical instabilities that foster the vertical interchange of organic matter (Sánchez and Gil, 1995). Both species appear to show a gradual expansion in their bathymetric distribution throughout their lifetimes, with the larger individuals tending to occupy shallower waters than the juveniles. Bearing in mind that the two species have similar characteristics, a certain degree of interspecific competition may be assumed (Sanchez et al, 1998).

Most flatfishes are associated with finer sediments, rather than with hard substrata. The structure of the sea bed is an important factor controlling their distribution and there is increasing evidence that flatfish species can distinguish between and select sediments on the basis of their grain size (Gibson, 1994).

Juveniles of these species feed mostly on detritivore crustaceans inhabiting deep-lying muddy bottoms. Adult *L. boscii* feeds mainly on crustaceans inhabiting muddy surfaces (Rodriguez-Marín and Olaso, 1993; Rodriguez-Marín, 2002) as opposed to *L. whiffiagonis*, which are more ichthyophagous and where rates of crustacean in diet decrease with fish size (Rodriguez-Marín, 2002). Such seabed occurs in the Cantabrian Sea at a greater depth than in the Mediterranean, since the internal Cantabrian continental shelf has a rocky structure. However, recent data show a greater presence of *L. boscii*, suggesting that this species is predominant on all soft bottoms of the continental shelf. Segregation of and competition between species may be the result of several niche aspects (depth, distribution, diet, etc). None of the two species represent an important part of the diet for the main fish predators in this area. However, Velasco (IEO, Santander, Spain, pers. comm.) observed that they are occassionally present in stomach contents of hake, anglerfish and rays.

The spawning period of these species is short. Mature males can be found from November to March and mature females from December to March, but spawning peaks in March. In southern areas megrim spawn from January to April (BIOSDEF, 1998; study contract 95/038).

The growth rate also varies, growth is quicker in the southern area for both species but the maximum length attained is smaller than in the north. The maximum age for megrim also varies with latitude. In Subarea VII the maximum age of megrim is 14 years, this decreases to 9 years in Divisions VIIIc and IXa (BIOSDEF, 1998; Landa et. al, 1996).

Fishery description

Management of megrim is both by TAC and technical measures. The minimum mesh size for towed gears ranges between 40 and 90 mm, depending on catch species composition. Minimum landing size is 20 cm.

Two species of megrim are included in the landings from ICES Divisions VIIIc and IXa: megrim and four-spot megrim. The percentage of megrim (*L. whiffiagonis*) in landings of both species by weight was between 12% and 25% over the whole period for which data are available.

Total estimated international landings for both species combined in 2006 were 1302 t, which is above the TAC (1269 t). No landings data are available for these stocks before 1986, although some Spanish harbours have longer landings series. Total landings increased sharply in 1989, and then decreased to their lowest level of 837 t in 2002 (see Figure 9.1.1).

The Spanish survey (SP-GFS) has provided abundance indices since 1983 (Figure 9.1.1). The survey indicates erratic trends, with a sharp increase in 1988 followed by a deep decrease. Since 1988, the lowest value of the series was found in 2003, increasing significantly in 2004 and again in 2005, which is among the highest in the series. The index value in 2006 is much closer to the historic average.

The *Prestige* oil spill in northwest Spanish coast (November 2002) prompted a redistribution of fishing effort, particularly in the Galician area. Some regulation measures, such as spatial and seasonal closures, were adopted in order to minimise the oil spill impact on fisheries. Regarding trawl fleets, A Coruña (15%) and Marin (14%) display lower effort in 2003 in relation to years 2002 and 2004.

Both species of megrim are taken as by-catch in the mixed bottom trawl fisheries targeting “white fish”, by Portuguese and Spanish fleets, and also in small quantities by the Portuguese artisanal fleet. The majority of the catches are taken by Spanish trawlers. The decreasing catch of hake has changed the target species of some Spanish fleets in recent years. These fleets now focus on other species, such as horse mackerel, blue whiting, or mackerel, and do not take megrim in the catch. Since the early 90´s the Spanish trawl fleet has diversified its gear, introducing a new trawl gear which targets primarily horse mackerel. This gear, named High Vertical Opening (HVO) trawl, affects catches of *L. boscii* more than those of *L. whiffiagonis*, because it operates mainly in the distribution area of the former species, which is different from that of the latter species. The increasing use of pair trawlers (for which the vast majority of catch is blue whiting) and HVO (around 77% of the total catch species is horse mackerel) that do not catch megrim has reduced the effort on these species in recent years.

Atlantic mackerel, anglerfish, blue whiting, horse mackerel, hake, different cephalopods and *Nephrops* account for a high percentage (around 70%) of all retained species in this multispecies trawl fishery. A great number of species are caught as by-catch. Discards are important, particularly for younger ages of both megrim species. Between 30-60% of the individuals caught are discarded by trawlers. Lack of commercial interest, variations in market price, fish size (MLS or market size), storage capacity as well as distance to home port are the main reasons for discarding. Artisanal fleets catch few megrims and discards of all species in these fleets are very low.

Summary of ICES advice for 2007 and management for 2006 and 2007

ICES advice for 2007 (as extracted from ACFM 2006 Summary Sheet):

In the absence of defined reference points, the state of the two stocks cannot be evaluated with regards to biological reference points.

At recent levels of fishing mortality for both species (*L. whiffiagonis* 0.15 and *L. boscii* 0.27), SSB has been stable or slightly increasing. Fishing mortality should not be allowed to increase. This level of exploitation would correspond to landings in 2007 of around 190 t for *L. whiffiagonis* and 1 240 t for *L. boscii.* The combined landings at the current exploitation level would be around 1 440 t.

Management applicable for 2006 and 2007:

The agreed combined TAC for megrim and four-spot megrim in ICES Divisions VIIIc and IXa for 2006 and 2007 were 1269 and 1440 t, respectively.

9.1 Megrim (*L. whiffiagonis)* in Divisions VIIIc and IXa

9.1.1 General

See general section for both species.

9.1.2 Data

9.1.2.1 Commercial catches and discards

Working Group estimates of landings for the period 1986 to 2006 are given in Table 9.1.1. The total estimated international landings in Divisions VIIIc and IXa for 2006 was 210 t, the largest value since the year 2000. Landings reached a peak of 980 t in 1990, followed by a steady decline to their lowest level of 117 t, reached in 2002. Some increase in landings has been observed since then.

Discards data are available for Spanish trawlers in the years displayed in the table below. Annual discards of megrim are estimated to be around 5 t to 70 t along the whole series. Discards in number represent between 15-45% of the total catch. Discards data are not used in this assessment because of the lack of data in several years of the series. Discard/Total Catch ratio and estimated CV are showed in the table below:

Spanish Discard/Total Catch ratio									
Year	1994	1997	1999	2000	2001	2003	2004	2005	2006
Weight Ratio	0.06	0.17	0.17	0.13	0.01	0.11	0.07	0.14	0.08
CV	50.2	24.0	21.9	41.4	57.6	19.6	27.3	48.2	29.0
Number Ratio	0.42	0.38	0.42	0.45		0.26	0.16	0.30	0.21

9.1.2.2 Biological sampling

Annual length compositions of total landings are displayed in Figure 9.1.2 for the period 1986 – 2006. Length distributions were available for Spanish and Portuguese landings until 1998, when Portuguese length frequency data were mainly based on samples from Aveiro. Due to the uncertainties of this port since 1999, Spanish length distributions were raised to the total international landings for all subsequent years. Portuguese landings only represent 13% of the total landings on average. There has been a decrease in landings of fish under 15 cm in length since 1994 and under 20 cm in recent years. This change probably results from stricter enforcement of the minimum landing size (20 cm) in Divisions VIIIc and IXa and a mesh size increase. Table 9.1.2 shows the total length distribution by area for 2006. The bulk of landings in numbers in recent years corresponds to fish of 20-30 cm in length.

Sampling levels for both species are given in Table 1.3.

Mean lengths and mean weights in landings since 1990 are shown in the table below. The values in 2006 are quite high but within the range of variability observed in the last few years.

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Mean length (cm)	22.3	23.5	24.6	23.4	25.1	24.7	24.6	24.6	24.7	25.3	25.8	25.1	26.0	25.7	26.1	25.3	26.7
Mean weight (g)	105	108	129	108	124	121	120	118	119	127	134	124	137	134	137	127	137

Age compositions of landings for 1990 - 2006 (Table 9.1.3) are based on Spanish ALKs and, as in previous years, age compositions for 1986–1989 are based on a survey ALK from 1986 combined with an annual ALK from 1990. Catch weights-at-age of international landings (Table 9.1.4) were also used as the weights-at-age in the stock.

Natural mortality was set to 0.2 and assumed constant over all ages and years, as previously. This is the same value used for *L. whiffiagonis* in Subareas VII and Divisions VIIIab. The sex combined maturity ogive (BIOSDEF, 1998) was the same used in previous assessments, and is as follows:

Age	0	1	2	3 and older
Propo. mature	0	0.34	0.90	1.00

9.1.2.3 Abundance indices from surveys

Portuguese (PT-GFS and PT-CTS) and Spanish (SP-GFS) survey indices are summarised in Table 9.1.5.

Portuguese surveys indicate low abundance and recruitment indices for the whole period except for the initial year of the Crustacean survey (1997). It should be taken into consideration that during years 1996, 1999, 2003 and 2004 the October Portuguese survey was carried out with a different vessel and gear from the one used in the rest of the series.

The Spanish survey (SP-GFS) covers the distribution area and depth strata of this species in Spanish waters. Total biomass and abundance indices from this survey were higher during the period 1988 - 1990, subsequently declining to lower mean levels, which are common through the rest of the time series. The indices for 2006 are in this range of low levels: the abundance index is the lowest in the entire series, whereas the biomass index is slightly better.

The Spanish survey recruitment indices for ages 0 and 1 indicate an extremely weak year class in 1993, followed by better recruitments, except for relatively low values for the 1997 and 1998 year classes. The 1999 year class appears to be relatively strong compared to those from previous years, but the 2000 to 2004 year classes again appear to be relatively low. The survey indicates very low recruitment at age 0 for 2005 and an even lower value for 2006 (which is equal worst with 1993 in the historic series). Age 0 is not used in the assessment due to the severe scarcity of commercial catches at this age. The age 1 abundance index is also extremely low in 2006.

Catch numbers-at-age per unit effort and effort values for the Spanish survey (SP-GFS) in Divisions VIIIc and IXa (1988 - 2006) are given in Table 9.1.6.

9.1.2.4 Commercial catch-effort data

Fishing effort and LPUE data were available for the period 1986 - 2006 for one fleet of Spanish trawlers from A Coruña (SP-CORUTR8c) fishing in Division VIIIc, and for Portuguese trawlers fishing in Division IXa for the period 1988 – 2006. Effort from the

Portuguese fleet is estimated from a sample of logbooks from sea trips where megrim occurred in the catch. No information from the Avilés fleet (SP-AVILESTR) fishing in Division VIIIc is available after 2003 (see Table 9.1.7 and Figure 9.1.3).

Commercial fleets used in the assessment to tune the model

Before 1993, A Coruña (SP-CORUTR8c) effort was generally stable, with a decreasing trend observed after that year (Table 9.1.7 and Figure 9.1.3). The lowest value was reached in 2003, in which restrictions imposed on fishing activity due to the Prestige oil spill had an influence on effort. A Coruña LPUE (SP-CORUTR8c) shows relatively high stable values for 1986 – 1992. Since 1998 LPUE has declined.

Avilés (SP-AVILESTR) effort has decreased throughout the whole period to a very low level in 2003. LPUE shows an increasing trend between 1986 and 1990, with a sharp decrease in 1991. Since then, it has had a further upward and downward fluctuation, with a peak in 1997, reaching its lowest value in 2003. No effort data are available for this fleet after 2003.

Catch numbers-at-age per unit effort and effort data for these fleets are given in Table 9.1.6.

Commercial fleets not used in the assessment to tune the model

Portuguese effort values are quite variable, except in 1999 and 2000 when they are significantly lower (Table 9.1.7 and Figure 9.1.3). Portuguese LPUE shows a steep decrease between 1990 and 1992, and has since remained at low levels, with the exception of a peak in 1997-1998. There is some increase in LPUE values in 2005 and 2006.

9.1.3 Assessment

See Section 1.5 for the general approach adopted by the Working Group for the catch-at-age analysis.

As this year this stock was subjected to an update assessment (no exploratory runs were carried out), the same settings and specifications used in last year's assessment were used again. Details follow.

9.1.3.1 Input data

The age range considered was 1 to 7+. Due to the low and fluctuating catches of age 0, data from this age were not included, though (as in previous years) they are presented in Table 9.1.3. Landed numbers-at-age and effort data for two commercial Spanish fleets, A Coruña (SP-CORUTR8c) for the period 1986 – 2006 and Avilés (SP-AVILESTR) for 1986-2003, and the Spanish survey (SP-GFS) in Divisions VIIIc and IXa (1988-2006) were used for tuning the VPA (see Table 9.1.6).

9.1.3.2 Model

Data screening

The FLEDA package of FLR was used to explore the quality of the input data. Figure 9.1.4 shows catch proportions at age, indicating that the bulk of the landings consisted of ages 1 and 2 until about 1994, shifting after that towards larger ages, mostly 2 to 4. This apparent change in exploitaiton pattern is also obvious from the standardized catch proportions at age, depicted in the same figure.

The internal consistency of each abundance at age data series used to tune the assessment model was examined by checking correlations between ages following cohorts. The results, displayed in Table 9.1.8, indicate that all series are good up to age 5. Age 6 is harder to track along cohorts, particularly for Spanish survey and the Coruña trawl fleet.

The increase in commercial landings in 2006 is in contrast with the low values obtained from the two tuning indices for 2006 (Spanish survey and Coruña fleet).

Final run

Final settings used for this year are the same used in last year's assessment and are detailed below:

		2006 WG		**2007 WG**	
Fleets	SP-CORUTR8c	90-05	2-6	90-06	2-6
	SP-AVILESTR	90-03	2-6	90-03	2-6
	SP-GFS survey	90-05	1-6	90-06	1-6
Taper			No		No
Tuning range			16		17
Ages catch dep. Stock size			1-4		1-4
q plateau			5		5
F shrinkage s.e.			1.5		1.5
year range			5		5
age range			3		3

The retrospective analysis has shown slight trends of overestimation of recruitment and SSB and underestimation of F in recent years (Figure 9.1.5).

9.1.3.3 Assessment results

Diagnostics from the XSA run are presented in Table 9.1.9 and log catchability residuals plotted in Figure 9.1.6. For all tuning fleets the log q residuals are larger for older ages and there is a negative trend in recent years and older ages for commercial fleets. Negative year effects are apparent for the SP-CORUTR8c commercial fleet since the year 2003.

Fishing mortality and population numbers at age from the final XSA run are given in Tables 9.1.10 and 9.1.11, respectively, and summary results presented in Table 9.1.12 and Figure 9.1.7. Fishing mortality is estimated to have increased in 2006. This result might be explained by the increase in commercial landings in 2006 coupled with the low values observed from the abundance indices. On the other hand, SSB in 2006 is estimated to be at a slightly higher value than SSB in 2005.

9.1.3.4 Year class strength and recruitment estimations

The 2004 year class was estimated to have 3.8 million at 1-year-old based on the information from the Spanish survey (SP-GFS) (53% of weight) and one commercial fleet (SP-CORUTR8c) (25% of weight). P-shrinkage and F-shrinkage contributed 21% and 2% of the weight, respectively. The estimate from last year's Working Group was close to 4.4 million at one year of age.

The 2005 year class was estimated to have 3.1 million fish, based on information from the Spanish survey (SP-GFS) (69% of weight). Survivors estimates based on P-shrinkage contribute 27% of the weight in the final estimate, whereas F shrinkage contributes 4%.

Estimates of recruitment for the years 1986 to 1989, for which age compositions were based on combined ALKs, were excluded from the estimation of GM recruitment. Year classes from the period of low SSB (starting from 1991) were used to estimate GM recruitment at age 1, which uses years 1992-2004. From Table 9.1.16, we note that replacing year classes of 2004-2005 by the GM would imply that 55% of the projected yield for 2008 and 64% of the SSB projected for 2009 would be arising from the GM value. Working Group estimates of year-class strength used for prediction can be summarised as follows:

Recruitment at age 1:

YEAR CLASS	THOUSANDS	BASIS	SURVEYS	COMMERCIAL	SHRINKAGE
2003	3413	XSA	37%	45%	18%
2004	3772	XSA	53%	25%	23%
2005	3075	XSA	69%		31%
2006	4052	GM $_{(92-04)}$			

9.1.3.5 Historic trends in biomass, fishing mortality and recruitment

From Table 9.1.12 and Figure 9.1.7, we see that SSB decreased from 2560 t in 1990 to 950 t in 1995, the lowest value in the series. Since then, SSB has remained relatively stable at low levels. SSB in 2006 is around 1100 t.

F has declined in recent years from the high levels observed prior to 1995 (Fbar, for ages 2-4, in range 0.31-0.46) and the high value reached in 1998 (0.38). The lowest value in the time series was reached in 2002 (Fbar = 0.12), and since then fishing mortality shows a slightly increasing pattern, with the biggest increase in 2006. Fishing mortality in 2006 (Fbar = 0.24) was estimated to be higher than that of 2005 (0.17). In last year's assessment, the estimate of Fbar for 2005 was 0.16.

Recruitment (at age 1) varies substantially throughout the time series, but shows a general decline from the high levels seen until the 1992 year class. The 1993 year class is the lowest value in the time series. Since 1998 recruitment has been at low levels.

9.1.3.6 Catch Options and prognosis

Population numbers for the catch forecast were taken from the final XSA outputs. Stock size at age 1 in the years 2007 to 2009 was assumed to be GM_{92-04} (4.1 million). The exploitation pattern used was the average of 2004-2006 scaled to the value in 2006 (corresponding to Fbar = 0.24, F *status quo*). This scaling was done to account for the increasing trend in the estimated F values starting in 2003 and the slight pattern of underestimation of F shown in the retrospective plot. Mean weights in the catch and in the stock were computed as averages over 2004-2006.

9.1.3.7 Short-term projections

The input data for deterministic short-term predictions are shown in Table 9.1.13. Management options for catch prediction are in Table 9.1.14. Figure 9.1.8 shows the short-term forecast summary. The detailed output by age group assuming *status quo* F for 2007-2009 is given in Table 9.1.15.

Under *status quo* F, landings in 2007 and 2008 are predicted to be 221 t and 229 t respectively. SSB will increase to around 1 160 t in 2008 and 1 220 t in 2009. Comparing these predictions for 2007 – 2009 with those from last year's assessment shows lower values in the estimation of SSB with the present assessment. This is in line with the slight pattern of overestimation of SSB found in the retrospective analysis, the estimated increase in F in 2006 and, in accordance with this increased estimate of F, the higher F value used in this year's short term projections (0.15 was used last year versus 0.24 this year).

The contributions of recent year classes to the predicted landings in 2008 and SSB in 2009, assuming $GM_{92\text{-}04}$ recruitment, are presented in Table 9.1.16. The assumed $GM_{92\text{-}04}$ age 1 recruitment in 2007 and 2008 contributes 19% to landings in 2008 and 41% to the predicted SSB at the beginning of 2009. Megrim starts to contribute strongly to SSB at 2 years of age.

9.1.3.8 Yield and biomass per recruit analysis

The results of the yield- and SSB-per-recruit analysis are in Table 9.1.17 (see also left panel of Figure 9.1.8, which plots yield-per-recruit and SSB-per-recruit versus Fbar). Assuming s*tatus quo* exploitation (Fbar = 0.24), and assuming $GM_{92\text{-}04}$ recruitment of 4.1 million, the equilibrium yield would be around 270 t with a SSB of 1 350 t.

F s*tatus quo* is higher than $F_{0.1}$ (= 0.16) which was estimated at the same level as in last year's assessment. The $F_{0.1}$ level produces an equilibrium yield of 250 t and SSB of 1 740 t. F_{max} is not well defined for this stock .

It should be taken into account that natural mortality (0.2) is almost as high as the value of *status quo* F and this has an effect on the yield and SSB per recruit results.

9.1.4 Biological reference points

The stock-recruitment series is plotted in Figure 9.1.9. Most of the high values of stock-recruitment series correspond to the initial years, when a combined ALK was used. After that, there is a narrow range of SSB values and a short time series of data for this stock. While recruitment has been variable, SSB has been relatively stable. With the stable low levels of SSB, both low and high recruitments have been estimated. The 1995 SSB, the lowest estimate in the series, leads to one of the larger recruitment values.

Even accepting the first few years of the stock recruitment series, the points in Figure 9.1.9 do not follow any of the usual stock recruitment functional relationships. In addition, current estimated Fbar = 0.24 is very close to the assumed natural mortality rate (0.2).

The table below shows a summary of the reference points proposed in the past. In 2000, there was a re-evaluation of historical data. However, reference points were not well defined. At present, there is no new information to define reference points for B_{lim} and B_{pa} for this stock.

	ACFM 1998	**WG 2000**	**ACFM 2000**	**WG 2002**	**ACFM 2002**
F_{lim}	**Not defined**	**Not defined**	**Not defined**	**Not defined**	**Not defined**
F_{pa}	**No proposal**	**No proposal**	**Not adopted**	**No proposal**	**Not adopted**
B_{lim}	**900 t (B_{loss},=B95 WG98)**		**Not defined**		
B_{pa}	**1 500 t (B_{lim} × 1.64)**	**900 t (B_{loss},=B_{95} WG98)**	**Not adopted**	**1 500 t (stock history)**	**Not adopted**

9.1.5 Comments on the assessment

The inclusion of discards in the assessment would be likely to have an influence in the perception of the state of the stock. Discards in number represent between 15-45% of the total catch and they are thought to be important for younger ages. It is therefore recommended to follow with the collection of discards data in order to get a larger number of years which could then be included in the assessment.

The behaviour of commercial fleets with regards to landings of age 1 individuals appears to have changed in time. Hence, data from commercial fleets used for tuning is only taken for ages 2 and older. However, the Spanish survey (SP-GFS) provides good information on age 1 abundance.

Comparison of this assessment with the one from last year shows very similar trends for F and SSB (Figure 9.1.10).

The assessment indicates that SSB has remained relatively stable at low levels since 1990. Since 1992 both high and low recruitment has been observed at these low stock levels.

Megrim starts to contribute strongly to SSB at 2 years of age. Around 41% of the predicted SSB in 2009 relies on year classes for which recruitment has been assumed to be $GM_{92\text{-}04}$.

Recent F is estimated to be similar to the assumed natural mortality, which should be kept in mind when interpreting yield per recruit results.

9.1.6 Management considerations.

It should be taken into account that megrim, *L. whiffiagonis,* is caught in mixed fisheries. There is a common TAC for both species of megrim (*L. whiffiagonis* and *L. boscii*), so the joint status of the two species should be taken into consideration when formulating management advice. Megrims are by-catch in mixed fisheries generally directed to white fish. Therefore, fishing mortality of megrims could be influenced by restrictions imposed on demersal mixed fisheries, aimed at preserving and rebuilding the overexploited stocks of southern hake and Nephrops.

Table. 9.1.1 Megrim (*L. whiffiagonis*) in Divisions VIIIc, IXa. Total landings (t).

	Spain			Portugal	Total
Year	VIIIc	IXa	Total	IXa	VIIIc, IXa
1986	508	98	606	53	659
1987	404	46	450	47	497
1988	657	59	716	101	817
1989	533	45	578	136	714
1990	841	25	866	111	977
1991	494	16	510	104	614
1992	474	5	479	37	516
1993	338	7	345	38	383
1994	440	8	448	31	479
1995	173	20	193	25	218
1996	283	21	305	24	329
1997	298	12	310	46	356
1998	372	8	380	66	446
1999	332	4	336	7	343
2000	238	5	243	10	253
2001	167	2	169	5	175
2002	112	3	115	3	117
2003	113	3	116	17	134
2004	142	1	144	5	149
2005	120	1	121	26	147
2006	173	2	175	35	210

Table 9.1.2 Megrim (*L. whiffiagonis*) Divisions VIIIc and IXa.
Annual length compositions of landings (´000 fish) in 2006

Length (cm)	Div. VIIIc	Div. IXa	Total
10			
11			
12			
13			
14			
15			
16		0.3	0.3
17	0.2	0.3	0.6
18	0.5	0.4	0.9
19	3.8	1.5	5.3
20	35.7	7.6	43.3
21	70.2	14.3	84.5
22	93.4	19.0	112.4
23	144.5	29.5	174.0
24	141.7	30.6	172.3
25	143.5	29.4	173.0
26	125.0	25.5	150.5
27	101.7	21.4	123.2
28	106.1	22.8	128.9
29	84.3	19.2	103.5
30	67.3	15.2	82.5
31	42.2	9.8	52.0
32	28.2	5.9	34.1
33	17.5	3.6	21.1
34	17.2	3.5	20.7
35	9.0	2.1	11.1
36	8.1	2.0	10.1
37	5.2	1.3	6.5
38	3.4	0.7	4.1
39	3.8	0.8	4.5
40	3.4	1.0	4.3
41	3.5	0.7	4.2
42	2.0	0.4	2.4
43	1.2	0.2	1.5
44	1.2	0.2	1.4
45	1.0	0.2	1.2
46	0.8	0.2	1.0
47	0.3	0.1	0.3
48	0.1	0.0	0.1
49	0.1	0.0	0.1
50+	0.4	0.1	0.5
Total	1267	270	1536

Table 9.1.3 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Catch numbers at age.

Catch numbers at age Numbers*10**-3

YEAR		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGE																						
	* 0	(15)	(0)	(0)	(0)	(8)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
	1	1013	2020	2977	760	4230	1018	1062	519	40	509	198	82	77	20	9	40	31	129	46	123	91
	2	1952	2303	3344	1903	2135	2352	392	1703	432	36	1486	1062	882	240	122	305	151	242	236	215	418
	3	668	752	1038	678	775	801	677	312	1784	254	37	1011	1205	960	598	300	310	265	205	401	467
	4	639	394	738	631	868	690	1120	526	549	620	279	76	881	693	507	244	86	175	242	160	248
	5	501	289	530	501	329	643	591	357	624	241	502	362	214	442	361	220	164	80	184	152	170
	6	201	80	181	190	376	141	77	102	330	69	147	305	328	105	83	160	80	54	100	86	106
+gp		194	71	130	253	558	59	68	36	119	72	81	116	149	207	161	118	37	48	71	41	36
TOTALNUM		5168	5909	8938	4916	9271	5704	3987	3555	3878	1801	2733	3014	3735	2667	1841	1387	860	993	1084	1177	1536
TONSLAND		659	497	817	714	977	614	516	383	479	218	329	356	446	343	253	175	117	134	149	147	210
SOPCOF %		95	95	95	99	99	100	100	100	100	101	102	100	101	101	101	101	100	101	100	98	100

* Age 0 was not used in the assessment.

Table 9.1.4 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Catch weights at age (kg.).

Mean weight at age

YEAR		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGE																						
	1	0.045	0.049	0.045	0.051	0.041	0.039	0.034	0.036	0.046	0.060	0.054	0.056	0.046	0.056	0.056	0.058	0.058	0.056	0.062	0.061	0.063
	2	0.102	0.084	0.090	0.102	0.098	0.091	0.095	0.080	0.069	0.071	0.088	0.083	0.070	0.070	0.072	0.085	0.082	0.089	0.085	0.080	0.092
	3	0.121	0.092	0.103	0.122	0.129	0.108	0.125	0.117	0.100	0.102	0.121	0.102	0.099	0.089	0.094	0.088	0.115	0.116	0.109	0.111	0.123
	4	0.164	0.143	0.150	0.164	0.166	0.146	0.155	0.147	0.130	0.127	0.128	0.126	0.130	0.119	0.121	0.118	0.119	0.150	0.130	0.143	0.159
	5	0.216	0.176	0.191	0.224	0.207	0.173	0.209	0.195	0.150	0.165	0.164	0.141	0.155	0.160	0.161	0.148	0.162	0.194	0.157	0.165	0.182
	6	0.316	0.314	0.290	0.293	0.241	0.252	0.321	0.237	0.190	0.212	0.211	0.199	0.189	0.216	0.215	0.172	0.206	0.252	0.204	0.199	0.228
+gp		0.477	0.415	0.424	0.520	0.369	0.420	0.534	0.538	0.344	0.340	0.354	0.341	0.324	0.296	0.296	0.256	0.388	0.382	0.320	0.380	0.393
SOPCOFAC		0.949	0.950	0.949	0.994	0.986	1.002	1.000	1.003	1.001	1.006	1.020	0.998	1.008	1.007	1.010	1.007	1.001	1.0059	1.0018	0.9837	0.9999

Table 9.1.5 Megrim (*L. whiffiagonis*) Divisions VIIIc, IXa.

Abundance and Recruitment indices from Portuguese and Spanish surveys.

	Biomass Index				
	Portugal (k/h)			Spain (k/30 min)	
	October	Crustaceans	s.e	Mean	s.e.
1983				0.96	0.14
1984				1.92	0.34
1985				0.89	0.15
1986				1.65	0.20
1987				ns	
1988				3.52	0.64
1989				3.13	0.53
1990	0.08			3.08	0.86
1991	0.11			1.22	0.17
1992	0.11			1.39	0.20
1993	0.04			1.46	0.24
1994	0.05			1.02	0.20
1995	0.01			1.03	0.16
A,1996	+			1.64	0.22
1997	+	1.4	1.0	1.79	0.25
1998	0.01	0.2	0.1	1.47	0.23
A,B,1999	+	0.1	0.1	1.59	0.29
2000	+	0.1	0.0	1.80	0.35
2001	0	0.0	0.0	1.45	0.28
2002	0.04	0.1	0.0	1.26	0.24
A,2003	0.01	0.1	0.1	0.82	0.16
A,2004	0.01	ns		1.08	0.20
2005	0.01	0.4	0.2	1.29	0.21
2006	0.02	0.3	0.2	1.03	0.18

	Abundance index			
	Portugal (n/h)		Spain (n/30 min)	
	Crustaceans	s.e.	Mean	s.e.
1983			14.0	2.45
1984			28.0	4.57
1985			9.0	1.34
1986			33.0	6.22
1987			ns	
1988			43.0	8.82
1989			42.0	7.04
1990			28.0	5.50
1991			10.0	1.67
1992			18.0	3.35
1993			15.0	3.23
1994			8.0	1.87
1995			11.0	1.86
A,1996			21.0	3.60
1997	7.2	4.8	20.0	3.26
1998	1.1	0.5	14.8	2.64
A,B,1999	0.6	0.5	15.5	3.05
2000	0.3	0.2	19.4	4.46
2001	0.1	0.0	12.8	2.77
2002	0.2	0.1	12.1	2.65
A,2003	0.2	0.1	7.2	1.26
A,2004	ns		8.4	1.39
2005	0.7	0.4	9.8	1.73
2006	0.4	0.2	6.4	1.16

	Recruitment index		
	At age 1	At age 0	At age 1
	Portugal (n)	Spain (n/30 min)*10	
	October		
1983		1.88	7.72
1984		0.32	16.08
1985		0.10	2.74
1986		13.78	11.19
1987		ns	ns
1988		0.65	16.60
1989		2.90	13.96
1990	5	0.11	9.13
1991	5	1.26	1.38
1992	8	0.01	12.03
1993	1	0.00	2.76
1994	+	0.60	0.05
1995	+	0.41	7.38
A,1996	+	0.45	11.26
1997	+	0.15	5.91
1998	+	0.02	2.56
A,B,1999	+	0.56	1.26
2000	+	0.05	6.92
2001	+	0.19	1.97
2002	+	0.08	2.53
A,2003	0.05	0.05	1.91
A,2004	+	0.14	1.83
2005	+	0.08	2.21
2006		0.00	0.89

+ less than 0.04

ns no survey

A Portuguese October Survey with different vessel and gear (Capricórnio and CAR net)

B Portuguese Crustacean Survey covers partial area only with a different Vessel (Mestre Costeiro)

Table 9.1.6 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Tuning data.

FLT01: SP-CORUTR8c. 1000 Days by 100 HP (thousand)(*)

1986	2006								
1	1	0	1						
1	7							Eff.	
10	34.4	91.2	37.7	45.2	38.7	14.8	8.5	39.8	1986
10	242.1	187.3	62.2	32.6	25.9	9.2	7.5	34.7	1987
10	67.8	215.4	75.8	71.3	54.0	19.0	9.5	42.2	1988
10	12.6	87.8	36.3	46.6	35.8	13.1	8.8	44.4	1989
10	22.1	80.4	48.6	81.3	34.5	36.3	36.5	44.4	1990
10	13.1	107.9	47.0	59.7	61.9	15.1	5.4	40.4	1991
10	5.7	23.7	66.6	144.5	91.3	11.8	10.0	38.9	1992
10	0.2	42.5	20.4	49.2	37.8	9.7	1.6	44.5	1993
10	0.0	3.5	52.5	28.8	42.2	30.1	6.3	39.6	1994
10	51.1	3.2	15.4	33.6	12.1	3.3	2.3	41.5	1995
10	1.2	54.7	2.7	17.6	46.7	14.7	8.6	35.7	1996
10	0.9	32.6	49.7	5.0	25.4	23.6	8.1	35.2	1997
10	0.5	15.3	42.5	52.9	15.0	30.9	13.9	32.6	1998
10	0.7	7.9	40.4	42.5	35.0	9.7	19.5	30.2	1999
10	1.2	5.5	36.8	50.8	48.6	12.3	14.4	30.1	2000
10	1.9	18.3	18.4	22.1	23.7	19.3	13.5	29.9	2001
10	1.7	10.6	35.9	9.9	27.1	14.3	5.6	21.8	2002
10	20.2	15.0	15.6	15.7	9.5	7.8	6.7	18.5	2003
10	1.4	7.5	8.5	12.8	12.1	9.0	8.4	21.1	2004
10	3.9	8.4	18.6	8.5	9.1	5.6	3.8	20.7	2005
10	2.2	11.6	16.1	11.3	8.6	6.2	2.5	19.3	2006

FLT02: SP-AVILESTR. 1000 Days by 100 HP (thousand) (*)

1986	2003								
1	1	0	1						
1	7							Eff.	
10	251	317	263	128	112	94	56	10.8	1986
10	410	327	355	168	101	117	39	8.3	1987
10	1177	731	605	288	125	156	69	9.0	1988
10	750	461	484	227	130	156	61	8.1	1989
10	3704	805	191	147	39	42	60	8.5	1990
10	870	759	203	89	74	13	7	7.7	1991
10								0.0	1992
10	544	705	43	47	25	12	9	7.6	1993
10	17	154	479	119	116	45	21	9.6	1994
10	34	2	36	117	58	22	12	6.1	1995
10	117	689	12	101	223	64	54	4.5	1996
10	88	812	573	31	141	118	43	4.7	1997
10	18	349	424	263	59	79	43	5.4	1998
10	10	105	382	252	156	36	67	6.8	1999
10	25	48	210	201	128	31	46	4.5	2000
10	43	234	226	142	135	98	100	1.8	2001
10	46	132	199	54	78	45	39	2.7	2002
10	23	76	95	63	28	22	25	2.5	2003

FLTO3: SP-GFS (n/30 min)

1988	2006								
1	1	0.75	0.83						
1	7								
1	16.60	12.48	5.18	4.54	2.66	0.74	0.53	101	1988
1	13.96	11.20	5.38	5.64	1.47	0.48	0.43	91	1989
1	9.13	7.69	3.04	3.61	1.26	1.36	1.57	120	1990
1	1.38	3.23	1.45	1.84	0.87	0.23	0.02	107	1991
1	12.03	1.07	1.57	2.24	1.14	0.21	0.13	116	1992
1	2.76	8.79	0.66	1.69	0.85	0.17	0.01	109	1993
1	0.05	0.65	4.24	1.30	0.71	0.27	0.02	118	1994
1	7.38	0.20	0.55	1.65	0.70	0.17	0.07	116	1995
1	11.26	6.45	0.25	1.03	1.00	0.35	0.17	114	1996
1	5.91	7.54	3.44	0.46	0.99	0.39	0.04	116	1997
1	2.56	4.30	4.33	2.08	0.41	0.60	0.15	114	1998
1	1.26	4.47	4.36	2.50	1.46	0.46	0.62	116	1999
1	6.92	2.46	2.84	3.42	2.14	0.70	0.19	113	2000
1	1.97	4.60	1.14	2.31	1.58	0.61	0.22	113	2001
1	2.53	3.15	3.74	0.44	1.38	0.51	0.12	110	2002
1	1.91	1.44	1.66	1.14	0.52	0.26	0.13	112	2003
1	1.83	1.94	1.31	1.30	0.80	0.66	0.46	114	2004
1	2.21	1.58	2.04	1.43	1.57	0.60	0.14	116	2005
1	0.89	1.40	1.57	0.82	0.88	0.61	0.16	115	2006

Age 1 excluded in this year assessment for SP-CORUTR8c and SP-AVILESTR fleets.

Table 9.1.7 Megrim (*L. whiffiagonis*). LPUE data by fleet in Divisions VIIIc and IXa.

	A Coruña Trawl in VIIIc			Avilés Trawl in VIIIc			Portugal trawl in IXa		
Year	Landings	Effort	LPUE [1]	Landings	Effort	LPUE [1]	Landings	Effort	LPUE [2]
1986	156	39.8	3.92	141	10.8	13.04			
1987	155	34.7	4.47	102	8.3	12.23			
1988	263	42.2	6.24	180	9.0	19.94	74.9	38.5	1.95
1989	196	44.4	4.41	143	8.1	17.75	92.2	44.7	2.06
1990	270	44.4	6.08	266	8.5	31.33	86.0	39.0	2.20
1991	211	40.4	5.22	102	7.7	13.28	85.5	45.0	1.90
1992	255	38.9	6.55	56	na		32.6	50.9	0.64
1993	121	44.5	2.72	67	7.6	8.76	31.7	44.2	0.72
1994	108	39.6	2.73	96	9.6	9.95	25.8	45.8	0.56
1995	28	41.5	0.67	50	6.1	8.16	21.4	37.0	0.58
1996	72	35.7	2.01	67	4.5	14.72	22.2	46.5	0.48
1997	75	35.2	2.12	83	4.7	17.70	41.5	33.4	1.24
1998	90	32.6	2.78	74	5.4	13.78	60.1	43.1	1.39
1999	73	30.2	2.40	83	6.8	12.21	4.3	25.3	0.17
2000	79	30.1	2.63	41	4.5	9.26	6.9	27.0	0.25
2001	49	29.9	1.65	24	1.8	13.01	1.3	43.1	0.03
2002*	36	21.8	1.66	21	2.7	7.78	1.0	31.2	0.03
2003*	25	18.5	1.36	13	2.5	5.06	15.3	40.5	0.38
2004	22	21.1	1.06	27	na		3.4	35.4	0.10
2005	18	20.7	0.88	35	na		19.0	42.6	0.45
2006	18	19.3	0.94	29	na		26.3	40.3	0.65

[1] LPUE as catch (kg) per fishing day per 100 HP.

[2] LPUE as catch (kg) per hour.

* Revised the effort from the Portuguese trawl

Table 9.1.8. Megrim (L.Whiffiagonis) in Divisions VIIIc & IXa. Correlation between different ages following cohorts.

"SP_CORUTR8c"

age	2	3	4	5	6
2	1.00	NA	NA	NA	NA
3	0.82	1.00	NA	NA	NA
4	0.70	0.61	1.00	NA	NA
5	0.69	0.65	0.55	1.00	NA
6	0.06	0.02	0.43	0.11	1.00

"SP_AVILESTR"

age	2	3	4	5	6
2	1.00	NA	NA	NA	NA
3	0.73	1.00	NA	NA	NA
4	0.53	0.74	1.00	NA	NA
5	0.38	0.63	0.46	1.00	NA
6	0.28	0.25	0.25	0.58	1.00

"SP_GFS"

age	1	2	3	4	5	6
1	1.00	NA	NA	NA	NA	NA
2	0.87	1.00	NA	NA	NA	NA
3	0.77	0.76	1.00	NA	NA	NA
4	0.53	0.60	0.67	1.00	NA	NA
5	0.44	0.50	0.66	0.54	1.00	NA
6	-0.08	-0.05	0.11	-0.34	0.25	1.00

Table 9.1.9. Megrim (L.Whiffiagonis) in Divisions VIIIc and IXa. Tuning diagnostics from FLXSA.

```
R version 2.4.1 (2006-12-18)

> library(FLCore)
Loading required package: lattice
Creating a new generic function for "print" in "FLCore"
FLCore 1.4-3 - "Golden Jackal"

> require(FLEDA)
Loading required package: FLEDA
FLEDA 1.4-2 - "The Jackal's Associate"

> require(FLXSA)
Loading required package: FLXSA
Loading required package: FLAsses


FLR XSA Diagnostics 2007-05-11 18:26:56

CPUE data from whiff.ind

Catch data for 21 years. 1986 to 2006. Ages 1 to 7.

        fleet first age last age first year last year alpha beta
1 SP-CORUTR8c         2        6       1990      2006     0    1
2 SP-AVILESTR         2        6       1990      2003     0    1
3      SP-GFS         1        6       1990      2006  0.75 0.83


 Time series weights :

   Tapered time weighting not applied

Catchability analysis :

    Catchability independent of size for ages >   4

    Catchability independent of age for ages >=   5

Terminal population estimation :

    Survivor estimates shrunk towards the mean F
    of the final   5 years or the  3 oldest ages.

    S.E. of the mean to which the estimates are shrunk =   1.5

    Minimum standard error for population
    estimates derived from each fleet =  0.2

   prior weighting not applied

Regression weights
     year
age   1997 1998 1999 2000 2001 2002 2003 2004 2005 2006
  all    1    1    1    1    1    1    1    1    1    1


Fishing mortalities
   year
age  1997  1998  1999  2000  2001  2002  2003  2004  2005  2006
  1 0.014 0.021 0.010 0.003 0.014 0.012 0.044 0.015 0.037 0.033
  2 0.210 0.208 0.085 0.075 0.127 0.069 0.127 0.105 0.090 0.169
  3 0.334 0.391 0.368 0.313 0.265 0.184 0.167 0.151 0.261 0.289
  4 0.136 0.549 0.410 0.338 0.203 0.113 0.150 0.226 0.169 0.256
  5 0.548 0.693 0.595 0.389 0.240 0.204 0.145 0.233 0.217 0.273
  6 1.141 1.650 0.913 0.207 0.298 0.128 0.095 0.273 0.162 0.231
  7 1.141 1.650 0.913 0.207 0.298 0.128 0.095 0.273 0.162 0.231
```

Table 9.1.9 (Continued)

XSA population number (thousands)

year	age 1	2	3	4	5	6	7
1997	6425	6199	3931	662	948	495	185
1998	4073	5186	4114	2303	473	449	198
1999	2308	3265	3448	2278	1089	194	376
2000	3462	1872	2456	1954	1238	491	948
2001	3092	2826	1422	1470	1141	687	503
2002	2772	2495	2038	893	983	735	339
2003	3333	2241	1906	1388	653	656	581
2004	3413	2612	1616	1321	978	462	326
2005	3772	2753	1925	1138	863	634	301
2006	3075	2977	2059	1214	787	569	192

Estimated population abundance at 1st Jan 2007

year	age 1	2	3	4	5	6	7
2007	0	2443	2067	1270	776	495	374

Fleet: SP-CORUTR8c

Log catchability residuals.

age	year 1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2	0.148	0.353	0.197	-0.104	-0.422	0.116	0.138	-0.100	-0.248	-0.219	-0.019
3	0.046	-0.067	0.225	-0.007	-0.074	-0.092	-0.167	-0.044	-0.114	-0.032	0.123
4	0.039	0.046	0.120	0.062	0.057	-0.076	-0.039	0.059	-0.029	-0.070	0.016
5	0.475	0.931	1.425	0.322	0.802	-0.470	0.198	-0.009	0.219	0.195	0.302
6	0.281	0.430	0.196	0.201	1.148	-0.594	0.172	0.814	1.370	0.774	-0.232

age	year 2001	2002	2003	2004	2005	2006
2	0.147	0.029	0.216	-0.105	-0.101	-0.025
3	0.201	0.202	-0.036	-0.143	0.030	-0.052
4	-0.015	0.050	-0.051	-0.058	-0.069	-0.042
5	-0.401	-0.135	-0.802	-0.925	-1.098	-1.030
6	-0.076	-0.523	-1.031	-0.452	-1.293	-1.056

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

	5	6
Mean_Logq	-5.5624	-5.5624
S.E_Logq	0.7181	0.7732

Regression statistics

Ages with q dependent on year class strength

	slope	intercept
Age 2	0.5736247	7.765948
Age 3	0.5725780	7.134350
Age 4	0.4026605	6.859218

Fleet: SP-AVILESTR

Log catchability residuals.

age	year 1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2	-0.033	0.023	NA	-0.074	0.045	-0.179	-0.022	0.006	-0.044	-0.043	0.052
3	-0.082	-0.157	NA	-0.273	0.034	-0.313	-0.119	0.128	0.028	0.091	0.094
4	-0.056	-0.198	NA	-0.408	0.158	-0.123	0.034	0.002	0.211	0.174	0.154
5	-0.579	-0.064	NA	-1.264	0.646	-0.064	0.719	0.535	0.406	0.516	0.088
6	-0.737	-0.895	NA	-0.769	0.374	0.113	0.741	1.247	1.125	0.925	-0.477

age	year 2001	2002	2003
2	0.124	0.088	0.055
3	0.402	0.170	-0.003
4	0.175	0.047	-0.171
5	0.184	-0.241	-0.882
6	0.397	-0.536	-1.165

Table 9.1.9 (Continued)

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

	5	6
Mean_Logq	-4.3887	-4.3887
S.E_Logq	0.6103	0.8334

Regression statistics
Ages with q dependent on year class strength

	slope	intercept
Age 2	0.3687564	7.054732
Age 3	0.5218515	6.276700
Age 4	0.6744863	5.614660

Fleet: SP-GFS

Log catchability residuals.

age \ year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1	-0.126	-0.172	-0.045	0.036	-0.399	-0.078	0.056	-0.008	0.014	0.120	0.333
2	0.032	-0.149	-0.240	0.022	-0.412	-0.259	-0.004	0.051	-0.045	0.212	0.328
3	0.039	-0.391	-0.151	-0.357	0.057	-0.428	-0.213	-0.015	0.070	0.180	0.202
4	0.120	-0.030	-0.029	-0.002	0.048	-0.122	-0.111	0.053	-0.057	-0.027	0.146
5	0.405	0.066	0.451	-0.266	0.223	-0.121	-0.144	-0.033	-0.106	0.254	0.345
6	0.213	-0.531	-0.697	-0.635	-0.032	-0.383	-0.023	0.152	1.084	1.075	0.008

age \ year	2001	2002	2003	2004	2005	2006
1	0.085	0.200	0.046	0.019	0.020	-0.101
2	0.321	0.243	0.040	0.050	-0.060	-0.129
3	0.158	0.395	0.093	0.096	0.204	0.061
4	0.145	-0.139	-0.069	0.023	0.125	-0.073
5	0.005	-0.009	-0.623	-0.526	0.261	-0.182
6	-0.393	-0.774	-1.360	0.062	-0.436	-0.257

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

	5	6
Mean_Logq	-6.2404	-6.2404
S.E_Logq	0.3050	0.6164

Regression statistics
Ages with q dependent on year class strength

	slope	intercept
Age 1	0.4930676	7.791819
Age 2	0.6016497	7.406939
Age 3	0.6457005	7.183256
Age 4	0.5739262	6.881961

Table 9.1.10. Megrim (L.Whiffiagonis) in Div VIIIc&Ixa. Estimates of fishing mortality at age from FLXSA

age \ year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	0.1327	0.2045	0.3650	0.0925	0.4864	0.2657	0.1217	0.1451	0.0330	0.0690	0.0285
2	0.3320	0.5007	0.6140	0.4216	0.4041	0.5541	0.1545	0.2923	0.1728	0.0376	0.2942
3	0.2495	0.2049	0.4428	0.2357	0.3022	0.2590	0.3015	0.1772	0.5699	0.1456	0.0493
4	0.4542	0.2283	0.3182	0.5339	0.5370	0.4840	0.7031	0.4063	0.5390	0.3945	0.2361
5	0.8010	0.3822	0.5472	0.3720	0.5966	1.0307	1.0535	0.5060	1.2960	0.4829	0.6507
6	0.5060	0.2737	0.4402	0.3842	0.5329	0.5570	0.3062	0.5004	1.3608	0.4440	0.6207
7	0.5060	0.2737	0.4402	0.3842	0.5329	0.5570	0.3062	0.5004	1.3608	0.4440	0.6207

age \ year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	0.0142	0.0211	0.0096	0.0029	0.0144	0.0124	0.0437	0.0150	0.0367	0.0333
2	0.2099	0.2082	0.0847	0.0748	0.1270	0.0692	0.1271	0.1052	0.0903	0.1686
3	0.3344	0.3911	0.3678	0.3134	0.2654	0.1841	0.1668	0.1510	0.2609	0.2886
4	0.1357	0.5494	0.4097	0.3379	0.2027	0.1125	0.1501	0.2262	0.1689	0.2558
5	0.5481	0.6926	0.5955	0.3889	0.2396	0.2039	0.1454	0.2331	0.2166	0.2729
6	1.1408	1.6499	0.9128	0.2066	0.2975	0.1281	0.0954	0.2731	0.1624	0.2307
7	1.1408	1.6499	0.9128	0.2066	0.2975	0.1281	0.0954	0.2731	0.1624	0.2307

Table 9.1.11. Megrim (L.Whiffiagonis) in Div VIIIc&Ixa. Estimates of stock numbers at age from FLXSA

age \ year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1	9011	12071	10758	9509	12138	4822	10244	4247	1360	8432	7790	6425	4073	2308
2	7637	6461	8055	6114	7098	6110	3027	7426	3008	1077	6443	6199	5186	3265
3	3343	4486	3206	3569	3284	3879	2875	2123	4539	2072	850	3931	4114	3448
4	1934	2133	2993	1686	2309	1987	2451	1741	1456	2102	1466	662	2303	2278
5	1005	1006	1390	1782	809	1105	1003	994	949	695	1160	948	473	1089
6	559	369	562	658	1006	365	323	286	490	213	351	495	449	194
7	535	326	400	870	1477	151	283	100	173	220	191	185	198	376

age \ year	2000	2001	2002	2003	2004	2005	2006	2007	GM 92-04
1	3462	3092	2772	3333	3413	3772	3075	-	4052
2	1872	2826	2495	2241	2612	2753	2977	2435	
3	2456	1422	2038	1906	1616	1925	2059	2059	
4	1954	1470	893	1388	1321	1138	1214	1263	
5	1238	1141	983	653	978	863	787	770	
6	491	687	735	656	462	634	569	490	
7	948	503	339	581	326	301	192	495	

Table 9.1.12. Megrim (L.Whiffiagonis) in Divisions VIIIc & IXa. Summary of landings and results from FLXSA

	Landings(t)	Fbar 2-4	R(age=1,thousands)	SSB(t)	Biomass
1986	659	0.3452	9011	2209	2555
1987	497	0.3113	12071	1835	2280
1988	817	0.4583	10758	2194	2586
1989	714	0.3970	9509	2482	2865
1990	977	0.4145	12138	2557	2955
1991	614	0.4324	4822	1620	1800
1992	516	0.3863	10244	1581	1839
1993	383	0.2919	4247	1406	1567
1994	479	0.4272	1360	1146	1208
1995	218	0.1926	8432	954	1295
1996	329	0.1932	7790	1276	1610
1997	356	0.2267	6425	1365	1654
1998	446	0.3829	4073	1320	1480
1999	343	0.2874	2308	1155	1263
2000	253	0.2420	3462	1240	1382
2001	175	0.1984	3092	992	1134
2002	117	0.1219	2772	1022	1148
2003	134	0.1480	3333	1186	1330
2004	149	0.1608	3413	972	1134
2005	147	0.1734	3772	1034	1208
2006	210	0.2377	3075	1106	1261

Table 9.1.13. Megrim (*L. whiffiagonis*) in Division VIIIc, IXa. Prediction with management option table: Input data

MFDP version 1a
Run: meg89
Time and date: 10:07 12/05/2007
Fbar age range: 2-4

Age	2007	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
	1	4052	0.2	0.34	0	0	0.062	0.035	0.062
	2	2435	0.2	0.9	0	0	0.086	0.151	0.086
	3	2059	0.2	1	0	0	0.114	0.291	0.114
	4	1263	0.2	1	0	0	0.144	0.271	0.144
	5	770	0.2	1	0	0	0.168	0.300	0.168
	6	490	0.2	1	0	0	0.210	0.277	0.210
	7	495	0.2	1	0	0	0.364	0.277	0.364

Age	2008	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
	1	4052	0.2	0.34	0	0	0.062	0.035	0.062
	2	.	0.2	0.9	0	0	0.086	0.151	0.086
	3	.	0.2	1	0	0	0.114	0.291	0.114
	4	.	0.2	1	0	0	0.144	0.271	0.144
	5	.	0.2	1	0	0	0.168	0.300	0.168
	6	.	0.2	1	0	0	0.210	0.277	0.210
	7	.	0.2	1	0	0	0.364	0.277	0.364

2009

Age		Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
	1	4052	0.2	0.34	0	0	0.062	0.035	0.062
	2	.	0.2	0.9	0	0	0.086	0.151	0.086
	3	.	0.2	1	0	0	0.114	0.291	0.114
	4	.	0.2	1	0	0	0.144	0.271	0.144
	5	.	0.2	1	0	0	0.168	0.300	0.168
	6	.	0.2	1	0	0	0.210	0.277	0.210
	7	.	0.2	1	0	0	0.364	0.277	0.364

Input units are thousands and kg - output in tonnes

Table 9.1.14. Megrim (L. whiffiagonis) in Div. VIIIc and IXa catch forecast : management option table

MFDP version 1a
Run: meg89
Megrim (L. whiffiagonis.) in Divisions VIIIc and IXa
Time and date: 10:07 12/05/2007
Fbar age range: 2-4

2007				
Biomass	**SSB**	**FMult**	**FBar**	**Landings**
1289	1102	1	0.2377	221

2008					2009	
Biomass	**SSB**	**FMult**	**FBar**	**Landings**	**Biomass**	**SSB**
1355	1162	0	0	0	1667	1472
.	1162	0.1	0.0238	26	1638	1444
.	1162	0.2	0.0475	50	1610	1416
.	1162	0.3	0.0713	75	1583	1389
.	1162	0.4	0.0951	98	1556	1362
.	1162	0.5	0.1188	121	1530	1336
.	1162	0.6	0.1426	144	1505	1311
.	1162	0.7	0.1664	166	1480	1287
.	1162	0.8	0.1901	187	1456	1263
.	1162	0.9	0.2139	208	1433	1239
.	1162	1	0.2377	229	1410	1216
.	1162	1.1	0.2614	249	1388	1194
.	1162	1.2	0.2852	268	1366	1173
.	1162	1.3	0.309	287	1345	1151
.	1162	1.4	0.3327	306	1324	1131
.	1162	1.5	0.3565	324	1304	1111
.	1162	1.6	0.3803	342	1284	1091
.	1162	1.7	0.404	359	1265	1072
.	1162	1.8	0.4278	376	1246	1053
.	1162	1.9	0.4516	392	1228	1035
.	1162	2	0.4753	408	1210	1017

Input units are thousands and kg - output in tonnes

Table 9.1.15. Megrim (L. whiffiagonis) in Divisions VIIIc and IXa. Single option prediction: Detail Tables.

MFDP version 1a
Run: meg89
Time and date: 10:07 12/05/2007
Fbar age range: 2-4

Year:	2007	F multiplier:	1	Fbar:	0.2377				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0.0353	128	8	4052	252	1378	86	1378	86
2	0.1513	311	27	2435	208	2192	187	2192	187
3	0.2911	474	54	2059	235	2059	235	2059	235
4	0.2705	273	39	1263	182	1263	182	1263	182
5	0.3003	182	31	770	129	770	129	770	129
6	0.2769	108	23	490	103	490	103	490	103
7	0.2769	109	40	495	180	495	180	495	180
Total		1583	221	11564	1289	8646	1102	8646	1102

Year:	2008	F multiplier:	1	Fbar:	0.2377				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0.0353	128	8	4052	252	1378	86	1378	86
2	0.1513	409	35	3202	274	2882	246	2882	246
3	0.2911	394	45	1714	196	1714	196	1714	196
4	0.2705	272	39	1260	181	1260	181	1260	181
5	0.3003	186	31	789	132	789	132	789	132
6	0.2769	103	22	467	98	467	98	467	98
7	0.2769	135	49	611	223	611	223	611	223
Total		1626	229	12095	1355	9101	1162	9101	1162

Year:	2009	F multiplier:	1	Fbar:	0.2377				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0.0353	128	8	4052	252	1378	86	1378	86
2	0.1513	409	35	3202	274	2882	246	2882	246
3	0.2911	518	59	2254	257	2254	257	2254	257
4	0.2705	226	33	1049	151	1049	151	1049	151
5	0.3003	186	31	787	132	787	132	787	132
6	0.2769	105	22	478	101	478	101	478	101
7	0.2769	147	54	669	244	669	244	669	244
Total		1720	242	12491	1410	9497	1216	9497	1216

Input units are thousands and kg - output in tonnes

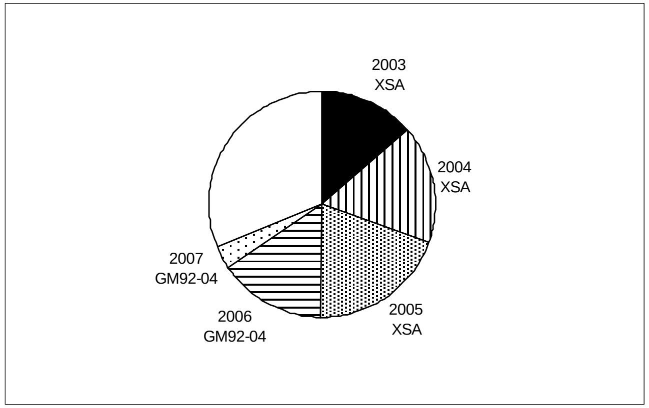
Table 9.1.16 **Megrim (L. whiffiagonis) in Divisions VIIIc and IXa**
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class			2003	2004	2005	2006	2007
Stock No. (thousands)			3413	3772	3075	4052	4052
of	1 year-olds						
Source			XSA	XSA	XSA	GM92-04	GM92-04
Status Quo F:							
% in	2007	landings	17.6	24.3	12.2	3.6	-
% in	2008		13.5	17.0	19.7	15.3	3.5
% in	2007	SSB	16.5	21.3	17.0	7.8	-
% in	2008	SSB	11.4	15.6	16.9	21.2	7.4
% in	2009	SSB	8.3	10.8	12.4	21.1	20.2

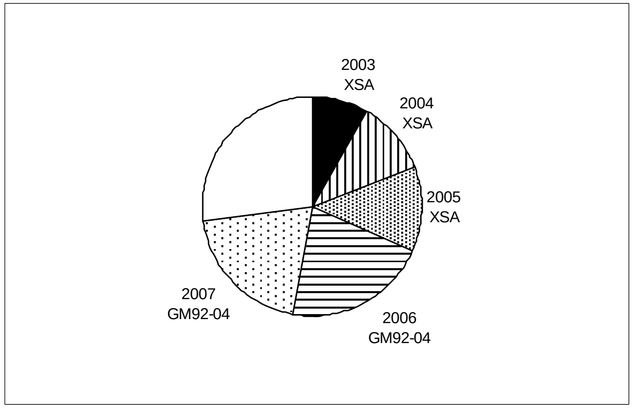
GM : geometric mean recruitment

Megrim (L. whiffiagonis) in Divisions VIIIc and IXa : Year-class % contribution to

a) 2008 landings



b) 2009 SSB



XSA	XSA	XSA	GM92-04	GM92-04
2003	2004	2005	2006	2007

Table 9.1.17. Megrim (L. whiffiagonis) in Divisions VIIIc and IXa, yield per recruit results.

MFYPR version 2a

Run: meg89

Time and date: 10:15 12/05/2007

Yield per results

FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0.0	0.0000	0.0000	0.0000	5.5167	1.0455	4.7748	0.9975	4.7748	0.9975
0.1	0.0238	0.0956	0.0202	5.0407	0.8937	4.2991	0.8457	4.2991	0.8457
0.2	0.0475	0.1705	0.0342	4.6679	0.7781	3.9266	0.7302	3.9266	0.7302
0.3	0.0713	0.2308	0.0441	4.3679	0.6878	3.6269	0.6399	3.6269	0.6399
0.4	0.0951	0.2805	0.0512	4.1212	0.6158	3.3805	0.5679	3.3805	0.5679
0.5	0.1188	0.3221	0.0563	3.9147	0.5573	3.1743	0.5094	3.1743	0.5094
0.6	0.1426	0.3575	0.0600	3.7393	0.5092	2.9991	0.4613	2.9991	0.4613
0.7	0.1664	0.3881	0.0627	3.5883	0.4690	2.8484	0.4212	2.8484	0.4212
0.8	0.1901	0.4147	0.0647	3.4569	0.4352	2.7173	0.3874	2.7173	0.3874
0.9	0.2139	0.4381	0.0661	3.3415	0.4064	2.6022	0.3587	2.6022	0.3587
1.0	0.2377	0.4588	0.0671	3.2393	0.3817	2.5003	0.3340	2.5003	0.3340
1.1	0.2614	0.4773	0.0678	3.1481	0.3603	2.4094	0.3126	2.4094	0.3126
1.2	0.2852	0.4940	0.0682	3.0662	0.3417	2.3277	0.2940	2.3277	0.2940
1.3	0.3090	0.5091	0.0685	2.9921	0.3253	2.2539	0.2777	2.2539	0.2777
1.4	0.3327	0.5229	0.0687	2.9248	0.3109	2.1869	0.2633	2.1869	0.2633
1.5	0.3565	0.5354	0.0688	2.8634	0.2981	2.1258	0.2505	2.1258	0.2505
1.6	0.3803	0.5470	0.0689	2.8071	0.2867	2.0697	0.2391	2.0697	0.2391
1.7	0.4040	0.5576	0.0688	2.7552	0.2765	2.0181	0.2289	2.0181	0.2289
1.8	0.4278	0.5675	0.0688	2.7072	0.2673	1.9704	0.2197	1.9704	0.2197
1.9	0.4516	0.5767	0.0687	2.6627	0.2589	1.9262	0.2114	1.9262	0.2114
2.0	0.4753	0.5852	0.0686	2.6213	0.2513	1.8851	0.2038	1.8851	0.2038

Reference point	F multiplier	Absolute F
Fbar(2-4)	1	0.2377
FMax	1.6001	0.3803
F0.1	0.6799	0.1616
F35%SPR	0.9369	0.2227

Weights in kilograms

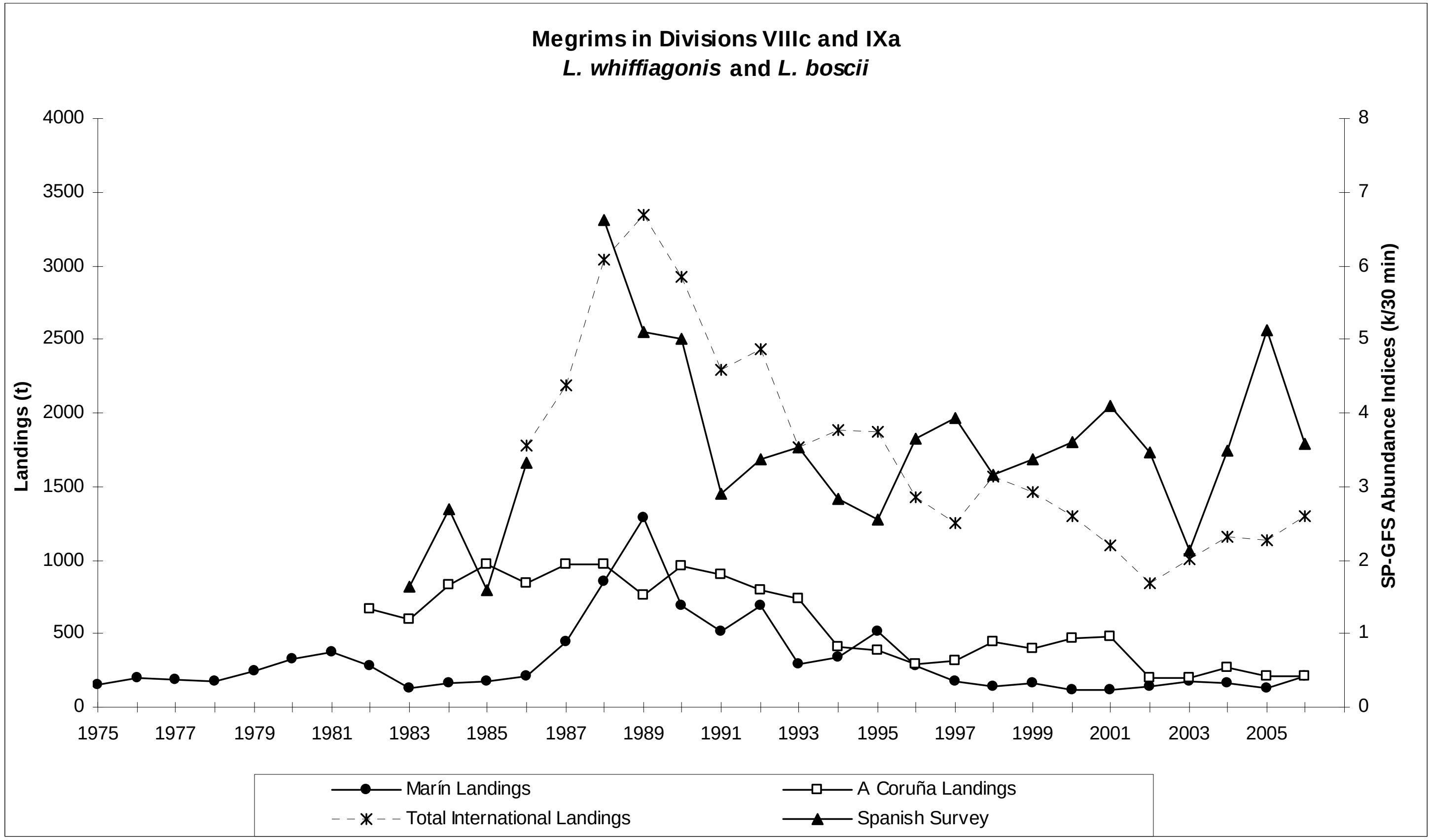


Figure 9.1.1 Historical landings and abundance indices of Spanish survey of megrims (both species combined).

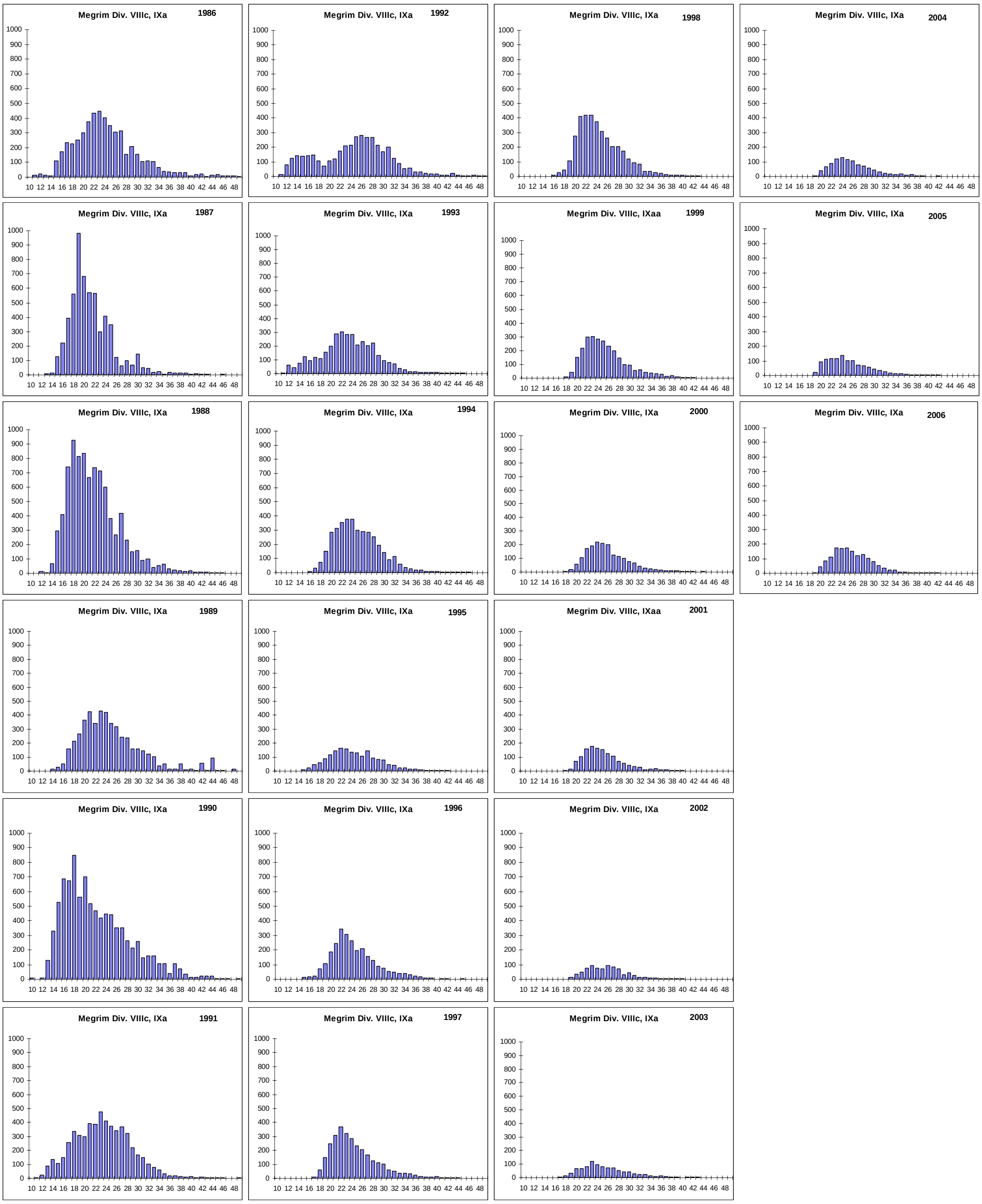


Figure 9.1.2 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa, Annual length compositions of landings ('000)

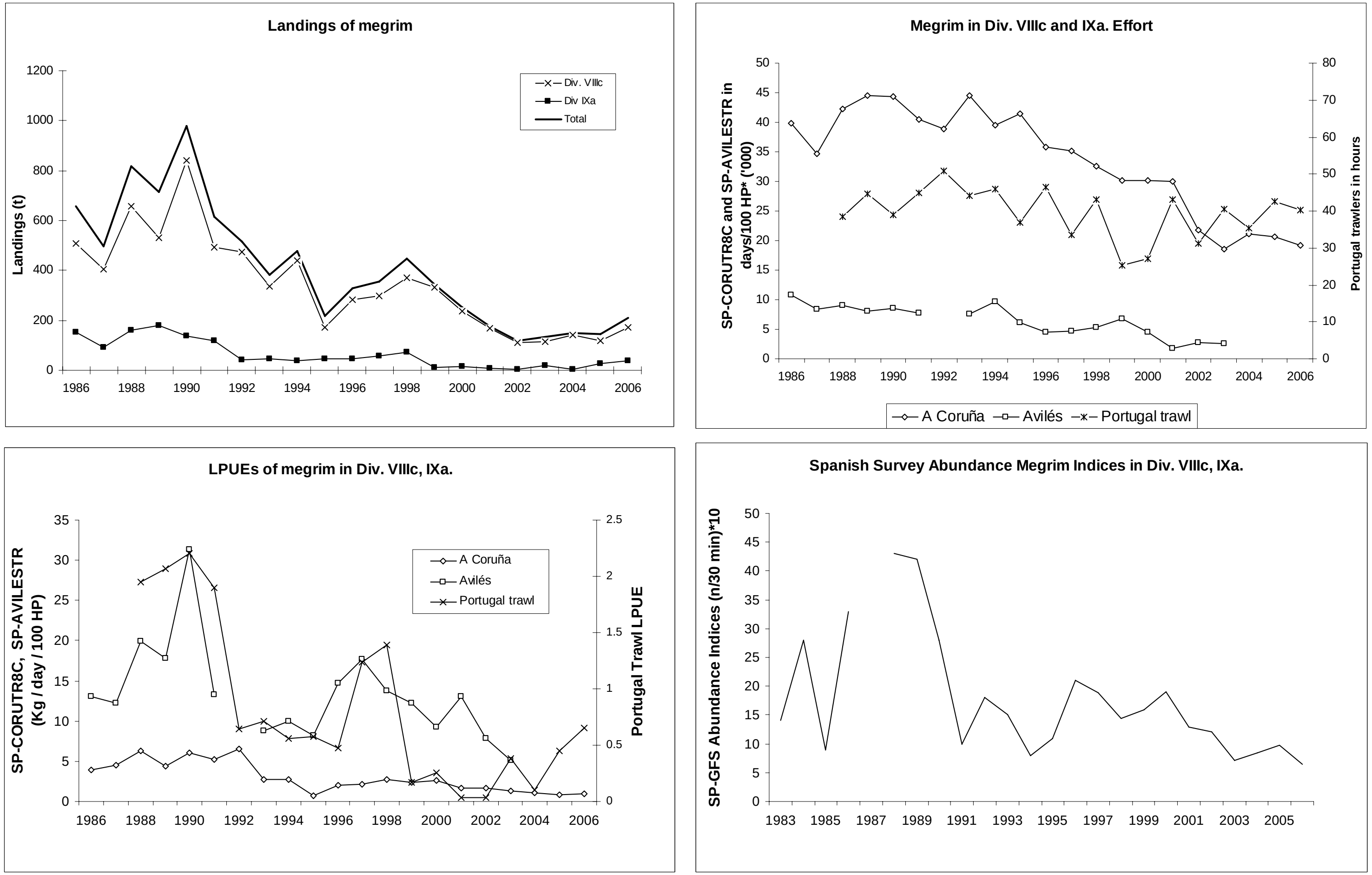
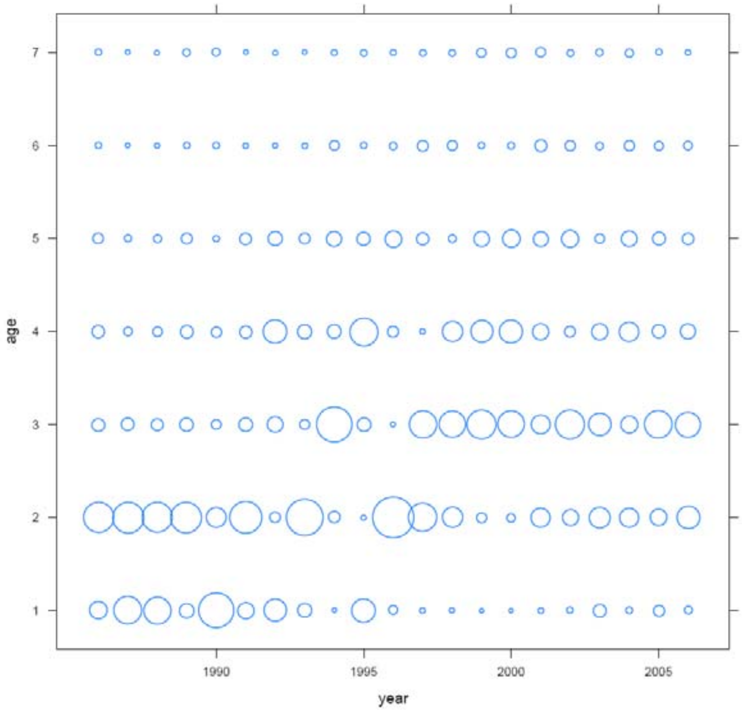


Figure 9.1.3 Megrim (*L.whiffiagonis*) in Divisions VIIIc, IXa. Landings (t), Efforts, LPUEs and Abundance Indices.

Catch proportions at age using FLEDA



Standardized catch proportions at age using FLEDA (black bubble means < 0)

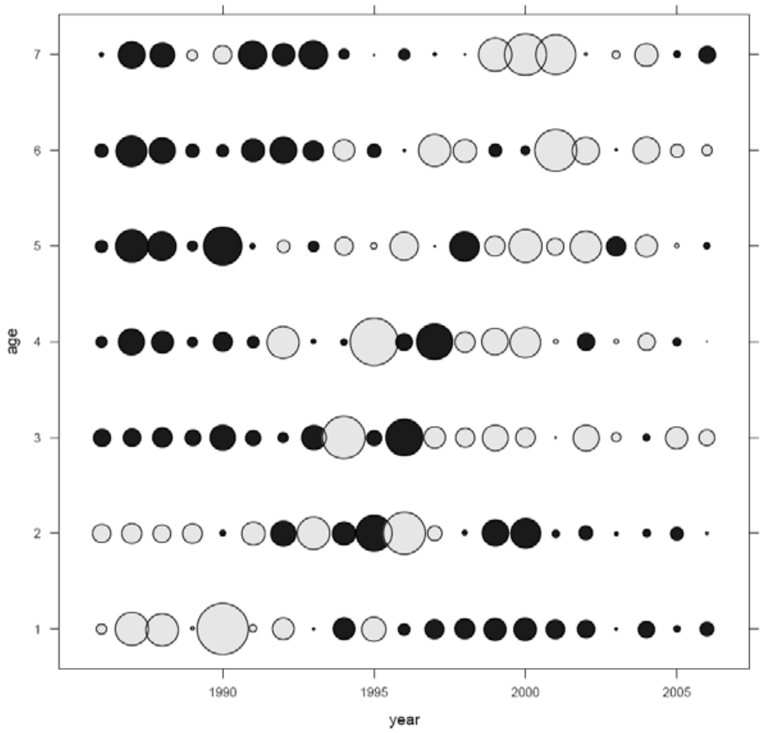


Figure 9.1.4. Megrim (L. Whiffiagonis) in Divisions VIIIc & IXa.

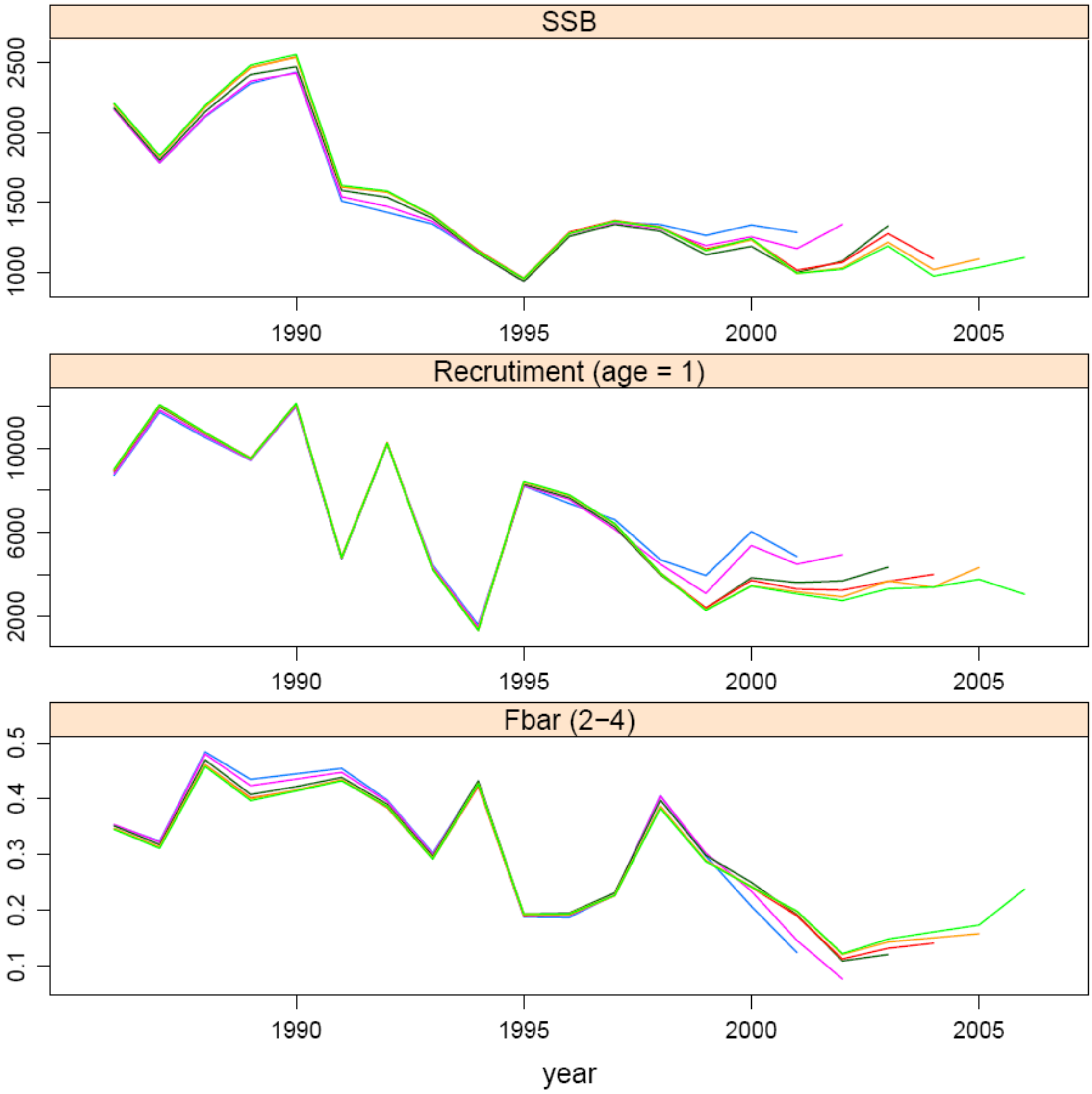


Figure 9.1.5. Megrim (L.Whiffiagonis) in Divisions VIIIc & IXa. Retrospective analysis from FLXSA

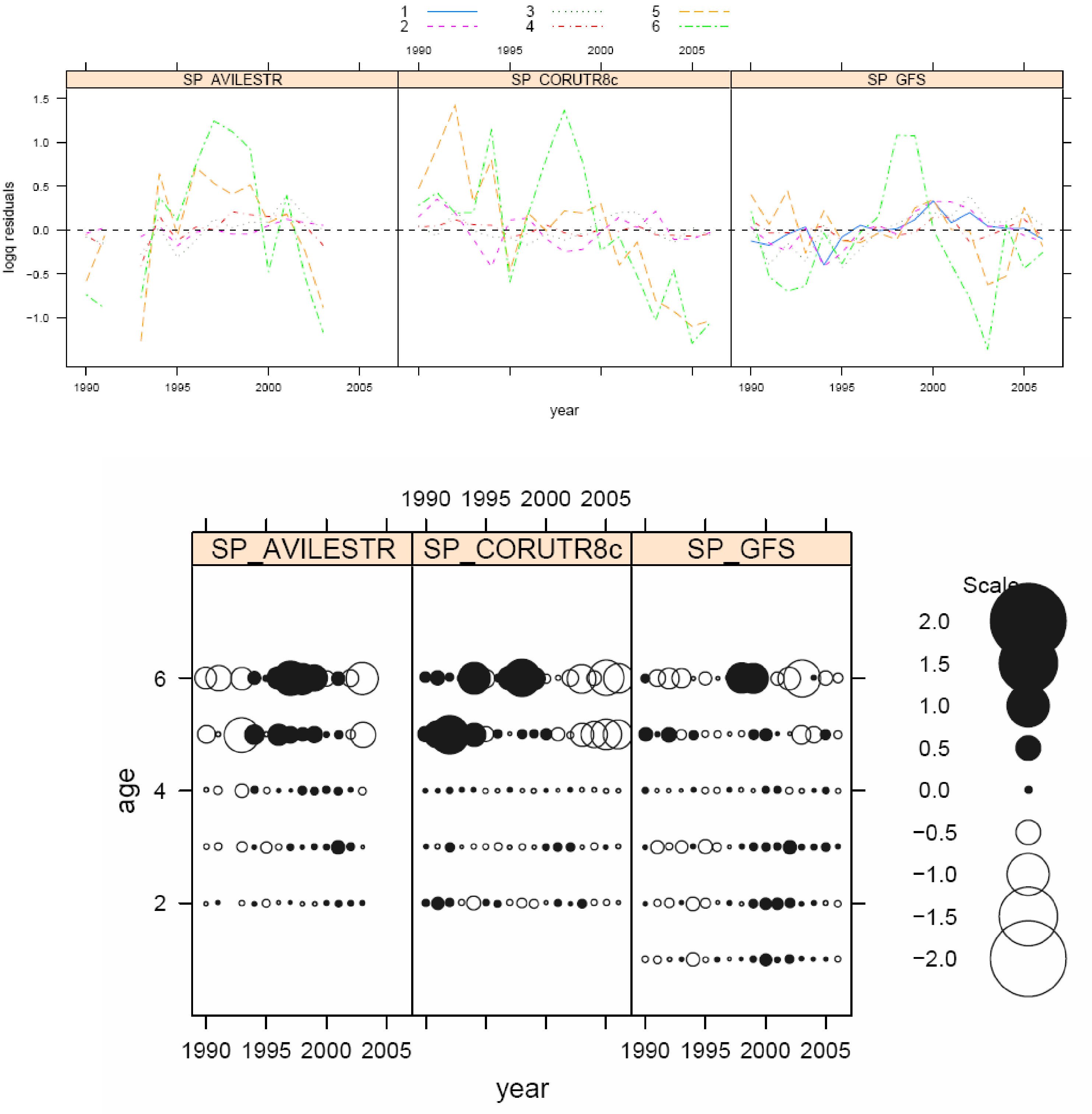


Figure 9.1.6. Megrim (L. Whiffiagonis) in Div VIIIc & IXa. Log catchability residuals from FLXSA from F

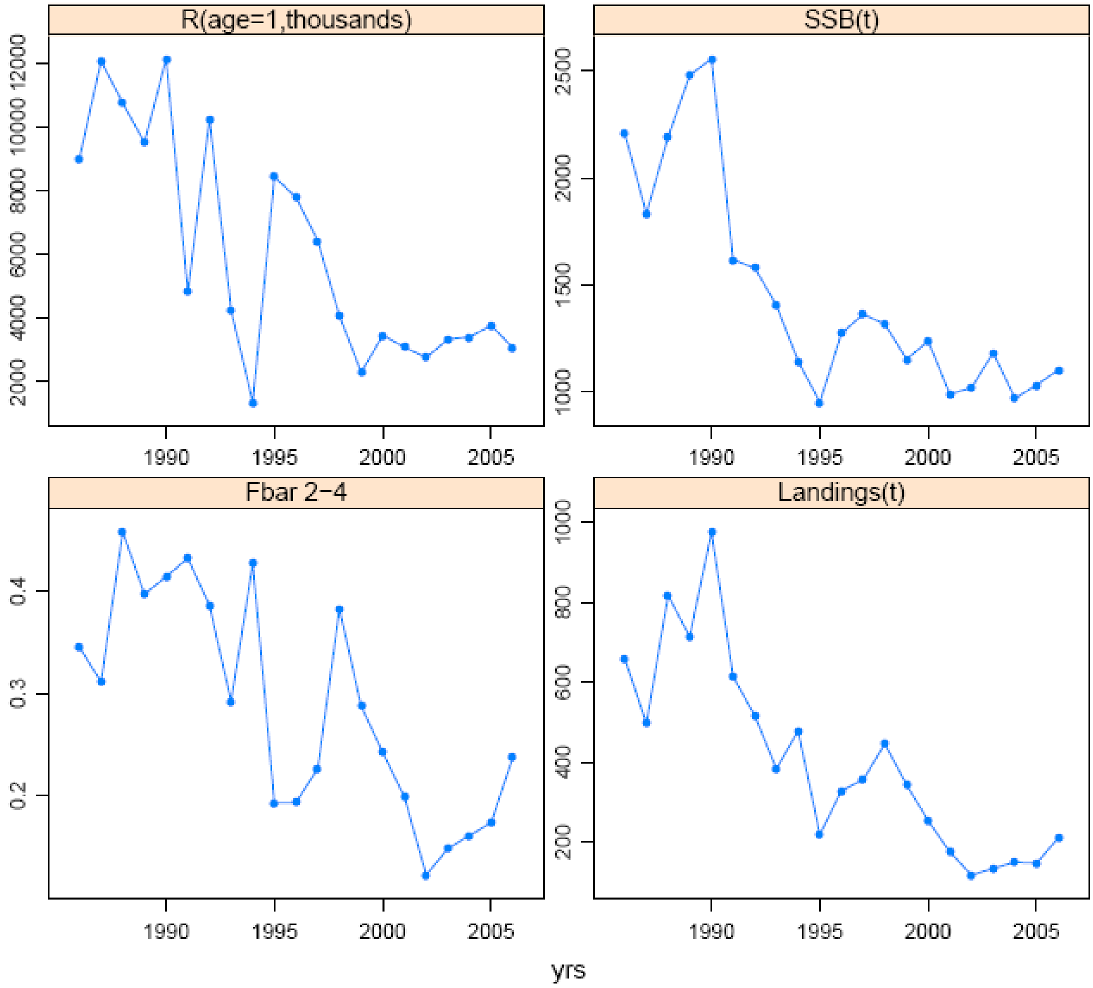
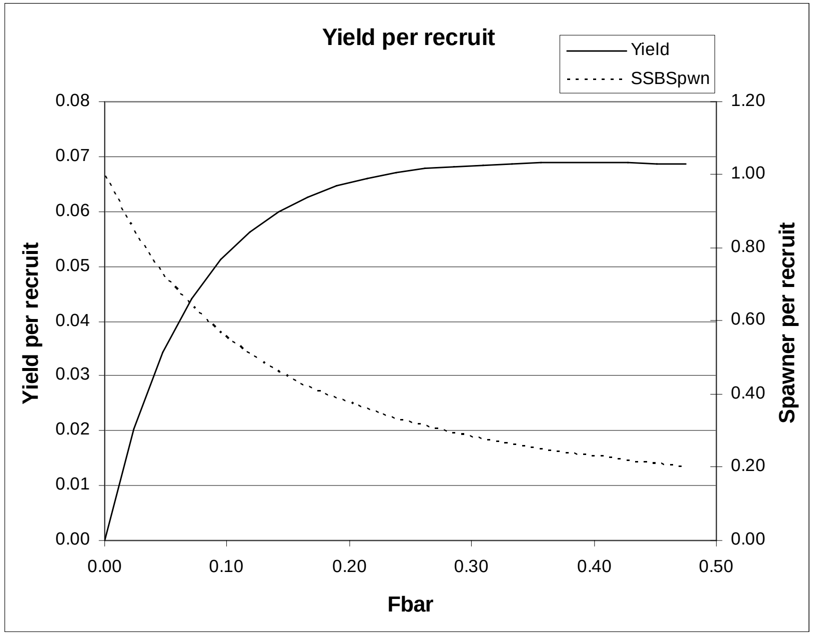
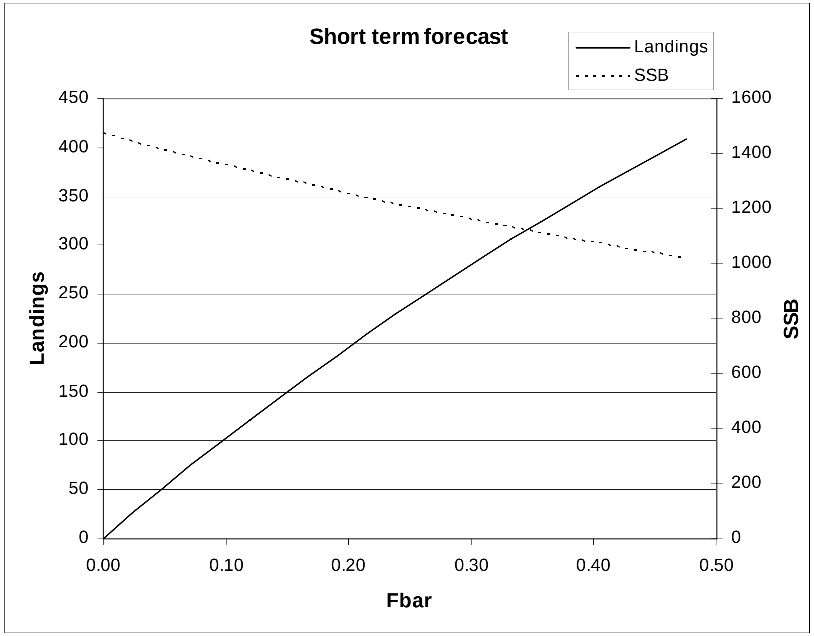


Figure 9.1.7. Megrim (L. Whiffiagonis) in Div VIIIc and IXa. Summary plot of landings and results from FLXSA





MFYPR version 2a
Run: meg89
Time and date: 10:15 12/05/2007

Reference point	F multiplier	Absolute F
Fbar(2-4)	1.0000	0.2377
FMax	1.6001	0.3803
F0.1	0.6799	0.1616
F35%SPR	0.9369	0.2227

Weights in kilograms

MFDP version 1a
Run: meg89
Megrim (L. whiffiagonis.) in Divisions VIIIc and IXa
Time and date: 10:07 12/05/2007
Fbar age range: 2-4

Input units are thousands and kg - output in tonnes

Figure 9.1.8. Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa, forecast summary

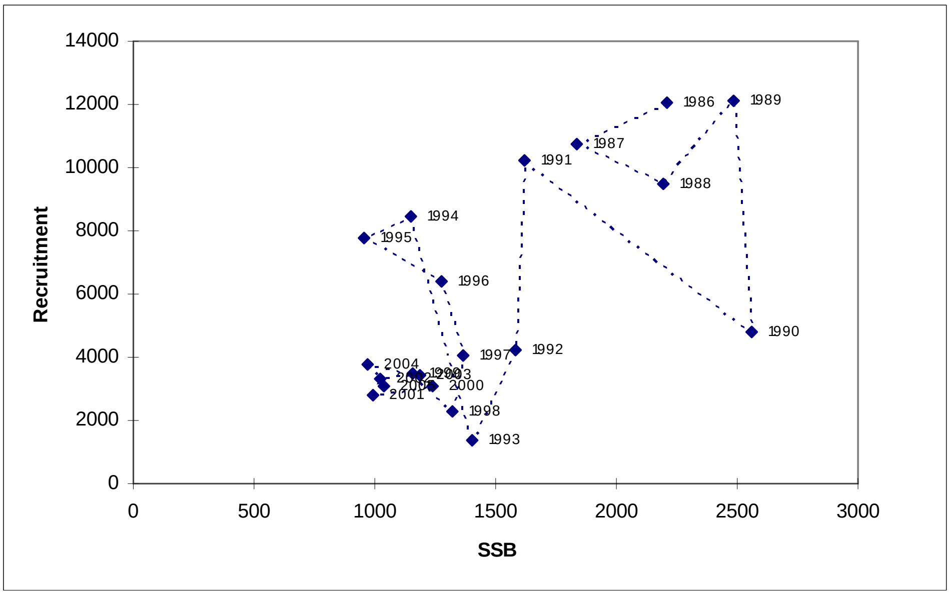


Figure 9.1.9. Megrim (L. whiffiagonis) in Divisions VIIIc and IXa. SSB-Recruitment plot.

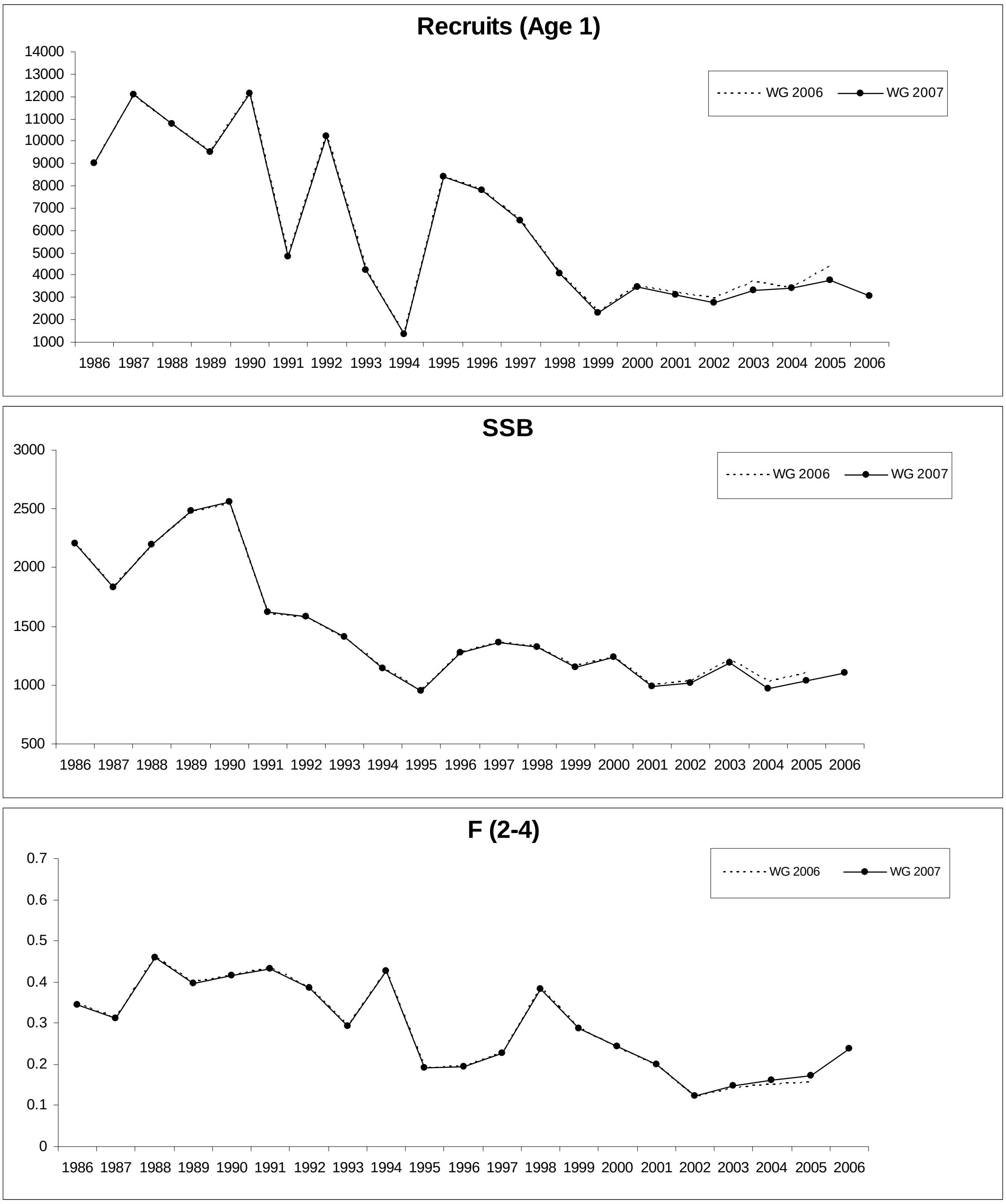


Figure 9.1.10. Megrim (*L. whiffiagonis*) in Div. VIIIc, IXa. Recruits, SSB and F estimates from WG06 and WG07

9.2 Four-spot megrim (*Lepidorhombus boscii*)

9.2.1 General

See general section for both species.

9.2.2 Data

9.2.2.1 Commercial catches and discards

The estimates of four-spot megrim international landings for the period 1986 to 2006 used by the WG are given in Table 9.2.1. As in previous assessments, Portuguese and Spanish landings of four-spot megrim were estimated using the relative abundances of the two species of megrim in the sampled landings.

Landings reached a peak of 2630 t in 1989 and have generally declined since then to their lowest value of 720 t in 2002. There has again been some increase of landings in the last few years. Total estimated international landings in Divisions VIIIc and IXa were 1010 t in 2004, 980 t in 2005 and 1090 t in 2006. Landings in 2006 are lower than predicted in last year's assessment (prediction was 1180 t *at status quo* F).

Discards data are available for Spanish trawlers in some years. Annual discards of four-spot megrim are estimated to be around 140 t to 520 t along the whole time series. Discards in number represent between 40-60% of the total catch. Discards data are not used in this assessment due to the lack of data in some years of the series. Discard / Total Catch ratio and CV are showed in the table below:

Spanish Discard/Total Catch ratio										
Year	1993	1994	1997	1999	2000	2001	2003	2004	2005	2006
Weight Ratio	0.27	0.3	0.28	0.24	0.33	0.13	0.21	0.3	0.3	0.27
CV	42.5	23.2	11.2	14.4	16.5	12.6	10.2	23.1	24.0	48.4
Number Ratio	0.61	0.60	0.62	0.59	0.60	0.40	0.49	0.56 *	0.56	0.42

* Modified in 2005 due to revision in the length data

9.2.2.2 Biological sampling

Annual length compositions of total landings are given in Figure 9.2.1 for the period 1986-2006. Length distributions were available for Spanish and Portuguese landings since 1986 and 1998, respectively. There has been a decrease of small fish (under 15 cm) landed since 1994. This change is considered to have resulted from stricter enforcement of the minimum landing size (20 cm) in Divisions VIIIc and IXa, as well as a mesh size increase regulation in year 2000. Table 9.2.2 shows the length distribution by fleet and country for 2006.

The sampling levels for both species are given in Table 1.3.

Mean length and weights in landings since 1990 are shown in the table below.

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Mean length (cm)	23.1	23.5	23.8	24.2	23.3	22.3	23	23.3	23.3	23.5	24.2	23.8	23.1	22.9	22.7	22.7	22.9
Mean weight (g)	116	118	122	128	111	96	107	112	109	113	121	114	105	101	98	97	99

Age compositions for 1990–2006 were based on Spanish annual ALKs. Age compositions for 1986–1989 were based on a survey ALK for 1986 combined with an annual ALK for 1990.

Due to very low landings in the age 0 group over the whole period (see Table 9.2.3), the values of these landings were not used in the assessment.

Weight-at-age of landings (given in Table 9.2.4) were also used as weight-at-age in the stock. There appears to have been some recovery from the very low weight-at-age values found last year for the older ages.

The natural mortality rate was set to 0.2, as it is usually done, and was assumed to be constant over all ages and years. This is the same value used for *L. whiffiagonis* in Subarea VII and Divisions VIIIabd, VIIIc and IXa. The same sex-combined maturity ogive (BIOSDEF, 1998) as used last year for the whole period is again used this year:

AGE	0	1	2	3	4	5 +
Prop. mature	0.0	0.55	0.86	0.97	0.99	1

9.2.2.3 Abundance indices from surveys

Portuguese and Spanish survey indices are summarised in Table 9.2.5. Two Portuguese surveys, named ``Crustacean´´ (PT-CTS) and ``October´´ (PT-GFS) surveys, provide indices for 2006. As mentioned in reports from previous years, a different vessel and gear were used in the October 2003 and 2004 surveys and the Crustacean survey had many operational problems in 2004, so its indices for that year can not be used. Hence, it is difficult at present to draw meaningful conclusions from the high indices found in 2003 and 2004. The Crustacean survey indicates very low abundance in 2006 (the lowest value in the 9 year series)

Total biomass, abundance and recruitment indices from the Spanish Ground-Fish Survey (SP-GPS) are also presented in Table 9.2.5. Total biomass indices from this survey had generally remained stable after a maximum level in 1988. A very low value was obtained in 2003. This was followed by a high value in 2004 and an even higher one (the highest in the series) in 2005. The very high index in 2005 applies to all ages and not just the recruitment ages (see Figure 9.2.2 and Table 9.2.6, which display abundance indices by age). Total biomass and abundance indices for 2006 are on the high side, closer to the average historic values. However, the recruitment index is very low. As was done in previous years, the 2003 index was excluded from the assessment, as it was felt to be too much in contradiction with the rest of the time series.

9.2.2.4 Commercial catch-effort data

Landed numbers-at-age per unit effort and effort data were available for commercial Spanish trawl fleets based in A Coruña (SP-CORUTR8c, for years 1986-2006) and Avilés (SP-AVILESTR, for years 1986–2003), fishing in ICES Division VIIIc (see Table 9.2.6). These fleets operate in different areas, each covering only a small part of the distribution of the species, which may partly explain differences between patterns from these fleets and those from the Spanish survey in some years. Furthermore, commercial catches are mostly composed of ages 3 and 4, while the Spanish survey catches mostly fish of ages 1 and 2.

Table 9.2.7 displays landings (in weight), fishing effort and LPUE for the two Spanish trawl fleets just mentioned as well as for the Portuguese trawl fleet fishing in Division IXa for the period 1988–2006 (see also Figure 9.2.3). The fishing effort of the Portuguese fleet was estimated from a sample of logbooks from sea trips where megrim was present in the landings. The LPUE series of the two Spanish fleets show conflicting trends until 1998, after which they show more agreement.

Commercial fleets used in the assessment to tune the model

A Coruña trawl commercial fleet (SP-CORUTR8c) was used for tuning. The effort of this fleet had been generally stable until year 1993, after which a steady declined started. The lowest effort value was reached in 2003, when restrictions imposed on fishing activity due to the Prestige oil spill influenced effort. Figure 9.2.3 depicts the time series of effort and LPUE values for this fleet. Due to the increased use of HVO gear (which catches very little megrim) by this fleet in recent years, estimated effort values for recent years are not directly comparable with those from earlier years. Hence, as done in the last 2 years, only catch and effort data up to year1999 from this tuning fleet are presently used in the assessment.

Commercial fleets not used in the assessment to tune the model

The effort of the Avilés trawl fleet (SP-AVILESTR) has been decreasing along the whole period, reaching very low levels in recent years.

The effort of the Portuguese trawl fleet appears to fluctuate within stable bounds, with the lowest values corresponding to 1999 and 2000. It shows a slightly declining trend from the 1990s until these two lowest years and a slightly increasing one since then.

The LPUE series from the Avilés trawl fleet (SP-AVILESTR) shows a generally upwards trend until 1995 and a decreasing one from then. The LPUE of the Portuguese trawl fleet has generally declined since 1992, with an increase in recent years.

9.2.3 Assessment

For this stock, this year's assessment is an update (so no exploratory XSA runs were performed). Hence, the assessment has been performed using the same settings used in the last 2 years. Details follow.

9.2.3.1 Input data

The age range considered was 0 to 7+. As in previous years, due to the very low and irregular landings of age 0 individuals, values corresponding to age 0 in the catch-at-age matrix (displayed in Table 9.2.3) were replaced by zeros.

Two fleets were used for tuning. Landings-at-age, for ages 3 and older, and effort data from the commercial A Coruña fleet SP-CORUTR8c were used for the period 1986-1999. Catch and effort data from the Spanish survey (SP-GFS) were used for all ages from 1988 to 2006, with the exception of year 2003.

Model

Data screening

The FLEDA package of FLR was used to explore the quality of the input data. Figure 9.2.4 shows catch proportions at age, clearly indicating that the bulk of the landings corresponds to ages 2 to 4. The standardized catch proportions at age figure highlights that the proportion of age 3 fish in the 2006 landings is above the average proportion computed throughout the time series of landings.

The internal consistency of each abundance index used to tune the assessment model was examined by checking correlations between ages following cohorts. The results, displayed in Table 9.2.8, indicate that both indices are good in this respect, although the correlations between age 0 and older ages in the cohort is not high.

Final XSA run

Settings for this year's assessment were the same ones used last year. Details are in the table:

		2006 WG		2007 WG	
Tuning fleets	SP-CORUTR8c	Years: 86-99	Ages: 3-6	Years: 86-99	Ages: 3-6
	SP-GFS	Years: 88-05 (2003 not included)	Ages: 0-6	Years: 88-06 (2003 not included)	Ages: 0-6
Taper			3 over 20		3 over 20
Tuning range			20		21
Ages catch dep. Stock size			0-1-2		0-1-2
Q plateau			5		5
F shrinkage s.e.			1.5		1.5
year range for F shrinkage			5		5
age range for F shrinkage			3		3

The retrospective analysis has shown a trend of underestimating F and overestimating SSB in recent years (Figure 9.2.5).

9.2.3.2 Assessment results

Diagnostics from the XSA final run are presented in Table 9.2.9 and log catchability residuals plotted in Figure 9.2.6. Diagnostics and residuals are very similar to those found in last year's assessment. Positive log catchability residuals are obtained for the survey indices in 2005, in line with the high values registered by the survey in that year. Small negative log catchability residuals are obtained for the survey indices in 2006.

Since the commercial fleet data are stopped in 1999, they do not intervene directly in the estimates of survivors at the end of 2006. Hence, survivor estimates are given by the survey and P-shrinkage for ages 0 to 2, and only by the survey for ages 3 to 6. F-shrinkage gets very low weight, due to the large s.e. value set for it (1.5).

Table 9.2.10 presents the fishing mortality-at-age estimates. Fbar (=$F_{2\text{-}4}$) in 2006 is estimated to be 0.29. The estimated value of Fbar for 2005 is 0.28, which is a bit higher than the value estimated in last year's assessment (0.26).

Population numbers-at-age estimates are presented in Table 9.2.11.

9.2.3.3 Year class strength and recruitment estimations

The 2004 year class estimate is 28 million individuals, obtained by averaging estimates coming from the Spanish survey tuning data (80% of weight), P-shrinkage (18% weight) and F-shrinkage (2% weight).

The 2005 year class estimate is 28 million individuals, estimated from the Spanish survey (70% of weight), P-shrinkage (28% weight) and F-shrinkage (2% weight).

The 2006 year class estimate is 20 million individuals, obtained by averaging a lower value coming from the Spanish survey (42% weight) and a higher one from P-shrinkage (58% weight).

As has been usually done, estimates of recruitment for years 1986 to 1989, when age compositions were based on combined ALKs, were excluded from the estimation of the 2007 and subsequent year classes. The geometric mean of estimated recruitments for the period 1990-2004, GM $_{90\text{-}04}$ (=25 million) was assumed as the recruitment for 2007 and subsequent years. This follows the standard practice of excluding the last two years from the GM computation. From Table 9.2.16, we see that replacing year classes of 2005-2006 by the GM would imply that 35% of the projected yield for 2008 and 69% of the SSB projected for 2009 would be arising from the GM value.

Working Group estimates of year-class strength used for prediction can be summarised as follows:

Recruitment at age 0:

YEAR CLASS	THOUSAND	BASIS	SURVEY	COMMERCIAL	SHRINKAGE
2004	28 438	XSA	80%	-	20%
2005	28 137	XSA	70%	-	30%
2006	20 178	XSA	42%	-	58%
2007	24 877	$GM_{90\text{-}04}$			

9.2.3.4 Historic trends in biomass, fishing mortality, and recruitment

Estimated fishing mortality and population numbers-at-age from the XSA run are given in Tables 9.2.10 and 9.2.11. Further results, including SSB estimates, are summarised in Table 9.2.12 and Figure 9.2.7.

SSB decreased from 7 300 t in 1988 to 3 600 t in 2001, the lowest value in the series, and has since experienced some increase. The 2006 SSB is estimated to be 5 100 t.

Recruitment has fluctuated around 25 million fish from 1990 to 2001, with the exception of the very weak 1993 and 1998 year classes (with 12 and 10 million individuals, respectively). From 2002 to 2005, recruitment has been above this average level, but it is estimated to have dropped to 20 million in 2006.

Estimates of fishing mortality values show two different periods: an initial one with higher values from 1989 to 1995 and, following a sharp decrease in 1996, a second period stabilised at a lower level.

9.2.4 Catch options and prognosis

For the catch forecast, population numbers in 2007 for ages 1 and older were taken from the final XSA output. Stock size at age 0 in years 2007-2009 was assumed to be GM_{90-04} (25 million). The exploitation pattern used (F *status quo*) was the unscaled average of 2004-2006, which gives a Fbar value of 0.31 (compared to 0.27, the unscaled averaged of 2003-2005, used in last year's Working Group). Mean weights in the catch and in the stock were computed as averages of 2004-2006 and are a bit lower than the ones assumed last year (averages of 2003-2005).

9.2.4.1 Short-term projections

The input data for deterministic short-term projections are given in Table 9.2.13.

Table 9.2.14 gives the management options for 2008, and their consequences in terms of projected landings and stock biomass. Figure 9.2.8 (right panel) plots short-term yield and SSB versus Fbar.

The detailed output by age group, assuming F *status quo* for 2007-2009, is given in Table 9.2.15. Under this scenario, projected landings for 2007 and 2008 are 1260 and 1200 t, respectively. Actual landings for 2006 were 1090 t.

Under F *status quo* for 2007 and 2008, projected SSB values for 2008 and 2009 are 4800 t and 4600 t, respectively. Hence, SSB would decrease from the 5100 t value estimated for 2006, returning in 2009 to the level currently estimated for 2005.

The contributions of recent year classes to the predicted landings in 2008 and SSB in 2009 are presented in Table 9.2.16. The year classes for which GM_{90-04} recruitment is assumed contribute less than 1% to landings in 2008 and around 17% and 37% to the SSB at the beginning of 2008 and 2009, respectively.

9.2.4.2 Yield and biomass per recruit analysis

The input data for this analysis are given in Table 9.2.13. Results are in Table 9.2.17. The left panel of Figure 9.2.8 plots yield-per-recruit and SSB-per-recruit versus Fbar.

Under F s*tatus quo* (Fbar=0.31), yield-per-recruit is 0.0423 kg and SSB-per-recruit is 0.1783 kg. In last year's assessment, F *status quo* was 0.27 and a yield-per-recruit of 0.0425 kg and a SSB-per-recruit of 0.1938 kg were obtained.

Assuming GM_{90-04} recruitment of 24.9 million, the equilibrium yield would be around 1050 t with a SSB value of 4400 t.

F_{max} is not well defined for this stock. Possible long-term reference points are $F_{0.1}$ (=0.18) and $F_{35\%SPR}$ (=0.27), both below the current F s*tatus quo*. Assuming GM_{90-04} (=24.9 million) and $F_{0.1}$ (=0.18), equilibrium yield would be around 950 t and SSB 6100 t.

In last year's assessment, it was obtained that $F_{0.1}$=0.17 and $F_{35\%SPR}$=0.26, so there has been minimal change in these reference points.

9.2.4.3 Biological reference points

There are no biological reference points for this stock. The table below summarizes the history of limit point considerations for this stock.

	ACFM 1998	WG-1999	WG-2000	ACFM 2000	WG-2002	ACFM 2003	WG-2003
$\mathbf{F}_{lim}$	0.25 ($\mathbf{F}_{loss}$ WG98)	No proposal	0.40 ($\mathbf{F}_{loss}$)		Not defined		
$\mathbf{F}_{pa}$	0.20 ($\mathbf{F}_{lim}\, e^{-1.645*\sigma}$)	No proposal	0.30 ($\mathbf{F}_{lim}\, e^{-1.645*\sigma}$)	Not adopted	0.31 ($\mathbf{F}_{med}$)	Not adopted	No proposal
$\mathbf{B}_{lim}$	3 400 t ($\mathbf{B}_{loss}$,=B_{96} WG98)	4 700 t ($\mathbf{B}_{loss}$=B_{96} WG99) *			Not defined		
$\mathbf{B}_{pa}$	5 000 t (B_{lim} × 1.4)	6 500 t	4 700 t ($\mathbf{B}_{loss}$,=B_{95})	Not adopted	5 000 t ($\mathbf{B}_{loss}$=B_{95})	Not adopted	No proposal

*** A new maturity ogive was used.**

Stock-recruitment data from before 1990 are not considered reliable. For the remaining years there is no evidence of reduced recruitment at the lower stock levels observed (see Figure 9.2.9)

At present, there is no new information to define biomass reference points B_{lim} and B_{pa} for this stock. B_{loss} is now estimated at 3600 t (2001 SSB). Two years ago there was an observed change in fishing exploitation pattern, which increased fishing mortality rates for older ages. This was repeated last year year but less so in the current year. The Working Group considers that fishing mortality reference points should not be proposed until a stabilisation of the exploitation pattern is clearly perceived.

9.2.5 Comments on the assessment

As this was an update assessment, everything has been performed using the same settings and specifications as in last the last two years. Details follow.

One commercial fleet (SP-CORUTR8c) and the Spanish survey (SP-GFS) were used for tuning. The SP-CORUTR8c fleet data used for tuning corresponds to ages 3 and older, which are not well represented in the survey. Only SP-CORUTR8c data up to year 1999 were used, as the increasing use of HVO trawl gear (targeting horse mackerel and with very few four-spot megrim catches) in the traditional Baca trawl fishery in recent years makes it difficult to compare effort values from recent years with those from earlier years.

The Spanish survey appears to provide good estimates for young and middle ages and covers most of the distribution areas of the stock. The indices for 2003 were not used for tuning due to the unusually low values obtained in that year, which are not in agreement with the high catches obtained by commercial fleets. Moreover, the high indices obtained by the Spanish survey in 2004 and 2005, are in contradiction with those low values detected in 2003. The 2006 indices from this survey are much closer to the historic average.

Comparison of this assessment with that from last year shows similar trends for F and SSB. However a shift in estimates of F (upwards) and SSB (downwards), especially in recent years, is apparent (Figure 9.2.10). Recruitment estimates for recent years have changed a bit, with the biggest downwards revision corresponding to recruitment in 2005. The Spanish survey SP-GFS gets a strong weight in the estimates for this stock.

Four-spot megrim starts to contribute strongly to SSB at 2 years of age, with 37% of the predicted SSB in 2009 relying on year classes with recruitment assumed to be given by GM_{90-}

$_{04}$. The GM recruitment assumed for the predictions is taken over the period 1990-2004, to avoid using data from years based on a combined ALK.

The fact that discards data are not used in the assessment of this stock may modify the perception of its state. Discards data were not used in this assessment because of the lack of data in some years of the series. Discards in number represent between 40-60% of the total catch. Including discards would obviously produce a more real picture of fishing exploitation and stock dynamics. Nevertheless, the most important effect of discards inclusion would probably be the chance of shifts in short and medium term predictions.

9.2.6 Management considerations

This assessment indicates that SSB decreased between 1988 and 1997, and subsequently stabilised at low levels. There appears to be a slight increasing term starting from 2002 to 2007. Fishing at F_{04-06} (Fbar=0.31) during 2007 and 2008 could result in some biomass decrease from the 2006 value.

There is no evidence of reduced recruitment at low stock levels.

As with *L. whiffiagonis,* it should be noted that four-spot megrim (*L. boscii*) is essentially caught in mixed fisheries, and management measures applied to this species may have implications for other stocks.

Both species of megrim are subject to a common TAC, so the joint status of these species should be taken into account when formulating management advice. The estimated Fbar values for the two species display a correlation of only 0.32 over the 21 years analysed, hinting towards difficulties for joint management of the two species.

9.2.7 Combined Forecast for Megrims (*L. whiffiagonis and L. boscii*)

Figure 9.3.1 plots total international landings and estimated stock trends for both species of megrim in the same graph, in order to facilitate comparisons.

The two species of megrim are included in the landings from ICES Divisions VIIIc and IXa. Both are taken as by-catch in mixed bottom trawl fisheries. Assuming *status quo* F for both species in 2007 (Fbar=0.24 --scaled to 2006-- for *L. whiffiagonis* and Fbar=0.31 --unscaled-- for *L. boscii*), Figure 9.3.2 gives the combined predicted landings for 2008 and individual SSB for 2009, under different multiplying factors of their respective *status quo* F values. At *status quo* F for both species in 2008, predicted combined landings in 2008 are around 1 430 t and combined SSB in 2009 is 5800 t. The equilibrium combined yield at *status quo* F level for both species, would be around 1320 t with a combined SSB of 5750 t.

The combined projected values for the two species have been computed as the sum of the individual projected values obtained for each species under its assumed exploitation pattern. As usual, the exploitation pattern for each species has been assumed to remain constant during the forecast period.

A

Table 9.2.1. Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Total landings (t).

	Spain			Portugal	Total
Year	VIIIc	IXa	Total	IXa	VIIIc IXa
1986	799	197	996	128	1124
1987	995	586	1581	107	1688
1988	917	1099	2016	207	2223
1989	805	1548	2353	276	2629
1990	927	798	1725	220	1945
1991	841	634	1475	207	1682
1992	654	938	1592	324	1916
1993	744	419	1163	221	1384
1994	665	561	1227	176	1403
1995	685	826	1512	141	1652
1996	480	448	928	170	1098
1997	505	289	794	101	896
1998	725	284	1010	113	1123
1999	713	298	1011	114	1125
2000	674	225	899	142	1041
2001	629	177	807	124	931
2002	343	247	590	130	720
2003	393	314	707	169	876
2004	534	295	829	177	1006
2005	473	321	794	189	983
2006	542	348	891	201	1092

Table 9.2.2. Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa, Length compositions of landings in 2006 ('000 fish)

	Spain		Portugal		Total		
Length (cm)	Div. VIIIc	Div. IXa	Trawler	Artisanal	Spain	Portugal	Total
10							
11							
12		0			0		0
13	1				1		1
14	0			1	0	1	2
15	6	0	1	1	7	2	8
16	31	5	6	3	36	9	45
17	35	56	19	4	90	23	113
18	170	164	47	32	334	79	413
19	354	474	93	35	828	128	956
20	666	618	122	41	1283	163	1447
21	788	691	175	49	1479	225	1704
22	833	549	196	57	1382	252	1634
23	663	369	165	59	1032	224	1256
24	529	263	142	40	792	182	974
25	379	229	119	51	608	170	779
26	266	139	93	38	405	131	535
27	196	85	74	25	281	99	380
28	143	56	43	17	198	60	258
29	89	41	21	12	130	32	162
30	52	25	11	0	77	12	89
31	37	18	7	2	55	9	64
32	19	10	5	0	29	5	34
33	12	4	1	0	16	1	17
34	5	2	0	1	7	1	8
35	3	1	0		3	0	3
36	2	1	1		2	1	3
37	1		0		1	0	1
38	0				0		0
39	1	0			1		1
40	1				1		1
41	0			0	0	0	0
42			0			0	0
43	0				0		0
44							
45	0				0		0
46							
47			0			0	0
48							
49							
50+							
Total	5281	3799	1340	468	9080	1808	10888

Table 9.2.3 Four-spot megrim (*L. boscii*) in Divisions VIIIc, IXa. Catch numbers at age. Numbers*10*-3

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGE																					
* 0	(4)	(1)	(9)	(2)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
1	110	2283	1525	733	1444	1160	846	546	83	1421	397	35	45	38	45	167	190	367	392	123	34
2	3475	11580	10092	7140	5184	3679	2667	2334	2915	2205	2136	1244	1204	1161	655	1138	2389	2802	2515	2522	2735
3	3690	5073	5455	5392	1885	3328	4000	2096	4515	6138	1267	2870	4236	2781	1645	1251	2361	2873	3084	2995	4506
4	3940	3593	4779	5909	3829	1911	5179	3799	2268	5596	3814	744	2940	3908	2782	2393	743	1476	2439	1841	2153
5	1132	1344	2366	3479	2311	2650	2200	1151	1612	1056	1896	1624	698	1402	1849	1870	387	499	1128	1370	988
6	849	569	1161	1778	1383	1028	738	635	839	582	204	1066	829	235	785	937	236	447	279	779	252
+gp	229	141	463	630	803	479	67	278	446	280	551	443	349	488	838	357	359	142	337	393	219
TOTALNUM	13425	24583	25841	25061	16839	14235	15694	10839	12678	17278	10265	8026	10301	10013	8599	8149	6665	8606	10174	10023	10887
TONSLAND	1124	1688	2223	2629	1945	1682	1916	1384	1403	1652	1098	896	1123	1125	1041	931	720	876	1006	983	1092
SOPCOF %	100	100	100	100	100	99	103	99	100	97	100	102	100	101	101	101	100	101	101	101	101

* Age 0 was not used in the assessment

Table 9.2.4 Four-spot megrim (*L. boscii*) in Divisions VIIIc, IXa. Catch weights at age (kg).

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGE																					
1	0.022	0.036	0.039	0.043	0.028	0.033	0.032	0.023	0.033	0.043	0.038	0.032	0.033	0.036	0.035	0.042	0.042	0.043	0.040	0.049	0.034
2	0.046	0.053	0.057	0.066	0.065	0.073	0.073	0.074	0.069	0.066	0.062	0.056	0.063	0.070	0.080	0.069	0.071	0.071	0.066	0.060	0.07
3	0.065	0.071	0.079	0.090	0.106	0.117	0.110	0.118	0.092	0.092	0.074	0.080	0.086	0.090	0.086	0.091	0.103	0.094	0.086	0.087	0.094
4	0.095	0.094	0.104	0.112	0.141	0.125	0.125	0.143	0.121	0.100	0.112	0.097	0.112	0.101	0.100	0.106	0.128	0.125	0.111	0.111	0.107
5	0.132	0.127	0.139	0.145	0.156	0.166	0.161	0.178	0.153	0.146	0.137	0.126	0.142	0.147	0.132	0.123	0.170	0.142	0.132	0.123	0.138
6	0.160	0.152	0.168	0.167	0.184	0.191	0.226	0.220	0.181	0.169	0.213	0.180	0.180	0.197	0.170	0.166	0.210	0.201	0.175	0.133	0.179
+gp	0.265	0.242	0.281	0.276	0.273	0.264	0.359	0.297	0.245	0.256	0.232	0.252	0.294	0.268	0.228	0.255	0.247	0.247	0.235	0.198	0.236
SOPCOFAC	1.0015	1.0017	1.0028	1.0015	0.9968	0.9907	1.0339	0.9865	1.0011	0.9719	0.9987	1.0174	1.0010	1.0128	1.0091	1.0072	0.9999	1.0115	1.0115	1.0111	1.0114

Table 9.2.5 Four-spot megrim (*L. boscii*) Divisions VIIIc, IXa.
Abundance and Recruitment indices of Portuguese and Spanish surveys.

Biomass Index

	Portugal (k/h)			Spain (k/30 min)	
	October	Crustacean	SE	Mean	SE
1983				0.67	0.13
1984				0.76	0.08
1985				0.71	0.11
1986				1.68	0.28
1987				ns	-
1988				3.10	0.33
1989				1.97	0.28
1990	0.26			1.93	0.14
1991	0.18			1.67	0.17
1992	0.14			1.98	0.20
1993	0.11			2.07	0.25
1994	0.16			1.82	0.23
1995	0.08			1.51	0.12
A,1996	0.10			2.00	0.19
1997	0.06	3.0	1.3	2.17	0.22
1998	0.04	2.7	0.9	1.80	0.20
A,B,1999	+	0.0	0.0	1.93	0.24
2000	0.08	2.2	0.8	1.89	0.28
2001	0.09	1.7	0.7	2.65	0.25
2002	0.02	2.8	1.0	2.21	0.22
A,2003	1.36	3.7	1.2	1.32	0.16
A,2004	1.27	ns		2.40	0.24
2005	0.05	2.6	0.8	3.84	0.41
2006	0.10	1.6	0.6	2.56	0.24

Abundance index

	Portugal (n/h)		Spain (n/30 min)	
	Crustacean	SE	Mean	SE
1983			11.8	1.8
1984			15.8	2.0
1985			14.0	1.7
1986			32.6	3.8
1987			ns	-
1988			59.2	6.5
1989			40.7	6.2
1990			40.3	3.0
1991			27.7	2.6
1992			49.1	5.2
1993			43.3	5.4
1994			26.9	3.6
1995			32.3	2.8
A,1996			44.8	4.1
1997	31.6	15.5	43.5	3.8
1998	26.5	10.7	34.3	4.5
A,B,1999	1.2	1.1	29.3	3.2
2000	20.6	8.5	33.0	4.6
2001	17.2	7.1	42.7	3.4
2002	40.6	13.7	34.6	3.3
A,2003	60.8	21.0	16.9	1.5
A,2004	ns		43.9	3.7
2005	34.5	12.0	62.9	6.2
2006	19.9	6.5	41.5	3.0

Recruitment index

	At age 1	At age 0	At age 1
	Portugal (n)	Spain (n/30 min)*10	
	October		
1983		9.8	57.4
1984		18.0	78.3
1985		1.5	74.5
1986		29.9	163.6
1987		ns	ns
1988		29.0	246.4
1989		84.9	166.8
1990	153	4.4	190.6
1991	26	25.3	92.5
1992	42	23.7	350.0
1993	8	3.0	213.8
1994	2	34.8	29.4
1995	4	19.2	195.8
A,1996	16	35.7	205.6
1997	1	35.4	133.4
1998	+	2.7	95.7
A,B,1999	+	9.4	74.6
2000	16	10.7	139.6
2001	25	5.9	169.5
2002	1	10.4	99.5
A,2003	8	6.5	49.5
A,2004	5	11.9	211.0
2005	+	47.1	177.0
2006		5.9	147.0

+ less than 0.04
ns no survey
A Portuguese October Survey with different vessel and gear (Capricórnio and CAR net)
B Portuguese Crustacean Survey covers partial area only with a different Vessel (Mestre Costeiro)

Table 9.2.6 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Tuning data

FLT01: SP-CORUTR8c. 1000 Days by 100 HP (thousand)(*)

1986	2006									
1	1	0	1							
1	7								Eff.	
10		16.1	481.7	526.6	641.7	191.7	131.9	28.4	39.8	1986
10		463.7	1870.3	671.2	430.3	170.6	77.8	23.9	34.7	1987
10		59.5	528.9	354.0	360.9	203.8	106.2	45.5	42.2	1988
10		17.8	204.7	189.2	257.9	201.4	116.9	48.4	44.4	1989
10		8.6	195.7	114.0	328.2	197.5	137.6	72.5	44.4	1990
10		17.8	154.5	251.2	161.1	327.5	138.4	70.5	40.4	1991
10		0.8	38.8	199.2	334.7	209.8	77.6	4.6	38.9	1992
10		0.2	60.7	162.9	377.3	140.9	77.5	27.4	44.5	1993
10		0.0	44.7	149.5	121.8	112.2	62.4	33.3	39.6	1994
10		0.9	25.8	217.6	236.1	96.9	65.3	18.8	41.5	1995
10		0.7	28.3	29.0	189.7	113.4	17.1	43.8	35.7	1996
10		0.3	19.7	97.0	34.9	124.8	109.4	51.4	35.2	1997
10		0.2	61.9	318.9	265.2	74.5	96.3	47.0	32.6	1998
10		0.3	56.6	191.4	302.2	150.9	29.8	40.7	30.2	1999
10		0.3	55.6	113.4	275.1	239.2	129.5	121.0	30.1	2000
10		10.1	105.3	155.9	338.3	310.6	172.5	58.8	29.9	2001
10		5.9	103.5	176.7	75.2	54.3	36.9	57.7	21.8	2002
10		15.2	224.4	283.4	167.0	58.8	52.0	17.5	18.5	2003
10		18.2	214.5	311.3	276.7	137.6	37.8	51.1	21.1	2004
10		7.0	167.1	257.9	170.0	131.9	76.9	46.1	20.7	2005
10		4.5	235.7	404.5	197.2	97.6	26.7	26.0	19.3	2006

FLT02: SP-AVILESTR. 1000 Days by 100 HP (thousand) (*)

1986	2003									
1	1	0	1							
1	7								Eff.	
10		1.8	135.5	130.9	110.7	38.7	33.2	16.6	10.8	1986
10		7.2	149.2	151.6	195.0	105.9	48.1	7.2	8.3	1987
10		295.1	1099.8	357.0	187.9	63.0	28.7	21.0	9.0	1988
10		121.5	623.8	276.6	165.0	76.9	39.7	21.1	8.1	1989
10		963.9	1591.1	204.8	180.1	97.7	37.7	28.2	8.5	1990
10		717.4	699.1	214.8	101.5	98.9	36.5	26.0	7.7	1991
0		0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1992
10		470.2	637.9	150.6	153.2	21.0	11.8	5.2	7.6	1993
10		26.0	670.5	642.4	175.7	81.1	33.3	19.8	9.6	1994
10		292.1	324.2	896.1	961.7	128.5	64.5	17.1	6.1	1995
10		16.4	300.7	199.2	568.4	251.1	18.0	54.5	4.5	1996
10		0.7	249.7	710.0	207.0	344.8	157.3	53.4	4.7	1997
10		0.5	120.9	474.2	347.9	74.5	91.4	23.4	5.4	1998
10		1.7	140.0	306.2	422.0	121.2	17.9	23.6	6.8	1999
10		3.3	79.6	351.0	536.0	217.7	50.9	54.6	4.5	2000
10		30.1	224.8	270.7	469.2	251.2	132.8	47.1	1.8	2001
10		4.1	260.6	348.8	155.1	84.9	30.6	37.3	2.7	2002
10		2.6	119.8	159.0	87.8	32.3	29.3	10.3	2.5	2003

FLT03: SP-GFS (n/30 min)

1988	2006									
1	1	0.75	0.83							
0	7								Eff.	
1	2.9	24.6	20.6	7.3	1.9	1.1	0.4	0.3	101	1988
1	8.5	16.7	8.4	3.6	2.1	1.1	0.3	0.1	91	1989
1	0.4	19.1	13.0	2.2	2.8	1.6	0.7	0.4	120	1990
1	2.5	9.3	9.3	3.7	1.6	1.0	0.2	0.1	107	1991
1	2.4	35.0	4.1	4.1	2.1	1.0	0.4	0.0	116	1992
1	0.3	21.4	16.7	2.3	1.5	0.5	0.4	0.2	109	1993
1	3.5	2.9	11.2	6.3	1.5	0.7	0.4	0.4	118	1994
1	1.9	19.6	2.4	4.4	3.2	0.3	0.2	0.2	116	1995
1	3.6	20.6	14.4	1.4	1.9	2.4	0.3	0.3	114	1996
1	3.5	13.3	14.0	8.7	1.1	1.5	1.0	0.3	116	1997
1	0.3	9.6	10.0	9.2	3.6	0.7	0.8	0.3	114	1998
1	0.9	7.5	10.9	6.0	2.9	1.0	0.2	0.3	116	1999
1	1.1	14.0	5.4	5.2	4.1	1.7	0.6	0.9	113	2000
1	0.6	17.0	12.7	4.7	3.8	2.2	1.0	0.7	113	2001
1	1.0	10.0	12.7	7.4	1.8	0.7	0.3	0.6	110	2002
1	0.7	5.0	4.1	4.1	1.7	0.6	0.5	0.3	112	2003
1	1.2	21.1	11.3	6.1	2.7	0.8	0.2	0.5	114	2004
1	4.7	17.7	22.4	11.2	4.0	1.6	0.6	0.7	116	2005
1	0.6	14.7	13.3	8.2	2.5	1.0	0.5	0.6	115	2006

SP-AVILESTR fleet excluded from the assessment.

Table 9.2.7 Four-spot megrim (*L. boscii*). LPUE data by fleet in Divisions VIIIc, IXa.

	A Coruña Trawl in VIIIc			Avilés Trawl in VIIIc			Portugal trawl in IXa		
Year	Landings	Effort	LPUE [1]	Landings	Effort	LPUE [1]	Landings	Effort	LPUE [2]
1986	682	39.8	17.1	45	10.8	4.1			
1987	811	34.7	23.4	60	8.3	7.2			
1988	706	42.2	16.7	102	9.0	11.3	146	38.5	3.8
1989	593	44.4	13.3	79	8.1	9.8	183	44.7	4.1
1990	692	44.4	15.6	142	8.5	16.8	164	39.0	4.2
1991	680	40.4	16.8	83	7.7	10.9	166	45.0	3.7
1992	542	38.9	13.9	56	na		280	50.9	5.5
1993	615	44.5	13.8	58	7.6	7.6	180	44.2	4.1
1994	303	39.6	7.7	118	9.6	12.3	146	45.8	3.2
1995	359	41.5	8.7	127	6.1	20.7	121	37.0	3.3
1996	219	35.7	6.1	64	4.5	14.1	155	46.5	3.3
1997	244	35.2	6.9	81	4.7	17.3	76	33.4	2.3
1998	355	32.6	10.9	67	5.4	12.5	83	43.1	1.9
1999	324	30.2	10.7	74	6.8	10.8	73	25.3	2.9
2000	389	30.1	12.9	54	4.5	12.1	93	27.0	3.4
2001	431	29.9	14.4	27	1.8	14.6	89	43.1	2.1
2002	234	21.8	10.7	26	2.7	9.5	97	31.2	3.1
2003	168	18.5	9.1	13	2.5	5.0	117	40.5	2.9
2004	241	21.1	11.4	27	na		111	35.4	3.1
2005	189	20.7	9.1	48	na		140	42.6	3.3
2006	198	19.3	10.3	35	na		149	40.3	3.7

[1] LPUE as catch (kg) per fishing day per 100 HP('000).

[2] LPUE as catch (kg) per hour.

Table 9.2.8. Four spot megrim (L.Boscii) in Divisions VIIIc & IXa. Correlation between different ages following cohorts.

"SP_CORUTR8c"

age	3	4	5	6
3	1.00	NA	NA	NA
4	0.66	1.00	NA	NA
5	0.35	0.38	1.00	NA
6	0.72	0.47	0.48	1.00

"SP_GFS"

age	0	1	2	3	4	5	6
0	1.00	NA	NA	NA	NA	NA	NA
1	0.34	1.00	NA	NA	NA	NA	NA
2	0.23	0.67	1.00	NA	NA	NA	NA
3	-0.02	0.35	0.50	1.00	NA	NA	NA
4	0.07	0.12	0.59	0.53	1.00	NA	NA
5	0.01	0.58	0.41	0.48	0.43	1.00	NA
6	-0.06	0.70	0.60	0.58	0.42	0.48	1.00

Table 9.2.9. Four Spot Megrim (L.Boscii) in Divisions VIIIc and IXa. Tuning diagnostics from FLXSA

```
R version 2.4.1 (2006-12-18)

> library(FLCore)
Loading required package: lattice
Creating a new generic function for "print" in "FLCore"
FLCore 1.4-3 - "Golden Jackal"

> require(FLEDA)
Loading required package: FLEDA
FLEDA 1.4-2 - "The Jackal's Associate"

> require(FLXSA)
Loading required package: FLXSA
Loading required package: FLAsses
```

```
FLR XSA Diagnostics 2007-05-11 21:57:33

CPUE data from boscii.ind

Catch data for 21 years. 1986 to 2006. Ages 0 to 7.

        fleet first age last age first year last year alpha beta
1 SP-CORUTR8c         3        6       1986      1999     0    1
2      SP-GFS         0        6       1988      2006  0.75 0.83


 Time series weights :

   Tapered time weighting applied
   Power =   3 over  20 years

Catchability analysis :

    Catchability independent of size for ages >   2

    Catchability independent of age for ages >=   5

Terminal population estimation :

    Survivor estimates shrunk towards the mean F
    of the final   5 years or the  3 oldest ages.

    S.E. of the mean to which the estimates are shrunk =   1.5

    Minimum standard error for population
    estimates derived from each fleet =  0.3

   prior weighting not applied



Regression weights
     year
age    1997 1998  1999  2000  2001  2002 2003  2004 2005 2006
  all 0.751 0.82 0.877 0.921 0.954 0.976 0.99 0.997    1    1
Fishing mortalities
   year
age  1997  1998  1999  2000  2001  2002  2003  2004  2005  2006
  0 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
  1 0.002 0.003 0.005 0.003 0.009 0.011 0.019 0.013 0.006 0.002
  2 0.060 0.087 0.101 0.115 0.094 0.173 0.213 0.172 0.111 0.174
  3 0.272 0.298 0.296 0.202 0.336 0.288 0.324 0.385 0.319 0.295
  4 0.361 0.496 0.496 0.548 0.507 0.342 0.295 0.505 0.419 0.400
  5 0.501 0.691 0.469 0.463 0.913 0.140 0.407 0.386 0.600 0.417
  6 0.551 0.520 0.526 0.526 0.454 0.261 0.238 0.420 0.505 0.204
  7 0.551 0.520 0.526 0.526 0.454 0.261 0.238 0.420 0.505 0.204
```

Table 9.2.9 (Cont'd)

XSA population number (thousands)

year	age 0	1	2	3	4	5	6	7
1997	20080	19535	23575	13317	2712	4554	2781	1144
1998	9961	16440	15962	18176	8306	1547	2259	941
1999	20915	8155	13419	11980	11048	4140	635	1305
2000	25073	17124	6643	9936	7292	5509	2121	2241
2001	24314	20528	13979	4846	6647	3453	2838	1071
2002	26737	19906	16656	10415	2836	3277	1135	1716
2003	40223	21890	16126	11475	6391	1649	2332	737
2004	28438	32932	17590	10668	6795	3897	899	1076
2005	28137	23283	26608	12126	5943	3357	2170	1084
2006	20178	23037	18951	19503	7218	3200	1508	1304

Estimated population abundance at 1st Jan 2007

year	age 0	1	2	3	4	5	6	7
2007	0	16524	18836	13045	11896	3964	1728	1008

Fleet: SP-CORUTR8c

Log catchability residuals.

age	year 1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
3	0.837	0.866	0.347	-0.106	-0.180	0.296	0.210	0.542	-0.494	0.173	-0.613
4	0.886	0.311	-0.043	-0.107	0.256	-0.203	0.477	0.744	0.123	-0.169	-0.208
5	0.197	-0.236	-0.229	-0.316	0.101	0.691	0.374	0.079	0.074	0.227	-0.612
6	0.113	-0.145	-0.092	0.067	0.153	0.669	0.213	0.294	0.059	0.192	-0.306

age	year 1997	1998	1999
3	-0.484	0.404	0.313
4	-0.708	0.259	0.106
5	-0.321	0.327	-0.048
6	0.063	0.130	0.229

Mean log catchability and standard error of ages with catchability independent of year class strength and constant w.r.t. time

	3	4	5	6
Mean_Logq	-6.5124	-5.6784	-5.2495	-5.2495
S.E_Logq	0.4696	0.4149	0.3416	0.2261

Fleet: SP-GFS

Log catchability residuals.

age	year 1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
0	-0.007	0.409	-0.279	-0.116	-0.094	-0.101	0.196	-0.103	0.329	0.425
1	0.236	-0.224	0.019	-0.138	0.306	-0.051	-0.674	0.173	0.010	0.004
2	0.112	-0.286	-0.147	-0.370	-0.652	-0.135	-0.443	-0.634	0.147	-0.171
3	-0.386	-0.894	-1.010	-0.809	-0.503	-0.586	-0.534	-0.654	-0.474	0.232
4	-1.161	-0.691	-0.337	-0.710	-0.312	-0.517	-0.075	-0.328	-0.640	-0.037
5	-0.621	-0.714	0.127	-0.142	-0.091	-0.726	-0.068	-0.214	0.301	0.047
6	-0.875	-0.881	-0.241	-0.936	-0.248	-0.261	0.009	-0.221	0.323	0.144

age	year 1998	1999	2000	2001	2002	2003	2004	2005	2006
0	-0.014	-0.030	-0.092	-0.268	-0.138	NA	-0.129	0.326	-0.162
1	-0.120	0.317	0.165	0.168	-0.258	NA	-0.079	0.086	-0.066
2	-0.100	0.169	0.186	0.276	0.167	NA	-0.007	0.212	0.082
3	-0.009	-0.024	-0.050	0.664	0.321	NA	0.191	0.607	-0.190
4	0.100	-0.383	0.419	0.394	0.385	NA	0.021	0.492	-0.188
5	0.500	-0.339	-0.047	1.050	-0.700	NA	-0.492	0.483	-0.092
6	0.172	-0.140	-0.052	0.107	-0.208	NA	-0.313	-0.091	-0.104

Table 9.2.9 (Cont'd)

```
 Mean log catchability and standard error of ages with catchability
 independent of year class strength and constant w.r.t. time

                3       4       5       6
Mean_Logq -7.1893 -7.3022 -7.5121 -7.5121
S.E_Logq   0.5007  0.4563  0.4782  0.3593

 Regression statistics
 Ages with q dependent on year class strength
          slope intercept
Age 0 0.5709521  9.840014
Age 1 0.9247292  7.340883
Age 2 0.9968373  7.058407
```

Table 9.2.10. Four Spot Megrim (L.Boscii) in Div VIIIc&Ixa. Estimates of fishing mortality at age from FLXSA

age \ year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1	0.0025	0.0590	0.0621	0.0262	0.0590	0.0777	0.0271	0.0188	0.0091	0.0668	0.0151
2	0.1241	0.3945	0.3977	0.4560	0.2608	0.2096	0.2574	0.0970	0.1318	0.3531	0.1355
3	0.2416	0.2686	0.3261	0.3838	0.2062	0.2661	0.3705	0.3309	0.2752	0.4498	0.3526
4	0.5145	0.3930	0.4377	0.7137	0.5206	0.3334	0.8664	0.7345	0.7307	0.6533	0.5640
5	0.3805	0.3289	0.4898	0.6700	0.6882	0.8613	0.8127	0.4686	0.8256	0.9472	0.4804
6	0.3814	0.3344	0.5292	0.8676	0.6224	0.7722	0.6249	0.5835	0.7597	0.8343	0.4660
7	0.3814	0.3344	0.5292	0.8676	0.6224	0.7722	0.6249	0.5835	0.7597	0.8343	0.4660

age \ year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1	0.0020	0.0030	0.0052	0.0029	0.0090	0.0106	0.0187	0.0132	0.0059	0.0016
2	0.0601	0.0870	0.1005	0.1154	0.0943	0.1726	0.2132	0.1720	0.1107	0.1738
3	0.2721	0.2978	0.2965	0.2021	0.3359	0.2884	0.3239	0.3849	0.3188	0.2948
4	0.3613	0.4963	0.4958	0.5476	0.5073	0.3419	0.2947	0.5053	0.4191	0.4000
5	0.5010	0.6906	0.4688	0.4635	0.9127	0.1399	0.4070	0.3855	0.5998	0.4173
6	0.5509	0.5200	0.5261	0.5260	0.4540	0.2612	0.2380	0.4202	0.5054	0.2041
7	0.5509	0.5200	0.5261	0.5260	0.4540	0.2612	0.2380	0.4202	0.5054	0.2041

Table 9.2.11. Four Spot Megrim (L.Boscii) in Div VIIIc&Ixa. Estimates of stock numbers at age from FLXSA

age \ year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
0	53785	34206	38219	34031	20944	42777	39665	12333	29704	35705	23860	20080
1	48071	44035	28006	31291	27862	17148	35023	32475	10098	24320	29233	19535
2	32915	39257	33987	21549	24956	21505	12990	27909	26094	8192	18626	23575
3	19002	23804	21663	18695	11183	15741	14278	8222	20738	18726	4712	13317
4	10827	12219	14899	12800	10427	7450	9877	8070	4835	12893	9778	2712
5	3953	5299	6753	7874	5133	5072	4370	3400	3170	1906	5493	4554
6	2959	2213	3122	3388	3299	2112	1755	1588	1742	1137	605	2781
7	792	544	1232	1181	1893	970	157	687	913	539	1620	1144

age \ year	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	GM 90-04
0	9961	20915	25073	24314	26737	40223	28438	28137	20178	-	24877
1	16440	8155	17124	20528	19906	21890	32932	23283	23037	16520	
2	15962	13419	6643	13979	16656	16126	17590	26608	18951	18830	
3	18176	11980	9936	4846	10415	11475	10668	12126	19503	13041	
4	8306	11048	7292	6647	2836	6391	6795	5943	7218	11890	
5	1547	4140	5509	3453	3277	1649	3897	3357	3200	3961	
6	2259	635	2121	2838	1135	2332	899	2170	1508	1726	
7	941	1305	2241	1071	1716	737	1076	1084	1304	1878	

Table 9.2.12. Four Spot Megrim (L.Boscii) in Divisions VIIIc and IXa. Summary of landings and results from FLXSA

	Yield(t)	Fbar(ages 2-4)	R(age = 0, thousands)	SSB(t)	Biomass
1986	1124	0.2934	53785	5305	6202
1987	1688	0.3520	34206	6579	7748
1988	2223	0.3872	38219	7270	8214
1989	2629	0.5178	34031	7048	8020
1990	1945	0.3292	20944	6354	7024
1991	1682	0.2697	42777	5871	6538
1992	1916	0.4981	39665	5334	6150
1993	1384	0.3875	12333	5429	6120
1994	1403	0.3792	29704	5186	5740
1995	1652	0.4854	35705	4596	5314
1996	1098	0.3507	23860	4284	5014
1997	896	0.2312	20080	4136	4697
1998	1123	0.2937	9961	4504	4975
1999	1125	0.2976	20915	4203	4594
2000	1041	0.2883	25073	3936	4413
2001	931	0.3125	24314	3598	4214
2002	720	0.2676	26737	4096	4780
2003	876	0.2773	40223	4225	5010
2004	1006	0.3541	28438	4284	5131
2005	983	0.2828	28137	4593	5452
2006	1092	0.2895	20178	5134	5775

Table 9.2.13 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa.
Prediction with management option table: Input data

MFDP version 1a
Run: bos89
Time and date: 07:25 12/05/2007
Fbar age range: 2-4

2007 Age	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
0	24877	0.2	0	0	0	0.002	0.000	0.002
1	16520	0.2	0.55	0	0	0.041	0.007	0.041
2	18830	0.2	0.86	0	0	0.065	0.152	0.065
3	13041	0.2	0.97	0	0	0.089	0.333	0.089
4	11890	0.2	0.99	0	0	0.110	0.441	0.110
5	3961	0.2	1	0	0	0.131	0.468	0.131
6	1726	0.2	1	0	0	0.162	0.377	0.162
7	1878	0.2	1	0	0	0.223	0.377	0.223

2008 Age	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
0	24877	0.2	0	0	0	0.002	0.000	0.002
1	.	0.2	0.55	0	0	0.041	0.007	0.041
2	.	0.2	0.86	0	0	0.065	0.152	0.065
3	.	0.2	0.97	0	0	0.089	0.333	0.089
4	.	0.2	0.99	0	0	0.110	0.441	0.110
5	.	0.2	1	0	0	0.131	0.468	0.131
6	.	0.2	1	0	0	0.162	0.377	0.162
7	.	0.2	1	0	0	0.223	0.377	0.223

2009 Age	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
0	24877	0.2	0	0	0	0.002	0.000	0.002
1	.	0.2	0.55	0	0	0.041	0.007	0.041
2	.	0.2	0.86	0	0	0.065	0.152	0.065
3	.	0.2	0.97	0	0	0.089	0.333	0.089
4	.	0.2	0.99	0	0	0.110	0.441	0.110
5	.	0.2	1	0	0	0.131	0.468	0.131
6	.	0.2	1	0	0	0.162	0.377	0.162
7	.	0.2	1	0	0	0.223	0.377	0.223

Input units are thousands and kg - output in tonnes

Table 9.2.14 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa catch forecast: management option table.

MFDP version 1a
Run: bos89
Four spot megrim (L. boscii) Division VIIIc and IXa
Time and date: 07:25 12/05/2007
Fbar age range: 2-4

2007				
Biomass	**SSB**	**FMult**	**FBar**	**Landings**
5648	5065	1	0.3088	1263

2008					2009	
Biomass	**SSB**	**FMult**	**FBar**	**Landings**	**Biomass**	**SSB**
5390	4790	0	0	0	6544	5916
.	4790	0.1	0.0309	141	6389	5762
.	4790	0.2	0.0618	276	6239	5613
.	4790	0.3	0.0926	407	6095	5470
.	4790	0.4	0.1235	533	5956	5333
.	4790	0.5	0.1544	654	5823	5200
.	4790	0.6	0.1853	771	5694	5072
.	4790	0.7	0.2162	884	5571	4949
.	4790	0.8	0.2471	993	5451	4831
.	4790	0.9	0.2779	1097	5336	4716
.	4790	1	0.3088	1199	5225	4606
.	4790	1.1	0.3397	1296	5119	4500
.	4790	1.2	0.3706	1391	5016	4398
.	4790	1.3	0.4015	1482	4917	4300
.	4790	1.4	0.4324	1569	4821	4205
.	4790	1.5	0.4632	1654	4729	4114
.	4790	1.6	0.4941	1736	4640	4026
.	4790	1.7	0.525	1815	4555	3941
.	4790	1.8	0.5559	1891	4472	3859
.	4790	1.9	0.5868	1964	4392	3780
.	4790	2	0.6176	2036	4316	3703

Input units are thousands and kg - output in tonnes

Table 9.2.15 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Single option prediction. Detail Tables.

MFDP version 1a
Run: bos89
Time and date: 07:25 12/05/2007
Fbar age range: 2-4

Year:	2007	F multiplier:	1	Fbar:	0.3088				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
0	0	0	0	24877	58	0	0	0	0
1	0.0069	103	4	16520	677	9086	373	9086	373
2	0.1522	2415	158	18830	1230	16194	1058	16194	1058
3	0.3328	3365	299	13041	1161	12650	1126	12650	1126
4	0.4415	3874	425	11890	1304	11771	1291	11771	1291
5	0.4675	1351	177	3961	519	3961	519	3961	519
6	0.3766	494	80	1726	280	1726	280	1726	280
7	0.3766	537	120	1878	419	1878	419	1878	419
Total		12140	1263	92723	5648	57266	5065	57266	5065

Year:	2008	F multiplier:	1	Fbar:	0.3088				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
0	0	0	0	24877	58	0	0	0	0
1	0.0069	127	5	20368	835	11202	459	11202	459
2	0.1522	1723	113	13432	878	11552	755	11552	755
3	0.3328	3416	304	13241	1178	12843	1143	12843	1143
4	0.4415	2494	274	7654	839	7578	831	7578	831
5	0.4675	2135	280	6260	820	6260	820	6260	820
6	0.3766	581	94	2032	330	2032	330	2032	330
7	0.3766	579	129	2025	452	2025	452	2025	452
Total		11057	1199	89889	5390	53492	4790	53492	4790

Year:	2009	F multiplier:	1	Fbar:	0.3088				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
0	0	0	0	24877	58	0	0	0	0
1	0.0069	127	5	20368	835	11202	459	11202	459
2	0.1522	2124	139	16561	1082	14242	931	14242	931
3	0.3328	2437	217	9445	841	9162	815	9162	815
4	0.4415	2532	278	7771	852	7694	844	7694	844
5	0.4675	1375	180	4030	528	4030	528	4030	528
6	0.3766	919	149	3211	521	3211	521	3211	521
7	0.3766	652	145	2279	508	2279	508	2279	508
Total		10166	1113	88543	5225	51821	4606	51821	4606

Input units are thousands and kg - output in tonnes

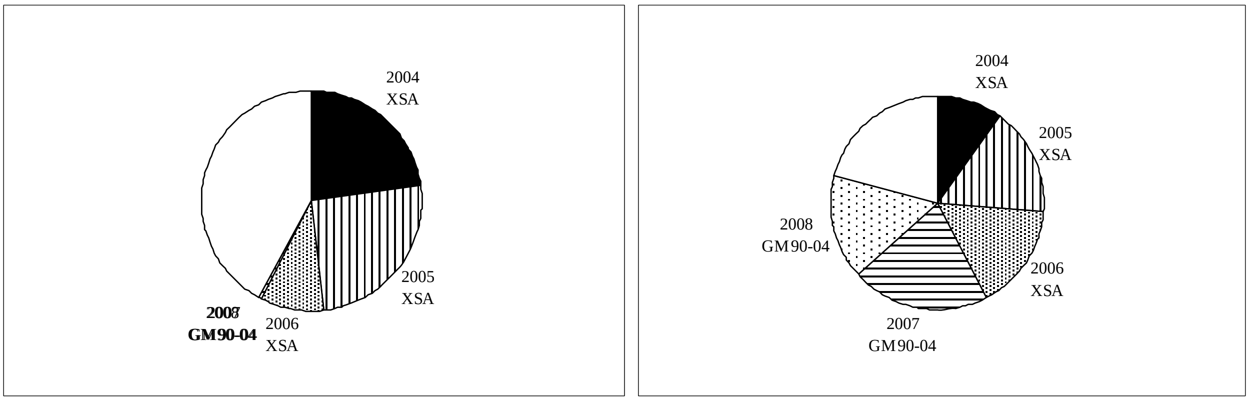
Table 9.2.16 **Four-spot megrim (L. boscii) in Divisions VIIIc and IXa**
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class			2004	2005	2006	2007	2008
Stock No. (thousands)			28438	28137	20178	24877	24877
of	0 year-olds						
Source			XSA	XSA	XSA	GM90-04	GM90-04
Status Quo F:							
% in	2007	landings	23.7	12.5	0.3	0.0	-
% in	2008		22.9	25.4	9.4	0.4	0.0
% in	2007	SSB	20.6	21.8	12.0	1.0	-
% in	2008	SSB	15.6	21.9	16.3	15.5	1.1
% in	2009	SSB	10.1	16.3	16.1	20.7	16.0

GM : geometric mean recruitment

Four-spot megrim (L. boscii) in Divisions VIIIc and IXa : Year-class % contribution to

a) 2008 landings **b) 2009 SSB**



XSA	XSA	XSA	GM90-04	GM90-04
2004	2005	2006	2007	2008

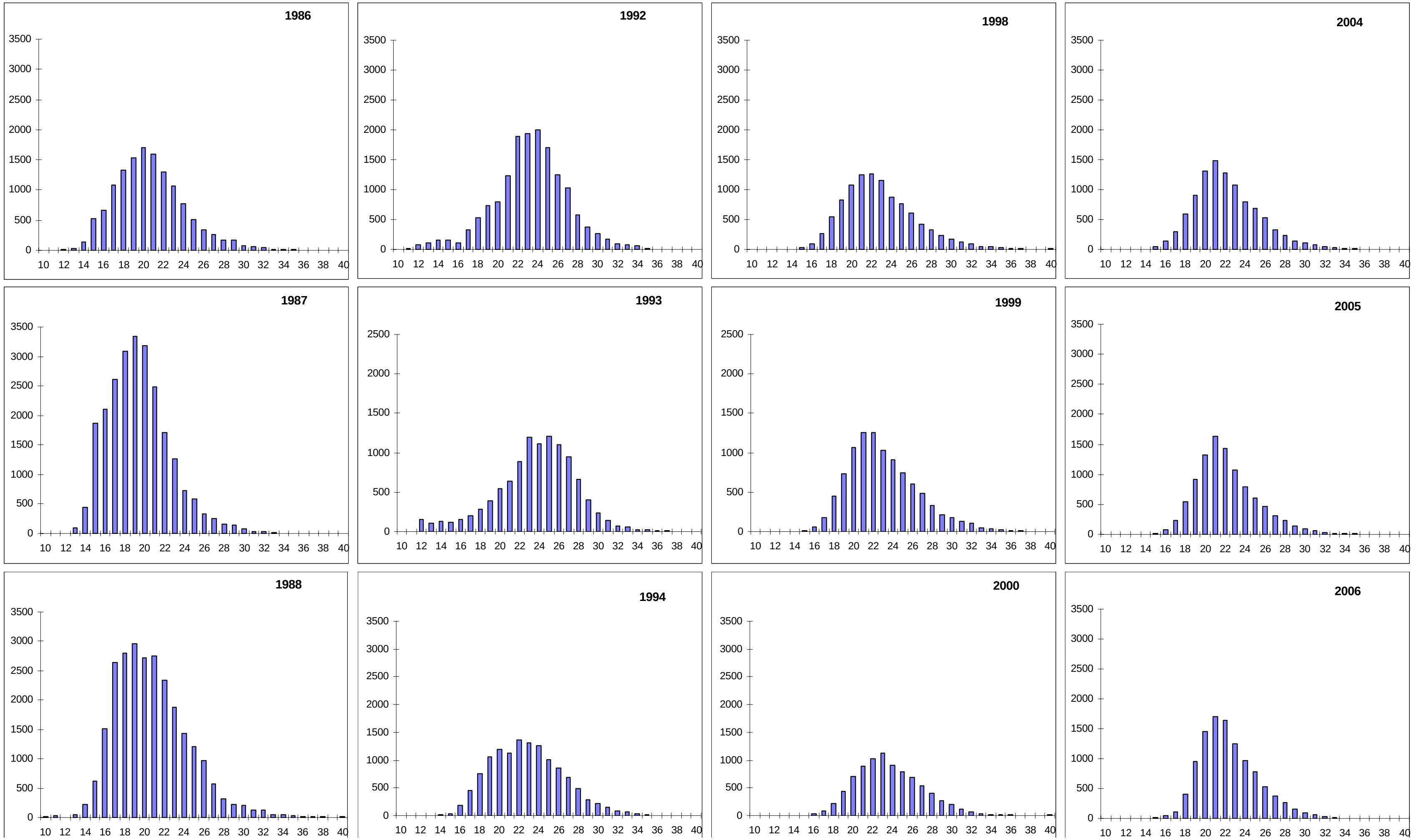
Table 9.2.17 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Yield per recruit results.

MFYPR version 2a
Run: bos89
Time and date: 08:05 12/05/2007
Yield per results

FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0	0	0	0	5.5167	0.5783	4.0334	0.5527	4.0334	0.5527
0.1	0.0309	0.0978	0.0144	5.0294	0.4787	3.5467	0.4532	3.5467	0.4532
0.2	0.0618	0.1685	0.0236	4.6779	0.4087	3.1957	0.3833	3.1957	0.3833
0.3	0.0926	0.2219	0.0297	4.4128	0.3573	2.9312	0.3319	2.9312	0.3319
0.4	0.1235	0.2636	0.0339	4.206	0.3183	2.7249	0.293	2.7249	0.293
0.5	0.1544	0.2971	0.0367	4.0403	0.2879	2.5596	0.2627	2.5596	0.2627
0.6	0.1853	0.3247	0.0387	3.9044	0.2638	2.4243	0.2386	2.4243	0.2386
0.7	0.2162	0.3477	0.0401	3.7912	0.2442	2.3114	0.219	2.3114	0.219
0.8	0.2471	0.3672	0.0411	3.6952	0.2281	2.2159	0.203	2.2159	0.203
0.9	0.2779	0.384	0.0418	3.6128	0.2147	2.134	0.1896	2.134	0.1896
1	0.3088	0.3986	0.0423	3.5413	0.2034	2.0629	0.1783	2.0629	0.1783
1.1	0.3397	0.4115	0.0427	3.4786	0.1937	2.0006	0.1687	2.0006	0.1687
1.2	0.3706	0.4229	0.0429	3.4231	0.1854	1.9455	0.1604	1.9455	0.1604
1.3	0.4015	0.4331	0.0431	3.3736	0.1782	1.8964	0.1532	1.8964	0.1532
1.4	0.4324	0.4422	0.0432	3.3291	0.1719	1.8523	0.1469	1.8523	0.1469
1.5	0.4632	0.4505	0.0433	3.2889	0.1663	1.8125	0.1414	1.8125	0.1414
1.6	0.4941	0.4581	0.0434	3.2524	0.1613	1.7763	0.1365	1.7763	0.1365
1.7	0.525	0.4651	0.0434	3.219	0.1569	1.7433	0.1321	1.7433	0.1321
1.8	0.5559	0.4715	0.0434	3.1883	0.1529	1.7129	0.1281	1.7129	0.1281
1.9	0.5868	0.4774	0.0434	3.16	0.1493	1.685	0.1245	1.685	0.1245
2	0.6176	0.4829	0.0434	3.1338	0.146	1.6591	0.1213	1.6591	0.1213

Reference point	F multiplier	Absolute F
Fbar(2-4)	1	0.3088
FMax	1.7765	0.5486
F0.1	0.5757	0.1778
F35%SPR	0.8693	0.2685

Weights in kilograms


1986
1992
1998
2004
1987
1993
1999
2005
1988
1994
2000
2006
10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40
0
500
1000
1500
2000
2500
3000
3500

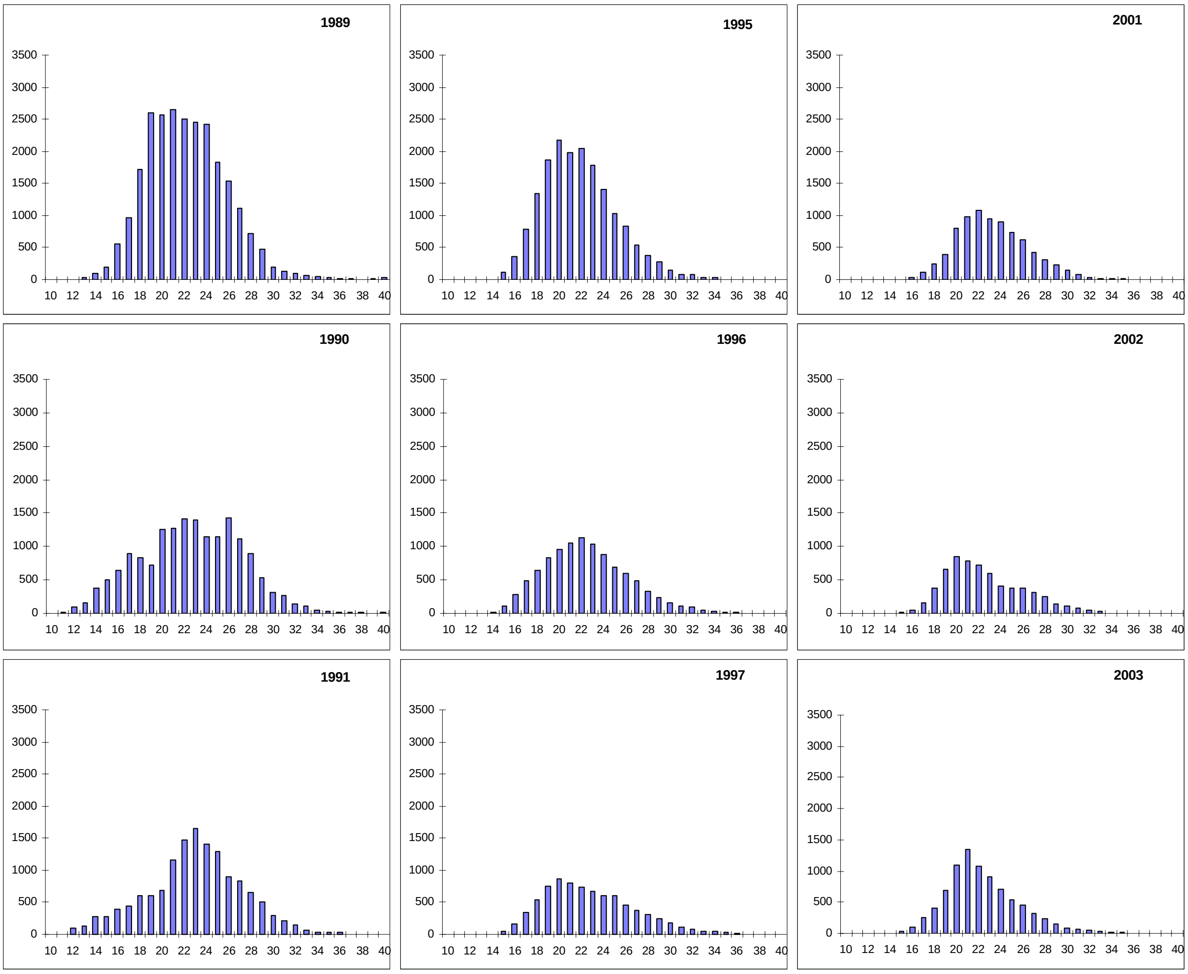


Figure 9.2.1 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Annual length compositions of landings ('000)

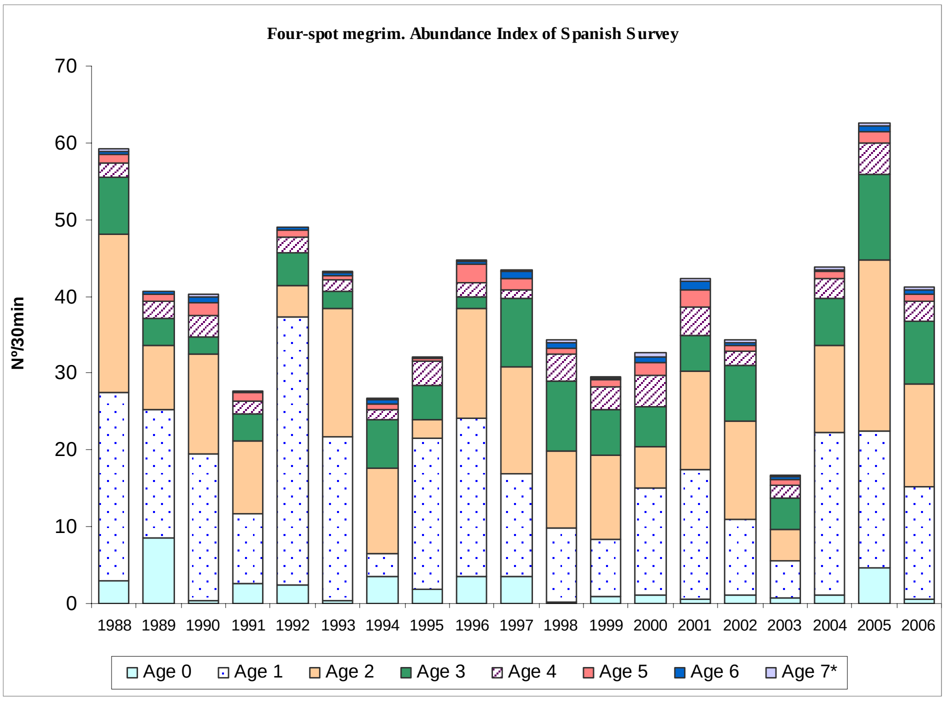


Figure 9.2.2. Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Spanish Survey age distribution

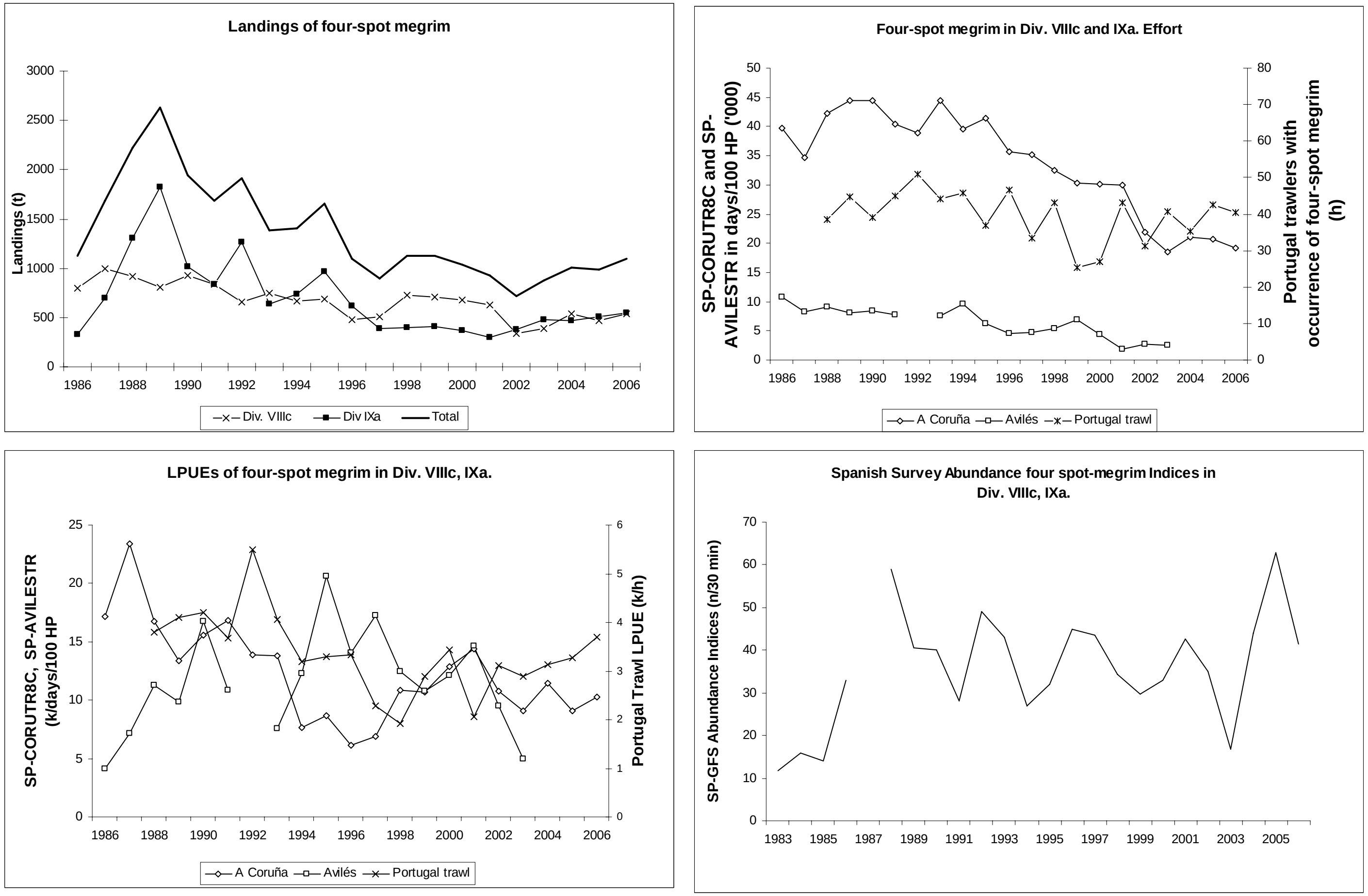
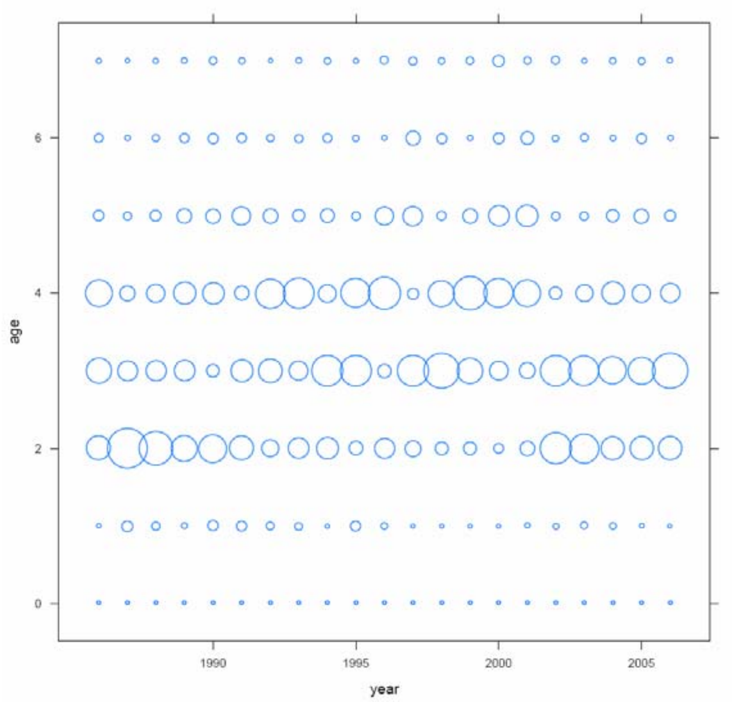


Figure 9.2.3 Four-spot megrim (*L.boscii*) in Divisions VIIIc and IXa. Landings (t), Efforts, LPUEs and Abundance Indices.

Standardized catch proportions at age using FLEDA (black bubble means < 0)



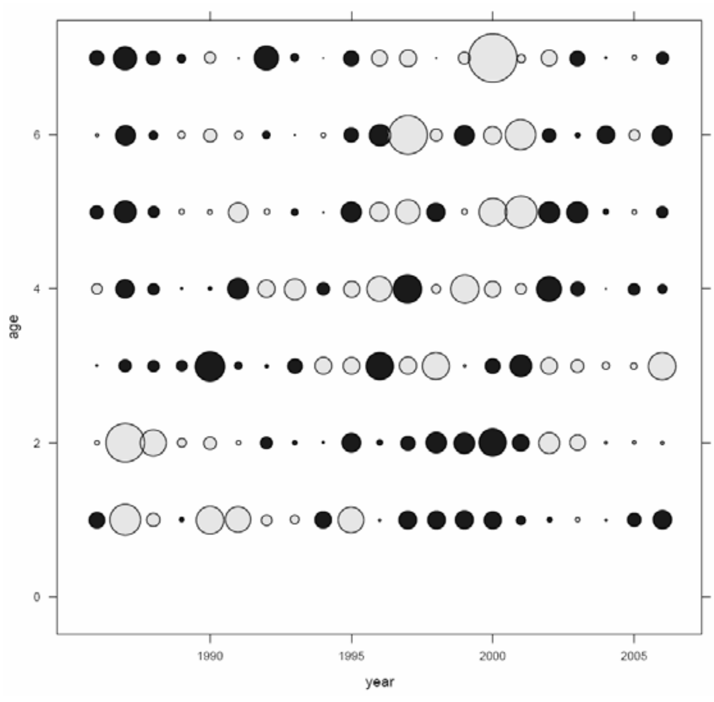


Figure 9.2.4. Four spot megrim (L. Boscii) in Divisions VIIIc & IXa. Catch proportions at age using FLEDA

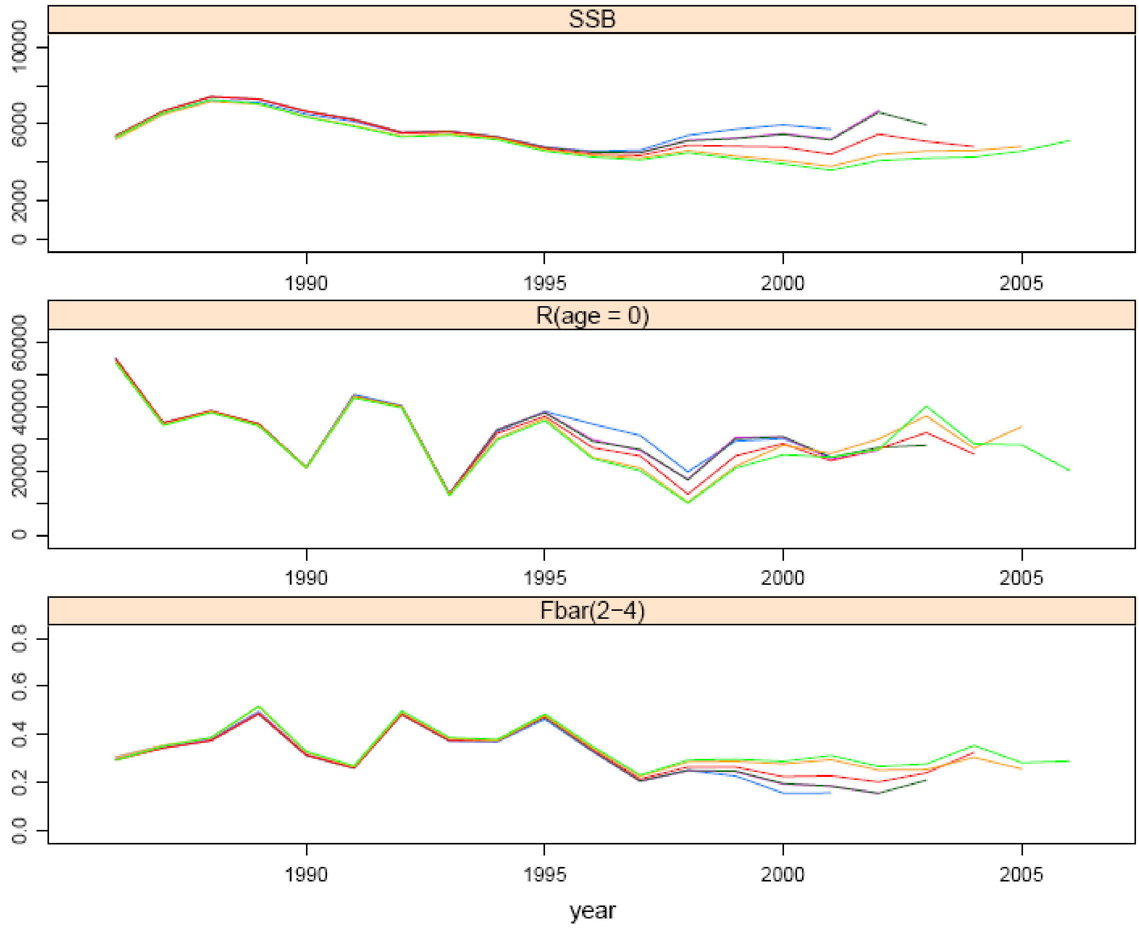
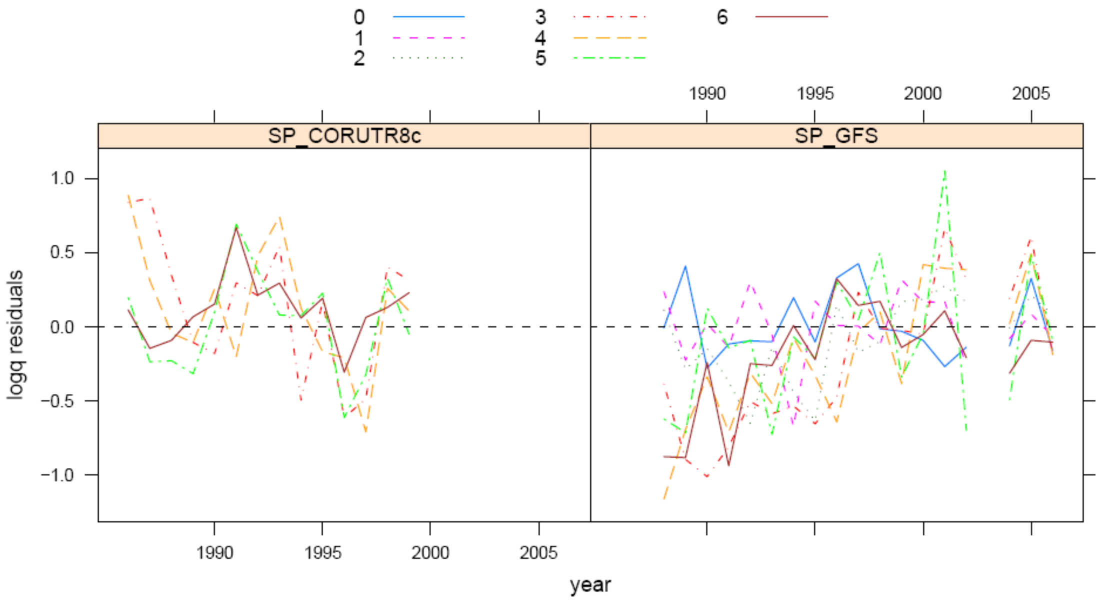


Figure 9.2.5. Four spot megrim (L.Boscii) in Divisions VIIIc & IXa. Retrospective analysis from FLXSA



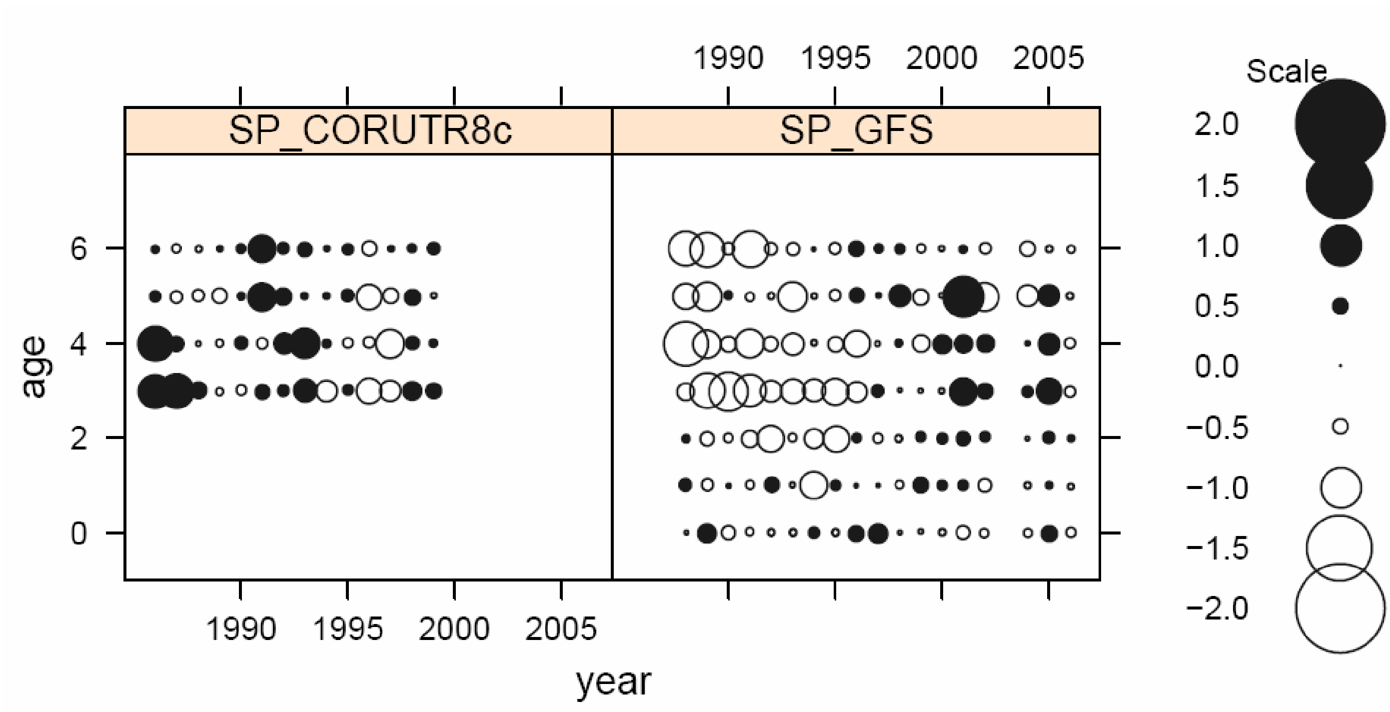


Figure 9.2.6. Four spot megrim (L. Boscii) in Div VIIIc & IXa. Log catchability residuals from FLXSA

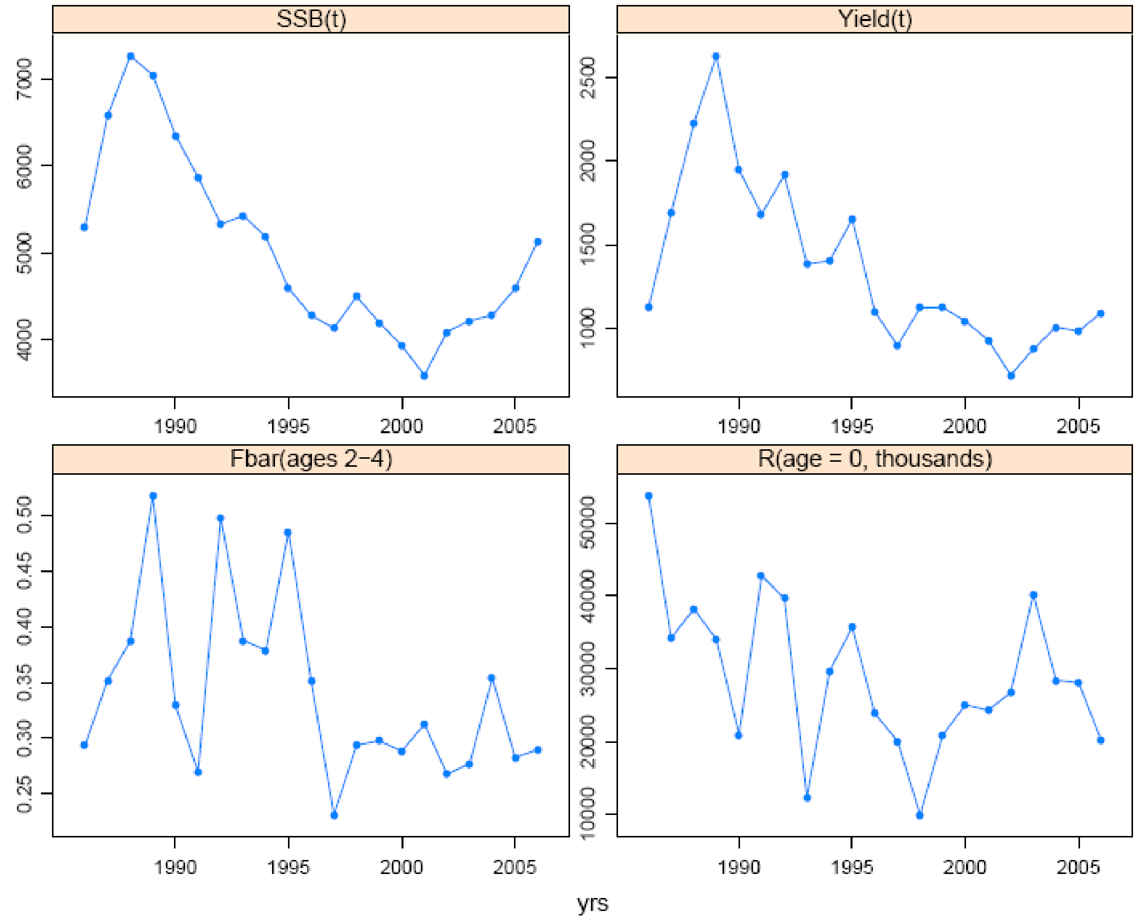
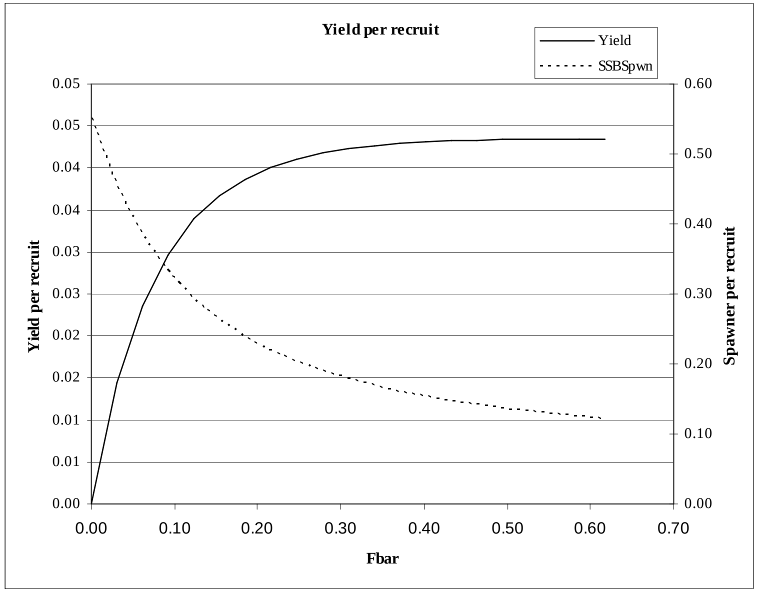
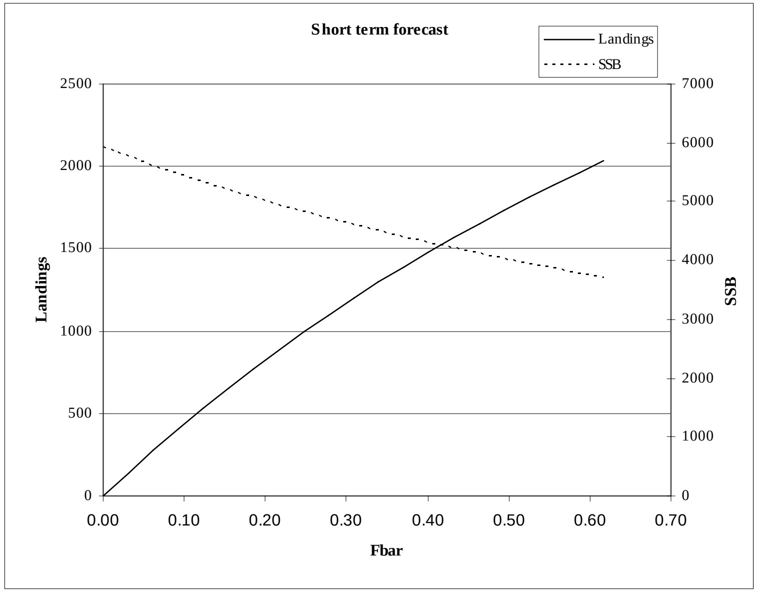


Figure 9.2.7. Four spot megrim (L. Boscii) in Div VIIIc and IXa. Summary plot of landings and FLXSA results





MFYPR version 2a
Run: bos89
Time and date: 08:05 12/05/2007

Reference point	F multiplier	Absolute F
Fbar(2-4)	1.0000	0.3088
FMax	1.7765	0.5486
F0.1	0.5757	0.1778
F35%SPR	0.8693	0.2685

Weights in kilograms

MFDP version 1a
Run: bos89
Four spot megrim (L. boscii) Division VIIIc and IXa
Time and date: 07:25 12/05/2007
Fbar age range: 2-4

Input units are thousands and kg - output in tonnes

Figure 9.2.8. Four-spot megrim (L. boscii) in Divisions VIIIc and IXa. Forecast summary

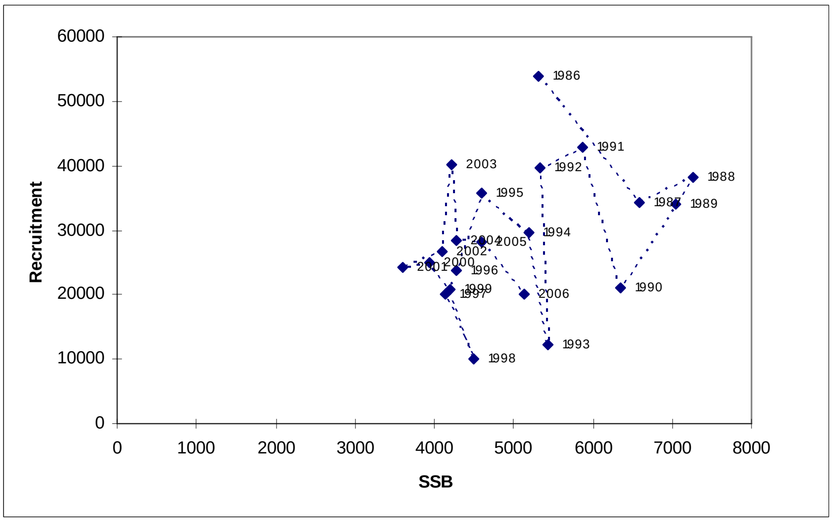


Figure 9.2.9. Four spot megrim (L. boscii) in Divisions VIIIc and IXa. SSB-Recruitment plot.

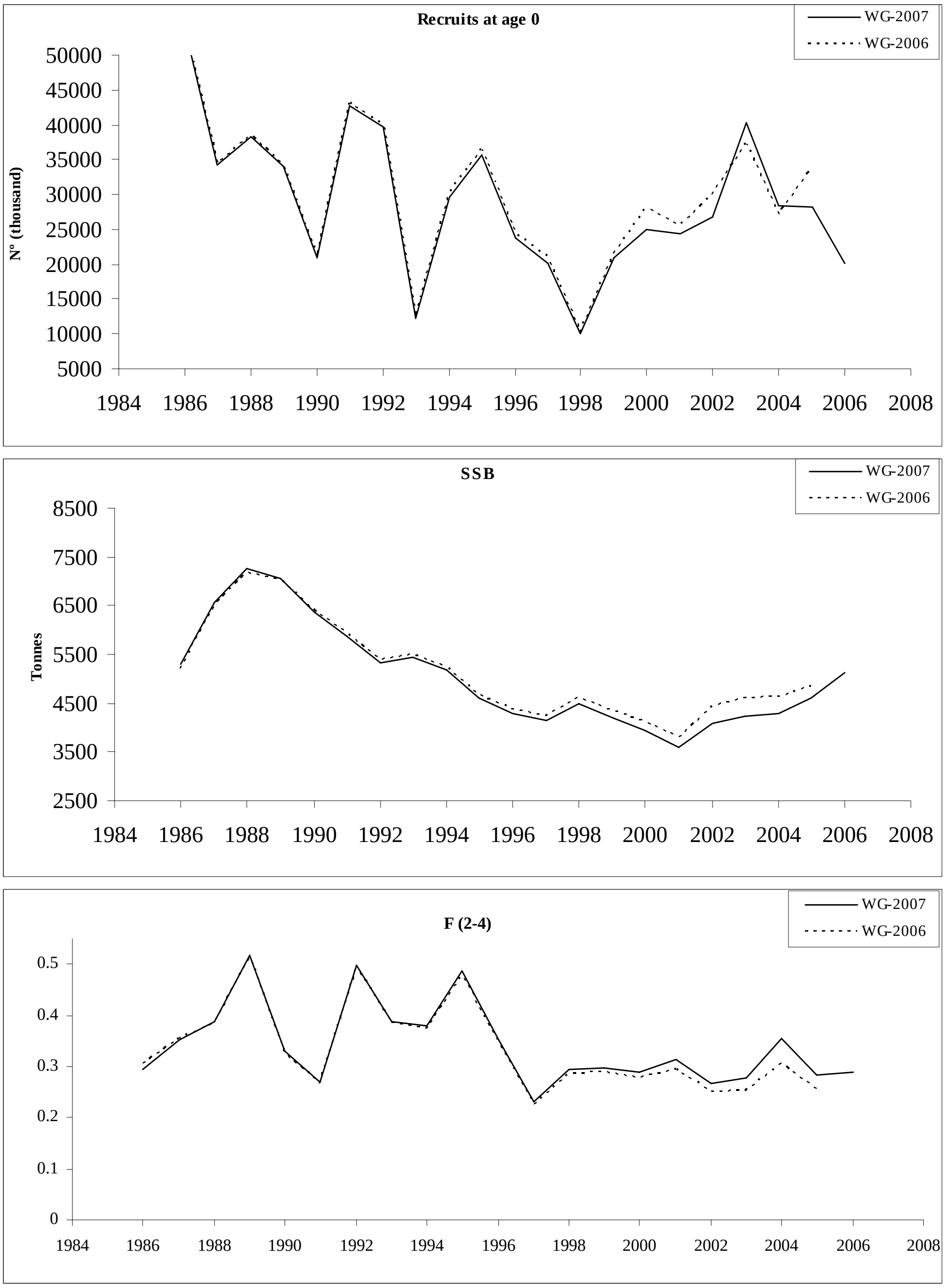


Figure 9.2.10. Four-spot megrim (L. boscii) Recruits, SSB and Fs from WG06 and WG07

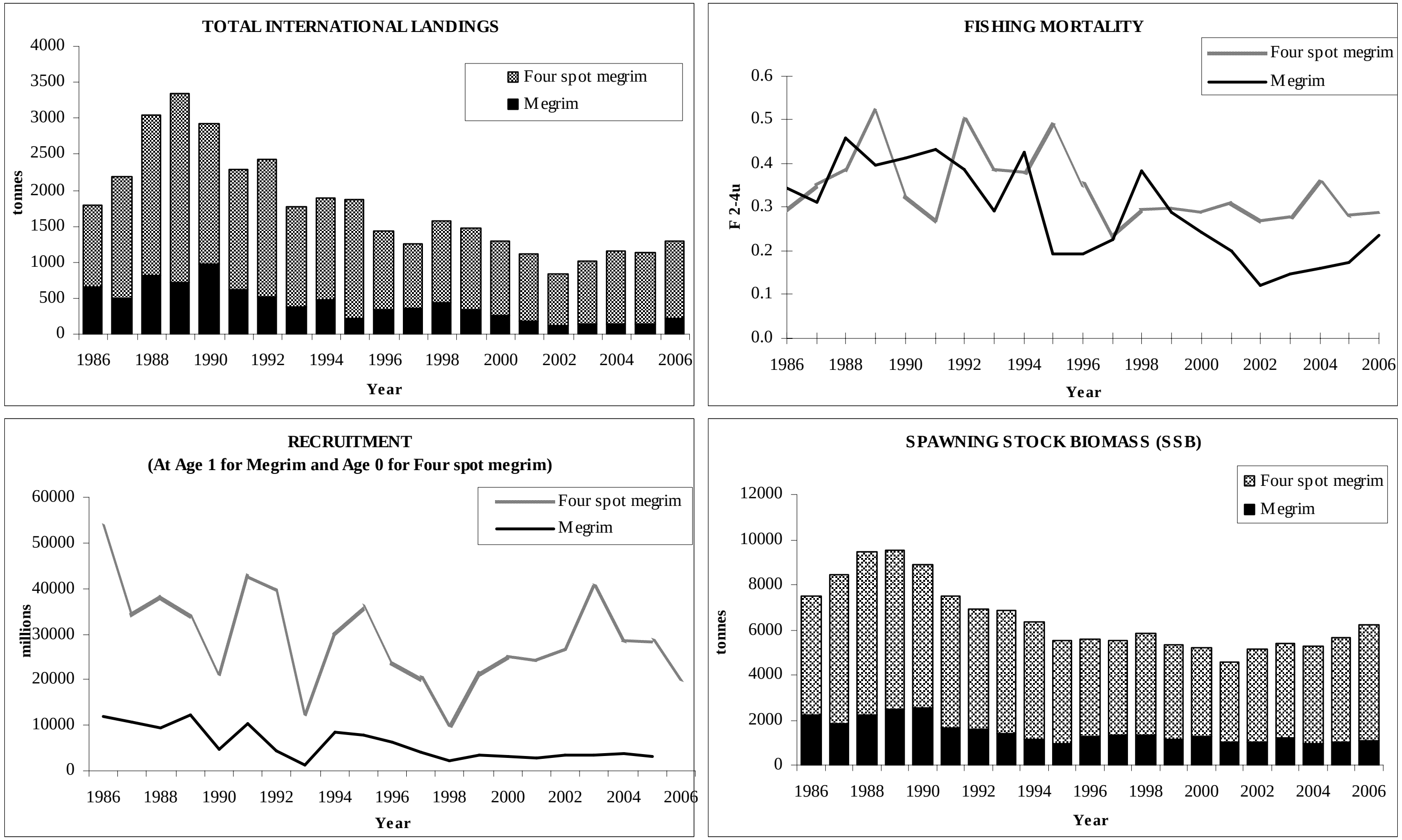


Figure 9.3.1. Stock trends for both stocks. Megrin and Four-spot megrim in Divisions VIIIc and IXa.

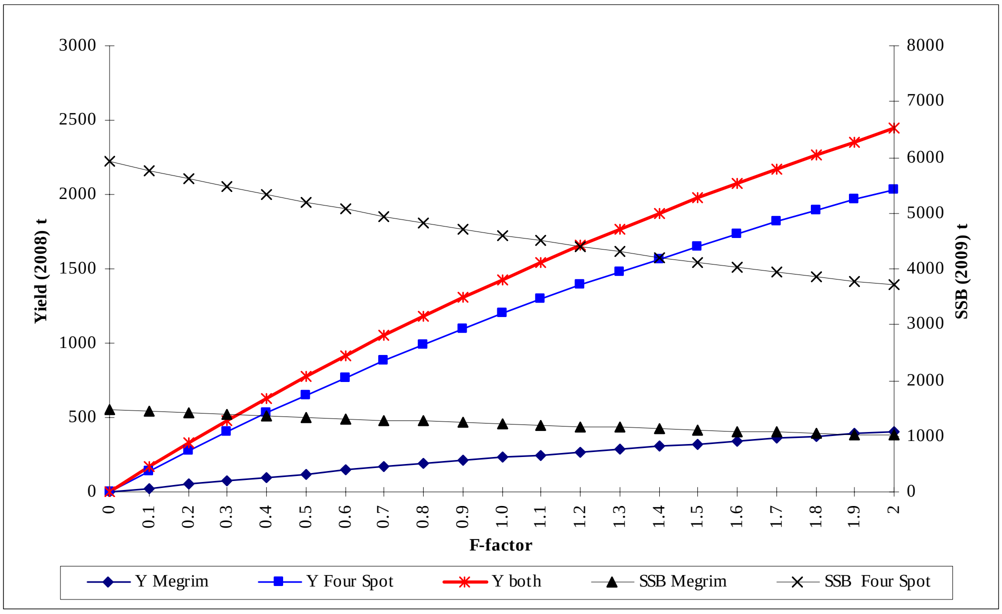


Figure 9.3.2. Megrims (*L. whiffiagonis and L. boscii*) in Divisions VIIIc and IXa. Combined Short Term Forecasts assuming status quo in 2007

10 *Nephrops* ICES Divisions VII bcjk & inshore rectangles along the south and south east coast of Ireland

10.1 FU 16 – Porcupine Bank

This year the working group only updated the fishery information and other indicators for *Nephrops* in Division VIIbcjk. A map of the spatial distribution of FU 16 is given in Figure 1.2 the FU includes *Nephrops* within the following ICES statistical rectangles; 31-36 D5-D6; 32-35 D7-D8.

10.1.1 Ecosystem aspects

A persistent Taylor column circulation around Porcupine Bank provides an important mechanism for the retention of pelagic eggs and larvae of the various marine species spawning in the area. (Mohn, et al., 2002). The *Nephrops* stock on the Porcupine Bank are distributed on mud patches in relatively deep waters 200-600 m. It is not know how larvae are retained over these grounds but the Taylor column may help with larval retention.

10.1.2 Fishery description

All fisheries in this area are seasonal and rather sporadic mainly targeting *Nephrops* when they available and when weather conditions are good. At other time the vessels switch to other fisheries.

France

In 2006, 18 French vessels reported *Nephrops* landings from the Porcupine Bank. Of these only 14 reported landings over 10t. The French fleet fishing *Nephrops* in FU 16 also fishes in Division VIIg and was described in detail in the 1999 WGNEPH report (ICES, 1999a). The French fleet only lands large *Nephrops* from this FU. Investigation of the landings data by statistical rectangle carried out by WGNEPH in 2002. These indicated that the majority of the French landings between 1999-2000 were from the south of the Porcupine Bank. The majority of French landings from 2003-2006 are from the same area. The increase in French effort in 2006 (particularly March) was due to good weather conditions and the closed area for cod in the Celtic Sea.

Republic of Ireland

In 2006, 34 Irish vessels reported *Nephrops* landings from the Porcupine Bank. Of these only 23 reported landings over 10t. This represents and increase of around 20% in the number of vessels participating in the fishery since 2005 and effort increase of 9%. The fishery is mainly seasonal taking place mainly between April and July, landings for the remainder of the year are minimal. Most of the Irish vessels are multi-purpose trawlers and are relatively large (between 20 and 35 m in total length). Irish vessels land both whole prawns and tails depending on markets from this FU and the sizes of the Irish landings are significantly smaller that those for the French and Spanish fleets.

The Irish vessels are mainly using twin-rig trawls. Fishing is often weather dependent (particularly for the smaller vessels), with trip duration varying between 7 and 10 days.

Investigation of the landings data by statistical rectangle provided to the WGNEPH in 2002 indicates that the majority of the Irish landings between 1995 and 2001 were from the south central area of the Porcupine Bank.

A decommissioning scheme was launched in Ireland October 2005 and continued in 2006. To date, a total of 36 vessels. A further decommissioning programme will be announced shortly under the EFF 2007-2013 following governmental review with the aim of removing a further 40% of the whitefish fleet. Despite this there has been a shift in recent years towards *Nephrops* fisheries due to increase enforcement of monkfish quotas.

Spain

A description of the Spanish fleets fishing *Nephrops* in FU 16 is given in the 1999 WGNEPH report (ICES, 1999a). Investigation of the landings data by statistical rectangle provided to the WG in 2002 indicates that the majority of the Irish landings between 1998 and 1999 were from the south of the Porcupine Bank.

10.1.3 ICES Advice for 2007.

There are no exploitation boundaries for this stock. Although the total reported landings appear relative stable for FUs 16,17,18 &19 combined (~3,500 t), there have been large changes in fishing effort and landings for individual stocks furthermore landings may be unreliable for some countries. This may lead to unbalanced exploitation of stocks and over-fishing. Therefore ICES advise these *Nephrops* fisheries should be constrained to recent levels of effort at an appropriate geographical scale (FU).

10.1.4 Management applicable to 2006 and 2007.

The TAC area for this stock covers Sub-area VII and includes several distinct *Nephrops* stocks or Functional Units. The TAC in 2006 was 21,498 t. This was increased to 25,153 t in 2007.

The following TCMs are in place for *Nephrops* in VII (excluding VIIa) after EC 850/9 in operation since 2000:

Minimum Landing Sizes (MLS); total length >85 mm, carapace length >25 mm, tail length >46 mm. Although it is legal to land smaller prawns from this fishery marketing restrictions imposed by producer organisations in France mean smaller *Nephrops* (<35 mm CL or 115 mm whole length) are not retained in this fishery.

Mesh Size Restrictions; Towed gears targeting *Nephrops* having at least 35% by weight of this species on board will require 70 mm diamond mesh plus an 80 mm square mesh panel as a minimum or having at least 30% by weight of *Nephrops* on board will require 80 mm diamond mesh. The French fleet mainly operates with a 100 mm mesh in this area.

10.1.5 Commercial Catches and Discards

Total international landings (Table 10.1.1) rose through the 1970s reaching a peak of >4000 t in 1982. They declined through the late 1980s, rose again in the mid 1990s to around 3000 t before declining low lever fluctuating around 1000t between 2000-2004. Landings in 2005 and 2006 were around 2000 t.

Throughout most of the series Spain has taken the majority of landings, with France contributing significantly to the major peak in the time series of 4289t. In recent years the landings of both Spain in particular, but also France have declined. Irish landings now form the second largest component in the international landings. The UK landings have been in the region of 100t-200t. *Nephrops* discard was provided by France for the first time in 2007. This suggest that discarding in 2006 by the French Fleet was minor (~1% by number).

10.1.6 Biological Sampling

Annual landings length compositions are available from Spain (1986-2006), France (1995-2006) and Ireland (1995-2005). These indicate quite different length distributions between countries. The sampling level is given in Table 1.3.

Mean sizes in the landings (Table 10.1.2, Figure 10.1.1). The longest time series is for Spain have been quite stable generally between 39 and 43 mm CL for the males, and between 34 and 38 mm CL for the females until 2002. Since 2002 there has been an increasing trend in the mean size in the landings. Mean *Nephrops* sizes in French landings also shows and increasing trend for both sexes with the highest mean lengths in 2006. Mean sizes in the landings of Irish trawlers is more variable but also shows and increase over the last number of years.

Raised frequency distributions of the sampled landings by sex is given Figures 10.1.2 and 10.1.3. It should be noted that discards have not been included and the extent of high grading in this fishery or any inter-annual variations in the practice is not known. The discrepancy between survey and commercial length frequencies pointed out last year and apparent in Table 10.1.2 suggests that either high-grading is occurring or the survey may have a different size distribution to the commercial fleets for some selectivity or spatio-temporal reason.

From these the following observations can be made; the modal length of males has been reasonably stable around 40 mm CL over time whereas the female modal length has fluctuated considerably from 33-40 mm. The proportion of females in the landings increased substantially in the mid 1990's up until 1995 when females accounted for almost 50% in number and 64%. Since then the trend has been towards more males in the landings and the last 3 years females have accounted for less the 10% of the numbers caught.

It is difficult to extract other useful signal in the length frequency data so for males a number of indicators were calculated (Figure 10.1.4). These included a recruitment proxy (% of males < 32 mm CL), and percentage of larger individuals (>45 mm CL) in the population and exploitation proxy. The exploitation proxy used was the slope of ln(CL) versus ln(Numbers) between 41-56 mm CL i.e. the downward limb on the RHS of the frequency distribution. These indicators suggest the following; recruitment has fluctuated in the past and recruitment in the last three years has probably been weak. The fishery now exploits a higher proportion of larger individuals than ever before in the time series. Although probably biased by the strong recruitment first appearing in the LFDs in 2002 the exploitation may also be at the highest level in the time series. It should be noted that similar patterns to those described above are apparent in the data provided for each country independently.

10.1.7 Commercial catch-effort data

Effort and LPUE data are not standardised, and hence do not take into account vessel capabilities, efficiency, seasonality or other factors that may bias perception of abundance trends. These data are presented by country in Table 10.1.3 and Figure 10.1.5.

The effort index for the Spanish fleet (all gears) operating in Porcupine shows a steady decline from the 1970s until the early 1990s. Since then Spanish effort has declined more gradually to a low in 2001 after which it has increased slightly. *Nephrops* LPUE data for the Spanish fleet (all gears) shows a generally declining trend until 2003 since then LPUE has increased dramatically from 9kg/hr in 2003 to 27kg/hr in 2005 before declining somewhat in 2006.

French fishing effort for vessels where *Nephrops* constituted 10% of the landed value has fluctuated widely with peaks in the mid 1980s and through the late 1990s. Effort reduced substantial from 1999 to the lowest observed in 2003. French effort has increased substantially in the most recent three years. LPUE data for the French fleet in FU 16 were high in the 1980s but declined with fluctuations to a series low in 2000 (14kg/hr). Since then French LPUE has been increasing to 31kg/hr in 2005.

Effort data (hours fished un-standardised) for this FU16 is available from 1995 for the Irish otter trawl *Nephrops* directed fleet. A threshold of 30% of *Nephrops* in reported landings by trip is used to identify the catches and effort of this fleet. This threshold was based on analysis of the trip by trip catch composition. Irish effort declined through the late 1990s to a series low in 2000. Since then it has risen quite rapidly to the series high in 2006 reflecting increased participation in the fishery by larger Irish vessels as described in section 10.1.2. Irish LPUE has fluctuated widely, reflecting the sporadic nature of targeting *Nephrops* in the Porcupine fishery, but in general has a declining trend. Another interesting observation is that the Irish and French LPUEs have converged at a similar level (~25-30kg/hr) even though Irish LPUEs were double those of the French fleet in the past.

10.1.8 Information from surveys

The only fishery independent source of data for this stock is the Spanish Porcupine trawl since 2001. The survey shows two things; a much lower mean size the commercial fleets and an increasing trend in mean size for both sexes (Figure 10.1.1). Last year the CPUE pattern was examined for this survey but this was extremely variable probably due to *Nephrops* emergence and the impact of weather on catches in the area. The survey should provide information on recruitment but may not be a reliable abundance index for this stock.

10.1.9 Assessment

An experimental age structured assessment for this stock was carried out by the *Nephrops* WG in 1993 (ICES, 1993), in 2003 (ICES, 2003) and by the WGHMM (ICES,2005) in all cases the assessments being considered inadequate due to the poor quality and unexplainable inconsistencies in the input data. A major problem was the lack of a time series of reliable standardised CPUE data unknown discarding/high-grading practices and unknown growth rate of *Nephrops* in this area. These data and methodological problems have not been over come this year. Accordingly the WG did not attempt an analytical assessment for this stock.

10.1.10 Management Considerations

Landings, LPUEs and effort for all fleets all decline in the early 2000’s probably reflecting a decline in stock abundance. There was a substantial increases in landings and LPUE in 2004 and 2005 indicating some signs of a stock increase but in 2006 these indicators show a decrease again causing renewed concern about stock status. All the size distribution information shows an increase in the size of *Nephrops* in this area. This may be due to combined effects of weak recruitment in recent years and the growth of a good year class that first entered the commercial fishery in 2002.

Effort has increased substantially for the Irish and French fleets in the fishery. Similarly although Spanish effort has not increased greatly there has been a very large increase in LPUEs indicating increased targeting of *Nephrops*. This increase in targeting this stock is undesirable, and effort and catches should be reduced until the perception of stock trends are reliable and an expansion of the fishery is shown to be sustainable.

Table 10.1.1. - Porcupine Bank (FU 16): Landings (tonnes) by country, 1965-2006.

Year	France	Rep. of Ireland	Spain	UK	Total
1965	514				514
1966	0				0
1967	441				441
1968	441				441
1969	609				609
1970	256				256
1971	500		1444		1944
1972	0		1738		1738
1973	811		2135		2946
1974	900		1894		2794
1975	0		2150		2150
1976	6		1321		1327
1977	0		1545		1545
1978	2		1742		1744
1979	14		2255		2269
1980	21		2904		2925
1981	66		3315		3381
1982	358		3931		4289
1983	615		2811		3426
1984	1067		2504		3571
1985	1181		2738		3919
1986	1060		1462	69	2591
1987	609		1677	213	2499
1988	600		1555	220	2375
1989	324	350	1417	24	2115
1990	336	169	1349	41	1895
1991	348	170	1021	101	1640
1992	665	311	822	217	2015
1993	799	206	752	100	1857
1994	1088	512	809	103	2512
1995	1234	971	579	152	2936
1996	1069	508	471	182	2230
1997	1028	653	473	255	2409
1998	879	598	405	273	2155
1999	889	609	448	185	2132
2000	313	227	213	120	872
2001	366	369	270	158	1163
2002	324	543	276	139	1282
2003	130	296	333	108	867
2004	232	494	588	126	1441
2005	380	741	799	208	2128
2006	446	732	571	192	1941

Table 10.1.2. - Porcupine Bank (FU 16): Mean sizes (mm CL) of male and female *Nephrops* in Spanish, French and Irish landings and the Spanish Porcupine Groundfish survey.

	Spain		Rep. Of Ireland		France		Porcupine Survey	
Year	Landings		Landings		Landings		Catch	
	Males	Females	Males	Females	Males	Females	Males	Females
1981	39.9	34.5	-	-	-	-	-	-
1982	40.9	34.8	-	-	-	-	-	-
1983	40.8	34.0	-	-	-	-	-	-
1984	39.7	33.1	-	-	-	-	-	-
1985	38.7	33.5	-	-	-	-	-	-
1986	40.7	36.4	-	-	-	-	-	-
1987	39.3	35.0	-	-	-	-	-	-
1988	40.7	38.3	-	-	-	-	-	-
1989	40.5	36.8	-	-	-	-	-	-
1990	41.0	36.1	-	-	-	-	-	-
1991	39.4	34.5	-	-	-	-	-	-
1992	39.2	34.1	-	-	-	-	-	-
1993	41.6	36.1	-	-	-	-	-	-
1994	40.8	36.5	-	-	-	-	-	-
1995	41.3	36.6	40.7	36.5	43.2	38.3	-	-
1996	41.6	35.1	34.6	35.3	41.7	38.9	-	-
1997	39.7	34.8	35.9	34.5	41.9	38.4	-	-
1998	41.1	34.6	37.2	35.6	41.9	38.4	-	-
1999	41.5	35.7	36.6	33.7	43.1	39.1	-	-
2000	41.1	34.8	na	na	45.3	40.5	-	-
2001	41.1	36.3	37.8	35.4	45.4	39.4	36.0	28.9
2002	39.7	35.3	36.1	38.5	45.3	40.3	37.5	31.7
2003	41.4	37.8	44.5	36.2	46.2	38.9	39.7	31.9
2004	43.5	38.5	43.5	35.7	46.4	41.5	39.9	30.5
2005	43.4	38.1	46.9	40.6	45.9	41.0	45.1	33.8
2006	43.9	38.0	na	na	48.9	41.4	44.1	35.0

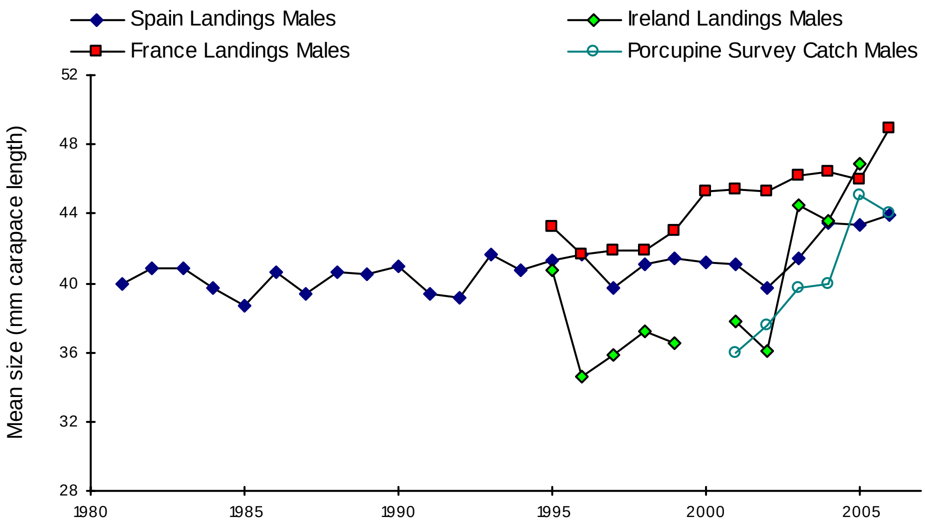
Table 10.1.3. - Nephrops Porcupine Bank (FU 16)

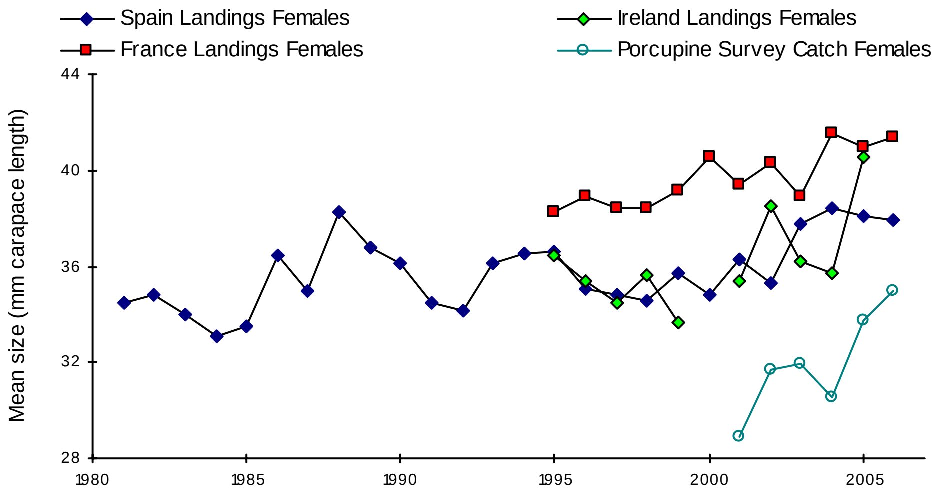
Landings and effort for the various different fleets exploiting the stock

Year	Spanish fleet			French Nep fleet[1]			Irish Nep Fleet[2]		
	Landings	Effort		Landings	Effort	LPUE (>10%)	Landings	Effort	LPUE
	Tonnes	day * BHP/100	T/day * BHP/100	Tonnes	('000's Hrs)	(kg/hr)	Tonnes	('000's Hrs)	(kg/hr)
1971	1444	159	9						
1972	1738	188	9						
1973	2135	181	12						
1974	1894	192	10						
1975	2150	229	9						
1976	1321	187	7						
1977	1545	196	8						
1978	1742	166	11						
1979	2255	157	14						
1980	2904	163	18						
1981	3315	143	23						
1982	3931	138	29						
1983	2811	108	26	615	18	35			
1984	2504	114	22	1067	30	35			
1985	2738	115	24	1181	33	36			
1986	1462	95	15	1060	28	38			
1987	1677	105	16	609	24	26			
1988	1555	109	14	600	22	27			
1989	1417	105	14	324	14	23			
1990	1349	96	14	336	15	23			
1991	1021	85	12	348	19	18			
1992	822	59	14	665	32	21			
1993	752	49	15	799	36	22	206		
1994	809	50	16	1088	38	28	512		
1995	579	48	12	1234	42	30	971	15	41
1996	471	43	11	1069	41	26	508	8	42
1997	473	42	11	1028	41	25	653	11	35
1998	405	43	10	879	40	22	598	10	42
1999	448	37	12	889	43	21	609	9	35
2000	213	30	7	313	23	16	227	2	31
2001	270	29	9	366	24	17	369	8	30
2002	276	31	9	324	18	22	543	10	38
2003	333	38	9	130	7	19	296	7	26
2004	588	32	18	232	9	25	494	16	21
2005	799	30	27	380	15	26	628	24	30
2006	571	39	15	446	22	21	683	28	25

[1]= Vessels where <10% of landed value was Nephrops [2]= Vessels where 20% of the landed weight was Nephrops

Figure 10.1.1 Nephrops in FU 16 (Porcupine Bank)
Landings mean sizes by sex and country
and in mean size in the catch for the Porcupine survey





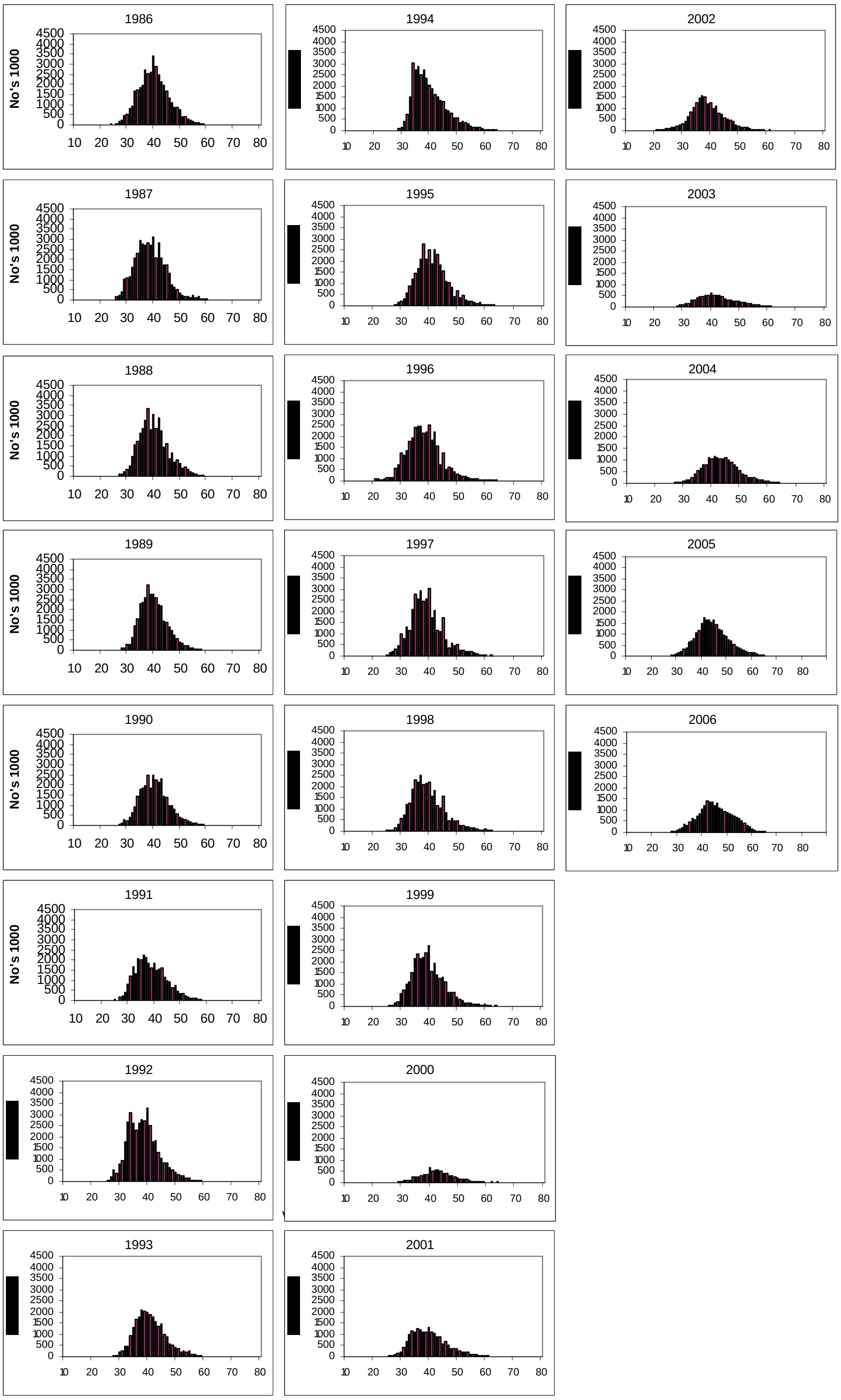


Figure 10.1.2. Nephrops FU 16 (Porcupine). Males landings length distributions

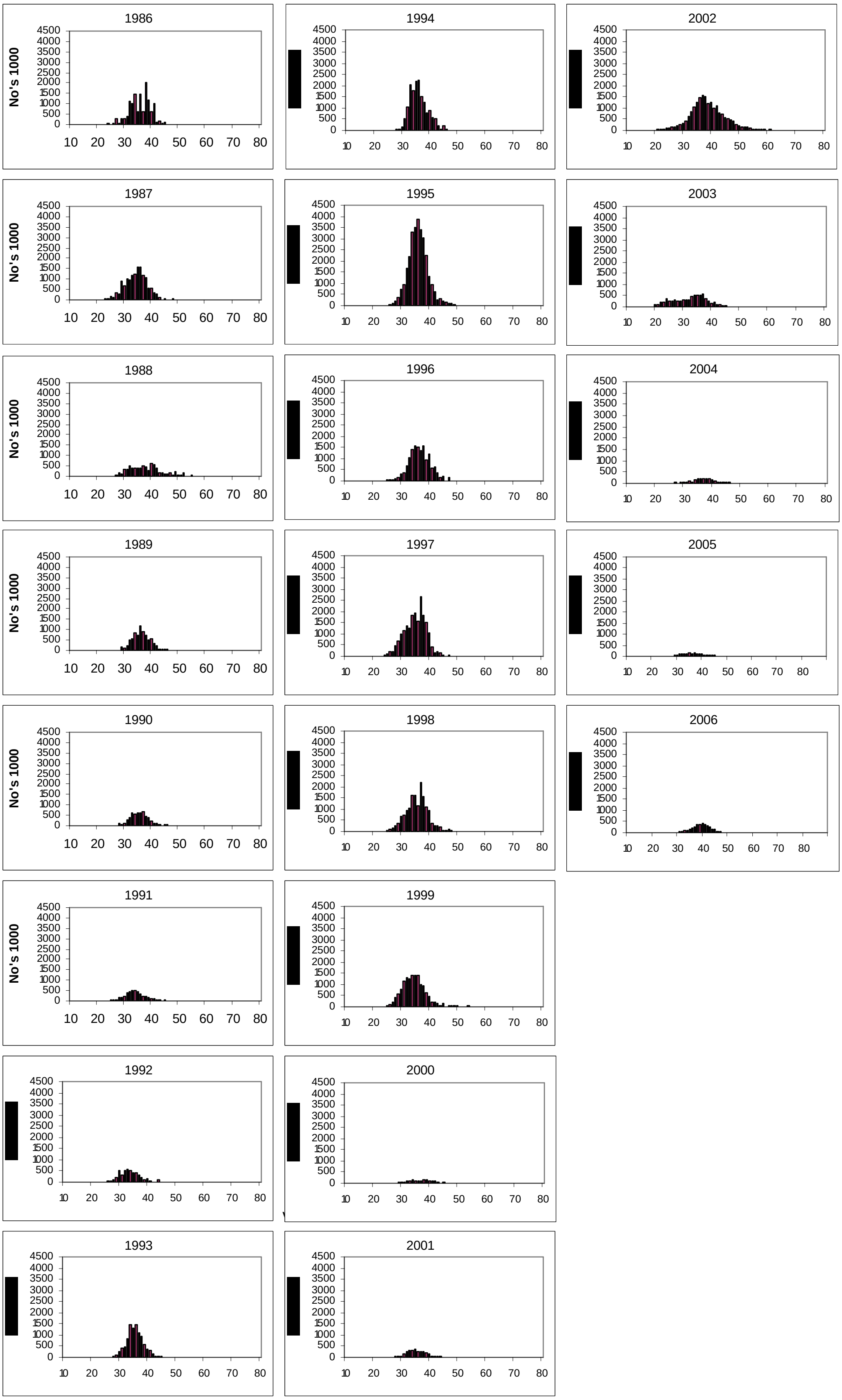


Figure 10.1.3. Nephrops FU 16 (Porcupine). Females landings length distributions

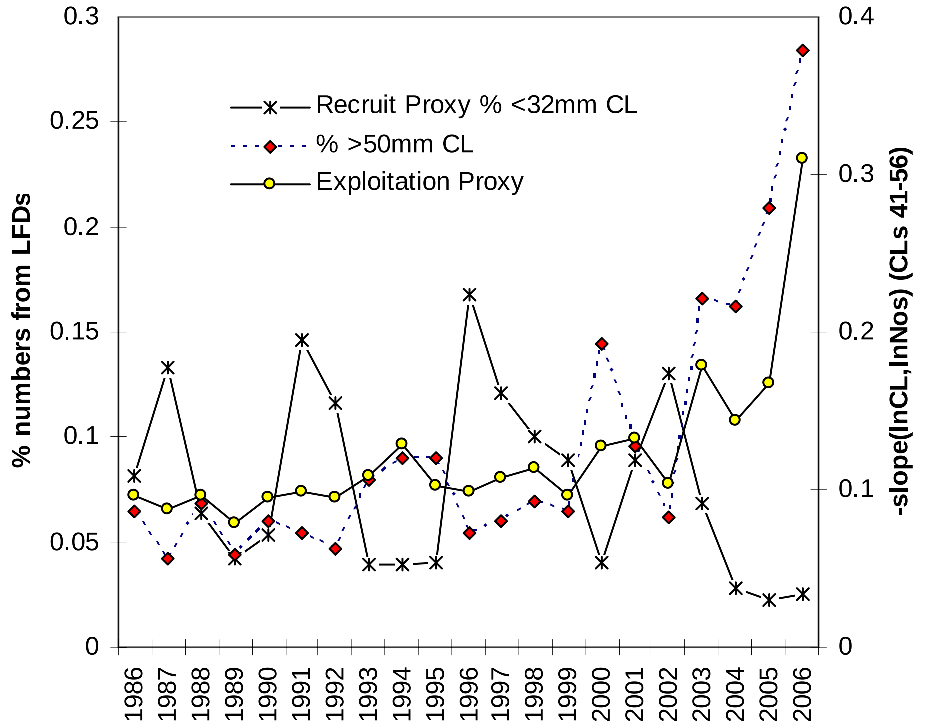
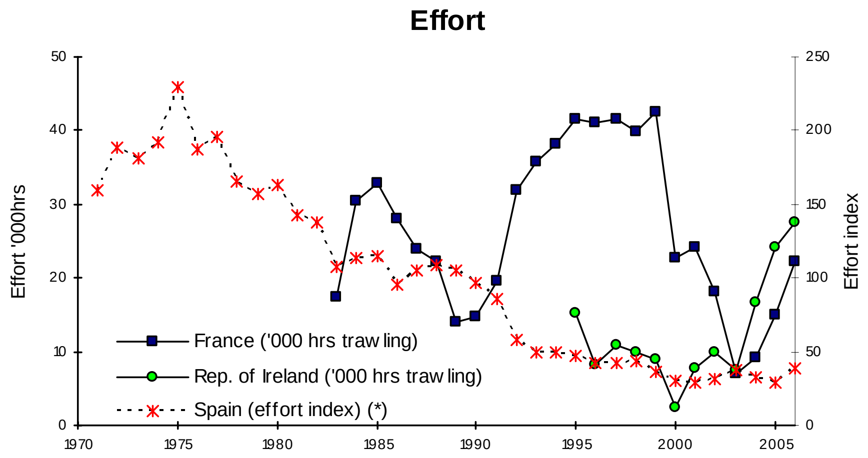
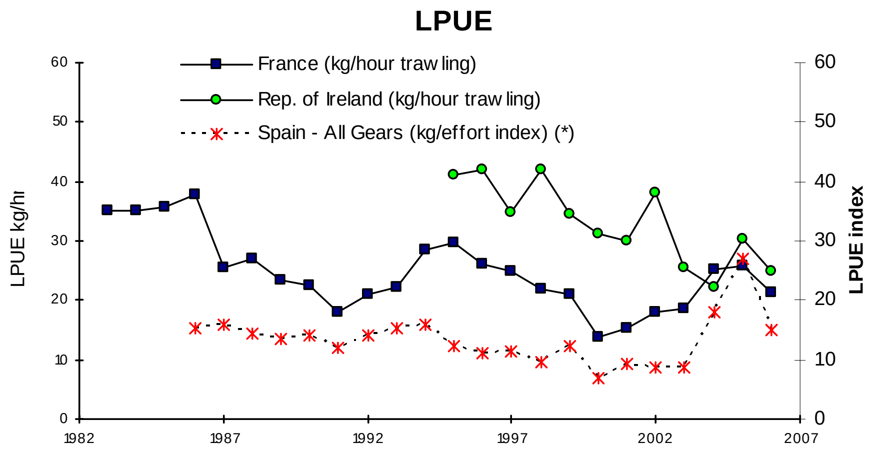


Figure 10.1.4 Nephrops FU 16 (Porcupine).
Trends in various proxies from Male length frequency data





(*) The Spanish effort index is based on a combination of hours at sea and average engine power. Irish and French effort and LPUE is unstandardised.

Figure 10.1.5 Nephrops FU 16 (Porcupine).
Effort and LPUE trends for fleets

10.2 FU 17 – Aran Grounds

This year the working group only updated the landings, effort and UWTV survey information for *Nephrops* in Division VIIb. A map of the spatial distribution of FU 17 is given in Figure 1.2 the FU includes *Nephrops* within the following ICES statistical rectangles; 34-35 D9-E0.

10.2.1 Ecosystem aspects

The Aran *Nephrops* ground is coincident with a pool of oceanic water, which is rich in nutrients and low in dissolved oxygen. The currents throughout the water column over the ground are generally weak. It is thought that this contributes to larval retention. However, there is a well-documented bottom density front on the eastern flank of the ground. This is a seasonal feature, which establishes in May and persists until autumn. The front causes a persistent jet like flow from south to north close to the seabed through the *Nephrops* ground. The mean position of jet varies from year to year by up to 30km. Timing and position of the jet may influence recruitment and settlement success of post-larval *Nephrops* since it could potentially advect larval from the area. Salinity differences, due to over winter fresh water input, are thought to heavily influence the density structure and location of this front. Until a time series of recruitment and jet dynamics is established it is not possible to draw any firm conclusions about the impact of this ecosystem feature on the stock and fishery. Work is underway to examine larval retention mechanisms through partial tracking models.

There is a growing body of information on the spatial extent of the sediment suitable for *Nephrops* from UWTV surveys, seabed mapping programmes and the fishing industry. Similarly work is underway to examine a range of explanatory variables (such as sediment) in relation to observed burrow densities from surveys (WKNEPHTV ICES, 2007).

10.2.2 Fishery description

Since 1996 the Republic of Ireland fleet had over 99 % of the landings from this FU. Thirty-five Irish vessels reported landings from this FU in 2005. However, only 25 of these vessels reported landings in excess of 10 t. This is a large increase in number of vessels operating in the fishery compared with 2005. The majority of these vessels are based in the port of Ros-a-Mhíl. Typical vessel length is 13-38m and engine power ranges from 120-870kW. The percentage of the landings made with the minimum mesh size (70 mm) also increased substantially from 5% in the period 2003-2005 to 18% in 2006. Fishing trips usually last 3-7 days. The most recent change in the fishery is the proportion of twin-rig vessels, which has increased to over 90 % of the fleet in the past nine years. Market forces and demands, availability of skilled crew and weather are significant factors in determining landings and catch composition.

The majority of the landings come from the grounds to the west and southwest of the Aran Islands known as the ‘back of the Arans ground’ (Working Document 14). The fishery on the Aran Grounds operates throughout the year, weather permitting with a seasonal trend (see section 10.2.5). In late 2005 and Q1 2006 it should be noted that landings were extremely low prompting concern from the industry about stock status. Landings levels improved in April-June and in the autumn fishery.

The main by-catch species landed by the *Nephrops* metiers in this area are monkfish and megrim (see section 2.1.3). A high proportion of the total catch is discarded (~43%) the main discard species are haddock, whiting and dogfish (Borges, 2005).

10.2.3 Data

No sampling of landings or discards was possible in 2006 due to the withdrawal of co-operation with scientific sampling programmes by the fishing industry. This situation has not been resolved so far in 2007 and will severely impact in the ability of ICES to assess the stock in the near future.

10.2.3.1 Commercial Catches and Discards

Prior to 1988 landings data for this fishery are only available to the WG for France. From a peak of 481t they decreased to 14t and remained low relative to the Irish catches since then (Table 10.2.1).

Since 1988 reported landings data for the Irish fleet were obtained from EU logbooks. These show an increasing trend from 1989 to a series high in 1998 of around 1,400 t. The reported Irish landings from FU17 have been around 650 t in recent years. There is concern about the accuracy of reported landings statistics for *Nephrops* by Irish vessels due to restrictive quotas and various misreporting practices.

Effort data for this FU is available from 1995 for the Irish otter trawl *Nephrops* directed fleet. A threshold of 30% of *Nephrops* in reported landings by trip is used to identify the catches and effort of this fleet. This threshold was based on an analysis of the trip-by-trip catch compositions. In 2006 this fleet accounted for ~90% of the landings and compared with an average of 70% over the time period. These data have not been standardised to take into account vessel or efficiency changes during the time period. Effort has declined somewhat since 2003 (Table 10.2.2). Landings per unit effort (LPUEs) have been fluctuating around an average of 37kg/hr with a slightly increase to the highest (52kg/hr) in the time series in 2006 (Figure 10.2.1).

In the past it was thought that *Nephrops* discarding in this fishery was low. Since 2001 discard rates have been estimated using unsorted catch and discards samples. Discard rates range between 15 to 21% of total catch by weight and 25-35% of total catch by number (Table 10.2.3). Discard rate of females tends to be higher due to the smaller average size. There is no information on discard survival rate in this fishery. No estimates of discards were available for 2006 due to the non co-operation of the fishing industry with sampling programmes.

10.2.4 Biological Sampling

There limited sampling in 2006 for this stock. The information provide last year remains unchanged.

10.2.5 Abundance indices from UWTV surveys

ACFM have recommended that UWTV surveys could provide useful fishery independent data on the status of poorly assessed *Nephrops* stocks. Since 2002 Ireland has conducted underwater television surveys on the Aran grounds and adjacent *Nephrops* grounds in FU 17. The results summarised in Table 10.2.4. For the Aran Grounds the results of a geostatistical analysis are reported and the random stratified estimates are given for the smaller Slyne Head and Galway Bay. The highest observed burrow densities occurred in 2004 with the lowest densities in the 2006 survey (Figure 10.2.2). The results indicate a significant decline (~40%) in both mean density and total burrow abundance on the Aran Grounds for 2006 to the lowest observed in the series.

The methods employed during the Aran UWTV surveys have recently been discussed and documented by WKNEPHTV (ICES, 2007). The workshop also considered the major uncertainties and assumptions in translating UWTV survey data to abundance or biomass.

The conclusion was that there is a continuum in terms of how surveys are used. Using the survey as a relative index to tune some assessment model is the least demanding since assumptions and bias (provided they are stay reasonably constant over time) are handled as catchability term. Using the survey as absolute estimator of biomass is the most rigorous since the assumptions and biases need to be accounted for or minimised to obtain an accurate result. Give the problems with commercial data for this stock it is not yet possible to have a full calibrated assessment therefore the survey can only be used as an absolute abundance estimate in terms of number of burrows visible.

For this particular survey field of view, occupancy and edge effects become critical when using the survey as an absolute abundance estimate. Whilst it is not possible to quantify these it is possible to estimate the relative scale of the problem. Variations in the field of view is not known since it is not straightforward to quantify. If anything it may lead to an over-estimation of burrow abundance by up to 30%. This bias may be weather dependent with overestimation more significant in poor weather conditions. Similarly the edge effect has not been estimated or corrected for may lead to an over-estimation bias in abundance by between 25-34%. Occupancy also and important unknown and in this survey the assumption is that all those burrow counted are occupied by a single *Nephrops*.

Simulations have shown that applying a 20% harvest ratio to *Nehrops* stocks looks sustainable in the long-term (ICES, 2007). However, these simulations assume perfect implementation of the survey and the catch. In the Aran Grounds this is not the case therefore it would be premature to continue with the harvest ratio approach discussed last year for this stock (ICES, 2006). The surveys may still be used to look the relationship between relative abundance (assuming constant bias in field of view, occupancy and edge effects) and landings and LPUE. When this is done some interesting correlations are observed. There is a negative relationship between survey abundance and landings and LPUE in the autumn fishery. There is also a positive relationship between survey abundance and landings and LPUE the following year.

This may be related to the biology, growth and recruitment dynamics of *Nephrops* on the Aran grounds. Previously, Lordan et al. (2005) have examined the life history of *Nephrops* in this area. That study indicated that female *Nephrops* emerge from their burrows in April or early May following the hatching of the eggs that they carried over winter. Maturation of females then occurs in May, June and July and once mature the females spawn and return to their burrows. The landings and LPUE patterns are linked to this cycle. With landings increasing in the spring as the females emerge and the males become more active. The sex ratio of males in the catches declines to less than 50% in May. Landings and LPUE are at their lowest in August and September. In the autumn a male and immature female dominated fishery (80%) occurs as the males become more active again.

The survey in June is timed towards the end of the main Spring fishery (Figure 10.2.3). The burrows represent small *Nephrops* which are establishing burrows for the first time (recruits) and this surviving from previous years. Note these are animals at least 1 year old since individuals hatched in April or early May would be too small to establish visible burrows at this stage. High burrow density in June may reduce autumn emergence because of a need to protect burrows. It is not likely to be an effect on-board selectivity because of large numbers of small *Nephrops* in the catch since there is no evidence of increase discards or indications of a recruiting cohort in years with high survey burrow density (Figure 10.2.3). The high burrow density in June may not translate into high landing and LPUEs until the following Spring when the recruits have had a year to grow.

It will be interesting to see if this relationship will be maintained in the future or is simply an artefact of the short data available. If it is then this could be a useful method to forecast short term stock development and landings. To be effective it would however require the timing of quota setting to be adjusted slightly to make effective use of the survey.

10.2.6 Assessment

10.2.7 Management strategies.

As yet there are no explicit management strategies for this stock but there have been some discussions amongst the fishing industry and scientists about developing a long term for the management of this fishery. Sustainable utilisation of the *Nephrops* stock will probably form the cornerstone of any management strategy for this fishery.

10.2.8 Management Considerations

In conclusion, the stock trends from the fishery (landings and LPUE) appear to be stable and effort has decreased in recent years. The relative UWTV survey index of burrow abundance has decreased since 2004. The 2006 estimate is the lowest since the series commenced in 2002. It is premature to have catch advice based on the survey although it may have some explanatory power when it comes to seasonal landings and LPUEs. Sampling of landings and discards stopped in 2006 due to non co-operation by the fishing industry and this will severely hamper attempts to have an adequate assessment for this stock short to medium term. Currently there is no serious concern about the stock status since burrow densities are still very high a new survey point will be available after June 07 which will provide a more up to date prognosis.

Current management dose not constrain landings from this fishery as the TAC is set for a much larger area and reported landings statistics are not thought to be reliable. Input control by constraining effort and fleet capacity around current levels would be an appropriate first step in managing this fishery.

Table 10.2.1 Nephrops in FU 17 (Aran grounds) Landings in tonnes by country

	FU 17			
Year	France	Rep. of Ireland	UK	Total
1974	477			477
1975	822			822
1976	131			131
1977	272			272
1978	481			481
1979	452			452
1980	442			442
1981	414			414
1982	210			210
1983	131			131
1984	324			324
1985	207			207
1986	147			147
1987	62			62
1988	14	814		828
1989	27	317		344
1990	30	489		519
1991	11	399		410
1992	11	361		372
1993	11	361	0	372
1994	18	707	4	729
1995	91	774	1	866
1996	2	519	4	525
1997	2	839	0	841
1998	9	1401	0	1410
1999	0	1140	0	1140
2000	1	879	0	880
2001	1	912	0	913
2002	2	1152	0	1154
2003	0	925	0	925
2004	0	525	0	525
2005	0	772	0	772
2006	0	635	0	635

Table 10.2.2 Nephrops in FU 17 (Aran Grounds)
Irish effort and LPUE for *Nephrops* directed fleet

Year	Irish Nephrops Directed Fleet		
	Effort (Hrs)	Landings (tonnes)	LPUE (kg/hr)
1995	15306	530	35
1996	9109	311	34
1997	15763	478	30
1998	21909	926	42
1999	19546	743	38
2000	17131	547	32
2001	18700	600	32
2002	18565	861	46
2003	19922	732	37
2004	12899	381	30
2005	14900	729	46
2006	10762	558	52

Table 10.2.3 Nephrops in FU 17 (Aran Grounds)
Landings and discard weight and numbers by year and sex

	Female		Male		Both sexes
Year	Landings (t)	Discards (t)	Landings (t)	Discards (t)	% Discard
2001	312	109	601	138	21%
2002	423	96	729	99	14%
2003	237	89	688	98	17%
2004	267	71	259	45	18%
2005	323	106	441	86	20%
2006	No Sampling				

	Female Numbers '000s		Male Numbers '000s		Both sexes
Year	Landings	Discards	Landings	Discards	% Discard
2001	18,665	12,161	29,949	13,250	34%
2002	23,105	9,374	31,256	8,326	25%
2003	14,530	9,577	29,538	8,744	29%
2004	16,109	7,068	12,930	4,282	28%
2005	20,280	11,383	21,828	8,967	33%
2006	No Sampling				

Table 10.2.4 Nephrops in FU 17 (Aran Grounds)

Results summary table for geostatistical analysis of UWTV survey

Ground	Year	Number of stations	Number of boundary points	Mean Density (No./M^2)	Var	Standard Deviation	CV_{geo}	Domain Area (km2)	Raised abundance estimate (million burrows)
Aran	2002	49	27	0.82	0.10	0.32	39%	892	753
Aran	2003	42	27	0.89	0.16	0.41	46%	894	817
Aran	2004	64	26	1.49	0.16	0.40	27%	889	1369
Aran	2005	70	28	1.14	0.08	0.28	25%	886	1047
Aran	2006	67	26	0.69	0.05	0.23	33%	889	635

Results summary table for empirical statistical analysis of UWTV survey

Ground	Year	Number of stations	Mean Density (No./M2)	Var	Standard Deviation	Standard Error	CViid (Relative SE)	Domain Area (km2)	Raised abundance estimate (million burrows)
Galway Bay	2002	7	1.58	0.14	0.37	0.14	8.8%	41	65
	2003	3	1.60	0.09	0.29	0.17	10.6%	41	66
	2004	9	0.73	0.18	0.42	0.14	19.4%	41	30
	2005	4	1.67	0.04	0.20	0.10	6.0%	41	69
	2006	3	1.01	0.06	0.25	0.15	14.5%	41	41
Slyne Grounds	2002	5	0.85	0.04	0.19	0.08	9.9%	26	22
	2003							26	
	2004	3	0.68	0.07	0.27	0.15	22.7%	26	18
	2005	3	0.55	0.00	0.05	0.03	5.6%	26	14
	2006	3	0.41	0.04	0.20	0.11	28.1%	26	11

Year	FU 17 Raised abundance estimate (million burrows)
2002	840
2003	883
2004	1416
2005	1130
2006	687

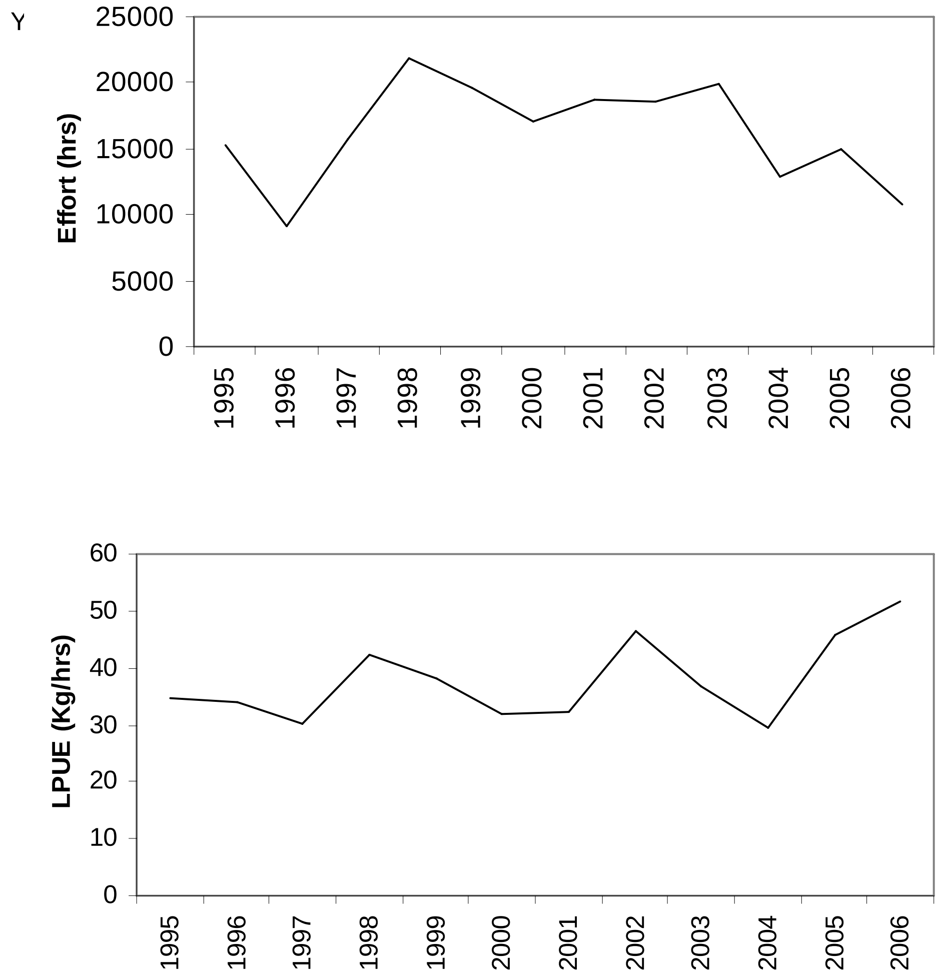


Figure 10.2.1 *Nephrops* in FU 17 (Aran Grounds)
Irish effort and LPUE for *Nephrops* directed fleet

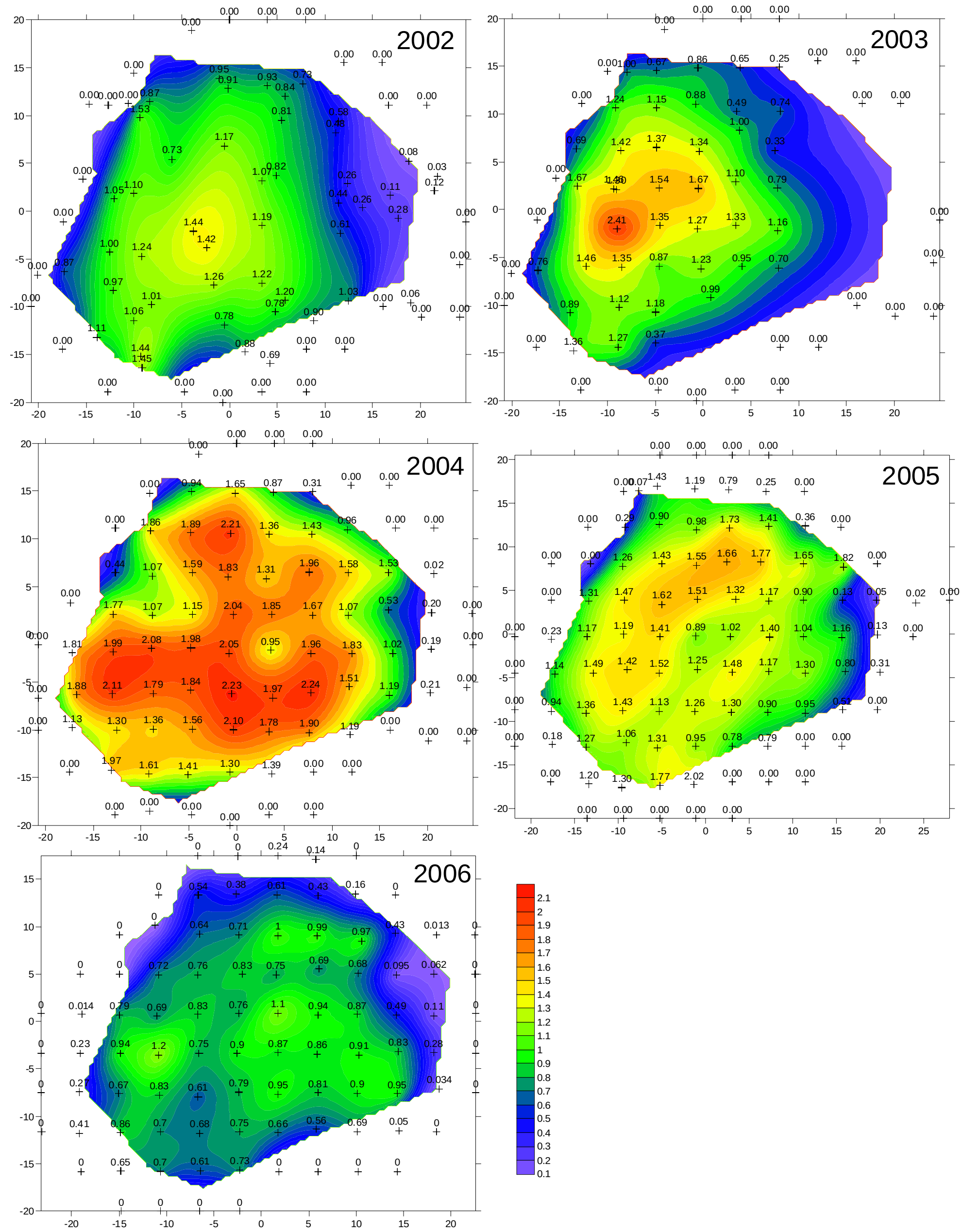
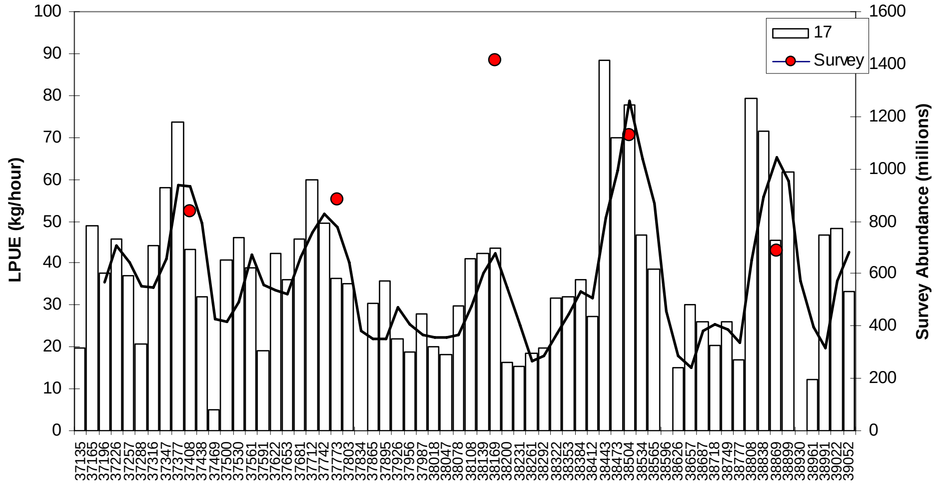
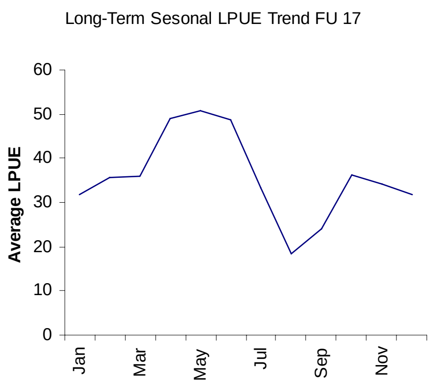


Figure 10.2.2 Nephrops in FU 17 (Aran Grounds)
Contour plots of the krigged density estimates for the Aran Grounds UWTV surveys from 2002-2006.

a) The LPUE (kg/hr) for the Nephrops fleet in FU17 together with UWTV survey abundance



b) The long-term (1995-2006) trend in LPUE



c) The relationship between LPUE in two different periods & survey abundance

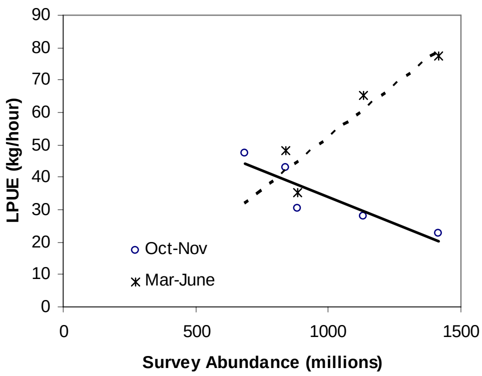


Figure 10.2.3 Nephrops in FU 17 (Aran Grounds)

10.3 FU 19 – Ireland SW and SE Coast

This year the working group only updated the landings, effort and mean size in samples for this area. A map of the spatial distribution of FU 19 is given in Figure 1.2 the FU includes *Nephrops* within the following ICES statistical rectangles; 31-33 D9-E0; 31E1; 32E1-E2; 33E2-E3.

10.3.1 Ecosystem aspects

General comments about the species biology, bottom topography substrate and circulation are presented in Section 10.1.1.

In FU 19 *Nephrops* are caught on a large number of spatially discrete small inshore grounds and on some larger grounds further offshore. Of these the 'Galley ground', around the Kinsale Gas Rigs and south of Cork appear to be the most important.

10.3.2 Fishery description

The number of Irish vessels reporting landings from FU19 was been around 80 vessels for the last few years. Of these, in 2006 only 27 reported landings in excess of 10 t and these 17 vessels accounted for 62 % of the total landings. The Irish fleet fishing *Nephrops* in FU 19 was described in detail in the 2001 WG report (ICES, 2001a). The minimum mesh size in use is 70 mm, with the average being 80mm. There were no landings by French vessels from FU 19 in 2006.

10.3.3 Data

The sampling level for the species is given in Table 1.3.

10.3.4 Commercial Catches and Discards

Landings data for FU19 are summarised in Table 10.3.1. The Republic of Ireland, France and the UK report landings for FU 19. The Republic of Ireland landings have fluctuated considerably throughout the time series, with a marked dip in 1994 (Figure 10.3.1.). The highest landings in the time series were observed in 2002-2004 (>1000 t). Landings in 2005 and 2006 have been below average for the serise. Landings by the French fleet have fluctuated with a declining trend throughout the time series from the highest value in 1989 of 245t to no landings in 2006. Landings from the UK are minor.

Effort and LPUE data are available for the Irish *Nephrops* directed fleet in FU 19 from 1995-2005 (Table 10.3.2, Fig 10.3.2). The effort increases substantially in 2002 this is in part due to the inclusion of smaller vessels (10-18 m) in the data set. These vessels did not record logbook operations prior 2002. The LPUE and effort series is based on the same criteria for FU 16 and 17 and will be contingent on the accuracy of landings data reported in logbooks. The LPUEs have fluctuated between 15-30kg/hr with a slightly declining trend. The LPUE are lower than for other FUs reflecting the smaller size of the vessels and generally more mixed nature of this fishery.

For FU18 landings information from 1993 was available to the WG only. The Republic of Ireland has taken 100% of the landings for the last seven years. The highest reported landings were in 1994 with124t landings in recent years have been minor (14 t in 2006).

10.3.5 Biological Sampling

Length frequency data of the landings were collected on an irregular basis in the years 1996 to 1997, 1999 and 2002 to 2006. Spatial and temporal coverage is also problematic with landings from FU 19 coming from several discrete grounds. In 2005 length frequency data are only available for quarters 2 and 3. The length frequencies for the remaining quarters have been derived by raising those length frequencies observed to the quarter 1 and 4 landings figures.

The data series of the mean sizes of *Nephrops* in the landings of Irish trawlers is too short and inconsistent to draw definite conclusions (Table 10.3.3, Figure 10.3.3). The mean size of males varied between 29 and 41 mm CL, and for females between 26 and 40 mm CL. There is slight increase in mean size for both sexes in 2006. So far, however, the data series is too short to provide useful information on the state of the stock.

It should be noted that due to the change in sampling methodology from 2001 onwards the profile of the length frequencies has changed as a result of inclusion of smaller individuals from the discard component.

10.3.6 Information from surveys

The UK March groundfish survey has been carried between 1984 and 2004. This survey was examined last year and there is a slight indication of a decline in mean sizes of *Nephrops* compared with those observed in the late 1980s. This survey also indicated substantial but stable differences in mean size from different stations within the FUs suggesting that different population size distributions of spatially discrete patches. In 2006 some UWTV stations were carried out within FU19 as part of the Celtic Sea UWTV survey (mainly targeting FU 20-22). The heterogeneous distribution of *Nephrops* and sediment in FU 19 will make accurate UWTV survey abundance estimate difficult to obtain on a regular basis.

10.3.7 Assessment

A much improved and longer historical time series of data is needed to carry out analytical assessment of this stock. Although sampling of this stock is required under the EU data collection regulation it is difficult to obtain precise length frequency data at the spatial resolution required to assess *Nephrops* in such a heterogeneous area where several small discrete fisheries occur. Future assessments would benefit from a higher spatial resolution of landings and effort data (possibly from VMS). Fishery independent methods such as UWTV surveys may also be useful for this FU in the future.

10.3.8 Management Considerations

The time series of LPUE data based on logbook data for FU 19 is short and highly variable. The LPUEs since 2003 have been stable slightly below the average of the series. Reported landings in the last 2 years have been around 20% below average.

10.4 Summary for Functional Units 16,17, 18, 19 and other rectangles in Divisions VIIbcjk.

The Functional Units 16,17, 18 and 19 occur within the larger Sub-area VII TAC area for management purposes. Consequently there is a risk that inappropriate levels of catches may be taken from stocks within the TAC area. Similarly unsustainable levels of effort and fishing mortality may be applied to these stocks. Landings for all FU's are summarised in Table 9.4.1. It should be note that different misreporting practices are also known to be occurring within this TAC area.

The WG recognise that there may be practical difficulties in managing effort *Nephrops* fisheries and constraining fleet mobility. The recent large changes inter-annual changes in effort and targeting practices in these fisheries may result in over exploitation, reducing longer-term yield and compromising sustainability.

Table 10.3.1 Nephrops in FU 18 and FU 19 (NW, SW and SE Ireland)
Landings in tonnes by Functional Unit

	FU 18			FU 19			
Year	Rep. of Ireland	UK	Total	France	Rep. of Ireland	UK	Total
1989				245	652	2	899
1990				181	569	4	754
1991				212	860	5	1077
1992				233	640	15	888
1993	9	1	10	229	672	4	905
1994	124	2	126	216	153	21	390
1995	24	2	26	175	507	12	695
1996	46	1	46	145	736	7	888
1997	13	2	15	93	656	7	756
1998	77	1	78	92	733	2	827
1999	15	0	16	70	499	3	572
2000	9	0	9	134	541	11	686
2001	2	0	2	105	702	2	809
2002	14	0	14	162	1130	0	1292
2003	16	0	16	151	1075	0	1226
2004	25	0	25	68	997	1	1066
2005	15	0	15	4	640	0	644
2006	14	0	14	0	662	0	662

Table 10.3.2. - Ireland SW and SE coast (FU 19): Irish effort hrs and LPUE, 1993-2006

Year	Irish Fleet		
	Nephrops trawlers (>30% landings weight)		
	Effort hrs	Landings Tonnes	LPUE Kg/hr
1995	9126	206	22.5
1996	9295	220	23.7
1997	9604	248	25.8
1998	15775	386	24.5
1999	13345	206	15.4
2000	9329	178	19.1
2001	9701	309	31.8
2002	25565	764	29.9
2003	28887	621	21.5
2004	26554	529	19.9
2005	23848	455	19.1
2006	24010	456	19.0

Table 10.3.3 Nephrops in FU 19 (Ireland SW and SE Coast)
Irish trawlers mean sizes in catch and landings data series

Year	Catches		Landings			
			<35mm CL		>35mm CL	
	Males	Females	Males	Females	Males	Females
1995	na	na	na	na	na	na
1996	34.5	31.3	31.1	29.7	38.7	38.8
1997	34.6	32.9	31.2	30.9	39.8	38.4
1998	na	na	na	na	na	na
1999	38.5	35.4	31.8	31.2	41.3	39.1
2000	na	na	na	na	na	na
2001	na	na	na	na	na	na
2002	30.4	28.8	29.7	28.8	39.9	40.5
2003	33.1	29.4	31.1	30.0	38.4	38.0
2004	32.8	28.8	32.0	30.2	39.8	37.7
2005	31.3	27.5	29.1	26.9	38.4	37.0
2006	34.4	31.7	31.4	30.4	38.9	37.7

na = not available

Table 10.4.1 Total Nephrops landings (in tonnes) VIIbcjk & inshore rectangles along the south and south east coast of Ireland

Year	FU 16	FU 17	FU 18	FU 19	Other Rectangles	TOTAL MA L
1965	514	-	-	-	-	514
1966	0	-	-	-	-	0
1967	441	-	-	-	-	441
1968	441	-	-	-	-	441
1969	609	-	-	-	-	609
1970	256	-	-	-	-	256
1971	1944	-	-	-	-	1944
1972	1738	-	-	-	-	1738
1973	2946	-	-	-	-	2946
1974	2794	477	-	-	-	3271
1975	2150	822	-	-	-	2972
1976	1327	131	-	-	-	1458
1977	1545	272	-	-	-	1817
1978	1744	481	-	-	249	2474
1979	2269	452	-	-	237	2958
1980	2925	442	-	-	205	3572
1981	3381	414	-	-	382	4177
1982	4289	210	-	-	234	4733
1983	3426	131	-	-	174	3731
1984	3571	324	-	-	187	4082
1985	3919	207	-	-	194	4320
1986	2591	147	-	-	113	2850
1987	2499	62	-	-	107	2669
1988	2375	828	-	-	140	3343
1989	2115	344	-	899	134	3492
1990	1895	519	-	754	102	3270
1991	1640	410	-	1077	169	3296
1992	2015	372	-	888	409	3683
1993	1857	372	10	905	455	3599
1994	2512	729	126	390	570	4327
1995	2936	866	26	695	397	4920
1996	2230	525	46	888	623	4312
1997	2409	841	15	756	340	4361
1998	2155	1410	78	827	514	4985
1999	2132	1140	16	572	322	4182
2000	872	880	9	686	243	2691
2001	1163	913	2	809	368	3256
2002	1282	1154	14	1292	243	3986
2003	867	925	16	1226	186	3219
2004	1441	525	22	1066	161	3215
2005	2128	772	15	644	176	3736
2006	1941	635	14	662	175	3428

- indicate no data available (landings form all areas are only available since 1993)

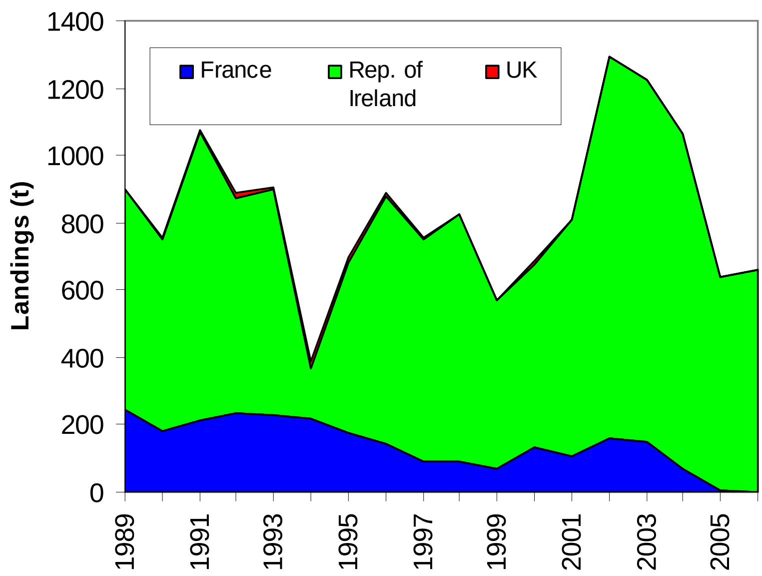


Figure 10.3.1 Nephrops in FU 19 (Ireland SW and SE Coast)
Landings in tonnes by country

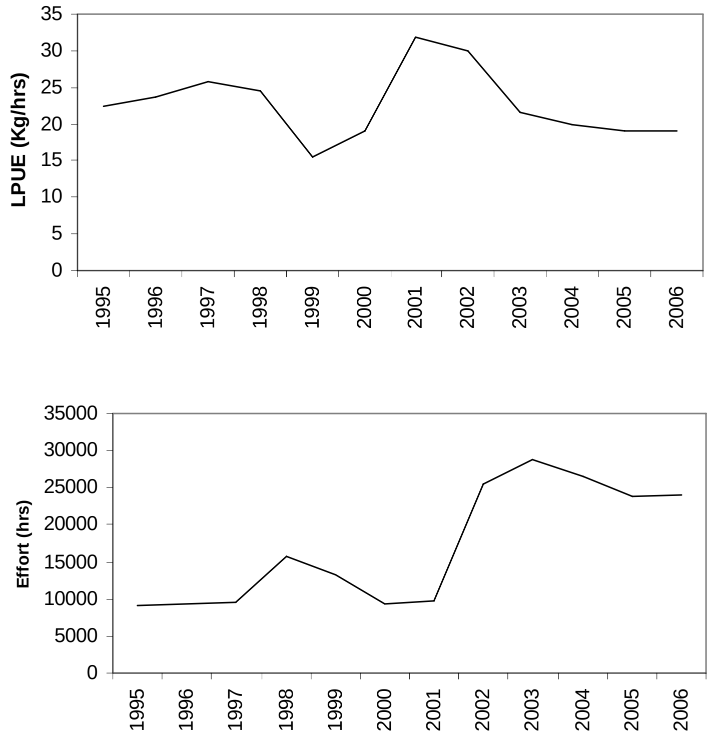


Figure 10.3.2 Nephrops in FU 19 (Ireland SW and SE Coast)
Trawl LPUE for Irish OTB vessels where >30% of landed weight was Nephrops

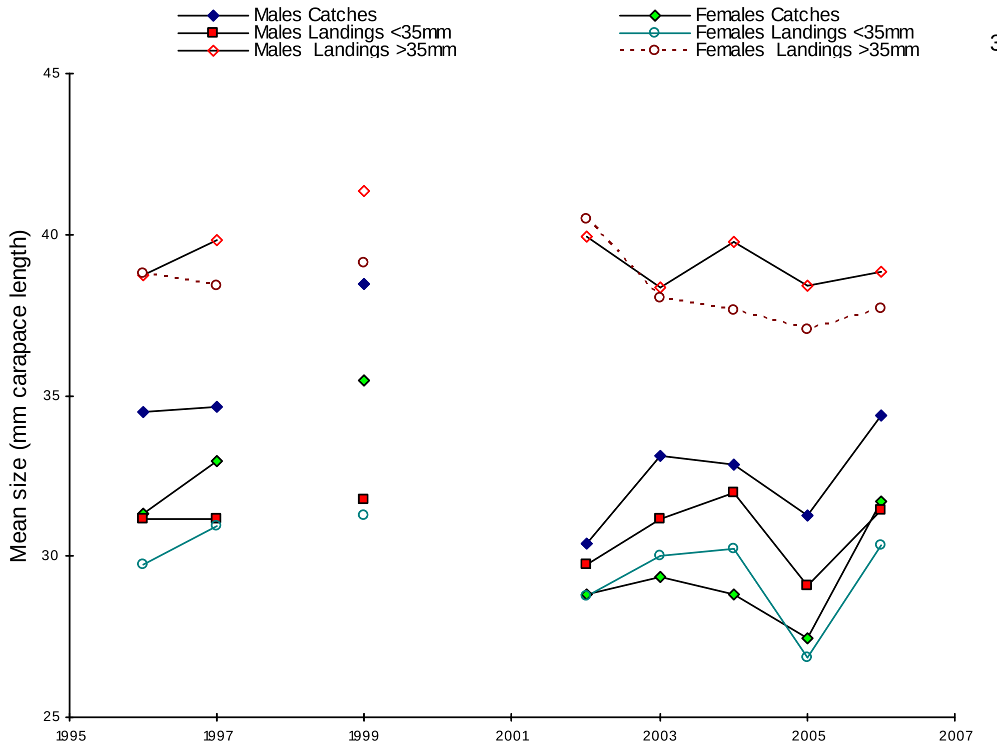


Figure 10.3.3 Nephrops in FU 19 (Ireland SW and SE Coast)
Mean size trends for catchs and whole landings by sex.

11 *Nephrops* in ICES Division VIIIa,b (FU 23-24)

Type of assessment in 2007: update. The WG proposed a benchmark assessment for next year.

No data revision has been carried out this year.

A survey specifically designed to evaluate abundance indices of *Nephrops* commenced in 2006 (Sec. 11.2.3).

A new additional method for discard data estimation and reconstruction of discard series, based on a probabilistic approach, was presented to the WG (WD 10). Although this year the type of assessment was scheduled as update, the WG investigated additional exploratory runs based on different approaches of derivation of discards for missing years (Sec. 11.3). The probabilistic approach method was considered promising and should be developed (see also Recommendations - Sec 1.3.3) for a benchmark assessment.

This year, several signals confirm a good incoming 2004 year class (Sec. 11.3.3). Following concerns on the ability to confirm and determine the strength of, this year class, further analysis were performed (Annex K2).

11.1 General

There are two Functional Units in ICES Division VIIIa,b: FU 23 (Bay of Biscay North) and FU 24 (Bay of Biscay South), together called Bay of Biscay *Nephrops*.

11.1.1 Ecosystem aspects

Nephrops present particular ground features and in the Bay of Biscay are located on the central mud bank (total surface area of the fishery close to 12000 km²; water depths comprised between 70 and 130 m). This species are exclusively targeted by trawlers which can also cause by-catch mortalities on associated species mainly on hake juveniles because this area is a nursery of the Northern stock of hake. By-catches of other species (anglerfish, blue whiting) are lower.

WG 2006 introduced some modifications of the maturity parameters by sex. As stated last year, maturity of males is explained by the first size of functional maturity (26 mm CL). Previously, maturity of females was assumed to be knife-edged whereas now it is described by a s-shaped curve (logistic model with L50 of 22.5-24 mm CL which is not significantly different to the value already used by WG *i.e.* 25 mm CL).

11.1.2 Fishery description

Nephrops in FUs 23-24 is exploited by French trawlers almost exclusively. The general features of the *Nephrops* fishery in the Bay of Biscay, as described in previous reports are still valid.

This fleet generates an average annual turnover close to 80 million euro *Nephrops* landings correspond to 40% of this turnover (32 million euro in 2005), but this amount varies strongly from one unit to another. The proportion of the turnover involving *Nephrops* is even higher in the northern part of the fishery (southern Brittany) while vessels of regions outside Brittany are more multi-purpose and target alternatively *Nephrops* (around dawn and dusk) and finfish during the same trip. Two thirds of the *Nephrops* trawlers (151 vessels) are concentrated in southern Brittany.

The intensity of *Nephrops* directed fishing varies during the year according to the seasonal variations of the accessibility of targeted species which is higher in spring and summer: more than 70% of the total landings of *Nephrops* (average of 1987-2006) take place during the 2nd and 3rd quarters. Also, very low quantities are landed in January even if the contribution of winter months has increased in recent years.

11.1.3 ICES Advice for 2007

Single-stock exploitation boundaries: " The present fishing mortality is well above the $\mathbf{F}_{max}$ of 0.20. Fishing at $\mathbf{F}_{max}$ in 2007 would be equivalent to landings of 2700 t. "

Exploitation boundaries in relation to precautionary consideration: "The stock appears to have tolerated the exploitation level exerted over a longer period. This would lead to advice of maintaining F at F *status quo*. A *status quo* F would, under the present assumption of an exceptional incoming year class, lead to an increase in catch opportunities of about 20% in 2007. However, as the strength of this year class is still considered uncertain, ICES recommends not to increase catches in 2007 over the recent level of 3600 t (2003-2005) until the strengths of the recent year classes have been confirmed."

11.1.4 Management applicable for 2006 and 2007

The *Nephrops* fishery is managed by TAC together with technical measures. For 2006, the agreed TAC was 4030 t (taking into account prt of the quota overshot in 2005) and the total landings reached 3430 t. For 2007, the TAC finally agreed is equal to 4320 t.

For a long-time, a minimum landing size of 26 mm CL (8.5 cm total length) was adopted by the French producers' organisations (larger than the EU MLS set at 20 mm CL *i.e.* 7 cm total length). Since December 2005, a new French MLS regulation (9 cm total length) has been established and this change had already significant impact on the data used by the WG for 2006.

A mesh change was implemented in 2000 and the minimum codend mesh size in the Bay of Biscay is 70 mm instead of the former 55 mm for *Nephrops*, which had replaced 50 mm mesh size in 1990-91. 100 mm mesh size is required in the *Hake* box. In 2006, it should be noted that *Nephrops* trawlers were, for one year, allowed to fish in the hake box with the current mesh size of 70 mm once they have adopted a square mesh panel of 100 mm. This derogation was still maintained for 2007.

A licence system was adopted in 2004 and, since then, there has been a cap on the number of *Nephrops* trawlers operating in the Bay of Biscay of 250. In 2006, the French producers' organisations adopted new additional regulations which had some effects on fishing effort limitation (see § 11.3.4).

11.2 Data

11.2.1 Commercial catches and discards

Total catches, landings and discards, of *Nephrops* in division VIIIa,b for the period 1960-2006 are given in Table 11.1.

Nearly all the landings from FUs 23-24 are taken by French trawlers. Small landings are reported by Belgium from rectangles inside the FUs, and by Spain from rectangles outside the FUs but inside the Divisions VIII ab (MA N) (see Table 11.1).

Throughout the mid-60's, the French landings gradually increased to a peak value of 7000 t in 1973-1974, then fluctuated between 4500 and 6000 t during the 80's and the mid-90's. An increase has been noticeable since 2001 apart from 2004. A slight decrease also occurred in 2006 (3430 t compared with 3690 t in 2005) due to the MLS change and to the fishing effort limitations.

Males usually predominate in the landings. Females are less accessible in winter because of burrowing and, moreover, they have a lower growth rate. As reported by WG 2006, the female proportion in landings slightly increased for the first ten years of the time series (1987-1997), but this trend has not continued during recent years because of a less typically seasonal fishing profile which affects sex ratio. Between 1998 and 2006, the cumulated percentage of the 1st and 4th quarters in the landings has increased from 19 to 30%. This can be explained by gradual specialisation in *Nephrops* trawling (proportion of twin trawlers has increased for more than 10 years).

Discards represent most of the catches of the smallest individuals as indicated by the available data (Figure 11.1). The average weight of discards per year in the period 1987-2006 (with derivation biases already stated by WGHMM 2006) is about 1660 t whereas discard estimates of the recent sampled years (2003-2006) reached a higher level of 2850 t. This change in the amount of discards could be the consequence of the restriction of individual quotas, the strength of the recent recruitments, the change in the MLS (which tends to increase the discards), although the change in the selectivity should tend to reduce the discards. The relative contribution of each of these three factors remains unknown.

11.2.2 Biological sampling

Discard data acquired by sampling on board are available for 1987, 1991, 1998 and since 2003. As applied by previous WG, for the intermediate years up to 2002, numbers discarded at length were derived in the following way (Table 11.2):

- the estimates for 1988-90 from the data collected during the 1987 discard sampling programme;
- estimates for 1992-97 from the 1991 sampling programme and
- estimates for 1999-2002 from the 1998 sampling programme.

The derivation method uses ratios at each length between discards and total numbers landed for the two sexes combined by quarter.

Since 2003, discards have been estimated from sampling catches programme on board *Nephrops* trawlers (181 trips and 449 hauls have been sampled for four years). Discards for sampled fishing trips are estimated by ratio estimator using the total number of fishing trips by quarter as auxiliary variable. In spite of improvements in agreement between logbook declarations and auction hall sales, the total number of trips is usually not well known and needs to be estimated. This can be done using the number of auction hall sales, when boats conduct daily trips, which is the case in the northern part of the fishery, but not in the southern one. Discard sampling from the southern part of the fishery was carried out only once in the past (2005), thus, the poor set of available data cannot yet be used by WG.

The derivation effect for the discards as explained above is shown in Figure 11.2. Derived discards mean length are obviously the same however, change was observed when a new discard sampling programme was conducted.

These variations in discard mean lengths reflects the influence of the annual variability of recruitment on the discard rate which is related to regulations on MLS and codend mesh size. The integration of a set of independent variables (recruitment strength, density of probability of discards, regulations, market considerations) to extrapolate reliable discard rate from sampled to missing years was already considered by WG in methodological analysis (ICES folders). This method took promising, but the WG considered it premature to switch to a new discard derivation method this year since it was an update assessment.

The length distribution of landings, discards, catches and removals are presented in Tables 11.3.a-d and in Figure 11.1. Removals at length are obtained by adding the landings and “dead discards" and applying a discard mean survival rate of 30% (see input parameters in Table 11.4).

Combined males and females mean lengths are presented for catches, landings and discards in Figure 11.2.

The L2AGE slicing program allocates length classes into age groups by assuming Von Bertalanffy model of individual growth (see input parameters in Table 11.4). The ages obtained are not absolute but relative ones (t0 is fixed at 0). This slicing is applied to length distributions by sex and these age distributions are summed to obtain a "sex combined" one. Age distributions of landings and discards are given by Figure 11.3. Removals age composition is shown in Table 11.5.

The natural mortality is assumed to be 0.3 for age group 1 and 2 (100% consisting of immature individuals for both sexes) and 0.25 for other age groups using a combination of the mortality rates of both sexes.

Since WG 2006, a new maturity ogive for sexes combined has been estimated and it has been applied to the whole series.

AGE	1	2	3	4	5	6	7	8	9+
PROPORTION OF MATURE (SEE WG 2006)	0	0	0.75	1	1	1	1	1	1

Recruitment is assumed to occur at the 1st January and SSB is calculated at this date.

The Table 11.4 shows the input parameters used in the assessment.

11.2.3 Abundance indices from surveys

At present abundance indices are not available for this stock. This situation will be improved in the future once a data time series has been collected. A survey specifically designed to evaluate abundance indices of *Nephrops* commenced in 2006 (with the most appropriate season: 2nd quarter, hours of trawling: around dawn and dusk and fishing gear: twin trawl). This survey (called LANGOLF) occurs once a year in May. Therefore, its results for abundance indices cannot be available for the WG of the same year. In medium-term, tuning data currently based on commercial catch-effort set (see §11.2.4) should be extended by using LANGOLF data.

11.2.4 Commercial catch-effort data

Commercial fleets used in the assessment to tune the model

Up to 1998, the majority of the vessels were not obliged to keep logbooks because of their size and fishing forms were established by inquiries. Since 1999 when logbooks became compulsory for all vessels longer than 10 m. The available log-book data cannot be considered as representative of the whole fishery during the overall time series and, since 2004, it was attempted to define a better effort index as described in the WGHMM 2005 report.

Effort data indices, landings and LPUE for the "Le Guilvinec District" *Nephrops* trawlers in the 2nd quarter are available for the whole time series (Table 11.7; Figure 11.4). Effort increased from 1987 to 1992, but there has been a decreasing trend since then. This trend in effort can be explained by the decrease in the number of fishing vessels following the decommissioning scheme implemented by the EU. The LPUEs of the "Le Guilvinec district" 2nd Quarter *Nephrops* fleet are fairly stable, fluctuating around a long-term average of 12.0 kg/hour (Figure 11.4), where the maximum in the series of 16.5 kg/hour occurs in 1988 and

2001. LPUE almost remained stable between 2005 and 2006 (12.9 to 13.4 kg/hour *i.e.* +3%) despite increase of MLS.

Changes in fishing gear efficiency and individual catch capacities of vessels, imply that the time spent at sea may not be a good indicator of effective effort and hence LPUE trends are possibly biased. Since the early 90's, the number of boats using twin-trawls increased (10% in 1991, 90% in 2004) and also the number of vessels using rock-hopper gear. Moreover, an increase in onboard computer technology has occurred. The effects of these changes are difficult to quantify as twin-trawling is not always recorded explicitly in the fisheries statistics and improvement due to computing technology is not continuous on the whole time series.

Annual age compositions for the "Le Guilvinec district" 2nd Quarter tuning series were obtained by using the ratios of Quarter 2-fleet-landings to Total-Quarter 2-landings.

11.3 Assessment

The male and female removals length distributions for the time series 1987-2006 were split by slicing into 9 'age groups'. The removals-at-age for each sex were summed and are presented in Table 11.5 and Figure 11.3.

Removal weights-at-age are averages weighted by numbers-at-age for each sex (Table 11.6).

All biological parameters used in this year's assessment (growth parameters, length-weight relationships, natural mortality rates, discard survival rates, etc.) were the same as by WG 2006.

11.3.1 Model

As in previous years, XSA was used by the WG to assess the history of the stock dynamics. A "combined sexes" assessment was performed.

Data screening

As in WGHMM 2006, a separable VPA was carried out to screen the removals-at-age data set using a terminal F of 0.4 at age 5 and a terminal S of 1 (Table 11.8). The results show that the residuals are generally low and do not follow any systematic pattern.

As since 2005, removals at age per unit effort for "Le Guilvinec district 2nd Quarter" have been used to tune the VPA. In the WGNEPH 2004, these tuning data were associated to a second tuning fleet covering the other harbours and districts of the Bay of Biscay for the same reference period. In 2005, the WG decided to remove this second fleet from the tuning data because the estimation of its fishing effort is based on logbook data which is of poor quality as explained previously.

Exploratory runs

Even if the assessment in 2007 is an update one, WG investigated additional exploratory runs based on different approaches of derivation of discards for missing years.

In order to eliminate dependence between years due to derivation of missing years from common datasets, WG carried out additional runs based on logistic derivation (*i.e.* simulation of the hand-sorting of marketable sizes) of discard length frequencies from those of landings year by year. Compilations of size composition of discards by quarter and by year are processed as described below (see details in WD10):

1) The first step involves applying hand-sorting selection of retained catches which is explained by s-shaped (logistic) function vs. size. As statistically tested by fleet, the hand-sorting function is stable within-quarter for given parameters of

the exploitation pattern (if MLS remains constant within period; thus, data of 2006 were removed from simulations on past years).

2) The second step consists in removing undersized individuals unusual in landings which can generate unreliably extreme values of discards due to sampling problems (very high CV of landings for the extreme size classes). Hence, size classes less than a tested threshold (1% of cumulative landings) were eliminated.

3) The third step allows generate missing size classes by applying a probability density function which is assumed to be symmetrical as the trawl meshes remain not significantly selective for *Nephrops*.

The whole calculation is based on multiple likelihood maximum function according to the number of missing years. Moreover, the simulated length frequencies of discards for sampled years (1987, 1991, 1998, 2003-2005) were validated by comparison with sampling results.

Two exploratory runs were undertaken for this probabilistic approach:

1) Discards for 2006 were set according to the sampling onboard, but this year was not included in the validation process because of the change of the exploitation pattern (MLS).

2) Discards for 2006 were calculated by the probabilistic method as for missing years.

The detailed features of the method are presented in the WD10. Files created from these calculations are available on ICES folders.

Final run

The same settings as in 2006 were used for the final run and are detailed in the following table:

Fleets	2006 XSA		2007 XSA		% of total landings 87-06
FR -Q2 –QGV	1987-2005	Ages 1-9+	1987-2006	Ages 1-9+	**11.2-18.7**
Taper	Yes (3 over 20)		Yes (3 over 20)		
Tuning range	Full		Full		
Age catchability dependent of stock size	No		No		
q plateau	6		6		
F shrinkage se	1.5		1.5		
year range of shrinkage	5		5		
age range of shrinkage	5		5		

11.3.2 Assessment results

The diagnostics from the final XSA are given in Table 11.10.

Log-catchability residuals resulting from XSA for the tuning fleet are presented in Figure 11.5. They are quite high from 1987 to 1990 for age groups 1 and 2. The high residuals for age 1 at the start of the series can be explained by the limited number of samples available to estimate the discards in 1987, which are used to derive estimates for 1988-1990. From 1991 onwards the residuals are lower, but some year effects appear around 2001.

The retrospective analysis shows a tendency to overestimate SSB and underestimate F in recent years with high divergence of retro-calculated values (Figure 11.6). Recruitments are not well estimated around 2000-2001, but in 2003 and 2004 the retrospective pattern is more satisfactory.

Summary results from the final XSA are given in Tables 11.11-13 and Figure 11.7.

Fbar $_{2006\ (ages\ 2\text{-}5)}$ was estimated at 0.41 (Table 11.11), SSB_{2006} at 12140 t (Table 11.13).

In last year's assessment, $Fbar_{2005\ (ages\ 2\text{-}5)}$ was estimated at 0.46 whereas this value is revised upwards (0.51) this year. The SSB value for 2005 was estimated at 9980 t by WG 2006, but the current estimation of the SSB_{2005} is 9360 t.

11.3.3 Year class strength and recruitment estimations

- The 2002 year class is now estimated at 694 million compared to an estimate of 700 million in last year's assessment.
- The 2003 year class is now estimated at 1006 million compared to an estimate of 1087 million in last year's assessment. This result confirms the last year's assessment.
- The 2004 year class is estimated at 2081 million compared with the 2825 million estimate given by XSA last year. Results of the retrospective analysis for this year class are noisy (difference of 26% between the two years' assessments), hence, the estimate above was removed. However, many signals confirm that a high recruitment occurred in 2005 (see details in Annex K2). Under the usual assumptions for conversion of size-frequencies of catches to age-compositions by sex, the high discarded number in 2006 is not exclusively explained by the MLS change from 8.5 cm to 9 cm (*i.e.* 25 mm CL to 27 mm CL). Moreover, only the year class 2003 could not provide a so high discard level (79%): even after MLS change, this class constitutes more than 50% of landings in 2006 (Figure K2.5). The discarded *Nephrops* usually belong to the age group 2 (the age group 1 is not harvested at a significant proportion by the fishing gears). Furthermore, even if mean size in landings increases up to 2 mm between 2005 and 2006, the mean size of catches almost remains stable. Hence, the presence of a high number of undersized individuals is quite evident (nevertheless, the difference of mean sizes between years may not be statistically significant in regard to the sampling design onboard).

In order to test the actual contribution of the year class 2004 in the discarded amount in 2006 independent of MLS change, the exploitation pattern of 2006 was replaced by the 2005's one. At the opposite of the calculation processed for the short-term projections (see § 11.4.1), the F discards for 2006 were scaled to the values of 2005 under the previous exploitation pattern (see Figure K2.3 providing hand-sorting logistic curves by quarter). As expected, discarded number in 2006 decreases (Table K2.3; Figure K2.4 compared with Figure 11.1). However, the discard rate remains high (66% instead of 79% under the new exploitation pattern). This value is comparable with the discard rate estimated by sampling onboard for 2005 (65%). Additionally, the size composition of discards is similar between both years. It is likely that the abundance of the successive year classes 2003 and 2004 is comparable. Even if the strength of the class 2004 provided by XSA was considered unreliable by WG, the estimate was replaced by a high value equal to the 2003 year class estimate *i.e.* 1006 million.

XSA provides an estimate of 2885 million for the year class 2005. There is no current evidence of a so high value. It was replaced by the geometric mean over the whole period 1987-2004 (672 million).

Working Group estimates of year class strength used for prediction can be summarized as follows:

Recruitment at age 1

YEAR CLASS	MILLION	BASIS
2002	694	XSA
2003	1006	XSA
2004	1006	Year class 2003
2005	672	GM 87-04
2006	672	GM 87-04

11.3.4 Historic trends in biomass, fishing mortality and recruitment

A full summary of the XSA estimated series is presented in Table 11.13 and Figure 11.7.

F_{bar} has declined gradually to 0.41 in 2006 with some fluctuations in the beginning of 90's. The reduction of the fishing effort in 2006 (-10% for the tuning time series; Table 11.7, Figure 11.4) may be because of applying new restrictions on the fishing allowed time (prohibition of trawling during week-ends) and on the total and by vessel landings (quarterly and individual quotas imposed by the French producer's organisations).

The average F_{bar} across the reference period (1987-2006) is 0.56.

SSB decreased by 20% in the 90's. Since 2000, there has been a gradual increase to the levels observed in the beginning of the time series.

Recruitment shows a decreasing trend from 1987 (954 million) to 1998 (489 million). There is an increase up to 2000 and the average recruitment value of 719 million for the years 2000-2004 is higher than the average values (672 million) of the whole time series .This is due to the year class 2003 which is estimated as the highest of the time series consistently with last year's assessment.

11.4 Catch options and prognosis

Short-term projections and yield per recruit analysis are also presented.

11.4.1 Short-term projections

Input data for the catch predictions are given in Table 11.14. Two additional runs (Annex K2) were also carried out replacing the estimate of the recruitment 2005 either by GM(1987-2004) *i.e.* 672 million or by 90th percentile of the series 1987-2004 *i.e.* 860 million.

The exploitation patterns for the projection are based on the unscaled average Fs-at-age in the years 2004-2006 ($F_{2-5} = 0.48$). These were then split into landings and dead discards F, based on the scaled values of F discards at age estimated in 2006 because the exploitation pattern was modified due to the MLS change. GM over 1987-2004 (672 million) was used for age 1 from 2006 onwards. Stock number at age 2 in 2007 and 2008 were respectively derived from the recruitment 2004 and GM87-04 which replaced the XSA initial values. They were reduced by the total mortalities at age 1 in 2006 and 2007. Mean weights-at-age for dead discards and landings were taken as the discards and landings averages for 2004-2006 respectively.

Table 11.15 and Figure 11.8 give the short-term yield and SSB forecasts.

Assuming *status quo* F, landings are predicted to increase from 3430 t in 2006 to 4720 t in 2007 and to decrease slightly in 2008 (4540 t). SSB is reduced in 2008 and 2009 (13940 t and 12870 t respectively). This is higher than the long-term arithmetic mean of the time series

(9130 t). The year classes for which recruitments were assumed contribute 32% to the landings in 2007 and 59% to the SSB in 2008 (Table 11.17). The contribution of these assumed recruitments is almost stable in landings compared with the last year's assessment (34% for 2007), but it is higher in SSB (52% for 2008). These percentages are high and show the significant impact of the assumptions about recruitment on the results of the short-term prediction.

It should be pointed out that the predicted landings for 2007 (4720 t) are higher than the 4320 t TAC 2007 for FUs 23-24.

11.4.2 Yield and biomass per recruit analysis

Y/R analysis were made for landings and discards separately assuming the exploitation pattern after the MLS change.

Results of equilibrium landings and SSB/R are given in Table 11.18 and Figure 11.8. In the Y/R curve based on landings only, F_{max} (0.16) is estimated to be at 51% of the reference F.

Under the current exploitation pattern, the predicted long-term yield gains upon a reduction of F to F_{max} would be about 17% and SSB per recruit would increase up to 108%. It is noticeable that the same values were 11% and 96% respectively under the previous exploitation pattern. This implies that the MLS change should be associated to drastic reductions of the fishing effort especially if the selectivity is not improved. $F_{0.1}$ is at 34% of the reference F.

11.5 Biological reference points

There is no reference point for this stock and without any further information the Group decided not to propose any this year.

11.6 Comments on the assessment

In the past, discards could not be sampled every year because of insufficient technical and financial resources. The continuation of the catch French *Nephrops* trawlers sampling programme on board will avoid the use of “derived” data for missing years. Applying discard data from ‘sampled’ to ‘non-sampled’ years bears the risk of inconsistency between the different data sets because it induces an inter-dependence between years and also prevents detection of any signal on recruitment strength. The additional exploratory runs based on discard derivation by applying probability concepts results in more contrast in recruitment, more regular residuals of Log catchabilities and better consistency in retrospective pattern for recruitment. This can be taken into consideration in further investigations.

The effort data used in the assessment do not account for likely increases in catch efficiencies associated with the introduction of new gears and equipment in this fishery. This would result in an under-estimation of F (and an over-estimation of SSB) for the period in which these technical changes occurred.

The comparison between 2006 and 2007 assessments is presented in Figure 11.9. The main difference between the two assessments is the upwards revision of $F_{bar(2-5)}$ in recent years by 10%.

The 2003 year class was estimated to be the highest of the whole time series. This estimate was supported by the good consistency with the last year's results. Its use for the recruitment 2005 may result in an optimistic short-term forecast.

The slicing process converting size-frequencies to age-compositions at the aim of performing XSA is often disapproved because it may induce lack of contrast between years (input set of common parameters for individual growth). Moreover, the Von Bertalanffy's equation is often invalidated for crustaceans. As it would not be reasonable to expect that methods of direct age determination for *Nephrops* will be routinely available in the foreseeable future, alternative methods as CSA have to be investigated. The main current disadvantage of CSA is linked to the recruitment indices required: as the independent survey cannot yet provide consistent dataset on young year classes, the recruitment indices can be given only by annual discard indicators. WG still applies "proportional method" of derivation for discards (see § 11.2.2), thus, no CSA investigation can be envisaged before replacing discards estimators by more reliable indices.

Information from the fishing industry

The French fishing industry and scientists have met to discuss information that can be used in the assessments. Industries have not provided any additional quantitative information that can be used in the assessment, but they supported information on landings and fishing effort compiled by WG. The perception of the stock trends by the industry generally encourages the signals given by the data used in this year assessment.

11.7 Management considerations

The combined sex VPA shows biomass increase in recent years, which is above the average long-term of the series.

There is no proposal for precautionary reference points for this stock. The only available proxies are F_{max} and $F_{0.1}$, based on landings only, which correspond to reductions in F of 49% and 66% respectively, under the current exploitation pattern.

Short-term forecasts indicate that landings and SSB are expected to increase by 32-38% and 15-21% respectively assuming *status quo* F. However, recruitment in recent years is high, but uncertain and contributes significantly to catches in the short-term.

Taking into account the large amounts of discards, improvement in fishing patterns should be encouraged. Trials of selective devices (grids, square mesh panels) for *Nephrops* are being carried out by fishermen and their use has to be encouraged in agreement with the recent increase of the French MLS in order to drastically reduce the discard rate. However, it should be noted that any improvement in the selectivity pattern needs to be combined with control of fishing mortality.

The license system in operation since 2004 and the restrictions applied by the Producers' Organisations since last year should increase the regulation of inputs by limiting the fishing time.

The WG emphasized that the agreed TAC in 2007 for VIIIab areas is at risk of being exceeded by the actual landings if the fishing effort remains at the *status quo* level. The *status quo* F provided a yield estimate of landings of 4720 t whereas the agreed TAC was equal to 4320 t. This should be taken into consideration in management policy that the fishing effort should be significantly reduced especially because the discarded amount remains high.

Table 11.1. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Estimates of catches (t) by FU for 1960-2006.

	Landings (1)					Total Discards		Catches
Year	FU 23-24 (2)	FU 23	FU 24	Unallocated (M A N)(3)	Total	FU 23-24		Total
	VIIIa,b	VIIIa	VIIIb	VIIIa,b	VIIIa,b	VIIIa,b		VIIIa,b
1960	3524	-	-	-	3524	-		3524
1961	3607	-	-	-	3607	-		3607
1962	3042	-	-	-	3042	-		3042
1963	4040	-	-	-	4040	-		4040
1964	4596	-	-	-	4596	-		4596
1965	3441	-	-	-	3441	-		3441
1966	3857	-	-	-	3857	-		3857
1967	3245	-	-	-	3245	-		3245
1968	3859	-	-	-	3859	-		3859
1969	4810	-	-	-	4810	-		4810
1970	5454	-	-	-	5454	-		5454
1971	3990	-	-	-	3990	-		3990
1972	5525	-	-	-	5525	-		5525
1973	7040	-	-	-	7040	-		7040
1974	7100	-	-	-	7100	-		7100
1975	-	6460	322	-	6782	-		6782
1976	-	6012	300	-	6312	-		6312
1977	-	5069	222	-	5291	-		5291
1978	-	4554	162	-	4716	-		4716
1979	-	4758	36	-	4794	-		4794
1980	-	6036	71	-	6107	-		6107
1981	-	5908	182	-	6090	-		6090
1982	-	4392	298	-	4690	-		4690
1983	-	5566	342	-	5908	-		5908
1984	-	4485	198	-	4683	-		4683
1985	-	4281	312	-	4593	-		4593
1986	-	3968	367	99	4434	-		4434
1987	-	4937	460	64	5461	1767	*	7228
1988	-	5281	594	69	5944	1909		7853
1989	-	4253	582	77	4912	1459		6371
1990	1	4613	359	87	5060	1280		6340
1991	1	4353	401	55	4810	1213	*	6022
1992	0	5123	558	47	5728	1583		7311
1993	0	4577	532	49	5158	1406		6564
1994	0	3721	371	27	4119	1060		5179
1995	0	4073	380	14	4467	1086		5554
1996	0	4034	84	15	4133	1005		5138
1997	2	3450	147	41	3640	1049		4688
1998	2	3565	300	40	3907	1453	*	5360
1999	2	2873	337	26	3238	1177		4415
2000	0	2848	221	36	3105	1213		4318
2001	1	3421	309	22	3753	1512		5265
2002	2	3323	356	36	3717	1645		5362
2003	1	3399	343	49	3792	1977	*	5769
2004	na	2970	315	5	3290	2193	*	5483
2005	na	3306	383	na	3689	2698	*	6387
2006	na	3000	430	na	3430	4544	*	7974

(1) working group estimates
(2) Up to 1974 data available for combined FUs only
From 1990, Belgian landings available for combined FUs
(3) Management Area N
* Observed discards (discards for other years are derived)

Year	FU 23	FU 24	Other	Total landings FUs 23-24	Discards	Total catches
1996	4034	84	15	4133	1005	5138
1997	3450	147	41	3638	1049	4687
1998	3565	300	40	3905	1453	5358
1999	2873	337	26	3236	1177	4413
2000	2848	221	36	3105	1213	4318
2001	3421	309	22	3752	1512	5264
2002	3323	356	36	3715	1645	5360
2003	3399	343	49	3791	1977	5768
2004	2970	315	5	3290	2193	5483
2005	3306	383	na	3689	2698	6387
2006	3000	430	na	3430	4544	7974

Table 11.2. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Derivation and estimations of discards

1987	sampled
1988	derived from 1987
1989	derived from 1987
1990	derived from 1987
1991	sampled
1992	derived from 1991
1993	derived from 1991
1994	derived from 1991
1995	derived from 1991
1996	derived from 1991
1997	derived from 1991
1998	sampled
1999	derived from 1998
2000	derived from 1998
2001	derived from 1998
2002	derived from 1998
2003	sampled*
2004	sampled*
2005	sampled*
2006	sampled*

* methodology explained in the Working Document proposed in the WGHMM 2005

Table 11.3.a Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) landings length distributions in 1987-2006.

Landings

CL mm/Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0
16	0	158	59	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0
17	149	230	77	12	35	62	0	0	0	0	0	0	0	0	0	0	19	6	0	0
18	331	553	131	64	30	0	0	31	20	0	0	0	0	14	13	0	13	0	23	5
19	1296	1886	901	48	79	138	0	72	61	0	0	0	0	11	38	0	0	15	24	0
20	3129	4227	2791	529	474	450	464	206	341	48	448	25	72	116	284	107	73	52	77	5
21	6476	8882	7039	1947	1572	1595	1285	482	1573	414	1313	288	219	433	643	925	241	224	250	69
22	13501	16050	12971	5913	4733	3948	3878	2824	2395	1311	2799	985	849	1015	2116	1122	578	825	718	130
23	21337	25374	18073	10910	7854	9701	7398	5366	5523	2799	4638	3171	1888	2531	6261	5513	1387	2002	2404	226
24	24339	33950	21960	13293	15521	20948	11949	9650	8731	6071	10005	6484	4032	5462	8915	10061	3450	5157	6013	816
25	32476	36294	25650	16440	19747	27876	21011	15079	14348	13239	19837	13980	10717	11357	17106	12951	7275	9987	12573	2821
26	29670	29808	22747	18205	22106	26617	23732	18312	19769	16779	19380	13535	10590	10212	13745	21403	11881	12797	16423	6327
27	28086	28380	22091	16109	21900	28410	26044	21181	25126	18384	22823	16602	12724	11528	17098	19433	15915	14422	20320	11915
28	24925	26017	19087	19595	21214	32091	27580	20488	20914	15744	19466	14432	12058	12639	15835	22074	16896	13964	20240	14531
29	18703	20920	14227	16250	17138	24760	20627	16527	15909	16332	20878	11832	9448	11473	13779	16559	15343	13221	16684	14478
30	18407	17862	13688	12055	14762	19828	21414	15903	19164	20214	21487	16335	16187	13888	16168	18105	15840	12552	14416	13587
31	11419	13156	9037	11088	12408	14281	13452	11207	13333	14009	9791	8539	9209	9828	11316	9989	12217	10635	11675	11728
32	10185	12822	8410	8540	8635	12786	12711	11490	13667	14392	9622	9237	9745	8936	11335	10284	10349	8973	9181	9626
33	8528	8848	7127	10649	7273	9297	11369	7022	7117	8576	6334	5947	6000	6333	8250	7813	7575	7321	7206	8367
34	5926	7812	6967	10543	7987	7318	7355	6684	7584	6524	4816	6619	5910	5225	6185	5308	5847	5530	6045	7068
35	5763	5935	6214	7637	5425	5928	6307	5646	4677	6578	4737	6700	5267	4895	5213	4309	4493	4213	4721	5108
36	4033	5064	4532	6274	4979	4998	4608	4337	3709	4133	2568	5308	4291	3242	4037	3157	3821	3092	3115	4085
37	4024	3754	3545	4841	4541	4195	4089	3752	3496	4226	2135	4722	3230	2946	2901	2049	3185	2708	2392	3182
38	3131	3106	3193	4966	2993	3933	2991	2771	2879	2788	1142	3527	2588	2687	2369	2224	2816	2026	2193	2652
39	2151	2778	2154	3339	2869	2987	2290	1841	1746	1596	927	2169	2186	2027	2297	1559	2316	1645	1525	1946
40	2425	2159	2175	2766	2414	2574	2206	1738	2015	1956	982	3084	2353	1862	1908	1398	2135	1523	1519	1595
41	1375	1753	1461	1951	2076	1546	1452	1150	1123	1250	520	1558	1362	1020	941	764	1553	1167	1078	1167
42	1350	1542	1130	1668	1662	1599	1111	1118	1558	1142	508	1490	1124	797	863	632	1576	875	898	989
43	1150	1209	1087	1908	1495	1348	1069	687	1039	610	370	1049	761	534	530	640	1156	743	798	739
44	965	704	1192	1401	1089	1050	745	500	915	414	219	748	708	413	383	432	876	690	612	634
45	641	581	1194	955	1058	766	684	550	700	464	253	902	429	421	523	416	882	603	571	597
46	645	689	669	713	666	734	584	353	460	374	135	525	424	248	294	328	596	485	396	479
47	509	391	641	715	431	567	417	407	437	397	140	327	276	213	368	241	506	379	327	442
48	343	333	526	863	636	588	456	270	494	264	92	382	104	205	188	188	378	321	304	384
49	290	254	378	470	377	263	145	178	254	205	57	132	151	177	183	79	227	332	263	320
50	319	216	351	230	263	256	238	273	255	179	76	154	159	154	160	115	283	328	250	287
51	135	241	240	181	210	107	126	156	214	123	38	191	58	109	135	73	192	221	157	247
52	192	48	180	335	180	159	202	107	175	77	30	115	93	85	102	46	171	155	166	201
53	137	70	150	121	124	111	55	136	91	84	26	156	23	133	82	51	134	131	129	137
54	111	112	218	99	189	94	120	77	55	75	11	93	11	63	40	20	89	100	92	157
55	76	85	187	53	63	61	128	66	91	53	9	114	16	75	53	30	63	57	96	138
56	111	41	123	26	28	66	50	49	47	62	12	7	5	18	24	13	26	95	61	118
57	74	39	116	43	34	61	72	36	77	48	8	31	14	20	46	6	52	60	51	134
58	39	65	70	2	11	68	58	47	88	48	9	14	5	16	29	6	22	36	39	135
59	32	60	36	13	17	28	13	31	36	30	8	10	2	7	26	3	12	42	38	86
60	21	7	30	5	24	7	54	26	32	9	5	8	4	2	21	11	9	17	17	115
61	21	15	15	4	11	0	25	12	4	4	0	0	3	8	7	0	6	9	26	41
62	0	0	21	10	0	44	3	8	0	9	1	10	0	1	2	0	5	3	14	21
63	19	13	10	0	3	28	0	5	20	4	5	4	0	0	5	1	1	5	8	19
64	0	7	0	0	0	14	7	10	0	0	0	0	0	4	0	0	0	7	7	19
65	8	0	4	0	0	0	30	16	4	0	0	4	2	1	0	1	0	1	12	12
66	0	0	0	0	0	0	7	0	20	2	4	0	0	0	0	0	2	1	6	10
67	0	0	0	0	0	0	18	3	0	0	0	0	0	0	0	0	0	1	4	9
68	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	4	8
69	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	2	0	1	6
70	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	2	5
71	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	1	0	1	5
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4
Total	**288974**	**324498**	**244875**	**213779**	**217338**	**274286**	**240638**	**188879**	**202294**	**182041**	**188694**	**161549**	**135304**	**133383**	**172819**	**180442**	**152485**	**139753**	**166167**	**127942**
Weights	**5397**	**5875**	**4835**	**4972**	**4754**	**5681**	**5109**	**4092**	**4452**	**4118**	**3610**	**3865**	**3209**	**3069**	**3730**	**3679**	**3742**	**3285**	**3689**	**3430**

Table 11.3.b Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) discards length distributions in 1987-2006.

Total Discards CL mm/Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0
11	0	0	0	0	114	167	143	109	148	128	92	85	59	74	75	94	0	0	94	0
12	0	0	0	0	0	0	0	0	0	0	0	128	89	110	113	141	70	0	413	70
13	0	0	0	0	93	147	139	84	56	65	76	162	138	143	191	217	294	363	1085	234
14	78	97	76	59	258	384	337	245	301	268	210	660	507	564	684	822	636	1722	3190	1138
15	2074	2174	1821	1673	1249	1895	1728	1148	1073	1058	1028	1741	1370	1462	1861	2186	1198	3152	7287	3102
16	3974	4053	3469	3140	2240	3339	3073	2019	1736	1786	1884	1861	1474	1554	2010	2349	3386	5548	13528	7810
17	13577	14887	10425	8655	4638	6824	6302	4133	3347	3497	3914	3527	2744	2957	3624	4197	5927	6784	15094	11655
18	29288	32816	23482	19987	10619	14908	13531	9408	8483	8297	8987	5003	4016	4207	5254	5880	8078	8836	19795	16139
19	28370	31363	23215	19980	12852	17524	15718	11346	10790	10148	10853	5991	4770	5041	6271	7098	11506	10161	19522	25891
20	60253	63749	49546	43147	22797	30242	26971	19970	19533	18146	19453	12091	9630	10098	12509	13968	12142	17361	22265	39742
21	45446	48597	37609	33037	18043	24296	21757	15876	15497	14594	15429	9973	7931	8238	10357	11586	18597	19250	32409	54220
22	51268	55078	42614	37864	24289	32524	29063	21354	21039	19695	20776	23278	18405	19216	23711	26333	21416	25898	35523	69870
23	23074	24630	19336	17235	15611	20115	17713	13687	14986	13676	13624	21641	17276	17526	22103	23990	28429	25210	40041	70094
24	7213	8375	6179	5468	13741	17107	15018	11903	13375	12258	12285	19750	15994	16182	20628	22367	26501	26756	36279	55408
25	2686	2850	2369	2172	14722	17933	15639	12662	14027	12581	13036	20487	16780	16884	21505	22987	23211	21343	30222	52660
26	672	806	485	391	7131	8990	7917	6166	6350	5744	6176	10676	8631	8817	10928	11696	17357	20085	19003	38812
27	270	350	255	242	1711	2447	2217	1532	1395	1348	1424	7502	5870	6421	7474	8420	9680	12006	8498	20124
28	0	0	0	0	999	1258	1098	867	890	777	844	3019	2394	2647	3034	3394	6187	6436	4603	10263
29	0	0	0	0	138	168	146	118	118	102	117	1357	1133	1241	1443	1573	2537	3487	1201	4188
30	0	0	0	0	291	344	296	248	256	216	247	686	613	608	778	782	1605	2115	1600	2578
31	0	0	0	0	97	115	99	83	85	72	82	129	135	123	173	155	1326	1901	1417	1109
32	0	0	0	0	0	0	0	0	0	0	0	481	433	426	549	548	574	1115	526	592
33	0	0	0	0	0	0	0	0	0	0	0	231	195	214	249	271	313	735	296	544
34	0	0	0	0	0	0	0	0	0	0	0	151	150	135	190	174	261	503	553	411
35	0	0	0	0	0	0	0	0	0	0	0	88	92	93	119	114	176	385	260	230
36	0	0	0	0	0	0	0	0	0	0	0	48	61	57	80	68	113	424	46	73
37	0	0	0	0	0	0	0	0	0	0	0	74	95	89	124	106	83	108	246	25
38	0	0	0	0	0	0	0	0	0	0	0	44	56	53	73	63	93	74	116	99
39	0	0	0	0	0	0	0	0	0	0	0	36	46	43	61	52	15	31	147	0
40	0	0	0	0	0	0	0	0	0	0	0	57	73	68	95	81	37	139	37	169
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	73	20	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	60	31	0
43	0	0	0	0	0	0	0	0	0	0	0	6	7	7	9	8	14	12	0	0
44	0	0	0	0	0	0	0	0	0	0	0	30	39	36	50	43	0	13	0	0
45	0	0	0	0	0	0	0	0	0	0	0	2	3	3	4	4	13	0	0	36
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**268244**	**289827**	**220879**	**193050**	**151634**	**200725**	**178905**	**132957**	**133485**	**124457**	**130538**	**150995**	**121209**	**125340**	**156331**	**171768**	**201841**	**222089**	**315346**	**487288**
Weights	**1767**	**1909**	**1459**	**1280**	**1213**	**1583**	**1406**	**1060**	**1086**	**1005**	**1049**	**1453**	**1177**	**1213**	**1512**	**1645**	**1977**	**2193**	**2698**	**4544**

Table 11.3.c Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) catches length distributions in 1987-2006.

Total catches CL mm/Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0
11	0	0	0	0	114	167	143	109	148	128	92	85	59	74	75	94	0	0	94	0
12	0	0	0	0	0	0	0	0	0	0	0	128	89	110	113	141	70	0	413	70
13	0	0	0	0	93	147	139	84	56	65	76	162	138	143	191	217	294	363	1085	234
14	78	97	76	59	258	384	337	245	301	268	210	660	507	564	684	822	636	1722	3190	1138
15	2074	2174	1821	1673	1249	1895	1728	1148	1073	1058	1042	1741	1370	1462	1861	2186	1198	3152	7287	3102
16	3974	4210	3528	3140	2240	3339	3073	2019	1736	1786	1897	1861	1474	1554	2010	2349	3386	5548	13528	7810
17	13727	15117	10502	8667	4673	6886	6302	4133	3347	3497	3914	3527	2744	2957	3624	4197	5946	6791	15094	11655
18	29620	33369	23613	20052	10649	14908	13531	9439	8503	8297	8987	5003	4016	4222	5267	5880	8092	8836	19819	16144
19	29666	33249	24116	20028	12931	17662	15718	11418	10850	10148	10853	5991	4770	5052	6309	7098	11506	10176	19547	25891
20	63382	67976	52337	43676	23271	30692	27435	20176	19874	18194	19901	12116	9701	10214	12793	14075	12215	17413	22342	39747
21	51922	57479	44647	34984	19615	25891	23042	16358	17070	15008	16741	10260	8150	8671	11000	12511	18838	19474	32659	54289
22	64770	71128	55584	43777	29023	36472	32941	24178	23435	21006	23575	24263	19254	20231	25827	27455	21994	26723	36241	70000
23	44411	50004	37409	28145	23464	29817	25111	19053	20509	16475	18261	24812	19164	20057	28364	29503	29815	27212	42445	70320
24	31551	42325	28138	18762	29262	38055	26967	21554	22106	18329	22290	26235	20026	21643	29544	32428	29951	31914	42292	56224
25	35162	39143	28020	18612	34469	45809	36650	27741	28375	25820	32874	34467	27497	28240	38612	35939	30486	31329	42795	55482
26	30342	30615	23232	18596	29237	35607	31650	24478	26119	22524	25556	24211	19222	19030	24673	33099	29238	32882	35426	45140
27	28357	28730	22346	16351	23611	30858	28261	22713	26521	19733	24247	24104	18594	17949	24573	27852	25595	26428	28818	32039
28	24925	26017	19087	19595	22213	33349	28678	21355	21804	16521	20310	17450	14453	15286	18869	25468	23082	20401	24843	24794
29	18703	20920	14227	16250	17276	24927	20773	16645	16027	16434	20995	13189	10581	12714	15223	18132	17880	16708	17885	18666
30	18407	17862	13688	12055	15053	20173	21710	16151	19420	20430	21735	17021	16800	14496	16946	18886	17445	14666	16016	16165
31	11419	13156	9037	11088	12505	14396	13551	11289	13419	14081	9874	8668	9344	9951	11489	10144	13544	12537	13092	12836
32	10185	12822	8410	8540	8635	12786	12711	11490	13667	14392	9622	9718	10178	9362	11884	10832	10923	10089	9707	10218
33	8528	8848	7127	10649	7273	9297	11369	7022	7117	8576	6334	6178	6196	6547	8499	8083	7888	8056	7502	8911
34	5926	7812	6967	10543	7987	7318	7355	6684	7584	6524	4816	6770	6060	5360	6375	5482	6108	6033	6598	7479
35	5763	5935	6214	7637	5425	5928	6307	5646	4677	6578	4737	6787	5359	4988	5332	4423	4669	4598	4981	5339
36	4033	5064	4532	6274	4979	4998	4608	4337	3709	4133	2568	5356	4352	3299	4116	3225	3934	3516	3161	4158
37	4024	3754	3545	4841	4541	4195	4089	3752	3496	4226	2135	4796	3325	3034	3025	2155	3268	2816	2638	3207
38	3131	3106	3193	4966	2993	3933	2991	2771	2879	2788	1142	3571	2645	2740	2443	2287	2908	2100	2309	2751
39	2151	2778	2154	3339	2869	2987	2290	1841	1746	1596	927	2205	2232	2070	2358	1611	2331	1676	1672	1946
40	2425	2159	2175	2766	2414	2574	2206	1738	2015	1956	982	3140	2425	1930	2002	1480	2172	1662	1556	1764
41	1375	1753	1461	1951	2076	1546	1452	1150	1123	1250	520	1558	1362	1020	941	764	1588	1240	1098	1167
42	1350	1542	1130	1668	1662	1599	1111	1118	1558	1142	508	1490	1124	797	863	632	1580	934	929	989
43	1150	1209	1087	1908	1495	1348	1069	687	1039	610	370	1055	769	541	540	649	1170	755	798	739
44	965	704	1192	1401	1089	1050	745	500	915	414	219	778	747	449	433	476	876	703	612	634
45	641	581	1194	955	1058	766	684	550	700	464	253	904	432	424	527	419	895	603	571	633
46	645	689	669	713	666	734	584	353	460	374	135	525	424	248	294	328	596	485	396	479
47	509	391	641	715	431	567	417	407	437	397	140	327	276	213	368	241	506	379	327	442
48	343	333	526	863	636	588	456	270	494	264	92	382	104	205	188	188	378	321	304	384
49	290	254	378	470	377	263	145	178	254	205	57	132	151	177	183	79	227	332	263	320
50	319	216	351	230	263	256	238	273	255	179	76	154	159	154	160	115	283	328	250	287
51	135	241	240	181	210	107	126	156	214	123	38	191	58	109	135	73	192	221	157	247
52	192	48	180	335	180	159	202	107	175	77	30	115	93	85	102	46	171	155	166	201
53	137	70	150	121	124	111	55	136	91	84	26	156	23	133	82	51	134	131	129	137
54	111	112	218	99	189	94	120	77	55	75	11	93	11	63	40	20	89	100	92	157
55	76	85	187	53	63	61	128	66	91	53	9	114	16	75	53	30	63	57	96	138
56	111	41	123	26	28	66	50	49	47	62	12	7	5	18	24	13	26	95	61	118
57	74	39	116	43	34	61	72	36	77	48	8	31	14	20	46	6	52	60	51	134
58	39	65	70	2	11	68	58	47	88	48	9	14	5	16	29	6	22	36	39	135
59	32	60	36	13	17	28	13	31	36	30	8	10	2	7	26	3	12	42	38	86
60	21	7	30	5	24	7	54	26	32	9	5	8	4	2	21	11	9	17	17	115
61	21	15	15	4	11	0	25	12	4	4	0	0	3	8	7	0	6	9	26	41
62	0	0	21	10	0	44	3	8	0	9	1	10	0	1	2	0	5	3	14	21
63	19	13	10	0	3	28	0	5	20	4	5	4	0	0	5	1	1	5	8	19
64	0	7	0	0	0	14	7	10	0	0	0	0	0	4	0	0	0	7	7	19
65	8	0	4	0	0	0	30	16	4	0	0	4	2	1	0	1	0	1	12	12
66	0	0	0	0	0	0	7	0	20	2	4	0	0	0	0	0	2	1	6	10
67	0	0	0	0	0	0	18	3	0	0	0	0	0	0	0	0	0	1	4	9
68	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	4	8
69	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	2	0	1	6
70	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	2	5
71	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	1	0	1	5
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4
Total	**557218**	**614325**	**465754**	**406829**	**368972**	**475011**	**419544**	**321836**	**335779**	**306498**	**319232**	**312544**	**256513**	**258723**	**329150**	**352210**	**354326**	**361842**	**481512**	**615230**
Weights	**7164**	**7784**	**6295**	**6252**	**5967**	**7264**	**6515**	**5152**	**5539**	**5123**	**4658**	**5318**	**4386**	**4282**	**5242**	**5324**	**5719**	**5478**	**6387**	**7974**

Table 11.3.d Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) removals length distributions in 1987-2006.

Removals=Landings+dead catches (discard survival rate : 30%)

CL mm/Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0
11	0	0	0	0	80	117	100	76	104	89	65	60	42	52	53	66	0	0	66	0
12	0	0	0	0	0	0	0	0	0	0	0	90	62	77	79	99	49	0	289	49
13	0	0	0	0	65	103	97	59	39	45	54	114	97	100	134	152	206	254	760	164
14	55	68	53	41	181	269	236	171	210	188	147	462	355	395	479	575	445	1205	2233	797
15	1452	1522	1274	1171	875	1327	1209	803	751	741	734	1219	959	1024	1303	1530	839	2206	5101	2171
16	2782	2995	2488	2198	1568	2337	2151	1413	1215	1250	1332	1302	1032	1088	1407	1644	2370	3883	9469	5467
17	9654	10651	7375	6070	3282	4839	4411	2893	2343	2448	2740	2469	1921	2070	2537	2938	4168	4755	10565	8158
18	20833	23524	16568	14055	7464	10435	9472	6617	5958	5808	6291	3502	2811	2959	3691	4116	5668	6185	13880	11302
19	21155	23840	17151	14034	9075	12405	11003	8014	7613	7104	7597	4194	3339	3540	4428	4968	8055	7127	13690	18124
20	45306	48851	37473	30732	16432	21619	19344	14185	14014	12750	14065	8489	6812	7185	9040	9884	8572	12205	15662	27825
21	38288	42900	33365	25073	14202	18602	16515	11595	12421	10630	12113	7269	5771	6200	7893	9036	13259	13699	22936	38023
22	49389	54605	42800	32418	21736	26715	24222	17772	17123	15097	17342	17280	13732	14466	18714	19555	15569	18954	25584	49039
23	37489	42615	31609	22974	18781	23782	19797	14947	16013	12372	14174	18320	13981	14800	21733	22306	21287	19649	30433	49292
24	29387	39813	26285	17121	25139	32923	22461	17983	18093	14652	18604	20310	15228	16789	23355	25717	22001	23887	31408	39602
25	34356	38288	27309	17960	30052	40429	31958	23943	24167	22046	28963	28321	22463	23175	32160	29042	23523	24927	33728	39684
26	30141	30373	23087	18479	27098	32910	29275	22628	24214	20800	23703	21008	16632	16384	21394	29590	24031	26857	29725	33496
27	28276	28625	22270	16278	23098	30124	27596	22253	26102	19328	23820	21853	16833	16023	22330	25327	22691	22826	26269	26002
28	24925	26017	19087	19595	21914	32972	28349	21095	21537	16288	20057	16545	13735	14492	17959	24450	21226	18470	23462	21715
29	18703	20920	14227	16250	17235	24877	20729	16609	15992	16403	20960	12782	10241	12342	14790	17660	17119	15662	17525	17409
30	18407	17862	13688	12055	14965	20069	21621	16077	19343	20366	21661	16815	16616	14314	16713	18652	16963	14032	15536	15391
31	11419	13156	9037	11088	12476	14362	13521	11265	13393	14059	9849	8629	9304	9914	11437	10097	13146	11966	12667	12504
32	10185	12822	8410	8540	8635	12786	12711	11490	13667	14392	9622	9574	10048	9234	11719	10667	10751	9754	9549	10041
33	8528	8848	7127	10649	7273	9297	11369	7022	7117	8576	6334	6109	6137	6483	8424	8002	7794	7836	7413	8748
34	5926	7812	6967	10543	7987	7318	7355	6684	7584	6524	4816	6725	6015	5320	6318	5430	6030	5882	6432	7356
35	5763	5935	6214	7637	5425	5928	6307	5646	4677	6578	4737	6761	5332	4960	5296	4389	4616	4483	4903	5269
36	4033	5064	4532	6274	4979	4998	4608	4337	3709	4133	2568	5341	4333	3282	4093	3205	3900	3389	3147	4136
37	4024	3754	3545	4841	4541	4195	4089	3752	3496	4226	2135	4774	3296	3008	2988	2123	3243	2784	2564	3199
38	3131	3106	3193	4966	2993	3933	2991	2771	2879	2788	1142	3558	2628	2724	2421	2268	2881	2078	2274	2721
39	2151	2778	2154	3339	2869	2987	2290	1841	1746	1596	927	2195	2218	2057	2340	1596	2327	1667	1628	1946
40	2425	2159	2175	2766	2414	2574	2206	1738	2015	1956	982	3123	2403	1910	1974	1455	2161	1620	1545	1713
41	1375	1753	1461	1951	2076	1546	1452	1150	1123	1250	520	1558	1362	1020	941	764	1577	1218	1092	1167
42	1350	1542	1130	1668	1662	1599	1111	1118	1558	1142	508	1490	1124	797	863	632	1579	916	920	989
43	1150	1209	1087	1908	1495	1348	1069	687	1039	610	370	1053	767	539	537	646	1166	751	798	739
44	965	704	1192	1401	1089	1050	745	500	915	414	219	769	735	438	418	463	876	699	612	634
45	641	581	1194	955	1058	766	684	550	700	464	253	904	431	423	526	418	891	603	571	622
46	645	689	669	713	666	734	584	353	460	374	135	525	424	248	294	328	596	485	396	479
47	509	391	641	715	431	567	417	407	437	397	140	327	276	213	368	241	506	379	327	442
48	343	333	526	863	636	588	456	270	494	264	92	382	104	205	188	188	378	321	304	384
49	290	254	378	470	377	263	145	178	254	205	57	132	151	177	183	79	227	332	263	320
50	319	216	351	230	263	256	238	273	255	179	76	154	159	154	160	115	283	328	250	287
51	135	241	240	181	210	107	126	156	214	123	38	191	58	109	135	73	192	221	157	247
52	192	48	180	335	180	159	202	107	175	77	30	115	93	85	102	46	171	155	166	201
53	137	70	150	121	124	111	55	136	91	84	26	156	23	133	82	51	134	131	129	137
54	111	112	218	99	189	94	120	77	55	75	11	93	11	63	40	20	89	100	92	157
55	76	85	187	53	63	61	128	66	91	53	9	114	16	75	53	30	63	57	96	138
56	111	41	123	26	28	66	50	49	47	62	12	7	5	18	24	13	26	95	61	118
57	74	39	116	43	34	61	72	36	77	48	8	31	14	20	46	6	52	60	51	134
58	39	65	70	2	11	68	58	47	88	48	9	14	5	16	29	6	22	36	39	135
59	32	60	36	13	17	28	13	31	36	30	8	10	2	7	26	3	12	42	38	86
60	21	7	30	5	24	7	54	26	32	9	5	8	4	2	21	11	9	17	17	115
61	21	15	15	4	11	0	25	12	4	4	0	0	3	8	7	0	6	9	26	41
62	0	0	21	10	0	44	3	8	0	9	1	10	0	1	2	0	5	3	14	21
63	19	13	10	0	3	28	0	5	20	4	5	4	0	0	5	1	1	5	8	19
64	0	7	0	0	0	14	7	10	0	0	0	0	0	4	0	0	0	7	7	19
65	8	0	4	0	0	0	30	16	4	0	0	4	2	1	0	1	0	1	12	12
66	0	0	0	0	0	0	7	0	20	2	4	0	0	0	0	0	2	1	6	10
67	0	0	0	0	0	0	18	3	0	0	0	0	0	0	0	0	0	1	4	9
68	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	4	8
69	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	2	0	1	6
70	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	2	5
71	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	1	0	1	5
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4
Total	**476745**	**527377**	**399490**	**348914**	**323482**	**414794**	**365872**	**281949**	**295733**	**269161**	**280070**	**267245**	**220150**	**221121**	**282250**	**300679**	**293774**	**295215**	**386908**	**469044**
Weights	**6634**	**7211**	**5857**	**5868**	**5603**	**6789**	**6093**	**4834**	**5213**	**4822**	**4344**	**4882**	**4033**	**3918**	**4788**	**4831**	**5126**	**4820**	**5578**	**6611**

Table 11.4. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Input data and parameters.

INPUT PARAMETERS		
Parameter	Value	Source
Discard Survival	0.30	Gueguen and Charuau, 1975
MALES		
Growth - K	0.140	after Conan and Morizur, 1979 ; plus unpublished data
Growth - L(inf)	76	"
Natural mortality - M	0.3	Morizur, 1982
Size at maturity (knife-edged)	26.3 mm CL	unpublished data (WKNEPH 2006)
Length/weight - a	0.00039	Conan, 1978
Length/weight - b	3.180	"
FEMALES		
Immature Growth		
Growth - K	0.140	after Conan and Morizur, 1979 ;Verdois et al., 2001
Growth - L(inf)	76	"
Natural mortality - M	0.3	Morizur, 1982
Size at maturity	25 mm CL	Morizur, 1982
Mature Growth		
Growth - K	0.110	after Conan and Morizur, 1979 ;Verdois et al., 2001
Growth - L(inf)	56	"
Natural mortality - M	0.2	based on Morizur, 1982 ; assuming lower rate for mature females
Length/weight - a	0.00081	Conan, 1978
Length/weight - b	2.970	"

Table 11.5. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Age composition of the Removals

Table 1	Removals numbers at age			Numbers*10**-3							
YEAR		1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
AGE											
	1	25573	28369	20440	17328	10216	14817	13493	9110	7988	8004
	2	259864	295370	217967	163050	133523	173781	145439	107113	107827	93154
	3	127252	129866	96257	82735	102945	138382	118472	99389	107835	94429
	4	42274	48477	37800	51193	46712	55403	51864	44117	43904	44882
	5	12918	15384	13177	19558	17025	19611	19775	12974	17060	17315
	6	4528	5170	6298	8334	7318	6818	8182	4335	6222	6196
	7	1908	2145	3141	3654	2807	2646	3975	2130	2469	2787
	8	936	1068	1463	1548	1324	1293	1917	1003	932	1019
+gp		1493	1528	2948	1514	1611	2042	2756	1778	1497	1376
0 TOTALNUM		476745	527377	399490	348914	323482	414794	365872	281949	295733	269161
TONSLAND		6634	7211	5857	5868	5603	6789	6093	4834	5213	4822
SOPCOF %		101	100	101	99	100	99	100	99	99	100
YEAR		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGE											
	1	8583	7670	6036	6458	8051	9303	11261	15758	36232	23117
	2	110729	99003	77413	82164	111944	115574	109582	117504	172918	258597
	3	99009	89911	74298	73448	95922	118923	98869	96280	116587	122019
	4	42158	39688	35997	35006	37879	38594	44283	36704	36234	40279
	5	11931	15353	15463	13786	15550	10841	17614	15950	13218	13009
	6	4512	7294	5392	5291	6545	4100	5991	6366	6073	5273
	7	1591	3862	2665	2306	2900	1400	2584	3040	2550	2771
	8	757	1914	1266	1192	1824	953	1516	1380	1244	1492
+gp		800	2550	1621	1470	1636	993	2076	2235	1853	2487
0 TOTALNUM		280070	267245	220150	221121	282251	300679	293774	295215	386908	469044
TONSLAND		4344	4882	4033	3918	4788	4831	5126	4820	5578	6611
SOPCOF %		99	100	101	100	101	101	99	100	100	100
	1										

Table 11.6. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Removals weight at age

Run title : bay of biscay M+F WG 2005 t0=0 9+

Table 2 Removals weights at age (kg)

	YEAR		1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
	AGE											
		1	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
		2	0.008	0.008	0.008	0.008	0.009	0.009	0.009	0.009	0.009	0.009
		3	0.016	0.017	0.016	0.017	0.016	0.017	0.016	0.017	0.017	0.017
		4	0.028	0.027	0.028	0.028	0.027	0.026	0.025	0.027	0.026	0.027
		5	0.042	0.040	0.039	0.040	0.040	0.038	0.033	0.038	0.036	0.035
		6	0.058	0.053	0.052	0.052	0.051	0.051	0.043	0.047	0.049	0.043
		7	0.069	0.061	0.063	0.066	0.064	0.062	0.050	0.058	0.062	0.053
		8	0.079	0.064	0.069	0.072	0.073	0.060	0.059	0.066	0.076	0.064
	+gp		0.090	0.087	0.084	0.072	0.078	0.081	0.078	0.081	0.093	0.079
0	SOPCOFAC		1.010	1.003	1.005	0.994	0.996	0.987	1.001	0.987	0.988	0.997

	YEAR		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	AGE											
		1	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.0035
		2	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.0085
		3	0.016	0.017	0.017	0.017	0.017	0.017	0.017	0.016	0.016	0.0165
		4	0.024	0.027	0.027	0.026	0.026	0.026	0.026	0.025	0.026	0.0269
		5	0.031	0.038	0.036	0.036	0.034	0.036	0.036	0.033	0.035	0.0368
		6	0.039	0.046	0.045	0.042	0.041	0.046	0.052	0.043	0.045	0.0476
		7	0.048	0.048	0.048	0.050	0.050	0.054	0.059	0.056	0.057	0.0592
		8	0.052	0.059	0.053	0.059	0.053	0.053	0.065	0.066	0.066	0.0705
	+gp		0.066	0.068	0.061	0.072	0.074	0.070	0.071	0.078	0.083	0.1028
0	SOPCOFAC		0.995	1.004	1.007	1.005	1.005	1.006	0.988	1.003	0.996	0.9971
		1										

Table 11.7. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b).

Effort and LPUE values of commercial fleets used in the assessment to tune the model.

Sub-area VIII a,b

	Le Guilvinec District Quarter 2		
Year	Landings(t)	Effort(100h)	LPUE(Kg/h)
1987	603	437	13.8
1988	777	471	16.5
1989	862	664	13.0
1990	801	708	11.3
1991	717	728	9.8
1992	841	757	11.1
1993	805	735	11.0
1994	690	671	10.3
1995	609	627	9.7
1996	715	598	12.0
1997	638	539	11.8
1998	622	489	12.7
1999	505	423	11.9
2000	438	405	10.8
2001	697	417	16.7
2002	527	371	14.2
2003	480	357	13.4
2004	387	327	11.8
2005	433	335	12.9
2006	409	306	13.4

Table 11.8. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Separable analysis

At 14/05/2007 20:49

Separable analysis
from 1987 to 2006 on ages 1 to 8
with Terminal F of .400 on age 5 and Terminal S of 1.000

Initial sum of squared residuals was 201.814 and
final sum of squared residuals is 8.593 after 69 iterations

Matrix of Residuals

Years / Ages	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96
1/ 2	-0.012	0.239	0.501	0.299	-0.282	0.24	0.042	0.05	-0.005
2/ 3	0.579	0.869	1.025	0.264	-0.023	0.317	-0.079	-0.005	0.043
3/ 4	-0.048	0.077	-0.181	-0.526	-0.249	0.005	-0.424	-0.054	-0.105
4/ 5	-0.028	0.116	-0.181	-0.025	-0.026	0.035	-0.051	0.05	-0.078
5/ 6	-0.055	-0.228	-0.32	-0.077	0.087	-0.045	0.157	-0.104	0.071
6/ 7	-0.123	-0.525	-0.14	0.128	0.286	-0.273	0.093	-0.181	-0.04
7/ 8	-0.039	-0.382	0.271	0.31	0.291	-0.246	0.386	0.332	0.293
TOT	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002
WTS	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

Years	1996/97	1997/98	1998/99	1999/**	2000/**	2001/**	2002/**	2003/**	2004/**	2005/**	TOT	WTS
1/ 2	-0.422	0.167	0.024	-0.204	-0.204	-0.457	0.138	0.051	-0.045	0.312	0	0.372
2/ 3	-0.369	0.329	0.117	-0.021	-0.007	-0.36	0.276	0.021	-0.124	0.184	0	0.26
3/ 4	-0.403	0.185	-0.139	-0.184	-0.042	-0.287	0.261	0.004	-0.024	0.048	0	0.461
4/ 5	0.083	0.249	-0.144	-0.012	0.077	0.021	0.024	0.003	-0.015	-0.032	0	1
5/ 6	0.165	-0.213	0.019	0.155	0.068	0.163	-0.113	0.058	-0.016	-0.092	0	0.663
6/ 7	0.275	-0.461	0.073	0.02	0.015	0.467	-0.157	-0.188	0.023	-0.143	0	0.383
7/ 8	0.481	-0.552	0.439	0.232	-0.105	0.3	-0.448	0.016	0.26	-0.129	0	0.295
TOT	0.002	0.001	0.001	0.001	0.001	0	0	0	0	0	1.989	
WTS	0.001	0.001	0.001	0.001	0.001	1	1	1	1	1		

Fishing Mortalities (F)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
F-values	0.6459	0.6575	0.5573	0.6521	0.5945	0.6845	0.7882	0.5698	0.6259	0.6452

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
F-values	0.501	0.5984	0.5338	0.5068	0.6336	0.4918	0.5797	0.5514	0.4934	0.4

Selection-at-age (S)

	1	2	3	4	5	6	7	8
S-values	0.0319	0.5827	1.161	1.1183	1	0.888	0.8204	1

Table 11.9. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Tune data

bay	of	biscay	TUNE	DATA	:	EFFORT	100HRS		
101									
FLEET	QGV	Q2							
1987	2006								
1	1	0.25	0.5						
1	9								
436.7	2038.3	23308.9	12847.9	5447	1854.7	669.1	311	143.5	166.3
470.6	2695.2	29783.6	17583.8	7337.2	2397.9	884.8	379.7	199.9	292.7
663.5	2648	29789.8	14875.8	6866	2901.9	1656.7	840.3	352.5	789.3
707.8	2088.7	19070.8	11166.9	8860.4	3778.1	1833.2	796.4	362.7	370.8
728.2	582.7	14687.8	13389.3	8283.4	3342.9	1302.1	483.7	230.6	225.7
756.6	746.4	19581.8	17246.3	9023.5	3920.1	1446.4	491.5	189.3	242.4
734.7	642	15853.5	14705.2	7927.1	3733.1	1966	959.4	422.7	653.8
670.6	573.8	13077.7	15461.9	8340	2378.7	940.9	429.6	233.5	445.1
626.9	495.9	11677.5	13228.4	5969.2	2784.4	1123.2	459.7	160.7	292.5
597.9	533.1	10521.1	12661.4	8264.6	3959.6	1550.5	743.8	307.4	371.3
539.0	590.9	13531.3	15653.4	8438.8	2863.2	1140.7	442.6	242.5	228.2
489.2	356.2	11080.9	11486.1	6575.5	2874.3	1431.5	789.4	426.4	527.2
422.9	305	9210.1	10053.8	6013.5	2828.6	985.2	546.9	250.7	253.2
405.2	271.6	8914.2	8186.3	5408.1	2461.7	1002.3	381.9	231.9	255.5
417.1	430.1	13370.9	13968.6	8169.1	3850.7	1731.9	716.9	399.1	294.8
371.3	379.1	12992.1	15801.6	5399	1904.3	714.2	249.9	217.3	181.6
357.0	310.4	8195	10153.6	6228.1	2708	908.4	444.4	256.5	361.9
327.1	550	9739.1	8548.6	5033.7	2621.9	1031.9	506.6	212.8	282.6
334.6	1409.8	14030.9	10522.3	4993.1	2127.6	1062.8	439.2	186.8	280.2
306.27	1394.2	20254.7	13349.6	5258.6	1967.3	811.8	428.9	239.7	366.9

Table 11.10. Nephrops in Fus 23-24 Bay of Biscay (VIIIa,b) - XSA tuning diagnostics

Lowestoft VPA Version 3.1

14/05/2007 20:49

Extended Survivors Analysis

bay of biscay M+F WG 2006 t0=0 9+

CPUE data from file TUNEFF.DAT

Catch data for 20 years. 1987 to 2006. Ages 1 to 9.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
FLEETQGV(	1987	2006	1	8	0.25	0.5

Time series weights :

Tapered time weighting applied
Power = 3 over 20 years

Catchability analysis :

Catchability independent of stock size for all ages

Catchability independent of age for ages >= 6

Terminal population estimation :

Survivor estimates shrunk towards the mean F
of the final 5 years or the 5 oldest ages.

S.E. of the mean to which the estimates are shrunk = 1.500

Minimum standard error for population
estimates derived from each fleet = .300

Prior weighting not applied

Tuning converged after 32 iterations

1

Regression weights

0.751	0.82	0.877	0.921	0.954	0.976	0.99	0.997	1	1

Fishing mortalities

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	0.019	0.018	0.012	0.011	0.015	0.018	0.019	0.018	0.02	0.009
2	0.366	0.359	0.291	0.259	0.303	0.358	0.344	0.316	0.321	0.222
3	0.646	0.641	0.555	0.549	0.606	0.683	0.662	0.643	0.663	0.433
4	0.657	0.63	0.619	0.596	0.662	0.563	0.632	0.593	0.573	0.54
5	0.445	0.571	0.579	0.547	0.626	0.423	0.585	0.524	0.469	0.441
6	0.349	0.581	0.426	0.422	0.587	0.349	0.467	0.46	0.411	0.367
7	0.264	0.614	0.461	0.345	0.461	0.248	0.412	0.491	0.357	0.354
8	0.344	0.629	0.441	0.41	0.542	0.284	0.496	0.43	0.405	0.39

1

XSA population numbers (Thousands)

YEAR	AGE 1	2	3	4	5	6	7	8
1997	525000	419000	236000	99200	37600	17400	7770	2950
1998	489000	382000	215000	96200	40000	18800	9540	4650
1999	572000	356000	198000	88400	39900	17600	8180	4020
2000	679000	418000	197000	88300	37100	17400	8960	4020
2001	612000	498000	239000	88700	37900	16700	8890	4940
2002	602000	447000	272000	102000	35600	15800	7230	4370
2003	694000	438000	231000	107000	45100	18200	8670	4390
2004	1010000	504000	230000	92900	44300	19600	8880	4470
2005	2080000	731000	273000	94200	40000	20400	9610	4230
2006	2890000	1510000	393000	109000	41400	19500	10500	5240

Estimated population abundance at 1st Jan 2007

0.00E+00	2.12E+06	8.97E+05	1.98E+05	4.96E+04	2.07E+04	1.05E+04	5.77E+03

Taper weighted geometric mean of the VPA populations:

7.97E+05	5.12E+05	2.47E+05	9.81E+04	4.00E+04	1.76E+04	8.25E+03	3.88E+03

Standard error of the weighted Log(VPA populations) :

0.5563	0.3851	0.1817	0.0789	0.0755	0.1009	0.1729	0.2623

1

Table 11.10 (Cont'd)

Log catchability residuals.

Fleet : FLEETQGVQ2

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	1.17	1.56	1.24	0.94	-0.39	-0.07	-0.11	-0.08	-0.12	0.01
2	0.48	0.67	0.48	-0.05	-0.38	-0.12	-0.2	-0.25	-0.25	-0.28
3	0	0.25	-0.25	-0.52	-0.47	-0.29	-0.36	-0.17	-0.25	-0.21
4	-0.14	0.07	-0.4	-0.25	-0.32	-0.28	-0.28	-0.19	-0.47	-0.03
5	-0.27	-0.16	-0.29	-0.23	-0.33	-0.16	-0.08	-0.43	-0.33	0.05
6	-0.32	-0.24	0.04	0.15	-0.32	-0.26	0.32	-0.31	-0.21	0.08
7	-0.13	-0.29	0.1	0.12	-0.21	-0.52	0.29	-0.05	-0.21	0.27
8	-0.02	0.12	0.01	0.05	-0.14	-0.12	0.27	-0.03	-0.04	0.23

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	0.31	-0.03	-0.2	-0.44	0.1	0.1	-0.2	0.09	0.28	0.03
2	0.11	0.1	0.11	-0.05	0.16	0.38	-0.03	0.08	0.05	-0.25
3	0.12	-0.01	0.06	-0.11	0.23	0.37	0.12	0.03	0.06	-0.07
4	0.07	-0.06	0.08	0.01	0.41	-0.06	0.1	0.1	0.05	0.02
5	-0.13	-0.04	0.09	0.06	0.48	-0.12	0.1	0.15	0	-0.04
6	-0.21	0.12	-0.1	-0.03	0.59	-0.21	-0.03	0.11	0.05	-0.09
7	-0.39	0.21	0.09	-0.36	0.29	-0.52	-0.03	0.2	-0.1	-0.12
8	0.01	0.32	0.01	-0.03	0.32	-0.14	0.14	-0.01	-0.11	0.01

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	1	2	3	4	5	6	7	8
Mean Log q	-13.2712	-9.5893	-8.7828	-8.4891	-8.4761	-8.5767	-8.5767	-8.5767
S.E(Log q)	0.2552	0.2045	0.2035	0.1973	0.2104	0.2357	0.2819	0.1668

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
1	0.9	0.774	13.3	0.86	20	0.23	-13.27
2	1.23	-1.175	8.79	0.73	20	0.25	-9.59
3	1.06	-0.153	8.58	0.42	20	0.23	-8.78
4	-3.11	-1.975	20.84	0.02	20	0.55	-8.49
5	0.67	0.559	9.17	0.23	20	0.15	-8.48
6	0.71	0.575	8.93	0.28	20	0.17	-8.58
7	0.77	0.606	8.72	0.41	20	0.22	-8.63
8	0.88	0.736	8.49	0.79	20	0.14	-8.53
1							

Terminal year survivor and F summaries :

Age 1 Catchability constant w.r.t. time and dependent on age

Year class = 2005

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLEETQGV(	2176533	0.3	0	0	1	0.961	0.009
F shrinkage	1074488	1.5				0.039	0.018

Weighted prediction :

Survivors at end of yea	Int s.e	Ext s.e	N	Var Ratio	F
2117717	0.29	0.14	2	0.473	0.009

1

Age 2 Catchability constant w.r.t. time and dependent on age

Year class = 2004

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLEETQGV(	907013	0.212	0.266	1.26	2	0.975	0.219
F shrinkage	566168	1.5				0.025	0.332

Weighted prediction :

Survivors at end of yea	Int s.e	Ext s.e	N	Var Ratio	F
896557	0.21	0.19	3	0.919	0.222

Table 11.10 (Cont'd)

Age 3 Catchability constant w.r.t. time and dependent on age

Year class = 2003

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLEETQGV(	201189	0.176	0.05	0.28	3	0.975	0.429
F shrinkage	115379	1.5				0.025	0.659

Weighted prediction :

Survivors at end of yea	Int s.e	Ext s.e	N	Var Ratio	F
198443	0.18	0.06	4	0.368	0.433

1

Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 2002

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLEETQGV(	49868	0.165	0.053	0.32	4	0.97	0.538
F shrinkage	42159	1.5				0.03	0.611

Weighted prediction :

Survivors at end of yea	Int s.e	Ext s.e	N	Var Ratio	F
49621	0.17	0.05	5	0.287	0.54

Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 2001

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLEETQGV(	20866	0.161	0.024	0.15	5	0.973	0.438
F shrinkage	16390	1.5				0.027	0.531

Weighted prediction :

Survivors at end of yea	Int s.e	Ext s.e	N	Var Ratio	F
20732	0.16	0.03	6	0.168	0.441

1

Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 2000

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLEETQGV(	10581	0.158	0.053	0.34	6	0.976	0.364
F shrinkage	7983	1.5				0.024	0.459

Weighted prediction :

Survivors at end of yea	Int s.e	Ext s.e	N	Var Ratio	F
10511	0.16	0.05	7	0.322	0.367

Age 7 Catchability constant w.r.t. time and age (fixed at the value for age) 6

Year class = 1999

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLEETQGV(	5785	0.154	0.062	0.4	7	0.978	0.353
F shrinkage	5013	1.5				0.022	0.397

Weighted prediction :

Survivors at end of yea	Int s.e	Ext s.e	N	Var Ratio	F
5767	0.15	0.06	8	0.371	0.354

Table 11.10 (Cont'd)

Age 8 Catchability constant w.r.t. time and age (fixed at the value for age) 6

Year class = 1998

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLEETQGV(	2770	0.148	0.033	0.22	8	0.979	0.389
F shrinkage	2444	1.5				0.021	0.431

Weighted prediction :

Survivors at end of yea	Int s.e	Ext s.e	N	Var Ratio	F
2763	0.15	0.03	9	0.209	0.39

1

FLEETQGVQ2

CPUE adjusted to start of year

	AGE							
YEAR	1	2	3	4	5	6	7	8
1987	5.284106	74.42091	42.5087	17.55147	5.674778	1.979589	0.934957	0.4471482
1988	6.509448	91.69231	54.37737	22.74345	6.956147	2.433196	1.030263	0.5797144
1989	4.51855	62.63294	30.37078	13.94963	5.809924	3.353584	1.716969	0.7225047
1990	3.334908	35.36019	21.01598	18.02317	7.519371	3.801847	1.641895	0.7186692
1991	0.9004741	25.55216	25.1332	16.07992	6.330607	2.466398	0.9522683	0.462103
1992	1.114145	34.1834	33.40953	17.67231	7.497551	2.594954	0.8588789	0.3935034
1993	0.9867646	28.14373	28.5294	16.14577	7.622751	4.090442	1.96962	0.8886666
1994	0.9636242	24.5306	31.81161	17.49449	4.763605	1.830566	0.8973522	0.4736992
1995	0.8903202	23.59918	29.75999	13.33879	6.17562	2.443915	0.9928493	0.3695001
1996	1.003641	21.95735	29.1796	19.83293	9.197663	3.472565	1.711994	0.6829345
1997	1.235349	32.1943	40.55835	21.95523	6.885884	2.646684	0.9950772	0.5616501
1998	0.8202448	28.96362	32.72261	18.66094	7.978364	3.988273	2.22655	1.209443
1999	0.8106063	27.15847	32.09971	19.65882	9.109562	2.998127	1.685973	0.7672228
2000	0.7530778	27.10991	27.2133	18.29885	8.179417	3.178895	1.176965	0.7321548
2001	1.160444	40.15686	46.08265	27.51048	12.79669	5.674057	2.241378	1.285552
2002	1.149946	44.72242	60.24711	19.68668	6.591609	2.405182	0.8105481	0.7144167
2003	0.9796249	29.18753	39.95097	24.23759	10.35435	3.324843	1.593591	0.9489306
2004	1.894396	37.47338	36.45938	21.0775	10.70075	4.11235	2.042125	0.8386379
2005	4.749801	52.87492	44.19048	20.27882	8.316139	4.064897	1.646669	0.7128841
2006	5.110855	80.3685	56.25352	23.05443	8.312137	3.336731	1.754414	0.9937634

1

Table 11.11. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b). Estimates of Fishimg mortality at age

Run title : bay of biscay M+F WG 2007 t0=0 9+

Table 8	Fishing mortality (F) at age									
YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
AGE										
1	0.0316	0.0422	0.0319	0.0269	0.0155	0.0252	0.0249	0.0176	0.016	0.0163
2	0.5919	0.6955	0.5933	0.4286	0.3335	0.4458	0.4119	0.3144	0.3337	0.2928
3	0.7382	0.7576	0.564	0.5187	0.5884	0.7768	0.7015	0.6135	0.6728	0.61
4	0.6667	0.764	0.5508	0.7286	0.679	0.8064	0.833	0.6658	0.6546	0.7193
5	0.527	0.5849	0.5113	0.6697	0.6122	0.7423	0.8399	0.5407	0.6344	0.6313
6	0.4365	0.4409	0.5409	0.7809	0.6128	0.5695	0.8907	0.4628	0.5827	0.5329
7	0.4796	0.4048	0.5662	0.7649	0.717	0.4985	0.8545	0.6544	0.5627	0.6066
8	0.5762	0.5841	0.5746	0.6577	0.7649	0.9679	0.9189	0.5756	0.7317	0.5111
+gp	0.5762	0.5841	0.5746	0.6577	0.7649	0.9679	0.9189	0.5756	0.7317	0.5111
0 FBAR 2- 5	0.6309	0.7005	0.5548	0.5864	0.5533	0.6928	0.6966	0.5336	0.5739	0.5634

	ishing mortality (F) at age										
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	FBAR **
	0.0192	0.0184	0.0123	0.0111	0.0154	0.0181	0.019	0.0184	0.0204	0.0094	0.0161
2	0.3664	0.3586	0.2912	0.2591	0.303	0.3577	0.3436	0.3156	0.3211	0.2217	0.2862
3	0.6463	0.6407	0.5553	0.5486	0.606	0.6833	0.6621	0.6431	0.6631	0.4335	0.5799
4	0.6574	0.6303	0.619	0.5963	0.6616	0.5628	0.6325	0.5934	0.5727	0.5402	0.5688
5	0.4453	0.5705	0.5786	0.5473	0.6257	0.4226	0.5849	0.5243	0.4694	0.4407	0.4781
6	0.3488	0.5805	0.426	0.422	0.5873	0.3487	0.4671	0.4601	0.411	0.3665	0.4125
7	0.2641	0.6137	0.4608	0.3448	0.4612	0.2478	0.4119	0.4909	0.3573	0.3535	0.4006
8	0.344	0.6288	0.4411	0.4097	0.5416	0.2841	0.4959	0.4301	0.405	0.3897	0.4083
+gp	0.344	0.6288	0.4411	0.4097	0.5416	0.2841	0.4959	0.4301	0.405	0.3897	
0 FBAR 2- 5	0.5289	0.55	0.511	0.4878	0.5491	0.5066	0.5558	0.5191	0.5066	0.409	
1											

Table 11.12. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Estimates of stocks number at age

Run title : bay of biscay M+F WG 2007 t0=0 9+

Table 10 Stock number at age (start of year) Numbers*10**-3

	YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
	AGE										
	1	954001	796879	757365	758511	769621	692837	638310	606643	584835	575374
	2	675847	684731	565925	543477	547004	561356	500513	461258	441571	426381
	3	276232	277013	253034	231642	262279	290306	266288	245609	249516	234316
	4	98446	102830	101131	112117	107390	113415	103969	102834	103570	99159
	5	35734	39363	37303	45403	42139	42412	39435	35201	41154	41915
	6	14507	16430	17080	17423	18100	17793	15724	13261	15965	16995
	7	5675	7302	8233	7744	6214	7638	7840	5025	6502	6943
	8	2422	2736	3794	3640	2807	2363	3613	2598	2034	2885
	+gp	3807	3857	7534	3503	3353	3649	5086	4537	3211	3844
0	TOTAL	2066671	1931141	1751399	1723461	1758907	1731769	1580778	1476966	1448357	1407813

Table 10 Stock number at age (start of year) Numbers*10**-3

	YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	GMST 87-**	AMST 87-**
	AGE													
	1	525258	489468	571651	679079	612157	601778	693939	1005717	2081276(1)	2885465(2)	0	671885	684079
	2	419359	381733	356005	418294	497516	446568	437801	504390	731491	1510662(3)	2117717(4)	485209	492763
	3	235692	215363	197582	197105	239161	272218	231350	230013	272525	393070	896557(5)	243328	244707
	4	99152	96182	88379	88310	88688	101607	107055	92924	94168	109355	198443	100133	100398
	5	37617	40016	39883	37062	37883	35642	45073	44295	39979	41362	49621	39742	39863
	6	17363	18767	17615	17415	16698	15780	18191	19559	20421	19470	20732	16859	16926
	7	7768	9540	8179	8960	8894	7228	8672	8881	9615	10545	10511	7526	7624
	8	2948	4646	4022	4018	4943	4367	4394	4473	4233	5238	5767	3370	3483
	+gp	3086	6096	5089	4900	4372	4509	5939	7163	6234	8638	7319		
0	TOTAL	1348243	1261811	1288405	1455143	1510311	1489698	1552413	1917416	3259941	4983804	3306667		
	1													

(1) replaced by 1005717=R2004
(2) replaced by 671885=GM(87-04)
(3) replaced by 729984=1005717*exp(-Z)
(4) replaced by 493114=671885*exp(-Z)
(5) replaced by 433235=729984*exp(-Z)

Table 11.13.Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b). Summary of Catches and XSA results

Run title : bay of biscay M+F WG 2007 t0=0 9+

Table 16 Summary (without SOP correction)

	RECI Age 1	TOTALBIO	TOTSPBIC	REMOVALS	LANDINGS	DISCARDS	YIELD/SSI	FBAR 2- 5
1987	954001	19718	9377	6634	5397	1767	0.7075	0.6309
1988	796879	19493	9657	7211	5875	1909	0.7468	0.7005
1989	757365	18233	9657	5857	4835	1460	0.6064	0.5548
1990	758511	18234	9868	5868	4972	1281	0.5946	0.5864
1991	769621	18619	9549	5603	4754	1213	0.5867	0.5533
1992	692837	19053	10003	6789	5681	1584	0.6787	0.6928
1993	638310	16829	8879	6093	5109	1405	0.6862	0.6966
1994	606643	16284	8663	4834	4092	1060	0.5581	0.5336
1995	584835	16408	9028	5213	4452	1087	0.5774	0.5739
1996	575374	15748	8625	4822	4118	1005	0.5591	0.5634
1997	525258	14655	7819	4344	3610	1049	0.5555	0.5289
1998	489468	14877	8791	4882	3865	1453	0.5554	0.55
1999	571651	14044	7967	4033	3209	1177	0.5063	0.511
2000	679079	14871	7849	3918	3069	1213	0.4992	0.4878
2001	612157	15934	8260	4788	3730	1512	0.5797	0.5491
2002	601778	16232	8924	4831	3679	1646	0.5413	0.5066
2003	693939	16905	9490	5126	3742	1977	0.5402	0.5558
2004	1005717	17813	8739	4820	3285	2193	0.5515	0.5191
2005	2081276(1)	24522	9356	5578	3689	2698	0.5962	0.5066
2006	2885465(2)	36697	12136	6611	3430	4544	0.5447	0.409
Arith. Mean	864008	18258	9132	5393	4230	1662	0.5886	0.5605
Units	(Thousands	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)	(Tonnes)		

(1) replaced by 1005717=R2004

(2) replaced by 671885=GM(87-04)

Table 11.14 Nephrops in Fus 23-24 bay of Biscay (VIIIa,b) Prediction with management option table: Input data

2007	Landings		Dead Discards							
Age	Exploitation pattern	Weight in landings	Exploitation pattern	Weight in discards	Stock size	Natural Mortality	Maturity ogive	Prop. of F bef. spaw.	Prop. of M bef. spaw.	Weight in stock
1	0.0000	0.004	0.0161	0.004	671885	0.30	0	0	0	0.004
2	0.0039	0.011	0.2822	0.009	493114	0.30	0	0	0	0.009
3	0.2989	0.017	0.2810	0.014	433235	0.25	0.75	0	0	0.016
4	0.5229	0.026	0.0458	0.023	198443	0.25	1	0	0	0.026
5	0.4661	0.035	0.0120	0.031	49621	0.25	1	0	0	0.035
6	0.4034	0.046	0.0092	0.034	20732	0.25	1	0	0	0.045
7	0.3975	0.058	0.0030	0.033	10511	0.25	1	0	0	0.057
8	0.4007	0.068	0.0076	0.043	5767	0.25	1	0	0	0.067
9+	0.3934	0.089	0.0148	0.060	7319	0.25	1	0	0	0.088
Unit	-	Kilograms	-	Kilograms	Thousands	-	-	-	-	Kilograms

2008	Landings		Dead Discards							
Age	Exploitation pattern	Weight in landings	Exploitation pattern	Weight in discards	Stock size	Natural Mortality	Maturity ogive	Prop. of F bef. spaw.	Prop. of M bef. spaw.	Weight in stock
1	0.0000	0.004	0.0161	0.004	671885	0.30	0	0	0	0.004
2	0.0039	0.011	0.2822	0.009		0.30	0	0	0	0.009
3	0.2989	0.017	0.2810	0.014		0.25	0.75	0	0	0.016
4	0.5229	0.026	0.0458	0.023		0.25	1	0	0	0.026
5	0.4661	0.035	0.0120	0.031		0.25	1	0	0	0.035
6	0.4034	0.046	0.0092	0.034		0.25	1	0	0	0.045
7	0.3975	0.058	0.0030	0.033		0.25	1	0	0	0.057
8	0.4007	0.068	0.0076	0.043		0.25	1	0	0	0.067
9+	0.3934	0.089	0.0148	0.060		0.25	1	0	0	0.088
Unit	-	Kilograms	-	Kilograms	Thousands	-	-	-	-	Kilograms

2009	Landings		Dead Discards							
Age	Exploitation pattern	Weight in landings	Exploitation pattern	Weight in discards	Stock size	Natural Mortality	Maturity ogive	Prop. of F bef. spaw.	Prop. of M bef. spaw.	Weight in stock
1	0.0000	0.004	0.0161	0.004	671885	0.30	0	0	0	0.004
2	0.0039	0.011	0.2822	0.009		0.30	0	0	0	0.009
3	0.2989	0.017	0.2810	0.014		0.25	0.75	0	0	0.016
4	0.5229	0.026	0.0458	0.023		0.25	1	0	0	0.026
5	0.4661	0.035	0.0120	0.031		0.25	1	0	0	0.035
6	0.4034	0.046	0.0092	0.034		0.25	1	0	0	0.045
7	0.3975	0.058	0.0030	0.033		0.25	1	0	0	0.057
8	0.4007	0.068	0.0076	0.043		0.25	1	0	0	0.067
9+	0.3934	0.089	0.0148	0.060		0.25	1	0	0	0.088
Unit	-	Kilograms	-	Kilograms	Thousands	-	-	-	-	Kilograms

Table 11.15 Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) - Catch predictions with management option table

Year: 2007						
	Landings		Dead Discards			
F Factor	Reference F	Landings in weight	Reference F	Discards in weight	Stock Biomass	Sp. Stock Biomass
1.0	0.3230	4720	0.1553	2272	23196	14696

Year: 2008							Year: 2009	
	Landings		Dead Discards					
F Factor	Reference F	landings in weight	Reference F	Discards in weight	Stock Biomass	Sp. Stock Biomass	Stock Biomass	Sp. Stock Biomass
0.0	0.0000	0	0.0000	0	21771	13942	28886	20630
0.1	0.0323	562	0.0155	220			27875	19666
0.2	0.0646	1097	0.0311	431			26912	18751
0.3	0.0969	1606	0.0466	633			25995	17880
0.4	0.1292	2089	0.0621	828			25122	17052
0.5	0.1615	2550	0.0777	1015			24291	16265
0.6	0.1938	2988	0.0932	1194			23499	15516
0.7	0.2261	3405	0.1087	1366			22745	14803
0.8	0.2584	3801	0.1242	1532			22027	14126
0.9	0.2907	4179	0.1398	1692			21342	13481
1.0	0.3230	4538	0.1553	1845			20690	12867
1.1	0.3553	4880	0.1708	1992			20068	12283
1.2	0.3876	5206	0.1864	2134			19475	11728
1.3	0.4199	5516	0.2019	2271			18910	11199
1.4	0.4522	5812	0.2174	2402			18371	10695
1.5	0.4845	6093	0.2330	2529			17857	10216
1.6	0.5168	6361	0.2485	2651			17367	9759
1.7	0.5491	6616	0.2640	2769			16899	9325
1.8	0.5814	6860	0.2795	2882			16453	8911
1.9	0.6137	7092	0.2951	2991			16027	8516
2.0	0.6460	7312	0.3106	3097			15621	8141

Table 11.16 Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) - Detailed tables

MFDP version 1a
Run: NEPH_scaled_S1
Time and date: 21:24 14/05/2007
Fbar age range (Total) : 2-5
Fbar age range Fleet 1 : 2-5

Year: 2007 F multiplier: 1 Fleet1 HCFbar: 0.323 Fleet1 DFbar: 0.1553

Age	Total F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	1	0	0.0161	9254	34	671885	2396	0	0	0	0
2	0.0039	1470	16	0.2822	105297	913	493114	4356	0	0	0	0
3	0.2989	87995	1525	0.281	82715	1158	433235	6990	324926	5242	324926	5242
4	0.5229	70853	1842	0.0458	6210	143	198443	5146	198443	5146	198443	5146
5	0.4661	16428	575	0.012	424	13	49621	1735	49621	1735	49621	1735
6	0.4034	6115	279	0.0092	139	5	20732	937	20732	937	20732	937
7	0.3975	3072	179	0.003	24	1	10511	603	10511	603	10511	603
8	0.4007	1693	115	0.0076	32	1	5767	389	5767	389	5767	389
9	0.3934	2110	188	0.0148	80	5	7319	643	7319	643	7319	643
Total		189736	4720		204174	2272	1890627	23196	617319	14696	617319	14696

Year: 2008 F multiplier: 1 Fleet1 HCFbar: 0.323 Fleet1 DFbar: 0.1553

Age	Total F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	1	0	0.0161	9254	34	671885	2396	0	0	0	0
2	0.0039	1460	16	0.2822	104592	906	489811	4327	0	0	0	0
3	0.2989	55735	966	0.281	52391	733	274406	4427	205804	3320	205804	3320
4	0.5229	67456	1754	0.0458	5912	136	188931	4900	188931	4900	188931	4900
5	0.4661	28972	1014	0.012	748	23	87508	3060	87508	3060	87508	3060
6	0.4034	7066	323	0.0092	161	5	23957	1083	23957	1083	23957	1083
7	0.3975	3123	182	0.003	24	1	10688	614	10688	614	10688	614
8	0.4007	1610	109	0.0076	30	1	5484	370	5484	370	5484	370
9	0.3934	1953	174	0.0148	74	4	6775	596	6775	596	6775	596
Total		167377	4538		173185	1845	1759446	21771	529148	13942	529148	13942

Year: 2009 F multiplier: 1 Fleet1 HCFbar: 0.323 Fleet1 DFbar: 0.1553

Age	Total F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	1	0	0.0161	9254	34	671885	2396	0	0	0	0
2	0.0039	1460	16	0.2822	104592	906	489811	4327	0	0	0	0
3	0.2989	55361	960	0.281	52040	729	272568	4397	204426	3298	204426	3298
4	0.5229	42726	1111	0.0458	3744	86	119666	3103	119666	3103	119666	3103
5	0.4661	27583	965	0.012	712	22	83314	2913	83314	2913	83314	2913
6	0.4034	12462	569	0.0092	283	10	42250	1910	42250	1910	42250	1910
7	0.3975	3609	211	0.003	28	1	12351	709	12351	709	12351	709
8	0.4007	1637	111	0.0076	31	1	5577	376	5577	376	5577	376
9	0.3934	1830	163	0.0148	69	4	6347	558	6347	558	6347	558
Total		146669	4106		170753	1793	1703769	20690	473931	12867	473931	12867

Input units are thousands and kg - output in tonnes

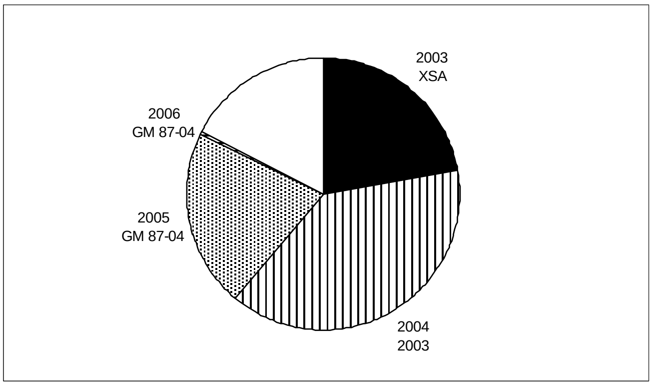
Table 11. 17 **Nephrops in FUs 23-24 bay of Biscay males and females combined**
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class			2003	2004	2005	2006	2007
Stock No. (thousands) of 1 year-olds			1005717	1005717	671885	671885	671885
Source			XSA	2003	GM 87-04	GM 87-04	GM 87-04
Status Quo F:							
% in	2007	landings	39.0	32.3	0.3	0.0	-
% in	2008		22.3	38.7	21.3	0.4	0.0
% in	2007	SSB	35.0	35.7	0.0	0.0	-
% in	2008	SSB	21.9	35.1	23.8	0.0	0.0
% in	2009	SSB	14.8	22.6	24.1	25.6	0.0

GM : geometric mean recruitment

Nephrops in FUs 23-24 bay of Biscay males and females combined : Year-class % contribution to

a) 2008 landings



b) 2009 SSB

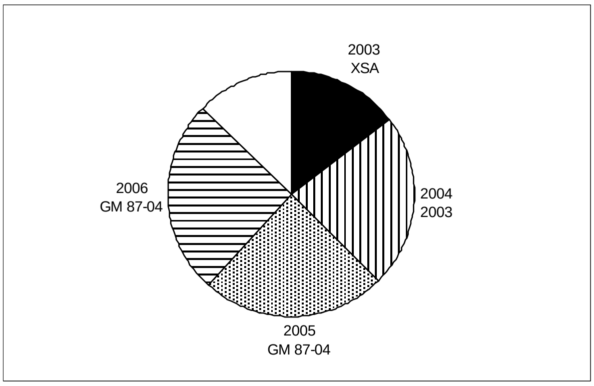


Table 11.18 Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) : Yield per recruit summary table

MFYPR version 2a
Run: NEPH_scaled_S1
Time and date: 21:25 14/05/2007
Yield per results

FMult	Landings LandingsFbar	LandingsNos	LandingsYield	DeadDiscards DeadDiscardsFbar	DeadDiscardsNos	DeadDiscardsYield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.2219	0.1243	2.3439	0.1119	2.3439	0.1119
0.1	0.0323	0.0724	0.0031	0.0155	0.0343	0.0004	3.7985	0.0969	1.9258	0.0847	1.9258	0.0847
0.2	0.0646	0.1197	0.0048	0.0311	0.0660	0.0008	3.4869	0.0781	1.6193	0.0659	1.6193	0.0659
0.3	0.0969	0.1509	0.0057	0.0466	0.0954	0.0011	3.2494	0.0646	1.3868	0.0525	1.3868	0.0525
0.4	0.1292	0.1714	0.0061	0.0621	0.1228	0.0014	3.0631	0.0547	1.2055	0.0427	1.2055	0.0427
0.5	0.1615	0.1845	0.0062	0.0776	0.1483	0.0016	2.9136	0.0473	1.0608	0.0353	1.0608	0.0353
0.6	0.1938	0.1924	0.0061	0.0932	0.1721	0.0019	2.7914	0.0416	0.9432	0.0297	0.9432	0.0297
0.7	0.2261	0.1967	0.0060	0.1087	0.1944	0.0021	2.6898	0.0371	0.8462	0.0253	0.8462	0.0253
0.8	0.2584	0.1984	0.0058	0.1242	0.2153	0.0023	2.6041	0.0335	0.7650	0.0218	0.7650	0.0218
0.9	0.2907	0.1981	0.0056	0.1397	0.2350	0.0025	2.5309	0.0307	0.6962	0.0190	0.6962	0.0190
1.0	0.3230	0.1965	0.0053	0.1553	0.2535	0.0026	2.4677	0.0283	0.6373	0.0167	0.6373	0.0167
1.1	0.3553	0.1938	0.0051	0.1708	0.2710	0.0028	2.4126	0.0264	0.5864	0.0148	0.5864	0.0148
1.2	0.3876	0.1905	0.0048	0.1863	0.2874	0.0030	2.3642	0.0248	0.5420	0.0132	0.5420	0.0132
1.3	0.4199	0.1867	0.0046	0.2018	0.3030	0.0031	2.3212	0.0234	0.5031	0.0119	0.5031	0.0119
1.4	0.4522	0.1825	0.0044	0.2174	0.3177	0.0032	2.2829	0.0222	0.4687	0.0108	0.4687	0.0108
1.5	0.4845	0.1781	0.0042	0.2329	0.3317	0.0033	2.2484	0.0212	0.4380	0.0098	0.4380	0.0098
1.6	0.5168	0.1736	0.0040	0.2484	0.3450	0.0034	2.2172	0.0203	0.4106	0.0090	0.4106	0.0090
1.7	0.5491	0.1690	0.0038	0.2639	0.3576	0.0035	2.1888	0.0195	0.3859	0.0083	0.3859	0.0083
1.8	0.5814	0.1644	0.0037	0.2795	0.3695	0.0036	2.1629	0.0189	0.3635	0.0076	0.3635	0.0076
1.9	0.6137	0.1598	0.0035	0.2950	0.3809	0.0037	2.1391	0.0182	0.3433	0.0071	0.3433	0.0071
2.0	0.6459	0.1553	0.0033	0.3105	0.3918	0.0038	2.1171	0.0177	0.3247	0.0066	0.3247	0.0066

Reference point	F multiplier	Absolute F
Fleet1 Landings Fb	1.0000	0.3230
FMax	0.5103	0.1648
F0.1	0.3403	0.1099
F35%SPR	0.4444	0.1435

Weights in kilograms
* based on landings

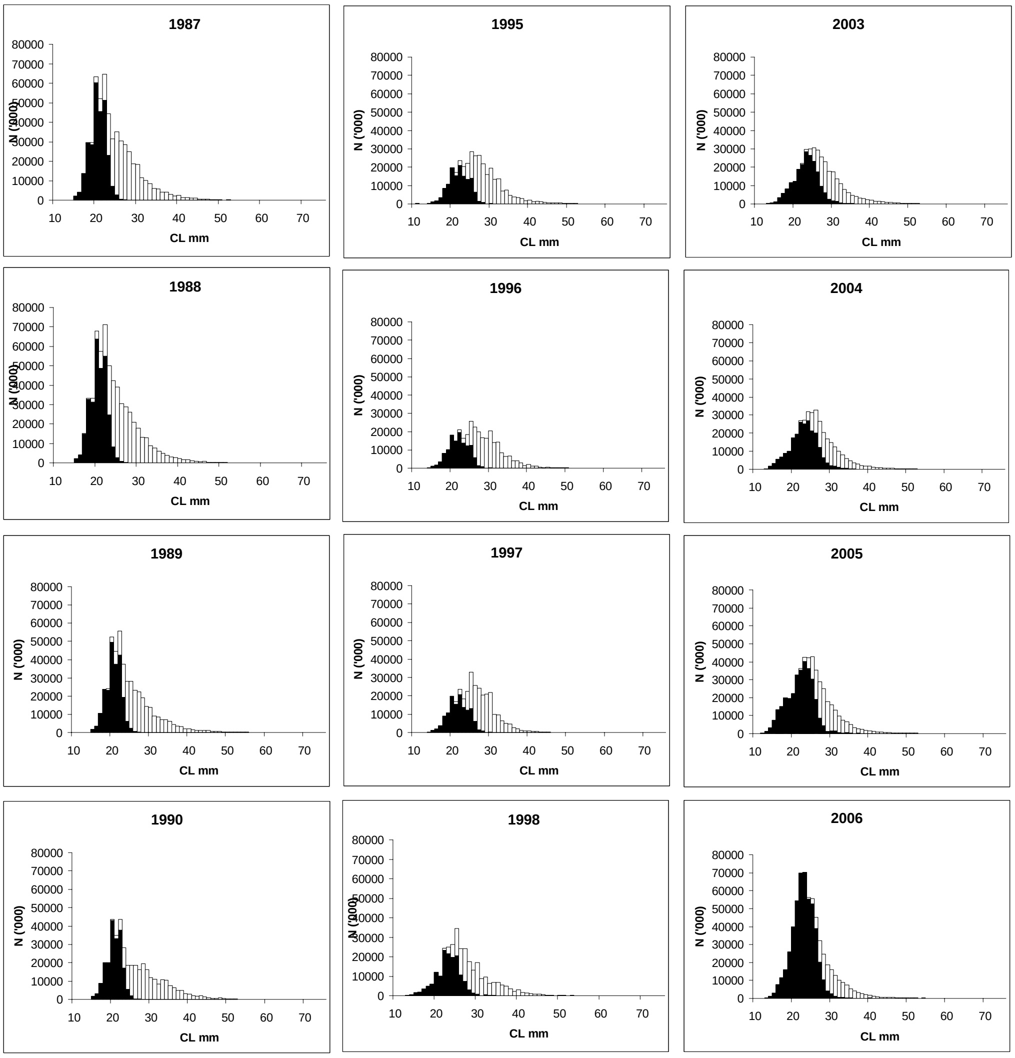

1987
1995
2003
1988
1996
2004
1989
1997
2005
1990
1998
2006
N ('000)
CL mm

Figure 11.1

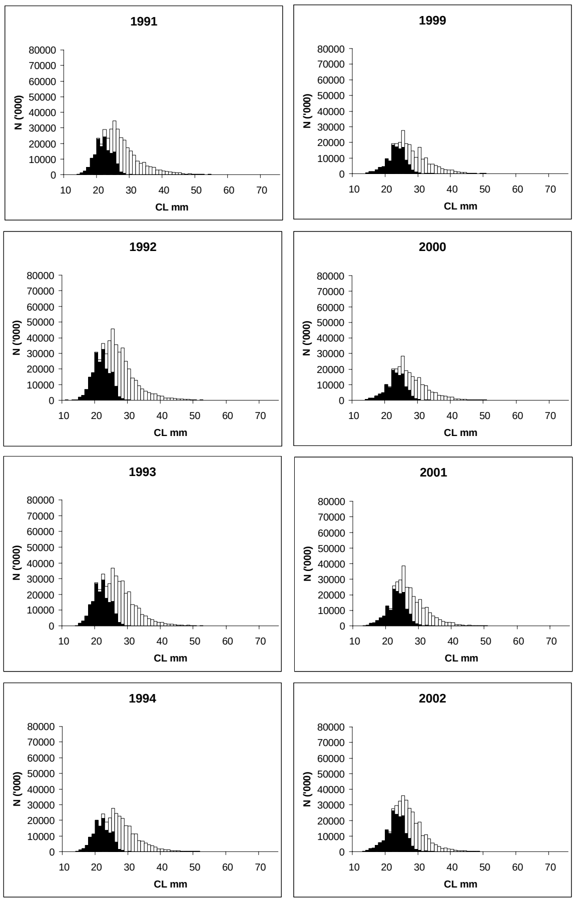


Figure 11.1. Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) catches (landings in white and discards in black) length distributions in 1987-2006.

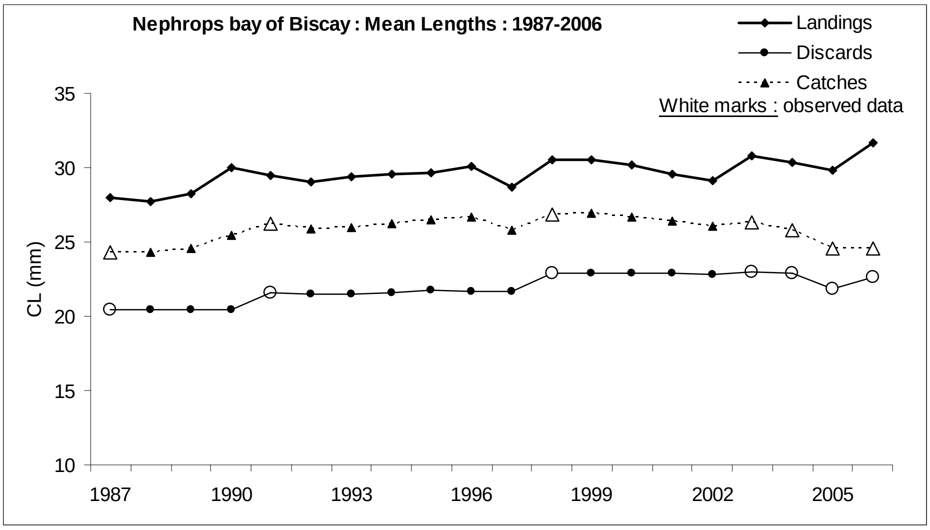


Figure 11.2. Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) - mean length of landings, discards and catches

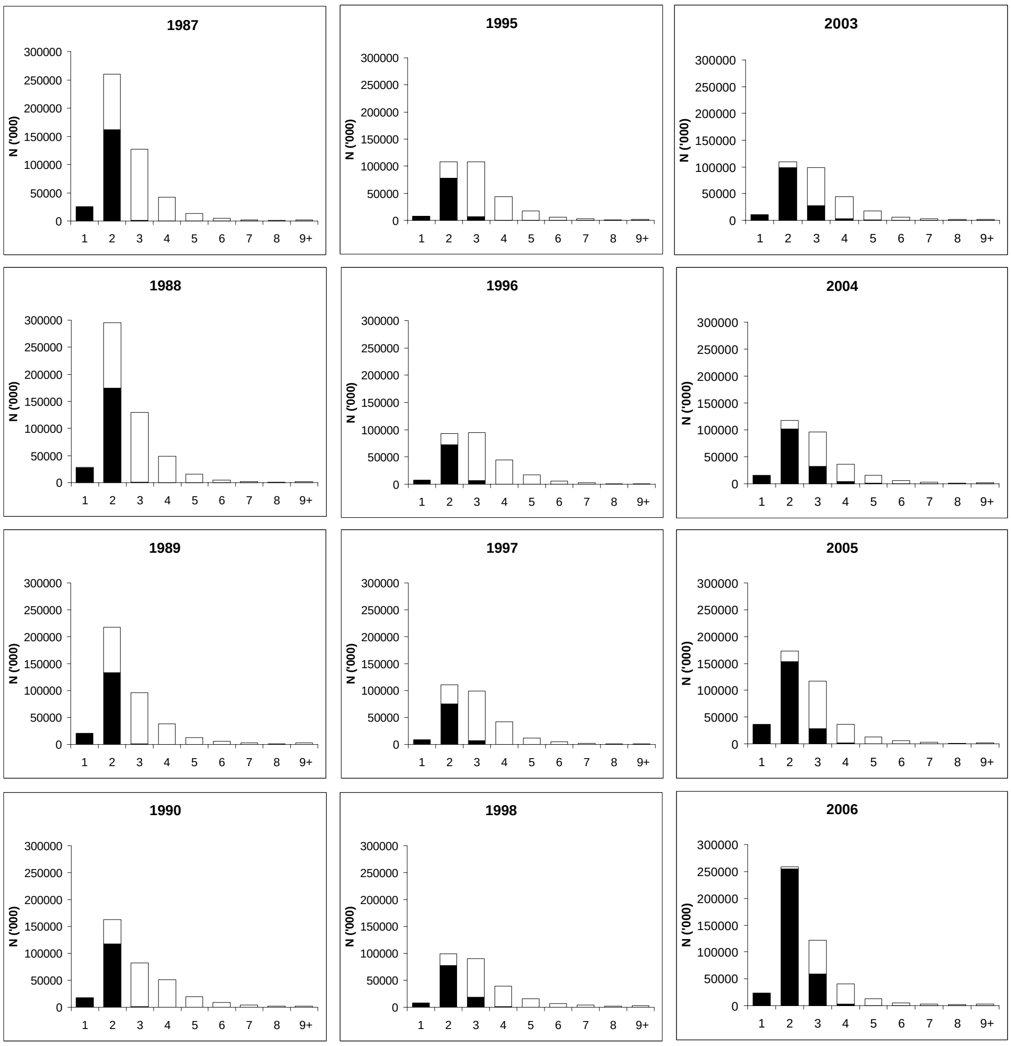

1987
1995
2003
1988
1996
2004
1989
1997
2005
1990
1998
2006
N ('000)
300000
250000
200000
150000
100000
50000
0
1 2 3 4 5 6 7 8 9+

Figure 11.3

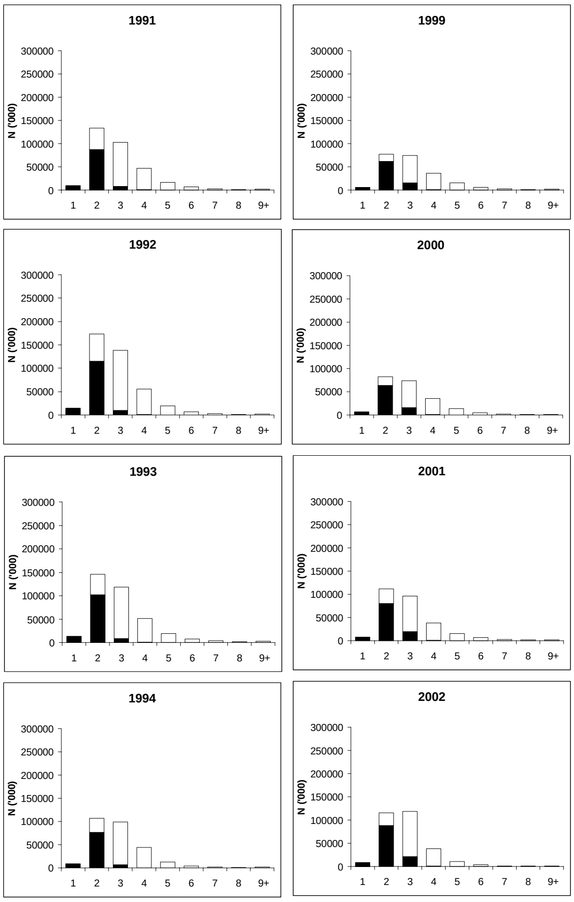
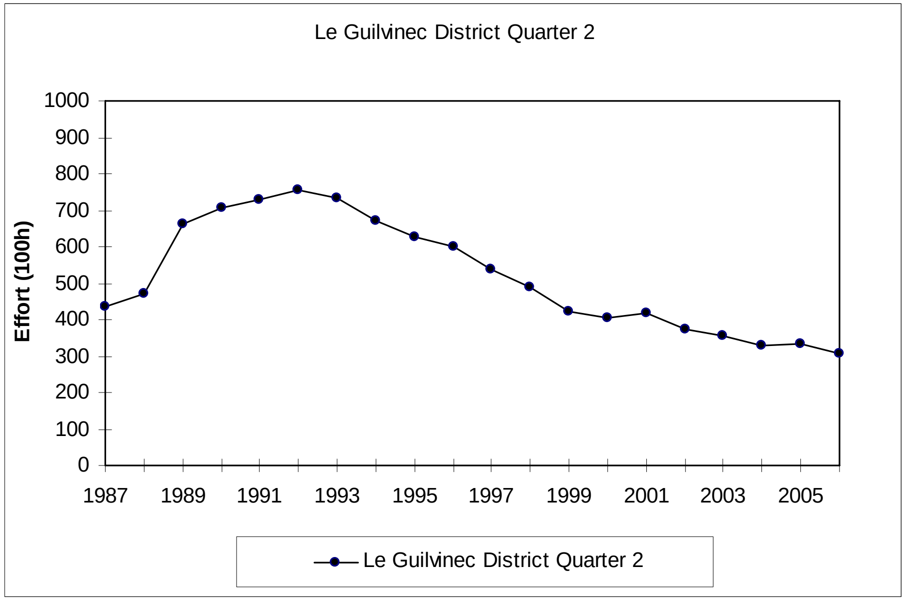


Figure 11.3 Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) catches (landings in white and dead discards in black; mortality of discards equal to .70) age distributions in 1987-2006.

I. Effort



II. LPUE

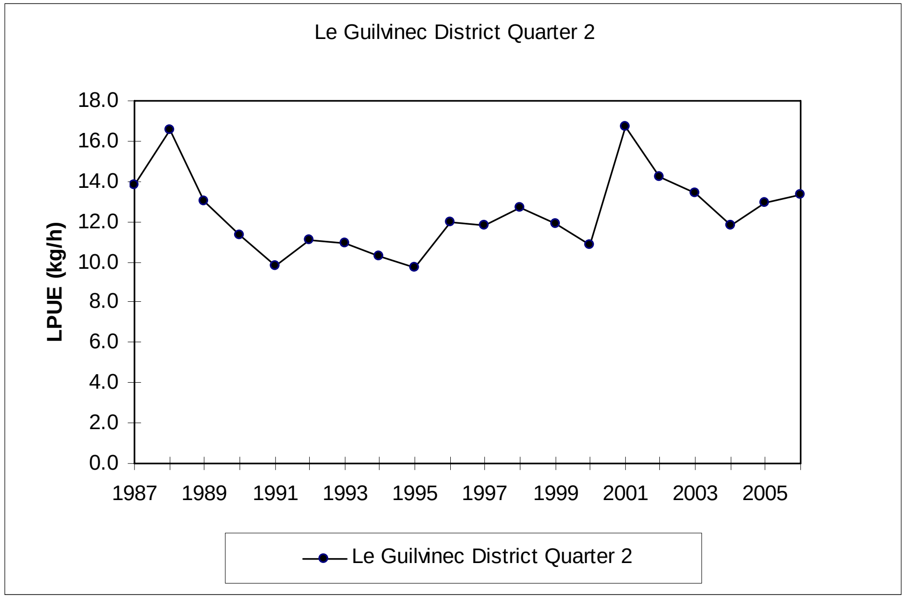
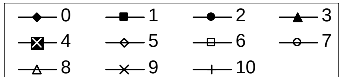


Figure 11.4. Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) - Effort and LPUE values of commercial fleets used in the assessment to tune the model.

LOG CATCHABILITY RESIDUAL PLOTS (XSA)



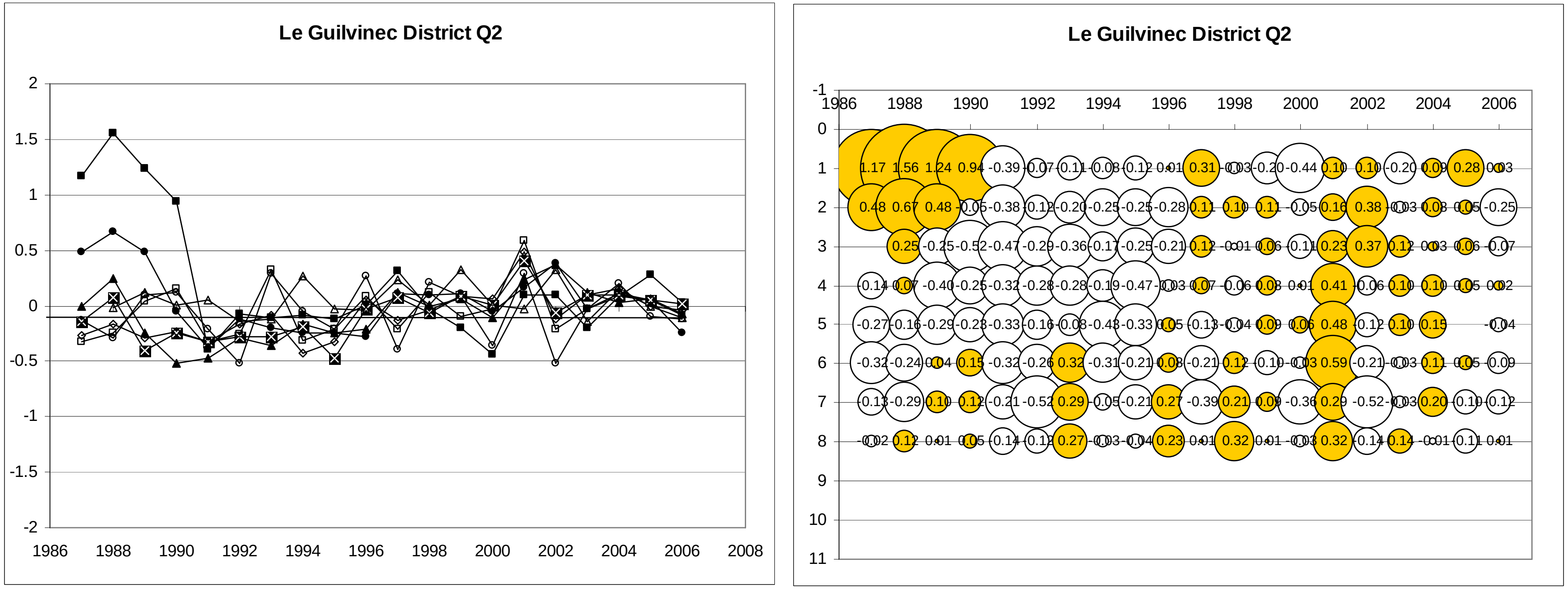


Figure 11.5 Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b)

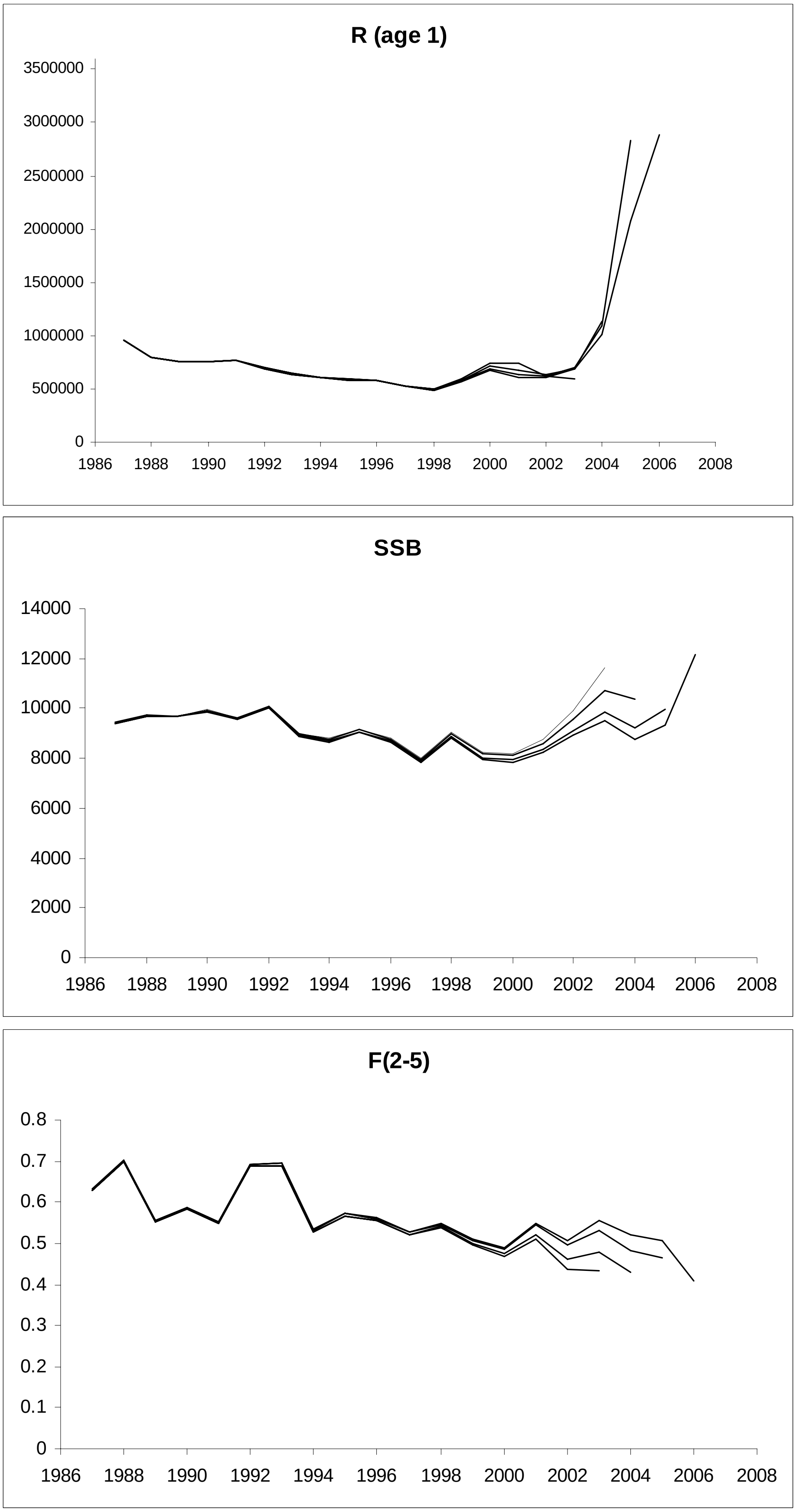


Figure 11.6 Retrospective Analysis (Nephrops Bay of Biscay FU 23-24)

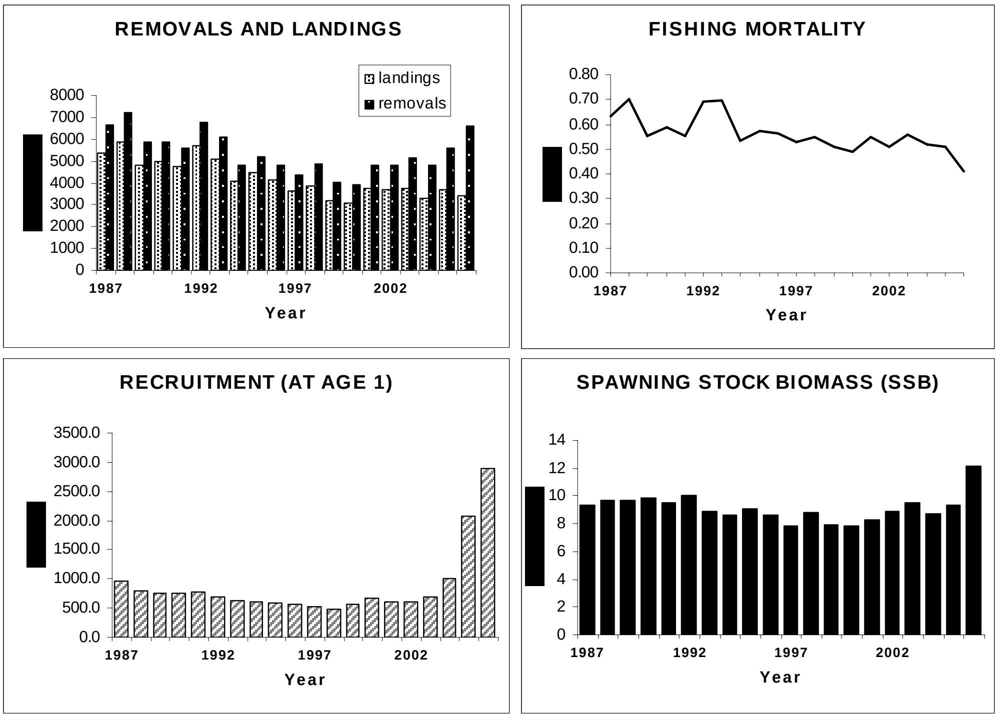


Figure 11.7. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Historical trends in biomass, fishing mortality and recruitment

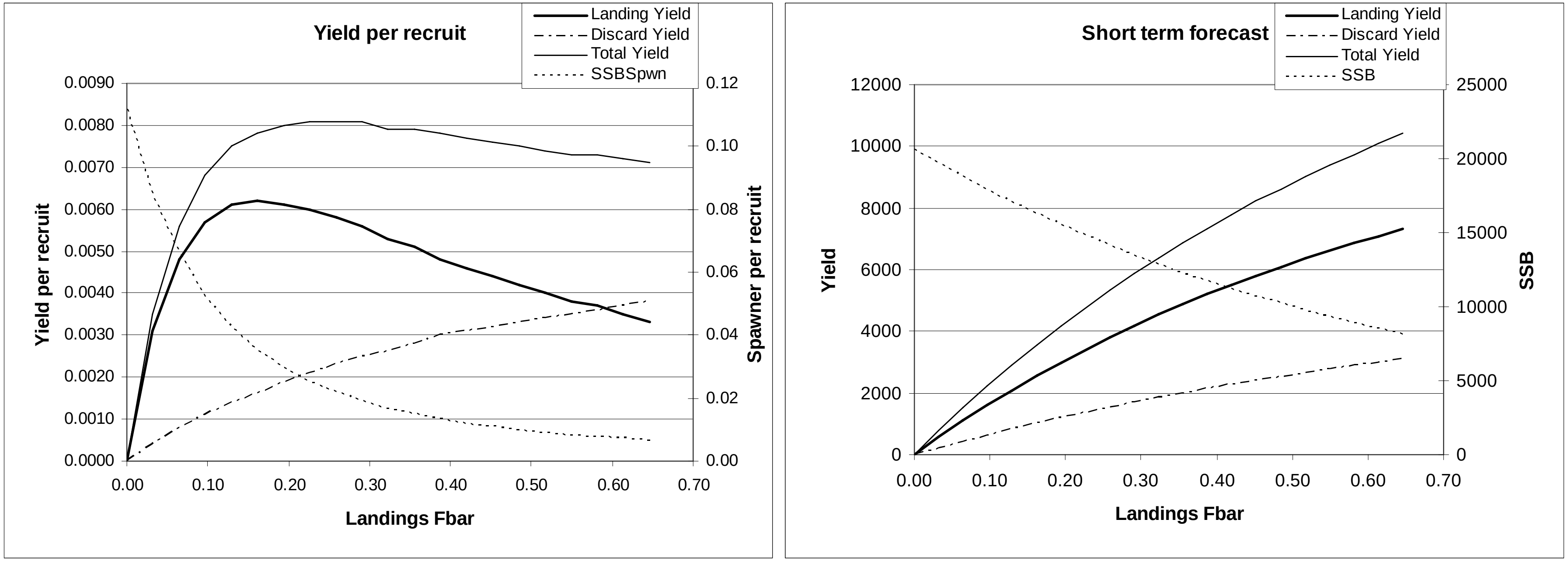


Figure 11.8. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Short term and long term predictions

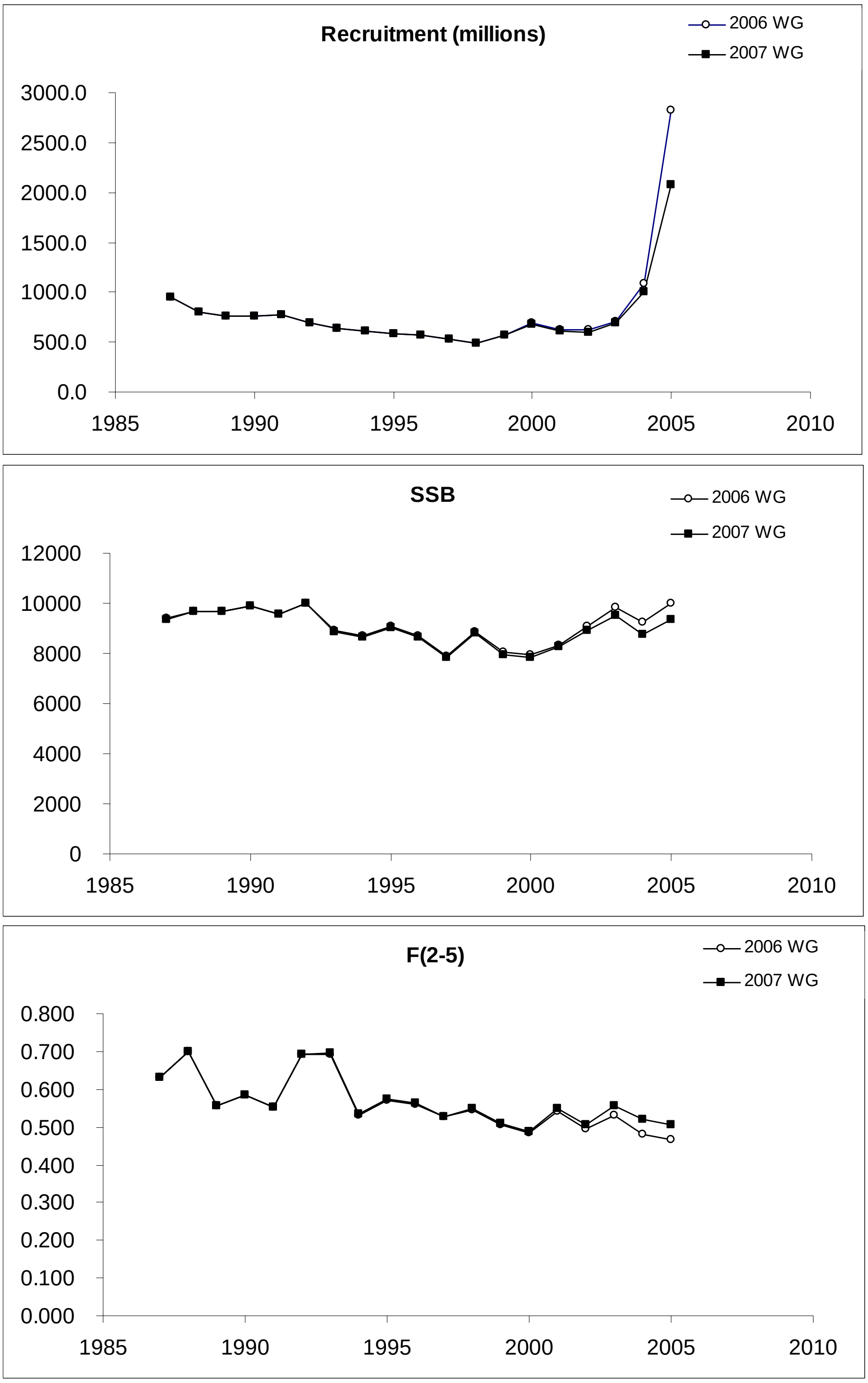


Figure 11.9. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Comparative Final Runs

12 *Nephrops* in Division VIIIc

12.1 *Nephrops* FU 25 (North Galicia)

12.1.1 General

12.1.1.1 Ecosystem aspects

Two Functional Units are comprised in Division VIIIc: FU 25 (North Galicia) and FU 31 (Cantabrian Sea).

In this geographical area, characterized by episodic upwelling of North Atlantic Central Water during summer, various coastal fisheries fish for pelagic and bottom resources. Annual catches of *Nephrops* are relatively small compared with other Atlantic *Nephrops* stocks, but this species gives one of the most valuable revenues for the trawl fleet.

Nephrops is a burrowing species and occurs on muddy sea bed on the continental shelves and upper slopes. The distribution of *Nephrops* in this area is limited to depths ranging from 90-600 m in a patchwork configuration where the substrate is suitable.

The life history of *Nephrops* consists of a pelagic larval phase and sedentary non-migratory juvenile and adult stages. After reaching sexual maturity, the male moults more frequently than the female, consequently growing faster. The emergence patterns of the *Nephrops* females during the incubation period results in a different exploitation pattern for males and females. There are no reports on *Nephrops*' predators in the area.

12.1.1.2 Fishery description

Nephrops is caught in the mixed bottom trawl fishery in the North and Northwest Iberian Atlantic. The fishery takes place throughout the year, with the highest landings in spring and summer. Since the decline of the main target species in the area, the bottom fisheries have targeted a variety of species, including hake, anglerfish, megrim, horse mackerel and mackerel. At present, the trawl fleet comprises three main components: baca bottom trawl, high vertical opening trawl (HVO) and bottom pair trawl, each targeting a different species. Only the baca trawl catches *Nephrops*. An extended description of these fisheries was given in STECF (2003). Trawl vessels can change the gear from year to year and consequently the target species and the fishing effort applied vary. The increasing use of pair trawlers and HVO (fishing for mackerel and horse mackerel) that do not catch *Nephrops* has reduced the fishing effort on the species in recent years.

The *Prestige* oil spill off the in northwest Spanish coast (November 2002) resulted in the adoption of several temporary regulations measures to minimize the impact on the fisheries, such as spatial and seasonal closures for fishing fleets. This caused a reduction in fishing effort of the trawl fleet from November 2002 to June 2003.

Nephrops is managed in the area by an annual TAC and technical measures. The European Union regulations establish 20 mm carapace length (CL) as a minimum landing size for *Nephrops* in the area. Few animals are caught under size. Generally, only soft and damaged individuals are discarded (Pérez et al., 1996). Although *Nephrops* represents around only 1% of the total weight landed by the bottom trawl fishery, the species is a very valuable component of the landings. The species have been regularly assessed since 1990 (ICES, 1990). A recovery plan for southern hake and Atlantic Iberian *Nephrops* stocks was implemented and enforced since 2006.

12.1.1.3 Summary of ICES Advice for 2007 and management applicable to 2006 and 2007

ICES advice for 2007

The stock assessments are only indicative of stock trends. In the absence of defined reference points, the state of the stocks cannot be evaluated in this regard. However, the stock suffers severe recruitment failure.

FU 25 (North Galicia): Recruitment has declined over the time series, and is now extremely low Landings and LPUE have fluctuated along a marked downward trend. Landings are currently very low. There is a sharp decline in stock biomass and recruitment. The fishing mortality has been reduced in recent years.

Management applicable to 2006 and 2007

In FU 25 and FU 31, there has been a progressive recruitment failure.

Given the very low state of the stock, ICES repeats its advice of a zero TAC for both fishing units in this management area.

12.1.2 Data

12.1.2.1 Commercial catches and discards

Landings were reported only by Spain (Table 12.1.1). Since the early 90s landings declined from about 400 t to less than 100 t. There was slight increase to 143 t in 2002, despite of the fishery being virtually closed during November and December, due to an oil spill off Spain's NW coast, Landings declined again to 89 t in 2003, when the fishery remained partially closed from January to April 2003. The estimates of landings in 2006 were 62 t, the lowest value recorded during the time series. The time series of the commercial landings (Figure 12.1.1) gives a clear decline trend, with actual figures representing 10% of the landings in the 70s.

12.1.2.2 Biological sampling

Length frequencies by sex of the *Nephrops* landings are collected as a rule on a monthly basis. The sampling levels are showed in Table 1.3.

The monthly sampling programme of the landings from this FU is considered to be at a sufficient level of intensity to produce reliable length compositions of the landings.

Annual length compositions for males and females combined, mean size and mean weight in the landings are given in Table 12.1.2 for the period 1982-2006. Mean sizes in the landings in the period 1996-2006 varied between 36.5 and 42.5 mm CL for the males, and between 34.7 and 39.4 mm CL for the females. The mean size time series show an increasing trend (Figure 12.1.1), that may be related to with the recruitment failure.

12.1.2.3 Commercial catch-effort data

Fishing effort and LPUE data were available for the A Coruña trawl fleet (SP-CORUTR8c) (Table 12.1.3 and Figure 12.1.1). These data were used in the assessment to tune the model last year. This fleet accounted for more than the 80% of the *Nephrops* landings from FU 25 up to 2003, diminishing afterwards and currently account by the 50%.

Fishery statistics are believed to be reliable. However, during the periods 1998-2001 and 2004-2006 the information sources failed and landings data were obtained from sampling program, not directly from the sale sheets as in the rest of the series, which makes the quality of estimates more questionable. The fishing effort corresponds to the bottom trawl fleet that fish in a mixed fishery for a demersal species (not directed to *Nephrops*) depending on market forces.

Fishing effort and LPUE data for 1999-2006 was preliminarily revised downward, because during this period part of the bottom trawl fleet (baca) operated partial or entirely with the HVO trawl for mackerel or horse mackerel (instead for mixed bottom species). The estimated number of the trips fishing with HVO trawlers targeting pelagic fishes each year during 1999-2006 was removed from the previous data of the fishing effort. The percentage of reduction ranged 3-38 %.

The overall trend in fishing effort is decreasing, with current effort being approximately half the level in 1999. The long time series of effort (Figure 12.1.1) shows a marked decrease between 1976 and 1987, then effort remained quite stable (fluctuating around 5000 trips) until 1995. Since then, fishing effort decreased up to the recent low levels of 1700 trips. Effort of the bottom trawl in this fishery is directed primarily at a set of demersal and bottom species, with *Nephrops* making only a small contribution to overall fishery landings.

LPUE shows an overall decreasing trend (Figure 12.1.1). After a period with quite variable LPUE until 1993, LPUE remained relatively stable around 40 kg/trip between 1993 and 1997. Since then LPUE fluctuated at low level (around 29 kg/trip).

12.1.3 Assessment

An age structured assessment for this FU was carried out by the WGHMM in 2006 (ICES, 2006) by using "catch-at- age" data generated by the slicing of sampled length distributions. The use of slicing to convert length compositions into age compositions is controversial, especially for older age groups (3 and older). The assessment was calibrated using data from a single commercial LPUE series, where the definition of fishing effort was based on nominal effort. This assessment was only indicative of stock trends. No improvements in relation to methodological assessment were achieved this year and the WG did not attempt an analytical assessment for this stock.

12.1.4 Biological reference points

There are no reference points defined for this stock.

12.1.5 Management Considerations

Nephrops is taken as by catch in the mixed bottom fishery. The overall trend shown in landings of *Nephrops* from the North Galicia FU 25 is of a strong decline. Landings have dramatically decreased since 1992. Current landings represent about 13% of the mean landings in the early period of the time series (1975-1980).

Nephrops is managed by TAC and technical measures. The TAC for Division VIIIc in 2006 was 131 t. Landings of *Nephrops* in 2006 were estimated to be 77 t, 41% below the TAC in division VIIIc (FU 25 and FU 31).

A recovery plan for southern hake and Atlantic Iberian *Nephrops* stocks was approved in December 2005 (Council Regulation (EC) No 2166/2005) and implemented since January 2006. The management objective is rebuilding the stock within the safe biological limits within a period of 10 years. This recovery plan includes a procedure for setting the TACs for *Nephrops* stocks, complemented by a system of fishing effort limitation (i.e. a reduction of 10% in the fishing mortality rate in the year of its application as compared with the fishing mortality rate estimated for the preceding year, within the limits of ±15% of the preceding year TAC).

12.2 *Nephrops* FU 31 (Cantabrian Sea)

12.2.1 General

12.2.1.1 Ecosystem aspects

Description made in previous section of this report (see 12.1.1.1) corresponds also to this area.

12.2.1.2 Fishery description

The description of these fisheries was updated and reported in STECF (2003). Mackerel and horse mackerel contribute 80% of the landed species by the baca bottom trawl fleet in the Cantabrian Sea, while hake and *Nephrops* together represent only 1% of the total landings by this fleet. Other trawl fleets components operating in the Cantabrian Sea (namely HVO trawl and pair trawl) do not catch *Nephrops*.

12.2.1.3 Summary of ICES Advice for 2007 and management applicable to 2006 and 2007

ICES advice for 2007

The stock assessments are only indicative of stock trends. In the absence of defined reference points, the state of the stocks cannot be evaluated in this regard.

FU 31 (Cantabrian Sea): No analytical assessment in 2006. Landings are currently at the lowest levels on record. Fishing effort is declining. LPUE are currently at low levels.

Management applicable to 2006 and 2007

In FU 25 and FU 31, there has been a progressive recruitment failure.

Given the very low state of the stock, ICES repeats its advice of a zero TAC for both fishing units in this management area.

12.2.2 Data

12.2.2.1 Commercial catches and discards

Nephrops landings from FU 31 are reported by Spain (the only participant in the fishery) (Table 12.2.1 and Figure 12.2.1) and are available for the period 1983-2006. The highest landings were recorded in 1989 and 1990. Since 1996 landings have declined sharply from 129 t to 15 t in 2006, similar to the lowest value in the time series obtained in 2005 (14 t).

12.2.2.2 Biological sampling

Length frequencies by sex of *Nephrops* landings were collected by the sampling program. The sampling levels are showed in Table 1.3.

Mean size of males and females in the landings, 1988-2005, shows a general increasing trend for both sexes (Figure 12.2.1). In 2006, a slight decrease was detected.

12.2.2.3 Commercial catch-effort data

The fishing effort data series includes two bottom trawl fleets operating in the Cantabrian Sea with home ports in Avilés and Santander. Total effort is not available for the period 2004-2006 due to the lack of information from Avilés. The available time series of effort shows a period of relative stability from the early 1980s to the beginning of the 1990s. Since 1992, effort shows a marked downward trend (Figure 12.2.1). The increased use of other gears

(HVO and pair trawl in recent years) has resulted in the reduction in effort by the baca trawl fleet, the only gear fishing for *Nephrops*. In 2006, the effort shows a slight increase.

The LPUE data series show fluctuations around the general downward trend. In recent years the LPUE has remained at low levels (Figure 12.2.1).

12.2.3 Assessment

There was insufficient information for FU 31, so no assessment was performed for this stock; the last analytical assessment was conducted in 2002 (ICES, 2002).

12.2.4 Management considerations

No assessment was performed for FU 31. A recovery plan for southern hake and Atlantic Iberian *Nephrops* stocks was implemented and enforced in 2006.

12.3 Summary for Division VIIIc

Nephrops in Division VIIIc includes two FUs (North Galicia, FU 25 and Cantabrian Sea, FU 31). Table 12.2.2 gives the landings in Div. VIIIc. Landings from both FUs have declined dramatically in recent years. The agreed *Nephrops* TAC for Division VIIIc in 2006 is 131 t. Landings in recent years 1998-2003 were below the TAC for 2006, and therefore the TAC is not restrictive.

The very low levels of landings from FU 25 and FU 31, indicate that both stocks are in very poor condition.

A recovery plan for southern hake and Atlantic Iberian *Nephrops* stocks was approved in December 2005 (Council Regulation (EC) No 2166/2005) and implemented since January 2006. This recovery plan includes a procedure for setting the TACs for *Nephrops* stocks, complemented by a system of fishing effort limitation (i.e. a reduction of 10% in the fishing mortality rate in the year of its application as compared with the fishing mortality rate estimated for the preceding year, within the limits of ±15% of the preceding year TAC).

Table 12.1.1. Nephrops FU 25, North Galicia
Landings in tonnes

Year	Trawl
1975	731
1976	559
1977	667
1978	690
1979	475
1980	412
1981	318
1982	431
1983	433
1984	515
1985	477
1986	364
1987	412
1988	445
1989	376
1990	285
1991	453
1992	428
1993	274
1994	245
1995	273
1996	209
1997	219
1998*	103
1999*	124
2000*	81
2001*	147
2002	143
2003	89
2004*	75
2005*	63
2006*+	62

* estimated landings from sampling program
+ preliminar

Table 12.1.2. Nephrops FU 25, North Galicia.
Landings length compositions, mean weight (kg) and mean length (CL, mm), 1982-2006

Size, CL/Year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
19	1	8	0	0	6	0	0	0	0	0	0	5
20	1	17	0	16	1	0	0	0	2	0	0	34
21	7	31	9	0	0	0	0	0	0	1	0	49
22	10	99	20	8	50	0	0	0	0	0	0	32
23	41	143	18	68	68	6	4	0	5	15	0	15
24	53	350	138	198	136	38	1	0	8	20	13	80
25	105	496	150	300	192	191	16	0	30	71	19	57
26	142	511	342	326	279	185	42	1	30	203	26	70
27	275	748	519	575	299	467	17	2	59	359	102	71
28	303	731	686	799	495	302	208	23	186	1038	331	105
29	382	761	1004	943	500	365	175	21	174	850	280	134
30	648	1068	1307	1253	470	505	535	84	278	1426	563	176
31	611	1004	1108	1215	602	446	504	95	329	1047	584	152
32	782	1009	1581	1045	779	618	613	248	535	1319	883	308
33	874	956	1323	817	812	526	906	369	547	946	831	472
34	906	782	1193	975	886	741	719	406	448	981	1114	533
35	927	777	1032	797	764	820	745	625	555	883	976	670
36	991	756	972	823	682	945	820	414	563	709	809	549
37	728	610	643	637	694	845	989	618	447	738	923	563
38	582	667	456	484	600	453	799	757	429	641	656	546
39	553	513	360	593	341	491	438	433	315	404	528	362
40	480	438	442	494	416	478	582	477	348	449	517	336
41	368	348	323	307	329	283	461	507	304	279	365	230
42	347	286	412	230	251	226	673	375	235	295	386	243
43	250	194	187	301	283	312	314	417	244	230	296	175
44	193	124	202	239	108	286	236	280	181	146	214	173
45	238	125	205	104	102	125	219	236	157	170	138	158
46	111	87	97	223	64	302	123	209	93	109	138	124
47	100	56	79	65	80	136	104	156	78	97	104	43
48	81	44	181	85	31	108	106	163	71	79	34	69
49	48	23	89	52	42	93	44	90	36	32	45	23
50	48	17	56	48	25	41	30	71	26	34	31	25
51	32	16	64	41	17	9	23	49	22	10	16	17
52	16	6	3	4	20	19	20	41	24	9	33	26
53	12	9	6	34	8	21	5	41	18	13	14	20
54	9	6	25	33	8	1	7	26	8	4	5	2
55	8	6	25	7	4	3	5	13	9	1	12	10
56	3	3	25	5	0	10	3	9	2	3	2	2
57	4	1	0	6	0	7	4	8	5	3	0	0
58	1	3	1	0	11	8	0	5	1	3	0	0
59	3	2	0	2	1	0	10	2	2	1	0	0
60	2	2	1	1	0	3	2	8	1	0	1	0
61	0	2	0	1	0	0	0	4	2	0	0	0
62	3	2	0	1	0	0	0	2	0	1	1	0
63	1	1	0	1	0	1	0	1	0	0	0	0
64	2	0	0	3	0	1	2	3	1	0	0	0
65	1	0	0	0	0	1	12	1	0	2	1	0
66	0	1	0	1	0	0	0	1	1	0	0	0
67	1	2	0	0	0	0	0	0	1	1	0	0
68	0	1	0	1	0	0	2	0	1	0	0	0
69	1	0	0	1	0	0	2	1	1	0	0	0
70	0	1	0	1	0	0	0	0	0	0	0	0
71	1	1	0	0	0	0	2	0	1	0	0	0
72	1	0	0	0	0	1	0	0	0	0	0	0
73	0	1	0	1	0	0	0	0	1	0	0	0
74	0	1	0	0	0	0	0	1	0	0	0	0
75	0	1	0	1	0	0	0	0	0	0	0	0
76	1	1	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	1	0	0	0	0	0	0
78	0	2	0	1	0	0	0	1	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0
80	1	0	0	0	0	0	0	0	0	0	0	0
Total number (thousand)	11285	13842	15281	14164	10457	10417	10521	7294	6814	13623	10992	6661
Total weight (tonnes)	431	432	515	477	363	411	444	376	281	452	427	274
Mean weight (kg)	0.038	0.031	0.034	0.034	0.035	0.039	0.042	0.052	0.041	0.033	0.039	0.041
CL Mean length (mm)	35.5	33.0	34.0	33.9	34.4	35.8	36.8	39.4	36.6	33.9	35.9	36.4

Size, CL/Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
19	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	1	0	0	0	0	0	0	0	0	0	0
21	1	0	2	0	0	0	0	0	1	0	0	0	0
22	1	7	5	5	0	0	0	0	0	0	1	1	0
23	10	6	6	7	1	1	0	10	2	0	1	1	1
24	10	19	29	16	2	5	2	0	2	1	2	2	1
25	60	64	38	18	6	15	7	10	2	0	7	5	2
26	118	77	56	53	12	26	9	19	5	2	7	8	3
27	179	108	91	49	16	21	5	20	14	3	12	13	9
28	281	213	179	186	47	67	32	79	30	2	26	25	15
29	262	189	225	178	38	91	24	125	43	5	28	25	18
30	335	424	266	441	92	194	85	112	105	14	46	43	25
31	330	370	342	303	65	136	60	129	102	26	45	56	39
32	410	444	404	492	99	197	127	288	198	36	60	66	55
33	471	433	454	387	69	100	95	319	181	51	71	87	69
34	507	480	520	695	152	300	219	302	272	66	70	83	62
35	564	707	396	543	193	258	218	265	308	85	91	98	85
36	547	480	360	500	139	241	158	243	259	110	98	102	88
37	462	462	341	323	192	208	144	285	236	123	101	88	87
38	454	459	329	407	178	211	113	238	185	147	98	92	80
39	330	315	257	299	123	138	82	192	129	130	81	69	67
40	301	507	233	326	203	202	134	212	186	129	96	81	64
41	178	239	166	141	101	110	64	115	99	81	78	61	59
42	222	300	145	166	106	106	73	150	117	79	63	52	49
43	113	219	122	98	81	58	30	103	67	65	57	47	44
44	99	116	82	57	65	61	48	98	109	52	39	36	32
45	99	142	74	84	82	72	40	68	78	46	44	34	30
46	52	74	55	31	35	42	20	35	65	57	35	26	26
47	38	56	55	37	41	23	10	22	34	42	26	20	18
48	25	30	37	26	31	26	17	24	35	37	23	14	17
49	29	12	21	16	16	16	11	18	23	27	16	13	11
50	18	16	21	28	28	41	13	18	24	27	19	11	14
51	8	8	12	3	5	6	8	16	34	20	13	7	9
52	11	6	6	5	9	9	8	10	18	16	12	8	8
53	10	6	11	4	4	4	2	15	13	11	9	6	7
54	7	4	7	3	3	5	5	4	4	9	7	5	4
55	7	3	5	5	3	7	7	7	9	6	6	5	4
56	4	2	3	0	2	4	2	5	6	5	5	3	9
57	5	1	2	1	0	2	3	0	5	7	4	3	4
58	2	1	5	0	1	2	4	1	9	4	4	3	2
59	1	1	5	0	1	0	0	1	4	5	3	2	1
60	0	1	3	1	1	0	2	1	2	2	2	2	1
61	1	1	2	0	0	0	2	0	1	1	3	1	1
62	0	1	3	0	0	0	0	0	3	3	2	1	7
63	1	1	1	2	0	0	0	0	10	0	2	1	1
64	0	1	1	0	0	0	0	0	0	1	2	1	6
65	0	0	4	0	0	0	0	0	4	1	2	1	1
66	0	0	1	1	0	0	0	0	1	2	1	1	0
67	0	0	0	1	0	0	0	0	2	1	1	1	1
68	0	0	1	0	0	0	0	0	0	1	1	1	0
69	0	0	1	0	0	0	0	0	0	2	1	1	0
70	0	0	1	0	1	0	1	0	2	1	1	1	0
71	0	0	0	0	0	0	0	0	0	1	2	0	6
72	0	0	0	0	0	0	0	0	0	1	1	0	6
73	0	0	0	0	0	0	0	0	0	1	1	1	0
74	0	0	1	1	0	0	0	0	1	0	1	0	0
75	1	0	1	0	0	0	0	0	0	1	0	0	0
76	0	0	1	0	0	0	0	0	0	0	0	0	0
77	1	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0
Total number (thousand)	6564	7002	5384	5938	2242	3004	1887	3561	3041	1540	1421	1314	1147
Total weight (tonnes)	246	273	209	219	103	124	81	147	143	89	75	63	62
Mean weight (kg)	0.037	0.039	0.039	0.037	0.046	0.041	0.043	0.041	0.047	0.058	0.052	0.048	0.054
CL Mean length (mm)	35.3	35.8	35.5	35.3	37.8	36.5	36.9	36.5	37.8	40.6	39.0	37.9	39.6

Table 12.1.3 Nephrops FU 25, North Galicia
Fishing effort and LPUE for SP-CORUTR8c fleet

	SP-CORUTR8c		
Year	Landings (t)	Effort (trips)	LPUE (kg/trip)
1986	302	5017	60.1
1987	356	4266	83.5
1988	371	5246	70.7
1989	297	5753	51.7
1990	199	5710	34.9
1991	334	5135	65.1
1992	351	5127	68.5
1993	229	5829	39.2
1994	207	5216	39.6
1995	233	5538	42.0
1996	182	4911	37.0
1997	187	4850	38.5
1998	67	4560	14.7
1999	121	4023	30.1
2000	77	3547	21.7
2001	145	3239	44.8
2002	115	2333	49.5
2003	65	1804	35.9
2004	40	2091	18.9
2005	32	2063	15.5
2006	33	1699	19.4

1999-2006 New revised estimates of effort and LPUE

Table 12.2.1. Nephrops FU31, Cantabrian Sea
Landings in tonnes

Year	Trawl	Creel	Total
1980			
1981			
1982			
1983	63		63
1984	100		100
1985	128		128
1986	127		127
1987	118		118
1988	151		151
1989	177		177
1990	174		174
1991	105	4	109
1992	92	2	94
1993	95	6	101
1994	146	2	148
1995	90	4	94
1996	120	9	129
1997	97	1	98
1998	69	3	72
1999	46	2	48
2000	33	1	34
2001	26	1	27
2002	25	1	26
2003	21	1	22
2004	17	0	17
2005	14	0	14
2006*	15	0	15

*preliminar

Table 12.2.2. Nephrops Management Area O
Landings in tonnes by FU and Management Area

Year	FU 25	FU 31	MA O
1975	731		731
1976	559		559
1977	667		667
1978	690		690
1979	475		475
1980	412		412
1981	318		318
1982	431		431
1983	433	63	496
1984	515	100	615
1985	477	128	605
1986	364	127	491
1987	412	118	530
1988	445	151	596
1989	376	177	553
1990	285	174	459
1991	453	109	562
1992	428	94	522
1993	274	101	375
1994	245	148	393
1995	273	94	367
1996	209	129	338
1997	219	98	317
1998	103	72	175
1999	124	48	172
2000	81	34	115
2001	147	27	174
2002	143	26	169
2003	89	22	111
2004	75	17	92
2005	63	14	77
2006*	62	15	77

*Preliminar

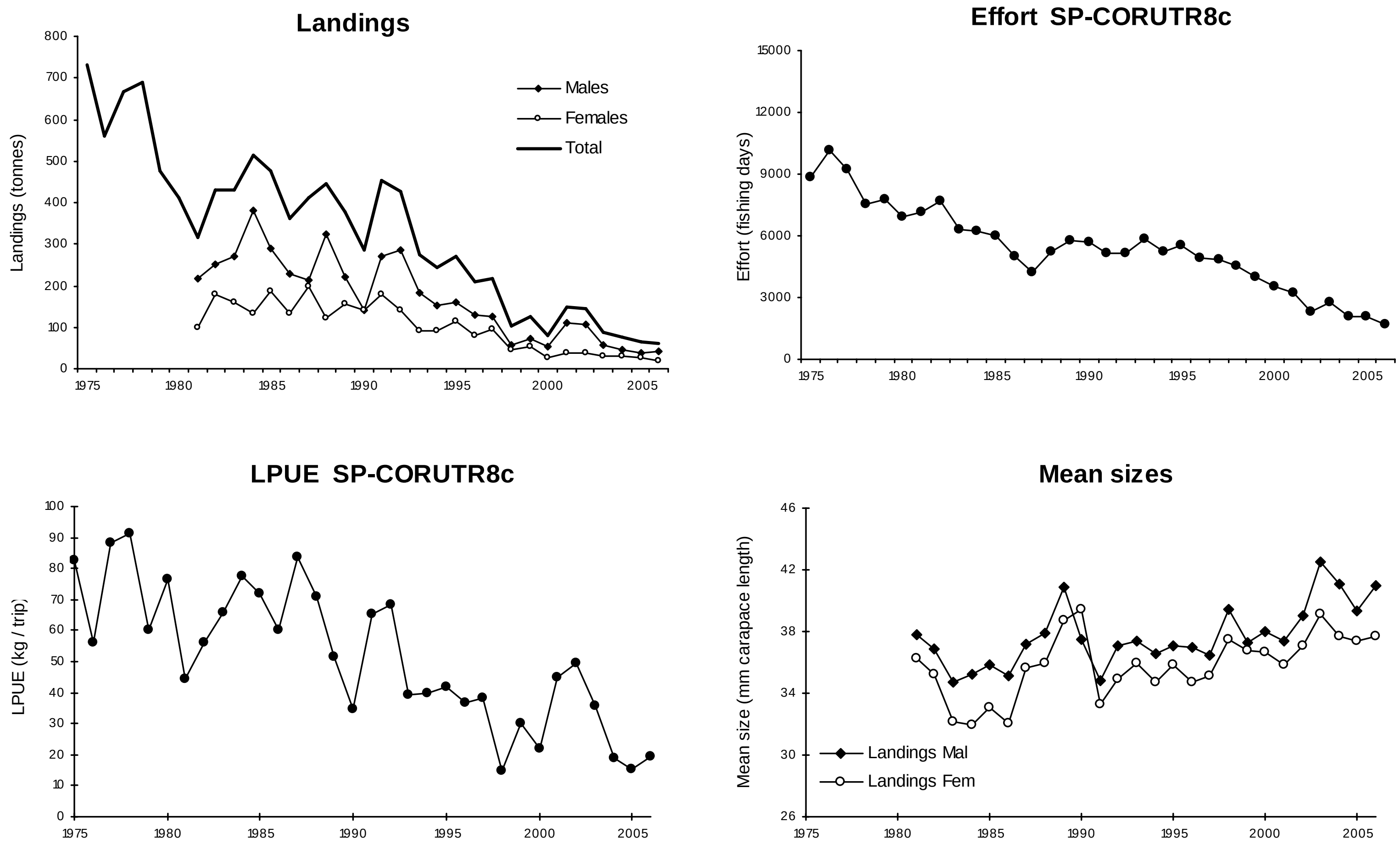


Figure 12.1.1. - Nephrops FU 25, North Galicia: Long-term trends in landings, effort, LPUEs, and mean sizes of *Nephrops*.

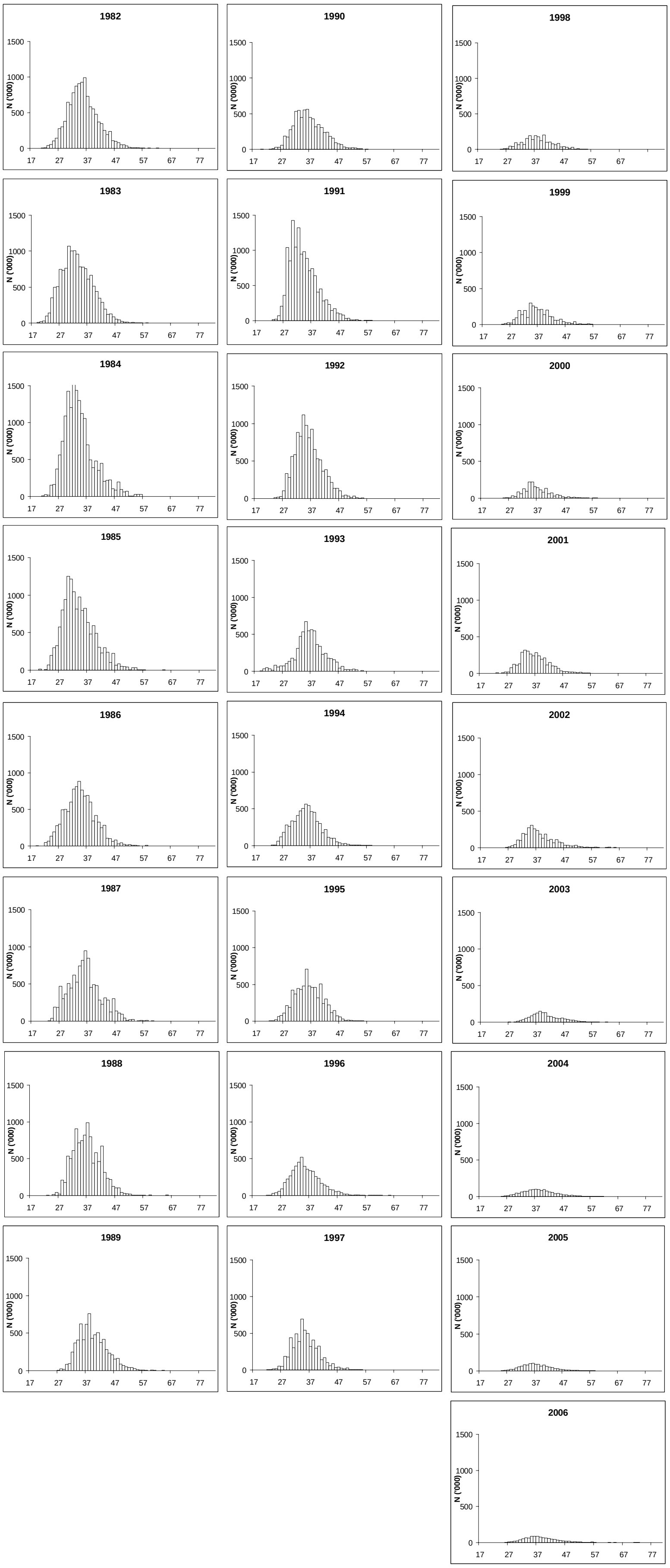


Figure 12.1.2.- Nephrops FU 25, North Galicia: length distributions in landings, 1982-2006.

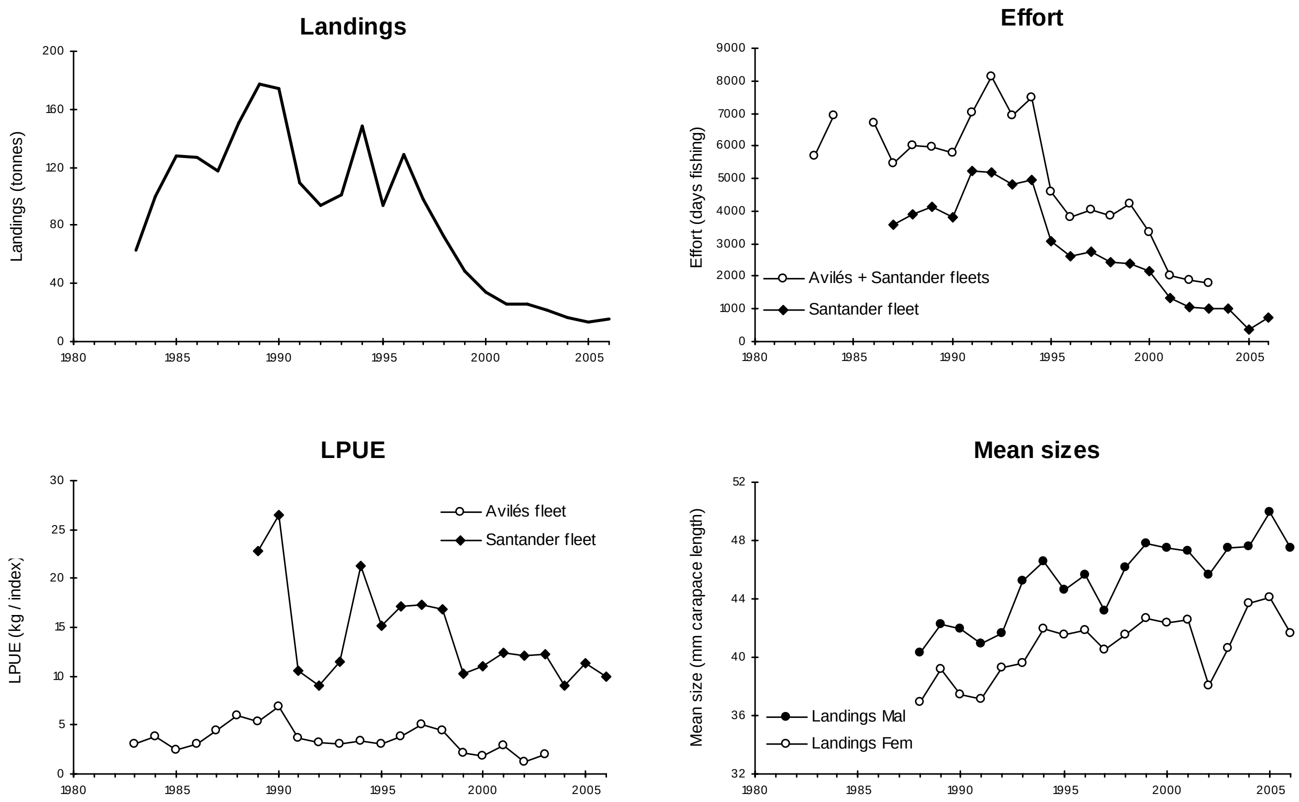


Figure 12.2.1. - Nephrops FU 31, Cantabrian Sea: Long-term trends in landings, effort, LPUE, and mean sizes.

13 Nephrops in Division IXa

The ICES Division IXa has five *Nephrops* Functional Units: FU 26, West Galicia; FU 27 North Portugal; FU 28, Alentejo, Southwest Portugal; FU 29, Algarve, South Portugal and FU 30, Gulf of Cádiz.

Tables 13.1 and 13.2 show the time series of recorded landings and TAC for the Division IXa.

13.1 Nephrops FU 26-27, West Galicia and North Portugal (Division IXa)

13.1.1 General

13.1.1.1 Ecosystem aspects

In the northern part of the Division IXa two Functional Units are considered: FU 26 (West Galicia) and FU 27 (North Portugal).

In this geographical area, characterized by episodic upwelling of North Atlantic Central Water during summer, various coastal fisheries fish for pelagic and bottom resources. Annual catches of *Nephrops* are relatively small compared with other Atlantic *Nephrops* stocks, but this species gives one of the most valuable revenues for the trawl fleet.

The distribution of *Nephrops* in this area is limited to depths ranging from 90-500 m. Patch pattern is clearly identified in shallower waters (80-140 m) in the west coast of Galicia. The life history of *Nephrops* consists of a pelagic larval phase and sedentary non-migratory juvenile and adult stages. After reaching sexual maturity, the male moults more frequently than the female, consequently growing faster. Berried females tend to remain inside their burrows during the incubation period (from August to February) remaining less available to fishing gear. The emergence patterns of the *Nephrops* females during the incubation period result in a different exploitation pattern for males and females. There are no reports on relevant *Nephrops*' predators in the area.

13.1.1.2 Fishery description

The description of bottom fisheries in the Northwest Spain was updated in STECF (2003). A more accurate definition of the Northern Spanish trawl fleet components has been carried out under the EC project IBERMIX and presented to this WG by Castro *et al.* (WD 01).

Nephrops is caught as a by-catch in the mixed bottom trawl fishery in the North and Northwest Iberian Atlantic. The commercial species of the fishery are hake, anglerfish, megrim, blue whiting, mackerel, horse mackerel and a set of other fish and cephalopods. The fishery takes place throughout the year, with the highest yields of *Nephrops* in spring and summer. The overall decline of some bottom commercial species in the area (mainly hake in the last decade) has influenced the fishing strategies of the trawl fleets in terms of gear modalities and target species.

At present, the trawl fleet fishing in the area comprises three components: baca bottom trawl, high vertical opening trawl (HVO) and bottom pair trawl, each targeting a different species. Only the baca bottom trawl catches *Nephrops*. Trawl vessels can change the gear from year to year and consequently the target species and the fishing effort applied vary. The increasing use of pair trawlers and HVO (fishing for mackerel and horse mackerel) that do not catch *Nephrops* has reduced the fishing effort on the species in recent years.

The *Prestige* oil spill off the northwest Spanish coast (November 2002) determined the adoption of several temporary measures to minimize the impact on the fisheries, such as spatial and seasonal closures for fishing fleets. This caused a reduction in fishing effort of the trawl fleet from November 2002 to June 2003.

Generally, only soft and damaged *Nephrops* individuals are discarded in the fishery (Pérez *et al*., 1996). Currently, *Nephrops* represents around 1% of the total weight landed by the bottom trawl fishery, but the species is a very valuable component of the landings. The species has been regularly assessed since 1990.

Nephrops is managed in the whole Division by an annual TAC, together with several technical measures. The European Union regulations establish 20 mm carapace length (CL) as a minimum landing size for *Nephrops* in the area. Few animals are caught under size. A recovery plan for southern hake and Atlantic Iberian *Nephrops* stocks was implemented and enforced since 2006.

13.1.2 Summary of ICES Advice for 2007 and management applicable to 2006 and 2007

ICES advice for 2007

The stock assessments are only indicative of stock trends. In the absence of defined reference points, the state of the stocks cannot be evaluated in this regard.

FU 26+FU 27 West Galicia and North Portugal: Landings have gradually declined since the 1980s, and are now very low. Recruitment appears to have failed in recent years and the stock size is considered to be extremely low. The fishing mortality has been declining since 1999.

Given that there has been a progressive recruitment failure and the stock is at an extremely low level, ICES advises that there is no fishing on *Nephrops* until the recruitment improves considerably.

Management applicable to 2006 and 2007

Because of the difference in stock status between FUs 26–27 (severely depleted) and the better situation for the more southerly components, a subdivision of the TAC by Functional Unit should be considered. The practice of managing three distinctive Nephrops stocks by a joint TAC may lead to unbalanced exploitation of the individual stocks. This is particularly true for *Nephrops* in Division IXa where the state of the individual stocks is quite different. In addition to this, landings have been in excess of the TAC for some recent years and the TAC has not constrained the fishery. Therefore fine-scale management of catches and/or effort at a geographic scale that corresponds to the *Nephrops* stock distribution should be implemented.

The reduction in F intended by the recovery plan for southern hake and *Nephrops* stocks appears to be consistent with the present ICES advice for Nephrops in FUs 28–29 and 30. For FUs 26–27, however, stronger measures are required to prevent a collapse of the stock. The assessment for all three stocks is too uncertain to allow the calculation of a precise TAC corresponding to the 10% reduction of F implied by the recovery plan.

13.1.3 Data

13.1.3.1 Commercial catches and discards

Landings are reported by Spain and minor quantities by Portugal (Table 13.1.1). The catches are taken by the Spanish fleets fishing on the West Galicia (FU 26) and North Portugal (FU 27) fishing grounds, and by the Portuguese artisanal fleet fishing on FU 27. *Nephrops* represents a minor percentage in the composition of total trawl landings but is a very valuable species for the profitability of these fleets.

Along the time series, landings by the Spanish fleets are mostly from FU 26, together with smaller quantities taken from FU 27. Prior to 1996, no distinction was made between the two FUs, and therefore they are considered together. Two periods can be distinguished in the time series of landings available 1975-2004 (Figure 13.1.1). During 1975-1989, landings fluctuated between 600 and 800 t. From 1990 onwards there has been a marked downward trend in landings. In 2006 the landings were 44 t, similar to the lowest level recorded in the time series (2005, landings 42 t).

Fishery statistics are considered to be reliable since the landings data are extracted from the sale sheets. Discards rates are very low, due to the high value of the species.

Total Portuguese landings from FU 27 have decreased since 1989, from about 90 t to the recent 12 t.

13.1.3.2 Biological sampling

Length frequencies by sex of the *Nephrops* landings are collected monthly. The sampling levels are shown in Table 1.3.

The length frequency distributions were obtained by sampling the commercial landings at port. The monthly sampling programme of the *Nephrops* landings from the FU 26 is considered to be at a sufficient level of intensity to produce reliable length compositions.

Annual length compositions for males and females combined, mean size and mean weight in landings are given in Table 13.1.2 and Figure 13.1.2 for the period 1988-2006.

13.1.3.3 Commercial catch-effort data

Fishing effort and LPUE data are available for Marín trawl fleet (SP-MATR) for the period 1994-2006 (Table 13.1.3). The overall trend for the LPUE of SP-MATR is decreasing. This fleet accounts for more than 40% of the landings from these FUs.

Time series of fishing effort and LPUE of the bottom trawl fleets with the home ports Muros and Riveira, 1984-2006, and Vigo, 1995-2006, are also available. These data are plotted in Figure 13.1.1 for complementary information.

13.1.4 Assessment

In the last two years, the assessment results have only been taken as indicative of trends. Methodological issues as age and growth determination are not solved and the use of slicing to convert length compositions into age compositions is uncertain. No analytical assessment for this stock was included in the WG TOR in 2007.

13.1.5 Biological reference points

There are no reference points defined for this stock.

13.1.6 Management Considerations

Nephrops is taken as by catch in the mixed bottom fishery. Landings of *Nephrops* have substantially declined since 1995. Current landings represent less than 10% of the mean landings in the early period of the time series (1975-1992).

A recovery plan for southern hake and Iberian *Nephrops* stocks was approved in December 2005 (CE 2166/2005) and implemented since January 2006.

The recovery plan includes a procedure for setting the TACs for *Nephrops* stocks, complemented by a system of fishing effort limitation (i.e. a reduction of 10% in the fishing mortality rate in the year of its application as compared with the fishing mortality rate estimated for the preceding year, within the limits of ±15% of the preceding year TAC). This plan also includes a seasonal closed area (June-August) for *Nephrops* in the West Galicia (FU 26) fishing grounds (Council Regulation (EC) No. 2166/2005).

13.2 FU 28 – 29 (SW and S Portugal)

13.2.1 General

13.2.1.1 Ecosystem aspects

The Norway lobster (*Nephrops norvegicus*) is distributed along the southwest and south Portuguese coasts, at depths ranging from 200 to 800 m. Its distribution along the continental slope is patchy and high abundance areas have been clearly identified. For the last 25 years, this species has been a very important resource for the demersal fisheries operating in the region (crustacean and demersal trawl fleets). With exception of the years when the abundance of pink shrimp (*Parapenaeus longirostris*) is extremely high, *Nephrops* constitutes the main target species of the majority of the crustacean trawl fleet, and is not generally caught as by-catch of other fleets. Demersal fish trawlers that regularly land *Nephrops,* do in fact target this resource, which in terms of overall profit, represents a significant additional income.

Differences in the length composition of catches originated from the FU28 (SW Portugal) and those originating from the FU29 (S Portugal) were observed during the surveys. At present there is no scientific evidence to separate these stocks and consider them two sub-populations. Further work in this area is needed to improve our knowledge about this stock.

Another topic that should be further investigated, is the possible interaction between the stocks found at FU29 and FU30 (Cadiz). Exchanges between the two populations are likely to occur since there are no known physical/geographical constraints limiting this exchange. Aiming for a better understanding of the *Nephrops* population dynamics, tagging experiments and genetic studies would provide valuable information, which would help supporting the issues dealt with during the Working Group.

Norway lobster is a benthic species that attains a maximum size of around 80mm of carapace length (CL) corresponding to a weight of approximately 400g. Lobsters spawn from August through to November off the shelf edge in deep waters. After spawning, females carry the eggs for a 3 to 4 month period after which the larvae hatch and become pelagic free swimmers. Larvae move freely in the water column for a short time period before settling into the mud grounds. Females reach the first maturity at 30 mm and males around 28 mm CL (ICES, 2006b).

A comprehensive study into the role of Norway lobsters in the ecosystem has not yet been carried out. It would be particularly useful to have such information, as *Nephrops* is known to be part of an extended and dynamic community of highly valuable commercial species. Interactions with the following species are of particular interest e.g. anglerfish, hake and blue whiting, among others. Both the multi species aspect of the fishery and the ecological factors or environmental conditions impacting on *Nephrops* population dynamics are not taken into account at present in this single species assessment.

13.2.1.2 Fishery description

An updated description of the Portuguese fisheries is provided in section 2.2.based on Silva and Murta (WD 3) and Duarte *et al.* (WD 4)

The trawl fleet comprises two components, namely the trawl fleet fishing for fish and the trawl fleet fishing for crustaceans. The trawl fleet fishing for fish operates off the entire coast while the trawl fleet directed to crustaceans operates mainly in the Southwest and South Portugal, in deep waters, where crustaceans are more abundant. The fish trawlers are licensed to use a mesh size >= 65 mm and the crustacean trawlers are licensed for two different mesh sizes, 55 mm for catching shrimps and >= 70 mm for Norway lobster.

In 2005, the number of licensed fish trawlers was 72 with an average of 705 HP, 182 GRT and 27 m of overall length, whereas the number of crustacean trawlers was 30, with an average of 563 HP, 178 GRT and 25 m of overall length (Silva and Cardador, 2006, WD to WGHMM06).

There are two main target species in the crustacean fishery, which are the Norway lobster and the deepwater rose shrimp. These two species have a different but overlapping depth distribution. Rose shrimp occurs from 100 to 350 meters of depth whereas Norway lobster distributes from 200 to 800 meters. From 2003 to 2005, the number of fishing trips directed to Nephrops presents an increasing trend. The number of fishing trips directed to one species or to the other depends on the abundance of these species each year (Silva and Murta, WD 3).

13.2.1.3 ICES Advice for 2007 and Management applicable for 2006 and 2007

ICES Advice for 2007

The stock assessments are only indicative of stock trends. In the absence of defined reference points, the state of the stocks cannot be evaluated in this regard.

FU 28+ FU 29 SW and S Portugal: Landings declined sharply from 1992 to 1996, but have increased since then to levels slightly below those of the mid-1980s. Recruitment and SSB were sharply reduced in the early 1990s. Recruitment was stable at a low level in the period 1996–2002, but has increased again in the last three years. After the lowest value in 1996, SSB has shown an increasing trend. Fishing mortality has shown the same decline to the mid-1990s and subsequent increase for the males, but appears to be stable for the females.

In FUs 28-29, the stock appears to have recovered from a low stock size after a period (1996-2001) of landings in the order of 200 t . The fishing mortality is high and the stock productivity can be improved with a reduction in fishing mortality to average levels of that period. Therefore, ICES advise that landings in 2007 should not exceed 200 t.

Management applicable for 2006 and 2007

Because of the difference in stock status between FUs 26–27 (severely depleted) and the better situation for the more southerly components, a subdivision of the TAC by Functional Unit should be considered. The practice of managing three distinctive *Nephrops* stocks by a joint TAC may lead to unbalanced exploitation of the individual stocks. This is particularly true for *Nephrops* in Division IXa where the state of the individual stocks is quite different. In addition to this, landings have been in excess of the TAC for some recent years and the TAC has not constrained the fishery. Therefore fine-scale management of catches and/or effort at a geographic scale that corresponds to the *Nephrops* stock distribution should be implemented.

The reduction in F intended by the recovery plan for southern hake and *Nephrops* stocks appears to be consistent with the present ICES advice for *Nephrops* in FUs 28–29 and 30. For FUs 26–27, however, stronger measures are required to prevent a collapse of the stock. The assessment for all three stocks is too uncertain to allow the calculation of a precise TAC corresponding to the 10% reduction of F implied by the recovery plan.

13.2.2 Data

13.2.2.1 Commercial catches and discards

Table 13.1 and Figure 13.2.1 show the landing data series for these Functional Units (FUs). Up to 1992 the estimated landings from FUs 28 and 29 have fluctuated between 450 and 530 t, with a long-term average of about 480 t. Between 1990 and 1996, the landings fell drastically, to an all time low of 132 t. From 1997 to 2005 landings have increased to levels observed during the early 1990s but decreased again in 2006. The value of total landings in 2006 was 248 t.

Males are the dominant component in all landings with exception for 1995 and 1996 when total female landings exceeded male landings (ICES, 2006a). For the last five years male to female sex-ratio has been close to 1.5:1.

Fernandes *et al.* (WD 8) present estimates of *Nephrops* discards in the Portuguese crustacean trawl fishery for the period 2004-2006. The analysis showed that percentages of discards in weight in relation to total catch were 4% in 2004, 10% in 2005 and 3% in 2006. The discard estimates varied between 7 t in 2006 and 44 t in 2005. The observed CV's were 18.5%, 35.5% and 76.1% respectively for 2004, 2005 and 2006. The high value of 2006 is probably related to a low discard sampling of Crustacean Trawl fleet in this year.

13.2.2.2 Biological sampling

Length distributions for both males and females for the Portuguese trawl landings are obtained from samples taken weekly at the main auction port, Vila Real de Sto. António. Sampling frequency in 2006 was at the same level as in the years before. The sampling data are raised to the total landings by market category, vessel and month. Information on discards was not taken into account in the estimation of the total catch length distributions due to lack of defined raising procedures. The length compositions of the landings are presented in Tables 13.2.1ab and Figures 13.2.2ab. The number of samples and measured individuals is presented in Table 1.3.

13.2.2.3 Abundance indices from surveys

Over the past decade, several groundfish and crustacean trawl surveys were carried out in FUs 28 and 29. Table 13.2.3 and Figure 13.2.1 show the average *Nephrops* CPUEs (kg/h trawling) from these surveys, which can be used as an overall biomass index. As the surveys were performed with a smaller mesh size than the commercial fishery, this information should provide a better estimation of the abundance for the first ages. There is an increase in the overall biomass index in the period 2003-2005, and also of small individuals in a particular juveniles concentration area in 2005 (Figure 13.2.3), which could be an indication of higher recruitment. In 2006, the CPUE from the crustacean survey dropped to the previous level.

13.2.2.4 Mean sizes

Mean carapace length (CL) data for males and females in the landings and surveys are presented for the period 1994-2006 (Table 13.2.4). Figure 13.2.1 shows the mean CL trends since 1984. The mean size of males and females have fluctuated along the period with no apparent trend.

13.2.2.5 Commercial catch-effort data

Total fishing effort (fishing days), estimated from the LPUE obtained from fishing logs, decreased from a peak value in 1985 to much lower values in the early 1990s. From 1999 to 2002, fishing effort increased substantially (Table 13.2.2 and Figure 13.2.1).

In 2001 and 2004-2005 only a few fishing log records were made available, as such data were clearly insufficient for producing LPUE and effort estimates for these years. The effort was instead estimated using the product of the number of fishing trips by the average trip duration in days. LPUE for all other years was obtained from fishing logs. It is important to note that these estimates represent nominal effort and do not take into account changes in the fleet composition or efficiency. The effort in 2003-2004 was estimated including only eleven months for each year as the crustacean fishery was experimentally closed in January 2003 (Portaria no. 1557-A/2002, 30th December 2002) and 30 days for *Nephrops* in September – October 2004.

A Portuguese national regulation (Portaria no. 1142, 13th September 2004) closed the crustacean fishery in January-February 2005 and enforced a ban in *Nephrops* fishing for 30 days in September – October 2005. As a result, the effort in 2005 corresponds to nine months.

The recovery plan for southern hake and Iberian *Nephrops* stocks was approved in December 2005 and in action since the end of January 2006. This recovery plan includes a reduction of 10% in F relative to the previous year (Council Regulation (EC) No 2166/2005). As a result, the number of fishing days per vessel was fixed in 240 accordingly (Council Regulation (EC) No 51/2006) for the year 2006. Besides this effort reduction, the Council Regulation (EC) No 850/98 was amended with the introduction of two boxes in Division IXa, one of them located in FU 28. In the period of higher catches (May-August), this box is closed for *Nephrops* fishing (Council Regulation (EC) No 2166/2005). As a result of these measures, the effort in 2006 corresponds to 11 months but it was not possible to see if the effort applied before in that box was transferred for other areas in FU 28 and 29.

Since 1989, LPUE has declined considerably, from almost 120 kg/day in 1989 to a mean of about 50 kg/day in the period 1995-2003 (Figure 13.2.1). This seems to be mostly the result of a decrease in male LPUE. Female LPUE was more or less stable throughout the whole period, with exception of a peak in 1995 (ICES, 2006a). The total LPUE shows an increase in 2003-2005, dropping again in 2006. Although there is a missing value for 2004, the same trend can be observed in the CPUE from the crustacean surveys.

13.2.3 Assessment

In the last two years, the assessment results have only been taken as indicative of trends. Methodological issues as age and growth determination are not solved and the use of slicing to convert length compositions into age compositions is uncertain. No analytical assessment for this stock was included in the WG TOR in 2007.

The crustacean trawl surveys series (1997-2005) have been used as a tuning fleet in analytical assessments. ICES has recommended the use of underwater TV surveys as a fishery-independent method of quantifying the abundance and distribution of stocks within this *Nephrops* Area.

In these FUs, a combined UWTV and trawl survey will be carried out in June 2007. The depth range to be covered is 200-750 metres. At these depths, the usual UWTV surveys are impracticable, due to the length of the cable needed and its costs. Attaching an UWTV camera to the headrope of the trawl net was tried in 2005. This technique has proven to be suitable for obtaining clear images of *Nephrops* and their burrows. The main advantage of combined surveys is the possibility of estimating both *Nephrops* abundance and catchability, particularly useful for calibrating trawl surveys (WKNEPHTV, 2007).

The work gives a new opportunity to improve the abundance estimation for *Nephrops* using trawl surveys.

13.2.4 Biological reference points

There are no biological reference points defined for this stock.

13.2.5 Evaluation of the recovery plan

Based on the assessment results for Nephrops stocks in FUs 28 and 29, an evaluation of the recovery plan for *Nephrops* was presented by Cardador and Silva (WD 28). Using a stochastic projection method, the authors assessed the short and medium term effects on *Nephrops* male SSB and landings from the reduction of the fishing effort, as stated in the recovery plan. The males were chosen because they constitute the most important and exploited component of the stock. The projections were performed for a 10-year period simulating two situations: (i) status quo fishing mortality (average for the period 2003-2005) for the entire period, and (ii) 10% annual decrease in fishing mortality for the first three years of the period. The reduction was considered for only three years because it is expected that the southern stock of hake reaches its F_{target} within this period. The simulations indicate that at the current levels of fishing mortality, SSB will not show any recovery. If fishing mortality is reduced annually by 10% during three years then SSB will increase and it is expected to reach the level of the early 90's in 2016 with a probability of 50%.

13.2.6 Management considerations

Nephrops is taken by a multi-species and mixed bottom trawl fishery.

A recovery plan for southern hake and Iberian *Nephrops* stocks was approved in December 2005 and in action since the end of January 2006. This recovery plan includes a reduction of 10% in F relative to the previous year and TAC set accordingly, within the limits of ±15% of the previous year TAC (Council Regulation (EC) No 2166/2005).

Besides the recovery plan, the Council Regulation (EC) No 850/98 was amended with the introduction of two boxes in Division IXa, one of them located in FU 28. In the period of higher catches (May-August), these boxes are closed for *Nephrops* fishing (Council Regulation (EC) No 2166/2005).

With the aim of reducing effort on crustacean stocks, a Portuguese national regulation (Portaria no. 1142, 13th September 2004) closed the crustacean fishery in January-February 2005 and enforced a ban in *Nephrops* fishing for 30 days in September – October 2005, in FUs 28-29. This regulation was revoked in January 2006, after the entry in force of the recovery plan and the amendment to the Council Regulation (EC) No 850/98, keeping only one month of closure of the crustacean fishery in January (Portaria no. 43/2006, 12th January 2006).

An evaluation of the *Nephrops* recovery plan presented to the WG (Cardador and Silva, WD 28) indicates that at current levels of fishing mortality, SSB will not show any recovery. If fishing mortality is reduced annually by 10% during three years, SSB will increase and it is expected to reach the level of the early 90's in 2016 with a probability of 50%.

13.3 Nephrops in FU 30 (Gulf of Cádiz)

13.3.1 General

13.3.1.1 Ecosystem aspects

Nephrops from the Gulf of Cadiz represents a Functional Unit *per se*. On the East, the Gibraltar Strait splits the Gulf of Cadiz from the Mediterranean and it is considered a natural border. On the West, the Guadiana River seems not to be a real boundary for splitting possible different populations (ie FU 29 and FU 30). The separation could be based on practical and management considerations. Nevertheless, the information on the specific *Nephrops* biology from this area is still scarce and the possible differences and exchange rate across the FU 29 and FU 30 needs to be studied.

13.3.1.2 Fishery description

Nephrops in the Gulf of Cádiz are caught in a mixed fishery targeted by the trawl fleet. Landings are clearly seasonal with high values from April to September (Jiménez, 2002). The species represents 1.5% of the total trawl landings from the area and the main landings ports are Huelva with 45%, Isla Cristina and Puerto de Santa María with 21% and Sanlúcar de Barrameda with 10% of the total *Nephrops* landings (Vila *et al*., 2005, WD30). Nevertheless, in the last four years, this species' landings from Isla Cristina and Puerto de Santa María ports overcame Huelva landings. The main *Nephrops* fishing grounds are located between 300 and 700 meters depth (Ramos *et al*., 1997). At the moment, the FU 30 provides the biggest Spanish *Nephrops* landings in the Iberian area. The Andalusian fishing sector modernization plan could be the main reason for this. The bottom trawl fleet has been modernized in a significant way, making it easier to access the more remote and deeper fishing grounds for a greater number of vessels.

Bottom trawl fishing fleet segmentation was performed using logbooks (Silva *et al.*, WD 05). The results, presented in Section 2, pointed out for only one highly multispecific fishery carried out by this fleet.

13.3.1.3 ICES Advice for 2007 and Management applicable for 2006 and 2007

ICES Advice for 2007

FU 30 Gulf of Cadiz: There is no analytical assessment for this stock. Landings have shown an increasing trend since 1996 to levels observed in the 1980s. The state of the stock is uncertain. The survey and LPUE information indicate that at present the stock is at about half of its level at the beginning of the time-series.

As the stock is clearly at least fully exploited, it is recommended not to increase the catches in 2007 above the lowest recent landings of 50 t.

Management applicable for 2006 and 2007

Because of the difference in stock status between FUs 26–27 (severely depleted) and the better situation for the more southerly components, a subdivision of the TAC by Functional Unit should be considered. The practice of managing three distinctive Nephrops stocks by a joint TAC may lead to unbalanced exploitation of the individual stocks. This is particularly true for *Nephrops* in Division IXa where the state of the individual stocks is quite different. In addition to this, landings have been in excess of the TAC for some recent years and the TAC has not constrained the fishery. Therefore fine-scale management of catches and/or effort at a geographic scale that corresponds to the Nephrops stock distribution should be implemented.

The reduction in F intended by the recovery plan for southern hake and *Nephrops* stocks appears to be consistent with the present ICES advice for Nephrops in FUs 28–29 and 30. For FUs 26–27, however, stronger measures are required to prevent a collapse of the stock. The assessment for all three stocks is too uncertain to allow the calculation of a precise TAC corresponding to the 10% reduction of F implied by the recovery plan.

13.3.2 Data

The sampling level for the species is given in Table 1.3.

13.3.2.1 Commercial catch and discard

The Working Group *Nephrops* landings estimates for FU 30 are given in Table 13.3.1. Landings were reported by Spain and minor quantities by Portugal. Data from the Gulf of Cadiz are based on Spanish sales notes, Fishermen Brotherhoods and Owners Associations.

Landings decreased from 108 tonnes in 1994 to 49 tonnes in 1996, the lowest all time recorded. Since then, *Nephrops* landings show a gradual increase up to a maximum value of 281 tonnes in 2003. In 2004, a decrease in landings has been recorded (more than 50%), followed by a new increase in 2005 (232 tonnes). In 2006, landings showed a similar value (225 tonnes).

A discard pilot survey was carried out in 2005 in the *Nephrops* fishing season (summer) in the Gulf of Cádiz where 20 fishing trips were sampled. A similar study targeting bottom trawl fleet was carried out in 2006 with 30 fishing trips sampled in the same period. Figure 13.3.1 shows the estimated length distributions of the discarded and retained *Nephrops* by trip in both years.

In 2005, the sizes of the discarded *Nephrops* ranged from 20 to 27 mm of carapace length (CL), with a mean size of 23.4 mm. The retained sizes were between 22 and 60 mm CL, with a mean size of 33.5 mm. In 2006, the size range was larger in the discarded *Nephrops* distribution and the mean sizes showed a decrease in relation to 2005. The discarded sizes ranged from 7 to 32 mm L, with a mean size of 20.5 mm and the retained sizes were between 17 and 55 mm CL, with a mean size of 29.4 mm. The estimated discarding rates were similar with 5.2% and 4.9% in weight, in 2005 and 2006, respectively.

The differences in the length frequency distributions observed in commercial landings and in the discard survey in 2005 may be related to the presence of observers onboard in the discard survey and to the low number of fishing trips targeting *Nephrops* (Silva *et al*., 2006, WD15). In 2006, the landings and retained length frequency distributions and the mean size were similar.

13.3.2.2 Biological sampling

The sampling of commercial landings followed a multistage stratified random scheme by month in the Port of Huelva. Since 2006 a new sampling scheme has been designed, which includes sampling in other fishing ports (Isla Cristina, El Puerto de Santa María and Sanlúcar de Barrameda) and excludes the Port of Huelva due to the decrease of the landings in this port.

Figure 13.3.2 shows the annual landings length composition for males, females and both sexes combined during the period 2001-2006. The length composition of landings in 2004 and 2005 presents a shift to smaller sizes in relation to previous years. As samples did not cover all the commercial categories in 2001-2003, length compositions from this period may be biased. During 2004 and 2005, all the commercial categories were sampled. The smallest category (CL 14 - 27 mm) accounted for 40-50 % of landings in 2004 and 2005 (Silva *et al*., 2006, WD15).

Mean sizes of *Nephrops* in landings from 2001 to 2006 are presented in the table below.

MEAN CARAPACE LENGTH (mm)	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Males (mm)	35.6	34.9	33.1	24.2	23.5	30.5
Females (mm)	34.0	32.0	32.6	24.8	24.9	29.7
Males + Females (mm)	34.8	33.3	32.8	24.4	24.0	30.2

A slight decrease in the mean size from 2001 to 2003 has been observed. In 2004 and 2005 the mean has decreased for both males and females. Data of the period 2001-2003 have to be taken with caution due to the sampling bias. In 2006, the mean sizes showed an increase in relation to 2004-2005 and a decrease in relation to the 2001-2003 period.

The results show some differences in relation to the previous periods. The number of samples and harbours covered in the last period assure a more reliable information.

For the estimation of biological parameters, monthly samples of *Nephrops* were obtained from commercial trawl landings in Sanlúcar de Barrameda between April 2004 and February 2005. *Nephrops* data from Spanish bottom trawl surveys carried out in March 2004 and 2005 were also included in the estimates.

Carapace length (CL) and total weight (W) relationships were $W=0.0004*CL^{3.1018}$ for males, $W=0.0007*CL^{2.9657}$ for females and $W=0.0006*CL^{3.0237}$ for the sexes combined. Female carapace length at first maturity was 29.4 mm, close to the estimated value of CL_{50}=30 mm for females off SW and S Portugal, FU 28-29 (Vila *et al.*, 2005, WD 20). No new information on biological parameters is available since 2004.

13.3.2.3 Abundance indices from surveys

The biomass and the abundance indices of *Nephrops* by depth strata, estimated from the Spanish bottom trawl spring surveys (SPS-GFS) carried out from 1993 to 2007 are shown in Table 13.3.2. The 2004 survey values are the lowest in the survey time series and this decrease has also been detected in the commercial LPUE for 2004. The results of the spring survey in 2005 show an increase relative to the previous year. This increase in 2005 is also detected, to a lesser extent, in the trend of the commercial LPUEs (Table 13.3.3). In 2006, a new decrease was observed, while in the commercial LPUE was detected an increase. The results from 2007 survey confirm the descending trend (Figure 13.3.5). The indices obtained from these surveys could be useful abundance indices, but they have to be considered with caution, as these surveys are not carried out during the main fishing season of *Nephrops.*

The length distributions obtained in the Spanish bottom trawl spring surveys (SPS-GFS) during the period 2001-2007 are presented in Figure 13.3.3.

13.3.2.4 Commercial LPUE

The estimate of the *Nephrops* directed effort in the Gulf of Cádiz has been obtained from daily fishing trips landings with at least 10% *Nephrops* in weight of the total landings. Figure 13.3.4a shows total bottom trawl fishing effort and the proposed directed effort estimate. LPUE series are shown in Figure 13.3.4b. Directed fishing effort was around 6.4% of the total trawl effort, about a 20% less than in 2005, and corresponds to 77.4% of the total landed *Nephrops* during 1994-2006 (Table 13.3.3). The fishing effort time series has been revised this year.

The directed fishing effort trend is clearly increasing from 1994 to 2005, with a decrease in 2006. LPUEs obtained from the directed effort show a gradual decrease from 1994 to 1998. After this year, the trend slightly increases until 2003. In 2004, the LPUE decreases to the minimum value recorded. In 2005, LPUE shows a slight rise that continued in 2006. The total bottom trawl LPUE trend was different from the target *Nephrops* LPUE from 1994 to 2000. Since 2000 onward, these trends were very similar.

The LPUE trend is quite similar to the abundance survey index in the stratum of 200-700 m, although a considerable increase is observed in 1996, which is not reflected in the LPUE trend (Figure 13.3.5). The lowest values were detected in 2004 in both series. In 2006, both series showed different trends with an increase in the commercial LPUE and a drop in the survey abundance index.

13.3.3 Assessment

A LCA assessment of *Nephrops* of the Gulf of Cádiz (FU 30) was attempted in 2004 for the first time in the ICES WGNEPH (ICES, 2004b). Given the uncertainties about input parameters, this assessment was considered as preliminary. Also, the steady state assumptions required for LCA assessment are questionable due to the observed trends in landings and effort.

The WGHMM TOR only included the update of catches for *Nephrops* stocks. Given the inconsistencies in the length compositions from 2001 to 2005 (Silva *et al*., 2006, WD 15) and in the absence of additional information, assessment of this FU was not tried.

13.3.4 Biological reference points

There are no reference points for this stock.

13.3.5 Management considerations

Nephrops fishery is taken in mixed bottom trawl fisheries, therefore the HCRs applied to other species will affect to this stock.

A Recovery Plan for the Iberian stocks of hake and *Nephrops* was approved in December 2005 (Council Regulation (EC) No 2166/2005). This recovery plan includes a reduction of 10% in F relative to the previous year and TAC set accordingly, within the limits of ± 15% of the previous year TAC.

Currently, a Fishing Plan is being followed by the trawl fleet in FU 30, Gulf of Cádiz (ORDEN APA/2883/2006, 19th September, B.O.E nº 225), which will be applied until next September and consequently affects to *Nephrops*. This plan restricts the daily fishing hours and establishes two days of fishing repose each week. Furthermore, the plan establishes a fishing closed season of 45 days, which took place last year between September 21st and November 4th.

This annual fishing plan started in 2004 and it is still in force. The effects of the closed season on Nephrops have not yet been evaluated. Although this plan may not have had an effect on the *Nephrops* fishery as the main directed effort occurs from April to September, the 2006 effort shows a decrease both in the total fleet effort and in directed effort.

13.4 Summary for Division IXa

ICES Division IXa includes five FUs which are managed together. The TAC is set for the whole Division. In 2006, the TAC was exceeded by 7%.

The northernmost stocks (FUs 26-27) continue to present a declining trend. The southern stocks remain low despite some increase in recent years.

The practice of managing three distinctive *Nephrops* stocks by a joint TAC may lead to unbalanced exploitation of the individual stocks. This is particularly true for this Division where the state of the individual stocks is quite different. In addition to this, landings have been in excess of the TAC for some recent years and the TAC has not constrained the fishing mortality. Therefore, fine scale management of catches and/or effort at a geographic scale that corresponds to the *Nephrops* stock distribution should be implemented.

A recovery plan for southern hake and Iberian *Nephrops* stocks was approved in December 2005 and in action since the end of January 2006. This recovery plan includes a reduction of 10% in F relative to the previous year and TAC set accordingly, within the limits of ±15% of the previous year TAC (Council Regulation (EC) No 2166/2005).

The Council Regulation (EC) No 850/98 was also amended with the introduction of two boxes, in FU 26 and the other in FU 28. These boxes are closed for *Nephrops* fishing for three and four months respectively, in peak of the fishing season (May-August) (Council Regulation (EC) No 2166/2005).

There is no clear evidence that these boxes will have an impact on the Nephrops stocks in FUs

Table 13.1. Nephrops in Division IXa (Management Area Q). Total recorded landings

	Division IXa - Management Area Q																
	FU 26+27 West Galicia + North Portugal							FU 28+29 SW+S Portugal						FU 30 Gulf Cadiz			Q Total
	26*	27					Total	28	29	28+29			Total	30		Total	
	Spain	Portugal			Spain	Total		Spain	Spain	Portugal				Portugal	Spain		
Year	Trawl	Artisanal	Trawl	Total	Trawl			Trawl	Trawl	Artisanal	Trawl	Total		Unalloc	Trawl		
1975	622						622	137	1510		34	34	1681				2303
1976	603						603	132	1752		30	30	1914				2517
1977	620						620	95	1764		15	15	1874				2494
1978	575						575	120	1979		45	45	2144				2719
1979	580						580	96	1532		102	102	1730				2310
1980	599						599	193	1300		147	147	1640				2239
1981	823						823	270	1033		128	128	1431				2254
1982	736						736	130	1177		86	86	1393				2129
1983	786						786				244	244	244				1030
1984	604		14	14		14	618				461	461	461				1079
1985	750	4	11	15		15	765				509	509	509		257	257	1531
1986	657	9	28	37		37	694				465	465	465		221	221	1380
1987	671	19	52	71		71	742			11	498	509	509		302	302	1553
1988	631	41	55	96		96	727			15	405	420	420		139	139	1286
1989	620	22	66	88		88	708			6	463	469	469		174	174	1351
1990	401	17	31	48		48	449			4	520	524	524		220	220	1193
1991	549	14	40	54		54	603			5	473	478	478		226	226	1307
1992	584	15	37	52		52	636			1	469	470	470		243	243	1349
1993	472	14	36	50		50	522			1	376	377	377		160	160	1059
1994	426	8	14	22		22	448				237	237	237		108	108	793
1995	501	1	9	10		10	511			1	272	273	273		131	131	915
1996	264		17	17	50	67	331			4	128	132	132		49	49	512
1997	359		6	6	68	74	433			2	134	136	136		97	97	666
1998	295		8	8	42	50	345			2	159	161	161		85	85	591
1999	194	5	0	6	48	54	248			5	206	211	211		120	120	578
2000	102	8	1	9	21	30	132			4	197	201	201		129	129	462
2001	105	4	2	6	21	27	132			2	269	271	271		178	178	582
2002	59	4	0	4	24	28	87			1	358	359	359		247	247	693
2003	39	7		7	26	33	72			35	327	362	362	4	281	285	718
2004	38	8	0	8	24	32	70			30	344	375	375	4	130	135	579
2005	16	10	0	10	16	26	42			31	382	413	413	3	232	235	690
2006**	15	12	0	12	17	29	44			17	232	248	248	4	225	229	520

* Prior 1996, landings of Spain recorded in FU 26 include catches in FU 27

** Preliminary values

Table 13.2. Nephrops in Division IXa (Management Area Q). TAC and recorded landings

Year	TAC (tonnes)	Total Landings (tonnes)
1995	2500	915
1996	2500	512
1997	2500	666
1998	2500	591
1999	2000	578
2000	1500	462
2001	1200	582
2002	800	693
2003	600	718
2004	600	579
2005	540	690
2006	486	520
2007	437	

Table 13.1.1. Nephrops FU 26-27, West Galicia and North Portugal
Landings in tonnes

	Spain		Portugal	Total
Year	FU 26*	FU 27	FU 27	FU 26-27
1975	622			622
1976	603			603
1977	620			620
1978	575			575
1979	580			580
1980	599			599
1981	823			823
1982	736			736
1983	786			786
1984	604		14	618
1985	750		15	765
1986	657		37	694
1987	671		71	742
1988	631		96	727
1989	620		88	708
1990	401		48	449
1991	549		54	603
1992	584		52	636
1993	472		50	522
1994	426		22	448
1995	501		10	511
1996	264	50	17	331
1997	359	68	6	433
1998	295	42	8	345
1999	194	48	6	248
2000	102	21	9	132
2001	105	21	6	132
2002	59	24	4	87
2003	39	26	7	72
2004	38	24	8	70
2005	16	16	10	42
2006**	15	17	12	44

*Prior 1996 landings of Spain from FU 26 include catches in FU 27
**preliminar

Table 13.1.2. Nephrops FU 26-27, West Galicia and North Portugal
Length compositions, mean weigth (kg) and mean size (CL, mm) in landings, 1988-2006.

Size, CL/Yea	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
10																			
11																			
12	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	71	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	69	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	451	110	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	191	289	13	0	0	0	0	0	0	0	0	3	17	0	0	0	0	0
17	0	128	518	17	0	0	7	0	0	0	0	0	3	11	0	0	0	0	0
18	0	683	898	25	0	0	2	1	0	0	0	0	16	19	0	4	0	0	0
19	0	679	1502	38	0	0	0	0	0	0	0	0	38	52	0	4	0	0	0
20	27	1057	2044	97	6	5	10	7	25	3	0	0	86	151	3	29	0	0	0
21	27	1260	2489	199	12	24	19	8	78	0	0	0	119	236	3	27	0	0	0
22	39	1657	2642	398	48	99	84	47	202	12	1	0	129	348	11	11	1	0	1
23	109	1901	3063	568	103	99	77	151	373	26	6	0	127	518	16	31	0	0	0
24	198	1626	2736	1216	284	222	169	338	550	46	7	3	93	466	22	17	1	2	1
25	290	2212	1802	1477	541	381	199	672	906	113	45	15	134	441	35	28	1	2	1
26	574	1675	1451	1516	829	542	289	709	960	184	40	43	145	365	56	22	6	2	2
27	854	1878	1333	1351	926	904	409	933	746	306	80	68	129	419	106	40	16	8	3
28	1272	1560	1319	1940	1079	1017	524	1298	842	402	138	109	123	274	74	46	20	12	6
29	1487	1716	913	1797	1023	987	613	1223	706	489	191	134	143	266	86	60	18	15	9
30	1615	1510	845	1501	1069	1140	767	1371	792	681	295	195	172	252	118	90	28	25	14
31	1960	1106	632	1450	1180	890	802	1378	609	719	359	239	182	209	105	102	24	21	15
32	1951	1472	772	1484	1197	912	847	1491	601	888	411	292	285	220	160	95	44	29	25
33	2288	1313	601	1126	1378	878	898	1444	517	780	525	377	176	201	167	84	50	26	28
34	1581	1299	572	1160	1001	849	853	1255	542	745	551	376	192	156	131	83	49	31	36
35	1487	952	518	1044	915	855	745	963	506	637	569	432	200	148	96	91	47	26	33
36	1161	634	407	879	776	901	611	744	433	527	484	360	176	120	110	85	50	21	29
37	838	545	284	651	627	736	546	580	348	484	417	321	175	143	106	111	62	31	36
38	1196	608	294	616	545	682	621	542	346	534	425	308	128	110	76	72	77	35	43
39	837	451	226	600	505	510	475	425	285	406	292	240	128	85	95	79	58	27	30
40	501	325	199	450	666	573	412	455	284	466	393	218	115	65	76	60	80	24	38
41	428	288	165	375	431	385	321	321	213	399	312	182	112	58	88	48	53	21	28
42	367	287	144	220	362	375	314	214	182	360	249	210	66	57	81	54	90	22	33
43	433	296	156	203	425	307	293	188	165	325	292	219	64	36	76	47	65	25	27
44	164	277	87	136	301	251	200	152	127	290	207	193	61	44	52	33	55	20	22
45	165	286	58	110	303	219	178	125	118	218	196	162	58	42	44	34	50	17	13
46	96	135	23	90	350	153	129	116	94	191	178	152	40	28	49	26	26	20	13
47	94	117	45	82	228	104	92	84	56	123	120	84	38	47	42	31	34	26	13
48	71	100	25	49	222	58	96	55	70	117	147	96	23	18	22	13	25	18	8
49	73	76	29	42	148	84	71	46	23	60	105	64	21	16	15	16	16	13	8
50	83	127	14	46	63	81	69	29	31	81	95	54	17	12	12	15	14	15	9
51	15	48	9	14	71	27	59	13	21	43	59	21	17	6	7	15	6	15	5
52	20	75	14	33	71	21	59	18	22	43	55	30	18	6	7	10	11	10	5
53	23	34	13	26	34	20	28	6	13	30	37	33	5	5	6	10	5	7	4
54	14	10	11	23	23	14	12	6	15	42	28	27	8	3	2	8	4	11	7
55	6	27	1	6	13	17	12	1	9	25	26	12	6	7	3	4	4	8	2
56	6	9	1	5	5	10	5	1	9	14	14	14	7	4	3	5	2	4	2
57	10	5	1	2	6	5	10	0	4	8	12	6	5	3	3	2	2	3	2
58	11	5	1	4	6	5	14	0	3	6	11	5	4	5	4	3	3	4	3
59	7	0	4	0	7	2	7	0	0	2	1	5	3	3	0	1	3	3	1
60	2	0	2	0	4	3	3	0	0	1	2	3	2	2	2	2	6	4	1
61	4	0	1	0	3	2	12	0	0	0	2	0	3	2	0	2	1	14	1
62	2	0	1	0	1	0	7	0	0	0	0	0	1	5	0	2	2	4	1
63	1	0	1	0	3	0	5	0	0	1	0	0	3	3	0	2	1	2	0
64	2	0	1	0	3	1	4	0	0	0	1	0	2	2	0	2	1	1	1
65	2	0	1	0	1	0	2	0	0	0	0	0	1	1	1	1	2	2	0
66	3	0	1	0	1	0	2	0	0	0	1	0	2	2	0	1	0	1	1
67	2	4	1	0	1	1	1	0	0	0	1	0	3	1	0	2	1	2	1
68	2	11	1	0	2	2	6	0	0	0	0	0	2	1	0	2	1	1	1
69	1	4	1	0	1	1	0	0	0	0	0	0	2	1	0	1	0	1	1
70	12	25	1	2	12	6	8	0	1	0	3	0	11	1	1	5	3	8	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Total number	22409	31275	29319	23087	17811	15360	12003	17411	11828	10827	7383	5302	3822	5712	2169	1666	1117	638	563
Total weight (	727	708	450	603	636	522	448	511	331	432	344	246	132	132	87	72	62	42	32
Mean weight	0.032	0.023	0.015	0.026	0.036	0.034	0.037	0.029	0.028	0.040	0.047	0.046	0.035	0.023	0.040	0.043	0.056	0.066	0.057
CL Mean leng	33.5	28.6	25.4	30.9	34.0	33.8	34.7	32.4	31.4	35.7	37.6	37.6	33.0	29.0	35.5	35.7	39.7	41.0	40.0

Table 13.1.3. Nephrops FU 26-27, West Galicia and North Portugal
Fishing effort and LPUE for SP-MATR fleet

	SP-MATR		
Year	Landings (t)	trips	LPUE (kg/trip)
1994	234	2692	113.9
1995	267	2859	93.3
1996	158	3191	49.5
1997	245	3702	66.3
1998	188	2857	66.0
1999	134	2714	49.5
2000	72	2479	28.9
2001	80	2374	33.6
2002	52	1671	31.2
2003	59	1597	24.0
2004	31	1980	19.3
2005	17	1629	10.3
2006	18	1547	11.9

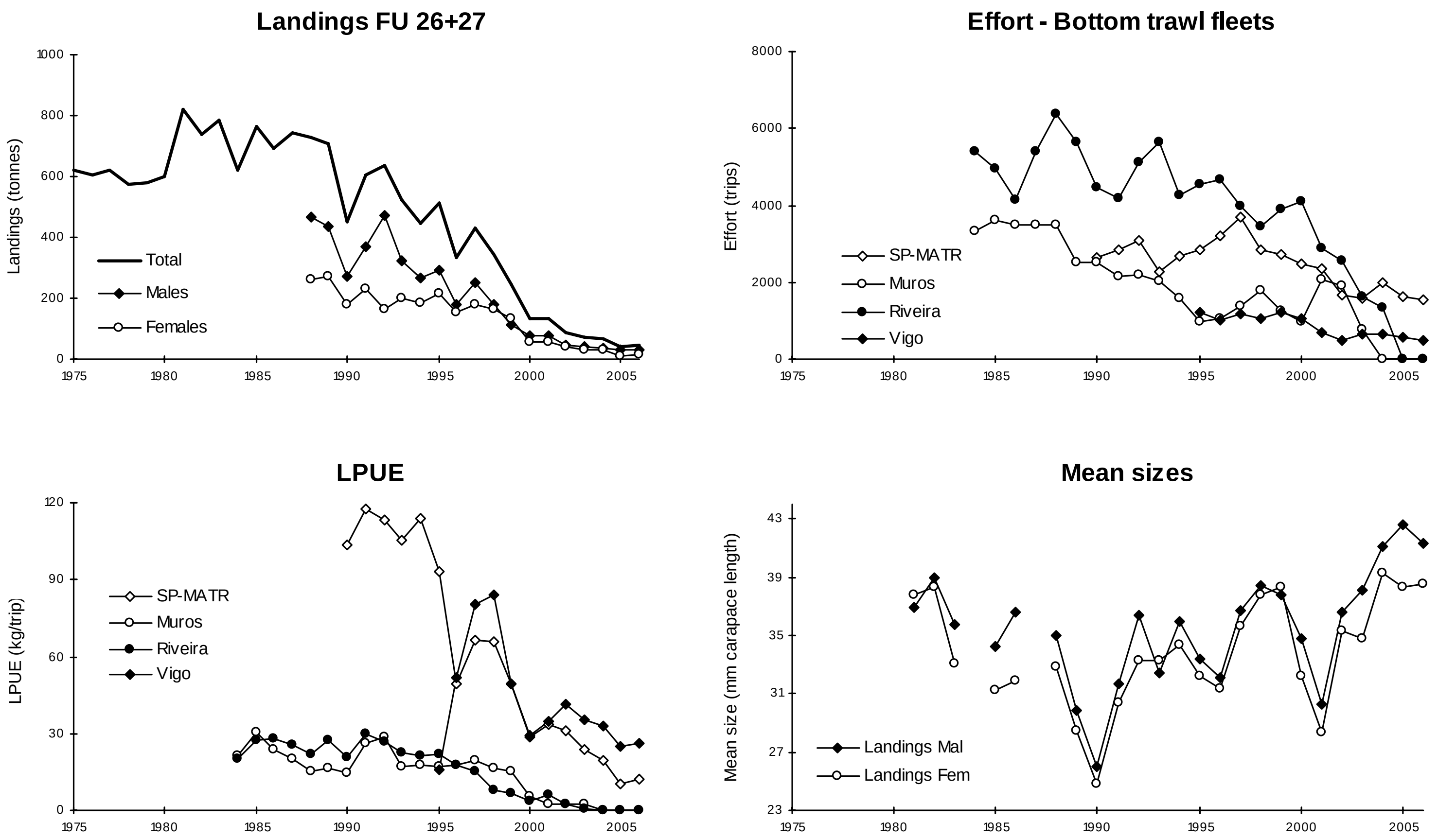


Figure 13.1.1. Nephrops FU 26+27, West Galicia and North Portugal: Long-term trends in landings, effort, LPUEs and mean sizes.

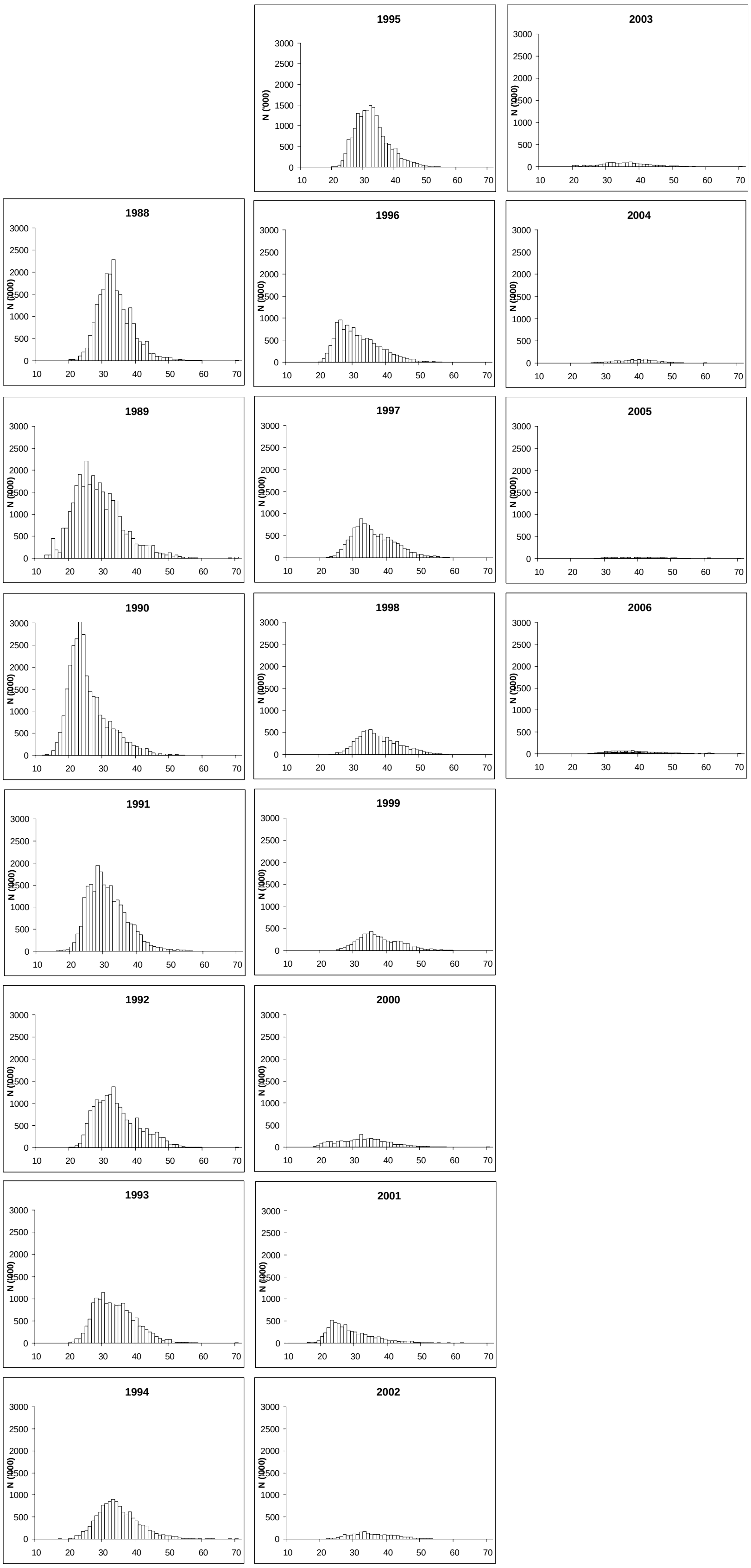


Figure 13.1.2. Nephrops FU 26-27, West Galicia and North Portugal: Nephrops length distributions in landings, 1988-2006.

Table 13.2.1.a. FU 28-29 - Length Composition of Nephrops Males (1984-2006)

Landings (thousands)																							
Age/Year	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
17																							
18																							
19					4	21					0									0			
20			0	16	4			6	4							4				0		4	
21		17	9			84		16	37	9						3	3	0	2	0	0	33	
22	7	5	14	15		97	9	29	96	38	9				2	0	16	1	2	13	5	51	9
23	24	7	7	8		143	5	19	55	34			8	4		5	8	3	1	3	19	32	19
24	14	40	121	209	51	272	27	53	202	42	18		17	9	8	9	20	5	2	11	26	106	47
25	109	83	115	81	97	229	116	69	181	149	34	3	23	6	16	39	13	6	3	39	57	117	41
26	250	170	137	446	128	205	182	111	263	72	68	0	36	43	32	33	58	8	11	56	155	150	63
27	282	326	170	718	208	269	149	94	185	95	77	0	54	95	81	49	85	24	24	87	233	202	77
28	374	500	289	871	399	280	337	139	506	272	157	0	56	78	65	68	44	24	48	60	257	280	114
29	439	559	341	727	456	283	415	159	462	382	95	28	38	88	65	109	148	53	60	145	297	326	173
30	412	742	328	584	442	317	695	239	725	548	187	11	68	104	160	133	87	74	139	244	361	522	226
31	277	670	389	742	457	230	813	325	755	548	231	24	92	172	129	272	111	92	123	186	329	565	220
32	373	784	680	806	446	367	866	260	670	674	383	108	151	283	289	88	161	274	233	325	563	744	310
33	339	531	213	236	428	265	702	133	345	365	149	83	70	90	95	182	92	139	281	245	424	439	206
34	389	635	609	721	656	328	785	239	451	655	270	215	159	251	269	152	160	224	257	263	421	566	269
35	478	525	590	245	664	291	755	171	296	475	224	169	147	169	118	175	100	173	274	270	416	330	171
36	378	463	519	342	572	295	449	138	399	639	221	147	78	154	166	143	158	163	265	193	271	262	145
37	528	346	322	406	424	356	465	77	351	391	107	262	172	149	167	128	162	167	247	231	202	293	150
38	496	383	606	355	571	302	479	120	378	344	179	134	113	58	85	75	106	99	254	193	176	228	143
39	353	309	361	240	326	332	611	126	348	306	95	151	62	46	47	180	81	109	229	169	110	176	84
40	447	337	323	156	366	316	829	200	248	174	144	232	83	82	83	83	96	159	254	209	197	152	85
41	247	230	316	335	164	314	797	141	243	158	93	247	78	37	53	184	102	130	163	158	128	129	106
42	371	246	507	264	215	360	628	174	246	170	168	293	85	33	167	58	91	195	163	164	209	152	157
43	199	156	198	62	102	364	335	121	242	107	127	65	31	21	43	102	47	181	167	168	132	119	80
44	194	233	422	215	128	481	553	125	371	179	150	88	42	28	69	63	86	173	122	119	145	174	120
45	165	144	233	206	93	339	324	90	220	150	87	27	22	21	34	111	61	140	113	101	153	140	79
46	148	178	189	170	72	231	228	128	167	55	79	58	21	33	38	67	85	144	106	75	123	116	96
47	129	161	140	74	76	191	202	122	191	96	68	31	38	20	34	59	88	120	111	74	116	113	51
48	176	212	149	79	85	193	121	62	178	102	78	25	15	9	24	40	55	80	104	81	108	64	46
49	89	138	104	58	43	73	92	78	111	47	47	16	20	4	13	50	37	79	86	58	71	53	35
50	91	142	50	34	53	94	58	67	69	30	50	12	9	3	33	32	65	93	103	92	99	70	24
51	66	120	63	27	34	114	59	44	50	38	29	4	6	7	14	32	34	71	72	63	50	41	26
52	64	135	66	44	38	77	33	40	35	15	46	11	16	7	31	8	53	88	94	72	78	46	32
53	45	99	32	37	23	40	19	16	29	18	22	5	6	6	11	13	18	41	69	57	37	23	18
54	73	101	35	45	22	35	27	29	50	23	18	5	8	16	19	15	31	54	53	56	59	25	29
55	20	67	25	31	22	37	30	26	29	19	9	3	4	10	8	9	19	34	28	45	31	12	12
56	20	35	14	20	16	20	30	19	5	5	11	2	4	3	6	13	19	29	43	29	66	15	9
57	10	33	5	15	12	22	7	10	6	5	11	3	7	16	8	8	19	37	37	24	19	9	5
58	13	14	8	14	11	17	14		11	4	6		5	3	5	4	13	23	26	20	15	10	5
59	7	10	3	9	4	16	5	2	9	3	10	0	5	2	3	4	10	15	16	13	18	8	8
60	3	6	3	4	3	13	2		10	8	1	1	1	4	1	1	8	15	25	16	28	13	5
61	3	1	4	4	1	5		1	3	2	1	0	1	9	1	2	14	9	11	8	13	9	6
62	3	1	2	1	2	3		1	7	5	1		2	7	1	3	6	10	11	15	19	8	7
63	1	1		1	1	4		5	0	1	0		2	3	0	2	1	4	11	11	9	7	6
64		2	0	2	1			1	3	1	2		0	4	0	1	1	9	11	8	11	10	6
65	0	0		2	2				3	1	1		0	4		0	4	6	5	4	4	9	6
66	0			0	1					1			0	4	0		1	5	8	3	8	3	4
67	0			0	0	0			6	5				6	0			4	3	5	2	2	5
68					0	2				0	1			0	0			1	6	6	2	3	3
69				0										0	0		0	3	3	2	3	2	3
70	0			1		0				2				0	0		0	6	2	4	3	4	4
71										0					0			2	2	4	1	1	2
72				0		0				1					0			2	2	4	2	3	3
73														0			0	0	1	1	1	2	2
74	0									1								0	1	1	1	3	1
75																		0	1	0	0	1	1
76																		0	0	0	0	0	1
77																			0	0	0	0	1
78		0			0																0	1	
79																			0		0	1	0
80									0													0	0
81																							
82																			0				0
Total	**8106**	**9897**	**8709**	**9679**	**7925**	**8329**	**12255**	**4023**	**9249**	**7463**	**3766**	**2466**	**1854**	**2200**	**2491**	**2811**	**2680**	**3602**	**4486**	**4503**	**6286**	**6977**	**3560**
Landings (t)	**292**	**353**	**315**	**277**	**249**	**318**	**351**	**345**	**304**	**232**	**139**	**98**	**65**	**74**	**88**	**116**	**117**	**190**	**222**	**201**	**245**	**230**	**136**

Table 13.2.1.b. FU 28-29 - Length Composition of Nephrops Females (1984-2006)

Landings	(thousands)																						
Age/Year	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
17																				0			
18					4																0		
19		0				35					0									1			
20	3	1	7		8	21				18								0		0	0	8	
21	1	1	22	3	21	102		21	9	49							3	1	0	3	15	47	3
22	8	21	30	78		88	19	11	102	63			0	13	2	5	18	0		3	12	86	12
23	66	21	7	31	28	135	15	69	38	21	2		0	0	4	4	6	7	0	9	54	53	33
24	79	102	118	270	153	258	38	173	164	41	22	2	11	20	15	25	49	7	10	19	80	133	38
25	228	205	104	357	163	197	138	198	203	191	73		13	20	25	27	24	15	11	36	126	125	48
26	272	284	186	684	220	282	140	436	361	111	92	1	35	102	74	94	81	24	15	66	261	266	92
27	345	491	359	902	429	326	247	418	448	235	134	0	37	77	91	76	139	34	34	66	332	285	121
28	431	523	322	1421	471	231	345	598	597	413	170	6	36	152	148	100	64	44	107	96	422	234	144
29	443	672	419	1253	516	285	491	590	514	523	269	31	45	178	114	121	171	90	127	171	481	416	310
30	422	588	381	928	499	317	575	771	599	775	326	104	50	199	199	236	152	131	237	238	488	649	257
31	487	593	418	948	482	501	639	414	736	752	427	182	95	394	168	263	131	167	195	150	400	567	255
32	485	653	700	946	766	306	859	807	617	824	558	322	198	502	376	485	283	316	296	355	629	860	433
33	613	415	406	227	527	314	596	375	430	449	283	251	53	163	116	187	153	184	467	265	530	454	235
34	618	467	654	774	813	511	734	310	369	359	353	641	209	278	298	346	235	252	429	307	481	463	296
35	562	563	447	447	460	435	519	284	287	194	246	674	184	150	112	287	193	158	470	248	391	258	220
36	469	329	316	386	489	274	243	130	267	203	237	811	142	135	166	317	225	174	351	188	272	206	140
37	505	353	400	223	206	318	189	108	333	154	147	692	267	129	171	201	213	144	302	198	218	186	124
38	383	284	330	269	265	285	207	135	251	100	128	348	151	39	48	184	85	108	300	199	183	184	133
39	274	142	211	146	288	148	216	74	176	150	66	194	67	35	59	151	92	112	213	153	137	92	151
40	171	119	80	119	132	131	230	131	147	110	114	344	120	21	89	111	79	133	186	273	163	87	98
41	58	106	55	65	128	149	73	39	68	108	77	361	63	31	64	81	66	79	110	163	99	75	113
42	50	36	133	54	43	127	210	62	69	95	73	165	111	18	84	73	67	91	80	184	149	119	96
43	30	27	21	40	28	109	58	82	26	43	23	64	29	2	34	38	41	55	87	127	85	72	36
44	17	13	47	147	27	91	77	6	46	42	43	88	90	18	71	34	49	56	57	72	81	62	38
45	14	11	27	84	19	27	41	21	40	34	13	54	36	8	22	18	23	29	51	65	82	52	29
46	7	6	5	40	14	38	31	45	25	37	11	13	15	4	28	18	38	33	40	36	63	40	46
47	5	3	3	26	9	24	16	7	12	29	7	18	23	3	23	7	52	26	25	24	55	35	20
48	4	1		71	11	29	7	15	18	15	4	15	8	2	6	9	25	12	24	27	46	19	10
49	1	0	3	17	4	9	1	17	17	23	4	1	6	7	6	4	21	15	19	18	29	25	6
50	1	0		2	6	3	1	2	32	8	17	1	2	1	6	5	10	15	26	24	24	24	6
51	0	0	3	4	3	7	2	4	4	5	0			1	2	2	10	9	22	13	15	17	8
52	1			5	5	8	1		5	6	1	1	0	1	1	3	16	6	19	20	16	17	6
53	2			2	3	1			9	6	0			0	0		6	6	10	12	9	10	1
54				4	1	1			1	1			1	0	1		5	2	2	14	9	6	7
55				0	1	1			6	2							1	2	3	9	4	5	1
56				3	0	2		5	14	5					0		3	1	3	7	7	2	1
57				0	0	1			4	1			0		0		1	0	2	4	2	3	0
58				0		0			4	1								1	1	1	2	0	0
59				1	0	0											0	1	0	0	1	1	1
60					0				1	0								0		0		2	
61						1											3	1		0	1		
62																			0	0	0	1	0
63									4	1								0	0			0	
64																					1	0	
65																					0	0	
66																	0	0				0	
67																							
68									4	1													
69																							
70																					0		
71																							
72																							
73																							
74																							
75																							
76																							
77																							
78																							
79																							
80																							
81																							
82																							
Total	**7052**	**7032**	**6218**	**10978**	**7243**	**6126**	**6962**	**6358**	**7059**	**6198**	**3920**	**5385**	**2095**	**2702**	**2621**	**3509**	**2829**	**2540**	**4332**	**3866**	**6458**	**6247**	**3566**
Landings (t)	**169**	**156**	**150**	**232**	**171**	**151**	**174**	**134**	**165**	**145**	**97**	**174**	**67**	**62**	**72**	**95**	**84**	**79**	**135**	**126**	**170**	**152**	**95**

Table 13.2.2. - SW and S Portugal (FUs 28-29): Effort and CPUE of Portuguese trawlers, 1994-2006.

Year	No. of trawlers	CPUE (t/boat)	Estimated days	CPUE (kg/day)
1994	31	7.6	4183	57
1995	30	9.1	4463	61
1996	25	5.3	3451	38
1997	25	5.5	2646	52
1998	25	6.4	4404	36
1999	29	7.3	3175	66
2000	33	6.1	4344	46
2001	33	8.2	5587	48
2002	34	10.5	6646	54
2003	35	9.3	6486	50
2004	33	12.6	5276	79
2005	32	11.9	3983	96
2006*	30	7.7	2722	85
* provisional				

Table 13.2.3. - SW and S Portugal (FUs 28-29): *Nephrops* CPUEs (kg/hour) in research trawl surveys, 1994-2006.

Groundfish surveys			Crustacean surveys	
Year	CPUE (kg/hour)		Month and year of survey	CPUE (kg/hour)
	Summer	Autumn		
1994	ns	0.4	May-94	2.3
1995	1.3	0.3	No surveys 1995-96	
1996	ns	0.0		
1997	0.7	0.1	Jun-97	2.6
1998	0.7	0.0	Jun-98	1.2
1999	0.3	0.0	Jun-99	2.5
2000	1.0	0.9	Jun-00	1.6
2001	0.6	0.3	Jun-01	0.8
2002	ns	0.0	Jun-02	2.4
2003	ns	0.2	Jun-03	2.6
2004	ns	0.5	Jun-04	nr
2005	ns	0.1	Jun-05	4.7
2006	ns	0.2	Jun-06	2.4
ns = no survey nr = not reliable				

Table 13.2.4. - SW and S Portugal (FUs 28-29): Mean sizes (mm CL) of male and female Nephrops in Portuguese landings, 1994-2006.

Year	**Landings**		**Demersal surveys**				**Crustacean surveys**	
	Males	Females	**Summer**		**Autumn**		Males	Females
			Males	Females	Males	Females		
1994	37.4	33.6	ns	ns	39.0	33.6	ns	ns
1995	39.3	37.0	42.1	35.6	42.0	34.9	ns	ns
1996	36.9	36.6	ns	ns	38.6	32.2	ns	ns
1997	35.9	32.8	40.4	36.9	39.1	31.7	43.7	41.9
1998	36.8	34.5	36.0	33.9	40.6	35.9	39.5	36.7
1999	38.7	34.6	45.1	40.4	43.8	32.8	39.7	37.5
2000	38.9	35.2	40.8	37.1	39.0	35.1	41.7	40.2
2001	41.6	36.1	40.5	34.5	47.2	41.6	44.5	39.9
2002	40.7	36.2	na	na	35.0	39.0	44.8	40.7
2003	39.1	36.4	ns	ns	37.5	32.3	39.7	36.7
2004	37.3	33.8	ns	ns	36.7	31.3	39.0	37.0
2005	35.6	33.0	ns	ns	40.6	39.1	37.3	35.7
2006	37.2	34.1	ns	ns	36.1	32.8	37.7	35.2
na = not available ns = no survey								

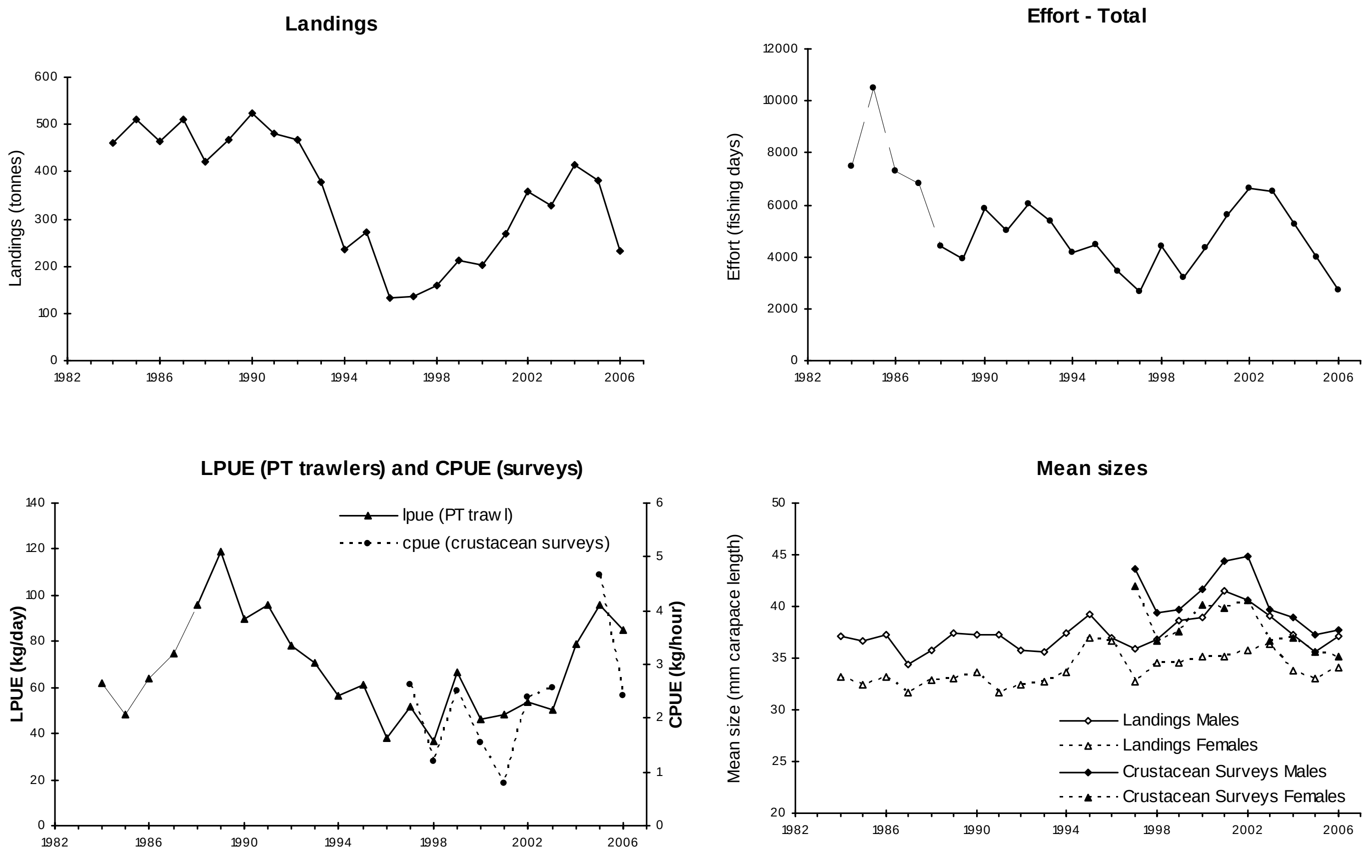


Figure 13.2.1. SW and S Portugal (FU 28+29): landings, effort, biomass indices and mean sizes of *Nephrops* in landings and landings. Note: Values of LPUEs and effort before 1988 are less reliable.

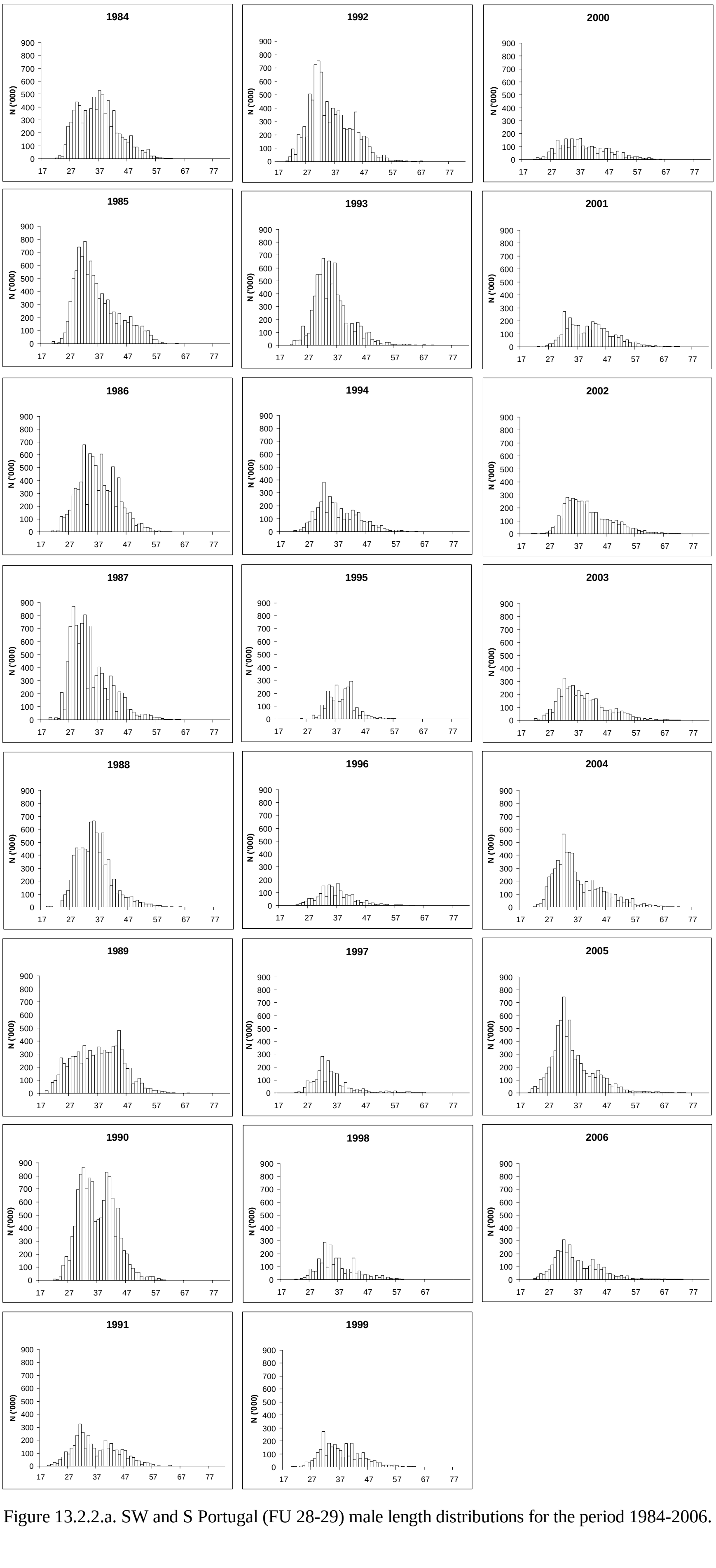


Figure 13.2.2.a. SW and S Portugal (FU 28-29) male length distributions for the period 1984-2006.

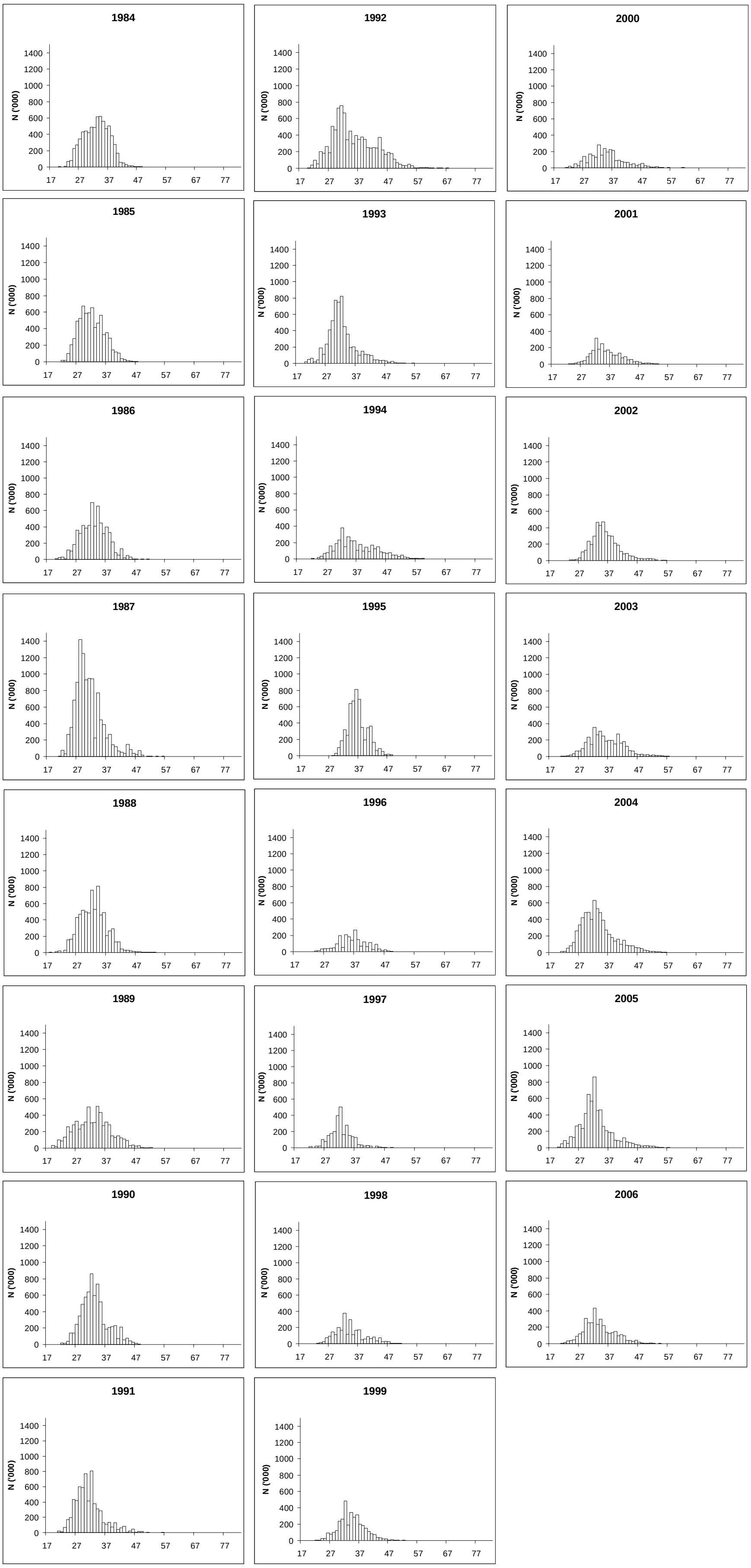


Figure 13.2.2.b. SW and S Portugal (FU 28-29) female length distributions for the period 1984-2006.

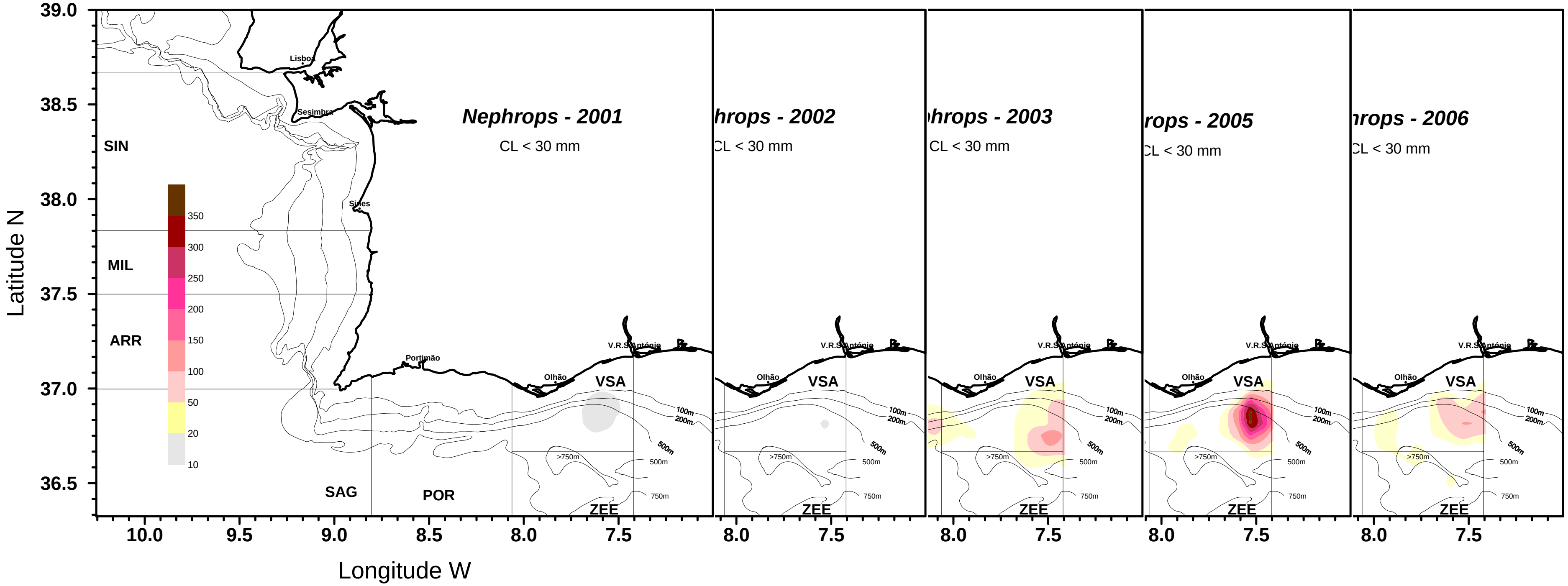


Figure 13.2.3. Distribution of number/hour of *Nephrops* with carapace length < 30 mm in the area of concentration of juveniles. Source: Crustacean surveys, 2001-2006. Data from 2004 are not reliable due to malfunctioning of the gear.

Table 13.3.1 Nephrops in FU 30 (Division IXa Gulf of Cádiz).
Landings in tonnes by Functional Unit

	FU 30		
	Spain	Portugal	Total
Year	Trawl	All gears	
1994	108		108
1995	131		131
1996	49		49
1997	97		97
1998	85		85
1999	120		120
2000	129		129
2001	178		178
2002	247		247
2003	281	4	285
2004	130	4	135
2005	232	3	235
2006	225	4	229

Table 13.3.2 Nephrops in FU 30 (Division IXa Gulf of Cádiz)
Abundance index from Spanish bottom trawl spring surveys (SPS-GFS)

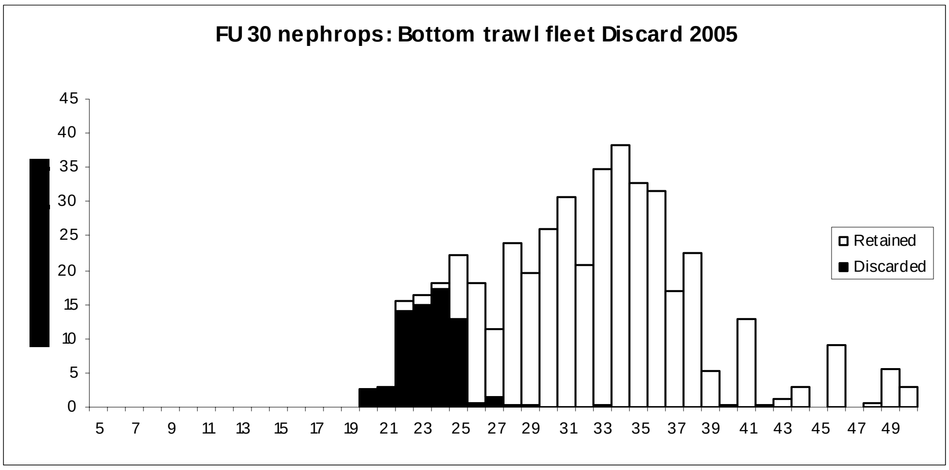
Spanish bottom trawl spring surveys						
	200-500 meters		500-700 meters		200-700 meters	
Year	Kg/60'	Nb/60'	Kg/60'	Nb/60'	Kg/60'	Nb/60'
1993	0.77	19	1.16	34	0.95	26
1994	1.23	31	0.40	8	0.76	18
1995	0.67	10			0.55	8
1996	0.56	10	1.33	29	0.93	19
1997	0.08	2	0.70	23	0.38	12
1998	0.40	16	0.23	7	0.30	11
1999	0.50	15	0.28	7	0.41	12
2000	0.22	7	0.57	15	0.37	10
2001	0.32	8	0.61	14	0.44	11
2002	0.49	17	0.45	11	0.47	14
2003	ns	ns	ns	ns	ns	ns
2004	0.15	5	0.15	4	0.15	5
2005	0.54	18	0.76	25	0.64	21
2006	0.24	6	0.66	20	0.42	12
2007	0.44	16	0.27	9	0.37	13

ns = no survey

Table 13.3.3 Nephrops in FU 30 (Division IXa Gulf of Cádiz) LPUE and effort targeting Nephrops from Spanish bottom trawl fleet

Year	Total landing (tonnes)	*Landing (tonnes)	*LPUE (kg/day)	**Effort (Fishing days)
1994	107.6	90.2	98.6	915
1995	130.6	107.2	99.4	1079
1996	48.5	40.4	88.2	458
1997	97.1	74.7	79.2	943
1998	85.3	50.5	62.2	811
1999	120.2	83.3	66.1	1259
2000	128.9	89.9	60.6	1484
2001	178.4	130.2	67.7	1924
2002	246.6	182.4	74.0	2466
2003	280.6	193.3	78.4	2467
2004	130.4	86.2	42.5	2029
2005	232.0	217.7	52.7	4134
2006	225	211	63.5	3327

*LPUE from landings with at least 10% Nephrops.
*Landing from fishing trips with at least 10% Nephrops
**Effort using LPUE from landings with at least 10% Nephrops



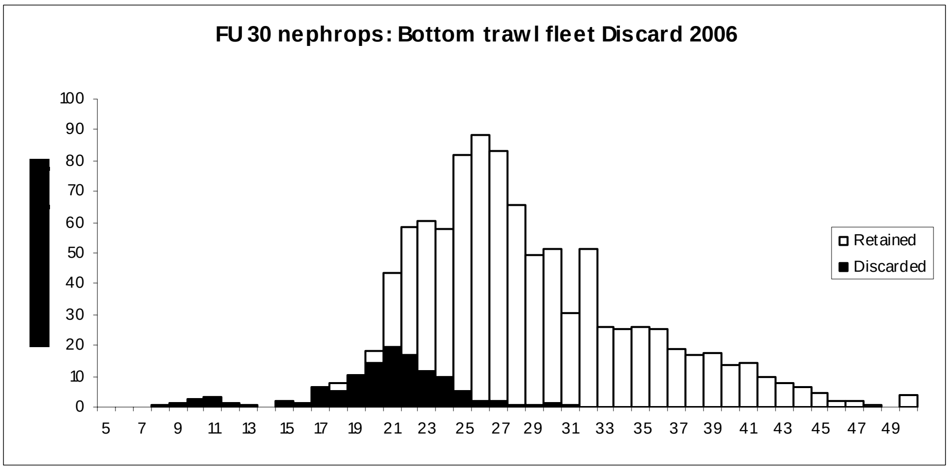


Figure 13.3.1. *Nephrops* in FU 30 (Division IXa – Gulf of Cadiz). Length distribution of retained and discarded fractions (mean number per trip) from *Nephrops* discard surveys in the period 2005-2006.

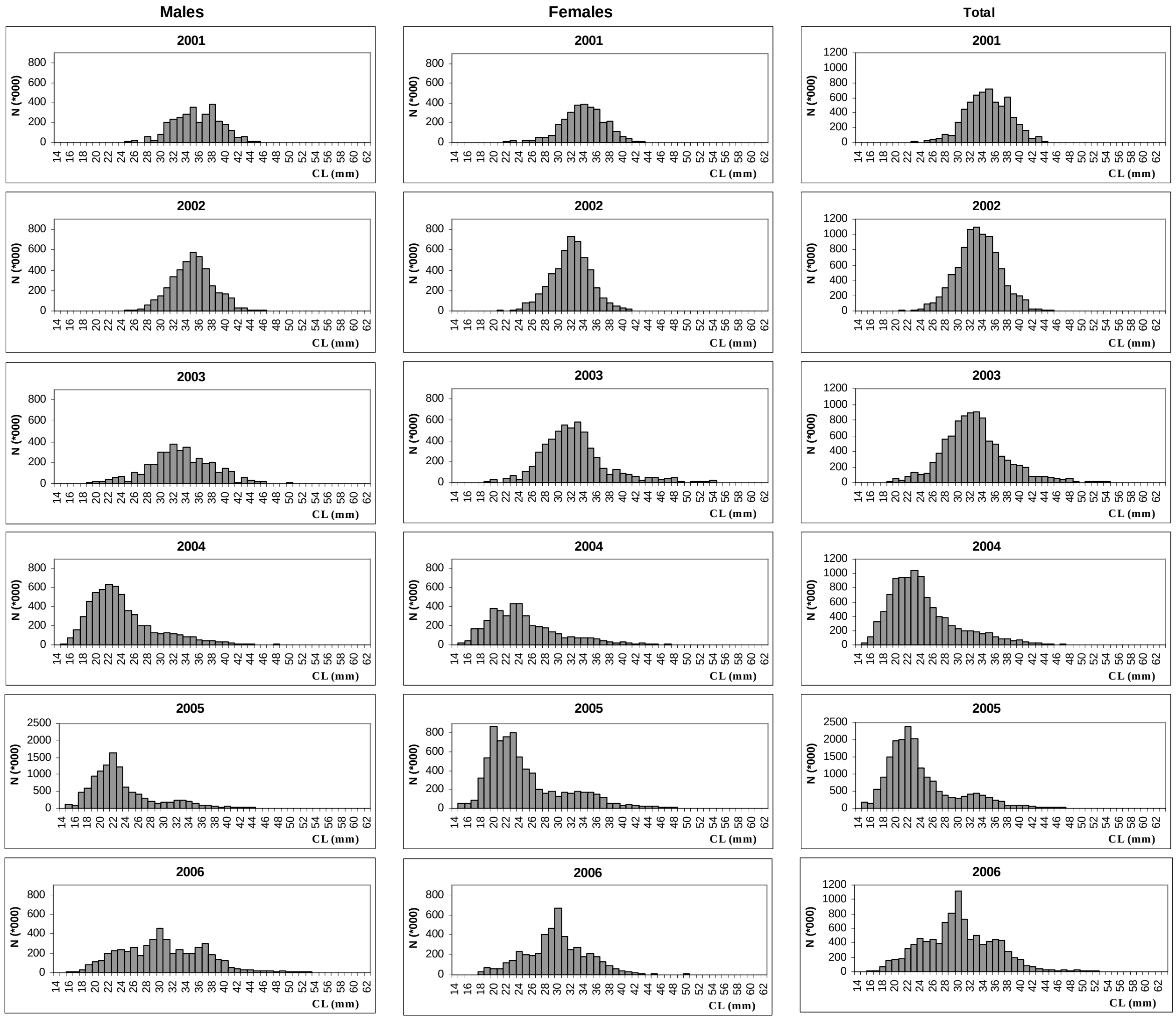


Figure 13.3.2 **Nephrops in FU 30 (Division IXa Gulf of Cádiz). Length distributions of landings from 2001 to 2006**

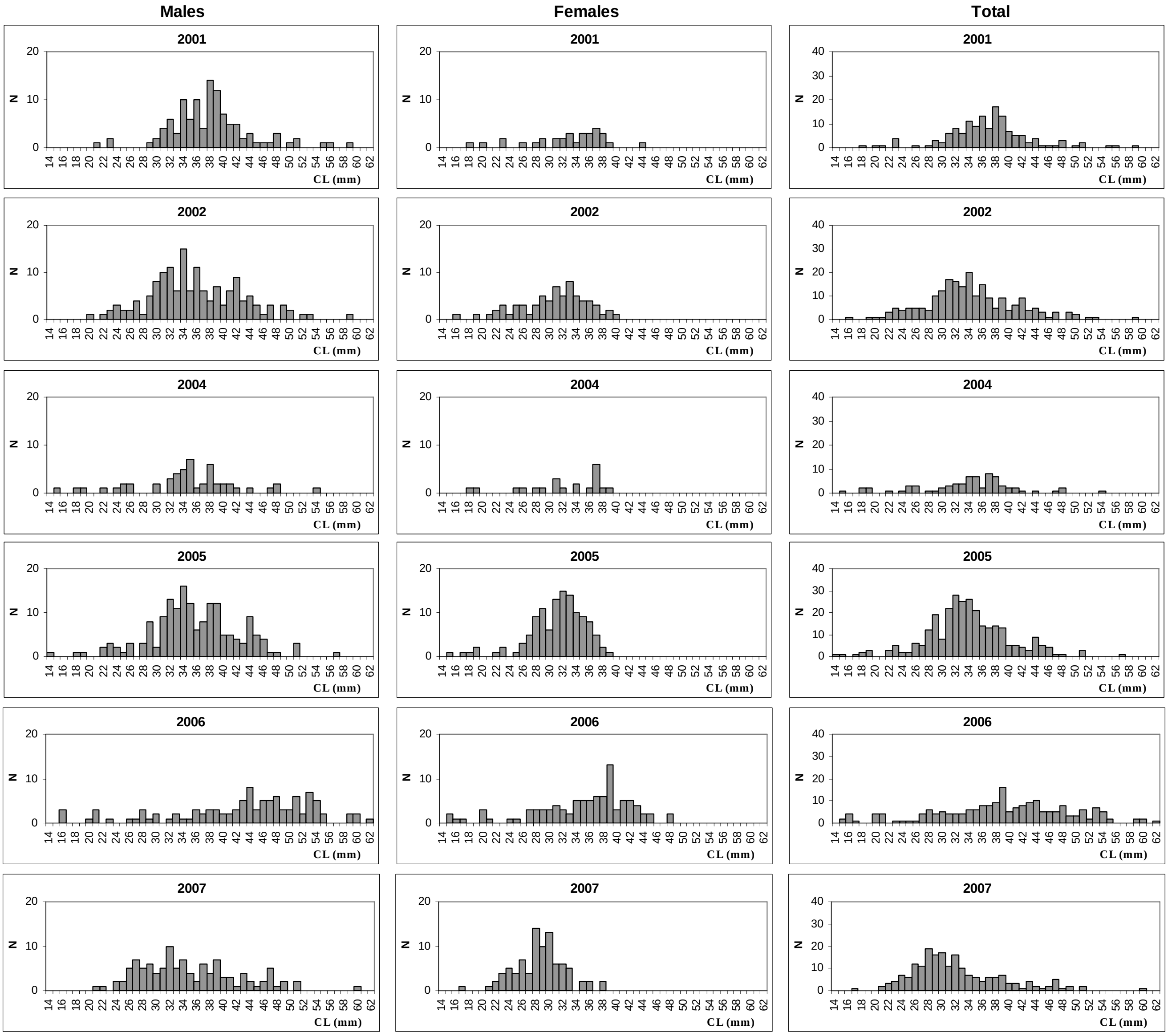
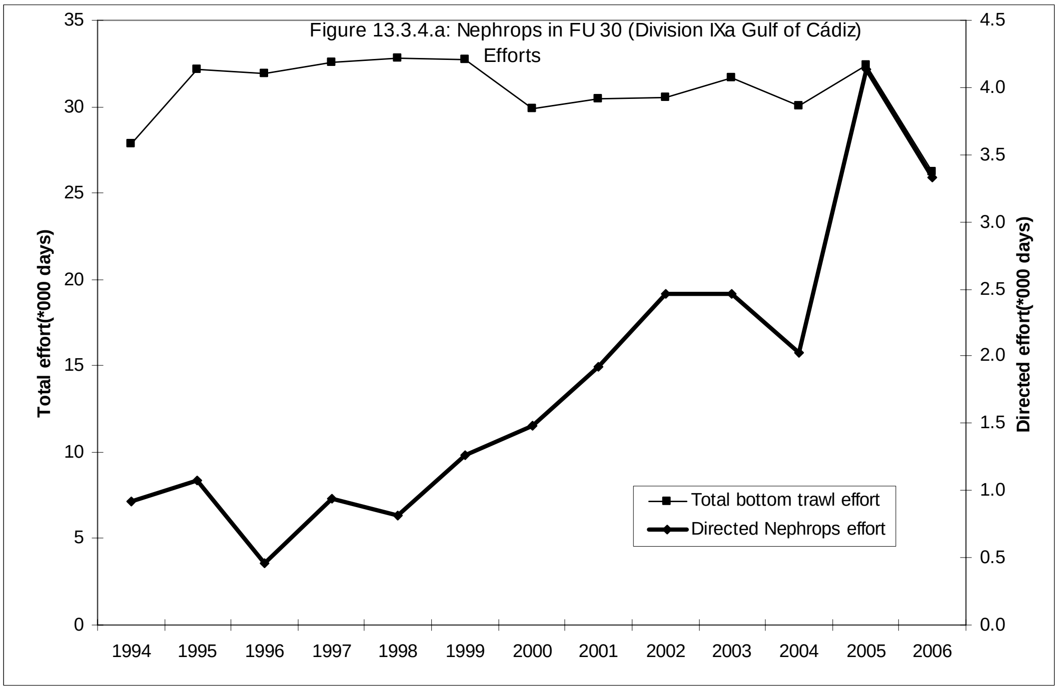
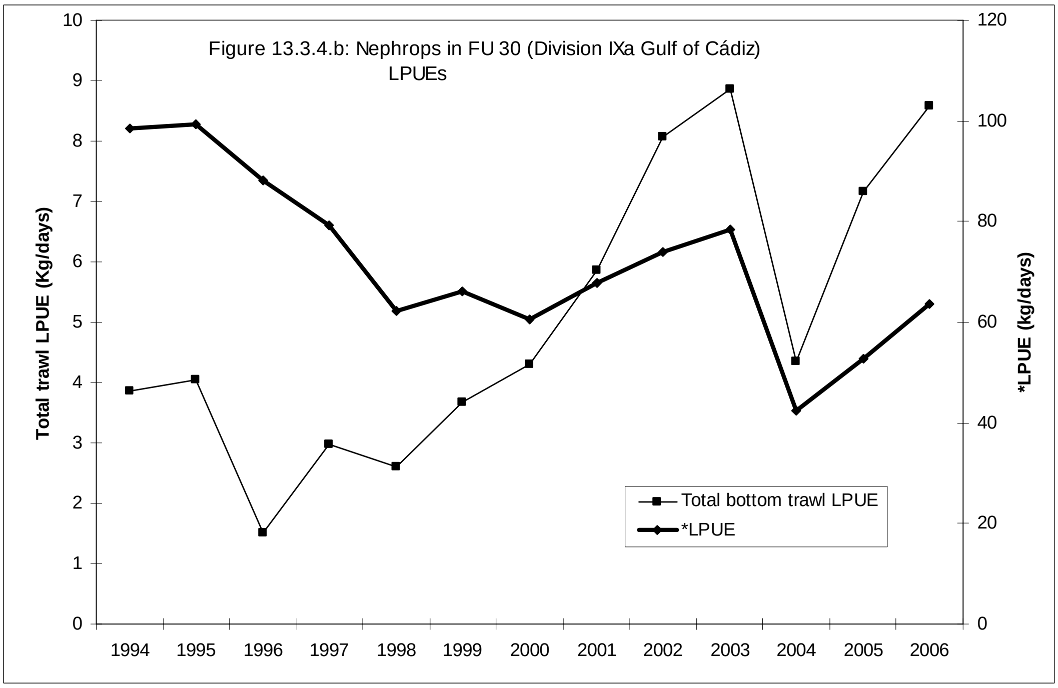


Figure 13.3.3 **Nephrops in FU 30 (Division IXa Gulf of Cádiz)**
Spanish bottom trawl spring surveys (SPS-GFS) length distributions : 2002-2007





Directed Nephrops effort estimated from landings with at least 10% Nephrops in weight
*LPUE estimated from landings with at least 10% Nephrops in weight

Figure 13.3.4ab. Nephrops in FU 30 (Division IXa Gulf of Cádiz). Efforts and LPUE from Spanish bottom trawl fleet (*LPUE estimated from landings with at least 10% Nephrops in weight)

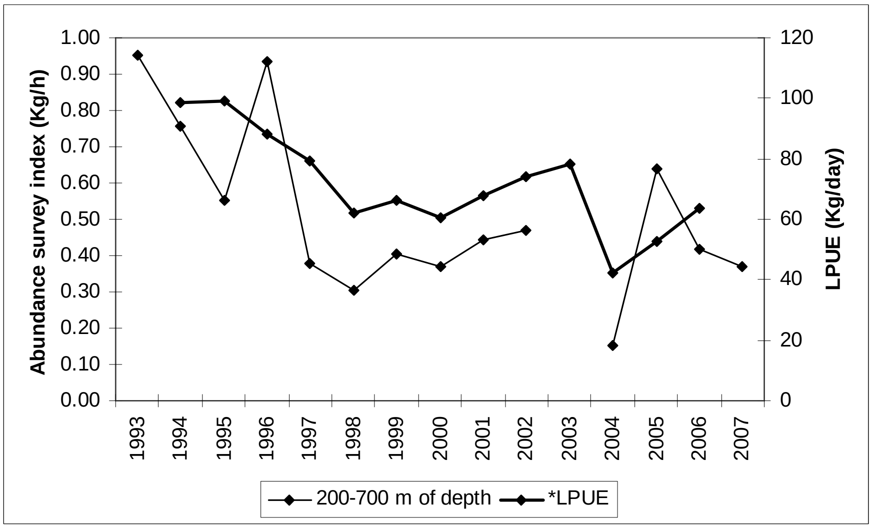


Figure 13.3.5 Nephrops in FU 30 (Division IXa Gulf of Cádiz).Abundance index from Spanish bottom trawl spring surveys (SPS-GFS) and commercial *LPUE from bottom trawl fleet.

14 References

Afonso-Dias, I.P. and J.R.G. Hislop, 1996. The reproduction of anglerfish *Lophius piscatorius* Linnaeus from the north-west coast of Scotland. Journal of Fish Biology 49: 18-39.

Alcázar, J., Carrasco, F., Llera, E., Menéndez, M., Ortea, J., and Vizcaíno, A., 1983. Recursos pesqueros de Asturias 3: Biología, dinámica y pesca de la merluza en Asturias. Consejería de Agricultura y Pesca del Principado de Asturias, Gijón, Spain. 135 pp.

Alheit, J. and Pictcher, T.J., 1995. Hake: Biology, fisheries and markets. Fish and Fisheries series. Chapman & Hall, London

Azevedo, M., 2006. Bayesian estimation of the key parameters of a fish population. *In* Bayesian Statistics and Its Applications. (S.K. Upadhyay, U. Singh and D.K. Dey, eds.). Anamaya Publishers, New Delhi, India: 17-35.

Azevedo, M and Cardador, F. 2006. Hake CPUE conversion factor from bottom trawl CAR into bottom trawl NCT, WD6.ICES CM 2006/ACFM: 29

Bellido, J.M., Pérez, N., Castro, J., and Araujo, H., 2003. Some insights on a possible *métiers* definition of the North coast Spanish demersal fishery by using total catch data. Working Paper No. 4 in 2003 WGHMM (ICES CM 2004/ACFM02).

Begley, J. and Howell, D. 2004. An overview of Gadget, the globally applicable Area-Disaggregated General Ecosystem Toolbox. ICES CM 2004/FF:13

Bertignac, M. and de Pontual, H., 2007. Consequences of bias in age estimation on assessment of the northern stock of European hake (Merluccius merluccius) and on management advice – ICES Journal of Marine Science, 64 (in print).

BIOSDEF, 1998. Biological Studies on Demersal Species (BIOSDEF) (Ref.: EU DG XIV Study Contract: 95/038): finished in 1998. Growth and reproduction information was collected and analysed for hake, anglerfish, and megrim in Subarea VII, Div. VIIIa,b,d and Div. VIIIc & IXa.

Cardador, F., 1995. Factors influencing the distribution and abundance of hake (Merluccius merluccius) in the Portuguese waters (ICES Div. IXa) based on groundfish surveys data. ICES CM 1995/G:20, 14pp

Cardador, F., Azevedo, M. and Jardim, J.E., 2006. A preliminary attempt to evaluate the recovery plan for the southern stock of hake (Divisions VIIIc and IXa). Working Document presented at the Study Group on Management Strategies – SGMAS- 23-27 January 2006 – Copenhagen.

Casey, J and Pereiro, J., 1995. European Hake (M. merluccius) in the North-east Atlantic. In: Hake : Biology, Fisheries and markets. 125-147, (Chapman & Hall, London. ISBN).

Castillo, A.G.F., Alvarez, P. and Garcia-Vazquez, E., 2005. Population structure of Merluccius merluccius along Iberian Peninsula coast. ICES J. Mar. Sci., 62: 1699-1704.

Castro, J. and Punzón, A., 2005. Pelagic *métiers* of the Northern Spanish coastal bottom trawl fleet. *WD04/05 in 2005 ICES WGMHSA* (ICES CM 2006/ACFM:08).

Cisternas, R., 1867. Catálogo de los peces comestibles que se crían en las costas del Mediterráneo y en los ríos y lagos de la provincia de Valencia.

Cunha, M.E., 1993. Spatial variation of the zooplankton biomass over the Portuguese continental shelf. ICES Doc. C.M. 1993/L:62, 7pp.

Duarte, R., Azevedo, M., Landa, J. and P. Pereda., 2001. Reproduction of anglerfish (*Lophius budegassa* Spinola and *Lophius piscatorius* Linnaeus) from the Atlantic Iberian coast. Fisheries Research 51: 349-361.

Duarte, R., Bruno, I., Quincoces, I., Fariña, A.C. and Landa, J., 2004. Morphometric and meristic study of white and black anglerfish (*Lophius piscatorius* and *L. budegassa*) from the south-west of Ireland to the south-western Mediterranean. ICES 2004 Annual Science Conference, Vigo (Spain). ICES CM 2004/EE: 22.

Duarte, R. and Cardador F., 2006. First approach to describe Portuguese Artisanal fleet components. Working Document presented to the WGHMM meeting, Bilbao, 9-18 May, 2006.

EC, 2006. EU Data Collection Regulation, 1543/2000 establishing a Community framework for the collection and management of data needed to conduct the CFP. Training workshop on fleet-based approach. Nantes, France, 13-17 March 2006.

Fariña, A.C., Duarte, R., Landa, J., Quincoces, I. and Sánchez, J.A., 2004. Multiple stock identification approaches of anglerfish (*Lophius piscatorius* and *L. budegassa*) in western and southern European waters. ICES 2004 Annual Science Conference, Vigo (Spain). ICES CM 2004/EE: 25.

Gessan, 2002. Genetic characterisation and stock structure of the two species of anglerfish (*Lophius piscatorius* and *L. budegassa*) of the north Atlantic. Ref.: EU DG XIV Study Contract: 99/013.

Hislop, J. R. G., Gallego, A., Heath, M. R., Kennedy, F.M., Reeves, S.A. and Wright., P.J., 2001. A synthesis of the early life history of the anglerfish, *Lophius piscatorius* (Linnaeus, 1758) in northern British waters. ICES Journal of Marine Science 58: 70-86.

ICES, 1991. Report of the ICES Working Group on Fisheries Units in Sub-areas VII and VIII. ICES CM, 1991/Assess:24.

ICES, 2003. Report of the Study Group on the Development of Fishery-based Forecasts. ICES CM 2003/ACFM:08 Ref. D.

ICES, 2004a. Report of the Working Group on the Assessment of Southern Stocks of Hake Monk and Megrim (WGHMM). ICES CM 2004/ACFM:02.

ICES, 2004b. Report of the Working Group on Nephrops Stocks (WGNEPH). Lisbon, Portugal, 28 March – 1 April 2004. ICES CM 2004/ACFM:19.

ICES, 2005. Report of the Working Group on the Assessment of Southern Stocks of Hake Monk and Megrim (WGHMM). ICES CM 2005/ACFM:02.

ICES, 2006a. Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim (WGHMM). Bilbao, Spain, 9 - 18 May 2006. ICES CM 2006/ACFM:29, 800 pp.

ICES, 2006b. Report of the Workshop on Nephrops Stocks (WKNEPH). ICES CM 2006/ACFM:12,

ICES 2007a. Report of the Workshop on Discard Raising Procedures (WKDRP). ICES CM 2007. ACFM:06. 55p

ICES, 2007b. Report of the Workshop on Sexual Maturity Sampling (WKMAT), *ICES CM 2007*/ACFM: 03, 85pp.

Inada, T., 1981. Studies on the Merluccidae fishes. Bull. Far Seas Fish. Res. Lab. 18, 172 pp.

Jardim, E. and Azevedo, M., 2006. FLEDA: Exploratory Data Analysis for FLR. http://flr-project.org/doku.php?id=pkg:fleda

Jiménez, M.P., Sobrino, I. and Ramos, F., 2004. Objective methods for defining mixed-species trawl fisheries in Spanish waters of the Gulf of Cadiz. *Fish. Res.* **67**: 195-206.

Kaufman, L. and Rousseeuw, P. J., 1990. Finding Groups in Data: An Introduction to Cluster Analysis. A Wiley-Interscience Publication. John Wiley & Sons, Inc. New York.

Lart, W. (co-ordinator), 2002. Monitoring of discarding and retention by trawl fisheries in Western Waters and the Irish Sea in relation to stock assessment and technical measures. Final Report. Contract Ref. 98/095.

Mattiucci, S., Abaunza, P., Ramadori, L. and Nascetti, G., 2004. Genetic identification of Anisakis larvae in European hake from Atlantic and Mediterranean waters for stock recognition. Journal of Fish Biology, 65(2): 495-510

Pérez, N., and Pereiro, F. J., 1985. Aspectos de la reproducción de merluza (Merluccius merluccius L.) de la plataforma gallega y cantábrica. Bol. Inst. Oceanogr., 2: 39–47.

Piñeiro, C. and Saínza, M., 2003. Age estimation, growth and maturity of the European hake (Merluccius merluccius (Linnaeus, 1758)) from Iberian Atlantic waters. ICES Journal of Marine Science, 60: 1086-1102.

Piñeiro, C. and Sainza, M. 2005. Report of the 4th Workshop on European Hake Age reading. WD presented to the 2005 WGHMM, ICES CM 2006/ACFM:01

Prager, M. H., 1994. A suite of extension to a non-equilibrium surplus-production model. Fish. Bull. 92: 374-389.

Prager, M. H., 2004. User's manual for ASPIC: A Stock-Production Model Incorporating Covariates (ver.5) And Auxiliary Programs. NMFS Beaufort Laboratory Document BL-2004-01, 25pp.

Punt, A.E. and Hilborn, R., 2001. Bayes-SA. Bayesian stock assessment methods in fisheries-user'smanual. FAO Computerized Information Series (Fisheries). No 12, Rome FAO. 56pp.

Punzón, A.; G. Costas; R. Gancedo; and R. Morlán (2001) Segmentation of the mixed baca trawl fishery that exploits demersal resources in the Cantábrico (ICES Division VIIIc). ICES CM 2001/Q:19.

Quincoces, I., Santurtún, M. and Lucio, P., 1998. Biological aspects of white anglerfish (*Lophius piscatorius*) in the Bay of Biscay (ICES Division VIIIa, b,d), in 1996–1997. ICES Doc. CM 1998/O:48: 29 pp.

Quincoces, I., 2002. Crecimiento y reproducción de las especies *Lophius budegassa* Spinola1807, y *Lophius piscatorius* Linneo 1758, del Golfo de Vizcaya. PhD Thesis. Basque Country University. 276pp.

Ramos, F., Sobrino, L. and Jiménez, M. P., 1997. Cartografiado temático de los caladeros de la flota de arrastre en el Golfo de Cádiz. Publicación de la Junta de Andalucía. Consejería de Agricultura y Pesca, 45/96, 44pp.

Sánchez, F. and Gil, J., 1999. Hydrographic mesoscale structures and Poleward Current as a determinant of hake (Merluccius merluccius) recruitment in southern Bay of Biscay. ICES Journal of Marine Science, 57: 152–170.

Sánchez, R., Sánchez, F. and Gil, J., 2003. The optimal environmental window that controls hake (Merluccius merluccius) recruitment in the Cantabrian Sea. ICES Marine Science Symposia, 219, 415-417

Silva, L., Gil, J., and Sobrino, I. 2002. Definition of fleet components in the Spanish artisanal fishery of the Gulf of Cadiz (SW Spain ICES Division IXa). *Fish. Res.* **59**: 117-128.

Silva, C. and Cardador F., 2006. Portuguese Trawl Fishery: Basis for a fleet/fishery segmentation. Working Document presented to the WGHMM meeting, Bilbao, 9-18 May, 2006.

STECF, 1994. Report of the Southern Hake Task Force. Lisbon, 10-14 October 1994. SEC(94)2231.

STECF, 2002. Report of the Subgroup on Resource Status (SGRST) of the Scientific, Technical and Economic Committee for Fisheries (STECF). Mixed Fisheries. Brussels, 22-26 October 2002.

STECF, 2003. Report of the STECF meeting on Hake Technical Measures. Lisbon, 27-31 October 2003.

Velasco, F. and Olaso, I., 1998. European hake Merluccius merluccius (L., 1758) feeding in the Cantabrian Sea: seasonal, bathymetric and length variations. Fisheries Research 38, 33-44.

Velasco, F., Olaso, I. and Sánchez, F., 2003. Annual variations in the prey of demersal fish in the Cantabrian Sea and their implications for food web dynamics. ICES Marine Science Symposia, 219, 408-410.

Velasco, F., Silva, L. and Sobrino, I. 2003. Exploring the hake Fishery in the Gulf of Cadiz: available information to perform a stock assessment. *Working Document presented at the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim 2003* [WD11].

Annex A: List of Participants and Working Documents

WGHMM, Vigo, Spain

8 - 17 May 2007

NAME	ADDRESS	TELEPHONE	FAX	E-MAIL
Esther Abad (part-time)	IEO Centro Oceanográfico de Santander Apdo 240 E-39080 Santander Spain	+34 942 291 060	+34 942 275 072	esther.abad@st.ieo.es
Manuela Azevedo (chair)	IPIMAR Av. Brasília, 1449-006 Lisboa Portugal	+351 213027000	+351213025948	mazevedo@ipimar.pt
Michel Bertignac	Sciences et Technologies Halieutiques IFREMER Centre de Brest BP 70 29280 Plouzane France	+33 298 224 525	+33 298224 653	michel.bertignac@ifremer.fr
Gérard Biais	IFREMER Station de La Rochelle, BP 7 17137 L Houmeau France	+ 33 546 500 661	+33 546 500 650	gerard.biais@ifremer.fr
José Castro	IEO Centro Oceanográfico de Vigo Cabo Estay - Canido Apdo 1552 E-36200 Vigo Spain	+34 986 492111	+34 986 498626	jose.castro@vi.ieo.es
Santiago Cerviño	IEO Centro Oceanográfico de Vigo Cabo Estay - Canido Apdo 1552 E-36200 Vigo Spain	+34 986 492111	+34 986 498626	Santiago.cervino@vi.ieo.es
Rafael Duarte	IPIMAR Av. Brasília, 1449-006 Lisboa Portugal	+351 213027000	+351213025948	rduarte@ipimar.pt

NAME	ADDRESS	TELEPHONE	FAX	E-MAIL
Carmen Fernandez	IEO Centro Oceanográfico de Vigo Cabo Estay - Canido Apdo 1552 E-36200 Vigo Spain	+34 986 492111	+34 986 498626	carmen.fernandez@vi.ieo.es
Spyros Fifas	IFREMER STH/LBH, Centre de Brest B.P. 70 29280 Plouzané France	+33298224378	+33298224653	Spyros.Fifas@ifremer.fr
Dorleta Garcia	AZTI Txatxarramendi Ugartea, z/g 48395 Sukarrieta Bizkaia (SPAIN)	+34946029400	+34946870006	dgarcia@suk.azti.es
Ane Iriondo	AZTI Txatxarramendi Ugartea, z/g 48395 Sukarrieta Bizkaia (SPAIN)	+34946029400	+34946870006	airiondo@suk.azti.es
Ernesto Jardim (part-time)	IPIMAR Av. Brasília, 1449-006 Lisboa Portugal	+351 213027000	+351213025948	ejardim@ipimar.pt
Colm Lordan	Marine Institute Rinville, Oranmore, Co.Galway, IRELAND	+353 91 387200	+353 91387201	colm.lordan@marine.ie
Jean-Claude Mahe (by correspondance)	IFREMER 8, rue François Toullec 56100 Lorient FRANCE	+33297873818	+33297873836	jean.claude.mahe@ifremer.fr
Cristina Morgado	IPIMAR Av. Brasília, 1449-006 Lisboa Portugal	+351 213027000	+351213025948	cmorgado@ipimar.pt
Paz Sampedro	IEO Centro Oceanográfico de La Coruna Muelle de Animas s/n E-15001 La Coruña Spain	+ 34 981 205 362		paz.sampedro@co.ieo.es

NAME	ADDRESS	TELEPHONE	FAX	E-MAIL
Mª Angeles Torres	IEO Centro Oceanográfico de La Coruna Muelle de Animas s/n E-15001 La Coruña Spain	+ 34 981 205 362		marian.torres@co.ieo.es
Marina Santurtun	AZTI Txatxarramendi Ugartea, z/g 48395 Sukarrieta Bizkaia (SPAIN)	+34946029400	+34946870006	msanturtun@suk.azti.es
Cristina Silva	IPIMAR Av. Brasília, 1449-006 Lisboa, Portugal	+351 213027000	+35121302594 8	csilva@ipimar.pt
Luis Silva	IEO Unidad de Cádiz Campus Río SanPedro (CAYTMAR); Avd. República Saharaui s/n. 11510 Puerto Real, (Cádiz)	+34956360162 90	+34956360164 15	Luis.silva@cd.ieo.es
Sarah Walmsley	Cefas Lowestoft Lab, Pakefield Rd, Lowestoft, Suffolk, NR33 0HT,UK	+44150252779 0	+44150252659 0	Sarah.walmsley@cefas.co.uk

Working Documents presented to the WGHMM 2007 meeting

WD1

Castro, J., Marín, M., Punzón, A., Abad, E., Silva, L., Santurtún, M. and Quincoces, I., 2007. *Métiers* of the Northern Spanish coastal bottom trawl fleet.

A non-hierarchical cluster analysis was used to classify the Spanish bottom trawl fleet operating in the ICES Divisions VIIIc and IXa North between 2003 and 2005. A classification of individual trips based on the species composition of landings from logbooks was made separately for the bottom otter trawl and the bottom pair trawl fleets. Up to four catch profiles were identified in the bottom otter trawl fleet: 1) targeting horse mackerel, 2) targeting mackerel; 3) targeting blue whiting; and 4) targeting a mixed of demersal species as hake, megrim, monk, and *Nephrops*. The bottom pair trawl fleet showed two catch profiles: 1) around 90% of trips targeting blue whiting; and 2) trips targeting mackerel. As a result, taking into account the knowledge of the fishery and the sampling limitations 3 métiers are proposed to split the OTB fleet, while no reasons to disaggregate the PTB fleet were found.

WD2

Abad, E., Punzón, A., Castro, J., Marín, M. and Silva, L., 2007. *Métiers* of the Northern Spanish coastal fleet using fixed gears.

Logbooks from the set longline and set gillnet fleets operating in ICES Divisions VIIIc and IXa North during the 2003-2005 period were analyzed in order to identify métiers with specific catch profiles. The CLARA method, a non-hierarchical cluster analysis, was used to classify the fishing trips. From the resulting clusters in set longline fleet, only 4 métiers were found to be consistent enough through the time series: 1) targeting conger, 2) targeting hake, 3) targeting pollack, and 4) targeting seabass. Regarding the set gillnet fleet, 2 significant métiers were found: 1) targeting hake and 2) targeting monkfish.

WD3

Silva, C. and Murta, A., 2007. Classification of the Trawl and Purse Seine fishing trips in the Portuguese Continental Waters.

The Portuguese trawl fleet comprises a trawl fleet fishing for fish and a trawl fleet fishing for crustaceans. The fish trawl fleet operates off the entire coast while the crustacean trawl fleet operates mainly in deeper waters of the southwest and south Portugal, where crustaceans are more abundant. For assessment purposes, the trawl and purse-seine fleets have been considered as single fleets, targeting a variety of species. However, given that different vessels from different fleets catch a variety of species, a fleet-based approach seems the most appropriate framework for fish stock assessment and management. This document discusses the need for a more accurate definition of fleet components in the mixed-species and multi-fleet fisheries of the Iberian Peninsula.

WD4

Duarte, R., Azevedo, M. and Cardador, F., 2007. *Métiers* of the Portuguese multi-gear (artisanal) fleet.

The Portuguese multi-gear (artisanal) fleet operates along the total Portuguese coast (ICES Division IXa) and catch a great diversity of benthonic, demersal and pelagic species (fish, shellfish, cephalopods and crustacean). This fleet contributes to an important part of the total annual landings of demersal fish species, in particular for hake and anglerfish. Vessels of the Portuguese multi-gear fleet operate generally with a range of different gears, including gill and trammel nets, hooks, longlines, traps and pots. Vessels may change fishing gears seasonally what may be related in some areas to seasonal changes in abundance of certain species or groups of species. But many vessels use simultaneously two or more gears in the same area or in different areas, what makes the analysis of fishing trip types and the definition of fleet segments more complex. Vessels mean engine power and mean length indicate that the multi-gear fleet vessels (mean engine power of 200 HP and a mean length of 15 m) are considerably larger than vessels from the small-scale regional fleet (means: 35 HP and 6.5 m) but are smaller compared to the purseine fleet (means: 330 HP and 20 m) and trawl fleet (means: 680 HP and 27 m). The objective of the present WD is to present a fleet segmentation of the Portuguese multi-gear fleet based on the main fishing trip types.

WD5

Silva, L., Castro, J., Punzón, A,, Abad, E., Acosta, J.J. and Marín, M., 2007. *Metiers* of the Southern Atlantic Spanish bottom trawl fleet (Gulf of Cádiz).

The bottom trawl fleet operating in the Division IXa South (Gulf of Cádiz) was classified by using a non-hierarchical cluster, CLARA method. The data bases used in the analysis were based on the vessels logbooks between 2003 and 2005. The fishing trips types obtained by this method were characterized by the species composition of the landings. The results may glimpse the identification of two metiers: a coastal metier targeting caramote prawn, wedge sole and cephalopods, and a deep metier targeting blue whiting, hake and deep rose shrimp. In spite of this, due to the low and different ASW obtained, among other described factors, it is proposed not to disaggregate the bottom trawl fleet in the Gulf of Cadiz.

WD6

Castro, J., Cardador, F., Santurtún, M., Punzón, A., Quincoces, I., Silva, C., Duarte, R., Murta, A., Silva, L., Abad, E. and Marín, M., 2007. Proposal of fleet segmentation for the Spanish and Portuguese fleets operating in the Atlantic national waters.

This paper is a resume of the fleet segmentation resulting from the IBERMIX4 project regarding the Spanish and Portuguese fleets operating in National waters. However, the métier level obtained must be aggregated up to the Nantes matrix level 5 (fishing activity regional level), which will be established as sampling level in the new DCR.

WD7

Pérez Contreras, N., 2007. Why Spanish Discard information is still not available to be used for some Stocks of Southern Shelf WGHMM?

The recent Workshop on Discard Raising Procedures (WKDRP, February 2007) recommended that several raising methods should be applied to data and the results should be compared to determine the most appropriate method. In the case of Spanish discard data, more raising variables are necessary to obtain raised values in order to compare the results and precision between procedures. Logbook effort and landings information are available for 2003 onwards and these could be used to produce discard estimates. However, this analysis has not yet been undertaken. It was decided to wait for the results of this additional analysis, rather than submit incomplete data that may have to be revised.

WD8

Fernandes, A., Barbosa, S., Jardim, E. and Pestana, G., 2007. Discards estimates of *Merluccius merluccius* and *Nephrops norvegicus* for 2004-2006 period for Crustacean and Fish Trawl fleets in IXa Portuguese area.

The Portuguese Discard Sampling Programme started in 2003 and is based on a quasi random sampling of co-operative commercial vessels. Two trawl fleets are sampled in this programme: Crustacean Trawl and Fish Trawl fleets. The total number of trips, performed by each fleet is now being used to estimate discards. This seems to be the best sampling variable to use, once there's no correlation between landings and discards. The method applied is one of the methods suggested during the Workshop on Discard Raising Procedures (ICES 2007). Once it's the first time this method is being used, it will still be validated during 2007. This document presents discards' results for hake (*Merluccius merluccius*) and *Nephrops*. The analysis for hake showed that the Crustacean Trawl fleet discarded less amounts of fish (8-22% of total discards), when compared to the other fleet. The CV's obtained for this estimate ranged between 39-51% for the Crustacean Trawl fleet and between 17-29% for the Fish Trawl fleet. Hake discards accomplished 59%, 64% and 53% (for 2004, 2005 and 2006 respectively) of the total catch in weight. In numbers, the percentages were much higher ranging from 91% in 2004 to 84% in 2006. The analysis for *Nephrops* showed that percentages of discards in weight, in relation to total catch, were of 4% in 2004, 10% in 2005 and 3% in 2006. The discard estimates varied between 7 t in 2006 and 44 t in 2005. The observed CV's were of 18,5%, 35,5% and 76,1% respectively for 2004, 2005 and 2006. The high value of 2006 may be related to a weak discard sampling of Crustacean Trawl fleet in this year.

WD9

Jardim, E., 2007. Southern hake: exploring discards data.

Discards data as been requested for a long time in order to have a clearer view of the fleets' activity. Under several projects and more recently funded by the EU Data Collection Regulation, discards data has been collected for the Spanish and Portuguese trawl fleets since 1994, with some missing years. These data represent an opportunity to better understand the fleets' behaviour and get more information about the population, in particular due to the fact that the discarded age are 0, 1 and 2, due mainly to the minimum landings size. These data also represent more complexity and technical problems. The first of which is how to rebuild the catch matrix to include it. This document explores the data available so far and tries to find correlations with other information available, namely the surveys' indices and the Cadiz landings, which are also focused on younger ages.

WD10

Fifas, S., 2007. Methodological aspects for calculation of discarded catches. Derivation applied on missing years. The *Nephrops* stock in FU23-24 (Bay of Biscay; Management Area N).

French trawlers almost exclusively exploit *Nephrops* in FUs 23-24. The fishery is managed using a TAC together with technical measures, such as MLS and minimum mesh size regulations. For 2005, the TAC was 3100 t, but the total landings reached 3690 t. For 2006, the TAC was 4030 t. The average weight of discards per year between 1987 and 2005 is about 1500 t whereas discards of the recent sampled years (2003-2005) reached a higher level of 2200 t. This change in the amount of discards could a result of recent recruitments or the increase in the MLS (although the change in the gear selectivity should reduce this effect).

Although data on the length distribution of landings has been collected for many years, detailed information on discards is lacking. This document presents estimates of discard length distributions derived using information for available years.

WD11

Morgado, C., Cervino, S., Jardim, E., Azevedo, M. and Chaves, C., 2007. Update Southern Hake Assessment in 2007.

Following the review of the WGHMM 2006, the ICES Review Group asked that the assessment for Southern Hake should be re-run without the Gulf of Cadiz survey tuning index. This working document presents the results of the re-run of the assessment without the survey showing that there are no changes in the perspective of the stock. Also for this year's assessment the following data were revised: 1983 and 1986 Spanish groundfish surveys and new annual maturity ogives. The impact of these revisions is shown. An exploratory analysis carried out with FLEDA package are presented as well as an update assessment using the same options as last year and excluding the Golf of Cadiz survey. In addition, the document presents the results of a Bayesian VPA assessment of the stock.

WD12

Duarte, R., Sampedro, P., Landa, J. and Azevedo, M., 2007. Revision of available data (landings, effort, length frequency distributions and age-length keys) from 1996-2005 for an age-structured assessment of Southern anglerfish stocks.

Southern white anglerfish (*Lophius piscatorius*) and black anglerfish (*L.budegassa*) assessment data were revised for years 1996-2005. The objective of this document is to describe this data revision and to make a summary of all available data.

WD13

Graham, N. and Ó Cuaig, M., 2007. Unaccounted Mortality (UM) of Anglerfish associated with IUU and Ghost Fishing in ICES area VII b-k.

The assessment of both *L. piscatorius* and *L. budgegassa* in ICES areas VII and VIII are largely reliant on commercial catch data and questions relating to their validity have been raised previously (WGHMM, 2007). It is important to identify which sources of unaccounted mortality/removals could be important for anglerfish stocks as failure to account for these components can result in biased assessments. In this paper we provide information on two sources of unaccounted mortality, namely ghost fishing associated with the deep water gillnet fishery and misreporting and underreporting of official catch data from analysis of observed and reported LPUE from Irish data and using the estimate of underreporting associated with the Spanish coastal and Grand sole fleet from Rocha *et al* (2004). In our opinion, these are likely to represent a significant source of bias and underestimation in true levels of removals. However, we do not attempt to estimate the *precise* levels of unaccounted removals but rather on their possible *magnitude*.

WD14

Lordan, C., 2007. Update on the UWTV Survey on the Aran, Galway Bay and Slyne Head *Nephrops* Grounds.

The *Nephrops* fishery 'at the back of the Aran Islands' is the mainstay of the Ros a Mhíl fleet. Sustaining this valuable fishery would be at the heart of any management plan for fisheries in the area. In 2006 the fifth in a series of annual UWTV survey was complete and the results of that survey together with a synthesis and analysis of the results. A geostatistical analysis indicates that burrow densities and abundances have fluctuated considerably in space and time. Highest densities occurred in 2004 with the lowest densities in the 2006 survey. Using the survey directly for assessment and management is not yet possible. However, there appears to a negative relationship between abundance and landings and LPUE in the autumn and a positive relationship between observed densities and landings and LPUE the following spring. Despite the low survey abundance in 2006 there is no serious concern about the stock.

WD15

Smith, M., Warnes, S., Forster, R., Mulligan, B., Whelpdale, P. and Dann, J., 2006. Fisheries Science Partnership: western anglerfish final report.

This report presents the results of FSP 2006/07 Programme 2, carried out on the anglerfish fishing grounds off the SW coast of England during October 2006. The project used the commercial beam trawler *Twilight III* (skipper M. Patterson) to survey the southern part of the survey area from 4 to 6, 8 to 12 and 14 to 17 September. The beam trawler *Billy Rowney* (skipper S. Moseley) surveyed the northern region from 7 to 12 and 23 to 28 September.

WD16

Velasco, F., Landa, J., Fontenla, J., Barrado, J. and Ámez, M. A., 2007. Results on megrim (*Lepidorhombus whiffiagonis*) and anglerfish (*Lophius piscatorius*) from the 2001-2006 Porcupine Bank bottom trawl surveys.

This paper presents the results on megrim (*Lepidorhombus whiffiagonis*) and white anglerfish (*Lophius piscatorius*) of the six years (2001-2006) of the Spanish bottom trawl survey in Porcupine Bank. Total abundances in weight and number, and also by age class of these species are presented and their consistency in following the cohorts along the time series is checked with views to their use as tuning fleet in the assessments of Northern Stocks of both species. Megrim abundance indices maintain a similar level along the six years studied, with small increases in 2003 and 2005. Megrim is mainly distributed at depths shallower than 450 m and around the central mound of the Porcupine bank, and close to the Irish shelf on the easternmost part of the bank. White anglerfish presented an increase in biomass from 2001 to 2004, mainly due to the good recruitment in 2001; in 2005 biomass levels returned to their values before the 2001 recruitment and remained at a similar level in 2006. Recruits and young specimens of this species are found mainly in the same shallower areas as megrim, nevertheless adults migrate to occupy the whole bank and probably they also migrate out and into the bank along their life.

WD17

G. Pestana, Silva C. and Cardador, F., 2007. The scientific role of the two Portuguese surveys.

This document and its annexes present a proposal that the Portuguese surveys *Nephrops* in FU 28+29 (CTVS) and the Groundfish survey for Hake (PESCADA-BD) should be internationally co-ordinated under the IBTS. Both surveys are classed as priority 1, as they provide data important in the assessment of stocks that are under recovery plans (Nephrops FU 28+29 and Hake VIIIc+IXa). The papers have been submitted to the IBTS for consideration and this group asked the WGHMM to discuss the matter and provide recommendations. The documents describe the rationale and need to have the two surveys internationally co-ordinated.

WD18

Chaves, C., Morgado, C. and Cardador, F., 2007. Portuguese groundfish survey for hake: some results from 2005 and 2006.

The Portuguese Groundfish Survey for Hake, began in 2005 and takes place in February/March in Portuguese Continental waters (ICES Div. IXa). The main objective of the survey is to estimate the distribution and abundance of hake during the spawning season. Additionally, data are collected to estimate abundance and biomass indices of the most important commercial species, to estimate biological parameters, maturity, sex-ratio, weight, food habits, and to estimate the length and/or age compositions for the main commercial species. The primary species is hake, with secondary species being horse mackerel, blue whiting, mackerel, Spanish mackerel, anglerfish, megrim and Norway lobster. In this document, the results from the first two years of this survey are described. Hake was found along the entire survey area with similar abundances and biomass indices in both surveys, with 384 ind/h and 18 kg/h in 2005 and 374 ind/h and 16 kg/h in 2006, respectively. The number of males and females sampled was similar during the two surveys (2000 individuals), but a significant difference was seen in the proportion of mature and immature male hake with 70% in 2005 and 37% in 2006. For female, the proportion was the same in both years with 12%.

WD19

Costas, G., Fariña, C., Sampedro, P., Landa, J., Morlán, R., Azevedo, M. and Duarte, R., 2007. CPUE standardization of artisanal gillnet fishery targeting anglerfish in Northwest of Iberian Peninsula.

Lophius piscatorius and *L. budegassa*, are valuable commercial species exploited by artisanal and trawl fleets of the Iberian Peninsula. Overall, for both species and for the total Iberian landings, the artisanal fleet is responsible for about 40% of landings. The Spanish gillnet fleet targeting these species catches approximately 55% of artisanal anglerfish landings. White anglerfish represent 77% of the total landings, with Spain landing 70%. In spite of the importance of the artisanal fishery for these stocks, no abundance index of this fishery has been used in stock assessments. This document presents the result of work to calculate a standardised catch-per-unit-effort (CPUE) series for this fleet.

WD20

Cerviño, S., Silva, L., Sobrino, I. and Pérez, N., 2007. Gulf of Cadiz hake update.

This document presents an update of data available for Gulf of Cadiz hake. Data include: Landings, length distributions, catch-at-age and weight-at-age, abundance and effort trends and maturity information. Trawlers make the majority of catches in this fishery and catches have decreased since 2003. However, the mean length of the catch has increased in the same time period.

WD21

Cerviño, S. and Jardim, E., 2007. XSA sensitivity analysis of F mean in F shrinkage assumption. Effects on Southern Hake assessment.

This document analyzes the effect of XSA shrinkage on Southern hake spawning stock biomass at the beginning of the time series (1982-84). There are reasons to think that F at the last true age in the model (age 7) is higher than the mean of previous Fs (ages 3 to 6). Under these circumstances the model overestimates the SSB in this 3 years.

WD22

Cerviño, S., Taylor, L., Jardim, E., Cardador, F., Velasco, F. and Punzón, A., 2007. A preliminary length based assessment for Southern hake with GADGET.

GADGET is a statistical model that contains a parametric model to simulate the ecosystem, statistical functions to compare the model output to data and search algorithms to optimise the model parameters. This document describes the use of this model to assess Southern hake stocks, using Spanish and Portuguese catch and survey data. Results provide similar trends to those obtained using XSA, though the time series is short.

WD23

Drouineau, H., Bertignac M. and Mahevas, S., 2007. A length-structured model for the European hake.

Collecting data for age-length keys can be very expensive and for European hake, age determination is uncertain. A length-based spatial model would remove the need for age information and would allow account to be taken of the spatial heterogeneities that can lead to bias in assessment models. This document presents the results of a length-based assessment of hake in 5 zones of the northeast Atlantic. Preliminary results are encouraging but show some discrepancies with XSA outputs and estimated growth is slow. Also the model does not explicitly take discards into accounts. However, it is hope that future work will include a discard model and a Bayesian model.

WD24

García, D., 2007. Northern and Southern Hake Recovery Plans: A Preliminary Analysis.

Both Northern and Southern hake are subject to recovery plans. This document describes simulations of the stock until 2040. Results suggest that given the harvest control rules in place for Southern hake, the probability of reaching the target SSB (35 000 t) is 100% from 2016 onwards.

WD25

Azevedo, M. and Duarte, R., 2007. Iberian anglerfish stocks assessed with the Schaefer production model: a Bayesian approach.

The Schaefer production model parameters and associated uncertainty were estimated for the Iberian anglerfish stocks. The stochastic approach was applied to each stock separately, using landings and commercial cpue data for the period 1989-2006. Annual biomass, fishing mortality, MSY reference points and B-ratio and F-ratio trends were estimated by stock. Finally, the Bayesian estimates for each stock were combined to analyse and compare B and F trends with the results from an updated assessment (stocks combined) performed with ASPIC.

WD26

Cardador, F., Azevedo, M. and Jardim, E., 2007. Medium term effects on the Southern Stock of Hake (ICES Divisions VIIIc and IXa) resulting from the application of the recovery plan.

Since 2002 ACFM has recommended for the Southern Stock of Hake (ICES Divisions VIIIc + IXa) that fishing mortality should be zero or if this is not applicable then a recovery plan should be implemented in order to rebuild the spawning stock biomass. In December 2005 a recovery plan was approved and published in 28.12.2005, in the Official Journal of the

European Union (L 345/5, Council Regulation (EC) No 2166/2005 of 20 December 2005). The recovery plan is applied to the Southern stock of hake and to the Norway lobster stocks in ICES Divisions VIIIc and IXa. This Regulation entered into force January 2006. This document describes simulations of the stock using two assessment methods (XSA and a Bayesian VPA). Both approaches suggest that under the current management regulations, SSB will decrease over the entire time period and that the target SSB of 35 000 t will not be reached.

WD27

Cardador, F. and Silva, C., 2007. Short and medium term effects on landings and spawning stock biomass in Norway lobster (*Nephrops norvegicus*) from the Southwest and South of Portugal (FUs 28+29) resulting from the application of the recovery plan.

Iberian *Nephrops* stocks are submitted to a recovery plan since 2006. This is in line with the recommendation from ICES in 2002 (ICES, 2002) for a zero catch or the implementation of a recovery plan. In December 2005, the recovery plan for the southern stock of hake and Iberian *Nephrops* stocks was approved and started in January 2006. The aim of the plan is to rebuild the stocks to safe biological limits within a period of 10 years, through a reduction in fishing mortality of 10% relative to the preceding year. In addition, in order to reduce the fishing mortality of *Nephrops* even further, a 3 and 4-month closed areas in the peak of the fishing season were introduced in FU 26 (West Galicia) and FU 28 (Alentejo), respectively, (Council Regulation (EC) No. 2166/2005). The management advice for *Nephrops* stocks is dependent on the level of exploitation of males which according to their behaviour are subject to higher fishing pressure than females. Under this consideration, in the present study, the evaluation of the effects of the measures of the recovery plan was performed on the population of males.

WD28

Duarte, R., Sampedro, P, Azevedo, M. and Landa, J. 2007. Exploratory data analysis and exploratory XSA assessment for Southern anglerfish in ICES Divisions VIIIc and IXa.

This Working Document presents the results of the exploratory data analysis and exploratory assessment with XSA. The analysis are performed by species separately using the FLR packages FLEDA and FLXSA.

Annex B: Figures

Figure B.1. Spanish commercial fleet LPUEs time series (not used in tuning).

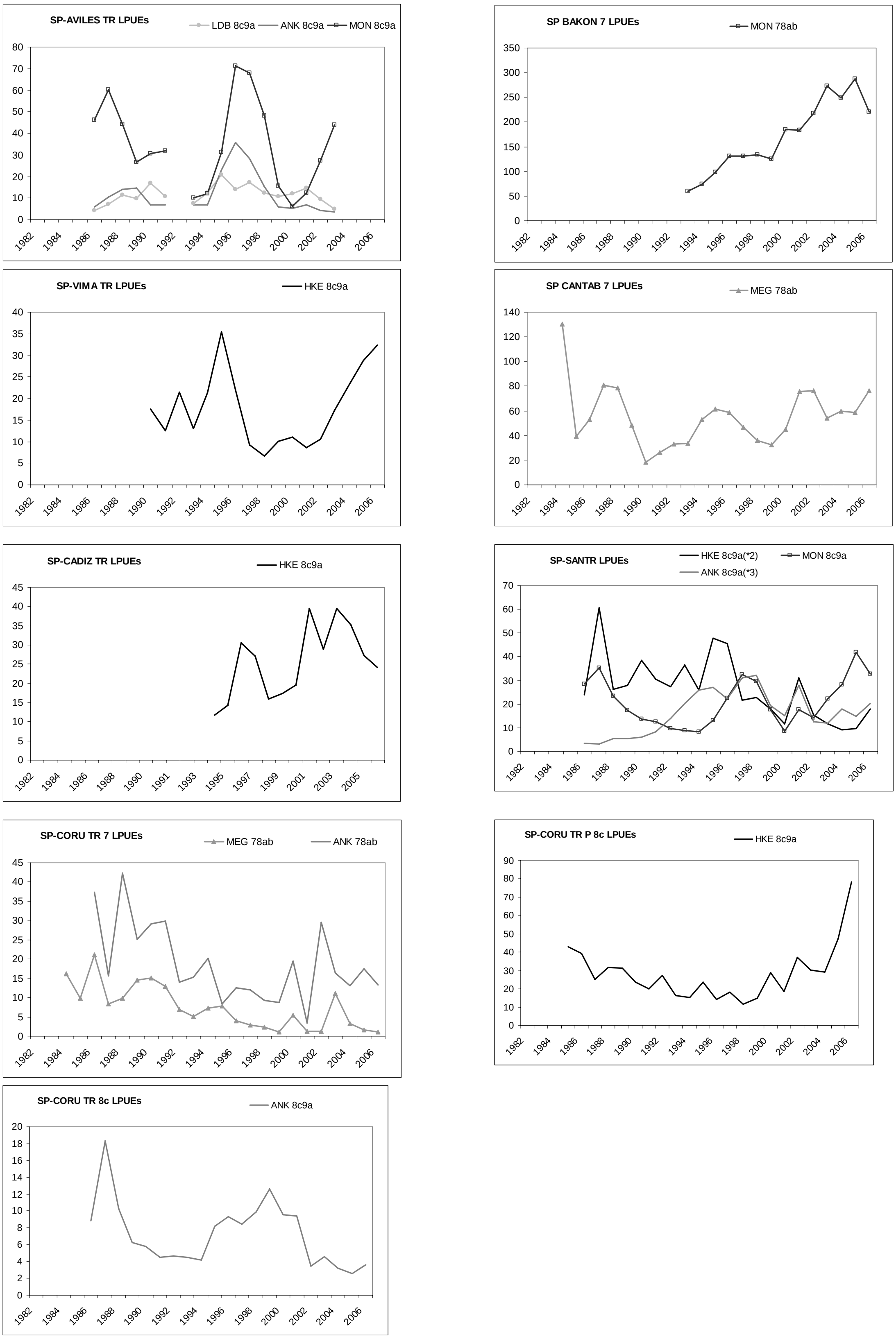


Figure B.2. French commercial fleet LPUEs time series (not used in tuning).

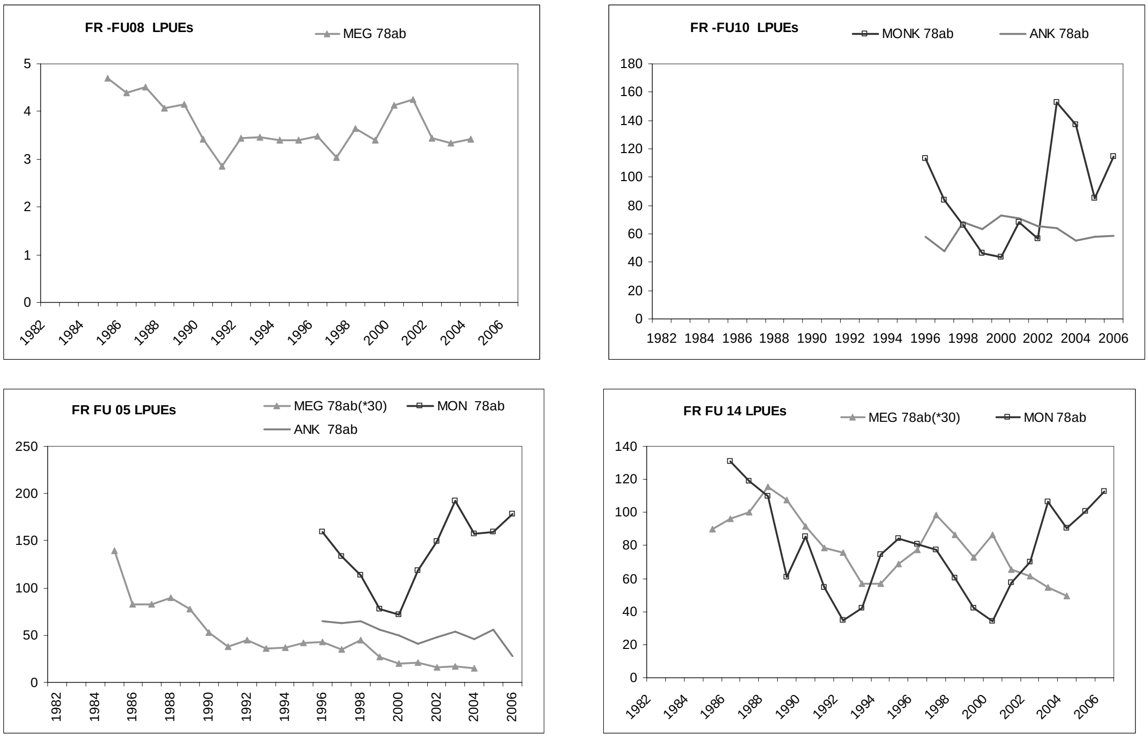


Figure B.3. Portugal commercial fleet LPUEs time series (not used in tuning).

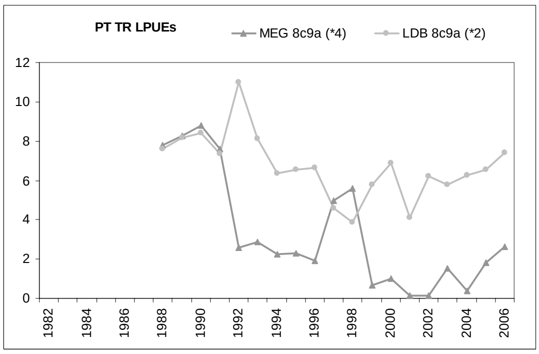


Figure B.4. UK commercial fleet LPUEs time series (not used in tuning).

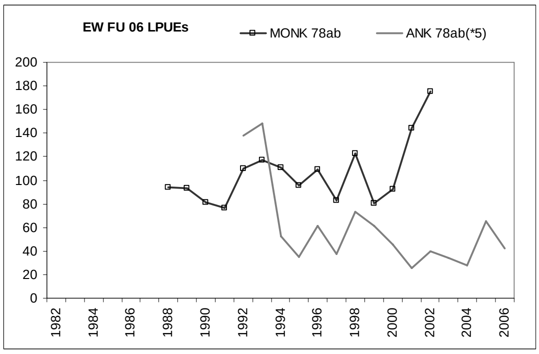
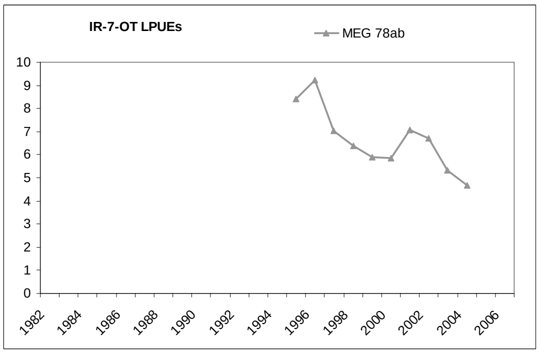


Figure B.5. Irish commercial fleet LPUEs time series (not used in tuning).



Annex C: Northern Hake Figures

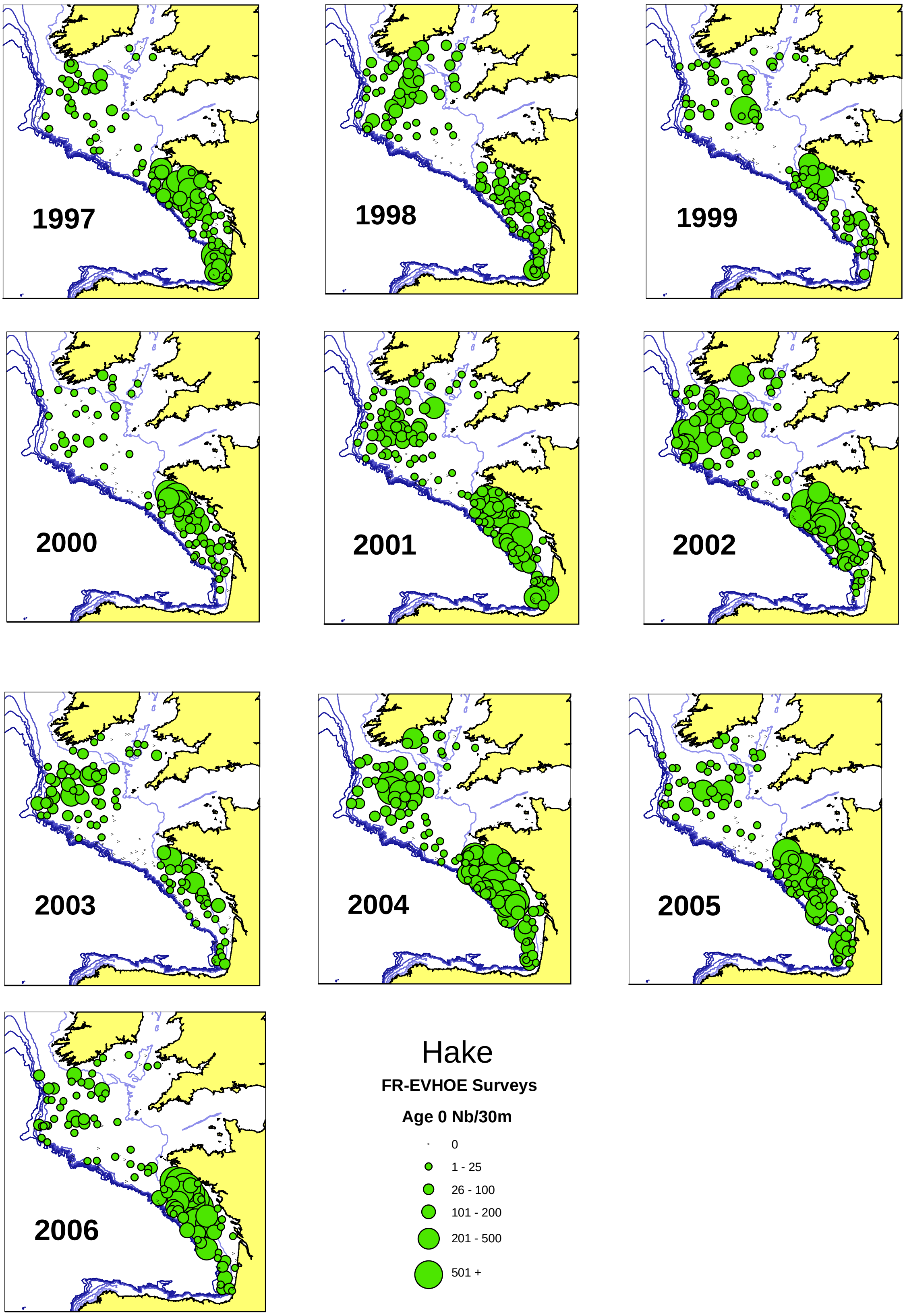


Figure C. 1 . Spatial distribution of Age 0 indices from FR-EVHOES survey from 1997 to 2006

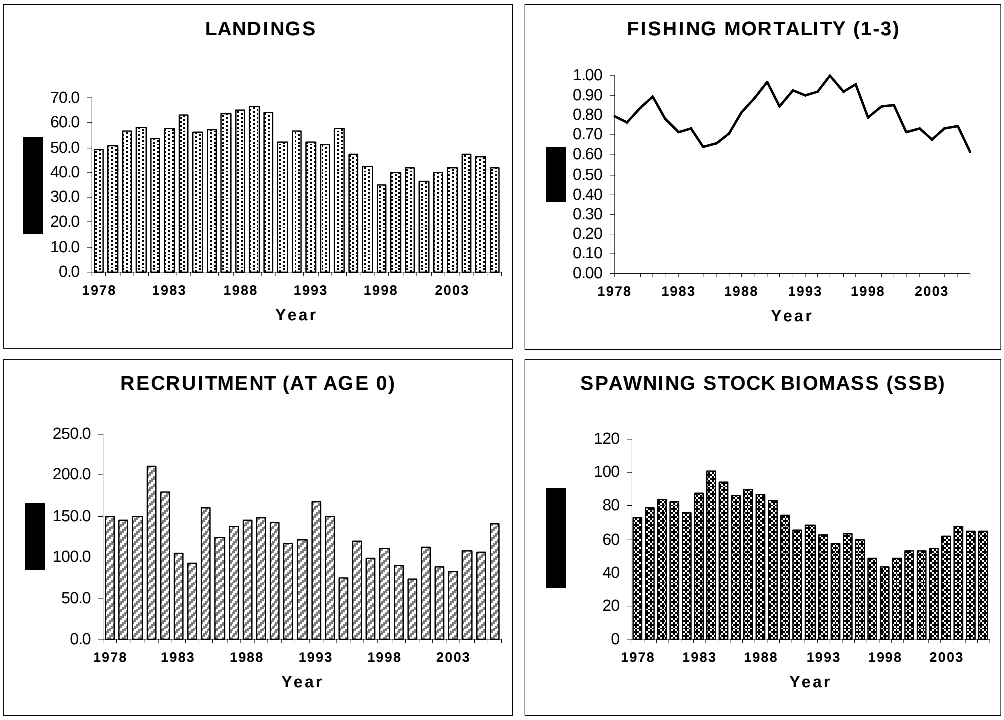


Figure C.2. Northern Hake stock (IIIa, IV, VI, VII, VIIIab) (No Age 0, "Simulated ALK)

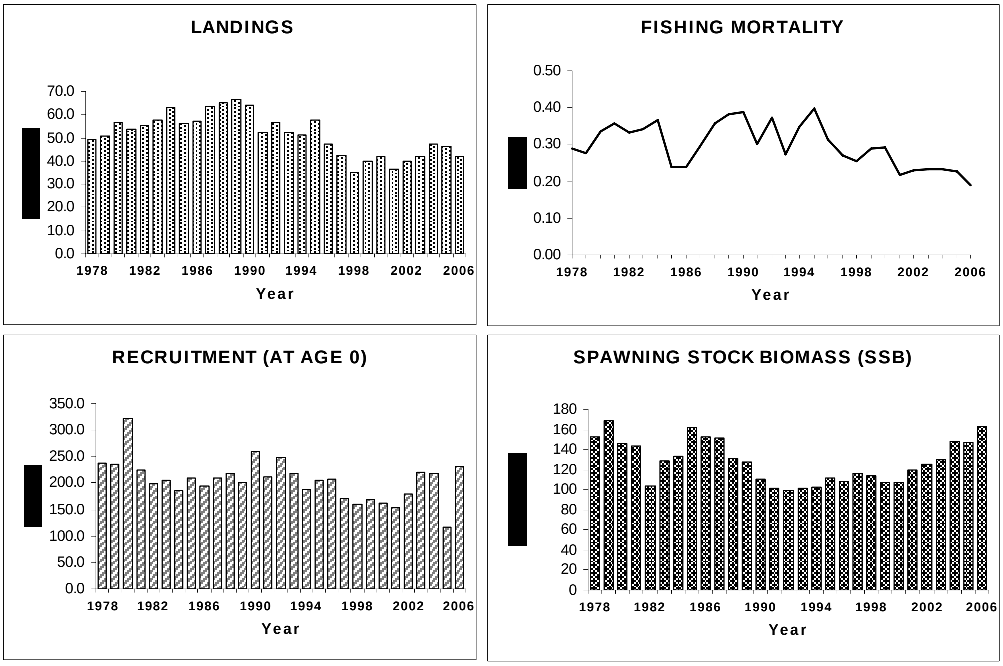
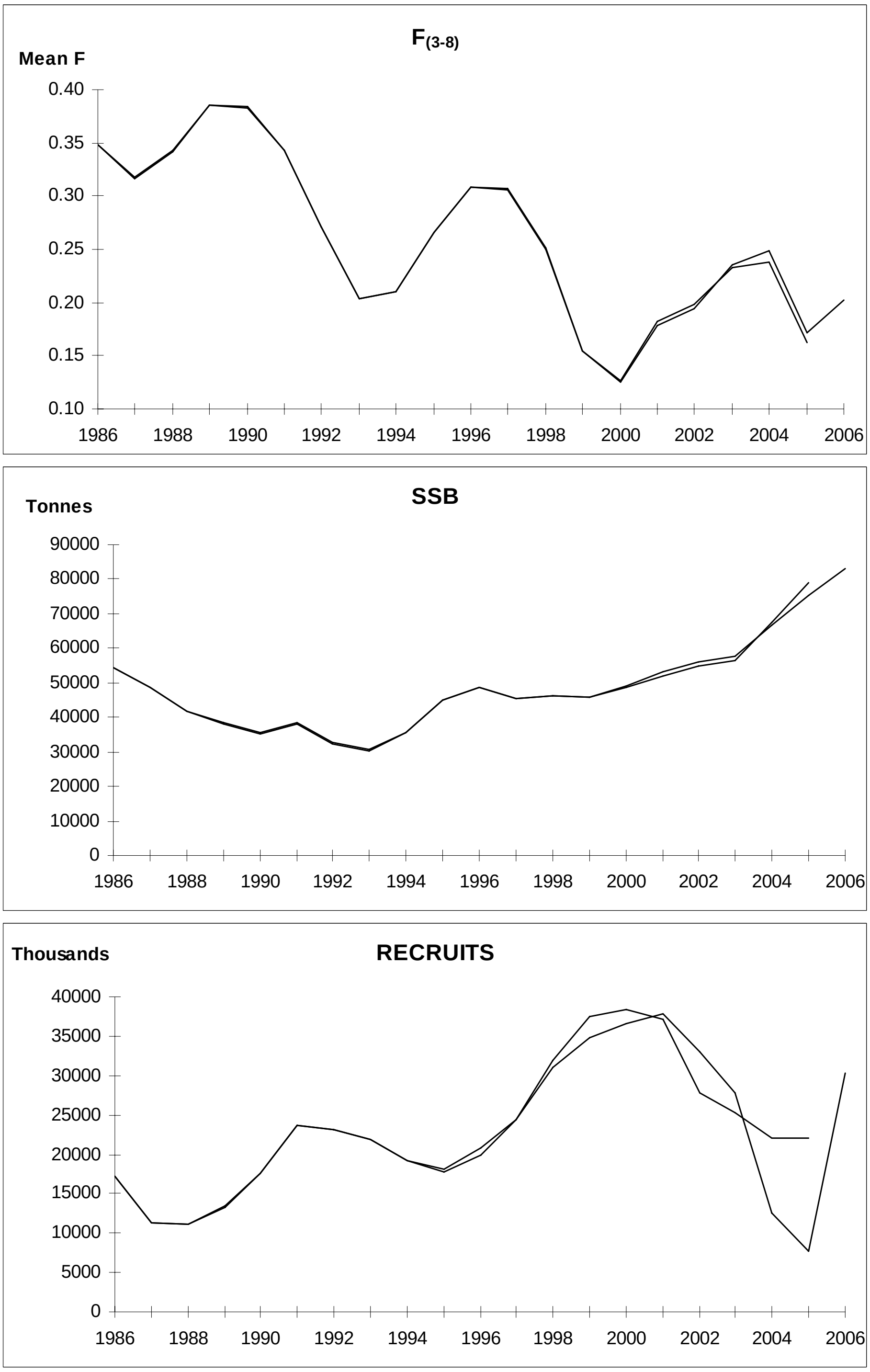


Figure C.3 Northern Hake stock (IIIa, IV, VI, VII, VIIIab) (No Age 0, "2006 Update with no taper")

Annex D: Figures and Tables – Anglerfish

Figure D.1.1. Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIabd. Comparison between this and last year assessment.



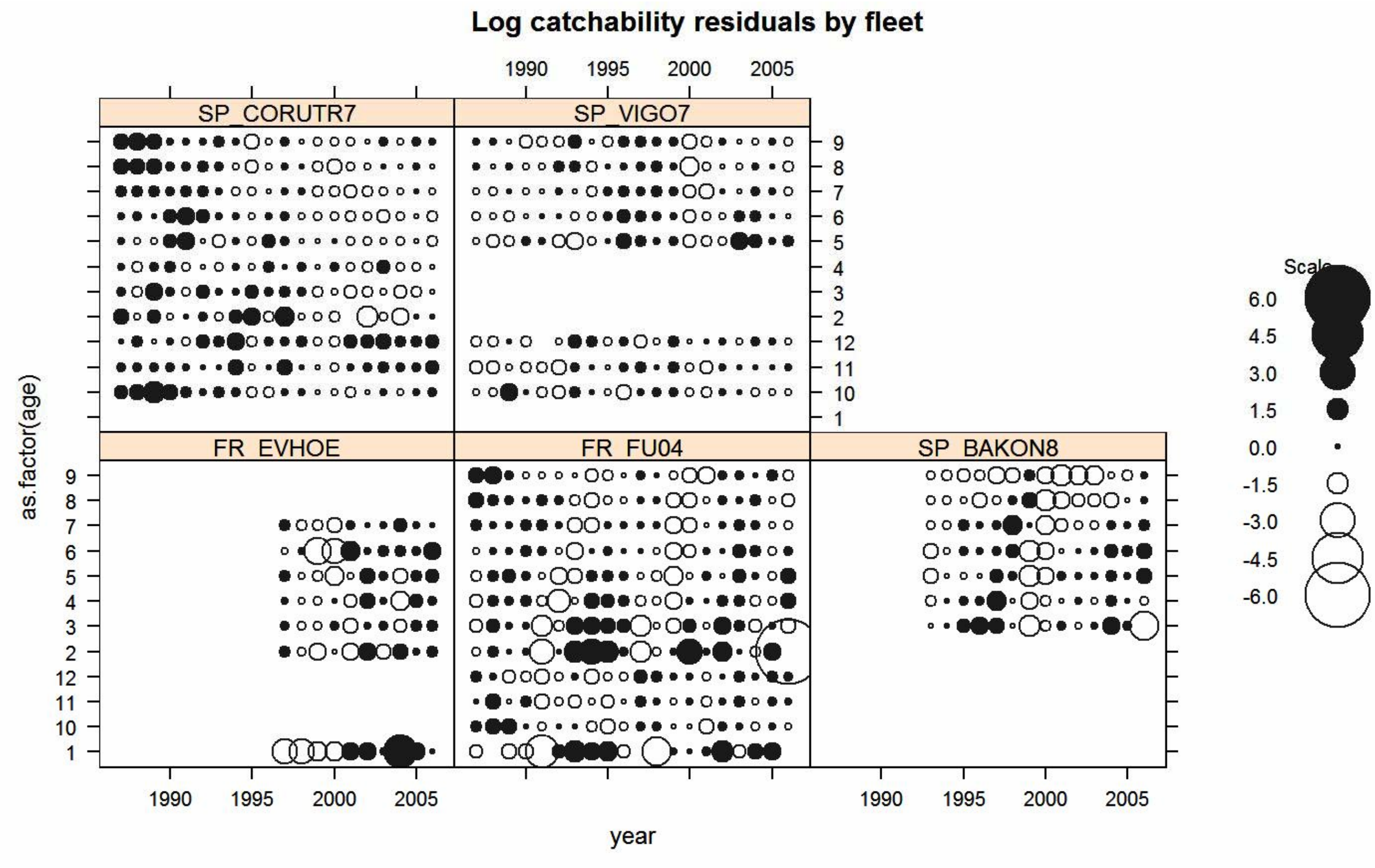


Figure D.1.2. Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b,d.

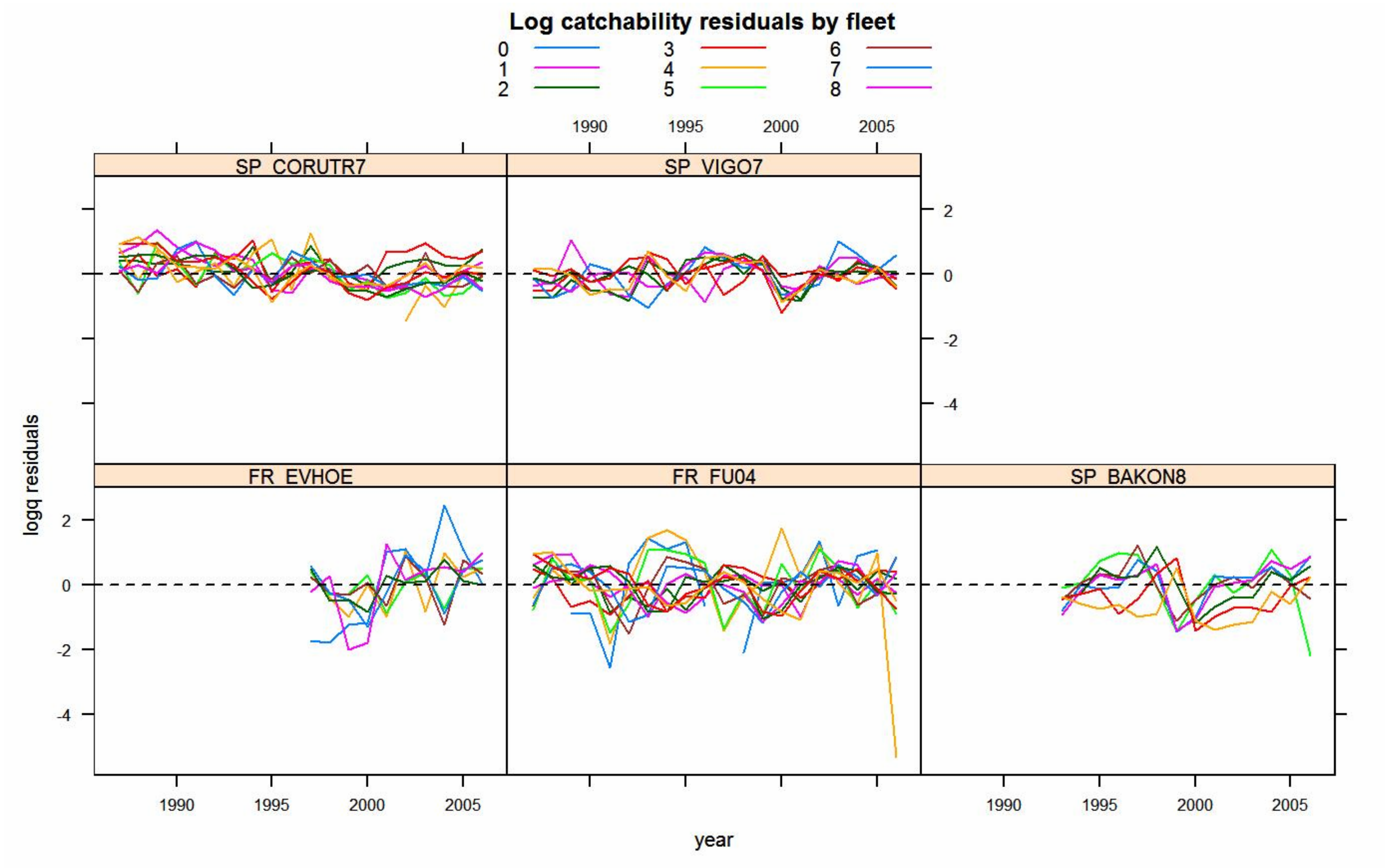


Figure D.1.3. Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b,d.

Table D.1.1. Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b,d.: Fishing mortality.

Run title : (L.piscatorius) AREAS VII AND VIII

At 3/05/2007 10:14

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
AGE											
1	0.0071	0.0158	0.0006	0.0061	0.022	0.0048	0.0069	0.0174	0.0206	0.0237	0.0121
2	0.042	0.0613	0.0819	0.059	0.0981	0.0203	0.0354	0.092	0.1095	0.1056	0.1149
3	0.1136	0.0944	0.2247	0.1763	0.1725	0.0622	0.0848	0.2128	0.2137	0.2019	0.239
4	0.2168	0.1714	0.2225	0.2908	0.3144	0.1583	0.0616	0.1492	0.2654	0.2501	0.2852
5	0.2806	0.1881	0.262	0.3859	0.3913	0.2928	0.1051	0.1045	0.2227	0.2481	0.3411
6	0.431	0.2833	0.3219	0.3601	0.5025	0.4306	0.3103	0.1638	0.2042	0.2963	0.314
7	0.5445	0.5046	0.4375	0.5004	0.5096	0.5731	0.4717	0.2463	0.1547	0.3574	0.3697
8	0.5014	0.6603	0.582	0.5955	0.4077	0.5392	0.5907	0.3477	0.2015	0.2431	0.3029
9	0.3738	0.6937	0.8077	0.5795	0.3064	0.3458	0.3372	0.4865	0.2714	0.1911	0.3542
10	0.2667	0.4739	0.7055	0.914	0.4164	0.2969	0.3456	0.52	0.3417	0.2053	0.1929
11	0.5536	0.3006	0.5039	0.3155	0.5747	0.1727	0.2378	0.2667	0.3162	0.2413	0.3306
12	0.4	0.464	0.3154	0.2626	0.2612	0.138	0.3102	0.3974	0.3127	0.2505	0.2329
+gp	0.4	0.464	0.3154	0.2626	0.2612	0.138	0.3102	0.3974	0.3127	0.2505	0.2329
0 FBAR 3- 8	0.348	0.317	0.3418	0.3848	0.383	0.3427	0.2707	0.2041	0.2104	0.2661	0.3087

Run title : (L.piscatorius UNSEXED

At 3/05/2007 10:14

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	FBAR **-**
AGE											
1	0.0029	0.0013	0.0042	0.0049	0.0164	0.0186	0.0104	0.0102	0.0444	0.0047	0.0198
2	0.0361	0.0328	0.0303	0.0692	0.0278	0.0589	0.0379	0.0183	0.1494	0.0788	0.0822
3	0.0961	0.083	0.0494	0.1011	0.0576	0.1398	0.1095	0.0513	0.105	0.1549	0.1037
4	0.2211	0.119	0.0832	0.1452	0.1099	0.1295	0.1883	0.1004	0.0868	0.2617	0.1496
5	0.3081	0.1487	0.1227	0.1278	0.2072	0.1216	0.2307	0.1988	0.1119	0.2526	0.1878
6	0.4037	0.2405	0.1705	0.1239	0.2379	0.2071	0.3008	0.3253	0.162	0.2187	0.2353
7	0.3939	0.4435	0.2391	0.1428	0.2221	0.2718	0.312	0.3932	0.2639	0.1665	0.2745
8	0.4143	0.4674	0.2586	0.1071	0.2385	0.2992	0.2693	0.4267	0.2969	0.1556	0.2931
9	0.4626	0.4447	0.4669	0.2077	0.1614	0.3713	0.3517	0.3528	0.4201	0.2045	0.3258
10	0.37	0.5282	0.6443	0.3167	0.1545	0.3628	0.3435	0.3442	0.3423	0.2831	0.3232
11	0.6078	0.4581	0.565	0.353	0.234	0.3777	0.4052	0.4535	0.428	0.4155	0.4323
12	0.5588	0.6652	0.6726	0.5136	0.3781	0.3724	0.4998	0.5586	0.5018	0.5143	0.5249
+gp	0.5588	0.6652	0.6726	0.5136	0.3781	0.3724	0.4998	0.5586	0.5018	0.5143	
0 FBAR 3- 8	0.3062	0.2504	0.1539	0.1246	0.1789	0.1948	0.2351	0.2493	0.1711	0.2017	
1											

Table D.1.2. Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b,d.: Stock numbers

Run title : (L.piscatorius) AREAS VII AND VIII

At 3/05/2007 10:14

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
AGE											
1	17138	11232	11083	13371	17560	23674	23203	21927	19217	18193	20794
2	14348	14647	9516	9534	11438	14785	20279	19834	18548	16203	15292
3	8579	11841	11857	7547	7735	8925	12469	16848	15571	14309	12549
4	5524	6591	9274	8151	5446	5603	7219	9859	11722	10823	10064
5	4409	3828	4779	6390	5246	3423	4117	5842	7310	7737	7254
6	4085	2867	2730	3165	3739	3053	2198	3190	4529	5035	5196
7	2934	2285	1859	1703	1901	1947	1708	1387	2331	3178	3222
8	1881	1465	1187	1033	889	983	945	917	933	1718	1914
9	1244	980	652	571	490	509	493	450	558	657	1160
10	787	737	422	250	275	311	310	303	238	366	467
11	205	519	395	179	86	156	199	189	155	146	257
12	183	102	331	205	113	42	113	135	124	97	99
+gp	228	314	432	441	275	375	318	314	168	295	367
0 TOTAL	61546	57408	54516	52541	55193	63785	73570	81196	81404	78757	78634

Run title : (L.piscatorius UNSEXED

At 3/05/2007 10:14

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	GMST 87-**
AGE												
1	24464	30986	34884	36525	37790	32917	27720	12634	7719	30373	0	20491
2	17683	20996	26636	29898	31285	31995	27809	23613	10764	6355	26019	18195
3	11733	14680	17489	22242	24012	26188	25964	23046	19956	7979	5055	14980
4	8504	9174	11628	14327	17303	19511	19600	20029	18844	15464	5882	10822
5	6513	5868	7010	9210	10665	13342	14753	13975	15592	14871	10246	7270
6	4439	4119	4353	5337	6976	7461	10169	10082	9860	12000	9942	4672
7	3267	2552	2787	3159	4058	4733	5221	6479	6268	7217	8300	2855
8	1916	1897	1410	1889	2357	2797	3104	3289	3763	4143	5259	1626
9	1217	1090	1023	937	1461	1599	1785	2041	1848	2407	3052	911
10	701	659	601	552	655	1070	949	1081	1235	1045	1689	516
11	331	417	335	272	346	483	641	579	659	755	678	289
12	159	155	227	164	164	236	285	368	317	370	429	159
+gp	227	308	428	538	562	279	405	410	434	407	400	
0 TOTAL	81154	92899	108810	125049	137634	142612	138406	117625	97259	103387	76952	

Table D.1.3. Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b,d.: Summary table

Run title : MC(L.piscatorius UNSEXED

At 3/05/2007 10:14

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECI Age 1	TOTALBIO	TOTSPBIC	LANDINGS	YIELD/SSE	FBAR 3- 8
1986	17138	86700	54365	23666	0.4353	0.348
1987	11232	81504	48693	21909	0.4499	0.317
1988	11083	71405	41709	20095	0.4818	0.3418
1989	13371	73200	38479	20474	0.5321	0.3848
1990	17560	71658	35522	19753	0.5561	0.383
1991	23674	73578	38626	16229	0.4202	0.3427
1992	23203	71990	32589	12818	0.3933	0.2707
1993	21927	79111	30581	13481	0.4408	0.2041
1994	19217	92207	35494	16120	0.4542	0.2104
1995	18193	99104	45185	19730	0.4367	0.2661
1996	20794	96030	48670	22141	0.4549	0.3087
1997	24464	87250	45414	21660	0.4769	0.3062
1998	30986	89866	46155	19572	0.4241	0.2504
1999	34884	97505	45758	17186	0.3756	0.1539
2000	36525	109490	49074	14925	0.3041	0.1246
2001	37790	116685	52987	16508	0.3115	0.1789
2002	32917	115895	56182	20130	0.3583	0.1948
2003	27720	113875	57675	23591	0.409	0.2351
2004	12634	124848	66755	27313	0.4092	0.2493
2005	7719	136778	75184	24778	0.3296	0.1711
2006	30373	142941	83046	25734	0.3099	0.2017
Arith. Mean	22543	96744	48959	19896	0.4173	0.2592
0 Units 1	(Thousands	(Tonnes)	(Tonnes)	(Tonnes)		

Table D.2.1 Anglerfish (budegassa) in areas VII and VIII - XSA Tuning diagnostics
Lowestoft VPA Version 3.1

21/05/2007 14:50

Extended Survivors Analysis

MONK (L.budegassa) AREAS VII AND VIII UNSEXED

CPUE data from file buda78ef-def0.dat

Catch data for 21 years. 1986 to 2006. Ages 2 to 14.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
FR-FU04	1988	2006	2	13	0	1
SP-VIGO7	1986	2006	2	13	0	1
FR-FU14	1986	2006	8	13	0	1
FR-EVHOE-S	1997	2006	0	13	0.8	0.88
SP-BAKON7	1997	2006	5	10	0	1
SP-BAKON8	1993	2006	5	13	0	1

Time series weights :

Tapered time weighting not applied

Catchability analysis :

Catchability independent of stock size for all ages

Catchability independent of age for ages >= 10

Terminal population estimation :

Final estimates not shrunk towards mean F

Minimum standard error for population
estimates derived from each fleet = .300

Prior weighting not applied

Tuning had not converged after 80 iterations

Total absolute residual between iterations
79 and 80 = .00010

Final year F values

Age	2	3	4	5	6	7	8	9	10	11
Iteration 79	0.0013	0.014	0.0911	0.1875	0.1656	0.1967	0.2198	0.2482	0.1978	0.2296
Iteration 80	0.0013	0.014	0.0911	0.1875	0.1656	0.1967	0.2198	0.2482	0.1978	0.2296

Age	12	13
Iteration 79	0.2039	0.2817
Iteration 80	0.2039	0.2817

Regression weights

	1	1	1	1	1	1	1	1	1	1

Estimated population abundance at 1st Jan 2007

AGE	2	3	4	5	6	7	8	9	10	11	12	13
	0.00E+00	1.93E+04	9.98E+03	1.37E+04	5.43E+03	3.09E+03	2.28E+03	1.02E+03	1.16E+03	9.97E+02	6.76E+02	4.06E+02

Taper weighted geometric mean of the VPA populations:

1.50E+04	1.25E+04	1.05E+04	8.24E+03	6.25E+03	4.64E+03	3.24E+03	2.25E+03	1.47E+03	9.43E+02	6.06E+02	3.86E+02

Standard error of the weighted Log(VPA populations) :

0.2113	0.1955	0.2004	0.1735	0.2184	0.223	0.2518	0.2155	0.2325	0.238	0.2492	0.2774

Table D.2.1 (Cont'd)

Log catchability residuals.

Fleet : FR-FU04

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2	99.99	-0.53	0.8	0.15	-0.26	0.71	-0.9	0.78	-0.18	99.99
3	99.99	0.2	0.22	0.01	0.15	0.3	-0.8	0.45	0.64	-0.09
4	99.99	0.62	-0.04	0.11	0.26	0.71	0.02	0.45	0.45	0.34
5	99.99	0.33	-0.04	-0.19	0.19	0.28	0.05	-0.44	0.28	0.39
6	99.99	0.04	-0.08	-0.13	-0.16	0.2	-0.01	-0.44	0.59	0.67
7	99.99	-0.41	-0.31	0.12	-0.1	0.36	-0.21	-0.08	0.44	0.21
8	99.99	-0.59	-0.35	0.12	0.19	0.15	0	0.06	0.1	0.13
9	99.99	-0.47	-0.17	0.04	0.04	0.11	0.24	0.04	0.32	0.22
10	99.99	-0.41	0.05	0.24	-0.05	0.2	0.56	0.19	0.17	-0.16
11	99.99	-0.43	0.06	0.36	0.19	0.28	0.32	0.93	-0.77	-0.13
12	99.99	-0.15	0.28	0.56	0.56	0.3	0.49	0.59	-0.38	0.05
13	99.99	0.18	0.38	0.55	0.31	0.08	0.32	0.24	-0.64	0.03

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
2	99.99	99.99	99.99	99.99	99.99	1.5	0.54	-2.6	99.99	99.99
3	-1.37	-1.08	-0.74	-0.5	0.5	2.01	0.09	99.99	99.99	99.99
4	-0.04	0.91	0.1	0.51	1.21	2.21	0.68	-1.69	-1.34	-5.49
5	-0.33	0.87	-0.91	0.32	0.62	1.4	1.09	-1.28	-1.39	-1.22
6	-0.28	0.62	-0.9	0.27	0.04	0.41	0.81	-0.71	-0.72	-0.21
7	-0.04	0.29	-0.84	-0.19	0.02	0.4	0.57	-0.34	0.52	-0.41
8	0.23	0.18	-0.1	0.18	-0.2	0.17	0.17	-0.17	0.36	-0.63
9	0.04	-0.05	0.01	0.4	-0.36	-0.06	0.09	-0.08	0.42	-0.79
10	0.03	-0.22	-0.19	0.24	-0.51	0.15	0.33	0.29	0.15	-1.04
11	0.18	0.45	-0.35	0.4	-0.13	0	0.17	0.52	-0.36	-0.57
12	0.62	0.38	-0.29	0.67	-0.4	0.19	0.33	0.33	0.49	-0.54
13	1.05	0.79	0.12	0.93	-0.12	0.28	-0.05	-0.06	1.04	0.22

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	2	3	4	5	6	7	8	9	10	11
Mean Log q	-14.1957	-12.33	-11.514	-10.4633	-9.7804	-9.2202	-8.9062	-8.6476	-8.5343	-8.5343
S.E(Log q)	1.1093	0.7992	1.5665	0.7851	0.4901	0.3792	0.2743	0.2978	0.3654	0.4272

Age	12	13
Mean Log q	-8.5343	-8.5343
S.E(Log q)	0.4435	0.5264

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
2	-0.4	-3.426	7.81	0.4	11	0.3	-14.2
3	23.91	-0.814	79.03	0	16	19.33	-12.33
4	-0.62	-1.514	7.84	0.05	19	0.94	-11.51
5	0.28	2.703	9.41	0.46	19	0.19	-10.46
6	0.45	2.612	9.19	0.57	19	0.19	-9.78
7	0.85	0.411	9.1	0.31	19	0.33	-9.22
8	0.85	0.632	8.78	0.52	19	0.24	-8.91
9	1.09	-0.236	8.73	0.29	19	0.33	-8.65
10	1.57	-0.98	9.25	0.15	19	0.57	-8.53
11	1.16	-0.323	8.74	0.19	19	0.5	-8.48
12	0.62	1.644	7.59	0.53	19	0.23	-8.32
13	0.68	0.944	7.5	0.34	19	0.29	-8.24
1							

Table D.2.1 (Cont'd)

Fleet : SP-VIGO7

Age	1986
2	1.11
3	0.35
4	0.01
5	-0.19
6	-0.13
7	-0.48
8	-0.46
9	-0.08
10	0.08
11	-0.09
12	-0.27
13	0.2

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2	-1.19	0.83	0.36	-0.64	-1.71	-0.58	-0.15	1.05	-0.8	-1.45
3	-0.15	0.73	-0.04	-0.38	-0.51	-0.89	-0.79	0.05	0.59	0.63
4	-0.24	0.23	-0.78	-0.71	-0.85	-0.91	-0.88	-0.06	0.03	-0.03
5	-0.43	-0.07	-0.56	-1.01	-0.74	-0.81	-0.85	-0.42	-0.02	-0.25
6	-0.46	-0.14	-0.15	-0.54	-0.63	-0.52	-0.67	-0.55	-0.05	0.23
7	-0.31	-0.53	-0.35	-0.33	-0.41	-0.11	-0.71	-0.5	-0.15	0.29
8	-0.43	-0.55	-0.4	-0.14	0.13	0	-0.32	-0.57	-0.26	-0.06
9	-0.09	-0.7	-0.27	-0.1	-0.04	0.1	-0.02	-0.43	0.01	-0.54
10	0.01	-0.66	0.01	0.22	-0.28	0.11	0.19	-0.27	-0.44	-0.63
11	-0.27	-0.56	-0.11	0.03	-0.41	0.09	-0.03	-0.16	-0.66	-0.81
12	-0.24	-0.64	-0.21	-0.07	0.03	0.06	-0.01	-0.17	-0.75	-0.63
13	0.33	0.06	0.16	-0.22	-0.11	-0.14	-0.15	-0.62	-0.81	-0.43

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
2	-0.59	99.99	-1.18	-0.39	2.63	2.25	1.08	0.98	-0.94	-0.69
3	-0.36	-0.86	-0.49	-0.25	1.46	1.29	0.44	-1.13	0.22	0.1
4	0.08	0.27	0.11	-0.2	0.46	1.3	0.97	-0.14	0.38	0.94
5	0.14	0.22	0.17	-0.22	0.08	0.63	1.83	0.93	0.48	1.09
6	0.27	0.08	0.52	0.04	-0.16	0	1.17	0.78	0.48	0.46
7	0.37	0.05	0.09	-0.26	0.13	0.12	0.68	0.67	1.31	0.43
8	0.44	0.2	0.42	0.19	-0.27	0.05	0.16	0.5	0.86	0.49
9	0.29	0.08	0.32	-0.11	-0.15	-0.18	-0.03	0.53	0.84	0.58
10	0.03	-0.11	0.08	0.08	-0.19	0.01	0.34	0.6	0.49	0.35
11	-0.01	0.25	-0.22	-0.23	0.12	-0.21	0.02	-0.16	-0.01	0.34
12	0.37	0	0.04	-0.66	-0.38	-0.16	0.19	-0.27	0.11	0.01
13	0.39	-0.07	-0.25	-0.89	-0.22	-0.32	-0.57	-0.26	0.03	0.07

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	2	3	4	5	6	7	8	9	10	11
Mean Log q	-14.5684	-12.9827	-11.9919	-11.5442	-11.4321	-11.2779	-11.2862	-11.2969	-11.3886	-11.3886
S.E(Log q)	1.2227	0.6988	0.6148	0.7031	0.4915	0.4971	0.3979	0.364	0.3302	0.3208

Age	12	13
Mean Log q	-11.3886	-11.3886
S.E(Log q)	0.3496	0.3921

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
2	-1.01	-1.587	4.59	0.03	20	1.19	-14.57
3	3.98	-0.934	23.55	0.01	21	2.79	-12.98
4	1.87	-0.669	14.37	0.03	21	1.17	-11.99
5	-0.82	-2.864	6.96	0.12	21	0.49	-11.54
6	-3.5	-3.036	-0.67	0.02	21	1.45	-11.43
7	-2.91	-3.293	0.19	0.04	21	1.18	-11.28
8	14.87	-3.187	55.69	0	21	4.9	-11.29
9	2.38	-1.593	16.23	0.07	21	0.83	-11.3
10	1.29	-0.705	12.59	0.23	21	0.43	-11.39
11	0.9	0.425	11.05	0.47	21	0.26	-11.54
12	0.84	0.688	10.75	0.5	21	0.26	-11.56
13	0.62	2.471	9.44	0.69	21	0.19	-11.57
1							

Table D.2.1 (Cont'd)

Fleet : FR-FU14

Age	1986
2	No data for this fleet at this age
3	No data for this fleet at this age
4	No data for this fleet at this age
5	No data for this fleet at this age
6	No data for this fleet at this age
7	No data for this fleet at this age
8	-0.31
9	-0.05
10	0.32
11	0.38
12	-0.18
13	-0.5

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2	No data for this fleet at this age									
3	No data for this fleet at this age									
4	No data for this fleet at this age									
5	No data for this fleet at this age									
6	No data for this fleet at this age									
7	No data for this fleet at this age									
8	-0.38	-0.38	0.12	0.23	0.3	0.42	0.49	0.44	0.07	-0.05
9	-0.06	-0.51	0	-0.07	0.21	0.14	0.76	0.39	0.05	0.07
10	-0.14	-0.19	0.33	0.15	0.11	0.11	0.79	0.22	-0.26	-0.35
11	0.02	0.17	0.22	0.31	0.27	0.23	0.28	0.94	-0.75	-0.41
12	-0.23	0.26	0.58	0.54	0.62	0.24	0.21	0.8	-1.05	0.18
13	0.04	0.28	0.6	0.73	0.5	-0.26	-0.27	0.46	-0.67	0.73

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
2	No data for this fleet at this age									
3	No data for this fleet at this age									
4	No data for this fleet at this age									
5	No data for this fleet at this age									
6	No data for this fleet at this age									
7	No data for this fleet at this age									
8	-0.12	0.02	0.64	0.22	-0.52	-0.05	-0.41	-0.02	-0.1	-0.63
9	-0.09	-0.15	0.43	0.63	-0.65	-0.22	-0.39	-0.38	-0.05	-0.05
10	0.12	-0.02	0	0.76	-1.28	-0.04	-0.15	-0.21	-0.34	0.04
11	0.37	0.34	-0.49	0.73	-0.46	-0.02	-0.43	-0.38	-0.23	0.37
12	0.66	0.34	-0.12	0.38	-0.09	0.02	-0.35	-0.69	-0.14	0.33
13	1.14	0.45	0.09	0.55	0.76	0.11	-1.17	-0.18	0.74	0.67

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	8	9	10	11	12	13
Mean Log q	-8.6654	-8.4904	-8.5616	-8.5616	-8.5616	-8.5616
S.E(Log q)	0.3516	0.3508	0.4235	0.4412	0.4737	0.6164

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
8	0.88	0.414	8.6	0.4	21	0.32	-8.67
9	2.61	-1.787	9.74	0.06	21	0.87	-8.49
10	1.02	-0.057	8.59	0.22	21	0.45	-8.56
11	0.81	0.545	8.19	0.31	21	0.36	-8.49
12	0.58	1.852	7.6	0.51	21	0.25	-8.45
13	0.99	0.031	8.3	0.2	21	0.58	-8.33
1							

Table D.2.1 (Cont'd)

Fleet : FR-EVHOE-S

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
2	1.2	-1.78	-0.77	-0.41	1.78	0.69	-0.16	-1.09	-0.04	0.57
3	0.18	-0.19	-1.17	0.29	1.2	0.7	-1.73	-0.1	0.45	0.36
4	-0.21	-0.16	0.31	-0.42	-0.26	1.24	-0.86	-1.02	0.86	0.51
5	0.68	0.2	-1.94	-1.96	0.2	1.6	0.24	-0.77	0.09	1.66
6	-1.05	-0.2	-0.23	-0.08	0.13	0.38	0	-0.38	99.99	1.43
7	-0.84	-0.69	0.07	-0.37	0.58	0.69	0.54	0.23	-1.14	0.93
8	0.54	-0.26	0.83	-0.68	0.35	-1.67	0.25	0.44	0.45	-0.24
9	0.95	-0.28	0.08	0.35	-0.12	-0.14	0.6	0.05	-0.58	-0.91
10	0.21	-0.41	99.99	0.63	0.32	-0.69	-0.21	0.75	-0.43	-0.17
11	-2.55	0.58	0.39	1.07	0.93	-0.02	-0.74	-0.07	0.38	-0.67
12	-1.9	0.19	99.99	0.59	-0.7	0.27	99.99	0.44	0.06	-0.16
13	-1	-0.12	99.99	99.99	0.91	0.47	-0.1	99.99	0.62	-0.49

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	2	3	4	5	6	7	8	9	10	11
Mean Log q	-11.6241	-11.1018	-10.5732	-10.7604	-10.4795	-10.5121	-10.1189	-10.0254	-10.1752	-10.1752
S.E(Log q)	1.0811	0.8695	0.7243	1.2531	0.6654	0.7191	0.7409	0.5426	0.5013	1.0625

Age	12	13
Mean Log q	-10.1752	-10.1752
S.E(Log q)	0.8248	0.6701

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
2	-1.14	-1.664	7.33	0.07	10	1.12	-11.62
3	0.48	0.991	10.22	0.31	10	0.42	-11.1
4	0.48	1.303	9.86	0.43	10	0.33	-10.57
5	0.37	0.788	9.6	0.16	10	0.47	-10.76
6	2.21	-0.516	12.71	0.03	9	1.55	-10.48
7	0.44	1.167	9.28	0.36	10	0.31	-10.51
8	0.59	0.661	9.23	0.25	10	0.45	-10.12
9	0.39	1.201	8.56	0.33	10	0.21	-10.03
10	-4.23	-1.067	-5.24	0.01	9	2.1	-10.18
11	-0.7	-1.075	4.41	0.05	10	0.74	-10.25
12	0.68	0.217	9.07	0.07	8	0.59	-10.33
13	0.25	3.119	6.96	0.78	7	0.11	-10.13
1							

Table D.2.1 (Cont'd)

Fleet : SP-BAKON7

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
2	No data for this fleet at this age									
3	No data for this fleet at this age									
4	No data for this fleet at this age									
5	0.47	0.1	0.22	-0.11	-0.29	0.03	0.73	-0.67	-0.16	-0.31
6	0.43	0.04	0.58	-0.07	-0.14	-0.17	0.31	-0.3	-0.51	-0.17
7	0.14	-0.48	-0.07	0.35	0.03	-0.15	0.25	0.07	-0.17	0.04
8	0.47	-0.14	0.25	-0.08	-0.19	0.18	-0.23	0.05	-0.47	0.16
9	0.33	0.18	0.36	0.3	-0.01	0.1	-0.43	-0.28	-0.41	-0.13
10	-0.21	0.2	0.24	0.04	0.28	0.08	-0.53	0.07	0.02	-0.2
11	No data for this fleet at this age									
12	No data for this fleet at this age									
13	No data for this fleet at this age									

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	5	6	7	8	9	10
Mean Log q	-12.1391	-11.4187	-11.3095	-11.4603	-11.5556	-11.6704
S.E(Log q)	0.4052	0.3434	0.2359	0.2753	0.3016	0.2477

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
5	0.75	0.446	11.35	0.29	10	0.32	-12.14
6	0.6	1.434	10.31	0.62	10	0.2	-11.42
7	0.95	0.139	11.16	0.49	10	0.24	-11.31
8	1.01	-0.024	11.49	0.44	10	0.29	-11.46
9	1.34	-0.329	12.91	0.1	10	0.43	-11.56
10	1.89	-0.797	15.61	0.09	10	0.48	-11.67
1							

Table D.2.1 (Cont'd)

Fleet : SP-BAKON8

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
2	No data for this fleet at this age									
3	No data for this fleet at this age									
4	No data for this fleet at this age									
5	99.99	99.99	99.99	99.99	99.99	99.99	-0.06	0.08	0.15	-0.26
6	99.99	99.99	99.99	99.99	99.99	99.99	-0.09	0.06	-0.02	-0.08
7	99.99	99.99	99.99	99.99	99.99	99.99	-0.05	0.49	0.17	-0.4
8	99.99	99.99	99.99	99.99	99.99	99.99	-0.16	0.28	-0.07	0.14
9	99.99	99.99	99.99	99.99	99.99	99.99	0.37	-0.07	-0.13	-0.06
10	99.99	99.99	99.99	99.99	99.99	99.99	0.21	-0.38	-0.55	0.51
11	99.99	99.99	99.99	99.99	99.99	99.99	0.3	0.73	0.45	0.62
12	99.99	99.99	99.99	99.99	99.99	99.99	0.22	0.64	1.13	0.01
13	99.99	99.99	99.99	99.99	99.99	99.99	0.59	0.42	0.93	-0.59

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
2	No data for this fleet at this age									
3	No data for this fleet at this age									
4	No data for this fleet at this age									
5	0.1	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
6	0.13	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
7	-0.21	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
8	-0.19	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
9	-0.11	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
10	0.21	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
11	0.39	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
12	-0.14	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
13	0.03	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	5	6	7	8	9	10	11	12	13
Mean Log q	-13.4485	-13.3456	-13.5814	-13.4091	-13.5886	-13.3941	-13.3941	-13.3941	-13.3941
S.E(Log q)	0.1655	0.0945	0.3442	0.2029	0.2099	0.4458	0.5808	0.6636	0.6584

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
5	1.12	-0.112	13.96	0.24	5	0.21	-13.45
6	1.04	-0.08	13.53	0.57	5	0.11	-13.35
7	0.41	1.096	10.62	0.54	5	0.14	-13.58
8	0.49	1.118	10.73	0.61	5	0.1	-13.41
9	10.96	-3.295	72.01	0.04	5	1.24	-13.59
10	0.62	0.678	11	0.51	5	0.3	-13.39
11	1.35	-0.781	15.1	0.62	5	0.25	-12.9
12	-1.92	-3.673	-6.95	0.35	5	0.49	-13.02
13	0.38	1.067	8.47	0.49	5	0.21	-13.12
1							

Table D.2.1 (Cont'd)

Terminal year survivor and F summaries :

Age 2 Catchability constant w.r.t. time and dependent on age

Year class = 2004

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FR-FU04	1	0	0	0	0	0	0
SP-VIGO7	9665	1.253	0	0	1	0.45	0.003
FR-FU14	1	0	0	0	0	0	0
FR-EVHOE-S	34035	1.134	0	0	1	0.55	0.001
SP-BAKON7	1	0	0	0	0	0	0
SP-BAKON8	1	0	0	0	0	0	0

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
19309	0.84	0.63	2	0.745	0.001

Age 3 Catchability constant w.r.t. time and dependent on age

Year class = 2003

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FR-FU04	1	0	0	0	0	0	0
SP-VIGO7	8532	0.621	0.445	0.72	2	0.567	0.016
FR-FU14	1	0	0	0	0	0	0
FR-EVHOE-S	12263	0.711	0.194	0.27	2	0.433	0.011
SP-BAKON7	1	0	0	0	0	0	0
SP-BAKON8	1	0	0	0	0	0	0

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
9983	0.47	0.23	4	0.495	0.014

1

Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 2002

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FR-FU04	373	0.94	1.373	1.46	2	0.113	1.506
SP-VIGO7	26959	0.442	0.249	0.56	3	0.514	0.047
FR-FU14	1	0	0	0	0	0	0
FR-EVHOE-S	16168	0.519	0.451	0.87	3	0.373	0.078
SP-BAKON7	1	0	0	0	0	0	0
SP-BAKON8	1	0	0	0	0	0	0

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
13735	0.32	0.55	8	1.746	0.091

Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 2001

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FR-FU04	2522	0.612	0.557	0.91	3	0.137	0.367
SP-VIGO7	6848	0.377	0.513	1.36	4	0.356	0.151
FR-FU14	1	0	0	0	0	0	0
FR-EVHOE-S	9209	0.483	0.374	0.77	4	0.214	0.115
SP-BAKON7	3988	0.425	0	0	1	0.293	0.247
SP-BAKON8	1	0	0	0	0	0	0

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
5431	0.23	0.24	12	1.069	0.187

Table D.2.1 (Cont'd)

Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 2000

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FR-FU04	2284	0.352	0.388	1.1	5	0.209	0.218
SP-VIGO7	4731	0.302	0.247	0.82	5	0.279	0.111
FR-FU14	1	0	0	0	0	0	0
FR-EVHOE-S	3133	0.399	0.63	1.58	5	0.159	0.164
SP-BAKON7	2622	0.275	0.006	0.02	2	0.352	0.193
SP-BAKON8	1	0	0	0	0	0	0

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
3090	0.16	0.18	17	1.124	0.166

Age 7 Catchability constant w.r.t. time and dependent on age

Year class = 1999

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FR-FU04	1562	0.27	0.373	1.38	5	0.243	0.275
SP-VIGO7	4734	0.264	0.203	0.77	6	0.236	0.099
FR-FU14	1	0	0	0	0	0	0
FR-EVHOE-S	3286	0.416	0.46	1.11	5	0.089	0.14
SP-BAKON7	1746	0.204	0.218	1.07	3	0.431	0.249
SP-BAKON8	1	0	0	0	0	0	0

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
2275	0.13	0.17	19	1.272	0.197

1

Age 8 Catchability constant w.r.t. time and dependent on age

Year class = 1998

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FR-FU04	766	0.211	0.262	1.24	6	0.271	0.282
SP-VIGO7	2362	0.242	0.181	0.75	7	0.185	0.1
FR-FU14	541	0.36	0	0	1	0.112	0.379
FR-EVHOE-S	798	0.359	0.297	0.83	7	0.074	0.272
SP-BAKON7	1040	0.177	0.158	0.89	4	0.357	0.215
SP-BAKON8	1	0	0	0	0	0	0

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
1015	0.11	0.13	25	1.195	0.22

Age 9 Catchability constant w.r.t. time and dependent on age

Year class = 1997

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FR-FU04	953	0.177	0.251	1.42	7	0.272	0.295
SP-VIGO7	2254	0.206	0.119	0.58	8	0.188	0.135
FR-FU14	1083	0.257	0.024	0.09	2	0.145	0.263
FR-EVHOE-S	890	0.312	0.243	0.78	8	0.079	0.313
SP-BAKON7	1018	0.158	0.125	0.79	5	0.315	0.278
SP-BAKON8	1	0	0	0	0	0	0

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
1159	0.09	0.1	30	1.077	0.248

Table D.2.1 (Cont'd)

Age 10 Catchability constant w.r.t. time and dependent on age

Year class = 1996

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FR-FU04	884	0.163	0.24	1.47	8	0.245	0.22
SP-VIGO7	1548	0.181	0.117	0.65	8	0.209	0.132
FR-FU14	988	0.226	0.03	0.13	3	0.143	0.199
FR-EVHOE-S	822	0.274	0.173	0.63	9	0.089	0.235
SP-BAKON7	867	0.144	0.096	0.66	6	0.314	0.224
SP-BAKON8	1	0	0	0	0	0	0

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
997	0.08	0.08	34	0.969	0.198

Age 11 Catchability constant w.r.t. time and age (fixed at the value for age) 10

Year class = 1995

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FR-FU04	650	0.154	0.116	0.75	9	0.248	0.238
SP-VIGO7	918	0.16	0.087	0.54	10	0.257	0.174
FR-FU14	576	0.206	0.194	0.94	4	0.158	0.265
FR-EVHOE-S	607	0.262	0.168	0.64	10	0.08	0.253
SP-BAKON7	590	0.141	0.052	0.37	6	0.257	0.259
SP-BAKON8	1	0	0	0	0	0	0

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
676	0.08	0.06	39	0.728	0.23

1

Age 12 Catchability constant w.r.t. time and age (fixed at the value for age) 10

Year class = 1994

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FR-FU04	373	0.152	0.118	0.78	10	0.252	0.22
SP-VIGO7	450	0.152	0.079	0.52	11	0.289	0.186
FR-FU14	370	0.195	0.129	0.66	5	0.173	0.222
FR-EVHOE-S	485	0.266	0.236	0.89	10	0.076	0.173
SP-BAKON7	396	0.139	0.1	0.72	6	0.21	0.208
SP-BAKON8	1	0	0	0	0	0	0

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
406	0.08	0.05	42	0.708	0.204

Age 13 Catchability constant w.r.t. time and age (fixed at the value for age) 10

Year class = 1993

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FR-FU04	276	0.15	0.103	0.69	12	0.253	0.249
SP-VIGO7	248	0.147	0.065	0.44	12	0.308	0.273
FR-FU14	212	0.191	0.166	0.87	6	0.172	0.313
FR-EVHOE-S	196	0.272	0.078	0.29	10	0.084	0.334
SP-BAKON7	228	0.138	0.166	1.2	6	0.183	0.294
SP-BAKON8	1	0	0	0	0	0	0

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
240	0.08	0.05	46	0.651	0.282

Table D_2.2. Anglerfish (budegassa) in areas VII and VIII - Fishing Mortality (F) at age

Table 8	Fishing mortality (F) at age										
YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
AGE											
2	0.0197	0.0075	0.0124	0.0157	0.0155	0.0067	0.0119	0.0239	0.0134	0.006	0.0053
3	0.0419	0.042	0.0587	0.0419	0.0493	0.0366	0.0358	0.0343	0.0307	0.0509	0.0494
4	0.0827	0.0952	0.122	0.0523	0.0805	0.0625	0.0812	0.058	0.078	0.0648	0.0684
5	0.1125	0.1143	0.1637	0.1191	0.0999	0.1238	0.0919	0.1023	0.0932	0.1264	0.1054
6	0.1457	0.1252	0.2022	0.2243	0.1638	0.1791	0.161	0.1573	0.1215	0.1948	0.2152
7	0.1453	0.1834	0.195	0.2468	0.2694	0.2465	0.3257	0.177	0.1835	0.247	0.2788
8	0.1767	0.1774	0.2087	0.2474	0.3262	0.3823	0.3411	0.259	0.2165	0.2429	0.2756
9	0.2855	0.2566	0.2247	0.3186	0.3604	0.3648	0.3889	0.3839	0.2391	0.322	0.2958
10	0.3408	0.291	0.2527	0.426	0.4928	0.3204	0.3864	0.4719	0.2461	0.2357	0.2565
11	0.3336	0.2739	0.2828	0.3759	0.4809	0.3679	0.3897	0.3704	0.45	0.1088	0.2876
12	0.2822	0.2508	0.298	0.4155	0.5287	0.5979	0.4233	0.409	0.3754	0.1207	0.3375
13	0.3018	0.4508	0.4022	0.4589	0.5266	0.5406	0.3507	0.3678	0.2812	0.1201	0.354
+gp	0.3018	0.4508	0.4022	0.4589	0.5266	0.5406	0.3507	0.3678	0.2812	0.1201	0.354
FBAR 6-10	0.2188	0.2067	0.2167	0.2926	0.3225	0.2986	0.3206	0.2898	0.2014	0.2485	0.2644

Table 8	Fishing mortality (F) at age										
YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	FBAR 04-06
AGE											
2	0.0022	0.0001	0.0012	0.0032	0.0428	0.0276	0.0087	0.007	0.0021	0.0013	0.0035
3	0.0141	0.0086	0.0114	0.0163	0.0752	0.0611	0.0233	0.0041	0.0172	0.014	0.0118
4	0.0702	0.0795	0.0558	0.0496	0.1101	0.1767	0.1183	0.0343	0.0609	0.0911	0.0621
5	0.1138	0.1839	0.1109	0.0955	0.127	0.2083	0.4932	0.1644	0.1055	0.1875	0.1524
6	0.1524	0.2648	0.2248	0.1693	0.1276	0.1464	0.3468	0.2089	0.1286	0.1656	0.1677
7	0.2245	0.2848	0.2227	0.168	0.2053	0.2224	0.3066	0.278	0.4068	0.1967	0.2938
8	0.3072	0.2926	0.376	0.2918	0.1607	0.2168	0.2121	0.2791	0.3103	0.2198	0.2698
9	0.3108	0.2793	0.3609	0.337	0.1935	0.1901	0.2104	0.3139	0.3367	0.2482	0.2996
10	0.3109	0.2408	0.268	0.3588	0.1636	0.2324	0.2714	0.3757	0.2504	0.1978	0.2746
11	0.3722	0.399	0.2162	0.3345	0.2558	0.2111	0.2014	0.3009	0.1986	0.2296	0.243
12	0.5216	0.3937	0.2866	0.3081	0.1929	0.2394	0.2495	0.2633	0.2961	0.2039	0.2544
13	0.769	0.5244	0.2981	0.3634	0.2213	0.2117	0.1583	0.2478	0.4268	0.2817	0.3188
+gp	0.769	0.5244	0.2981	0.3634	0.2213	0.2117	0.1583	0.2478	0.4268	0.2817	
FBAR 6-10	0.2612	0.2725	0.2905	0.265	0.1701	0.2016	0.2694	0.2911	0.2866	0.2056	

Table D_2.3. Anglerfish (budegassa) in areas VII and VIII - Stock numbers at age

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
AGE											
2	13476	15781	16196	16922	17983	16214	14154	14351	14602	13119	12662
3	13638	11372	13481	13768	14337	15240	13862	12039	12060	12401	11224
4	12156	11257	9386	10942	11364	11746	12646	11511	10012	10067	10144
5	10250	9632	8809	7151	8938	9025	9498	10035	9349	7971	8121
6	7999	7884	7395	6437	5463	6962	6863	7457	7798	7331	6046
7	6209	5951	5987	5200	4427	3992	5010	5029	5484	5944	5193
8	4371	4622	4264	4240	3497	2911	2685	3113	3626	3929	3996
9	2712	3153	3331	2979	2850	2172	1709	1643	2068	2513	2652
10	1911	1755	2099	2290	1864	1711	1298	997	963	1402	1568
11	1167	1170	1129	1403	1287	980	1069	759	535	648	953
12	934	719	766	732	829	685	584	623	451	294	500
13	782	606	482	489	416	421	324	329	356	267	224
+gp	815	454	498	754	567	564	605	526	346	1302	568
TOTAL	76420	74356	73823	73307	73824	72622	70307	68414	67652	67187	63852

Table 10 Stock number at age (start of year) Numbers*10**-3

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	GMST 86-04
AGE												
2	13822	16469	17584	14137	11403	9343	12849	24173	13695	22462	0	14421
3	10841	11870	14174	15117	12129	9404	7822	10964	20660	11762	19309	12664
4	9195	9200	10130	12062	12800	9683	7614	6578	9398	17479	9983	10779
5	8154	7378	7314	8246	9879	9869	6985	5823	5470	7611	13735	8745
6	6290	6263	5283	5634	6450	7489	6897	3671	4252	4237	5431	6714
7	4196	4649	4136	3632	4094	4887	5568	4197	2564	3218	3090	4882
8	3382	2885	3009	2850	2643	2870	3367	3527	2735	1469	2275	3407
9	2611	2141	1854	1778	1832	1937	1989	2344	2296	1726	1015	2292
10	1698	1647	1394	1112	1093	1299	1378	1387	1474	1411	1159	1489
11	1044	1071	1114	918	669	799	887	904	820	988	997	954
12	615	619	619	772	565	446	557	624	576	579	676	612
13	307	314	360	400	489	401	302	373	413	369	406	392
+gp	392	789	753	619	1055	608	903	533	404	363	475	
TOTAL	62548	65297	67723	67276	65101	59034	57118	65098	64758	73675	58552	

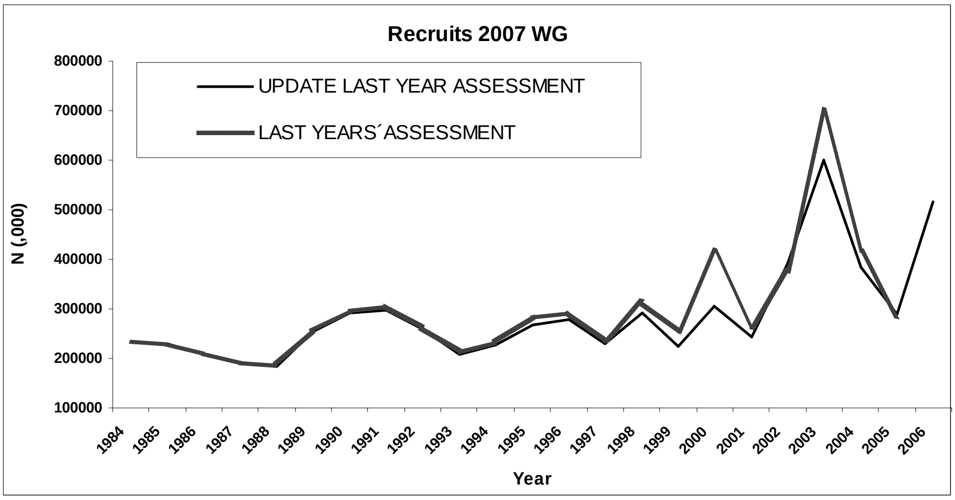
Table D_2.4. Anglerfish (budegassa) in areas VII and VIII - Summary table (without SOP corrections)

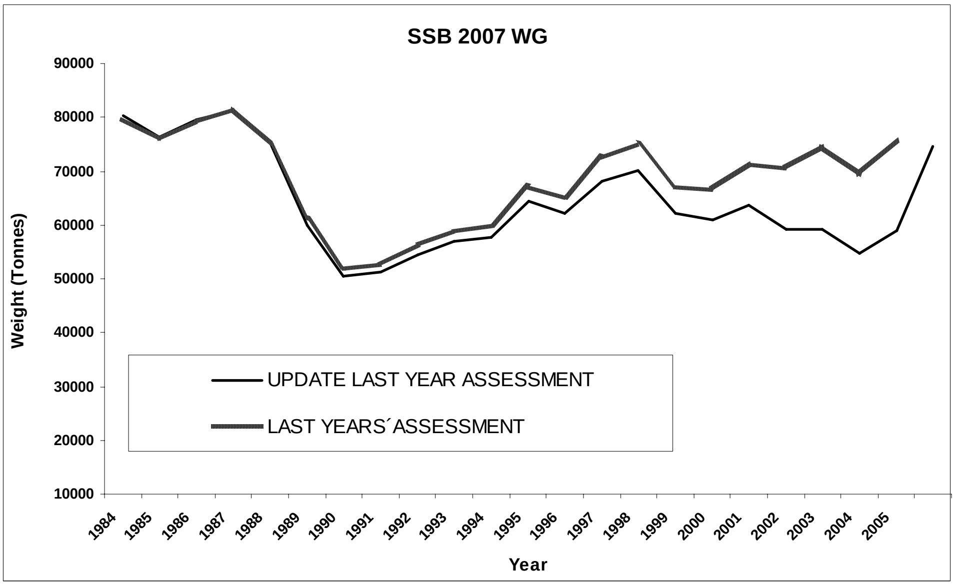
Terminal Fs derived using XSA (Without F shrinkage)

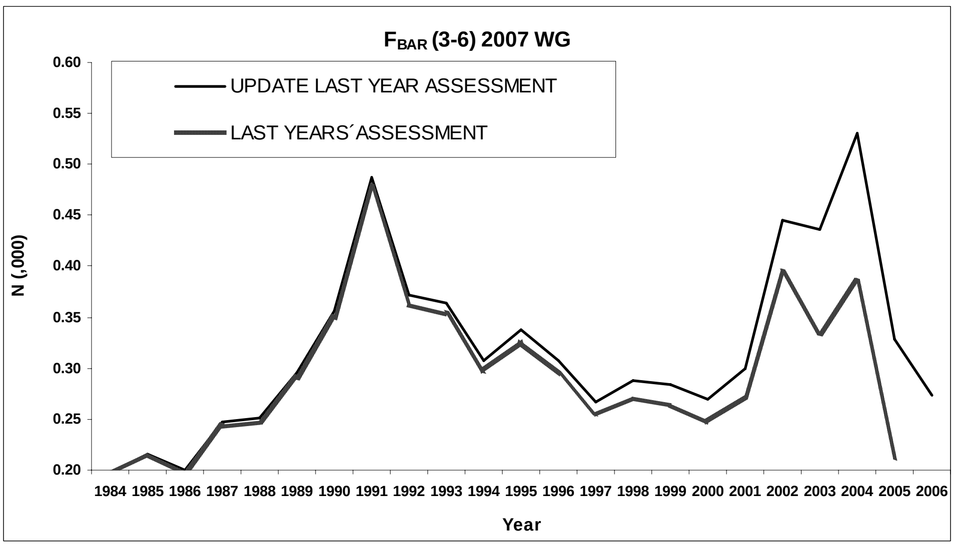
	RECI Age 2	TOTALBIO	TOTSPBIC	LANDINGS	YIELD/SSE	FBAR 6-10
1986	13476	49536	29676	8217	0.2769	0.2188
1987	15781	45052	26632	7619	0.2861	0.2067
1988	16196	47059	27890	8382	0.3005	0.2167
1989	16922	44728	27145	9533	0.3512	0.2926
1990	17983	41299	24612	9632	0.3914	0.3225
1991	16214	40438	23377	8840	0.3781	0.2986
1992	14154	40333	22996	8266	0.3595	0.3206
1993	14351	35378	19959	6659	0.3336	0.2898
1994	14602	37883	20624	5814	0.2819	0.2014
1995	13119	46242	29141	7053	0.242	0.2485
1996	12662	42175	25215	8092	0.3209	0.2644
1997	13822	37698	22472	8114	0.3611	0.2612
1998	16469	38144	23942	8599	0.3592	0.2725
1999	17584	38962	24472	7325	0.2993	0.2905
2000	14137	37325	22853	7037	0.3079	0.265
2001	11403	39602	24497	5688	0.2322	0.1701
2002	9343	40171	24066	6534	0.2715	0.2016
2003	12849	41840	26713	8134	0.3045	0.2694
2004	24173	41722	24777	7590	0.3063	0.2911
2005	13695	43809	23647	7428	0.3141	0.2866
2006	22462	38527	22296	5773	0.2589	0.2056
Arith. Mean	15305	41330	24619	7635	0.3113	0.2569
0 Units	(Thousands	(Tonnes)	(Tonnes)	(Tonnes)		
1						

Annex E: Megrim (L.whiffiagonis) Figures and Tables

Megrim (*L.whiffiagonis*) in VII and VIIIabd. Comparison between 2006 and 2007 XSA runs for Recruits, SSB and Fbar.







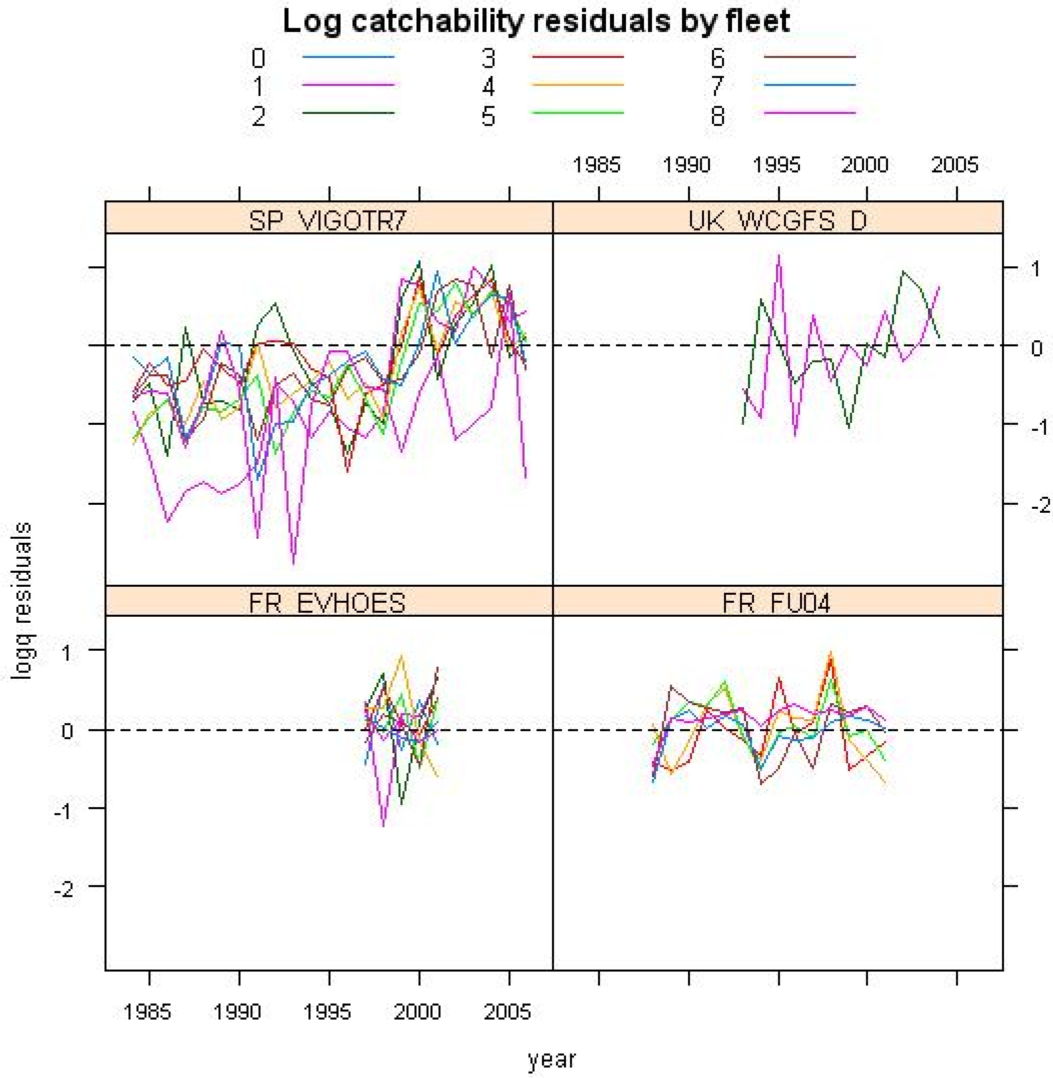


Figure E.2 Megrim (L.whiffiagonis) in Divisions VIIb,c,e-k and VIIIa,b,d log catchability residuals by fleet.

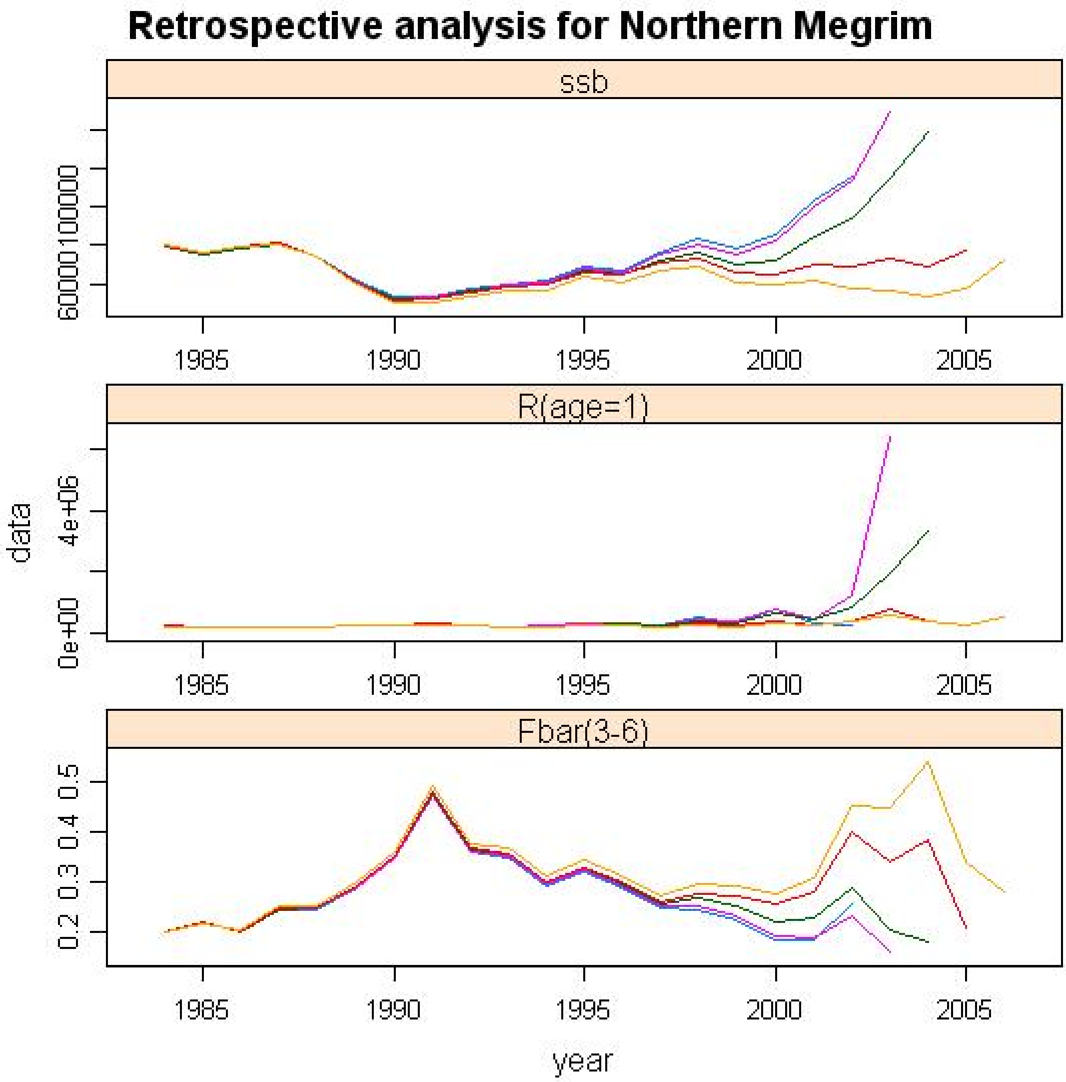
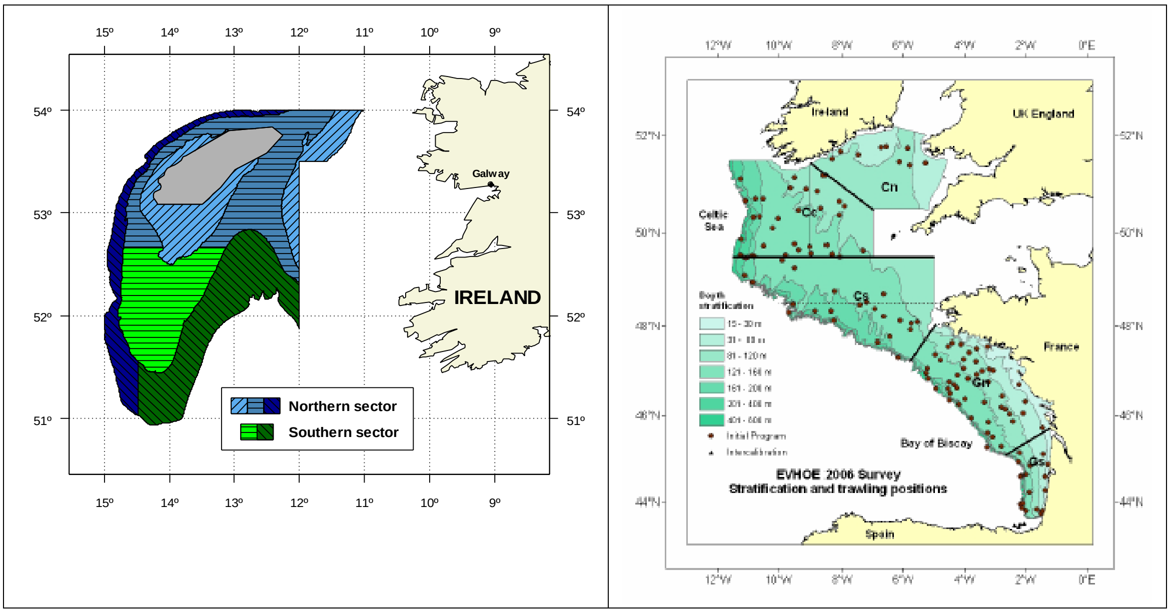


Figure E.3 Megrim (L. whiffiagonis) in Divisions VIIb,c,e-k and VIIIa,b,d. Retrospective XSA.



Landings by UK vessels into England & Wales and England and Wales vessels landing outside the UK 2006

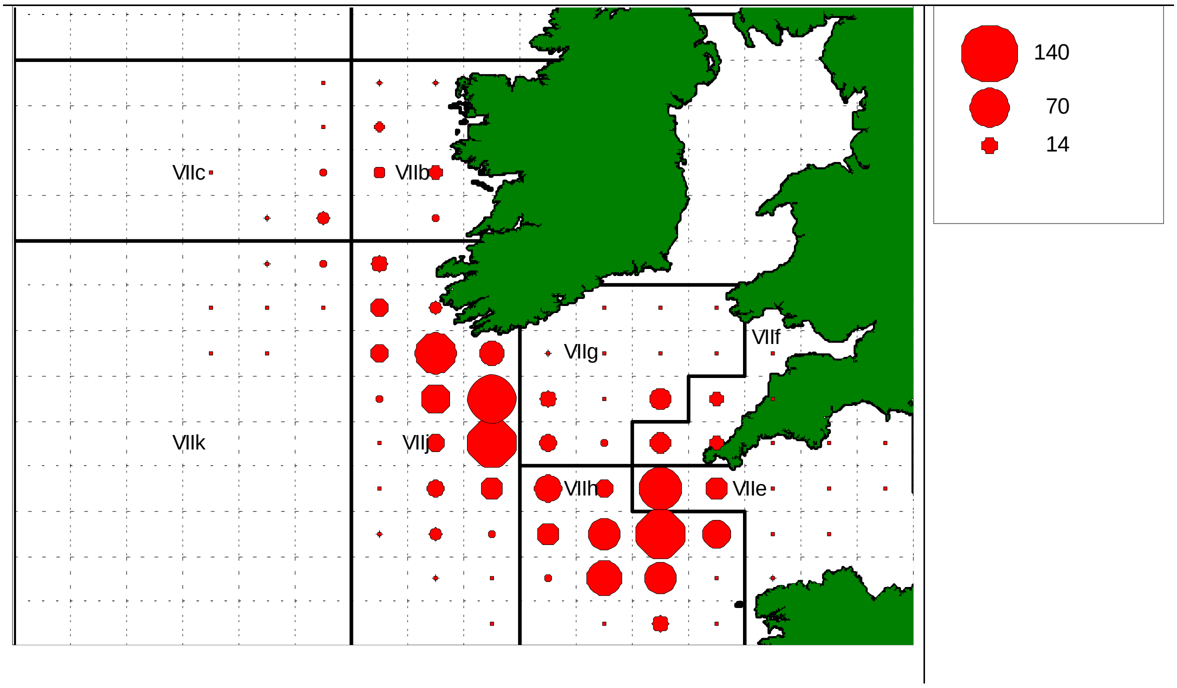
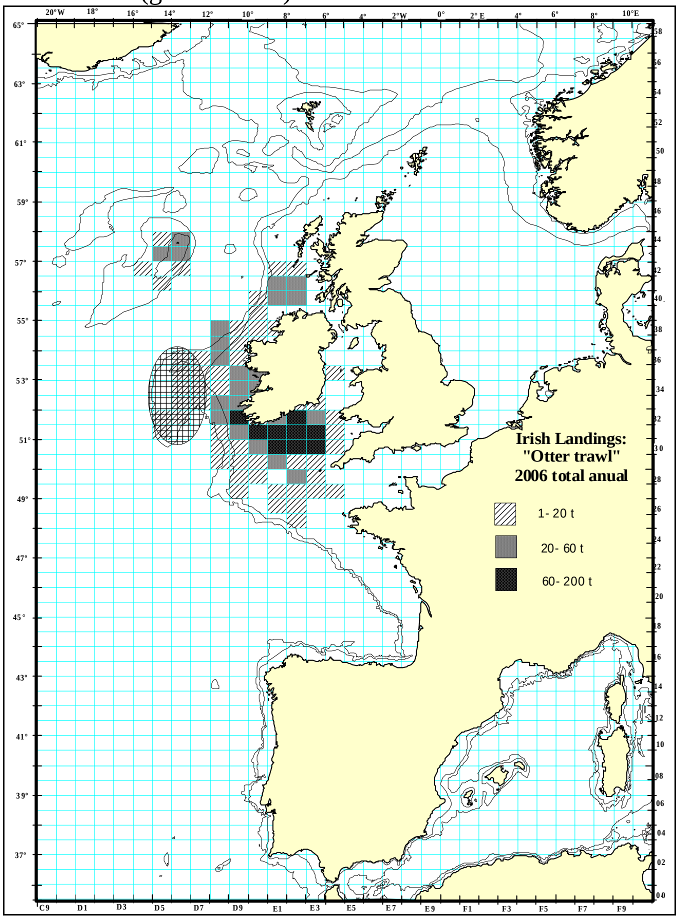
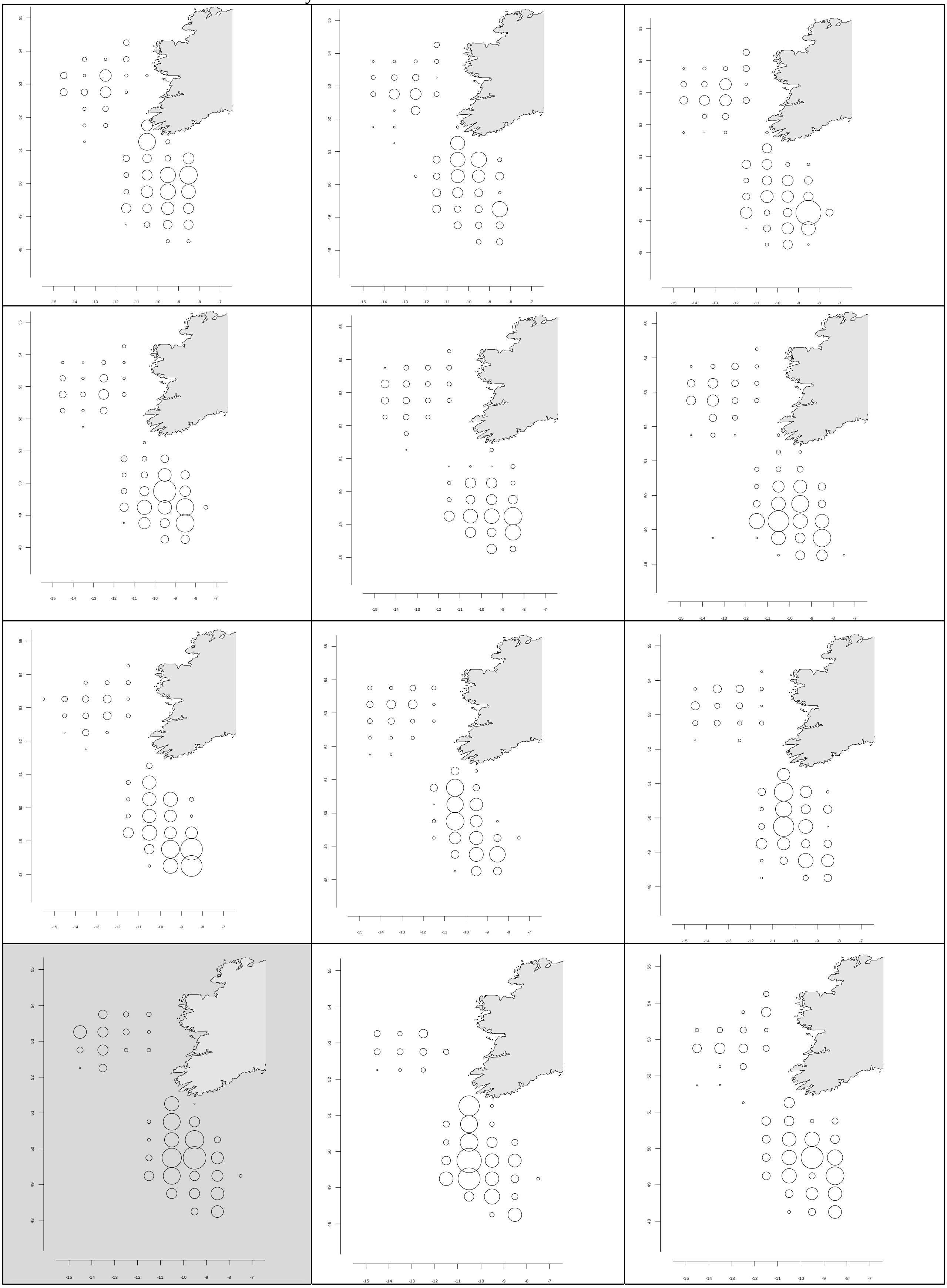


Figure E.4 Maps showing area covered and distribution of hauls by for 2006: Left: Spanish Porcupine Ground Fish Survey and Right: France EVHOE Survey. (WGIBTS, 2007)

Irish landings distribution by ICES Statistical rectangle in relation to Porcupine area covered by Spanish Ground Fish Survey (red line) from 2001 to 2006. In 2006, FR-EVHOE Survey is also marked (green colour).



Monthly spatial distribution of Spanish catches from the Vigo trawl fleet in Subarea VII along 2006.Starting from the left to right: January to December. Month when Porcupine Survey coincided with the fishery is shaded.



Annex Table E.1 Megrim (L. whiffiagonis) in Divisions VIIb,c,e-k and VIIIa,b,d. Tuning diagnostic.

Lowestoft VPA Version 3.1

9/05/2007 16:31

Extended Survivors Analysis

Megrim whif 7 and 8ab southern 04 index file

CPUE data from file meg7e206.txt

Catch data for 23 years. 1984 to 2006. Ages 1 to 10.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
"SP-VIGOTR7"	1984	2006	2	9	0	1
"FR-FU04"	1988	2006	4	9	0	1
"UK-WCGFS-I	1993	2006	2	3	0.15	0.25
"FR-EVHOES"	1997	2006	1	9	0.83	0.92

Time series weights :

Tapered time weighting applied
Power = 3 over 20 years

Catchability analysis :

Catchability independent of stock size for all ages

Catchability independent of age for ages >= 8

Terminal population estimation :

Survivor estimates shrunk towards the mean F
of the final 5 years or the 3 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 had not converged after 40 iterations

Total absolute residual between iterations
39 and 40 = .00639

Final year F values

Age	1	2	3	4	5	6	7	8	9
Iteration 39	0.011	0.0552	0.1163	0.1758	0.3689	0.4346	0.3006	0.3088	0.0772
Iteration 40	0.011	0.0552	0.1162	0.1756	0.3683	0.4335	0.2987	0.3069	0.0766

1

Regression weights

0.751	0.82	0.877	0.921	0.954	0.976	0.99	0.997	1	1

Fishing mortalities

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	0.003	0.004	0.003	0.001	0.007	0.002	0.018	0.022	0.006	0.011
2	0.039	0.071	0.07	0.022	0.046	0.037	0.09	0.068	0.042	0.055
3	0.118	0.179	0.169	0.114	0.084	0.135	0.189	0.282	0.078	0.116
4	0.264	0.302	0.252	0.296	0.25	0.345	0.467	0.517	0.24	0.176
5	0.371	0.358	0.357	0.327	0.336	0.559	0.558	0.638	0.365	0.368
6	0.315	0.311	0.358	0.341	0.526	0.739	0.531	0.685	0.63	0.433
7	0.329	0.414	0.447	0.404	0.56	0.581	0.636	0.26	0.621	0.299
8	0.447	0.424	0.503	0.46	0.627	0.249	0.322	0.446	0.351	0.307
9	0.435	0.493	0.365	0.426	0.383	0.154	0.116	0.142	0.534	0.077

Table E.1 (Cont'd)

XSA population numbers (Thousands)

YEAR	AGE 1	2	3	4	5	6	7	8	9
1997	2.30E+05	2.27E+05	1.70E+05	1.03E+05	6.11E+04	3.46E+04	2.16E+04	9.85E+03	4.95E+03
1998	2.91E+05	1.88E+05	1.79E+05	1.24E+05	6.47E+04	3.45E+04	2.07E+04	1.27E+04	5.15E+03
1999	2.25E+05	2.37E+05	1.43E+05	1.22E+05	7.49E+04	3.70E+04	2.07E+04	1.12E+04	6.82E+03
2000	3.05E+05	1.84E+05	1.81E+05	9.92E+04	7.78E+04	4.29E+04	2.12E+04	1.08E+04	5.54E+03
2001	2.42E+05	2.49E+05	1.47E+05	1.32E+05	6.04E+04	4.59E+04	2.50E+04	1.16E+04	5.61E+03
2002	3.93E+05	1.97E+05	1.95E+05	1.11E+05	8.44E+04	3.53E+04	2.22E+04	1.17E+04	5.07E+03
2003	6.00E+05	3.21E+05	1.55E+05	1.40E+05	6.42E+04	3.95E+04	1.38E+04	1.02E+04	7.46E+03
2004	3.85E+05	4.83E+05	2.40E+05	1.05E+05	7.16E+04	3.01E+04	1.90E+04	5.99E+03	6.03E+03
2005	2.90E+05	3.08E+05	3.69E+05	1.48E+05	5.14E+04	3.10E+04	1.24E+04	1.20E+04	3.14E+03
2006	5.15E+05	2.36E+05	2.42E+05	2.80E+05	9.55E+04	2.92E+04	1.35E+04	5.46E+03	6.92E+03

Estimated population abundance at 1st Jan 2007

	0.00E+00	4.18E+05	1.83E+05	1.77E+05	1.92E+05	5.42E+04	1.55E+04	8.25E+03	3.31E+03

Taper weighted geometric mean of the VPA populations:

	3.15E+05	2.42E+05	1.86E+05	1.25E+05	6.76E+04	3.46E+04	1.78E+04	9.41E+03	5.19E+03

Standard error of the weighted Log(VPA populations) :

	0.3233	0.2878	0.2873	0.295	0.1968	0.1852	0.2473	0.2926	0.2785
1									

Log catchability residuals.

Fleet : "SP-VIGOTR7"

Age	1984	1985	1986
1	No data for this fleet at this age		
2	99.99	99.99	99.99
3	99.99	99.99	99.99
4	99.99	99.99	99.99
5	99.99	99.99	99.99
6	99.99	99.99	99.99
7	99.99	99.99	99.99
8	99.99	99.99	99.99
9	99.99	99.99	99.99

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	No data for this fleet at this age									
2	-1.84	-1.72	-1.88	-1.74	-1.5	-0.48	-0.7	-1.16	-0.85	-1.04
3	0.23	-0.72	-0.71	-0.8	0.27	0.54	-0.07	-0.48	-0.73	-1.37
4	-0.46	-0.04	-0.26	-0.47	0.03	0.06	0.04	-0.3	-0.4	-1.6
5	-0.97	-0.45	-0.93	-0.79	0.05	-0.77	-0.59	-0.45	-0.19	-0.67
6	-1.19	-0.75	-0.81	-0.66	-0.37	-1.34	-0.82	-0.57	-0.65	-0.25
7	-1.16	-0.9	-0.18	-0.34	-1.17	-0.48	-0.32	-0.66	-0.75	-0.25
8	-1.12	-0.69	0.06	0.05	-1.66	-0.95	-0.94	-0.48	-0.35	-0.16
9	-1.24	-0.64	0.22	-0.54	-2.42	-0.39	-2.77	-0.76	-0.05	-0.07

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	No data for this fleet at this age									
2	-1.17	-0.86	0.83	0.76	0.32	0.17	1	0.75	0.3	0.44
3	-0.73	-0.99	0.6	1.06	-0.42	0.28	0.54	1.03	-0.15	0.09
4	-0.6	-0.51	0.01	0.87	-0.11	0.4	0.64	0.84	0.07	-0.26
5	-0.47	-0.91	0.14	0.74	-0.07	0.56	0.41	0.69	-0.06	0.15
6	-0.64	-1.1	-0.19	0.53	0.42	0.8	0.34	0.7	0.51	0.06
7	-0.14	-0.47	-0.42	-0.1	0.66	0.81	0.8	-0.18	0.75	-0.35
8	-0.05	-0.42	-0.48	0.05	0.93	-0.01	0.35	0.65	0.6	-0.21
9	-0.52	-0.56	-1.36	-0.61	-0.12	-1.24	-1.07	-0.88	0.64	-1.72

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	2	3	4	5	6	7	8	9
Mean Log q	-9.7967	-8.8119	-8.0523	-7.7651	-7.7365	-8.0605	-8.3957	-8.3957
S.E(Log q)	0.8409	0.7401	0.6317	0.5371	0.6437	0.5817	0.5588	1.1095

Table E.1 (Cont'd)

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
2	0.4	1.938	11.37	0.51	20	0.3	-9.8
3	0.61	0.803	10.1	0.3	20	0.46	-8.81
4	1.08	-0.11	7.76	0.16	20	0.71	-8.05
5	0.42	1.846	9.71	0.5	20	0.21	-7.77
6	0.47	1.07	9.17	0.29	20	0.3	-7.74
7	0.98	0.022	8.09	0.16	20	0.6	-8.06
8	0.85	0.306	8.51	0.28	20	0.49	-8.4
9	-2.39	-1.851	7.13	0.03	20	1.7	-9.15
1							

Fleet : "FR-FU04"

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	No data for this fleet at this age									
4	99.99	-0.41	-0.51	-0.41	0.25	0.03	-0.12	-0.34	0.66	-0.05
5	99.99	0.07	-0.55	-0.14	0.33	0.53	-0.11	-0.37	0.26	0.15
6	99.99	-0.17	0.15	0.36	0.31	0.63	-0.08	-0.5	-0.02	0.05
7	99.99	-0.57	0.57	0.37	0.28	0.25	0.29	-0.69	-0.48	-0.03
8	99.99	-0.64	0.15	0.26	0.04	0.17	0.09	-0.47	-0.07	-0.12
9	99.99	-0.44	0.15	0.11	0.14	0.2	0.24	0.05	0.25	0.3

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	No data for this fleet at this age									
4	0.09	0.88	-0.51	-0.32	-0.16	99.99	99.99	99.99	99.99	99.99
5	0.12	0.99	-0.14	-0.39	-0.65	99.99	99.99	99.99	99.99	99.99
6	-0.1	0.62	-0.1	-0.01	-0.4	99.99	99.99	99.99	99.99	99.99
7	-0.47	0.34	0.22	0.3	-0.07	99.99	99.99	99.99	99.99	99.99
8	-0.12	0.1	0.17	0.12	-0.02	99.99	99.99	99.99	99.99	99.99
9	0.18	0.24	0.15	0.27	0.1	99.99	99.99	99.99	99.99	99.99

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	4	5	6	7	8	9
Mean Log q	-9.1028	-8.7141	-8.3822	-7.8718	-7.4196	-7.4196
S.E(Log q)	0.4705	0.5149	0.3522	0.3764	0.1845	0.2238

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
4	0.81	0.168	9.58	0.13	14	0.42	-9.1
5	1.77	-0.319	6.89	0.03	14	0.99	-8.71
6	1.84	-0.663	6.62	0.11	14	0.68	-8.38
7	0.7	0.601	8.48	0.44	14	0.28	-7.87
8	0.66	1.822	8.03	0.85	14	0.1	-7.42
9	1.14	-0.8	7.05	0.87	14	0.1	-7.23
1							

Fleet : "UK-WCGFS-D"

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	No data for this fleet at this age									
2	99.99	99.99	99.99	99.99	99.99	99.99	-0.54	-0.9	1.16	-1.14
3	99.99	99.99	99.99	99.99	99.99	99.99	-0.98	0.59	0.04	-0.49
4	No data for this fleet at this age									
5	No data for this fleet at this age									
6	No data for this fleet at this age									
7	No data for this fleet at this age									
8	No data for this fleet at this age									
9	No data for this fleet at this age									

Table E.1 (Cont'd)

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	No data for this fleet at this age									
2	0.38	-0.44	0.01	-0.25	0.44	-0.19	0.05	0.74	99.99	99.99
3	-0.2	-0.18	-1.04	0.02	-0.15	0.94	0.72	0.1	99.99	99.99
4	No data for this fleet at this age									
5	No data for this fleet at this age									
6	No data for this fleet at this age									
7	No data for this fleet at this age									
8	No data for this fleet at this age									
9	No data for this fleet at this age									

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	2	3
Mean Log q	-11.4725	-9.7623
S.E(Log q)	0.6208	0.6089

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
2	0.51	1.484	11.91	0.56	12	0.3	-11.47
3	0.49	0.838	10.92	0.27	12	0.31	-9.76
1							

Fleet : "FR-EVHOES"

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	-0.42	0.59	-0.27	0.38	-0.19	99.99	99.99	99.99	-0.1	99.99
2	0.35	-1.21	0.19	0.16	0.63	99.99	99.99	99.99	-0.19	99.99
3	0.23	0.71	-0.94	0.09	0.65	99.99	99.99	99.99	-0.64	99.99
4	-0.01	0.51	0.09	-0.08	0.39	99.99	99.99	99.99	-0.79	99.99
5	0.29	0.28	0.93	-0.15	-0.57	99.99	99.99	99.99	-0.58	99.99
6	0.13	0	0.47	-0.49	0.37	99.99	99.99	99.99	-0.42	99.99
7	-0.13	0.22	0.09	-0.47	0.75	99.99	99.99	99.99	-0.44	99.99
8	0.18	0.03	-0.1	-0.15	0.08	99.99	99.99	99.99	-0.01	99.99
9	0.21	-0.15	0.13	-0.18	-0.01	99.99	99.99	99.99	-0.15	99.99

Mean log catchability and standard error of ages with catchability
independent of year class strength and constant w.r.t. time

Age	1	2	3	4	5	6	7	8	9
Mean Log q	-17.1155	-15.733	-15.6054	-15.2883	-15.0766	-14.6325	-14.4704	-14.4571	-14.4571
S.E(Log q)	0.3896	0.6411	0.687	0.4807	0.5999	0.4118	0.4782	0.1198	0.1653

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
1	0.3	2.495	13.88	0.79	6	0.08	-17.12
2	0.52	0.549	14.11	0.28	6	0.36	-15.73
3	3.31	-0.736	23.56	0.03	6	2.4	-15.61
4	22.35	-0.596	91.79	0	6	11.65	-15.29
5	0.3	1.412	12.28	0.55	6	0.16	-15.08
6	0.57	0.54	12.86	0.32	6	0.26	-14.63
7	0.45	1.576	11.95	0.71	6	0.19	-14.47
8	1.36	-0.352	16.3	0.22	6	0.18	-14.46
9	0.8	0.862	13.29	0.85	6	0.13	-14.49
1							

Terminal year survivor and F summaries :

Table E.1 (Cont'd)

Age 1 Catchability constant w.r.t. time and dependent on age

Year class = 2005

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"SP-VIGOTR7"	1	0	0	0	0	0	0
"FR-FU04"	1	0	0	0	0	0	0
"UK-WCGFS-D	1	0	0	0	0	0	0
"FR-EVHOES"	1	0	0	0	0	0	0
F shrinkage n	417650	1.5				1	0.011

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
417650	1.5	0	1	0	0.011

1

Age 2 Catchability constant w.r.t. time and dependent on age

Year class = 2004

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"SP-VIGOTR7"	282706	0.875	0	0	1	0.179	0.036
"FR-FU04"	1	0	0	0	0	0	0
"UK-WCGFS-D	1	0	0	0	0	0	0
"FR-EVHOES"	165403	0.425	0	0	1	0.756	0.061
F shrinkage n	178287	1.5				0.064	0.057

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
182965	0.37	0.14	3	0.39	0.055

Age 3 Catchability constant w.r.t. time and dependent on age

Year class = 2003

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"SP-VIGOTR7"	211717	0.578	0.102	0.18	2	0.544	0.098
"FR-FU04"	1	0	0	0	0	0	0
"UK-WCGFS-D	1	0	0	0	0	0	0
"FR-EVHOES"	145397	0.699	0	0	1	0.363	0.139
F shrinkage n	130329	1.5				0.092	0.154

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
176583	0.43	0.12	4	0.292	0.116

1

Age 4 Catchability constant w.r.t. time and dependent on age

Year class = 2002

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"SP-VIGOTR7"	192196	0.435	0.288	0.66	3	0.543	0.176
"FR-FU04"	1	0	0	0	0	0	0
"UK-WCGFS-D	403851	0.654	0	0	1	0.22	0.087
"FR-EVHOES"	101679	0.749	0	0	1	0.179	0.309
F shrinkage n	83364	1.5				0.058	0.366

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
192375	0.32	0.26	6	0.8	0.176

Table E.1 (Cont'd)

Age 5 Catchability constant w.r.t. time and dependent on age

Year class = 2001

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"SP-VIGOTR7'	76518	0.352	0.225	0.64	4	0.52	0.274
"FR-FU04"	1	0	0	0	0	0	0
"UK-WCGFS-D	58154	0.459	0.025	0.05	2	0.209	0.347
"FR-EVHOES"	24551	0.524	0	0	1	0.222	0.684
F shrinkage n	37603	1.5				0.05	0.495

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
54215	0.25	0.2	8	0.816	0.368

1

Age 6 Catchability constant w.r.t. time and dependent on age

Year class = 2000

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"SP-VIGOTR7'	18608	0.332	0.16	0.48	5	0.532	0.373
"FR-FU04"	1	0	0	0	0	0	0
"UK-WCGFS-D	20658	0.461	0.455	0.99	2	0.132	0.341
"FR-EVHOES"	10623	0.388	0.198	0.51	2	0.279	0.583
F shrinkage n	9622	1.5				0.057	0.628

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
15537	0.23	0.14	10	0.601	0.433

Age 7 Catchability constant w.r.t. time and dependent on age

Year class = 1999

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"SP-VIGOTR7'	9202	0.343	0.207	0.6	6	0.532	0.27
"FR-FU04"	1	0	0	0	0	0	0
"UK-WCGFS-D	16535	0.466	0.248	0.53	2	0.065	0.159
"FR-EVHOES"	6884	0.339	0.279	0.82	3	0.346	0.347
F shrinkage n	4027	1.5				0.056	0.536

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
8254	0.23	0.15	12	0.644	0.299

1

Age 8 Catchability constant w.r.t. time and dependent on age

Year class = 1998

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"SP-VIGOTR7'	4017	0.332	0.184	0.55	7	0.61	0.258
"FR-FU04"	1	0	0	0	0	0	0
"UK-WCGFS-D	2708	0.472	0.049	0.1	2	0.045	0.362
"FR-EVHOES"	2422	0.38	0.167	0.44	4	0.284	0.397
F shrinkage n	2389	1.5				0.061	0.402

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
3312	0.25	0.13	14	0.509	0.307

Table E.1 (Cont'd)

Age 9 Catchability constant w.r.t. time and age (fixed at the value for age) 8

Year class = 1997

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
"SP-VIGOTR7"	5722	0.297	0.285	0.96	8	0.366	0.071
"FR-FU04"	4484	0.515	0	0	1	0.032	0.089
"UK-WCGFS-D	5346	0.482	0.006	0.01	2	0.031	0.075
"FR-EVHOES"	5515	0.257	0.082	0.32	5	0.544	0.073
F shrinkage n	1002	1.5				0.028	0.349

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
5288	0.18	0.14	17	0.755	0.077

Table E 2. Megrim (*L.whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. Estimates of fishing mortality at age.

Run title : 7 and 8ab southern 04 index file

At 9/05/2007 16:31

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR	1984	1985	1986
AGE			
1	0.0005	0	0.0022
2	0.0857	0.0073	0.0323
3	0.1778	0.0965	0.1033
4	0.1967	0.187	0.166
5	0.1597	0.2259	0.2203
6	0.2566	0.3518	0.3126
7	0.3772	0.5786	0.4184
8	0.4392	0.4865	0.498
9	0.36	0.476	0.4128
+gp	0.36	0.476	0.4128
0 FBAR 3- 6	0.1977	0.2153	0.2005

Table 8 Fishing mortality (F) at age

YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
AGE										
1	0.0029	0.0025	0.0063	0.0012	0.0027	0.0029	0.0036	0.0025	0.0034	0.0034
2	0.0326	0.0531	0.0276	0.0558	0.0224	0.0485	0.0507	0.044	0.0524	0.0469
3	0.2065	0.2207	0.2032	0.185	0.2734	0.3342	0.1656	0.1645	0.1617	0.1335
4	0.2157	0.2028	0.1958	0.2891	0.4657	0.4186	0.439	0.3041	0.3705	0.2212
5	0.2282	0.2742	0.2584	0.3473	0.6613	0.3656	0.4346	0.3918	0.4526	0.425
6	0.3407	0.3056	0.5243	0.6017	0.5503	0.3702	0.4149	0.3683	0.3647	0.4527
7	0.3129	0.3558	0.8099	0.6097	0.4912	0.5025	0.4699	0.3478	0.3018	0.4375
8	0.2996	0.4268	0.7766	0.869	0.4661	0.5508	0.4733	0.4282	0.4224	0.4832
9	0.3211	0.4207	0.7224	0.6484	0.4557	0.4638	0.5008	0.6186	0.5298	0.5967
+gp	0.3211	0.4207	0.7224	0.6484	0.4557	0.4638	0.5008	0.6186	0.5298	0.5967
0 FBAR 3- 6	0.2477	0.2508	0.2954	0.3558	0.4877	0.3721	0.3635	0.3072	0.3374	0.3081
1										

Run title : 7 and 8ab southern 04 index file

At 9/05/2007 16:31

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	FBAR **-**
AGE											
1	0.0034	0.0038	0.0028	0.0007	0.007	0.0018	0.0183	0.0216	0.0062	0.011	0.0129
2	0.0391	0.0706	0.0699	0.0219	0.0457	0.0369	0.0896	0.0675	0.0422	0.0552	0.055
3	0.1182	0.1789	0.1691	0.1142	0.0838	0.1354	0.1893	0.2825	0.0776	0.1162	0.1588
4	0.2635	0.3017	0.2521	0.2963	0.2502	0.3455	0.4671	0.5172	0.2398	0.1756	0.3109
5	0.3711	0.358	0.357	0.3271	0.3363	0.5593	0.5583	0.6379	0.3653	0.3683	0.4572
6	0.3147	0.3107	0.358	0.3412	0.5263	0.7393	0.5308	0.6846	0.6304	0.4335	0.5828
7	0.3289	0.414	0.4473	0.4043	0.5603	0.581	0.6358	0.2596	0.6211	0.2987	0.3931
8	0.4473	0.4237	0.5034	0.4596	0.6271	0.2488	0.3224	0.446	0.3513	0.3069	0.3681
9	0.435	0.4925	0.3649	0.4256	0.3825	0.1542	0.1157	0.1423	0.5342	0.0766	0.251
+gp	0.435	0.4925	0.3649	0.4256	0.3825	0.1542	0.1157	0.1423	0.5342	0.0766	
0 FBAR 3- 6	0.2669	0.2873	0.284	0.2697	0.2991	0.4449	0.4364	0.5306	0.3283	0.2734	
1											

Table E 3. Megrim (*L.whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. Estimates of fishing mortality at age.

Run title : 7 and 8ab southern 04 index file

At 9/05/2007 16:31

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-3

	YEAR	1984	1985	1986
	AGE			
	1	232264	228912	208798
	2	187108	190068	187415
	3	176460	140612	154488
	4	131058	120943	104529
	5	91404	88138	82133
	6	62190	63792	57569
	7	43649	39394	36739
	8	24095	24508	18084
	9	16785	12716	12336
	+gp	14561	9615	12248
0	TOTAL	979574	918699	874340

Table 10 Stock number at age (start of year) Numbers*10**-3

	YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
	AGE										
	1	191427	184002	254881	292429	298646	259026	209235	226277	266831	277981
	2	170569	156281	150279	207377	239122	243846	211457	170686	184789	217724
	3	148562	135166	121339	119689	160566	191436	190201	164560	133727	143575
	4	114071	98943	88751	81077	81445	100015	112206	131954	114296	93140
	5	72491	75275	66136	59740	49715	41854	53880	59222	79707	64602
	6	53950	47242	46850	41818	34561	21010	23774	28565	32771	41504
	7	34481	31418	28493	22707	18759	16320	11879	12855	16181	18631
	8	19795	20647	18022	10379	10104	9397	8084	6079	7433	9797
	9	8998	12011	11032	6787	3563	5191	4435	4123	3243	3989
	+gp	8420	14751	8980	6573	3417	3809	3589	5642	4010	4692
0	TOTAL	822765	775735	794762	848577	899897	891904	828739	809963	842989	875634
	1										

Run title : 7 and 8ab southern 04 index file

At 9/05/2007 16:31

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-3

	YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	GMST 87-**
	AGE												
	1	230498	291135	224907	304951	242113	392736	600303	384925	290045	515380	0	273249
	2	226824	188066	237458	183616	249496	196850	320976	482551	308410	236000	417650	215386
	3	170087	178587	143480	181282	147082	195137	155321	240272	369286	242072	182965	159687
	4	102858	123730	122268	99193	132406	110742	139530	105230	148310	279758	176583	107148
	5	61124	64703	74922	77801	60387	84413	64183	71604	51365	95535	192375	64730
	6	34579	34530	37034	42926	45928	35321	39504	30069	30976	29185	54215	36345
	7	21608	20668	20720	21197	24984	22216	13808	19022	12414	13501	15537	20083
	8	9848	12732	11185	10846	11584	11680	10174	5986	12013	5462	8254	10678
	9	4948	5155	6824	5535	5608	5066	7456	6034	3138	6922	3312	5725
	+gp	6904	4086	6040	4093	3525	2896	5151	2781	3290	5527	9480	
0	TOTAL	869277	923392	884838	931440	923113	1057057	1356407	1348473	1229247	1429342	1060370	
	1												

Table E 4. Megrim (*L.whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. Estimates of fishing mortality at age.

Run title : 7 and 8ab southern 04 index file

At 9/05/2007 16:31

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECI Age 1	TOTALBIO	TOTSPBIC	CATCHES	LANDINGS	DISCARDS	YIELD/SSE	FBAR 3- 6
1984	232264	100252	80202	18828	16659	2169	0.2348	0.1977
1985	228912	97996	76328	19597	17865	1732	0.2567	0.2153
1986	208798	99403	79513	21248	18927	2321	0.2672	0.2005
1987	191427	101859	81415	18819	17114	1705	0.2311	0.2477
1988	184002	91605	75314	19302	17577	1725	0.2563	0.2508
1989	254881	75920	59943	21815	19233	2582	0.3639	0.2954
1990	292429	71547	50442	17655	14371	3284	0.35	0.3558
1991	298646	74825	51140	18376	15094	3282	0.3593	0.4877
1992	259026	77657	54575	18588	15600	2988	0.3406	0.3721
1993	209235	76292	57047	18037	14929	3108	0.3162	0.3635
1994	226277	76844	57825	16385	13685	2700	0.2834	0.3072
1995	266831	83454	64478	19068	15862	3206	0.2957	0.3374
1996	277981	81627	62176	18135	15109	3026	0.2917	0.3081
1997	230498	90839	68199	17296	14230	3066	0.2536	0.2669
1998	291135	92655	70223	19716	14345	5371	0.2808	0.2873
1999	224907	81236	62100	16850	13715	3135	0.2713	0.284
2000	304951	80475	60945	15517	14485	1033	0.2546	0.2697
2001	242113	88944	63634	17081	15806	1275	0.2684	0.2991
2002	392736	85536	59247	17454	15988	1466	0.2946	0.4449
2003	600303	90747	59088	18561	15414	3147	0.3141	0.4364
2004	384925	89555	54698	18811	14300	4511	0.3439	0.5306
2005	290045	86638	58995	14542	12712	1831	0.2465	0.3283
2006	515380	103826	74582	14479	12011	2468	0.1941	0.2734
Arith. Mean	287291	86945	64440	18094			0.2856	0.32
0 Units	(Thousands	(Tonnes)	(Tonnes)	(Tonnes)				
1								

Annex F: Stock Annex – Bay of Biscay Sole

Stock specific documentation of standard assessment procedures used by ICES.

Stock:	Sole (division VIIIab)
Working Group:	Assessment of Hake, Monk and Megrim Stocks
Date:	July 2004 (G. Biais)
Last updated:	May 2007 (G. Biais)

A General

A.1 Stock definition

The Bay of Biscay sole stock extends on shelf that lies along Atlantic French coast from the Spanish boarder to the West point of Brittany. This shelf forms a geographical unit, being narrow at its two extreme parts, particularly in the south. As sole is chiefly present at less than 150m, this geography of the living area gives some supports to the absence or only limited exchanges with other southern or northern stocks. However, a tagging experiment carried out in 1992 on two nursery areas has shown that fish may move from southern coast of Brittany to the Iroise sea, in the West of Brittany (KoutsiKopoulos et al., 1993).

Several spawning grounds are known at depth from 30 to 100 m , from south to north (Arbault *et al*., 1986) :

in the north of Cap Breton, off the Landes coast,

Between Arcachon and the Gironde estuary,

in front of La Rochelle,

in front of the Loire estuary,

in several but limited areas off the southern coast of Britanny.

Nursery grounds are located in the coastal waters, in bays (Pertuis d'Antioche, Pertuis Breton, Baie de Bourgneuf) and estuaries (Gironde, Loire, Vilaine) (Le Pape *et al*., 2003a).

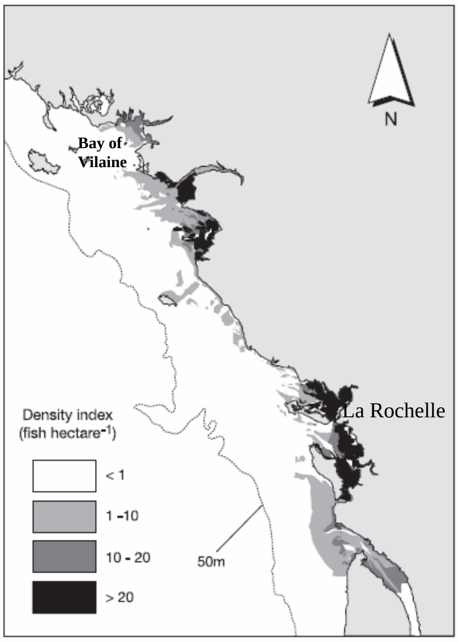


Figure 1 : Fitted 0-group sole density (number of fish per hectare) in the Bay of Biscay (Le Pape *et al.*, 2003a).

A.2 Fishery

The French fleet is the major participant in the Bay of Biscay sole fishery with landings being about 90% of the total official international landings over the historical series. Most of the remaining part is usually landed by the Belgian fleet.

The fishery is largely a fixed net fishery directed on sole, particularly in the first term on the year. The other component is a French and Belgian trawl fishery. The French trawlers are otter trawlers with mixed species catches (sole, cuttlefish, squid, hake, pout, whiting….). The Belgium trawlers are beam trawlers directed at sole, but monk is an important part of its catch. The French coastal boats of these two fisheries have a larger proportion of young fish in their catch than offshore boats. These boats less than 12 m long contribute to the landings by about one third from 2000 onwards. Sole is a major resource for all these boats, given the price of this species on the market. Although the species is taken throughout the year, the catch of coastal netters is less important in autumn, those of coastal trawlers in winter and those of offshore French boats are heaviest in the first quarter.

Otter trawling predominated until the late 1980s, including a small-mesh shrimp fishery which decreased markedly in the beginning of the 1990s. The fixed fishery begun in the 1980s, and it have expanded in the 1990 to account for two third to three quarters of the French landings in the beginning of 2000s. The beam trawl effort increased also rapidly and continuously in the 1990s. It has decreased after 1999 until 2004 to increase again since then. On the opposite, the otter trawl effort shows a decreasing trend until 1999 but it is stable in recent years.

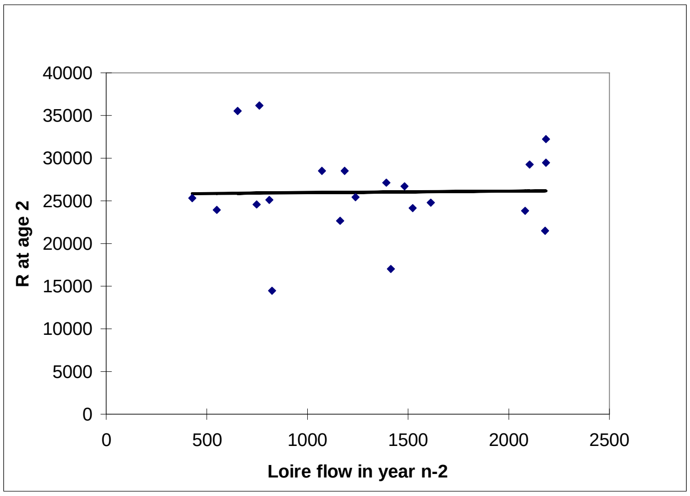
Catches have increased continuously since the beginning of the 1980s, until a maximum was reached in 1994 (7 400 t). They have decreased afterwards to 4000-4500t in 2003-2006.

A.3 Ecosystem aspects

The quality and the extend of the nursery grounds have likely a major effect in the dynamic of sole recruitment. Studies in Vilaine bay showed a significant positive relationship between the fluvial discharges in winter-spring and the size of the nursery (Le Pape *et al.*, 2003b) . The extent of the river plume influences both the larval supply and the size and biotic capacity of habitats in estuarine nursery grounds and determines the number of juveniles produced.

The WGSSDS looked at the possibility of such effect for the whole Bay of Biscay stock at it 2006 meeting. The relationship between recruitment and river flows was investigated using the Loire river flow in the first half of the year which is considered to be a representative index of the water discharge influences on nursery areas in the Bay of Biscay. Unfortunately, no relationship can be seen between this index and the recruitment at age 2 (Figure 2). The environmental effect is likely to be more complex at the Bay of Biscay scale.

Figure 2: relationship between recruitment at age 2 (as estimated by WGSSDS in 2006) and mean Loire flow in first half year



B. Data

B.1 Commercial Catch

B.1.1 Discards estimates of the French offshore trawlers

Discards estimates are available for the French offshore trawlers from 1984 to 2003. They were provided by the French trawl surveys FR-RESSGASC-S from 1984 to 2002. This surveys were carried out each quarter until 1997, but only in the second and last quarter since 1998. Consequently, discards in the first and third quarter have been estimated using respectively the last quarter survey of the preceding year and the second quarter survey from 1998 onwards.

In 2003, this survey was discontinued but commercial trawler sample trips can be used, doing the same assumptions and using the same estimation method than previously for the FR-RESSGASC-S estimates

Discards estimates when using RESSGASC surveys (Gwen Drez R/S using 55mm Vendéen trawl)

Assumptions :

Between length T1 and T2, defined for being :

T1 = Length above which discards are assumed to be low

T2 = Length above which catch are low

Trawls of the Gwen Drez R/S and the offshore trawlers have the same selectivity

Gwen Drez R/S operate in the same area and in the same conditions than the offshore trawlers during the quarter (up to 1997) or the semester of the survey (quarter 4 year n + quarter 1 year n+1 for november survey year n; quarter 2 and 3 for may survey)

If so, RESSGASC length distribution is representative of total catch distribution between T1 and T2, and

discard estimate = (RGL . OTT/RGT) – OTL

with

RGL = Catch number at length L during a RESGASC survey

RGT = Total catch number from T1 = 21 cm to T2 = 35 cm during a RESSGASC survey

OTL = Total catch number at length L of the offshore trawlers in the quarter (or the half-year since 1998) of the survey

OTT = Total catch number from T1 = 21 cm to T2 = 35 cm of the offshore trawlers in the quarter (or the half-year since 1998) of the survey

OTT/RGT = proportionality factor between offshore trawler fleet catch and RESSGASC catch in number

(Guichet R. *et al.*, 1998.)

Discards estimate when using catch sampling at sea on offshore trawlers in 2003

Assumptions 1) is still valid if the trawls used during the sampled trips are the same than in the fleet (probably more likely than for the RESSGASC survey in recent years)

Assumptions 2) is valid if trawl hauls were sampled in the main fishing areas and if there is only a small effect of fishing area on the length composition of the offshore trawlers fleet (likely in offshore waters)

<u>Note</u> : if T1 chosen to be lower than the size at which discards are negligible, the discards are underestimated.

Demonstration :

K = OTT/RGT for T1 < T1’ with T1’ true length above which discard are negligible

RGT = RGT’’ + RGT’

With RGT’’= Total catch number from T1 to T1’ during a RESSGASC survey

RGT’ = Total catch number from T1’ to T2 during a RESSGASC survey

OTT = OTT’’ + OTT’

With OTT’’ = Total catch number from T1 to T1’ of the offshore trawler fleet

OTT’ = Total catch number from T1’ to T2 of the offshore trawler fleet

K’ = OTT’/RGT’ “true” proportionality factor

Then

OTT’ = K’ . RGT’

Furthermore, if D are the discards between T1 and T1’

Then D = RGT’’. K’ - OTT’’

And OTT’’ = RGT’’. K’ - D

K = OTT/RGT

K . RGT = OTT’’ + OTT’ = (K’ . RGT’’ – D) + K’ . RGT’ = K’ . (RGT’’ + RGT’) – D

K . RGT = K’. RGT -D

K’ = K + D/ RGT

Then K’>K and discards are underestimated when using K

B.1.2 Landing numbers at length

The quarterly French sampling for length compositions is by gear (trawl or fixed net) and boat length (below or over 12m long). The contributions of each of these components of the French fleet to the landings are estimated by quarter from logbook data, assuming that the landings associated with logbooks are representative of the whole landings. In 2000-2002, surveys on fishing activities by month have provided a likely less biased estimate of landing split by gear than logbooks, which are filled in only by a part of the fleet (50-60% of the landings in 2000-2002). As logbooks are often recorded in the file with delay, the process is to use logbooks to get a landing split in the last year only if it is close to the mean over the three preceding years when the percentage of landings associated with logbook is well below preceding years. If not, the quarterly mean over the three preceding years is used.

B.1.3 Catch number at age

Age compositions of the French landings and discards (up to 2003) are estimated using quarterly ALKs. Up to 1998, it is only FR-RESSGASC-S surveys ALKs. From the second half of the 1998 year and up to 2002, the first and third quarter ALKs are obtained from commercial landings samples. In 2003, commercial landing samples are completed by fish caught during a survey which was planned to design gear and methodology for the future survey ORHAGO aiming at a sole abundance index series in the Bay of Biscay. In 2004 and 2005, only market samples are used. In 2006, samples are mainly used but the beginning of the ORHAGO survey series provides age estimates at length for a large part of the landing length distribution in the last quarter of the year. Another survey (Langolf) provides also some fish in the second quarter. Market samples are used to complete these ALKs for the upper part of the distribution.

Prior to 1994, the age composition of French offshore trawler catches is raised to include Belgian landings. In 1994 and 1995, FR-RESSGASC-S ALKs are applied to Belgian length distributions. From 1996 ahead, catch numbers at age of the Belgian fleet are estimated with Belgian ALKs. French and Belgian age composition are added before being raised to the total international catch except in 2001 where the Belgian age compositions were raised to the total of Belgian and Dutch landings.

French offshore trawlers discards are estimated to have represented about 1 to 3 % of the total catches in recent years (1991-2003) and less than 0.5% since in 2002 and 2003. Given their low contribution to the total catch, their monitoring was not continued in 2004 and they have been no longer used in the assessment, as recommended by ACFM, since 2005. Available discards estimates for a limited number of trips shows that discards of beam trawlers and gillnetters are also generally low. They can be occasionally high in the inshore trawlers fleet. However, this fleet only account for 12% of the total French landing and therefore discards estimates are not considered to be a priority for this stock given their likely low contribution to the total catch.

B.2 Biological

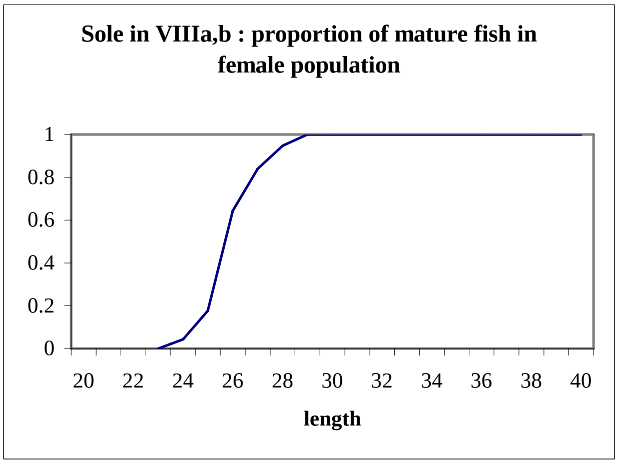
Weights at Age

French mean weights at age are estimated using quarterly length-weight relationships. Belgian mean weight at age are straight estimates. International mean weights at age are French-Belgian quarterly weighted mean weights.

Stock weights are set to the catch weights.

Maturity ogive

In assessments up to the 2000 Working Group, a knife-edge maturity was used, assuming a full maturity at age 3.



During the 4 first months in 2000, the maturity at length and at age was observed on 296 female fish, 112 being between 24 cm and 28 cm long, which is the observed length range for maturity occurrence of sole in Bay of Biscay. The sampling was assumed to be at random within a length class of 1 cm. The maturity ogive was then estimated applying a maturity/age/length key thus obtained to the length distribution of the first quarter in 2000.

The maturity at age was so estimated to be :

AGE	≤ 1	2	3	4	≥ 5
Mature	0	0.32	0.83	0.97	1

Natural Mortality

Natural mortality is assumed to be 0.1 for all age groups and all years.

B.3 Surveys

RESSGASC survey series are available but it must be known that these surveys were carried out to provide hake discard estimates and consequently not well designed for providing abundance indices. Each quarter from 1987 to 1998, and thereafter each second and fourth quarter of the year, the survey aimed to catch as commercial fishing boats in the same areas. These series were disrupted in 2003.

Consequently, the abundance indices provided by these surveys are closed of commercial CPUE with the advantage to guarantee that no change occurred in fishing gear but the disadvantage to provide a CPUE based on a limited number of hours.

Because the change from a quarterly to an half yearly planning of this survey in 1998, the annual FR-RESSGASC-S CPUE series was turn to four quarterly ones at the 2001 WG. An attempt to use the series in the first and the third quarters (which end in 1997) was made, but the quality was too poor to retain them at following WG. Therefore, only the second and fourth quarters series have been used in the tuning process since 2002.

B.4 Commercial CPUE

Four series of commercial fishing effort data and LPUE indices are available : La Rochelle offshore trawlers (FR-ROCHEL), Les Sables d'Olonne offshore trawlers (FR-SABLES), trawlers landing sole in other harbours than La Rochelle and Les Sables (FR-OTHER) and a Belgian beam trawlers series, this two latter being presented for the first time respectively at the 2005 WG and at the 2004 WG.

The effort of the French commercial fleets was revised in 2002. Some corrections were made when the data base was checked to be stored in a new data management system (mean difference over years 3%, maximum 12%). The unit of effort was changed from hours corrected for horse power (H x 100 kW) to hours because this correction was considered introducing more noise, because of the quality of its measurement, than any improvement in this rather homogeneous fleet.

French commercial LPUE in the tuning files came from the fraction of catches for which gear and fishing effort data are available. As a consequence, the tuning effort series were partial and no estimate of effort can be provided by fleet but only for the total effort of French offshore trawlers (revised in 2004 using LPUE calculated for the whole trawler fleet).

Up to 2004 WG, the French commercial LPUE were calculated using all the available effort data. At 2005 WG, the French series of commercial fishing effort data and LPUE indices were revised to take into account changes in fishing areas due to change in targeting species in recent years and the decreasing number of offshore trawlers which land sole in La Rochelle and Les Sables. A minimum 10% of sole in total landing of a trip (data from 1984 to 1998) or of a day (from 1999 onwards) was selected to avoid effects of a shift in target species from sole to cephalopods in recent years. A second threshold was fixed on the percentage of nephrops in total landing (below or equal to 10%) to avoid the inclusion of trips or days during which a large part of effort is devoted to this species. To limit the effect of change in fishing power of the fleets throughout the tuning period and particularly the effect of the decreasing number of La Rochelle trawlers, a minimum number of years (10 from 1984 or 7 in the last 10 years) with sole landings was added to include boats in a fleet. The criterion of skippers having declared to have looked for sole in 2003-2004 (IFREMER annual activities survey) was added to avoid inclusion of boats fishing sole sporadically.

The series of LPUE of trawlers landing sole in other harbours than La Rochelle and Les Sables (FR-OTHER) was presented at 2005 WG for the first time. This additional information was estimated to be helpful to compensate for the lack of La Rochelle LPUE in 2004 which results from the combination of the decrease of number of boats in this fleet and from a delay in recording its 2004 logbooks. The same threshold in landing percentage was used to calculate this new LPUE series but neither the criterion of a minimum duration of participation in the fishery nor the skipper survey on target species were used.

C. Historical stock development : Assessment Methods and Settings

WG year XSA	1998 XSA	1999 & 2000 XSA	2001 XSA	2002 XSA	2003 XSA	2004 XSA	2005 XSA	2006 XSA	2007 XSA
Catch data range	1984-1997	1984-1998	1984-2000	1984-2001	1984-2002	1984-2003	1984-2004	1984-2005	1984-2006
Age range in catch data	1-8+	1-8+	1-8+	1-8+	1-8+	2-8+	2-8+	2-8+	2-8+
FR – SABLES	88-97 1-7	89-98 1-7	84-00 2-7	84-01 2-7	84-02 2-7	84-03 2-7	91-04 revised 2-7	91-05 2-7	91-06 corrected 2-7
FR – ROCHEL	88-97 1-7	89-98 1-7	84-00 2-7	84-01 2-7	84-02 2-7	removed	Removed	91-05 corrected 2-7	91-06 corrected2-7
FR – ROCHEL1	Not used	Not used	Not used	Not used	Not used	84-92 2-7	Removed	Removed	Removed
FR – ROCHEL2	Not used	Not used	Not used	Not used	Not used	93-03 2-7	95-04 revised 2-7	87-02	87-02 2-7
FR – OTHER	Not used	Not used	Not used	Not used	Not used	Not used	95-04 2-7	Removed	**REMOVED**
FR – RESSGASC-S	88-97 1-7	89-98 1-7	removed	removed	removed	removed	**REMOVED**	Removed	Removed
FR – RESSGASC-S 2	Not used	Not used	87-00 2-6	87-01 2-6	87-02 2-6	87-02 2-6	87-02 2-6	87-02 2-6	87-02 2-6
FR – RESSGASC-S 3	Not used	Not used	87-97 2-6	removed	removed	removed	Removed	Removed	Removed
FR – RESSGASC-S 4	Not used	Not used	87-00 1-6	87-01 1-6	87-02 1-6	87-02 2-6	87-02	87-02 2-6	87-02 2-6
Taper	No	No	Yes	Yes	**YES**	**NO**	**NO**	**NO**	**NO**
Tuning range	10	10	17	18	**19**	**20**	**14**	15	15
Ages catch dep. Stock size	No	No	No	No	No	No	No	No	No
Q plateau	6	6	6	6	6	6	6	6	6
F shrinkage se	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Year range	5	5	5	5	5	5	5	5	5
age range	3	3	3	3	3	3	3	3	3
Fleet se threshold	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
F bar range	2-6	2-6	2-6	2-6	2-6	3-6	2-6	3-6	3-6

Age range in the assessment was changed from 0-8+ to 1-8+ in 1998, and to 2-8+ in 2004. In both cases, this change is largely due to the uncertainties in discards estimates.

Because French 1999 catch were not available at the 2000 WG, the 2000 XSA was identical to the 1999 XSA.

The age range of F bar was change from 2-6 to 3-6 at the 2004 WG because the age 2 is not fully recruited. This age range was turned back to 2-6 by ACFM because its implication on reference points. The Review Group asked nevertheless to investigate changing it again to 3-6 in 2005 and ACFM accepted the change to 3-6 in 2006.

D. Short term projection

Inputs

WG YEAR	1998	1999	2000	2001	2002	2003	2004
Recruitment	Age 1 GM 84-95	Age 1 GM 84-96	Age 1 GM 92-96	Age 1 GM 92-99	Age 1 GM 92-00	Age 1 GM 92-01	Age 2 GM 93-02
Age 2	XSA	derived from GM	derived from GM	derived from GM	Derived from GM	Derived from GM	XSA
Age 3	XSA	derived from GM	derived from GM	derived from GM	Derived from GM	Derived from GM	XSA + Derived from GM
Age>3	XSA	XSA	XSA	XSA	XSA	XSA	XSA
F	Unscaled 95-97	Unscaled 96-98	- Unscaled 96-97 at age 1 - Unscaled 96-98 at age>1	- Unscaled 98-99 at age 1 - Unscaled 98-00 at age>1	- Unscaled 99-00 at age 1 - Unscaled 99-01 at age>1	- Unscaled 00-01 at age 1 - Unscaled 00-02 at age>1	Scaled 01-03
Weight at age	Unweighted 95-97	Unweighted 96-98	Unweighted 96-98	Unweighted 96-98	Unweighted 99-01	Unweighted 00-02	Unweighted 01-03

WG YEAR	2005	2006	2007
Recruitment	Age 2 GM 93-03	Age 2 GM 93-04	Age 2 GM 93-05
Age 2	GM	GM	GM
Age 3	Derived from GM	Derived from GM	Derived from GM
Age>3	XSA	XSA	XSA
F	- Unscaled 03-04 in 2005 - Unscaled 00-04 in 2006-07	- Unscaled 03-04 at age 2 - Unscaled 03-05 at age>2	- Unscaled 03-04 at age 2 - Unscaled 03-05 at age>2
Weight at age	Unweighted 02-04	Unweighted 03-05	Unweighted 04-06

Up to 2003 : recruitment is at age 1. XSA last year numbers are considered poorly estimated and are overwritten using a geometric mean of past recruitment values.

In 2004 : recruitment is at age 2. XSA last year numbers are used.

In 2005, 2006 and 2007: recruitment is at age 2. XSA last year numbers are considered poorly estimated and are overwritten using a geometric mean of past recruitment values.

Recruitments at age 1 have been estimated to be at a lower level after 92 (after 93 at age 2). Consequently a short term geometric mean is used.

The exploitation pattern is generally an un-scaled 3 year arithmetic mean (2 years at first age when recruitment is overwritten by GM).

A scaled mean was used in 2004 to take in account the 2002 fixed net catchability increase and available information on landings in the first part of 2004.

An un-scaled 5 year arithmetic mean (4 years at age 2 when recruitment is overwritten by GM) was used in 2005 for the same reason.

Catch and stock weights at age are taken as the mean of the last 3 years. In 2007, weight in catches were corrected for a change in transformation coefficient for the French landing.

Maturity ogive and natural mortality estimates are those indicated previously.

E. Medium term projections

Medium term projection are carried out using the following inputs :

last year deleted when recruitment is overwritten by GM (in SUM file)

short series of same length than adopted GM for recruitment estimate (in SUM file)

TAC year population number and fishing mortality (=WG year+1) to be consistent with the short term forecast (in SEN file).

Several stock recruit relationships have been used used since 1997. The Shepherd model was used in 1997, the Ricker model in 1998-2000, the Beverton-Holt model in 2001. The fit is very poor with all of them and a ramdom bootstrap has been was preferred since 2002.

F. Yield and biomass per recruit / long term projections

Yield per recruit calculations are conducted using the same input values as those used for the short term forecasts.

G. Biological reference points

The following biological reference points were proposed for this stock since 1998 :

	ACFM 1998	**ACFM 1999**	**WG & ACFM 2001**	**WG 2004**
			Change in maturity ogive	Change in recruitment age and in FBar age range
$\mathbf{F}_{lim}$	Not defined	Not defined	0.5 (potential collapse)	Not defined
$\mathbf{F}_{pa}$	0.40 (*prob* $(SSB_{MT}<\mathbf{B}_{pa})<.1$)	0.45 (*prob* $(SSB_{MT}<\mathbf{B}_{pa})<.05$)	$\mathbf{F}_{pa} = \mathbf{F}_{lim}\ e^{(-1.645 * .2)}$ = 0.36.	F proposal
$\mathbf{B}_{lim}$	Not defined	Not defined	Not defined	Not defined
$\mathbf{B}_{pa}$	11 300 t ($\mathbf{B}_{loss}$)	11 300 t ($\mathbf{B}_{loss}$)	13 000 t	Not relevant

H. Other Issues

None

I. References

Arbault S., P. Camus and C. Le Bec, 1986. Estimation du stock de sole (Solea vulgaris, Quensel 1806) dans le golfe de Gascogne à partir de la productio d'œufs. *J. Appl. Ichtyol*. , 4, 145-156.

KoutsiKopoulos C., D. Dorel, Y. Desaunay, B. Le Cann and A. Forest, 1993. Interaction entre processus physiques et comportement individuel : conséquence sur l'organisation et le fonctionnement du stock de sole (*Solea solea* L.) du golfe de Gascogne. Les recherches françaises en évaluation quantitative et modélisation des ressources et des systèmes halieutiques. Actes du premier Forum Halieumétrique, Ortom ed., 49-74.

Guichet R., Ph. Moguedet, B. Mesnil and A. Battaglia, 1998. Echantillonnage biologique des rejets de poissons et autres organismes dans le golfe de Gascogne. Rapport final du Contrat BIO ECO 94-054 CEE DG XIV. IFREMER La Rochelle, 121 p.

Le Pape O., Chauvet F., Mahevas S., Lazure L., Guérault G. & Désaunay, Y. (2003a). Quantitative description of habitat suitability for the juvenile common sole (*Solea solea*, L.) and contribution of different habitats to the adult population in the Bay of Biscay (France). J. Sea Res. 50, 139-149.

Le Pape O., Désaunay, Y. & Guérault G. (2003b). Relationship between fluvial discharge and sole (*Solea solea*) recruitment in the Bay of Biascay (France), ICES Marine Science Symposia 219 : 241-248

Annex G: Gulf of Cadiz Hake

General

Ecosystem aspects

Considerations on the stock relationships for Gulf of Cadiz Hake

Hake from the Gulf of Cadiz has generally been considered part of the Southern stock of hake. Nevertheless, there are serious concerns with this definition due to differences between the length distribution of catches in this area and those corresponding to other distribution areas of the stock. In addition, the large amounts of small individuals indicated by catches in this area can not be tracked down in other areas when becoming older. Because of these concerns, hake from the Gulf of Cadiz was removed from the assessment of the Southern Stock of Hake in 2003. The geographical area excluded corresponds to the Gulf of Cadiz from the Portuguese border at the Guadiana river to the Gibraltar strait. There is no reason to support the premise that the Guadiana river is a real boundary separating two possibly different populations. This division arises mainly from practical and management considerations, since the stated large amounts of small fish are fished within this area by Spanish trawlers. To the east, Gibraltar Strait separates the Gulf of Cadiz from the Mediterranean sea and it is considered a natural border due to the differences observed in the species biology in the two areas. In this respect, Silva *et al.* (2005, WD 16) have studied the spawning season and size at first maturity of hake in the Gulf of Cadiz concluding that the results obtained are more similar to those of the Southern Stock than of Mediterranean hake. This similarity is larger regarding size at first maturity, which is much smaller in the Mediterranean, while in the Gulf of Cadiz is even slightly larger than in the northern part of the Iberian Peninsula. Castillo et al. (2005) also have identified a complex genetic structure for the Southern stock where Cádiz hake was found to be genetically closer to Atlantic hake than to Mediterranean hake. Nevertheless, the similarities with the population on the northern African shelf, and the exchange rates across the Gibraltar Strait, and with the Northern African and Portuguese shelves still need to be investigated.

Fishery description

Hake in the Gulf of Cadiz is caught in a mixed fishery mainly by Spanish trawlers, but also by artisanal fleets. For the trawl fleet, this area is considered a zone of exception with regards to the rest of the statistical subdivision in the North eastern Atlantic, due to the derogation for the use of a smaller minimum mesh size of 40 mm. The trawl fleet is quite homogenous, operating mainly from four coastal localities: Isla Cristina, Sanlucar de Barrameda, Puerto de Santa María and Huelva. Two main groups can be distinguished among the larger trawlers. The most common group normally fish in shallow waters (30-100 m) with a mixture of target species (sparids, cephalopods, wedge sole, hake and horse mackerel). The other group operates at in between 90 and 500 m of depth and mainly targets blue whiting, shrimp, horse mackerel, hake and Norway lobster. Hake makes up around 7-8% of the total landings of the trawl fleet in this area; the rest of the landings are very heterogeneous and include more than 30 different species (several fish species, shrimps and cephalopods are also important target species). Currently, hake and the others target species from Gulf of Cádiz bottom trawl fleet are landed by an unique and highly multispecific *metier* (see Section 2).

The artisanal fleet, consisting of small vessels with a mean length of 7.7 m, varies seasonally in terms of gears used as well as targeted species. Hake is mainly caught by gillnets with 80 mm mesh size. This fleet targets the adult portion of the hake population in the area, which gathers near the coast during the winter. Information regarding length distribution of these landings was not available in previous years, but it is available since 2004.

The trawl landings represent on average 97% of the total hake catch, while the artisanal landings constitute the remaining 3%. Hake artisanal catches occur mainly between October and March, while trawl landings are more abundant between March and August.

Management applicable to 2004 and 2005

The Gulf of Cadiz hake is under similar management measures to the rest of the Southern stock, with the exception of some specific technical measures. Southern Hake is managed by TAC and technical measures. The agreed TAC for the whole Southern Hake stock in 2006 was 6661 t and in 2007 it is 5995 t. Cadiz landings in 2006 was 659 t.

Technical measures applied to Gulf of Cadiz hake are: (i) minimum landing size of 27 cm, as for the rest of the stock, (ii) trawl fishing banned at less than 6 miles from the coast or in waters shallower than 50 m, and (iii) minimum mesh size of 40 mm for the trawl fleet, smaller than in the rest of the stock area. Currently, a Fishing Plan is being followed by the entire trawl fleet in Division IXa South, Gulf of Cádiz, (ORDEN APA/2883/2006, 19 of September, B.O.E nº 225), which will be applied until next September and consequently affects hake. This Plan restricts daily fishing hours and establishes two days a week of no fishing. Furthermore, the plan establishes a fishing closure period of 45 days, which took place last year between September 21th and November 4th .

A Recovery Plan for the Iberian stock of hake (EC, 2166/2005) has been approved last December (see section 6.6). Measures implemented in this Plan doesn't affects Cádiz hake with the exception of TAC setting; the Recovery Plan establishes that TAC for non assessed areas will be proportional to the mean catch relationship during the last 3 years.

Data

Commercial catches and discards

Landings

The landings data used in Gulf of Cadiz are based on Spanish sales notes and Owners Associations data compiled by IEO.

Total landings from the Gulf of Cadiz Hake by gear for the period 1982-2006, as estimated by the WG, are given in Table G.1. Landings from the trawl fleet are available since 1982, while landings from the artisanal fleet are only available from 1993.

Landings show two ascending periods, from 1982 to 1991 and from 1994 to 2001, with a drop in the landings from 1992 to 1994, the minimum of the series. In 2005, the total landings estimate for 2006 were 659, continuing the decreasing trend for the last 4 years. Both trawl and artisanal landings have decreased in last year. The October closure for the trawl fleet could have contributed to the decrease of landings.

Discards

A pilot discard survey with observers on board was carried out in 2005 under the EU DCR programme. Preliminary results of the survey indicated a discarding rate of Hake of about 10% in weight, corresponding to 88 tonnes (Table G.1). In 2006 the discarding rate was lesser than 2005 with 2% in weight, corresponding to 12.5 tonnes. Figure G.1 shows the catch length composition including discards. The proportion of discards in numbers in 2006 was about 20%.

Biological Sampling

Sampling of commercial landings is carried out by IEO. The length composition sampling design follows a multistage stratified random scheme by month and harbour for the trawl fleet. Sampling from the artisanal fishery started in 2004, when data have were available for the first time. Age sampling started in 2000 and follows a stratified random sampling design by quarter and length class (of 1 cm) as part of the Southern Stock sampling scheme.

Length Composition

Table G.2 presents the length composition by gear in 2006, including discards. Length compositions of the trawl landings are available since 1994.,. The trawl fleet landings length composition has a mode around 12-18 cm depending on the year, with an increase to 19 cm in 2004, 20 cm in 2005 and 27 cm in 2006. As stated above, the artisanal fleet targets a different component of the stock. Length distribution usually shows two modes; in 2007 the mean length was 32 cm, with modes at 27 and 32 cm, similar than previous .

Figure G.2 shows the length distributions of trawl landings and annual mean length for the time series available for this fleet. Length composition in recent years has changed, with an increase from 18 cm in 2002 to 28 in 2006. The decrease of mean size in landing in mainly due to an high control implementation.. Before 2004, length distributions had remained quite stable since 1996, with modes varying between 12 and 18 cm depending on the year. Length compositions in 1994 and 1995 were very different from the rest of the series, which may be partly due to the fact that the sampling programme began in 1994.

Age Composition

Otoliths from commercial landings and surveys have been collected since 2000. Catch at age for 2005 and 2006 were derived using the Cadiz ALK from that year, whereas earlier years were derived using a yearly ALK from the entire southern stock

In a preliminary assessment carried out in 2003 (Velasco et al., 2003b), the same ALKs as for the rest of the stock were used (see Table 6.3 in the report) and the same procedure has been used for 2004. In 2005 the ALK from Gulf of Cádiz hake was used. Table G.3 shows the catch at age matrix for the Gulf of Cadiz hake landings. Landings are composed mainly of fish of ages 0 and 1, which constitute between 60% and 95% in the numbers of landings for all years. In recent years this percentage has been decreasing, with the lowest proportion observed in 2006 (40%). This was mainly due to an increase in landings control.

Length-weight relationship, weights-at-age and M

In the preliminary assessment carried out in 2003 the length weight parameters for the whole stock were applied (Table G.4).. Length-weight relationships for males, females and both sexes combined was presented for first time in 2004 and was undated since then.

Maturity Ogive

Maturity ogives separated for both sexes as well as combined have been estimated in the area during 2004 (Silva *et al.*, 2005, WD 16). The L_{50} for females is larger than in the northern part of the Iberian Peninsula, while the males fall within the range of values found in the rest of the stock. Data for 2005 and 2006 are available.

Surveys

Two groundfish surveys are carried out annually in the Gulf of Cadiz in March (since 1994, but not in 2003) and November (from 1997). A stratified random sampling design with 5 bathymetric strata, covering depths between 15 and 700 m, is used in this area, with one hour towing hauls (ICES, 2002d).

Survey total abundance indices in weight and number are presented in Table G.5, and Figure G.3. The November survey in 2004 indicated a high abundance of small individuals, and this good signal has been corroborated by the 2005 March survey, which had the highest abundance in number of the whole series. In 2006, the March survey abundance index showed a hard decrease while November survey showed the highest value in the time series. Biomass indices from both surveys show different trends when compared with the LPUE series from the trawl fishery in recent years, although in the past the trends were similar.

Otoliths for hake ALKs for these surveys are collected from year 2000 and the age distribution was calculated this year for the first time. Table G.6 shows abundance-at-age for the Spring and Autumn surveys. Spring survey abundance at age 0 shows the highest value in 2000 and the lowest value in 2006 mean Autumn survey shows the higher values in recent years, with the highest time series value in 2006.

Survey abundance at age in each year and survey (Autumn and Spring surveys) were calculated on the basis of the ALK from the corresponding survey.

Commercial CPUE

Effort series from the Gulf of Cadiz trawl fleet is collected from sale notes and Owners Associations data and compiled by IEO.

Landings, LPUE and effort data are available only for the trawl fleet. These data are given in Table G.7 and shown in Figure G.4. The effort from the trawl fleet remains quite constant, around 30000 fishing days during the time series available, with a small peak in 1998 with 32824. In 2006, the number of fishing days has been lesser than 2005 with 26248 fishing days. This fact could be due to fishing plans set up by Spanish administration which include a close season of 45 days.

The trawl fleet LPUE series shows a fluctuating pattern, with an increase in the last four years. Effort unit (fishing days) is a measure of global effort rather than of the real effort on hake, since this fleet targets up to 30 different species and the behaviour of the fleet varies depending on the market and the relative abundance of several species. A common upwards trend with a decrease from 2004 to 2006 is observed.

Assessment

Although there is good information from this area, with the currently available methods, it is not possible at present to include the Gulf of Cadiz to be assessed with the rest of the Southern Stock. However, in the future, assessment models incorporating migration patterns could be explored.

References

Castillo, A.G.F., P Alvarez and E Garcia-Vazquez. 2005. Population structure of *Merluccius merluccius* along Iberian Peninsula coast. *ICES J. Mar. Sci*., 62: 1699-1704.

Silva, L., F. Velasco, Y. Vila and I. Sobrino. 2005. Preliminary results on Gulf of Cadiz hake *Merluccius merlucius* (Linnaeus, 1758) biology. Working Document presented to the WGHMH 2005. Nº 16. Lisboa 9-20 May 2005

Velasco, F.; Silva, L.; and Sobrino, I. 2003. Exploring the hake Fishery in the Gulf of Cadiz: available information to perform a stock assessment. Working Document presented to the WGHMH 2003, Copenhagen 14-24 May, 2003.

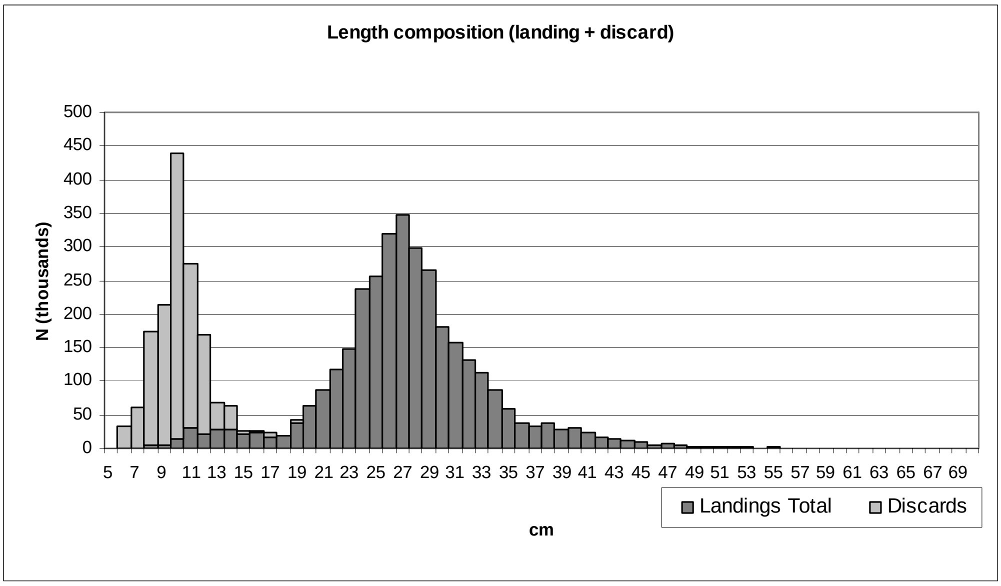


Figure G.1 Landings and discards size distribution in 2006

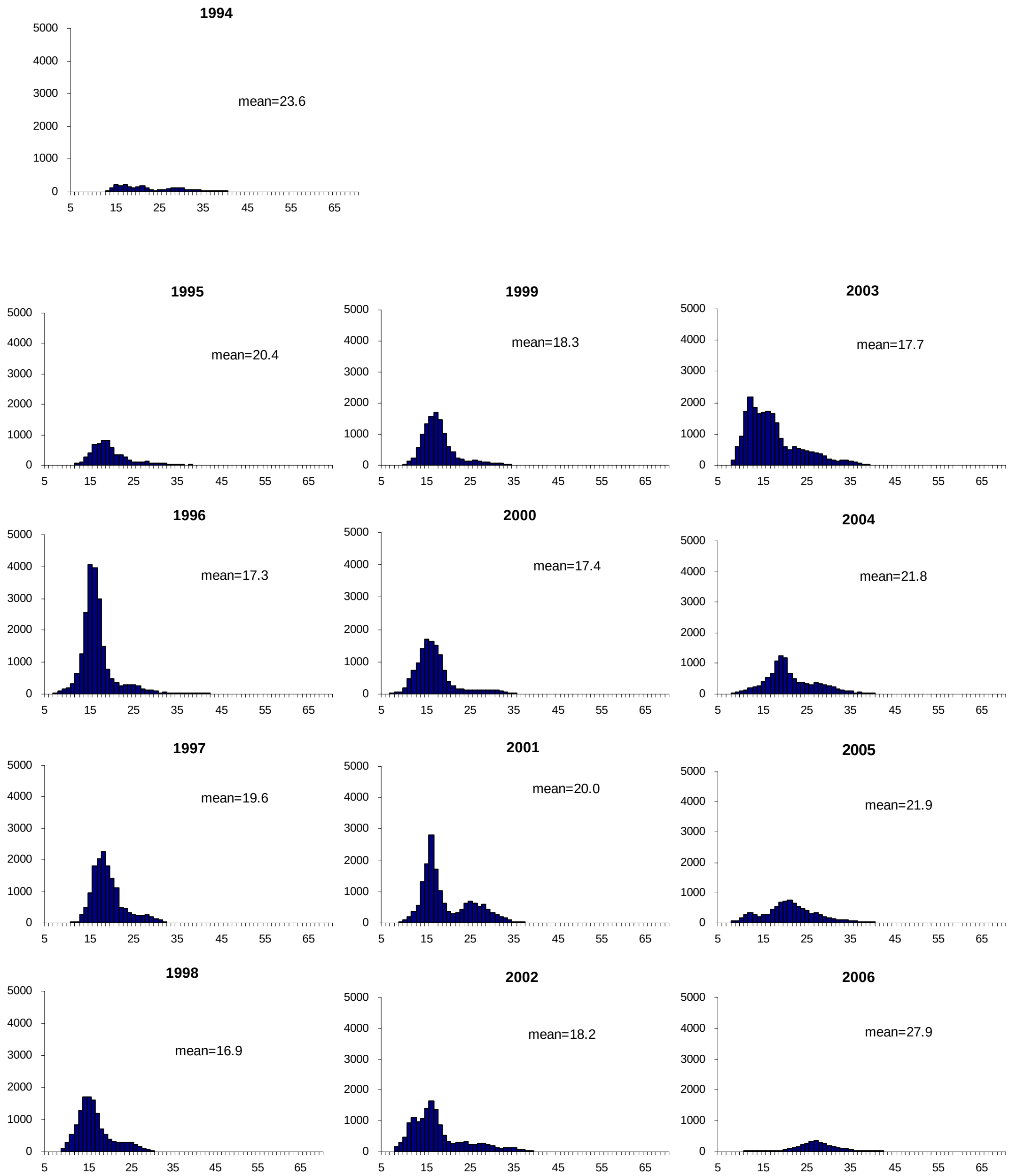


Figure G.2 Cádiz hake landings size distribution (numbers in thousands)

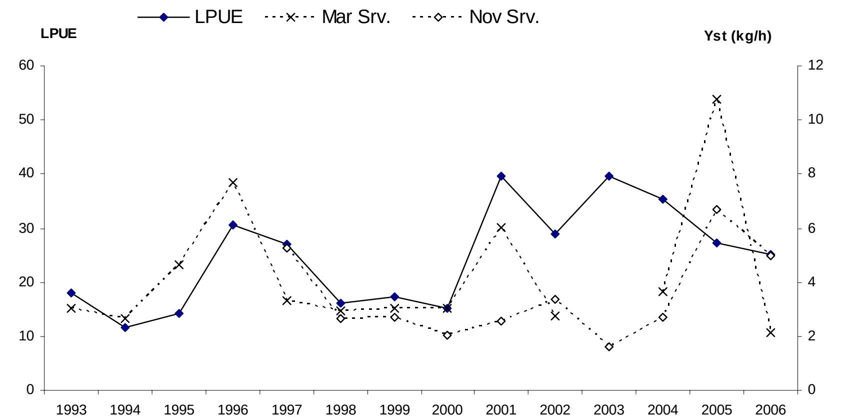


Figure G.3. GULF OF CADIZ HAKE - Trawl LPUE and survey abundance indices (kg / 1 h. haul) from 1993 to 2006

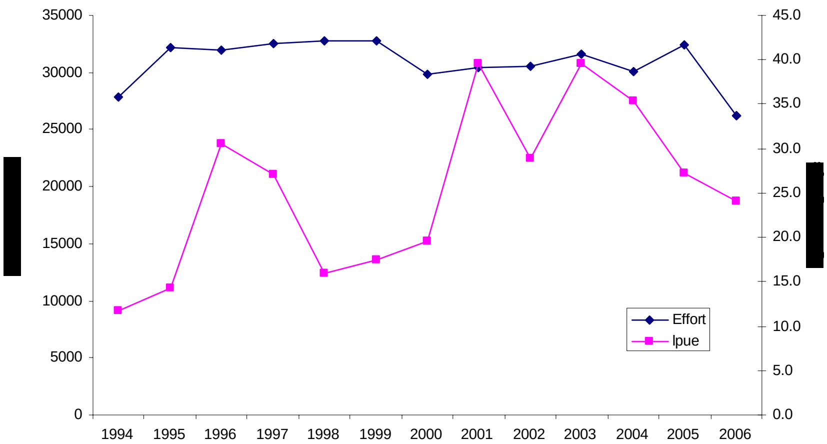


Figure G.4 GULF OF CADIZ HAKE - Fishing effort and LPUE trends for the trawl fleet

Table G.1.- GULF OF CADIZ HAKE: Landings and Catch estimates (tonnes) by

Year	Trawl	Artisanal	Total Landings	Discards	Total Catch
1982	485		485		
1983	574		574		
1984	694		694		
1985	789		789		
1986	976		976		
1987	952		952		
1988	986		986		
1989	899		899		
1990	1196		1196		
1991	1210		1210		
1992	975		975		
1993	541	5	546		
1994	326	5	331		
1995	458	4	462		
1996	975	32	1007		
1997	880	43	923		
1998	523	44	567		
1999	570	24	595		
2000	584	14	598		
2001	1203	38	1242		
2002	883	21	904		
2003	1251	19	1270		
2004	1062	33	1095		
2005	885	24	909	88	996
2006	634	25	659	12.5	671

Table G.2 GULF OF CADIZ HAKE - trawl catches length compositions (thousands) in 2006

Length class (cm)	Landings Trawl	Landings Artisanal	Landings Total	Discards	Catch Total
5					
6				33	33
7				60	60
8	5		5	167	173
9	5		5	209	214
10	15		15	424	439
11	31		31	243	274
12	21		21	148	169
13	28		28	41	69
14	27		27	36	64
15	20		20	5	25
16	23		23	4	27
17	18		18	6	24
18	18		18		18
19	37		37	4	41
20	63	0	63		63
21	87		87		87
22	117	0	117		117
23	149	0	149		149
24	238	0	238		238
25	256	0	257		257
26	318	1	319		319
27	332	16	348		348
28	284	13	297		297
29	251	13	264		264
30	176	6	181		181
31	156	2	157		157
32	119	12	132		132
33	103	9	112		112
34	79	9	88		88
35	55	4	60		60
36	34	3	37		37
37	31	1	32		32
38	34	2	36		36
39	27	2	29		29
40	29	1	30		30
41	23	0	24		24
42	16	1	17		17
43	15		15		15
44	12		12		12
45	9		9		9
46	5		5		5
47	6		6		6
48	4		4		4
49	3		3		3
50	3		3		3
51	1		1		1
52	2		2		2
53	1		1		1
54	0		0		0
55	1		1		1
56					
57					
58	1		1		1
59					
60	1		1		1
61					
62					
63					
64					
65					
66					
67					
68					
69					
70					
TOTAL N.	3291	97	3388	1382	4770
Nominal weight	634	25	659	12.5	671
SOP	614	24	638	13.1	651
SOP factor	1.03	1.05	1.03	0.95	1.03
Mean length (cm)	27.8	31.5	27.9	10.6	22.9

* estimaded values

Table G.3

GULF OF CADIZ HAKE. Catch in numbers by age

Table 1 Catch numbers at age Numbers*10**-3

YEAR													
AGE	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	975	1622	15036	4990	8518	4979	6750	3678	5438	10321	1400	2089	205
1	819	3524	4772	8179	3753	5733	4621	8188	6155	8959	6872	3974	1091
2	543	1086	1703	1818	976	657	1108	3842	2046	2643	2538	2614	1724
3	259	235	256	205	43	328	448	1182	1084	812	526	782	250
4	93	42	83	2	3	12	9	59	80	78	93	117	85
5	19	5	9	0	0	0	0	10	7	8	27	30	22
6	4	0	2	0	0	0	0	2	2	2	8	11	12
7	2	0	0	0	0	0	0	0	0	0	2	1	0
+gp	2	0	0	0	0	0	0	0	0	0	0	0	0
0 TOTALNUM	2715	6513	21861	15196	13293	11709	12936	16961	14813	22821	11467	9619	3388
TONSLAND	331	462	1007	926	567	595	598	1242	904	1270	1095	909	659
SOPCOF %	100	100	100	101	101	100	100	100	100	100	102	100	100

proportions	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	0.36	0.25	0.69	0.33	0.64	0.43	0.52	0.22	0.37	0.45	0.12	0.22	0.06
1	0.30	0.54	0.22	0.54	0.28	0.49	0.36	0.48	0.42	0.39	0.60	0.41	0.32
2	0.20	0.17	0.08	0.12	0.07	0.06	0.09	0.23	0.14	0.12	0.22	0.27	0.51
3	0.10	0.04	0.01	0.01	0.00	0.03	0.03	0.07	0.07	0.04	0.05	0.08	0.07
4	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.03
5	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table G.4. Cadiz weight in stock.

	YEAR												
AGE	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
0	0.034	0.03	0.026	0.032	0.022	0.026	0.023	0.023	0.023	0.017	0.023	0.019	0.022
1	0.089	0.052	0.05	0.055	0.061	0.051	0.044	0.042	0.035	0.049	0.059	0.068	0.117
2	0.182	0.132	0.14	0.145	0.136	0.145	0.122	0.137	0.128	0.148	0.158	0.122	0.193
3	0.255	0.277	0.349	0.224	0.272	0.217	0.218	0.219	0.244	0.275	0.292	0.253	0.368
4	0.411	0.441	0.537	0.528	0.465	0.37	0.419	0.402	0.414	0.42	0.52	0.435	0.591
5	0.627	0.518	0.6	0.582	0.584	0.683	0.717	0.668	0.661	0.582	0.764	0.708	0.798
6	0.941	0.696	0.778	0.655	0.778	0.738	0.733	0.757	0.76	0.63	0.961	0.740	1.057
7	1.337	0.755	1.193	0.908	0.857	0.908	1.081	0.82	0.788	0.854	1.17	0.894	0
+gp	1.782	0	1.216	0	0	0	1.081	0.755	0.759	0	1.66	0.000	0

Table G.5 GULF OF CADIZ HAKE - November and march groundfish surveys; abundances indices for total Gulf of Cadiz area.

	Spring survey					Autum survey				
Year	Hauls	Biomass (kg/h)	s.e.	Abundance (nº/h)	s.e.	Hauls	Biomass (kg/h)	s.e.	Abundance (nº/h)	s.e.
1993	30	3.04	0.53	32	6.2					
1994	30	2.68	0.33	34	4.8					
1995	30	4.66	1.28	87	36.7					
1996	31	7.66	1.14	103	21.8					
1997	30	3.34	0.52	83	19.5	27	5.28	2.77	52	17.2
1998	31	2.93	0.67	30	12.4	34	2.66	0.42	18	3.5
1999	38	3.03	0.37	54	11.4	38	2.71	0.44	35	11.1
2000	41	3.02	0.47	51	14.9	30	2.03	0.61	25	4.8
2001	40	6.01	0.79	106	25.3	39	2.57	0.45	31	5.2
2002	41	2.74	0.25	35	3.6	39	3.39	0.78	127	37.8
2003						41	1.61	0.28	22	4.6
2004	40	3.65	0.47	104	19.7	40	2.72	0.69	94	39.1
2005	40	10.77	5.65	226	145.4	42	6.68	1.29	120	31.3
2006	41	2.15	0.40	17	3.3	41	4.99	2.00	224	157.1

Table G.6. Abundance at age in Cádiz Spring survey and Cádiz Autum survey

Autum Survey	0	1	2	3	4	5	6	7	8
2000	17.77	2.26	1.86	1.26	1.41	0.33	0.19	0.07	0.00
2001	22.50	2.85	3.30	1.12	0.58	0.18	0.08	0.11	0.02
2002	116.24	7.16	2.68	0.65	0.32	0.18	0.12	0.08	0.08
2003	15.78	2.60	1.39	1.14	0.68	0.21	0.20	0.00	0.07
2004	83.60	7.31	2.41	0.99	0.19	0.06	0.00	0.00	0.00
2005	88.66	27.38	2.42	1.13	0.29	0.08	0.04	0.00	0.00
2006	209.97	6.97	3.15	1.37	0.58	0.23	0.00	0.00	0.00

Table G.7 GULF OF CADIZ HAKE. Landings (tonnes), Catch per unit effort and effort (fishing days) for the trawl fleet

Gulf of Cadiz Trawl			
Year	Landings (tonnes)	lpue (Kg/fishing day)	Effort
1993	541	17.9	30199
1994	326	11.7	27823
1995	458	14.2	32194
1996	975	30.5	31951
1997	880	27.0	32573
1998	523	15.9	32824
1999	570	17.4	32731
2000	584	19.5	29875
2001	1203	39.6	30416
2002	883	28.9	30526
2003	1251	39.5	31643
2004	1062	35.4	30029
2005	885	27.3	32419
2006	659	25.1	26248

* - Kg/fishing day

ANNEX H - Southern Hake

1 Introduction

This document is an annex to the Southern Hake Assessment with several complementary analysis relevant to the work carried out by ICES WGHMM in 2007. All analysis were carried out with R/FLR (http://r-project.org, http://flr-project.org).

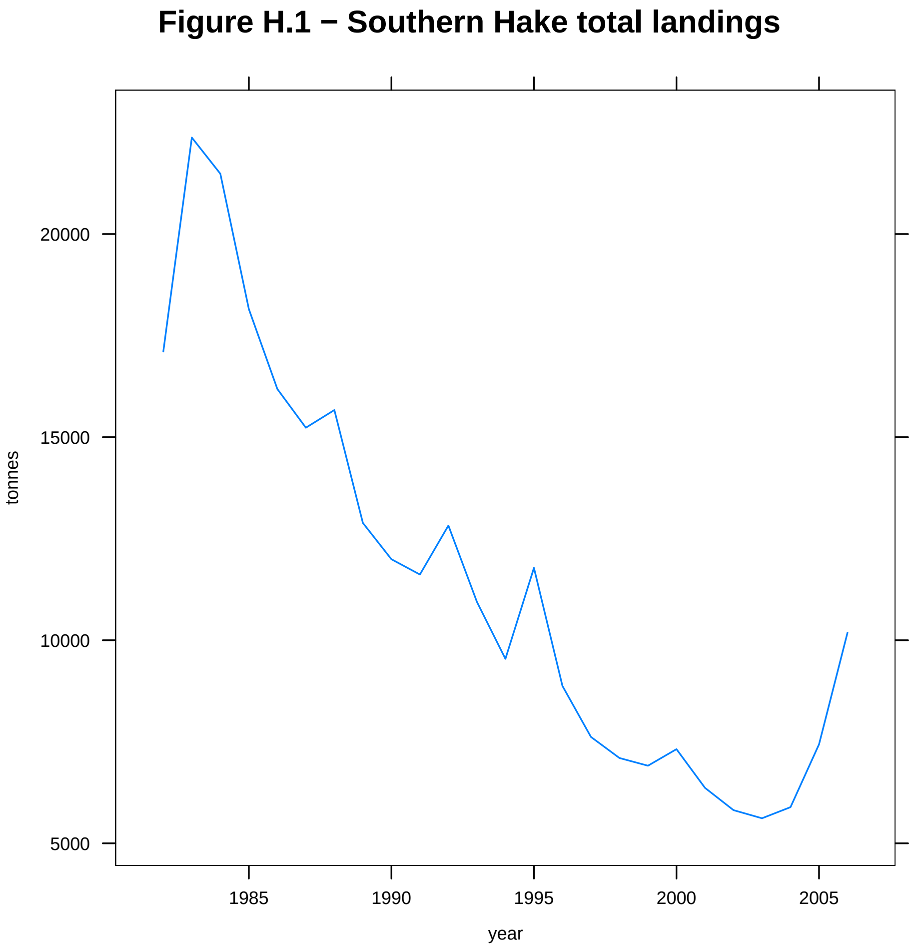
```
> library(FLCore)

FLCore 1.4-3 - "Golden Jackal"

> library(FLAssess)
> library(FLBayes)

FLBayes 1.4-1

> library(FLEDA)

FLEDA 1.4-2 - "The Jackal's Associate"

> library(FLSTF)
> library(FLXSA)
```

2 Exploratory Data Analysis

The following analysis screens the data available for assessment, checking for missing data, unusual values, patterns, inspection of data consistency (within and between data series) and extracting signals from the basic data.

2.1 catch trends

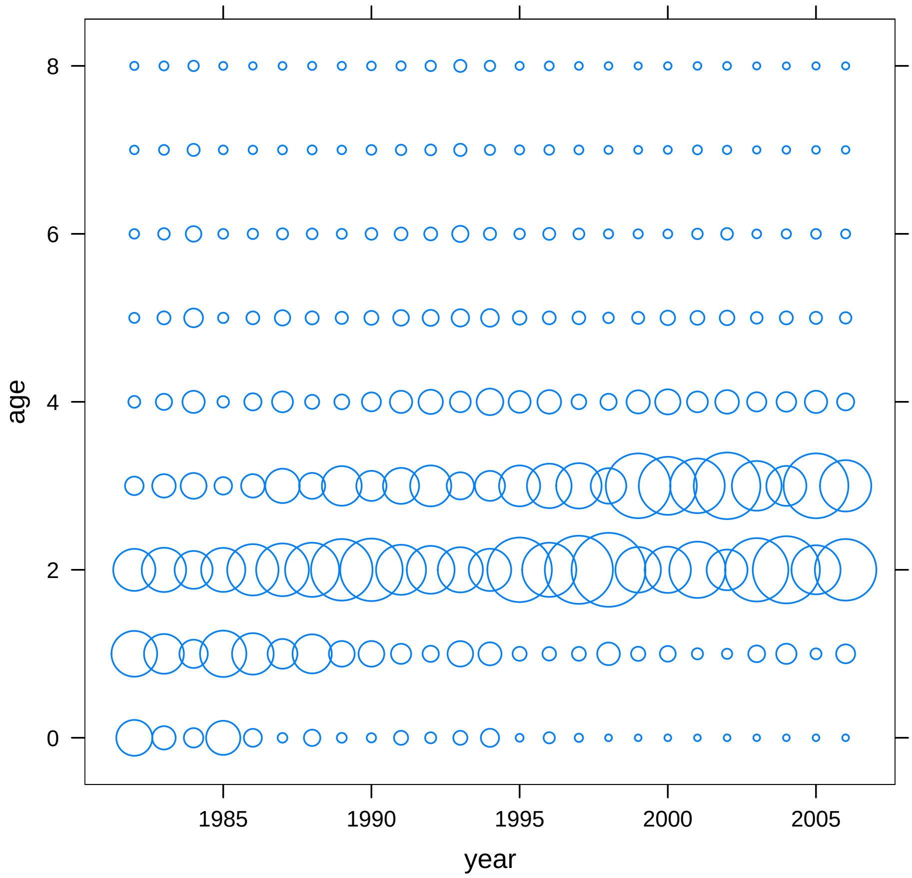
```
> summary(hke07@catch)

An object of class "FLQuant" with:
dim  :  1 25 1 1 1
quant:  age
units:  tonnes

Min    :  5616.713
1st Qu.:  7318.054
Mean   :  11477.23
Median :  10943.84
3rd Qu.:  15232.40
Max    :  22375.63
```



Since 1983 there was a declining trend in landings, from 22400 t, to the lowest in the series in 2003, around 5600 t. In 2005, total landings increased to around 7400 t, and in 2006 to 10200 t.

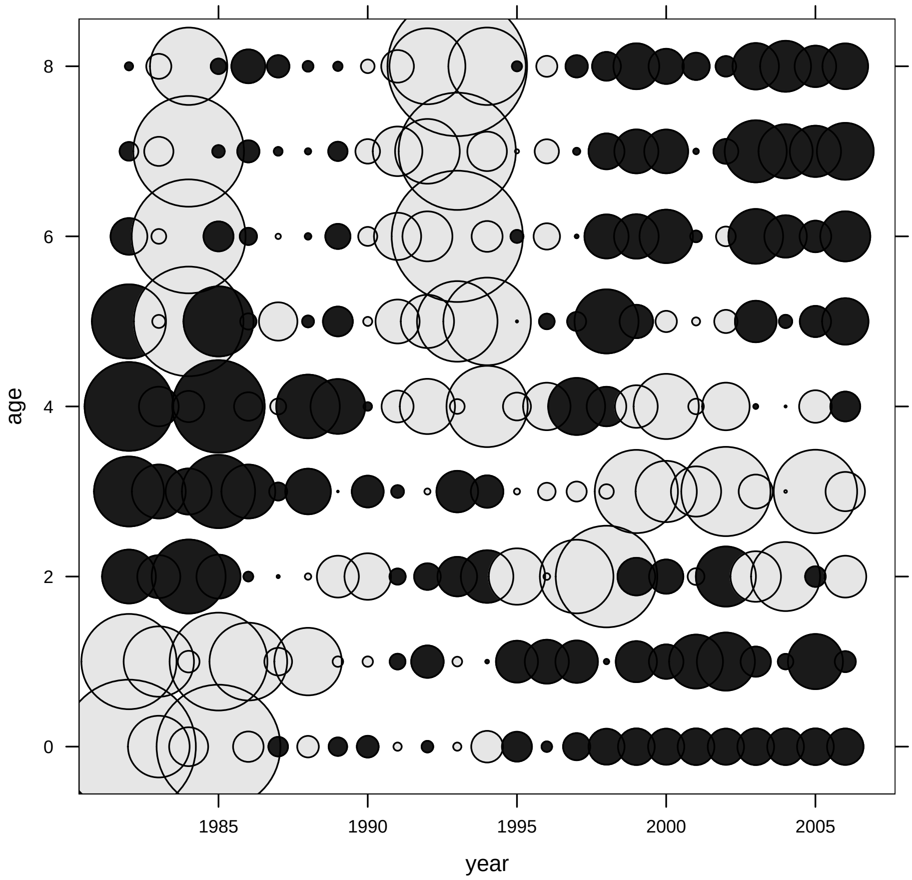
2.2 Catch at age proportions

Figure H.2 − Proportion at age for Shouthern Hake



This Figure shows the proportion of each age per year. The plot emphasizes the decrease of the catch proportion at ages 0 and 1 after 1989, when the MLS was enforced and indicates age 2 as fully recruited to the fishery after 1994, suggesting a change in the exploitaion pattern.

Figure H.3 – Standardized catch proportion at age for Southern Hake



2.3 Abundance indices

The following analysis show the number of missing observations and 0 observations by tuning fleet.

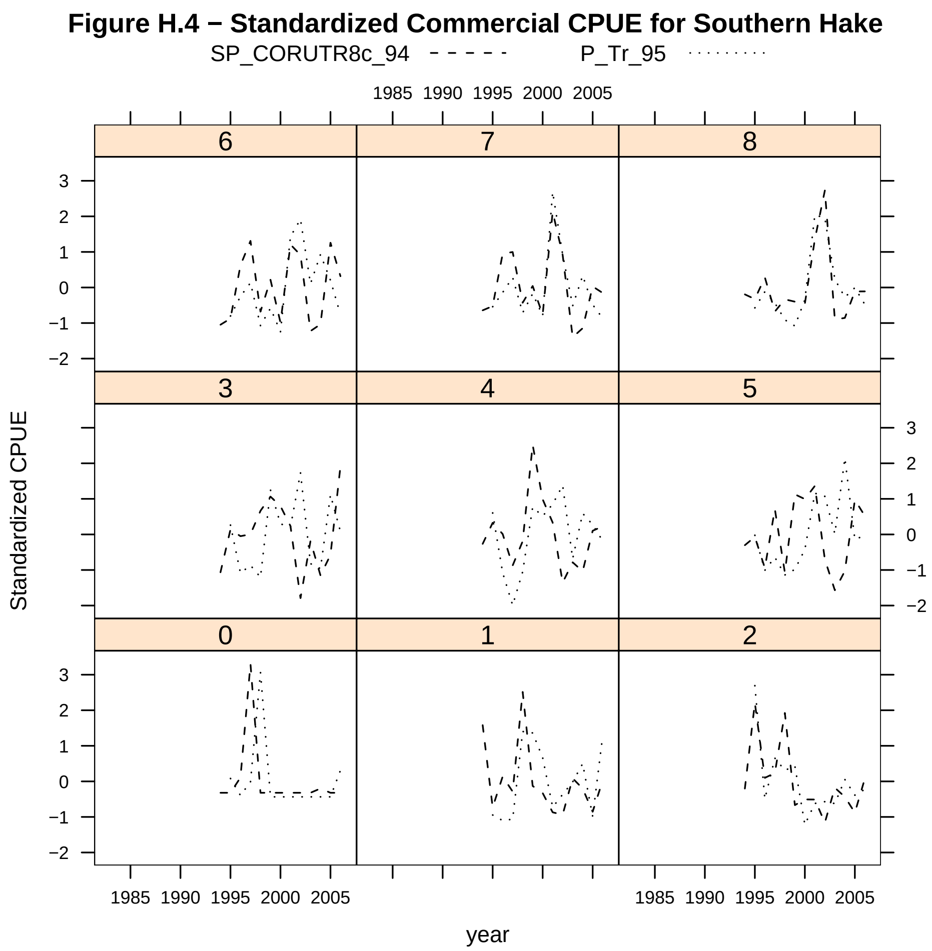
```
> mv0(FLQuants(lapply(hke07.ind, index)))

$ P_Tr_89
An object of class "FLQuant":

, , unit = unique, season = all, area = unique

     year
check 1989 1990 1991 1992 1993 1994
   NA    0    0    0    0    0    0
   0     0    0    0    1    0    0

attr(,"units")
[1] "NA"

$ P_Tr_95
An object of class "FLQuant":

, , unit = unique, season = all, area = unique

     year
check 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006
   NA    0    0    0    0    0    0    0    0    0    0    0    0
   0     0    0    0    0    1    1    1    1    1    1    1    0
```

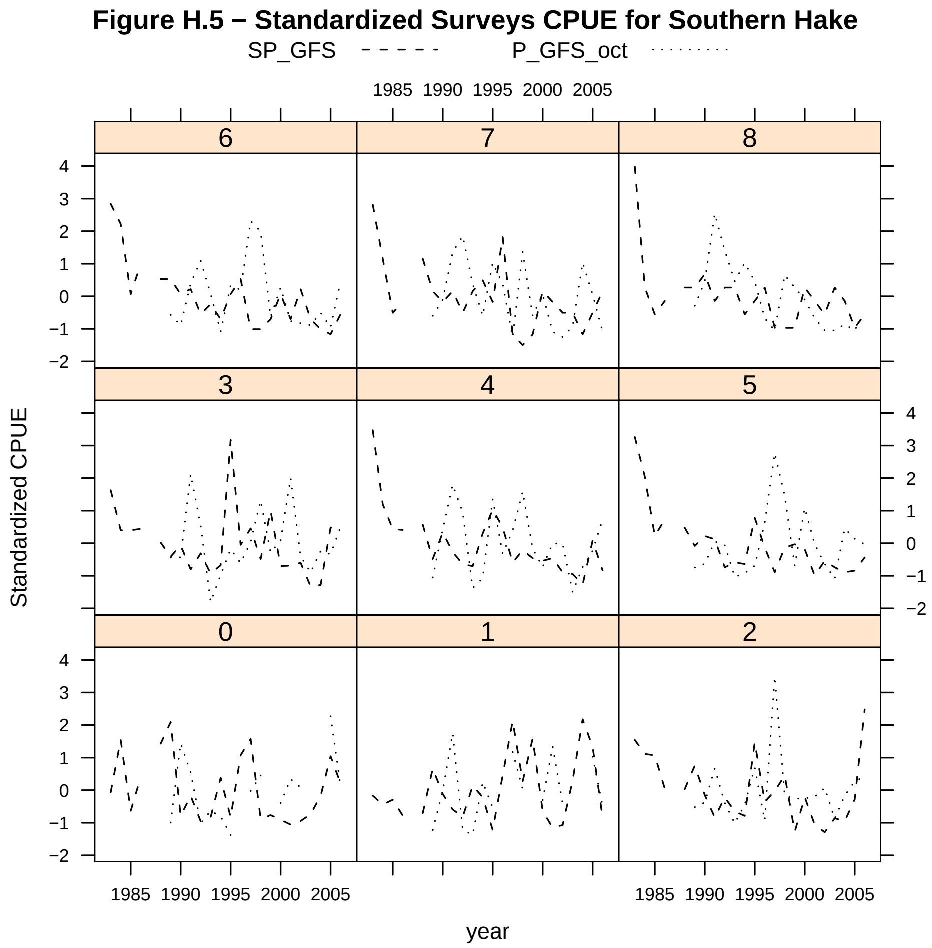
```
attr(,"units")
[1] "NA"

$ SP_CORUTR8c_85
An object of class "FLQuant":

, , unit = unique, season = all, area = unique

     year
check 1985 1986 1987 1988 1989 1990 1991 1992 1993
   NA    0    0    0    0    0    0    0    0    0
   0     0    0    0    0    0    0    1    1    0

attr(,"units")
[1] "NA"

$ SP_CORUTR8c_94
An object of class "FLQuant":

, , unit = unique, season = all, area = unique

     year
check 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006
   NA    0    0    0    0    0    0    0    0    0    0    0    0    0
   0     1    1    0    0    1    1    1    1    1    1    0    1    1

attr(,"units")
[1] "NA"

$ SP_CORUTRP8c_85
An object of class "FLQuant":

, , unit = unique, season = all, area = unique

     year
check 1985 1986 1987 1988 1989 1990 1991 1992 1993
   NA    0    0    0    0    0    0    0    0    0
   0     0    0    0    0    1    0    1    1    1

attr(,"units")
[1] "NA"

$ SP_CORUTRP8c_94
An object of class "FLQuant":

, , unit = unique, season = all, area = unique

     year
check 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006
   NA    0    0    0    0    0    0    0    0    0    0    0    0    0
   0     1    1    1    1    1    1    1    1    1    1    1    1    1

attr(,"units")
[1] "NA"

$ SP_SANTR
An object of class "FLQuant":

, , unit = unique, season = all, area = unique

     year
check 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999
```

```
   NA    0    0    0    0    0    0    0    0    0    0    0    0    0    0
   0     1    1    1    1    1    1    1    1    1    2    2    2    1    1
     year
check 2000 2001 2002 2003 2004 2005 2006
   NA    0    0    0    0    0    0    0
   0     1    1    1    1    1    2    3

attr(,"units")
[1] "NA"

$ SP_VIMATR
An object of class "FLQuant":

, , unit = unique, season = all, area = unique

     year
check 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003
   NA    0    0    0    0    0    0    0    0    0    0    0    0    0    0
   0     0    1    0    0    1    1    0    0    1    1    0    1    0    1
     year
check 2004 2005 2006
   NA    0    0    0
   0     0    1    1

attr(,"units")
[1] "NA"

$ SP_GFS
An object of class "FLQuant":

, , unit = unique, season = all, area = unique

     year
check 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996
   NA    0    0    0    0    9    0    0    0    0    0    0    0    0    0
   0     0    0    0    0    0    0    0    0    0    0    0    0    0    0
     year
check 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006
   NA    0    0    0    0    0    0    0    0    0    0
   0     1    2    1    0    0    0    0    0    1    0

attr(,"units")
[1] "NA"

$ P_GFS_jul
An object of class "FLQuant":

, , unit = unique, season = all, area = unique

     year
check 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001
   NA    0    0    0    0    0    9    0    9    0    0    0    0    0
   0     0    0    0    0    0    0    0    0    0    0    0    0    0

attr(,"units")
[1] "NA"

$ P_GFS_oct
An object of class "FLQuant":

, , unit = unique, season = all, area = unique
```

```
      year
check 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002
   NA    0    0    0    0    0    0    0    2    0    0    2    0    0    0
   0     0    0    0    0    0    0    0    0    1    0    0    0    0    1
      year
check 2003 2004 2005 2006
   NA    2    2    0    0
   0     1    0    1    0

attr(,"units")
[1] "NA"
```

2.3.1 Time series





Figures above show trends by age of commercial and survey indices used for assessment. The series were centered and scaled to $Gau(0,1)$.

2.4 Internal consistency

The following Figures show the internal consistency of each fleet with regards to cohort identification. Note that the line is a linear regression model and it must be considered with care.

Figure H.6 – Pairwise plot of age by cohort ("P–TR–95")

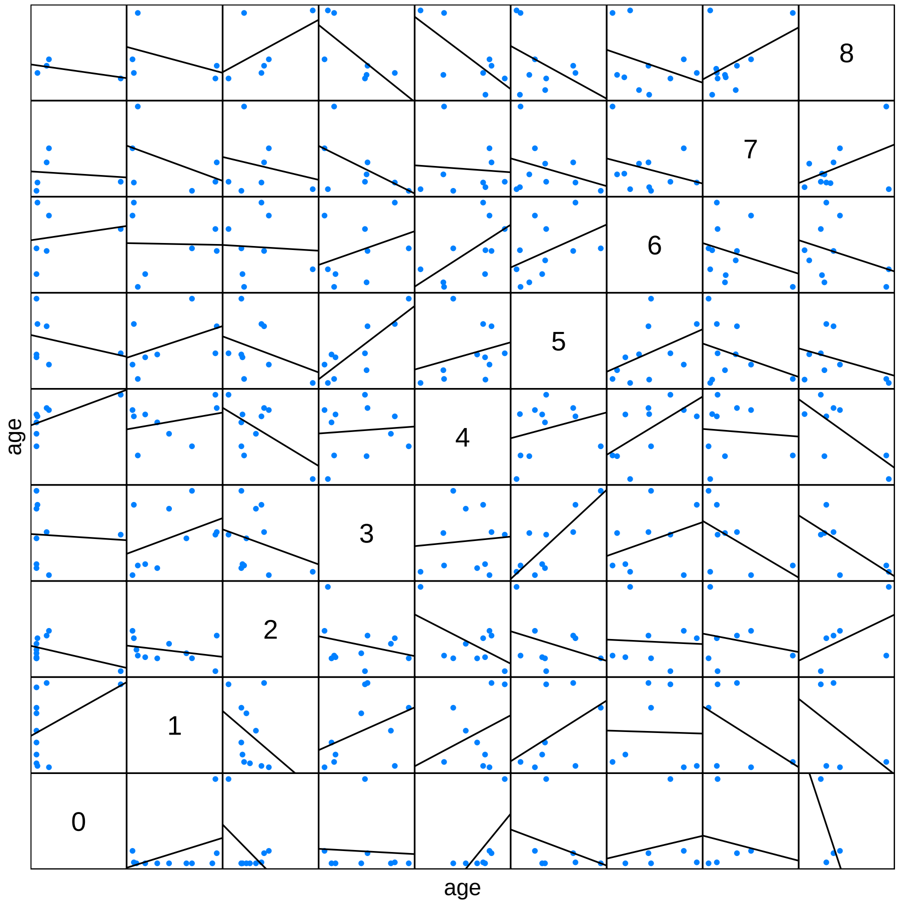


Figure H.7 – Pairwise plot of age by cohort ("SP–CORUTR8c–94")

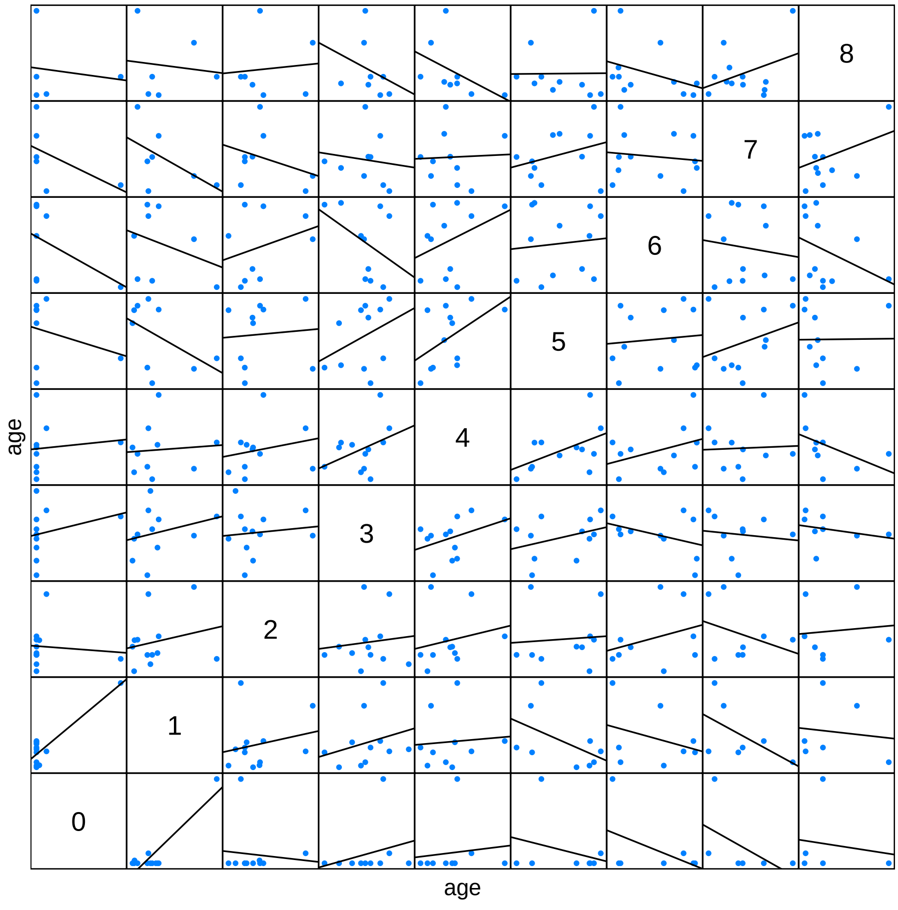


Figure H.8 – Pairwise plot of age by cohort ("SP−CORUTRP8c−94")

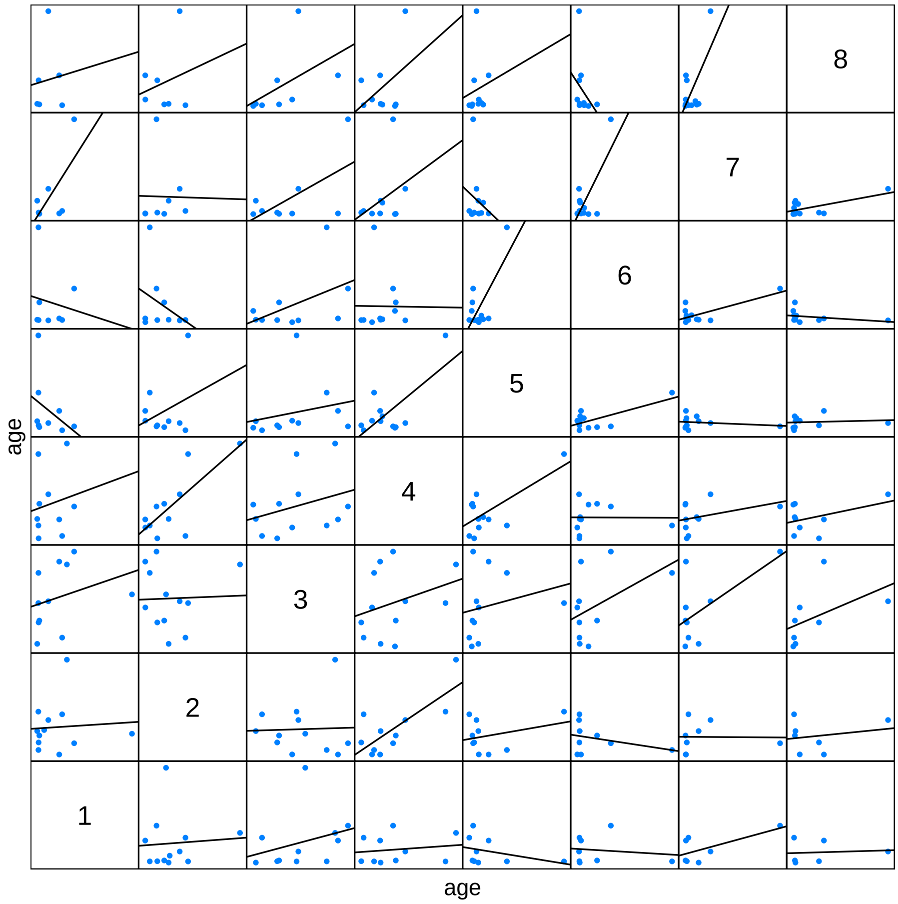


Figure H.9 – Pairwise plot of age by cohort ("SP−SANTR")

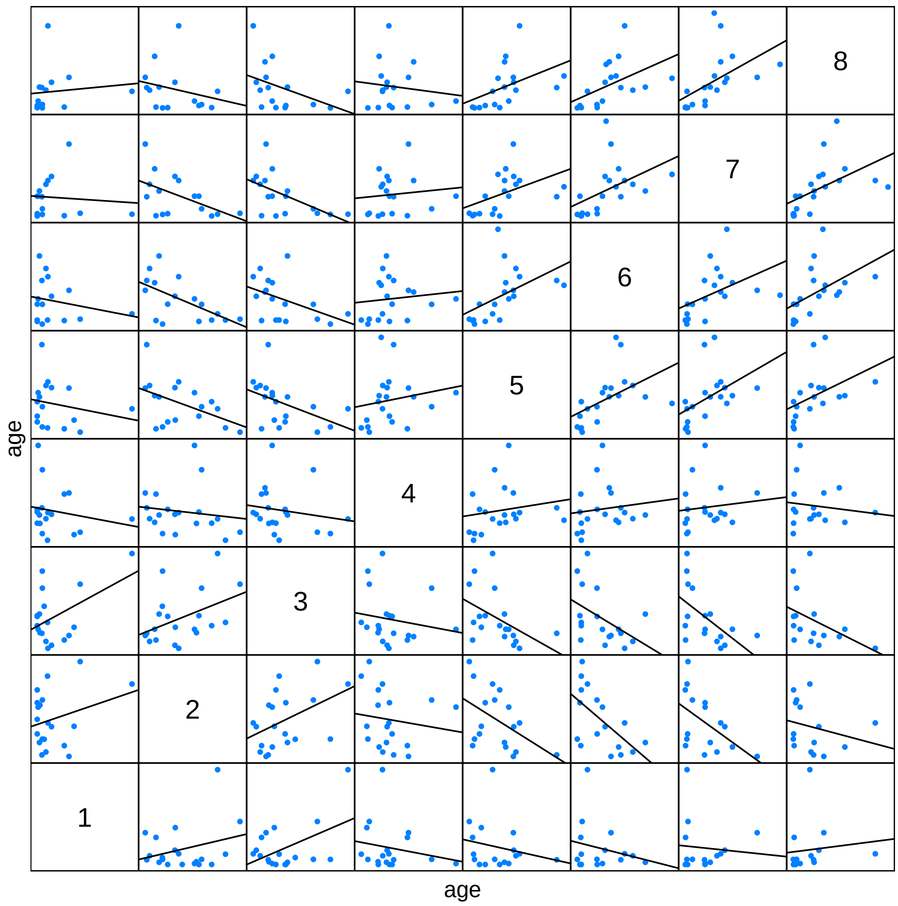


Figure H.10 – Pairwise plot of age by cohort ("SP–VIMATR")

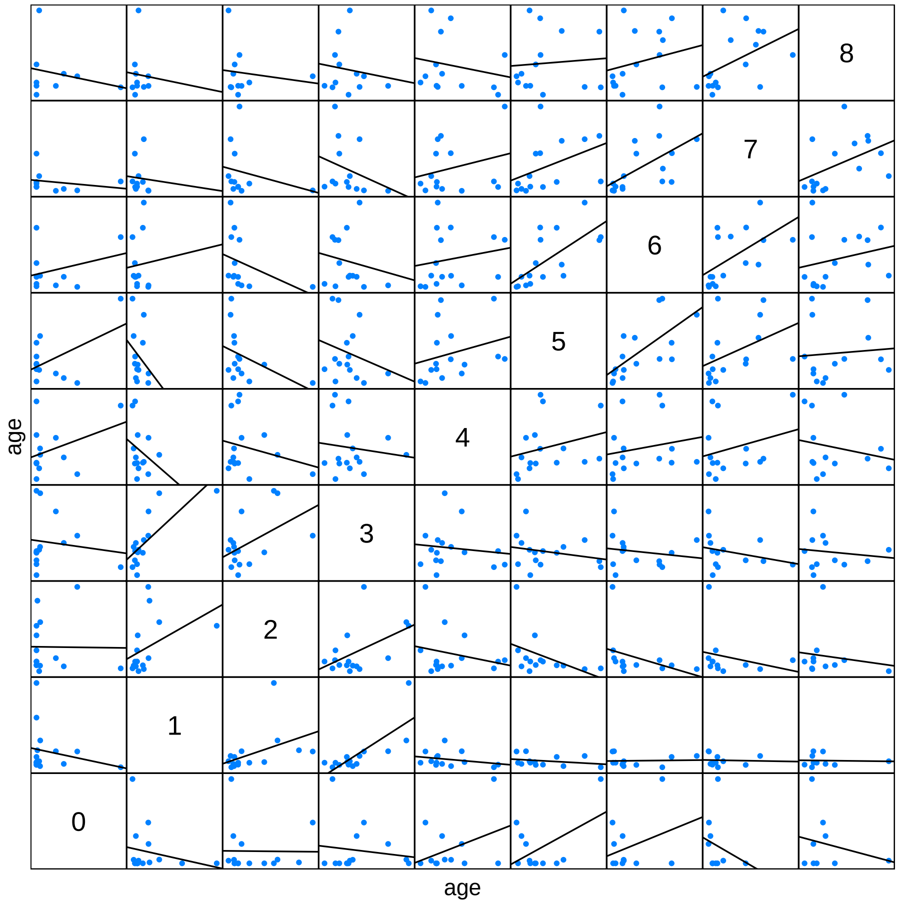


Figure H.11 – Pairwise plot of age by cohort ("SP–GFS")

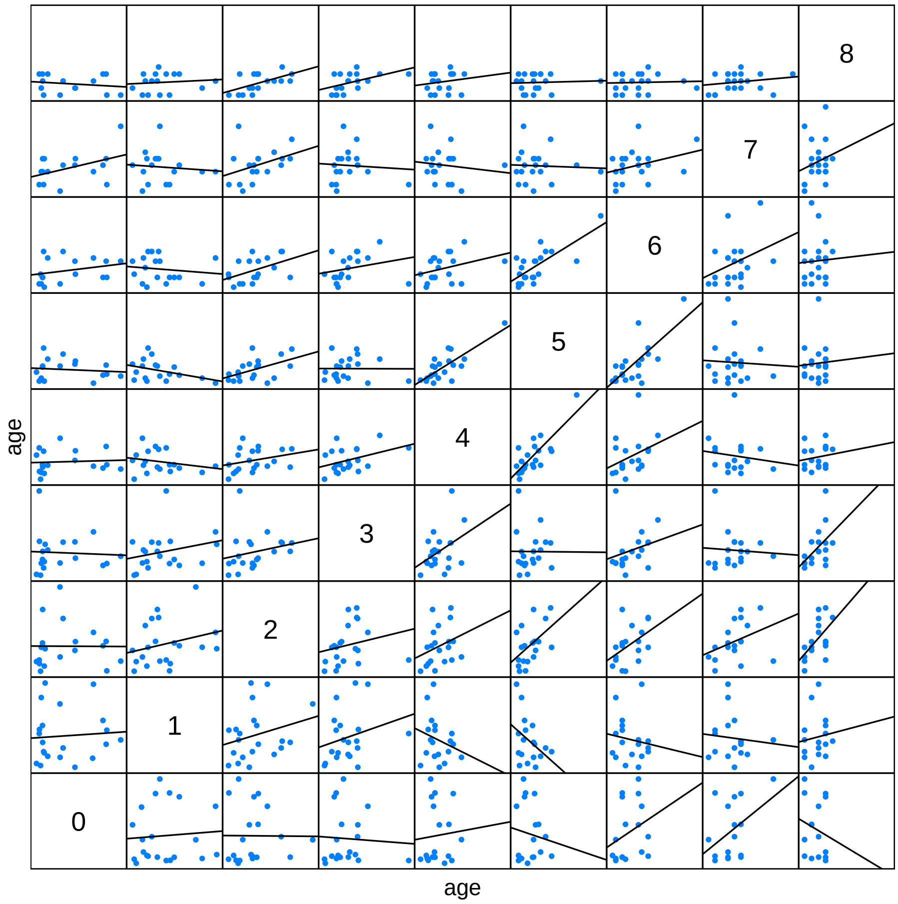


Figure H.12 – Pairwise plot of age by cohort ("P–GFS–jul")

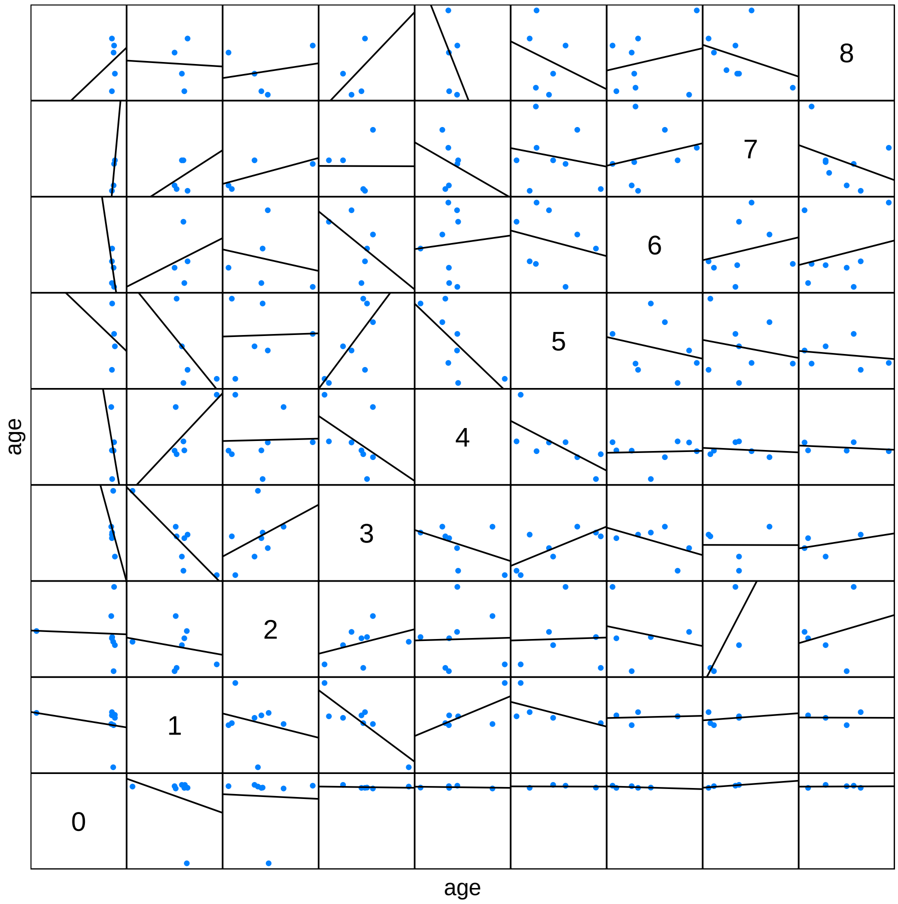
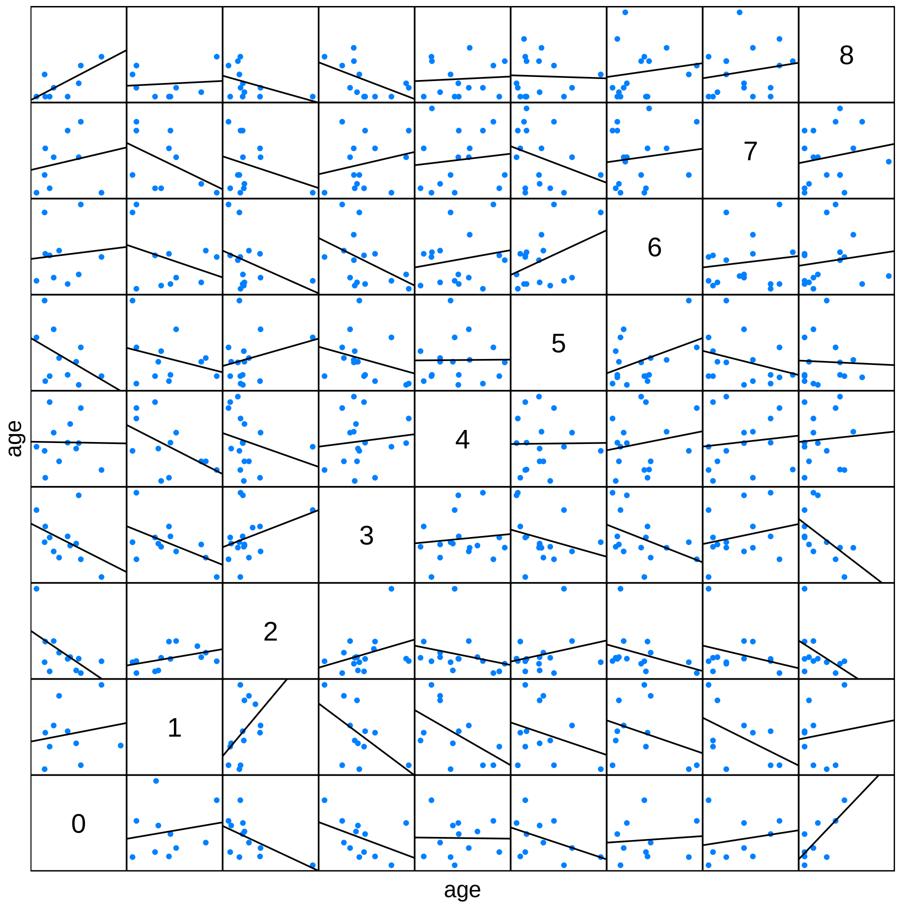


Figure H.13 – Pairwise plot of age by cohort ("P–GFS–oct")



The following are pearson correlation matrices for each survey.

```
> lst <- lapply(hke07.ind, index)
> lapply(lst, cor)

$P_Tr_89
, , unit = unique, season = all, area = unique

   age
age          0          1          2            3          4           5
  0  1.0000000         NA         NA           NA         NA          NA
  1  0.9788893  1.0000000         NA           NA         NA          NA
  2  0.9346118  0.9773121  1.0000000           NA         NA          NA
  3  0.9956469  0.9507759  0.9618101  1.000000000         NA          NA
  4 -1.0000000 -0.4091826 -0.2444428 -0.503384738  1.0000000          NA
  5         NA -1.0000000 -0.4896843  0.001273525 -0.8669659  1.00000000
  6         NA         NA -1.0000000  0.317283167  0.6677576 -0.48329596
  7         NA         NA         NA -1.000000000  0.1451346  0.01641220
  8         NA         NA         NA           NA -1.0000000  0.93807636
   age
age          6         7  8
  0         NA        NA NA
  1         NA        NA NA
  2         NA        NA NA
  3         NA        NA NA
  4         NA        NA NA
  5         NA        NA NA
  6  1.0000000        NA NA
  7 -0.5665139 1.0000000 NA
  8 -0.0657606 0.1503186  1


$P_Tr_95
, , unit = unique, season = all, area = unique

   age
age           0           1           2          3           4          5
  0  1.00000000          NA          NA         NA          NA         NA
  1  0.41755717  1.00000000          NA         NA          NA         NA
  2 -0.48415503 -0.31688948  1.00000000         NA          NA         NA
  3 -0.05925934  0.40681060 -0.27415847  1.0000000          NA         NA
  4  0.67378343  0.30437151 -0.55727454  0.0845264  1.00000000         NA
  5 -0.29185096  0.45681679 -0.34019458  0.8414026  0.27615478  1.0000000
  6  0.18788187 -0.02449459 -0.05263599  0.3513754  0.62514374  0.4450041
  7 -0.12794250 -0.48195090 -0.21373542 -0.5409713 -0.07566128 -0.3169843
  8 -0.65731218 -0.46102308  0.51149281 -0.7128324 -0.73376146 -0.3961669
   age
age          6         7  8
  0         NA        NA NA
  1         NA        NA NA
  2         NA        NA NA
  3         NA        NA NA
  4         NA        NA NA
  5         NA        NA NA
  6  1.0000000        NA NA
  7 -0.2883914 1.0000000 NA
  8 -0.3337885 0.4668558  1


$SP_CORUTR8c_85
, , unit = unique, season = all, area = unique
```

```
   age
age          0          1          2          3          4          5
  0  1.0000000         NA         NA         NA         NA         NA
  1  0.4170175  1.0000000         NA         NA         NA         NA
  2  0.3242948  0.7700567  1.0000000         NA         NA         NA
  3  0.7879545  0.5863611  0.3354109  1.0000000         NA         NA
  4  0.7836516  0.6761030  0.6999482  0.7857813  1.0000000         NA
  5  0.1874816  0.8839890  0.6055924  0.8124280  0.6831199  1.0000000
  6  0.6710049  0.5850834 -0.5693974  0.4592811  0.3435990  0.2231583
  7 -1.0000000  0.6911377  0.1608722 -0.8241858 -0.6636156 -0.1212515
  8         NA -1.0000000 -0.5843338 -0.9676469 -0.7444954 -0.8332124
   age
age          6         7  8
  0         NA        NA NA
  1         NA        NA NA
  2         NA        NA NA
  3         NA        NA NA
  4         NA        NA NA
  5         NA        NA NA
  6  1.0000000        NA NA
  7  0.5676290 1.0000000 NA
  8 -0.4079037 0.2617171  1


$SP_CORUTR8c_94
, , unit = unique, season = all, area = unique

   age
age           0           1           2          3           4          5
  0  1.00000000          NA          NA         NA          NA         NA
  1  0.89837889  1.00000000          NA         NA          NA         NA
  2 -0.09293083  0.22601618  1.00000000         NA          NA         NA
  3  0.26267531  0.27261465  0.11640776  1.0000000          NA         NA
  4  0.11331929  0.08062144  0.21729290  0.3844972  1.00000000         NA
  5 -0.27981027 -0.50077132  0.08010572  0.3580693  0.50643815 1.00000000
  6 -0.47552216 -0.32791196  0.31133060 -0.4053311  0.36414901 0.10238589
  7 -0.52376378 -0.55598294 -0.33504848 -0.1269943  0.04340819 0.30993538
  8 -0.14606432 -0.12072593  0.09700957 -0.2766908 -0.46339416 0.00983703
   age
age          6         7  8
  0         NA        NA NA
  1         NA        NA NA
  2         NA        NA NA
  3         NA        NA NA
  4         NA        NA NA
  5         NA        NA NA
  6  1.0000000        NA NA
  7 -0.1264894 1.0000000 NA
  8 -0.3720557 0.3756991  1


$SP_CORUTRP8c_85
, , unit = unique, season = all, area = unique

   age
age            0           1           2          3          4           5
  0  1.000000000          NA          NA         NA         NA          NA
  1 -0.024213979  1.00000000          NA         NA         NA          NA
  2  0.856494623  0.12774209  1.00000000         NA         NA          NA
  3  0.256880402  0.62513583  0.06431365  1.0000000         NA          NA
  4 -0.004426541  0.75164631  0.43405633  0.3787806  1.0000000          NA
  5  0.093251133 -0.03678887  0.74887201  0.1592959  0.3072464  1.00000000
```

```
  6  0.649080482 -0.54158211 -0.16099002  0.5243012 -0.4174735  0.07533307
  7  1.000000000  0.03480130 -0.62783622  0.1854498 -0.1117649 -0.48619583
  8           NA  1.00000000 -0.91855101 -0.1629572  0.1784311 -0.64521802
   age
age          6         7  8
  0         NA        NA NA
  1         NA        NA NA
  2         NA        NA NA
  3         NA        NA NA
  4         NA        NA NA
  5         NA        NA NA
  6  1.0000000        NA NA
  7  0.5077912 1.0000000 NA
  8 -0.3842595 0.1150839  1


$SP_CORUTRP8c_94
, , unit = unique, season = all, area = unique

   age
age  0           1           2         3            4          5          6
  0 NA          NA          NA        NA           NA         NA         NA
  1 NA  1.00000000          NA        NA           NA         NA         NA
  2 NA  0.07000460  1.00000000        NA           NA         NA         NA
  3 NA  0.30221029  0.03444238 1.0000000           NA         NA         NA
  4 NA  0.16182731  0.76903109 0.3138275  1.000000000         NA         NA
  5 NA -0.36430211  0.31210721 0.2317147  0.705774143  1.0000000         NA
  6 NA -0.14013805 -0.32669985 0.4754098 -0.008351738  0.7154727  1.0000000
  7 NA  0.65648260 -0.01487638 0.6239157  0.366079220 -0.1950714  0.7392021
  8 NA  0.09410052  0.21887098 0.4953932  0.431988057  0.1179978 -0.3083424
   age
age         7  8
  0        NA NA
  1        NA NA
  2        NA NA
  3        NA NA
  4        NA NA
  5        NA NA
  6        NA NA
  7 1.0000000 NA
  8 0.6516383  1


$SP_SANTR
, , unit = unique, season = all, area = unique

   age
age  0           1          2          3          4         5         6
  0 NA          NA         NA         NA         NA        NA        NA
  1 NA  1.00000000         NA         NA         NA        NA        NA
  2 NA  0.28308973  1.0000000         NA         NA        NA        NA
  3 NA  0.48504812  0.4406345  1.0000000         NA        NA        NA
  4 NA -0.18962542 -0.1410526 -0.1685739  1.0000000        NA        NA
  5 NA -0.21007659 -0.4792519 -0.4641474  0.1788211 1.0000000        NA
  6 NA -0.22172786 -0.6000875 -0.4628511  0.1226257 0.4976690 1.0000000
  7 NA -0.08397816 -0.5217153 -0.5727688  0.1138155 0.4603690 0.4567758
  8 NA  0.11114587 -0.2472992 -0.4250438 -0.1310345 0.4432811 0.4932766
   age
age         7  8
  0        NA NA
  1        NA NA
  2        NA NA
```

```
  3        NA NA
  4        NA NA
  5        NA NA
  6        NA NA
  7 1.0000000 NA
  8 0.5144542  1


$SP_VIMATR
, , unit = unique, season = all, area = unique

   age
age           0           1          2          3          4         5
  0  1.00000000          NA         NA         NA         NA        NA
  1 -0.21868620  1.00000000         NA         NA         NA        NA
  2 -0.01122208  0.43884572  1.0000000         NA         NA        NA
  3 -0.13113268  0.77341175  0.5046684  1.0000000         NA        NA
  4  0.38062926 -0.27582324 -0.2380396 -0.1252423  1.0000000        NA
  5  0.51484970 -0.27039801 -0.4346283 -0.2385200  0.2681961 1.0000000
  6  0.31018587  0.04932316 -0.3659214 -0.1723529  0.1867582 0.6794644
  7 -0.23143084 -0.05176447 -0.2388465 -0.2823949  0.2671071 0.4200532
  8 -0.23663553 -0.04868970 -0.1413225 -0.1392483 -0.2034549 0.0812851
   age
age         6         7  8
  0        NA        NA NA
  1        NA        NA NA
  2        NA        NA NA
  3        NA        NA NA
  4        NA        NA NA
  5        NA        NA NA
  6 1.0000000        NA NA
  7 0.5781404 1.0000000 NA
  8 0.2464336 0.4599191  1


$SP_GFS
, , unit = unique, season = all, area = unique

   age
age            0           1         2           3          4           5
  0  1.000000000          NA        NA          NA         NA          NA
  1  0.073119607  1.00000000        NA          NA         NA          NA
  2 -0.006882283  0.26636141 1.0000000          NA         NA          NA
  3 -0.054969540  0.26080459 0.2283690  1.00000000         NA          NA
  4  0.070846705 -0.24447049 0.2890774  0.40568771  1.0000000          NA
  5 -0.118612946 -0.39226550 0.5017713 -0.00563963  0.7951873  1.00000000
  6  0.286597080 -0.13819683 0.4651538  0.25149405  0.3414465  0.74312656
  7  0.436811640 -0.09781152 0.3696676 -0.06941484 -0.1350083 -0.04972975
  8 -0.182918024  0.11256281 0.5666520  0.49214919  0.1623280  0.05773336
   age
age          6         7  8
  0         NA        NA NA
  1         NA        NA NA
  2         NA        NA NA
  3         NA        NA NA
  4         NA        NA NA
  5         NA        NA NA
  6 1.00000000        NA NA
  7 0.33857768 1.0000000 NA
  8 0.04692146 0.2123322  1
```

```
$P_GFS_jul
, , unit = unique, season = all, area = unique

   age
age           0           1           2            3           4          5
  0  1.00000000          NA          NA           NA          NA         NA
  1 -0.23915325  1.00000000          NA           NA          NA         NA
  2 -0.04389987 -0.21283648  1.00000000           NA          NA         NA
  3 -0.22177340 -0.86935841  0.37114980  1.000000000          NA         NA
  4 -0.27184107  0.66561486  0.02656259 -0.468067313  1.00000000         NA
  5 -0.05020612 -0.56431949  0.03192775  0.741053933 -0.70506847  1.0000000
  6 -0.44055202  0.10801849 -0.21574149 -0.482448523  0.05368429 -0.2453792
  7  0.88680384  0.21827735  0.71953716 -0.002579625 -0.16432915 -0.1907096
  8  0.05843873 -0.01468252  0.21311588  0.406275002 -0.33366018 -0.2058295
   age
age         6          7  8
  0        NA         NA NA
  1        NA         NA NA
  2        NA         NA NA
  3        NA         NA NA
  4        NA         NA NA
  5        NA         NA NA
  6 1.0000000         NA NA
  7 0.2360535  1.0000000 NA
  8 0.2440477 -0.3482991  1


$P_GFS_oct
, , unit = unique, season = all, area = unique

   age
age           0          1          2          3           4           5
  0  1.00000000         NA         NA         NA          NA          NA
  1  0.18214330  1.0000000         NA         NA          NA          NA
  2 -0.56228095  0.4506889  1.0000000         NA          NA          NA
  3 -0.43458988 -0.5488078  0.3363598  1.0000000          NA          NA
  4 -0.01451303 -0.5419345 -0.2661230  0.1116628 1.000000000          NA
  5 -0.44144832 -0.2932014  0.2505632 -0.2806945 0.009869607  1.00000000
  6  0.09244123 -0.3405950 -0.3506480 -0.4408555 0.188848196  0.41346321
  7  0.19146435 -0.4906627 -0.2789132  0.2200466 0.116360720 -0.30921643
  8  0.74003799  0.1004250 -0.4253350 -0.5417007 0.072000153 -0.03877374
   age
age         6         7  8
  0        NA        NA NA
  1        NA        NA NA
  2        NA        NA NA
  3        NA        NA NA
  4        NA        NA NA
  5        NA        NA NA
  6 1.0000000        NA NA
  7 0.1295258 1.0000000 NA
  8 0.1486160 0.1801883  1
```

Its safe to say the indices ar enot consistent.

2.5 Biomass

Figure H.14 − Catch weight at age for southern hake

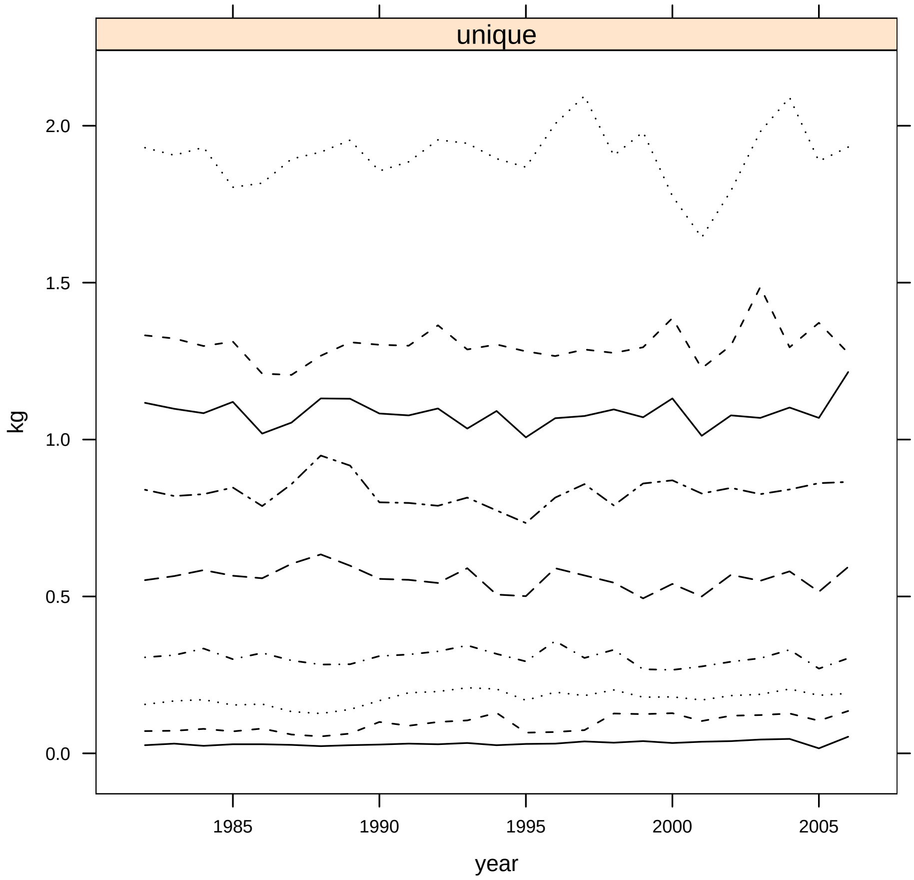
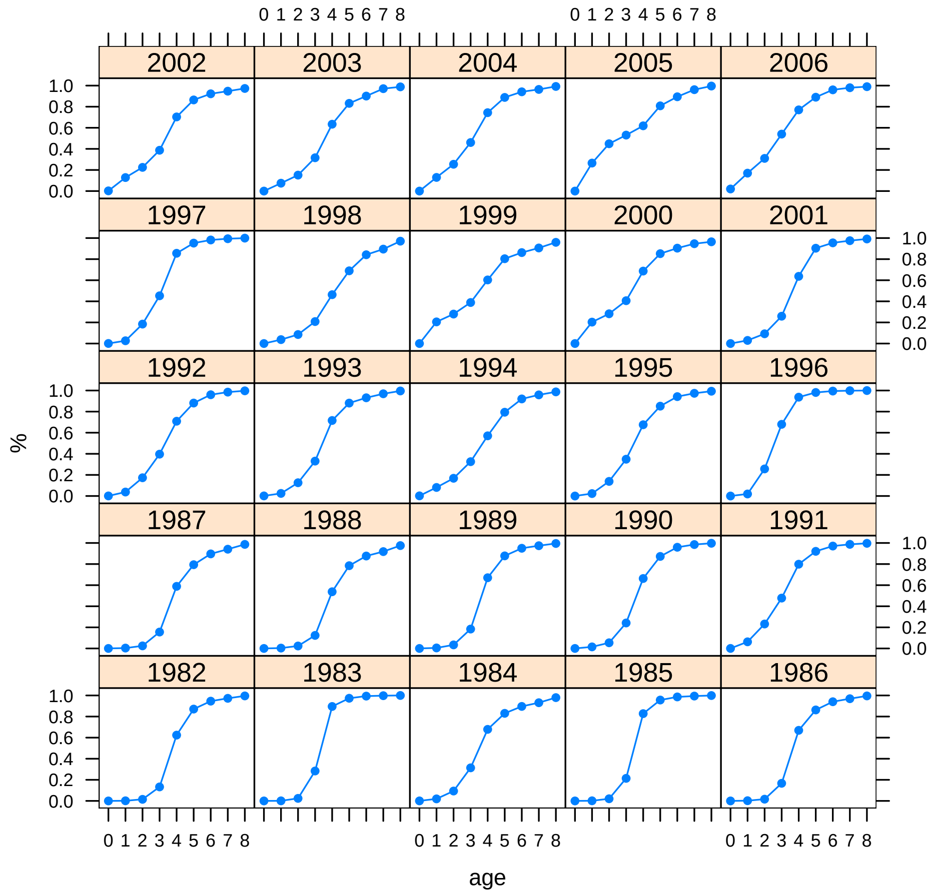
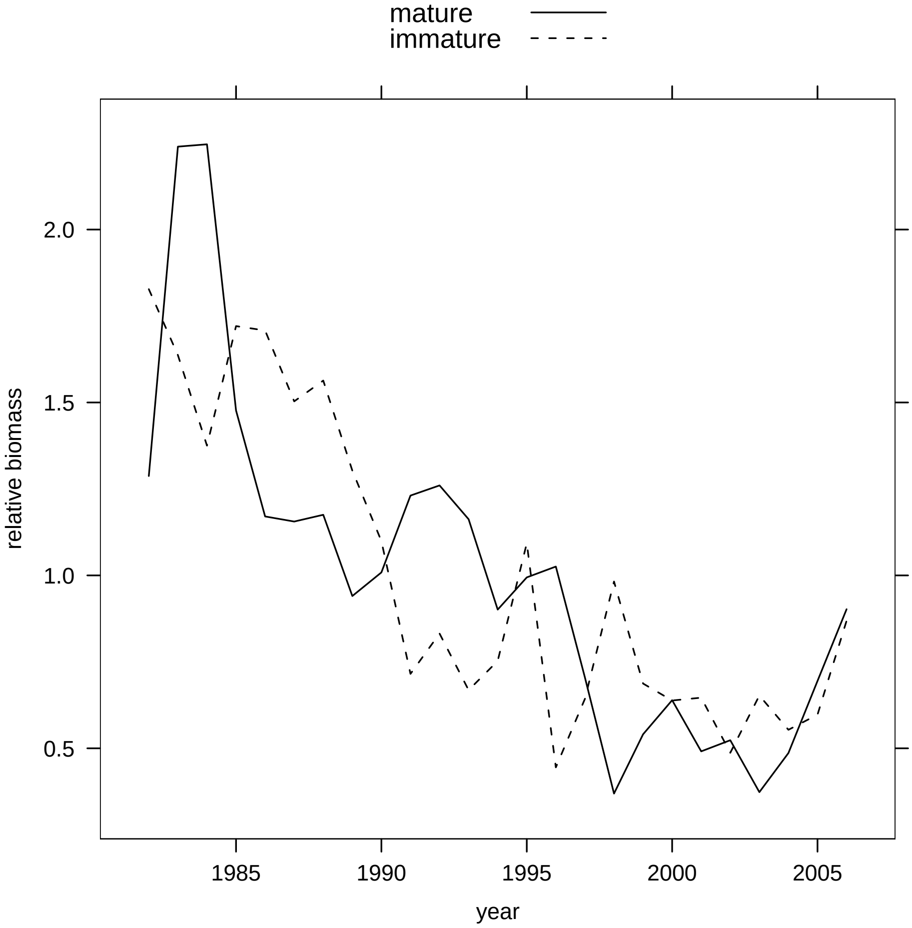


Figure H.15 – Maturity ogive for southern hake

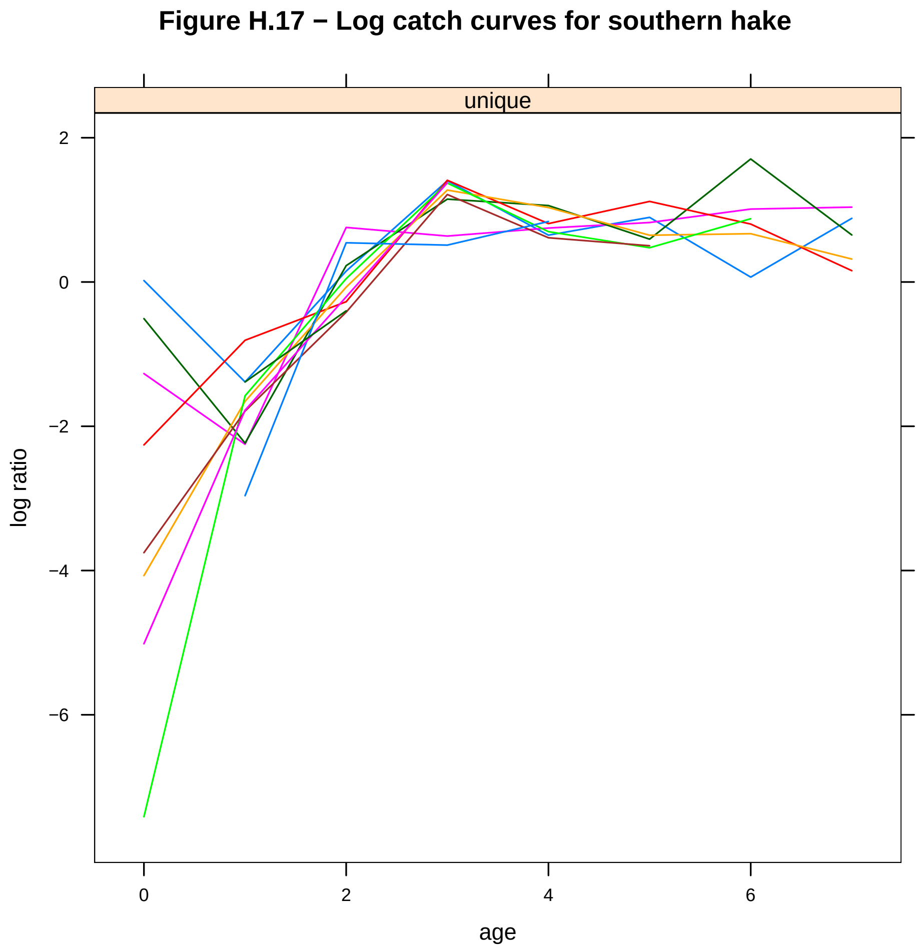


Using catch at age data, weights at age and proportion mature at age, mature and immature biomass were computed.



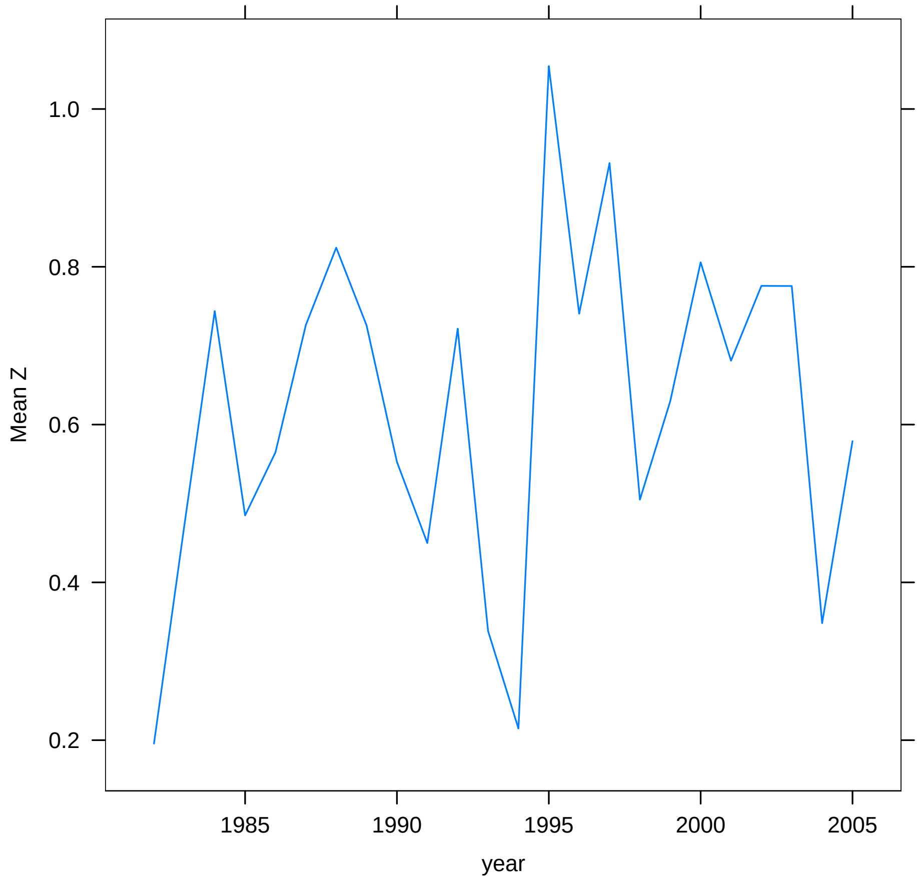
Trend analysis of the mature component of the stock indicates a sharp decrease from mid 80s to late 90s being currently at low levels. Note that in this stock the immature are not well sampled due to minimum landing size, so age 0 in the catch at age matrix was replaced by "0".

2.6 Total mortality




```
> hke07z <- z(catch.n(hke07), agerng = 2:5)
> summary(hke07z)

Average Total Mortality
      Year Cohort
mean 0.618  0.663
var  0.046  0.011

> t.test(hke07z)

        Welch Two Sample t-test

data:  Zy and Zc
t = -0.8978, df = 34.614, p-value = 0.3755
alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval:
 -0.14567775  0.05636071
sample estimates:
mean of x mean of y
0.6184109 0.6630694
```

Figure H.18 – Total mortality (Z) for southern hake

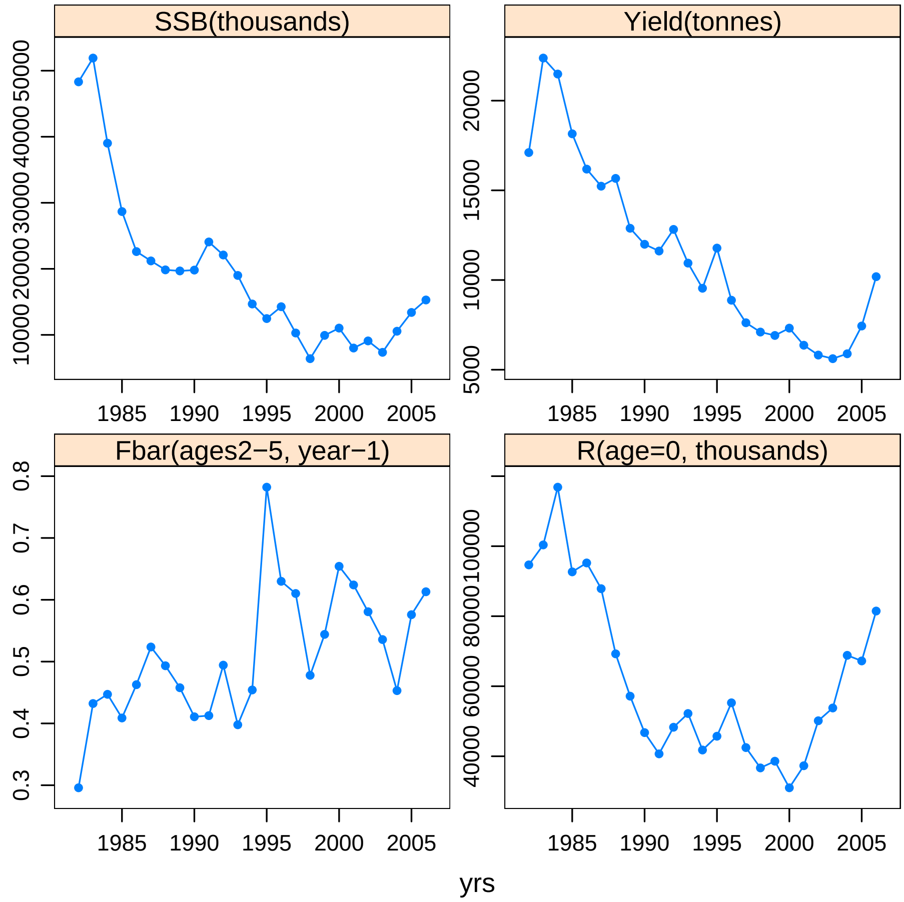


Despite the underlying assumptions in the computation of mean Z the catch at age data indicates average total mortality since 1982 of around 0.7(note that natural mortality for the southern hake is assumed constant at 0.2). Mortality seems to have been the lowest in 1982 and 1993-1994 and the highest in 1995.

3 Assessment with VPA

This sections was carried out with the same options as the final run on the main report to provide inputs for projections. Diagnostics and retrospective are presented in the main report.

Figure H.19 − Summary plot for Southern Hake assessment



4 Short Term Forecast

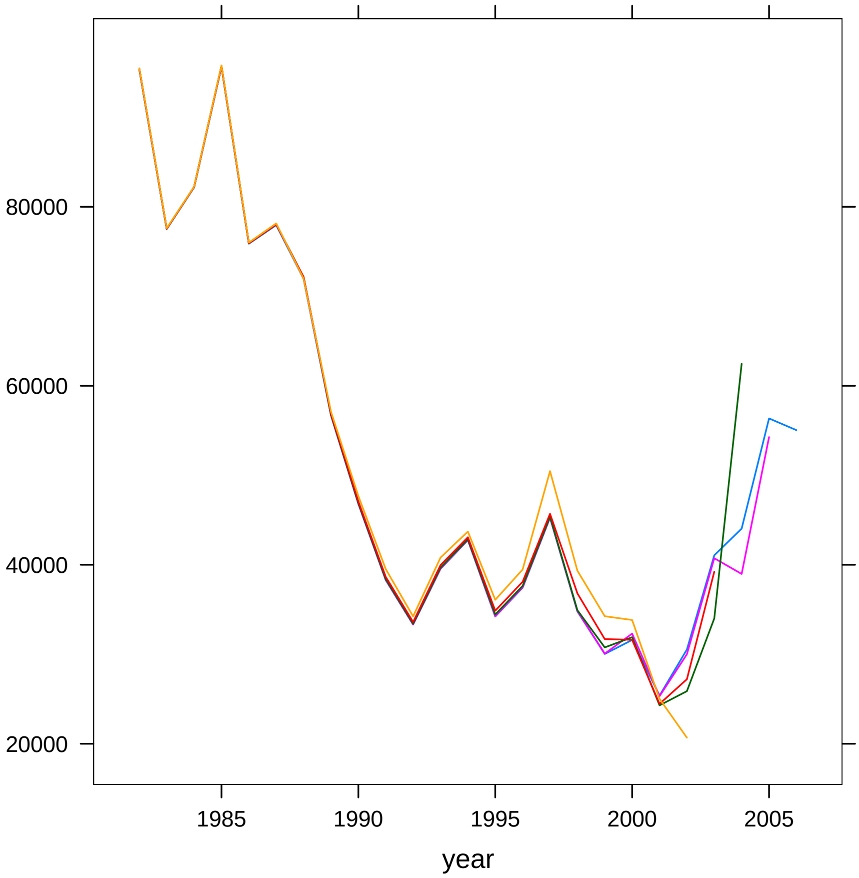
In this section are presented alternative forecasts to the one included on the main report body. The forecasts presented here project a 10% decrease in F per year as previewed by the recovery plan.

To carry out short term forecasts we decided to use the last 3 years to compute mean values of stock weight at age, maturity at age and selection pattern.

Due to the retrospective pattern in recruitment and the inconsistency between the 2 surveys estimating this age, it was decided to replace age 0 in 2006 by the geometric mean between 1989 and 2005.

Age 1 estimates were also questioned. However the estimate is very consistent between the 2 surveys and the retrostpectuve pattern in the age did not show a clear bias (see figure below).

Figure H.20 − Retrospective pattern at age 1



The group discussed the level of F to start the projections. The indications we have is that F is raising on the latest 3 years which supports the scaling of the exploitation pattern to the last year F estimates.

The projections were carried out with the four options discussed above, F scaled and unscaled, accepting age 1 in 2006 or not.

Table H.1 - Projection settings

f	Fsq	Fsc
Ycls05 Yes	A	B
Ycls05 No	C	D

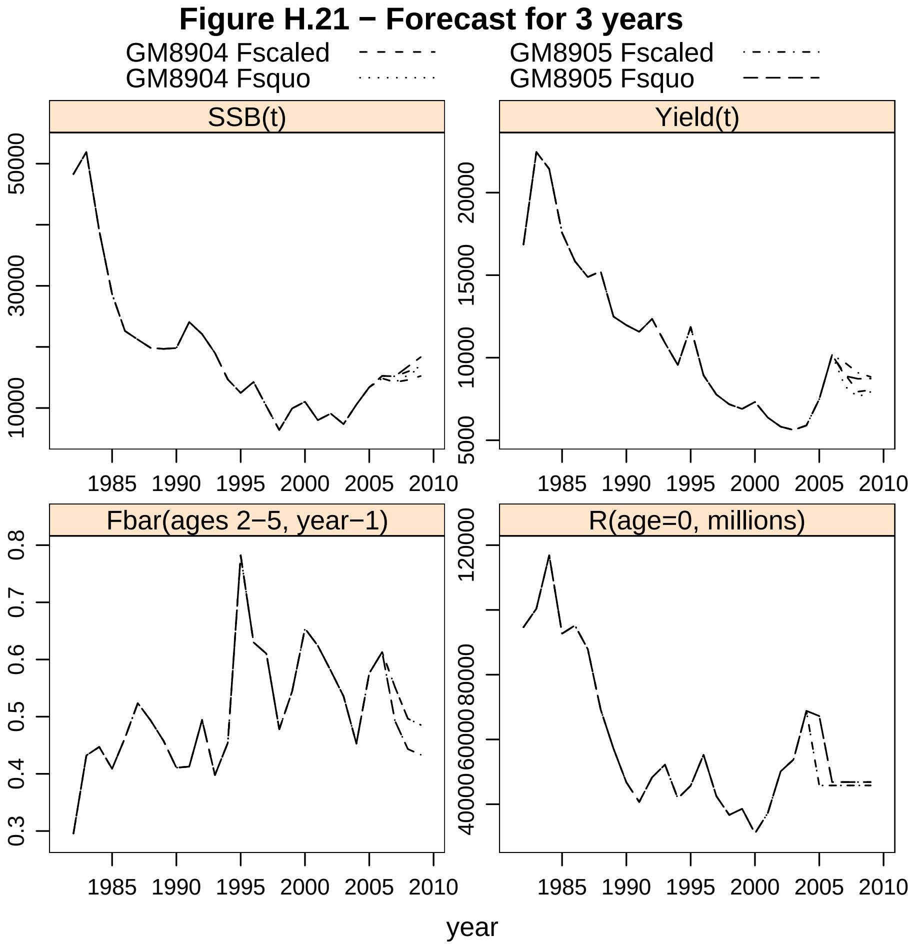


Table H.2 - Influence of GM on SSB in 2009 and Yield in 2008

```
> round(df.imp, 2)
```

```
  yld08 ssb09
A  0.16  0.54
B  0.17  0.57
C  0.46  0.71
D  0.47  0.73
```

5 S/R

A key issue for all stocks is the relation between stock and recruitment. In this section we present a bayesian adjust of this relationship. The main interest is to have a clearer view of the uncertainty associated with this parameter.

We used a ricker model parameterized by $R = \alpha.SSB.e^{-\beta.SSB}$ considering $\log R \sim Gau(\log(\alpha) + \log(SSB) - \beta.SSB, \sigma^2)$. Prioris for α were lognormal, β uniform and σ^2 InverseGamma.

```
> hke07.bsr@params <- rickerBayes(hke07.bsr@rec, hke07.bsr@ssb,
+     hke07.bsr@mcmc, plot = FALSE, conv = FALSE)$params
```

```
Acceptance probability for (beta) = 0.448500
```

5.1 Diagnostics

Check autocorrelation of the chains.

Figure H.22 − alpha

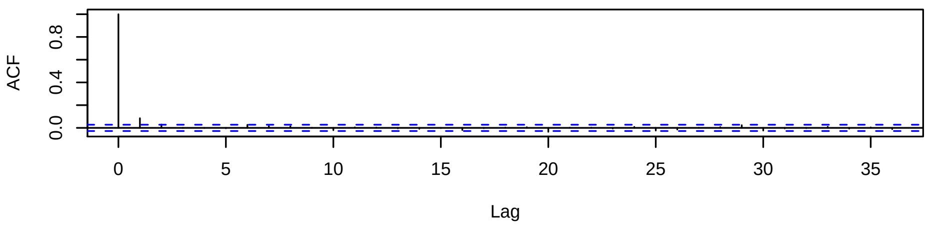


Figure H.23 − beta

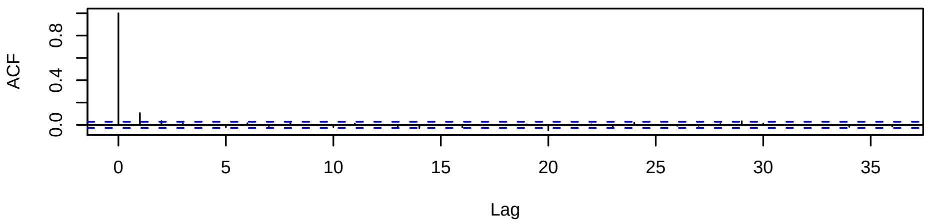
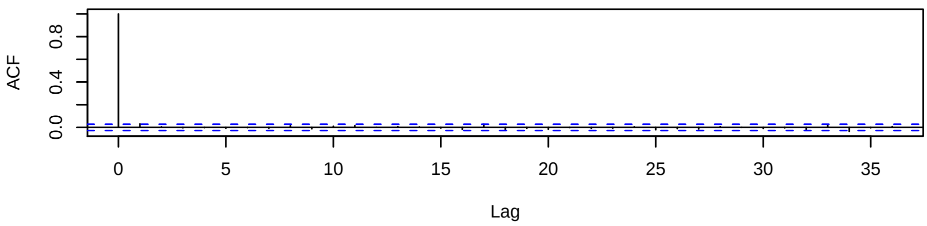


Figure H.24 − sigma



Check prioris influence.

Figure H.25 − Alpha priori and posterior

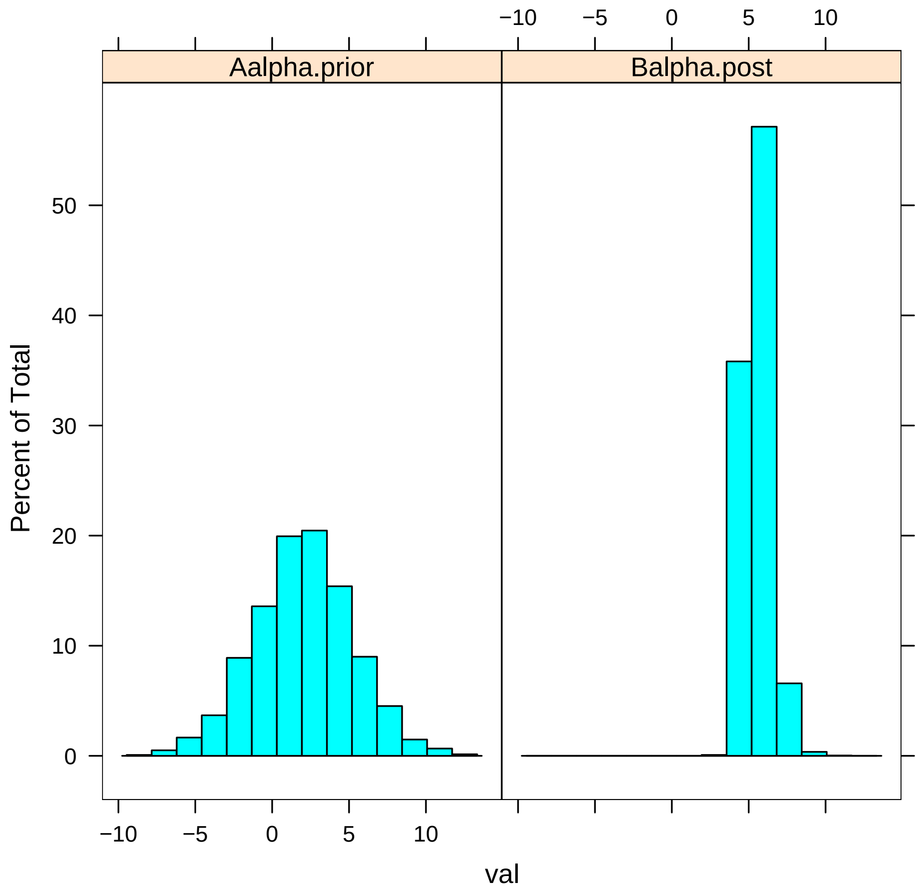


Figure H.26 − Beta priori and posterior

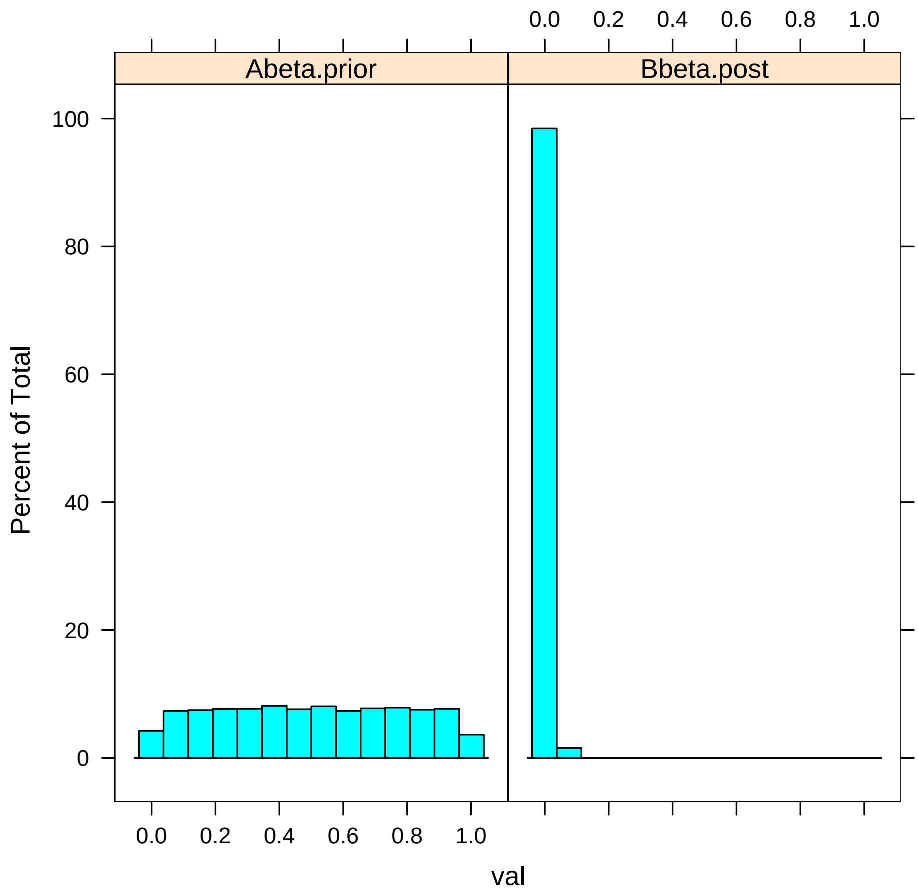
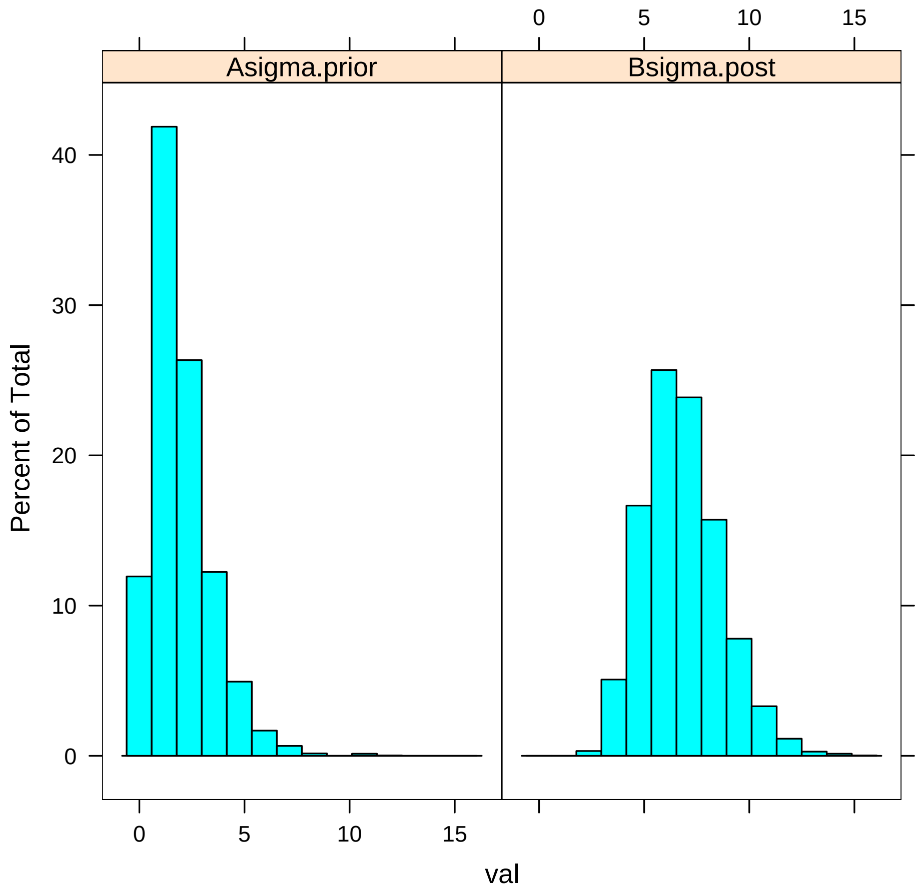


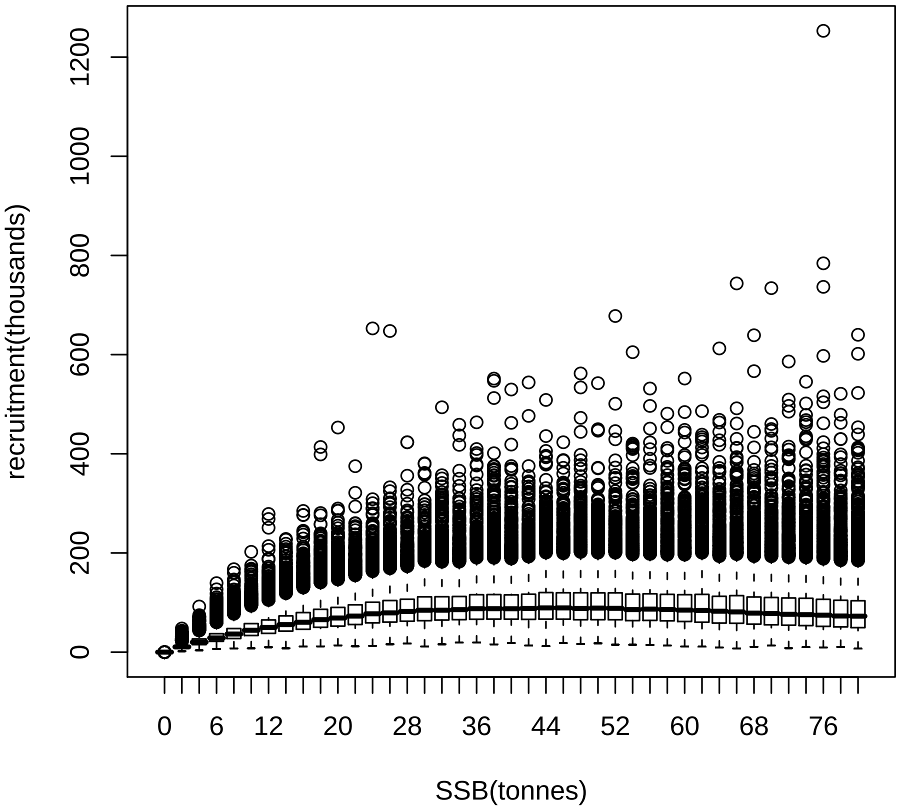
Figure H.27 − 1/sigma priori and posterior



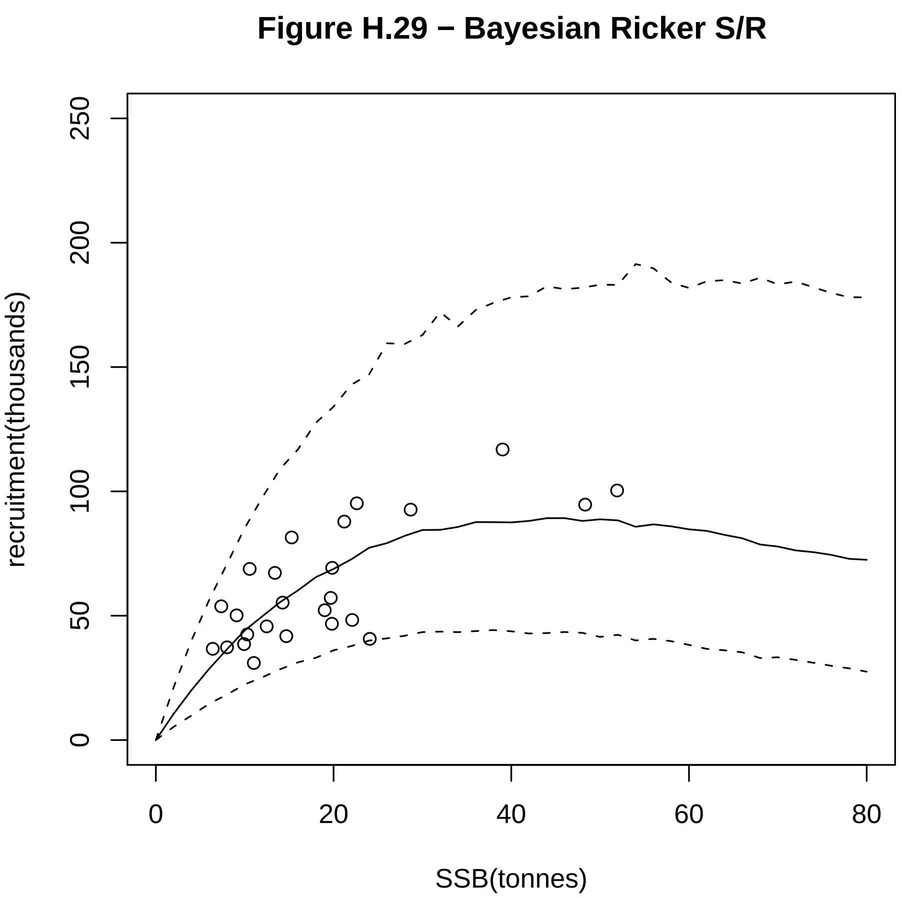
5.2 S/R variability

Predicted recruitment for several levels of SSB. Note the variability of this relation.

Figure H.28 − Bayesian Ricker S/R



Credibility interval (90%) and observed values of recruitment.



6 Gadget

The group has explored other assessment methods to deal with this stock. This plot shows the summary results of first implementation of GADGET compared with the XSA results. GADGET toolbox develops age-length based models to implement marine ecosystem models considering the fishing effect. The goal of this first implementation was to replicate the XSA model as far as possible. The results should considered preliminary ones since some model features need a better tunning. Nevertheless the present results shows similar trends than those from the XSA. Since both models are based in different assumptions this results support our confidence on the present assessment results.

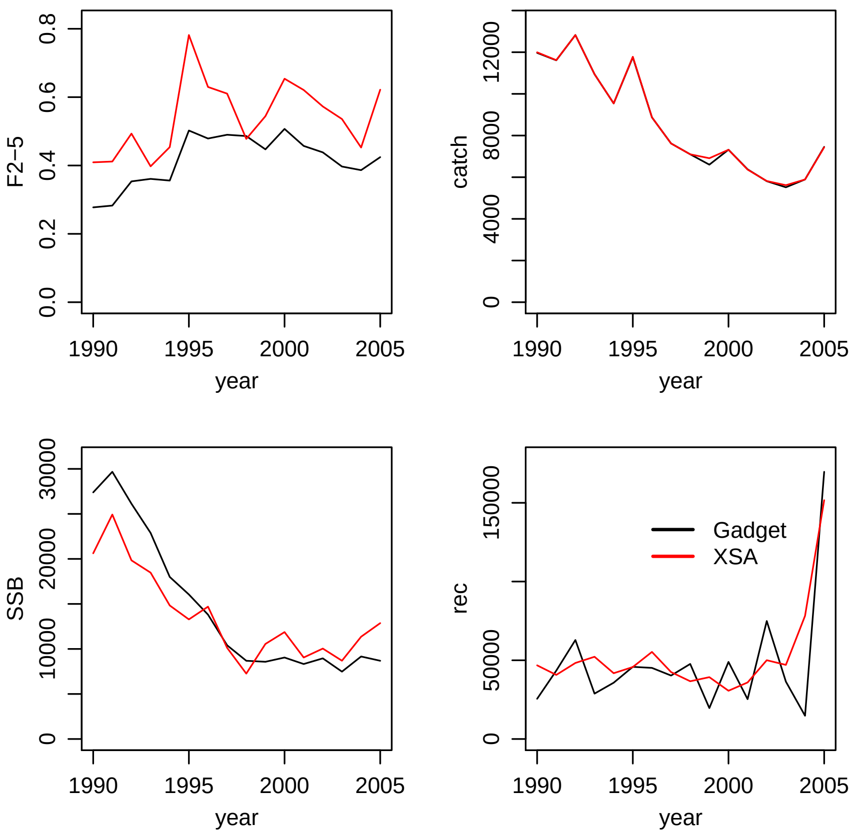
Figure H.30 - Gadget results.

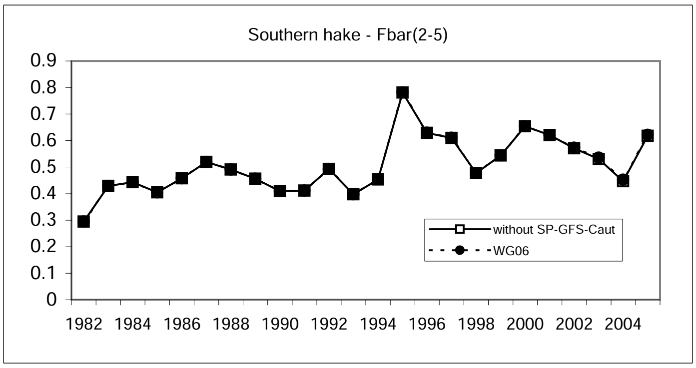
7 Cadiz

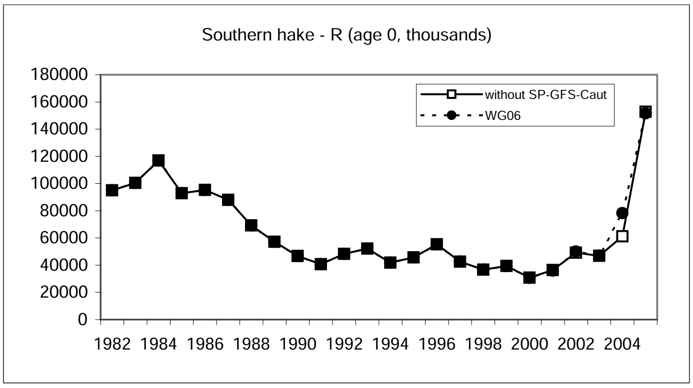
Last year an atempt was made to include information collected on the Gulf of Cadiz on the assessement. The rationale was that inspite the problem with the landings in the Gulf of Cadiz, there was information about the population (note the difference between information about the fisheries and about the porpulation) that could be helpfull on tuning the VPA. Having this is mind the Autmun Bottom Trawl Survey from that area was used for assessment. The figure below shows the difference between the 2 assessements.

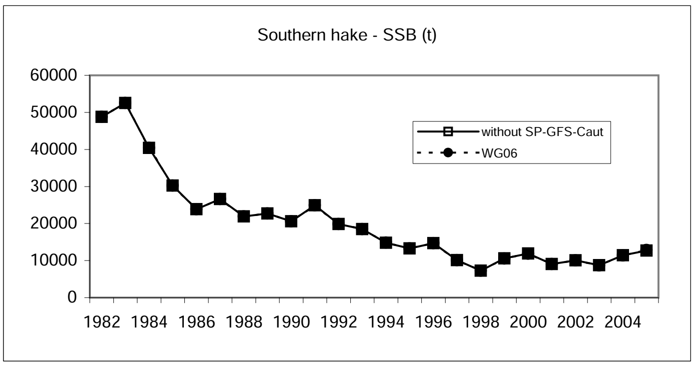
Figure H.31 - Comparison between assessment with and without the GoC survey.

Southern hake summary plots



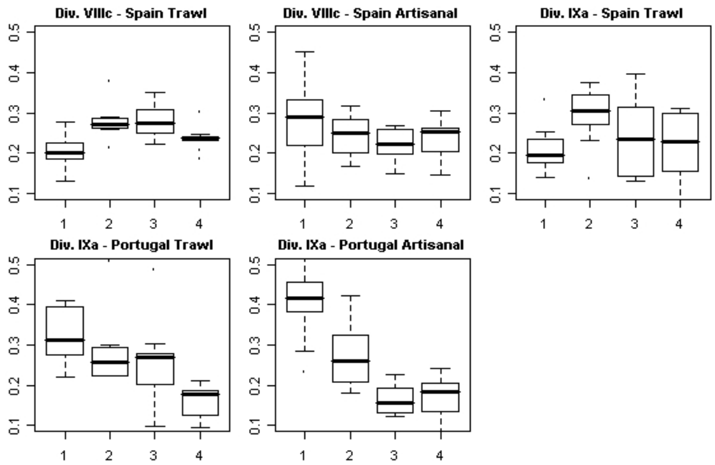

Southern hake - Fbar(2-5)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004
without SP-GFS-Caut
WG06


Southern hake - R (age 0, thousands)
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004
without SP-GFS-Caut
WG06


Southern hake - SSB (t)
60000
50000
40000
30000
20000
10000
0
1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002 2004
without SP-GFS-Caut
WG06

Annex I: Anglerfish – L. Piscatorius and L. Budegassa

L. piscatorius



L. budegassa

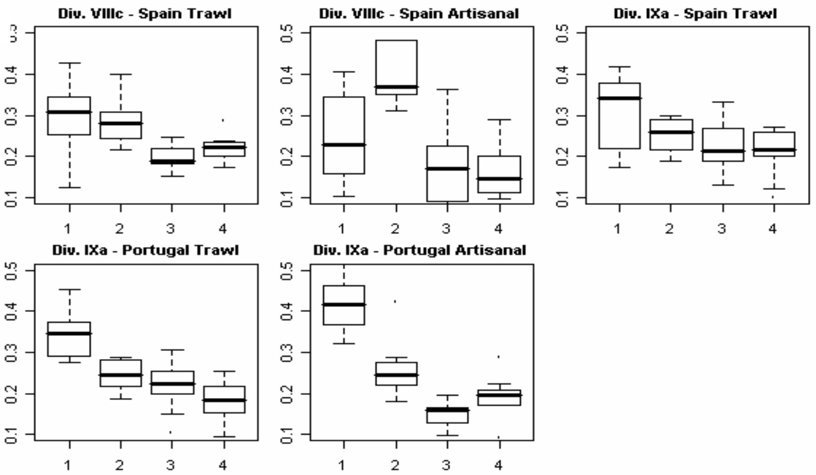


Figure I1. **ANGLERFISH (*L. piscatorius* and *L. budegassa*).**

Box-plots showing the contribution of each quarter to the annual landings, by ICES Division, country and gear (1996-2005). The box represents the 1st quartile (lower hinge), the median (middle) and the 3rd quartile (upper hinge). The lower and upper whisker is 1.5 times the inter-quartile range out from the box. Each circle represents data points that lie beyond the extremes of the whiskers.

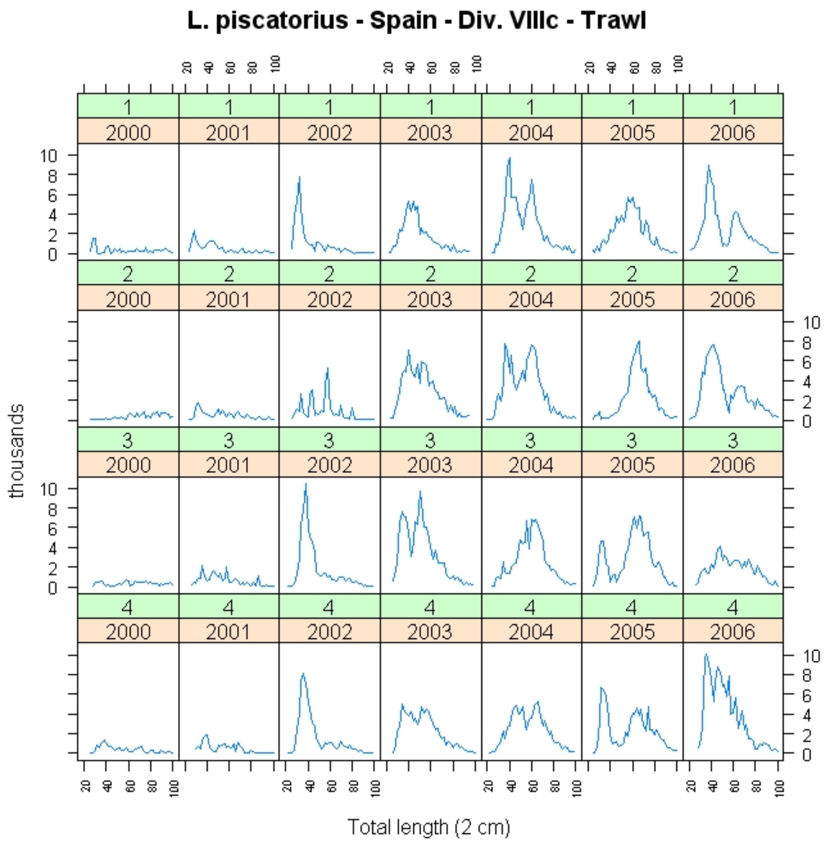


Figure I2. **ANGLERFISH (*L. piscatorius*).**

Length distribution ('000) by quarter for years between 2000 and 2006 in ICES Division VIIIc for the Spanish trawl fleet

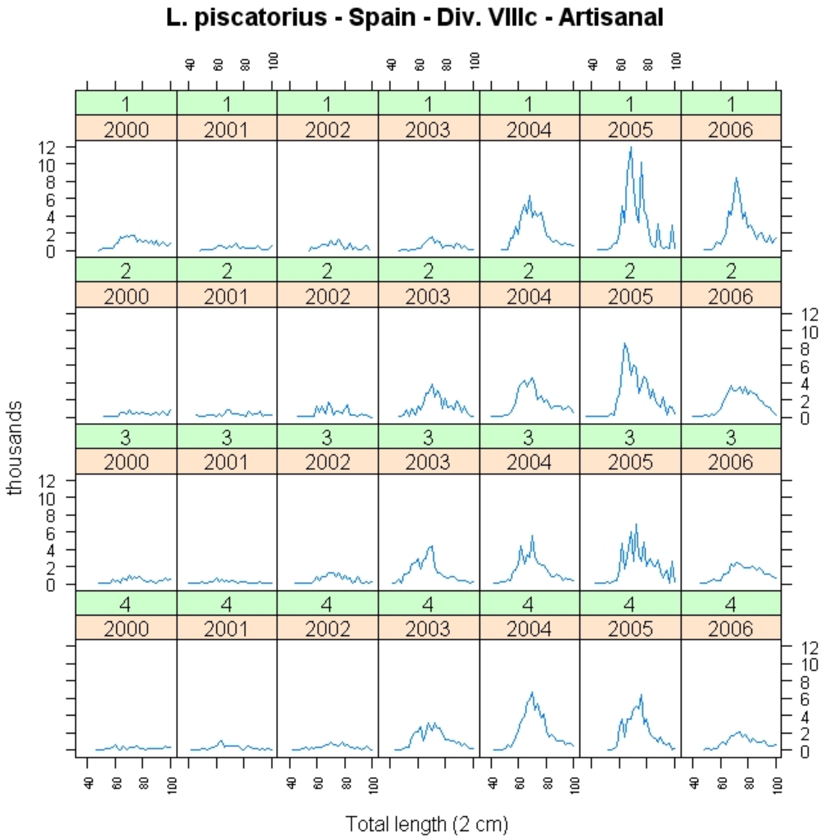


Figure I3. **ANGLERFISH (*L. piscatorius*).**

Length distribution ('000) by quarter for years between 2000 and 2006 in ICES Division VIIIc for the Spanish gillnet fleet

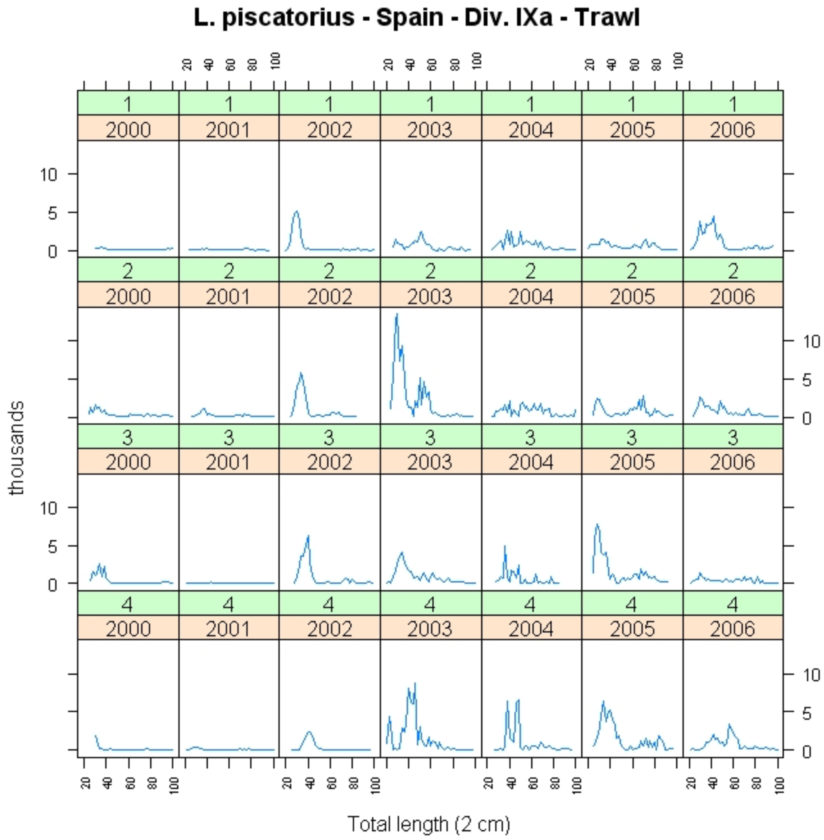


Figure I4 **ANGLERFISH (L. piscatorius).**

Length distribution (‘000) by quarter for years between 2000 and 2006 in ICES Division IXa for the Spanish trawl fleet

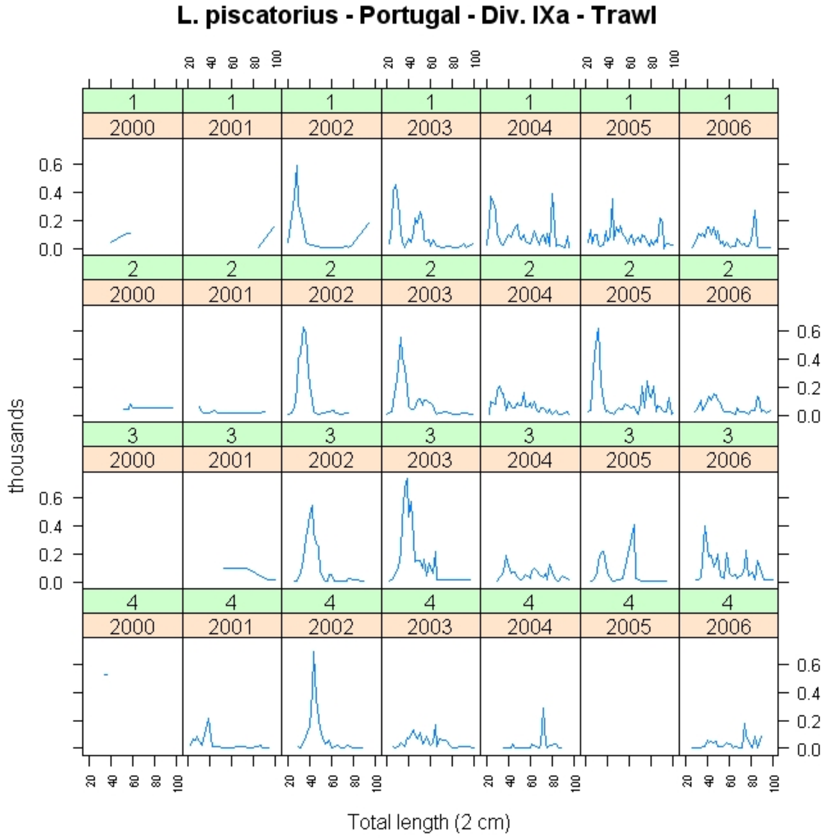


Figure I5. **ANGLERFISH (L. piscatorius).**

Length distribution ('000) by quarter for years between 2000 and 2006 in ICES Division IXa for the Portuguese trawl fleet

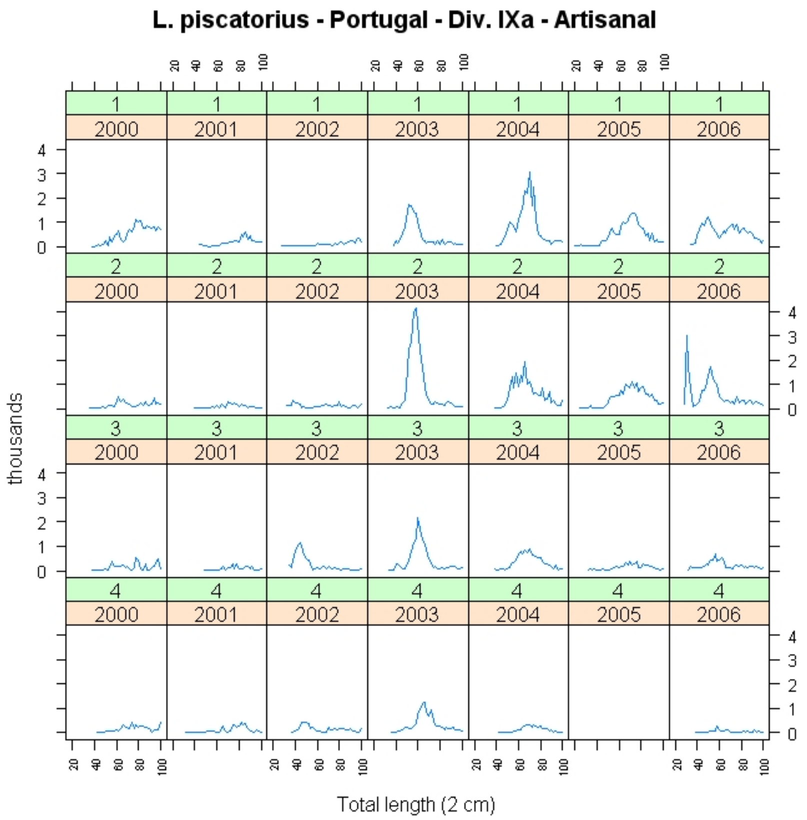


Figure I6. **ANGLERFISH (L. piscatorius).**

Length distribution ('000) by quarter for years between 2000 and 2006 in ICES Division IXa for the Portuguese artisanal fleet

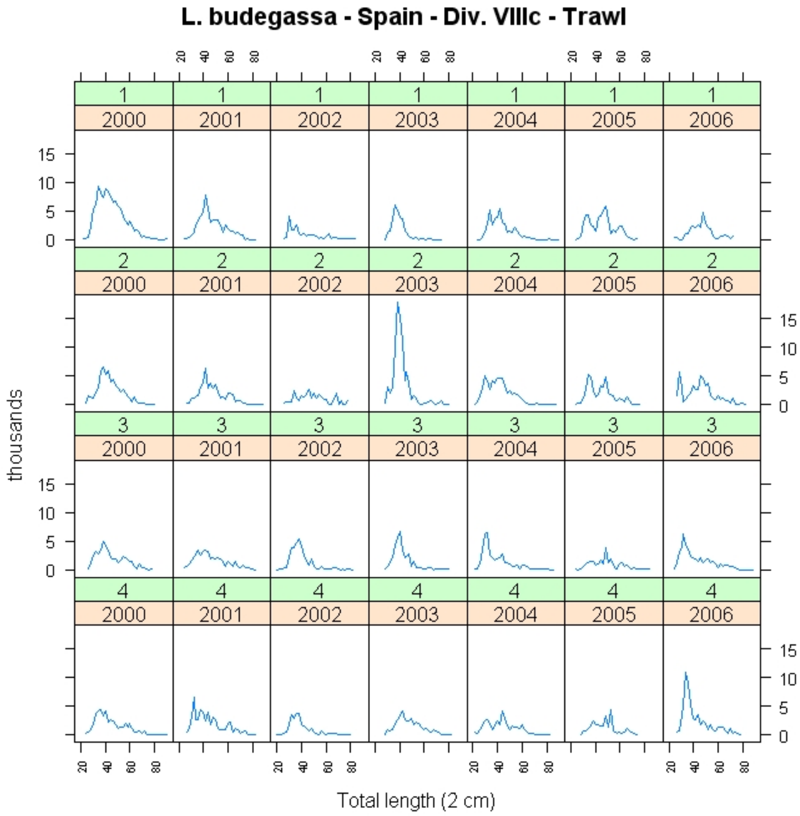


Figure I7. ANGLERFISH (L. budegassa).

Length distribution ('000) by quarter for years between 2000 and 2006 in ICES Division VIIIc for the Spanish trawl fleet

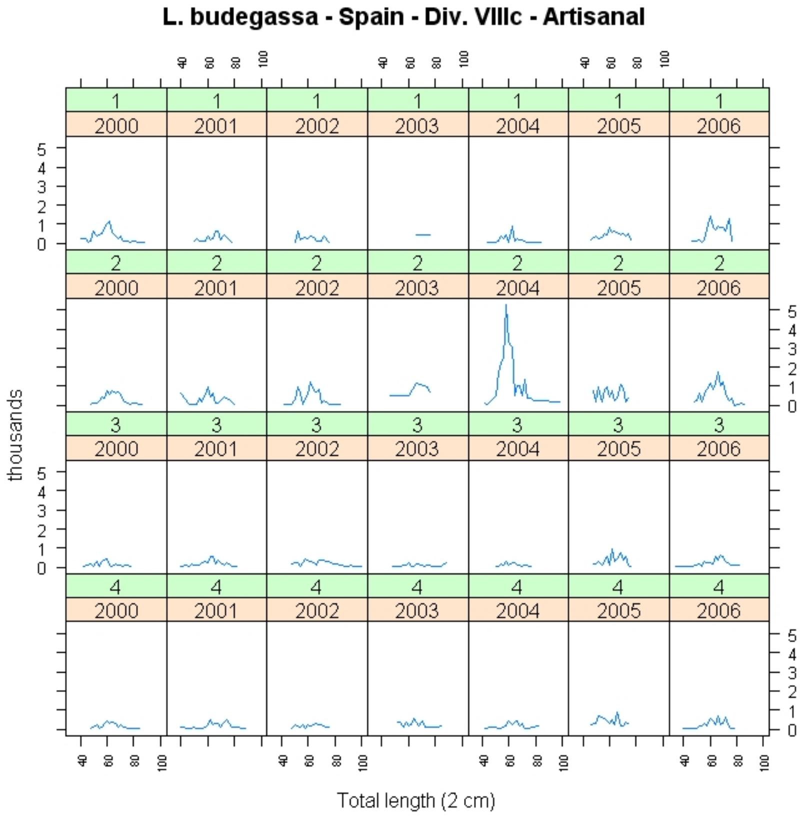


Figure I8. **ANGLERFISH (L. budegassa).**

Length distribution (‘000) by quarter for years between 2000 and 2006 in ICES Division VIIIc for the Spanish gillnet fleet

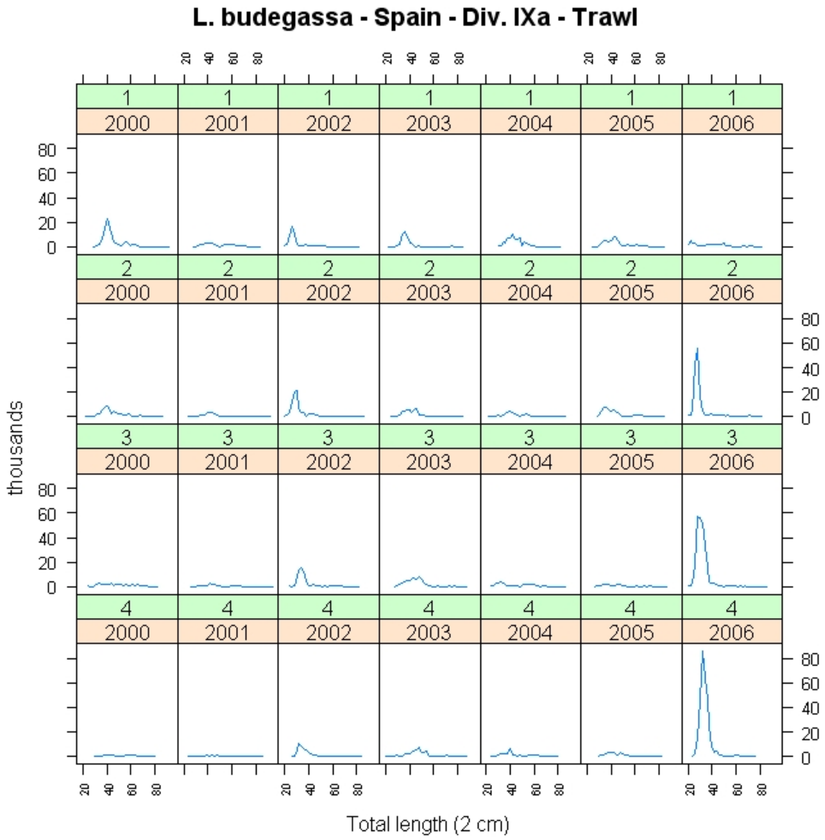


Figure I9. **ANGLERFISH (L. budegassa).**

Length distribution ('000) by quarter for years between 2000 and 2006 in ICES Division IXa for the Spanish trawl fleet

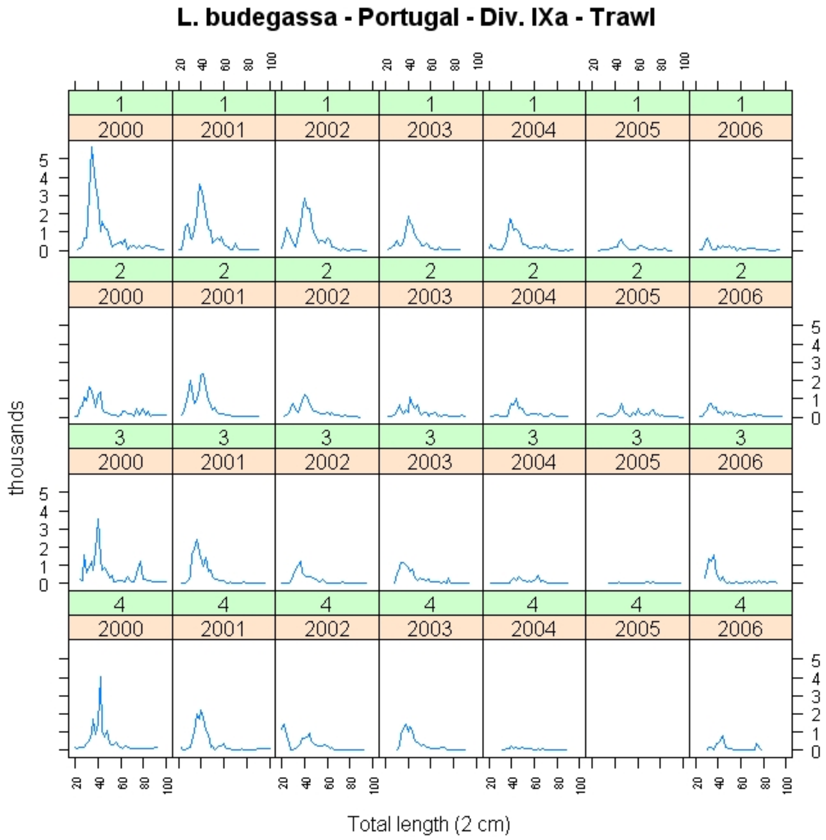


Figure I10. **ANGLERFISH (L. budegassa).**

Length distribution ('000) by quarter for years between 2000 and 2006 in ICES Division IXa for the Portuguese trawl fleet

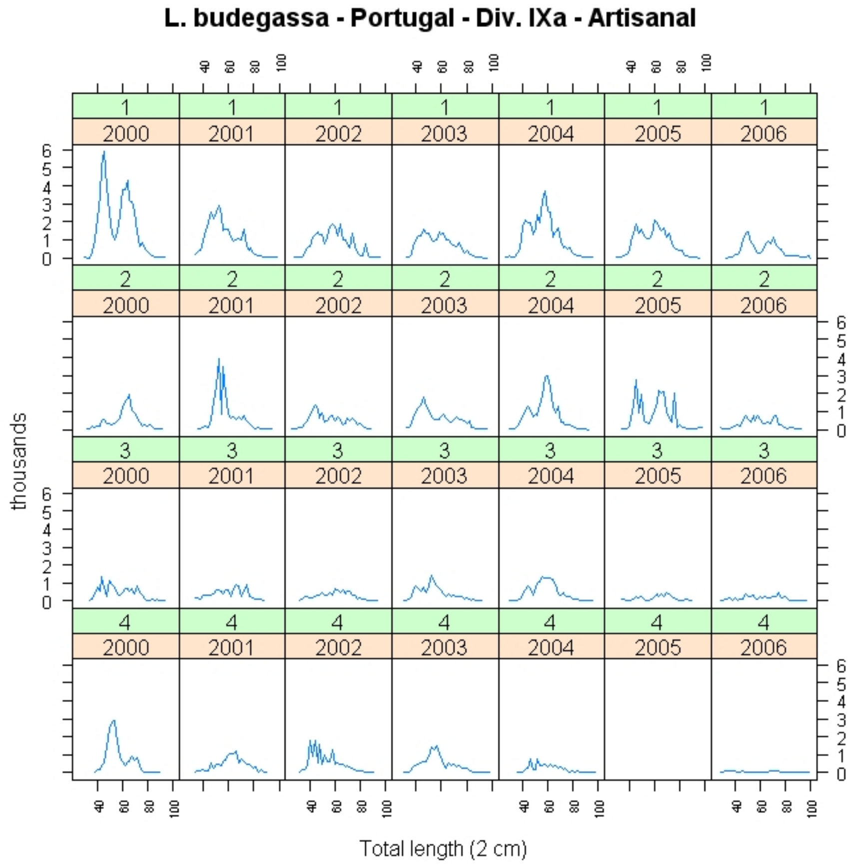


Figure I11. **ANGLERFISH (L. budegassa).**

Length distribution (‘000) by quarter for years between 2000 and 2006 in ICES Division IXa for the Portuguese artisanal fleet

Annex K: 2. Nephrops - Bay of Biscay (FU 23-24)

Why the recruitment 2005 should be strong?

The update assessment 2007 for the *Nephrops* stock of the Bay of Biscay (FU23-24) was carried out by applying the status quo method (proportional derivation of discards for the missing years) as in previous years. This method may introduce some bias due to interdependence between years and alternative approaches were developed and will be used for further investigations. Since 2003, discards have been estimated from sampling catches program on board *Nephrops* trawlers (181 trips and 449 hauls have been sampled for four years). Discards for sampled fishing trips are estimated by ratio estimator using the total number of fishing trips by quarter as auxiliary variable. It is expected that this program should improve accuracy of information on annual recruitment index used by WG for year assessments. In the basis of the new dataset on discards, WG 2006 had accepted the strength of the recruitment 2004 and this conclusion converges with results of WG 2007 (this recruitment is estimated at 1006 million this year close to 1087 of the last's year assessment). The good consistency of recruitment abundance for the year class 2003 is also confirmed by the retrospective analysis this year (Figure K2.1).

Even if retrospective analysis for the year class 2003 is consistent between 2006 and 2007, the trajectories are noisy for the year class 2004 (more than 40% of difference between values provided by retrospective analysis for the recruitment 2005: Figure K2.1).

In spite of this inconvenience, different indices argue that the recruitment 2005 corresponds to a high level at least comparable with the estimate of the recruitment 2004. Thus, even if WG decided to remove R2005 because there is not current evidence of a so high value, it decided to replace by R2004 for the short-term projections [as explained in the report, two additional projections were also performed by replacing R2005 either by the percentile 0.90 of the recruitments (time series 87-04) or by GM (87-04)].

The change in the amount of discards could usually be the consequence of the strength of the recent recruitments or of the change in the MLS (which tends to increase the discards), although the change in the selectivity should tend to reduce the discards. As given by Figure K2.2 and Table K2.1, the total discards in 2006 may indicate the strength of the year class 2004. Under the usual assumptions for conversion of size-frequencies of catches to age-compositions by sex, the high discarded number in 2006 is not exclusively explained by the modification of the exploitation pattern (MLS change from 8.5 cm to 9 cm *i.e.* 25 mm CL to 27 mm CL). Moreover, only the year class 2003 could not provide a so high discard level (79%): even after MLS change, this class constitutes more than 50% of landings in 2006 (Figure K2.5). The discarded *Nephrops* usually belong to the age group 2 (the age group 1 is not harvested at a significant proportion by the fishing gears). Furthermore, even if mean size in landings increases up to 2 mm between 2005 and 2006, the mean size of catches almost remains stable. Hence, the presence of a high number of undersized individuals is quite evident (nevertheless, the difference of mean sizes between years may not be statistically significant in regard to the sampling design onboard).

In order to test the actual contribution of the year class 2004 in the discarded amount in 2006 independent of MLS change, the exploitation pattern of 2006 was replaced by the 2005's one. At the opposite of the calculation processed for the short-term projections, the F discards for 2006 were scaled to the values of 2005 under the previous exploitation pattern (see Figure K2.3 providing hand-sorting logistic curves by quarter). As expected, discarded number in 2006 decreases (Table K2.3; Figure K2.4 compared with Figure 11.1 of the report 2007). However, the discard rate remains high (66% instead of 79% under the new exploitation pattern). This value is comparable with the discard rate estimated by sampling onboard for

2005 (65%). Additionally, the size composition of discards is similar between both years. It is likely that the abundance of the successive year classes 2003 and 2004 is comparable.

Despite these arguments for the strength of the recruitment 2005, some disadvantages can be expressed for the choice of the R2004 for replacing R2004. The comparative examination of the short-term projections using respectively R2004 and GM(87-04) for R2005 shows that the landings 2008 depend strongly on the assumed value of the recruitment (Figure K2.6: this recruited class may provide 39% of landings in 2008; under GM assumption this percentage remains high: 30% *i.e.* more than 600 t).

Nevertheless, replacing GM for the recruitment 2005 may not be pertinent[1] (Figure K2.7) because it does not reflect current positive trend on evolution of the stock. In addition to GM, WG also explored a third supplementary run based on the percentile 0.90 of the recruitment's time series 87-04. The results in terms of short-term projections for these runs are provided by the annex K2.

1 In the case of the recruitment 2006 (its value estimated at 2885 million was removed and replaced by GM87-04), there is no current information allowing anything else than the use of GM for short-term projections. The recruitment 2005 is completely different: it is already harvested at a significant proportion by the *Nephrops* trawlers, thus, its strength seems to be more reliable.

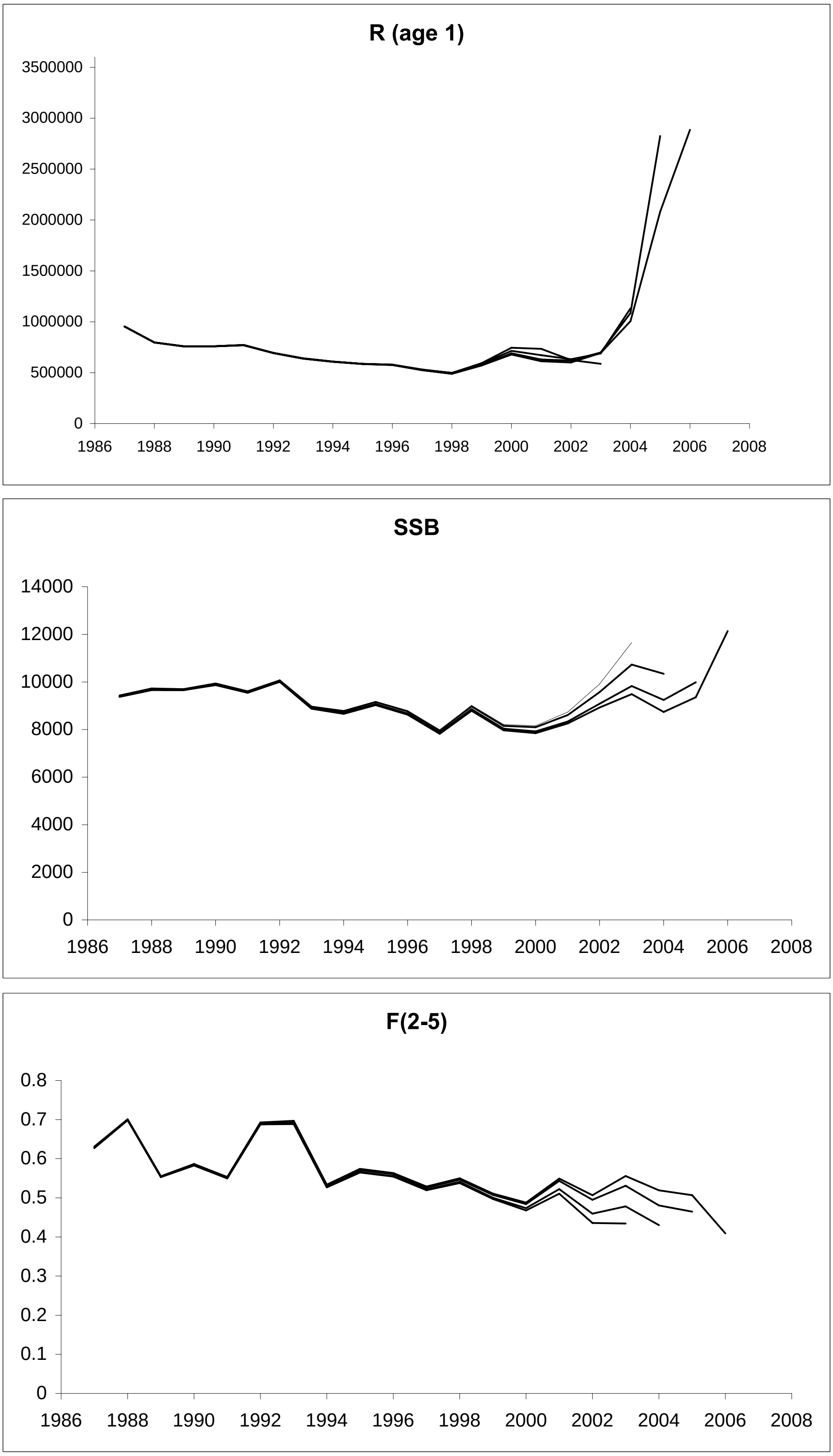


Figure K2.1. Results of the retrospective analysis for the Nephrops FU23-24 (Bay of Biscay).

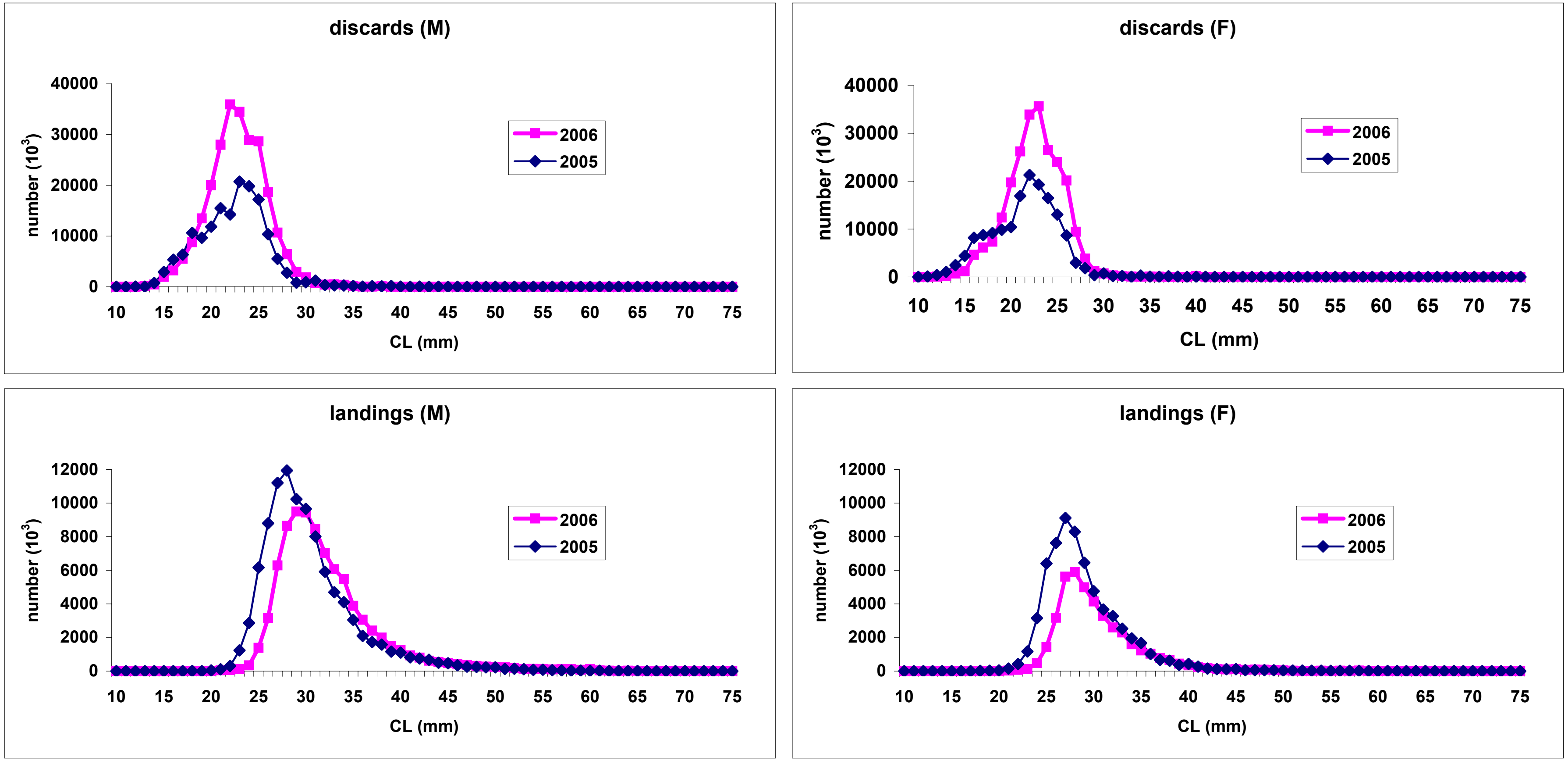


Figure K2.2. Nephrops FU23-24 (Bay of Biscay). Distributions of length frequencies (carapace length, CL) by sex for discards and landings. Comparison 2005 and 2006.

Table K2.1. Nephrops FU23-24 (Bay of Biscay). Top: Discards and landings by year. Bottom: mean sizes (CL, in mm) of landings, discards and total catches for 2005 and 006.

Year	discards (10^3)	landings (10^3)	discard rate (%)
1987	268 244	288 974	48
1991	151 634	217 338	41
1998	183 120	188 694	49
2003	201 841	152 485	57
2004	222 089	139 753	61
2005	315 346	166 165	65
2006	487 288	127 942	79

Year	Landings	Discards	Total catches
2005	29.8	21.8	24.6
2006	31.7	22.7	24.5

Table K2.2. Nephrops **FU23-24 (Bay of Biscay). Total and by age group numbers and % of discarded individuals. Top: values estimated by sampling onboard. Bottom: the discards for 2006 are calculated by scaling F discards to the 2005's value (assumption that the exploitation pattern does not change *i.e.* MLS is maintained at 8.5 cm).**

unscaled Fdisc values					
% disc	1	2	3	4+	Total
65.5	51741	219223	40395	3986	315346
79.2	33020	364337	84461	5470	487288

scaled on 2005 Fdisc values					
% disc	1	2	3	4+	Total
65.5	51741	219223	40395	3986	315346
66.2	33012	327845	42277	4272	407406

Table K2.3. Nephrops **FU23-24 (Bay of Biscay). Short-term projections. Landings, discards and SSB (t) according to prognosis run (1: R2005 replaced by R2004, 2: R2005 replaced by percentile .90 (on series 87-04), 3: R2005 replaced by GM(87-04)).**

year	R2004 (1005717)			percentile .90 (87-04) (859636)			GM (87-04) (671885)		
	landings	discards	SSB	landings	discards	SSB	landings	discards	SSB
2007	4719	2272	14695	4341	2099	13428	4056	1883	12449
2008	4538	1845	13943	4192	1823	12926	3865	1798	12012

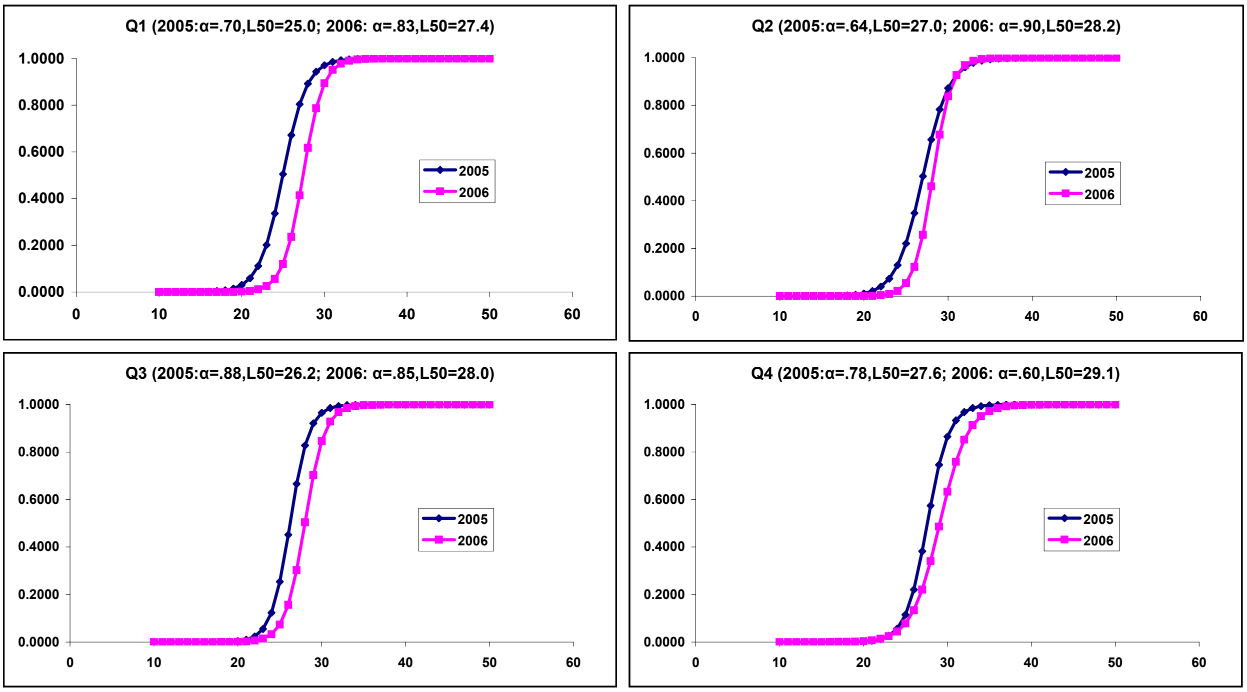
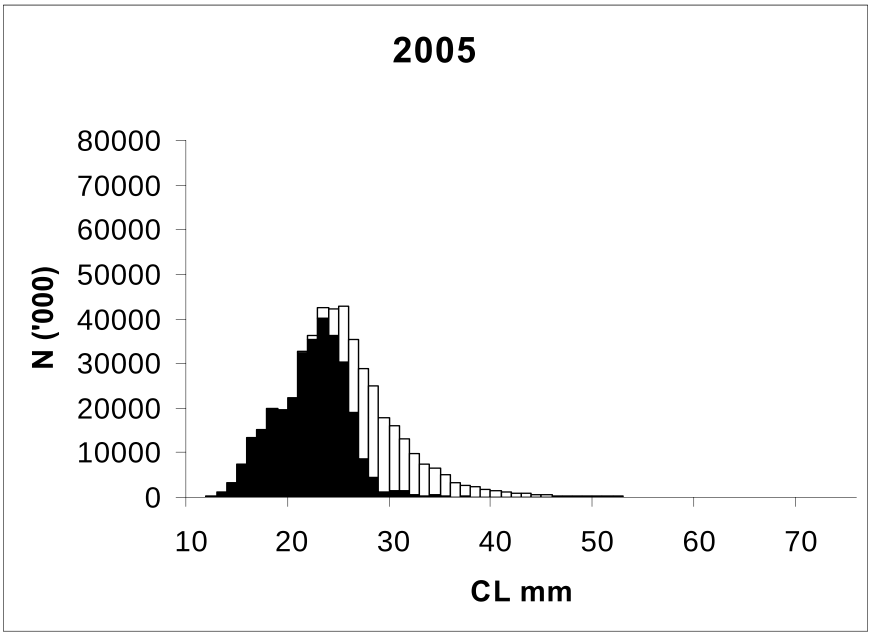


Figure K2.3. Nephrops FU23-24 (Bay of Biscay). Hand-sorting s-shaped curves (rate of retention vs. size) applied onboard. Note: the change of MLS occurred in December 2005 and, hence, the hand-sorting onboard in Q4 was probably affected (December corresponds to low landed quantities).



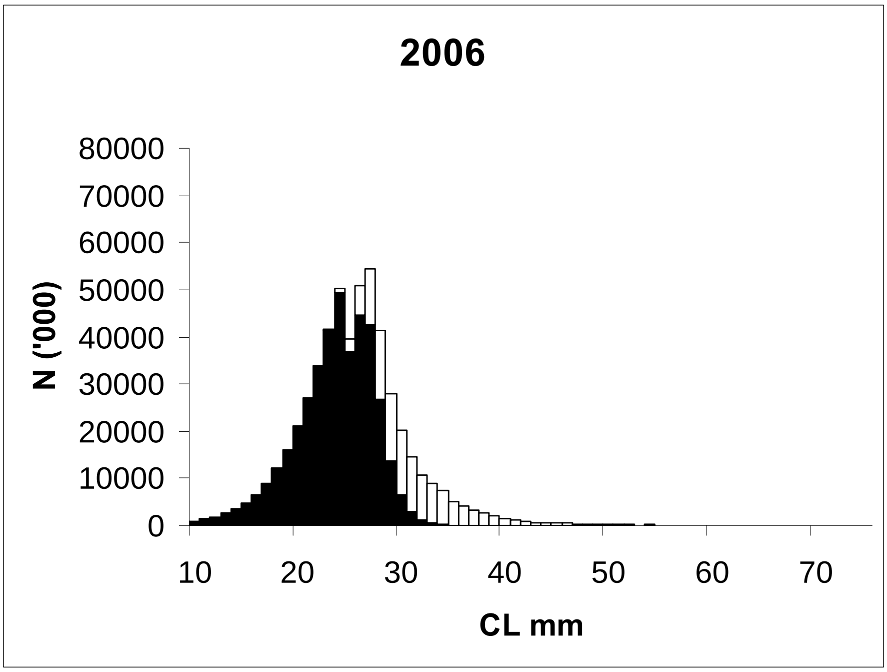


Figure K2.4. Nephrops **FU23-24 (Bay of Biscay). Discarded (in dark) and landed (in white) individuals. The distribution of length frequencies for 2006 was calculated by assuming F discards scaled on 2005's value (the hand-sorting onboard was assumed to be unchanged between 2005 and 2006).**

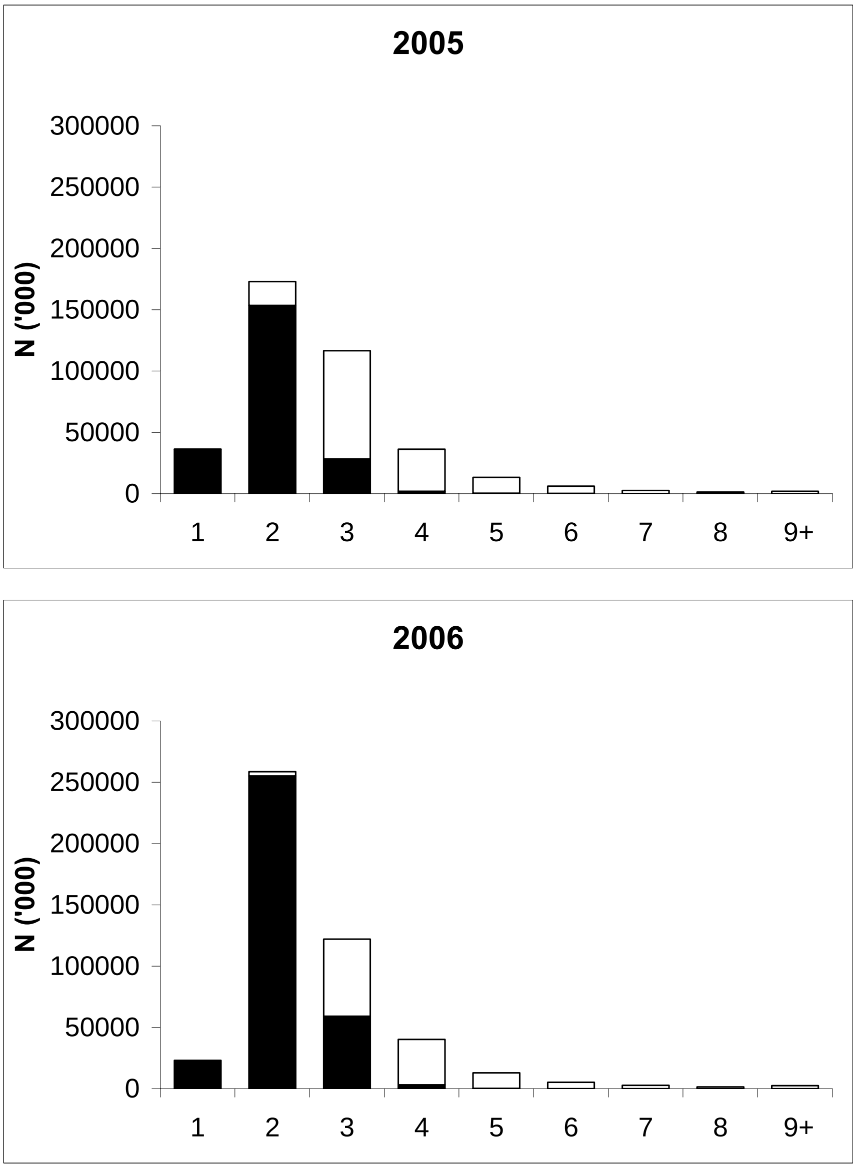


Figure K2.5. Nephrops FU23-24 (Bay of Biscay). Age composition of catches (in white: landings; in dark: dead discards, mortality rate=0.70). Years 2005 and 2006.

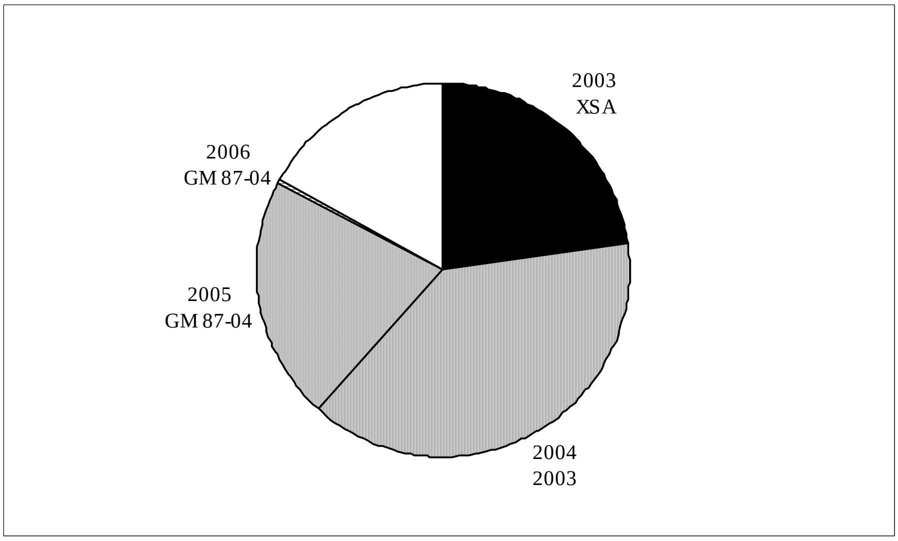


Figure K2.6. Nephrops FU23-24 (Bay of Biscay). Relative contribution in landings 2008 by year class and source of estimation used for predictions.

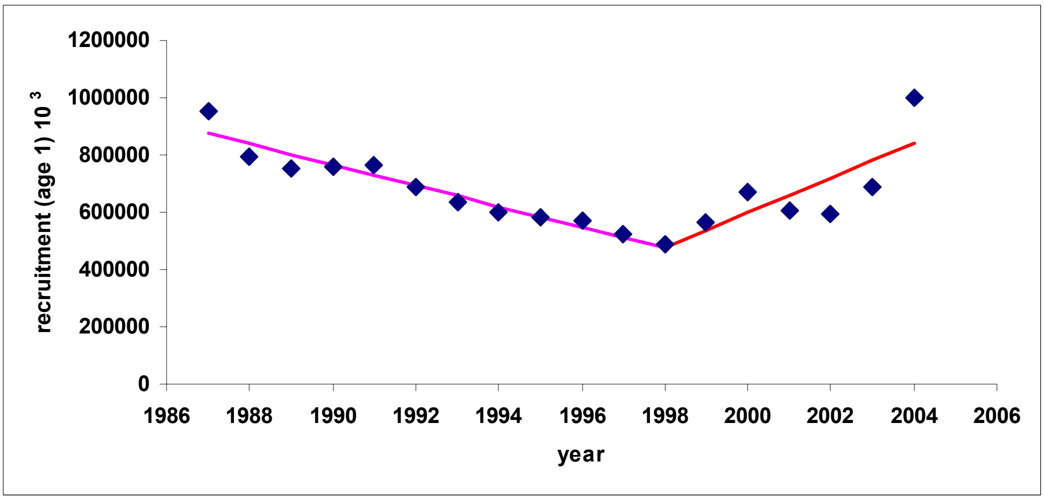


Figure K2.7. Nephrops FU23-24 (Bay of Biscay). Years 1987-2004. Evolution of the recruitment.

Short-term projection

Recruitment 2005 replaced by GM (1987 – 2004)

Table 11.14 Nephrops in Fus 23-24 bay of Biscay (VIIIa,b) Prediction with management option table: Input data

2007	Landings		Dead Discards							
Age	Exploitation pattern	Weight in landings	Exploitation pattern	Weight in discards	Stock size	Natural Mortality	Maturity ogive	Prop. of F bef. spaw.	Prop. of M bef. spaw.	Weight in stock
1	0.0000	0.004	0.0161	0.004	671885	0.30	0	0	0	0.004
2	0.0039	0.011	0.2822	0.009	493114	0.30	0	0	0	0.009
3	0.2989	0.017	0.2810	0.014	289430	0.25	0.75	0	0	0.016
4	0.5229	0.026	0.0458	0.023	194783	0.25	1	0	0	0.026
5	0.4661	0.035	0.0120	0.031	47836	0.25	1	0	0	0.035
6	0.4034	0.046	0.0092	0.034	19498	0.25	1	0	0	0.045
7	0.3975	0.058	0.0030	0.033	8991	0.25	1	0	0	0.057
8	0.4007	0.068	0.0076	0.043	4695	0.25	1	0	0	0.067
9+	0.3934	0.089	0.0148	0.060	5792	0.25	1	0	0	0.088
Unit	-	Kilograms	-	Kilograms	Thousands	-	-	-	-	Kilograms

2008	Landings		Dead Discards							
Age	Exploitation pattern	Weight in landings	Exploitation pattern	Weight in discards	Stock size	Natural Mortality	Maturity ogive	Prop. of F bef. spaw.	Prop. of M bef. spaw.	Weight in stock
1	0.0000	0.004	0.0161	0.004	671885	0.30	0	0	0	0.004
2	0.0039	0.011	0.2822	0.009		0.30	0	0	0	0.009
3	0.2989	0.017	0.2810	0.014		0.25	0.75	0	0	0.016
4	0.5229	0.026	0.0458	0.023		0.25	1	0	0	0.026
5	0.4661	0.035	0.0120	0.031		0.25	1	0	0	0.035
6	0.4034	0.046	0.0092	0.034		0.25	1	0	0	0.045
7	0.3975	0.058	0.0030	0.033		0.25	1	0	0	0.057
8	0.4007	0.068	0.0076	0.043		0.25	1	0	0	0.067
9+	0.3934	0.089	0.0148	0.060		0.25	1	0	0	0.088
Unit	-	Kilograms	-	Kilograms	Thousands	-	-	-	-	Kilograms

2009	Landings		Dead Discards							
Age	Exploitation pattern	Weight in landings	Exploitation pattern	Weight in discards	Stock size	Natural Mortality	Maturity ogive	Prop. of F bef. spaw.	Prop. of M bef. spaw.	Weight in stock
1	0.0000	0.004	0.0161	0.004	671885	0.30	0	0	0	0.004
2	0.0039	0.011	0.2822	0.009		0.30	0	0	0	0.009
3	0.2989	0.017	0.2810	0.014		0.25	0.75	0	0	0.016
4	0.5229	0.026	0.0458	0.023		0.25	1	0	0	0.026
5	0.4661	0.035	0.0120	0.031		0.25	1	0	0	0.035
6	0.4034	0.046	0.0092	0.034		0.25	1	0	0	0.045
7	0.3975	0.058	0.0030	0.033		0.25	1	0	0	0.057
8	0.4007	0.068	0.0076	0.043		0.25	1	0	0	0.067
9+	0.3934	0.089	0.0148	0.060		0.25	1	0	0	0.088
Unit	-	Kilograms	-	Kilograms	Thousands	-	-	-	-	Kilograms

Table 11.15 Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) - Catch predictions with management option table

Year:	2007					
	Landings		Dead Discards			
F Factor	Reference F	Landings in weight	Reference F	Discards in weight	Stock Biomass	Sp. Stock Biomass
1.0	0.3230	4056	0.1553	1883	20369	12449

Year:	2008						Year: 2009	
	Landings		Dead Discards					
F Factor	Reference F	landings in weight	Reference F	Discards in weight	Stock Biomass	Sp. Stock Biomass	Stock Biomass	Sp. Stock Biomass
0.0	0.0000	0	0.0000	0	19841	12012	26903	18647
0.1	0.0323	478	0.0155	214			25998	17789
0.2	0.0646	933	0.0311	419			25135	16974
0.3	0.0969	1365	0.0466	616			24313	16198
0.4	0.1292	1777	0.0621	806			23529	15459
0.5	0.1615	2169	0.0777	988			22783	14757
0.6	0.1938	2542	0.0932	1163			22072	14088
0.7	0.2261	2897	0.1087	1331			21393	13452
0.8	0.2584	3236	0.1242	1493			20747	12846
0.9	0.2907	3558	0.1398	1648			20130	12269
1.0	0.3230	3865	0.1553	1798			19542	11720
1.1	0.3553	4157	0.1708	1942			18981	11197
1.2	0.3876	4435	0.1864	2081			18446	10699
1.3	0.4199	4700	0.2019	2214			17936	10225
1.4	0.4522	4953	0.2174	2343			17448	9773
1.5	0.4845	5193	0.2330	2467			16983	9342
1.6	0.5168	5423	0.2485	2586			16539	8932
1.7	0.5491	5641	0.2640	2701			16115	8541
1.8	0.5814	5849	0.2795	2812			15711	8168
1.9	0.6137	6048	0.2951	2919			15324	7813
2.0	0.6460	6237	0.3106	3022			14955	7475

Table 11.16 Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) - Detailed tables

MFDP version 1a
Run: NEPH_scaled_S2
Time and date: 22:13 14/05/2007
Fbar age range (Total) : 2-5
Fbar age range Fleet 1 : 2-5

Year: 2007 F multiplier: 1 Fleet1 HCFbar: 0.323 Fleet1 DFbar: 0.1553

Age	Total F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	1	0	0.0161	9254	34	671885	2396	0	0	0	0
2	0.0039	1470	16	0.2822	105297	913	493114	4356	0	0	0	0
3	0.2989	58786	1019	0.281	55259	774	289430	4669	217073	3502	217073	3502
4	0.5229	69546	1808	0.0458	6095	140	194783	5051	194783	5051	194783	5051
5	0.4661	15837	554	0.012	409	13	47836	1673	47836	1673	47836	1673
6	0.4034	5751	263	0.0092	131	4	19498	881	19498	881	19498	881
7	0.3975	2627	153	0.003	20	1	8991	516	8991	516	8991	516
8	0.4007	1378	94	0.0076	26	1	4695	317	4695	317	4695	317
9	0.3934	1669	149	0.0148	63	4	5792	509	5792	509	5792	509
Total		157067	4056		176554	1883	1736024	20369	498668	12449	498668	12449

Year: 2008 F multiplier: 1 Fleet1 HCFbar: 0.323 Fleet1 DFbar: 0.1553

Age	Total F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	1	0	0.0161	9254	34	671885	2396	0	0	0	0
2	0.0039	1460	16	0.2822	104592	906	489811	4327	0	0	0	0
3	0.2989	55735	966	0.281	52391	733	274406	4427	205804	3320	205804	3320
4	0.5229	45065	1172	0.0458	3950	91	126218	3273	126218	3273	126218	3273
5	0.4661	28437	995	0.012	734	23	85894	3003	85894	3003	85894	3003
6	0.4034	6812	311	0.0092	155	5	23096	1044	23096	1044	23096	1044
7	0.3975	2937	171	0.003	23	1	10052	577	10052	577	10052	577
8	0.4007	1377	94	0.0076	26	1	4691	316	4691	316	4691	316
9	0.3934	1565	139	0.0148	59	4	5430	477	5430	477	5430	477
Total		143391	3865		171182	1798	1691483	19841	461185	12012	461185	12012

Year: 2009 F multiplier: 1 Fleet1 HCFbar: 0.323 Fleet1 DFbar: 0.1553

Age	Total F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	1	0	0.0161	9254	34	671885	2396	0	0	0	0
2	0.0039	1460	16	0.2822	104592	906	489811	4327	0	0	0	0
3	0.2989	55361	960	0.281	52040	729	272568	4397	204426	3298	204426	3298
4	0.5229	42726	1111	0.0458	3744	86	119666	3103	119666	3103	119666	3103
5	0.4661	18427	645	0.012	476	15	55659	1946	55659	1946	55659	1946
6	0.4034	12232	559	0.0092	278	9	41471	1874	41471	1874	41471	1874
7	0.3975	3480	203	0.003	27	1	11907	683	11907	683	11907	683
8	0.4007	1540	105	0.0076	29	1	5245	354	5245	354	5245	354
9	0.3934	1510	134	0.0148	57	3	5240	461	5240	461	5240	461
Total		136737	3732		170496	1785	1673452	19542	443613	11720	443613	11720

Input units are thousands and kg - output in tonnes

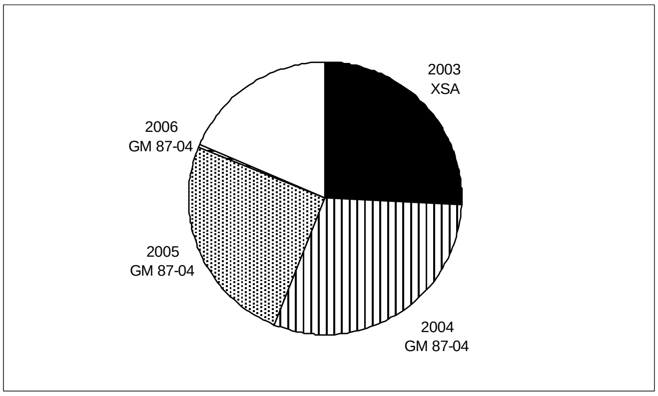
Table 11. 17 **Nephrops in FUs 23-24 bay of Biscay males and females combined**
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class			2003	2004	2005	2006	2007
Stock No. (thousands)			1005717	671885	671885	671885	671885
of		1 year-olds					
Source			XSA	GM 87-04	GM 87-04	GM 87-04	GM 87-04
Status Quo F:							
% in	2007	landings	44.6	25.1	0.4	0.0	-
% in	2008		25.8	30.3	25.0	0.4	0.0
% in	2007	SSB	40.6	28.1	0.0	0.0	-
% in	2008	SSB	25.0	27.3	27.6	0.0	0.0
% in	2009	SSB	16.0	16.6	26.5	28.1	0.0

GM : geometric mean recruitment

Nephrops in FUs 23-24 bay of Biscay males and females combined : Year-class % contribution to

a) 2008 landings



b) 2009 SSB

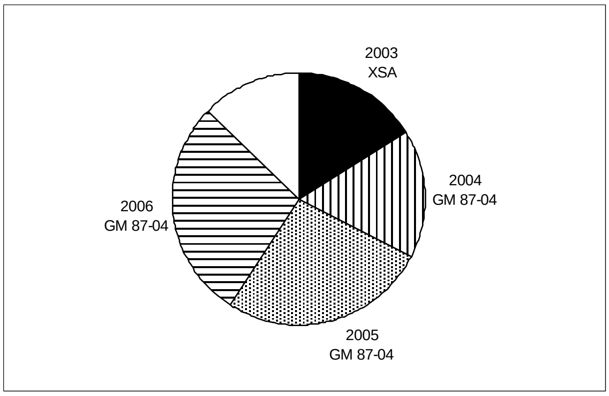


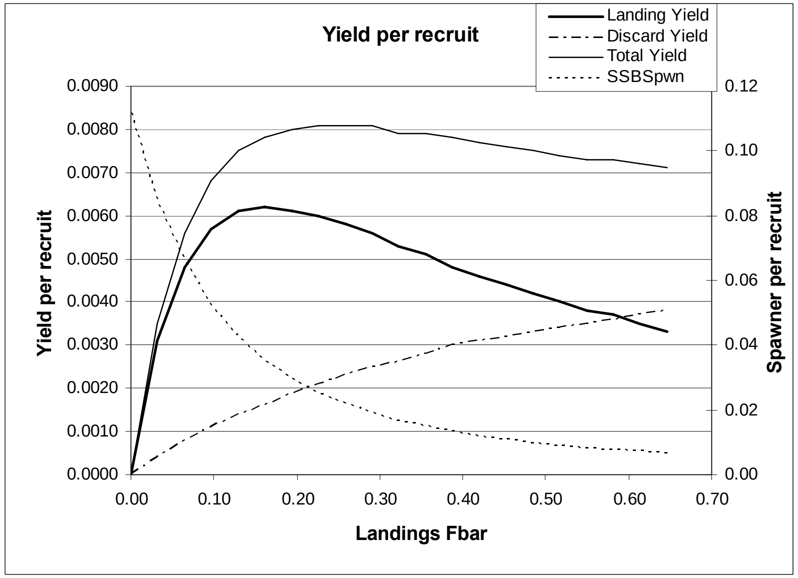
Table 11.18 Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) : Yield per recruit summary table

MFYPR version 2a
Run: NEPH_scaled_S2
Time and date: 22:14 14/05/2007
Yield per results

	Landings			DeadDiscards								
FMult	LandingsFbar	LandingsNos	LandingsYield	DeadDiscardsFbar	DeadDiscardsNos	DeadDiscardsYield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.2219	0.1243	2.3439	0.1119	2.3439	0.1119
0.1	0.0323	0.0724	0.0031	0.0155	0.0343	0.0004	3.7985	0.0969	1.9258	0.0847	1.9258	0.0847
0.2	0.0646	0.1197	0.0048	0.0311	0.0660	0.0008	3.4869	0.0781	1.6193	0.0659	1.6193	0.0659
0.3	0.0969	0.1509	0.0057	0.0466	0.0954	0.0011	3.2494	0.0646	1.3868	0.0525	1.3868	0.0525
0.4	0.1292	0.1714	0.0061	0.0621	0.1228	0.0014	3.0631	0.0547	1.2055	0.0427	1.2055	0.0427
0.5	0.1615	0.1845	0.0062	0.0776	0.1483	0.0016	2.9136	0.0473	1.0608	0.0353	1.0608	0.0353
0.6	0.1938	0.1924	0.0061	0.0932	0.1721	0.0019	2.7914	0.0416	0.9432	0.0297	0.9432	0.0297
0.7	0.2261	0.1967	0.0060	0.1087	0.1944	0.0021	2.6898	0.0371	0.8462	0.0253	0.8462	0.0253
0.8	0.2584	0.1984	0.0058	0.1242	0.2153	0.0023	2.6041	0.0335	0.7650	0.0218	0.7650	0.0218
0.9	0.2907	0.1981	0.0056	0.1397	0.2350	0.0025	2.5309	0.0307	0.6962	0.0190	0.6962	0.0190
1.0	0.3230	0.1965	0.0053	0.1553	0.2535	0.0026	2.4677	0.0283	0.6373	0.0167	0.6373	0.0167
1.1	0.3553	0.1938	0.0051	0.1708	0.2710	0.0028	2.4126	0.0264	0.5864	0.0148	0.5864	0.0148
1.2	0.3876	0.1905	0.0048	0.1863	0.2874	0.0030	2.3642	0.0248	0.5420	0.0132	0.5420	0.0132
1.3	0.4199	0.1867	0.0046	0.2018	0.3030	0.0031	2.3212	0.0234	0.5031	0.0119	0.5031	0.0119
1.4	0.4522	0.1825	0.0044	0.2174	0.3177	0.0032	2.2829	0.0222	0.4687	0.0108	0.4687	0.0108
1.5	0.4845	0.1781	0.0042	0.2329	0.3317	0.0033	2.2484	0.0212	0.4380	0.0098	0.4380	0.0098
1.6	0.5168	0.1736	0.0040	0.2484	0.3450	0.0034	2.2172	0.0203	0.4106	0.0090	0.4106	0.0090
1.7	0.5491	0.1690	0.0038	0.2639	0.3576	0.0035	2.1888	0.0195	0.3859	0.0083	0.3859	0.0083
1.8	0.5814	0.1644	0.0037	0.2795	0.3695	0.0036	2.1629	0.0189	0.3635	0.0076	0.3635	0.0076
1.9	0.6137	0.1598	0.0035	0.2950	0.3809	0.0037	2.1391	0.0182	0.3433	0.0071	0.3433	0.0071
2.0	0.6459	0.1553	0.0033	0.3105	0.3918	0.0038	2.1171	0.0177	0.3247	0.0066	0.3247	0.0066

Reference point	F multiplier	Absolute F
Fleet1 Landings Ft	1.0000	0.3230
FMax	0.5103	0.1648
F0.1	0.3403	0.1099
F35%SPR	0.4444	0.1435

Weights in kilograms
* based on landings



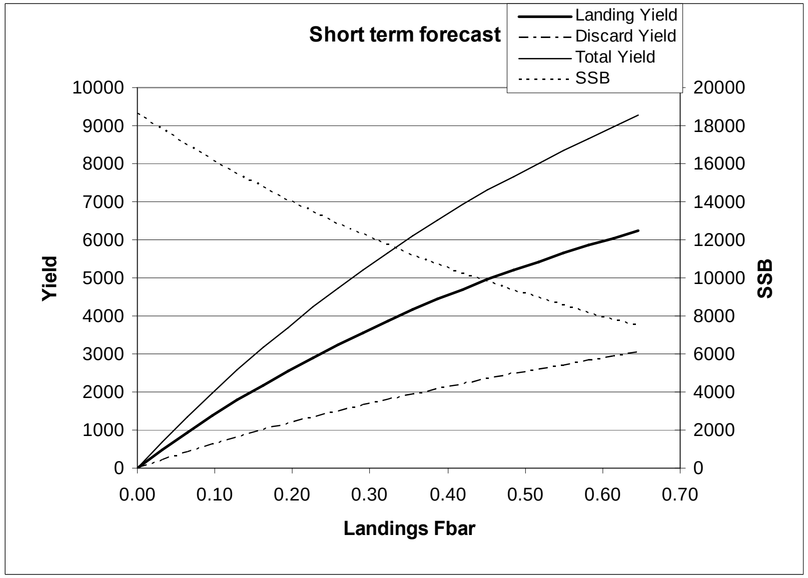


Figure 11.8. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Short term and long term predictions

Run: NEPH_scaled_S2
Time and date: 22:14 14/05/2007

Reference point	F multiplie	Absolute F
Fleet1 Landings Fbar(2-5)	1.0000	0.3230
FMax	0.5103	0.1648
F0.1	0.3403	0.1099
F35%SPR	0.4444	0.1435

Weights in kilograms

MFDP version 1a
Run: NEPH_scaled_S2
Time and date: 22:13 14/05/2007
Fbar age range (Total) : 2-5
Fbar age range Fleet 1 : 2-5

Input units are thousands and kg - output in tonnes

Short-term projection

Recruitment 2005 replaced by percentile 0.90

(time series 1987-2004)

Table 11.14 Nephrops in Fus 23-24 bay of Biscay (VIIIa,b) Prediction with management option table: Input data

2007	Landings		Dead Discards							
Age	Exploitation pattern	Weight in landings	Exploitation pattern	Weight in discards	Stock size	Natural Mortality	Maturity ogive	Prop. of F bef. spaw.	Prop. of M bef. spaw.	Weight in stock
1	0.0000	0.004	0.0161	0.004	671885	0.30	0	0	0	0.004
2	0.0039	0.011	0.2822	0.009	493114	0.30	0	0	0	0.009
3	0.2989	0.017	0.2810	0.014	370308	0.25	0.75	0	0	0.016
4	0.5229	0.026	0.0458	0.023	194783	0.25	1	0	0	0.026
5	0.4661	0.035	0.0120	0.031	47836	0.25	1	0	0	0.035
6	0.4034	0.046	0.0092	0.034	19498	0.25	1	0	0	0.045
7	0.3975	0.058	0.0030	0.033	8991	0.25	1	0	0	0.057
8	0.4007	0.068	0.0076	0.043	4695	0.25	1	0	0	0.067
9+	0.3934	0.089	0.0148	0.060	5792	0.25	1	0	0	0.088
Unit	-	Kilograms	-	Kilograms	Thousands	-	-	-	-	Kilograms

2008	Landings		Dead Discards							
Age	Exploitation pattern	Weight in landings	Exploitation pattern	Weight in discards	Stock size	Natural Mortality	Maturity ogive	Prop. of F bef. spaw.	Prop. of M bef. spaw.	Weight in stock
1	0.0000	0.004	0.0161	0.004	671885	0.30	0	0	0	0.004
2	0.0039	0.011	0.2822	0.009		0.30	0	0	0	0.009
3	0.2989	0.017	0.2810	0.014		0.25	0.75	0	0	0.016
4	0.5229	0.026	0.0458	0.023		0.25	1	0	0	0.026
5	0.4661	0.035	0.0120	0.031		0.25	1	0	0	0.035
6	0.4034	0.046	0.0092	0.034		0.25	1	0	0	0.045
7	0.3975	0.058	0.0030	0.033		0.25	1	0	0	0.057
8	0.4007	0.068	0.0076	0.043		0.25	1	0	0	0.067
9+	0.3934	0.089	0.0148	0.060		0.25	1	0	0	0.088
Unit	-	Kilograms	-	Kilograms	Thousands	-	-	-	-	Kilograms

2009	Landings		Dead Discards							
Age	Exploitation pattern	Weight in landings	Exploitation pattern	Weight in discards	Stock size	Natural Mortality	Maturity ogive	Prop. of F bef. spaw.	Prop. of M bef. spaw.	Weight in stock
1	0.0000	0.004	0.0161	0.004	671885	0.30	0	0	0	0.004
2	0.0039	0.011	0.2822	0.009		0.30	0	0	0	0.009
3	0.2989	0.017	0.2810	0.014		0.25	0.75	0	0	0.016
4	0.5229	0.026	0.0458	0.023		0.25	1	0	0	0.026
5	0.4661	0.035	0.0120	0.031		0.25	1	0	0	0.035
6	0.4034	0.046	0.0092	0.034		0.25	1	0	0	0.045
7	0.3975	0.058	0.0030	0.033		0.25	1	0	0	0.057
8	0.4007	0.068	0.0076	0.043		0.25	1	0	0	0.067
9+	0.3934	0.089	0.0148	0.060		0.25	1	0	0	0.088
Unit	-	Kilograms	-	Kilograms	Thousands	-	-	-	-	Kilograms

Table 11.15 Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) - Catch predictions with management option table

Year: 2007						
	Landings		Dead Discards			
F Factor	Reference F	Landings in weight	Reference F	Discards in weight	Stock Biomass	Sp. Stock Biomass
1.0	0.3230	4341	0.1553	2099	21674	13428

Year: 2008							Year: 2009	
	Landings		Dead Discards					
F Factor	Reference F	landings in weight	Reference F	Discards in weight	Stock Biomass	Sp. Stock Biomass	Stock Biomass	Sp. Stock Biomass
0.0	0.0000	0	0.0000	0	20756	12926	27864	19607
0.1	0.0323	519	0.0155	217			26905	18697
0.2	0.0646	1013	0.0311	426			25992	17831
0.3	0.0969	1483	0.0466	626			25123	17007
0.4	0.1292	1930	0.0621	818			24295	16224
0.5	0.1615	2355	0.0777	1002			23506	15479
0.6	0.1938	2759	0.0932	1180			22754	14771
0.7	0.2261	3145	0.1087	1350			22038	14097
0.8	0.2584	3511	0.1242	1514			21356	13455
0.9	0.2907	3860	0.1398	1672			20706	12845
1.0	0.3230	4192	0.1553	1823			20086	12264
1.1	0.3553	4508	0.1708	1969			19495	11711
1.2	0.3876	4809	0.1864	2110			18932	11184
1.3	0.4199	5096	0.2019	2245			18394	10683
1.4	0.4522	5369	0.2174	2375			17882	10206
1.5	0.4845	5629	0.2330	2500			17393	9751
1.6	0.5168	5877	0.2485	2621			16926	9319
1.7	0.5491	6113	0.2640	2738			16481	8906
1.8	0.5814	6338	0.2795	2850			16056	8513
1.9	0.6137	6552	0.2951	2958			15650	8139
2.0	0.6460	6756	0.3106	3062			15263	7783

Table 11.16 Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) - Detailed tables

MFDP version 1a
Run: NEPH_scaled_S3
Time and date: 21:54 14/05/2007
Fbar age range (Total) : 2-5
Fbar age range Fleet 1 : 2-5

Year: 2007 F multiplier: 1 Fleet1 HCFbar: 0.323 Fleet1 DFbar: 0.1553

Age	Total F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	1	0	0.0161	9254	34	671885	2396	0	0	0	0
2	0.0039	1470	16	0.2822	105297	913	493114	4356	0	0	0	0
3	0.2989	75214	1304	0.281	70701	990	370308	5974	277731	4481	277731	4481
4	0.5229	69546	1808	0.0458	6095	140	194783	5051	194783	5051	194783	5051
5	0.4661	15837	554	0.012	409	13	47836	1673	47836	1673	47836	1673
6	0.4034	5751	263	0.0092	131	4	19498	881	19498	881	19498	881
7	0.3975	2627	153	0.003	20	1	8991	516	8991	516	8991	516
8	0.4007	1378	94	0.0076	26	1	4695	317	4695	317	4695	317
9	0.3934	1669	149	0.0148	63	4	5792	509	5792	509	5792	509
Total		173494	4341		191995	2099	1816902	21674	559326	13428	559326	13428

Year: 2008 F multiplier: 1 Fleet1 HCFbar: 0.323 Fleet1 DFbar: 0.1553

Age	Total F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	1	0	0.0161	9254	34	671885	2396	0	0	0	0
2	0.0039	1460	16	0.2822	104592	906	489811	4327	0	0	0	0
3	0.2989	55735	966	0.281	52391	733	274406	4427	205804	3320	205804	3320
4	0.5229	57658	1499	0.0458	5053	116	161489	4188	161489	4188	161489	4188
5	0.4661	28437	995	0.012	734	23	85894	3003	85894	3003	85894	3003
6	0.4034	6812	311	0.0092	155	5	23096	1044	23096	1044	23096	1044
7	0.3975	2937	171	0.003	23	1	10052	577	10052	577	10052	577
8	0.4007	1377	94	0.0076	26	1	4691	316	4691	316	4691	316
9	0.3934	1565	139	0.0148	59	4	5430	477	5430	477	5430	477
Total		155984	4192		172286	1823	1726754	20756	496456	12926	496456	12926

Year: 2009 F multiplier: 1 Fleet1 HCFbar: 0.323 Fleet1 DFbar: 0.1553

Age	Total F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	1	0	0.0161	9254	34	671885	2396	0	0	0	0
2	0.0039	1460	16	0.2822	104592	906	489811	4327	0	0	0	0
3	0.2989	55361	960	0.281	52040	729	272568	4397	204426	3298	204426	3298
4	0.5229	42726	1111	0.0458	3744	86	119666	3103	119666	3103	119666	3103
5	0.4661	23576	825	0.012	608	19	71213	2490	71213	2490	71213	2490
6	0.4034	12232	559	0.0092	278	9	41471	1874	41471	1874	41471	1874
7	0.3975	3480	203	0.003	27	1	11907	683	11907	683	11907	683
8	0.4007	1540	105	0.0076	29	1	5245	354	5245	354	5245	354
9	0.3934	1510	134	0.0148	57	3	5240	461	5240	461	5240	461
Total		141887	3912		170629	1789	1689005	20086	459167	12264	459167	12264

Input units are thousands and kg - output in tonnes

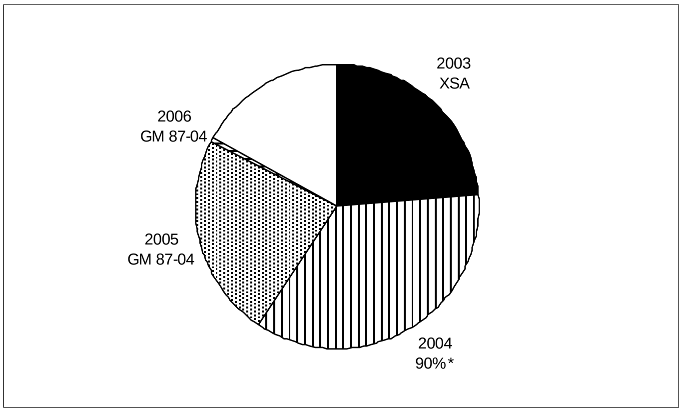
Table 11. 17 **Nephrops in FUs 23-24 bay of Biscay males and females combined**
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class			2003	2004	2005	2006	2007
Stock No. (thousands) of		1 year-olds	1005717	859636	671885	671885	671885
Source			XSA	90%*	GM 87-04	GM 87-04	GM 87-04
Status Quo F:							
% in	2007	landings	41.6	30.0	0.4	0.0	-
% in	2008		23.7	35.8	23.0	0.4	0.0
% in	2007	SSB	37.6	33.4	0.0	0.0	-
% in	2008	SSB	23.2	32.4	25.7	0.0	0.0
% in	2009	SSB	15.3	20.3	25.3	26.9	0.0

GM : geometric mean recruitment

Nephrops in FUs 23-24 bay of Biscay males and females combined : Year-class % contribution to

a) 2008 landings



b) 2009 SSB

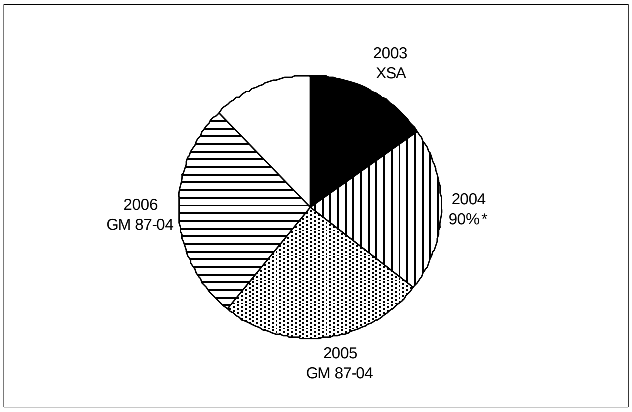


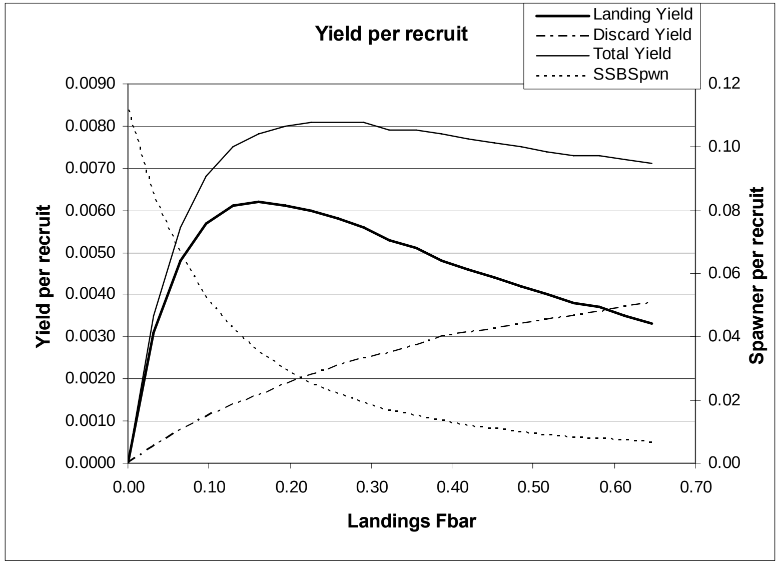
Table 11.18 Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) : Yield per recruit summary table

MFYPR version 2a
Run: NEPH_scaled_S3
Time and date: 21:54 14/05/2007
Yield per results

	Landings			DeadDiscards								
FMult	LandingsFbar	LandingsNos	LandingsYield	DeadDiscardsFbar	DeadDiscardsNos	DeadDiscardsYield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0.0	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.2219	0.1243	2.3439	0.1119	2.3439	0.1119
0.1	0.0323	0.0724	0.0031	0.0155	0.0343	0.0004	3.7985	0.0969	1.9258	0.0847	1.9258	0.0847
0.2	0.0646	0.1197	0.0048	0.0311	0.0660	0.0008	3.4869	0.0781	1.6193	0.0659	1.6193	0.0659
0.3	0.0969	0.1509	0.0057	0.0466	0.0954	0.0011	3.2494	0.0646	1.3868	0.0525	1.3868	0.0525
0.4	0.1292	0.1714	0.0061	0.0621	0.1228	0.0014	3.0631	0.0547	1.2055	0.0427	1.2055	0.0427
0.5	0.1615	0.1845	0.0062	0.0776	0.1483	0.0016	2.9136	0.0473	1.0608	0.0353	1.0608	0.0353
0.6	0.1938	0.1924	0.0061	0.0932	0.1721	0.0019	2.7914	0.0416	0.9432	0.0297	0.9432	0.0297
0.7	0.2261	0.1967	0.0060	0.1087	0.1944	0.0021	2.6898	0.0371	0.8462	0.0253	0.8462	0.0253
0.8	0.2584	0.1984	0.0058	0.1242	0.2153	0.0023	2.6041	0.0335	0.7650	0.0218	0.7650	0.0218
0.9	0.2907	0.1981	0.0056	0.1397	0.2350	0.0025	2.5309	0.0307	0.6962	0.0190	0.6962	0.0190
1.0	0.3230	0.1965	0.0053	0.1553	0.2535	0.0026	2.4677	0.0283	0.6373	0.0167	0.6373	0.0167
1.1	0.3553	0.1938	0.0051	0.1708	0.2710	0.0028	2.4126	0.0264	0.5864	0.0148	0.5864	0.0148
1.2	0.3876	0.1905	0.0048	0.1863	0.2874	0.0030	2.3642	0.0248	0.5420	0.0132	0.5420	0.0132
1.3	0.4199	0.1867	0.0046	0.2018	0.3030	0.0031	2.3212	0.0234	0.5031	0.0119	0.5031	0.0119
1.4	0.4522	0.1825	0.0044	0.2174	0.3177	0.0032	2.2829	0.0222	0.4687	0.0108	0.4687	0.0108
1.5	0.4845	0.1781	0.0042	0.2329	0.3317	0.0033	2.2484	0.0212	0.4380	0.0098	0.4380	0.0098
1.6	0.5168	0.1736	0.0040	0.2484	0.3450	0.0034	2.2172	0.0203	0.4106	0.0090	0.4106	0.0090
1.7	0.5491	0.1690	0.0038	0.2639	0.3576	0.0035	2.1888	0.0195	0.3859	0.0083	0.3859	0.0083
1.8	0.5814	0.1644	0.0037	0.2795	0.3695	0.0036	2.1629	0.0189	0.3635	0.0076	0.3635	0.0076
1.9	0.6137	0.1598	0.0035	0.2950	0.3809	0.0037	2.1391	0.0182	0.3433	0.0071	0.3433	0.0071
2.0	0.6459	0.1553	0.0033	0.3105	0.3918	0.0038	2.1171	0.0177	0.3247	0.0066	0.3247	0.0066

Reference point	F multiplier	Absolute F
Fleet1 Landings Ft	1.0000	0.3230
FMax	0.5103	0.1648
F0.1	0.3403	0.1099
F35%SPR	0.4444	0.1435

Weights in kilograms
* based on landings



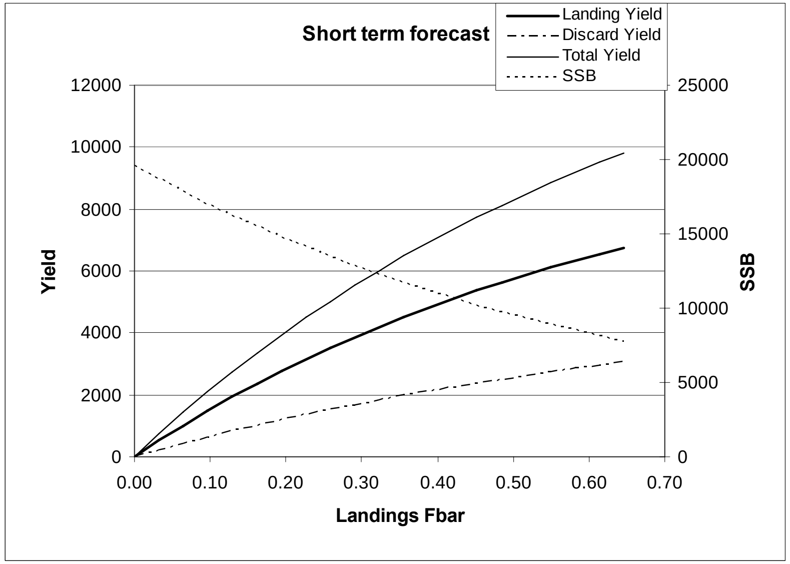


Figure 11.8. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Short term and long term predictions

Run: NEPH_scaled_S3
Time and date: 21:54 14/05/2007

Reference point	F multiplie	Absolute F
Fleet1 Landings Fbar(2-5)	1.0000	0.3230
FMax	0.5103	0.1648
F0.1	0.3403	0.1099
F35%SPR	0.4444	0.1435

Weights in kilograms

MFDP version 1a
Run: NEPH_scaled_S3
Time and date: 21:54 14/05/2007
Fbar age range (Total) : 2-5
Fbar age range Fleet 1 : 2-5

Input units are thousands and kg - output in tonnes

Annex L (Technical minutes from RGBBI and RGWDS for the stocks in the remit of WGHMM)

Technical Minutes Bay of Biscay and Iberian Waters Review Group

1-3 October 2007

Chair	**Jesper Boje**
Members	Jan Jaap Poos
	Gary Shepherd
WG Chairs	Manuela Azevedo
	Beatriz Roel
Secretariat	Mette Bertelsen.

Stocks from both WGHMM and WGMHSA reports

Overall comments

XSA in the FLR suite is used for a number of stocks in the WGHMM report. In the present versions of XSA in FLR the output does not provide sufficient diagnostics for examination of the influence of tuning fleets and tuning options, i.e. regressions and partial estimates of survivors and F. Until this has been coped with by FLR developers, it is suggested to run the Lowestoft XSA for the final run to have the full diagnostics included in the report. Also the ICES secretariate seems to be happy for this solution in order to produce the standard figures and tables.

Likewise, FLR is commonly used as an exploratory tool and plots from these analyses are often provided in the wg reports. However, other exploratory exercises are possible and i.e. SURBA provides good plots like CC, yc plots etc. Again, until FLR developers have implemented such things in the FLR suite, wg members should not limit themselves to the FLR package.

Assessments in Bayesian frameworks seem to be more widespread in recent years. WGMG provided guidelines for proper documentation for this kind of approaches and addressed this issue at a previous meeting in 2003 (Lisbon meeting ?). Even though Bayesian approaches are only used in parallel to other approaches and considered exploratory, WG's need to make sure that these guidelines are followed.

Information relevant for the final assessment should always be provided directly in the WG report and <u>not in annexes nor in working documents</u> if to be considered in the quality review of an assessment. This is because annexes and wd's are not always strictly adhered to a wg report when later made accessible for the public.

Bay of Biscay sole

Was assessed last year in WGSSDS

The assessment was classified as an update assessment.

The ACFM Subgroup questioned why the unallocated landings varies so much in recent years – should be explained by WG (Table 6.1 in WG report).

Discards not recorded from 2004- and is considered insignificant so it is not used in the assessment. Question why is age 1 then not used in the age matrix so there will be estimates of recruits of age 1? No recent independent information available (surveys stopped in 02) – only available information is French LPUE series. There is a problem with lack of information on incoming year classes (no surveys). Forecast based on GM.

The French RESSGASC surveys stopped in 2002; the justification given by the WG for keeping them as tuning fleets is that they contribute to the stability of the estimation of parameters. However, signals in some periods seems to contradict the commercials series and as the surveys mainly estimates ages 6 and 7 in the XSA, it is suggested to take out this tuning fleet. This of course leaves the assessment only with commercial indices, which is not ideal.

It is unclear why age 1 is not used in the assessments; discarding is assumed to be low is recent years. Recruitment is based on age 2 and therefore seem very stable. The contribution of adding age 1 to the assessment should therefore be evaluated.

It is recognized that presently recruitment is mainly estimated by the French trawlers “les sables”.

The GM93-05 recruitment has a huge influence on the forecast, so it should be very well justified.

Megrim in 8c9a

It is noted that for next year WGHMM has proposed to do benchmark for *L.boscii* in 2008 and not for *L. whiffiagonis*

Advice in recent years have been not to increase fishing mortality, it must be recognised that status quo F for *L.whiffiagonis* is based on an increasing trend in F.

L. *Whiffiagonis* - Megrim

The RG reiterates last years RG advise to look more into the exploitation pattern – F matrix - of this stock next year. There seems to be a shift in exploitation pattern around 1995.

The review was hampered by the lack of appropriate documentation tuning diagnostic, i.e. regression statistics and fleet weighting in survivor estimation. This points to the general use of FLR package, that presently do not include these output facilities.

The Spanish survey data that is used in the tuning is based on very scarce catch rates, although there seem to be a satisfactory internal consistency. The underlying catch rates are approx less than 1 fish per 30 min haul.

It is noted that recruitment for the short term prognosis is gm(92-06) that includes the strong 1991 yc !

L. *Boscii* – Four spot megrim

Last year’s review group recommended that WGHMM in 2007 proposed reference points. However, WGHMM considered to do a benchmark in 2008 of this stock and to deal with the reference points therefore in 2008

The comments from review group last year was investigated by WGHMM and it did not make a difference if the 2005 survey index was included or not.

It was noted that the survey used for tuning were based on higher catch rates than for whiffiagonis.

Angler (*L.piscatorius*) 8c-9a –benchmark

- Status : benchmark assessments for each species -

- Assessment model: XSA and ASPIC explored and supported by Bayesian modelling of stock production models ; the RG adopted Bayesian approach as indicative of trends and F and B relative to MSY
- No change from last yr in assess method
- B<Bmsy and F>Fmsy; length compositions indicate good yc coming into 2006 catches (budegasssa)
- Management plan: both species under common TAC – no man. Plan.

The analytical approaches carried out by the WG was acknowledged, and the WG has done a good job in exploring different methods to assess these stocks.

It is unclear why fleet standardization only involved the gillnet fleet ; the remaining trawl fleets should also be considered. This of course imply that an age-based assessment will be possible to carry out in the future.

Catch at age bobble plots do not track the yc very well; they might suggest ageing problems, i.e. growth is faster than aged. Also weight at age seem amazingly stable over the years, suggesting that ageing is too "consistent".

The WG rejection of the XSA was agued by mainly strong pattern in log q residuals in single runs indicating a shift in fishery combined with problems with age reading. However, RG noted that also the short time span available for the assessment compared to number of age groups in the fishery do not allow for an appropriate number of cohort to have passed the fishery and thereby limit the basis for F estimates.

Analysis of length compositions in catches should be considered in order to improve knowledge of growth. Some trends in the catch compositions indicate that cohorts might be tracked.

Some problems in were identified for the production model assessment: the estimated MSY seem high as catches only exceeded MSY in a few years in the beginning of the time period, but the stock did not sustained these catches and B/Bmsy decreased since then. This suggest that the parameter estimation might have more solutions depending on starting guesses on i.e. initial B, r. However, sensitivity analyses of starting guesses of the initial biomass does not affect the assessment (only in the development in the first part of the time series). The RG carried out ASPIC runs with different starting values of K/initial B. Results were consistent for the recent period, that B/Bmsy eq 0.3-0.4, but the decline in early period varied depending on starting guesses. The consistency of the estimates in the recent period led the RG to accept the ASPIC as descriptive of state of stock for the last years. In order to improve the stock production model the WG is encouraged to access more historical data as input for the model, i.e. pre 1980 catches.

The issue with huge fluctuation in F, but not in effort, is a recurrent issue. The variable F from ASPIC is within the uncertainty of the F as estimated in the Bayesian approach, i.e. any changes seem thus not significant.

Southern hake

- Status: Observation stock
- Assessment model: XSA + VPA Bayesian assess – proposed by WG, accept by RG – tuning by 3 comm + 2 surveys
- Last yr assess rejected – this accepted, the view of the RG was that last yrs assess should have been accepted

- B<Blim for a while, Flim<F<Fpa, R uncertain, seem to be high recent years
- Man. Plan. Agreed 2006: SSB above 35 000 t within 10 years and to reduce fishing mortality to 0.27. The main elements in the plan are a 10% annual reduction in F and a 15% constrain on TAC change between years. Plan is **not** evaluated by ICES

Previously this assessment has been rejected due to several reasons listed in the report: problems in age reading/growth patterns, stock structure remains unknown and lack of discard information. However, the RG this year did not found any single reason or combinations thereof, so serious as to reject the assessment. It was recognized that in the light of the history the quality of the assessment is at the edge of what is acceptable, and the shift in acceptance/rejection of this assessment by various RGs is not a desirable procedure. However, presently ICES have not established any rigid rules for qualities of assessment, and also with the development of alternative approaches this will become more difficult in the future. Some of the reasons given previously to reject any analytical assessment such as discrepancy in growth patterns compared to the northern hake stock, and uncertainties in stock structure is difficult to take into account by the RG as a quantification of the problem remains unknown and also because no or little documentation of the problems are given in the (current) WG report. Therefore, the acceptance of the present assessment by the WG is mainly based on diagnostics from the final run and not that the previously mentioned problems was considered to be solved.

The Review Group felt it hard to accept the stochastic assessment (going from XSA) since the data sources (LPUE data not used for the Bayesian assessment) for the two methodologies have not been the same.

The review group asked that a plot with survey result indices is to be included in the next WGHMM report, in order to assess the single indices.

Although the WG says that input data have improved in recent years, i.e. ALK established for some surveys and that sampling has improven, it is hard to find documentation for these statements in the report.

It is unclear why an XSA with surveys only was carried out in order to compare with the Bayesian VPA ? Also due to this, it is unclear whether the XSA estimates can be compared to the Bayesian VPA estimates as they are in many figures. Is it the intension that the Bayesian VPA should provide the uncertainty of the point estimates from the XSA ? Due to the missing diagnostics in the XSA run (as mentioned elsewhere in this report) it was not possible to evaluate the influence of the commercial fleets on the F and survivor estimates. The RG suggest that WG next year conduct both types of assessment and to present runs with similar tuning basis.

WG asked for guidance on 1) USE SP-GFSCAUT 2) ASSESS with uncertainty and 3) stochastic stf? Ad 1. the RG did not assessed this. Ad 2: the RG and ACFM appreciate any assessments with uncertainty on the estimates, but the present advisory scheme/rules not always allow for such assessments. In the future the intensions are to include uncertainty, but it is, however, a slow process and should not prevent the WG to conduct assessment with uncertainty estimates. Ad 3: same as on ad 2.

Although the RG accepted the assessment, the concerns on the discard problems are still valid from last years review and as addressed in the WG report.

Axis values in some figures are unreadable (i.e. Figure 7.3).

The RG noted that as the TAC is overshoot in recent years, a 10% F reduction will have no effect in reducing the exploitation rate.

Technical Minutes of Review Group of Widely Distributed Stocks

Copenhagen 1-3 October

Participants

Asgier Aglen	(Norway)
Jan Horbowy	(Poland) Chair for mackerel management plan
Bob Mohn	(Canada) (External)
John Simmonds	(UK) Chair
Valentin Trujillo	(Spain)
Working Group Chairs:	Manuela Azevedo (IPIMAR, Portugal) WGHMM
	Beatriz Roel (CEFAS UK) WGMHSA
	Morten Vintner (DIFRES Denmark) WGNPBW
	Frans van Beek (IMARES The Netherlands) WGNPBW

Northern Hake

Type of the assessment: Update under observation list.

The report mentions the trajectories of landings and discard information available, but some comments on the quality of landings (e.g. misreporting, underreporting) and discards (e.g. spatial and temporal coverage, fisheries) are required. Discard information obtained for the main countries involved in the fishery should be summed up (even raw values) to know an idea of the relative importance and possible impact of discards information into the assessment and advice.

Some of the fishery-independent information is quite noisy and gives no very useful information to assess this stock under the current approach. This kind of information should be investigated in a deeper way to produce better estimates, markedly recruitment estimates. Examine within and between series correlations to try to select a more informative subset. Do not include uninformative time series.

Try to standardize all plots (effort, LPUEs etc.) of commercial and surveys to facilitate the consistency and comparisons among them, otherwise is quite difficult for tracking trends. Provide single plots of main trends by series to show which series provides which signal.

Produce figures with relative contribution of plus group since this is a critical aspect for this stock and due to the problems observed in the historical trends. There are indications that there is not just a modelling problem, markedly in the mid 80's. This should be arranged and investigated either through evaluation of input data and through modelling process (not only through taper time or tuning window in XSA).

As last year's assessment three types of exploratory assessments were carried out, called:

1. Update;
2. Update no taper time weight;
3. Simulated ALK (faster growth).

It is possible that too many uninformative fleets are used to tune the assessment which makes the interpretation is more difficult (e.g. trends in A Coruña fleet seem to be different). The information used to tune VPA should be standardized and only the most valuable information should be retained. Due to the amount of indices used it should be useful to plot the final survivors' estimates with errors by index at age to see possible consistency among indices in an easy way.

Consider and analyse in a deeper way the relationship between the variability of recruitment indices from FR-EVHOE and the recruitment estimated by the model.

Despite of situation of an update assessment the important issue on growth's doubts should be followed up and efforts made to try to solve this problem progressively. As a first step a WS of ageing in a wider context, not just as in the past, focusing in ageing criteria, and secondly consider what if an extensive tag program with either internal or external tags would be likely to help (learning from previous or redfish experiences already mentioned in Technical Minutes of 2006).

Other modelling approaches (such as length based) are less sensitive to these kinds of problems (as it was attempted this year and presented at ICES ASC) are welcomed or perhaps inclusion of aging errors explicitly in a model, (observation and process errors). Otherwise the perception of the stock will remain in a doubtful position and the manpower should be focused in these crucial issues for this species.

For the near future if there is no more or new relevant information for this stock only present update assessments and try to solve data/methods inside the new benchmark model framework. Do not spend much more energy on developing a further XSA Northern Hake assessment unless there is significant improvement achieved mainly on growth and / or ageing.

Evaluation of hake recovery plan

To evaluate properly the evaluation of recovery plan made by the WG is quite important first to understand the reason of what such bias is produced between the "true" and "observed" population's estimates of the simulations realised. It seems that probability of SSB > Blim is high in any of simulations with the three different S/R assumed: 1) segmented regression, 2) segmented regression breaking in B_{lim} and 3) Ricker. For that reason it is quite difficult to be conclusive among scenarios (ref. WD_24 of WG)

If the assessment has a permanent bias, then reference points are equally biased so there is no problem. It is important to see what might be the cause. If data are simulated with no error do you get the same effect?. Does the XSA 'selection' match simulated fishery selection?

Without establishing the reason for the bias it will not be possible to determine the outcome, in terms of advice etc.

If the source of the bias can be determined then the simulations on the evaluation of recovery plan should be rerun with appropriate treatment to include or exclude the bias. Any evaluation of the recovery state should include consideration of any potential bias in the biomass reference points and the assessment terminal values. In addition if growth is faster the variability in recruitment may be higher and risk of stock below Blim higher and this should be taken into account for management purposes, i.e. consider this for evaluations or proposals of any management plan when any concrete action is proposed to advice.