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Report of the Working Group on the Assessment of Southern Shelf Demersal Stocks (WGSSDS)

26 June – 5 July 2007

ICES Headquarters, Copenhagen

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1 General

1.1 Participants

Robert Bellail	France
Wim Demaré (chair)	Belgium
Spyros Fifas	France
Hans Gerritsen	Ireland
Ian Holmes	United Kingdom
Sven Kupschus	United Kingdom
Colm Lordan	Ireland
Sara-Jane Moore (by correspondence)	Ireland
Matthew Parker-Humphreys	United Kingdom
Willy Vanhee	Belgium

1.2 Terms of Reference

The Working Group on the Assessment of Southern Shelf Demersal Stocks [WGSSDS] (Chair: W. Demaré, Belgium) from 26 June to 5 July 2007 at ICES HQ, to:

a) assess the status of and provide catch options for 2008 for cod, haddock, whiting, and plaice in Divisions VIIbc, VIIe, VIIfg, and VIIh-k;

>> See relevant stock sections

b) update the catch information for Nephrops in Divisions VIIfgh and VIIa south of 53ºN;

>> See relevant stock sections

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

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

>> 5 weeks before the start of the 2008 WGSSDS meeting

(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.

>> See section 2.1 and relevant stock sections

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

>> Cod VII-k and plaice VIIe were scheduled as benchmark

(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.

>> See relevant stock sections

(5) 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.

>> Section 2.6 and relevant Stock Annexes

(6) consider existing knowledge of important impacts of fisheries on the ecosystem;

>> Relevant stock sections

(7) 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;

>> The management plan for sole VIIe is discussed in the stock section (3.1).

>> The impact of the temporal closure of ICES rectangles 30E4, 31E4 and 32E3 is discussed under the relevant stock sections of the Celtic Sea stocks (Section 4). A more general discussion is given in section 2.1.

>> Last year some CS5 simulations were carried out for VIIe plaice and sole, and VIIfg plaice and sole. These were not repeated this year, but commented on in the relevant stock sections.

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

>> See relevant stock sections

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

>> See paragraph 'the fishery' in every stock section

(10) where misreporting and/or discarding is considered significant provide qualitative and where possible quantitative information, by fisheries and the describe the methods used to obtain the information and its influence on the assessment and predictions.

>> See sections 1.3.1 and 1.3.2, and relevant stock sections.

(11) 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

>> no template available, overview of sampling data in table 1.3.1

(12) implement the roadmap for medium and long term strategy of the group as developed in AMAWGC.

>> See section 2.7

WGSSDS will report by 9 July 2007 to the attention of ACFM.

1.3 Data available

As in previous years, data for the WG were prepared in advance of the meeting, and all revisions to data are discussed in the appropriate stock sections. In addition, WG members attempted to provide provisional assessments and these were presented early in the meeting itself. The WG considered that this approach had been useful, building on and extending the previous practice of carrying out provisional assessments prior to the meeting.

Major inadequacies in the data are discussed in this section under each of the data categories. Inadequacies in the data, and the possible consequences for the assessment and projection, are also discussed in each stock section in the 'comments on the assessment' sub-section.

1.3.1 Landings

Several stocks assessed by this Working Group (WGSSDS) are managed by means of TACs that apply to areas other than those corresponding to individual stocks, notably in Sub-area VII.

Misreporting is a well known problem for most stocks and some years ago ACFM and the RG asked for more transparency on this issue. Misreporting includes misallocation of catches to other TAC-areas, under- and over reporting and species misreporting. While the level of misallocation was quantified for some Southern Shelf stocks, the other types of misreporting rely on anecdotal/qualitative information and is in many cases not taken account of in the stock assessments of this WG. However, an increased number of observer trips are taking place on the major fleets, and the information gathered during these trips is probably the best way to quantify most types of misreporting. Currently, member states are very reluctant to provide this information because of confidentiality issues and one of their major concerns is that this information will be (mis-)used outside the scientific community.

In Ireland, sampling rates have been substantially reduced since late 2005 due to non-cooperation of the industry with sampling programmes. Access to samples has been denied in several ports on the south-west, west, north-west coasts. In addition, at-sea discard sampling programmes have been temporarily suspended in several areas. This is a direct result of the miss-use of scientific data that were gathered on-board commercial vessels for legitimate scientific purposes but which came into the public domain as a result of an investigation into illegal landings. This has clearly lead to a derogation of the quality of scientific data in the short tem.

The working group acknowledges the comment by the RG of 2005 that ... *not documenting this information leads to stakeholder and client concerns about the lack of transparency in the ICES process. It also makes the decision making process for the RG and ACFM problematic when misreporting is mentioned as either a problem or occurring without a detailed steer on the likely impact of this on the stock assessment, forecast and future management* ... But nevertheless, the working group felt that it could provide a general steer on the likely impact of misreporting on the stock assessment, forecast and future management, despite the lack on detailed information on the level of misreporting per country (see text table below). It is unlikely that member states are willing to provide detailed information on misreporting per country as long as there are no guarantees that this information will not be mis-used.

The WG urges that this problem is tackled at a higher level and that a framework is created in consultation with ICES, the European Commission and stakeholders that provides clear guidelines on how to include and use these type of data, and with legal guarantees that these data will not be mis-used (e.g to prosecute countries). In attendance of such a framework, the WG provides qualitative and where possible quantitative information on misreporting per stock and not per country. This information is summarized in the text table below. Where misreporting is known to be a problem, a reference is made to the section where the possible impact on the assessment, forecast and/or future management of the corresponding stock is described.

Stock	Type of misreporting	Categorization of misreporting (Substantial, minor, not a problem, unknown)	Impact taken account for (Fully, partly, not accounted for)	Reference to stock assessment text
Sole VIIe	Misallocation	Substantial, reduced rate in recent years	Fully	Section 3.1.5 and Section 3.1.12
Sole VIIe	Underreporting	Minor	Not accounted for	Section 3.1.5 and Section 3.1.12
Sole VIIe	Overreporting	Not a problem		
Sole VIIe	Species misreporting	Not a problem		
Plaice VIIe	Misallocation	Not a problem		
Plaice VIIe	Underreporting	Not a problem		
Plaice VIIe	Overreporting	Not a problem		
Plaice VIIe	Species misreporting	Not a problem		
Cod VIIe-k	Misallocation	Minor	Fully	Section 4.1.1&2
Cod VIIe-k	Underreporting	Substantial for some fleets	Not accounted for	Section 4.1.1&2
Cod VIIe-k	Over reporting	Not a problem		
Cod VIIe-k	Species misreporting	Not a problem		
Whiting VIIe-k	Misallocation	Not a problem		
Whiting VIIe-k	Underreporting	Unknown	Not accounted for	Section 4.2.12
Whiting VIIe-k	Overreporting	Minor	Not accounted for	Section 4.2.12
Whiting VIIe-k	Species misreporting	Unknown	Not accounted for	Section 4.2.12
Plaice VIIfg	Misallocation	Minor	Not accounted for	Section 4.4.12
Plaice VIIfg	Underreporting	Unknown	Not accounted for	Section 4.4.12
Plaice VIIfg	Overreporting	Not a problem		
Plaice VIIfg	Species misreporting	Not a problem		
Sole VIIfg	Misallocation	Substantial	Fully	Section 4.3.12
Sole VIIfg	Underreporting	Unknown	Not accounted for	Section 4.3.12
Sole VIIfg	Overreporting	Not a problem		
Sole VIIfg	Species misreporting	Not a problem		
Haddock VIIbk	Misallocation	Unknown	Not accounted for	Section 4.5.12
Haddock VIIbk	Underreporting	Substantial (some fleets and some years only)	Not accounted for	Section 4.5.12
Haddock VIIbk	Overreporting	Unknown	Not accounted for	Section 4.5.12

Haddock VIIbk	Species misreporting	Unknown	Not accounted for	Section 4.5.12
Nephrops FU 20-22	Misallocation	Unknown	Not accounted for	Section 4.8.7
Nephrops FU 20-22	Underreporting	Minor	Not accounted for	Section 4.8.7
Nephrops FU 20-22	Overreporting	Not a problem		
Nephrops FU 20-22	Species misreporting	Not a problem		

1.3.2 Discard information

Under the Data Collection Regulation (DCR), discard data are gathered on a regular basis and for most Southern Shelf stocks discard information is now available to the WG for several years. The discard information is mostly used in a qualitative manner, rather than being quantified into the assessments. A major restraint is the lack of historical discard data and consequently these need to be estimated. There have been a number of examples (i.e. Rockall haddock, *Nephrops* in FU 23-24 and in FU 20-22, and North Sea plaice) where this exercise has been carried out and the 2006 WG discussed the potentials to apply these and other methods to some of the Southern Shelf stocks. The different methods are summarized below.

The Rockall haddock example

Extract from section 4 of the WGNSDS 2006 report (ICES 2006b). ...*To determine abundance of discards the following procedure was used: (a) A theoretical catch at length distribution (%) was calculated by applying the theoretical selectivity curve to the survey length composition. (b) An estimate of total catch at length was made by summing the reported landings by length to the number of discards at length calculated from the assumed discard ogive and the landings at length data.(c) An intermediate theoretical catch size distribution in numbers is calculated by dividing the estimate of the total numbers retained (numbers greater than 34cm) in "(b)" by the fraction retained from the theoretical catch length distribution calculated in "(a)". (d) Theoretical discard size frequency is then calculated by applying the theoretical discard ogive to the intermediate theoretical catch size distribution. ... The amount of discarded haddock by age was determined using a length-age key derived by the data collected during the trawl survey allowing for selectivity of the fishery. ...*

The North Sea plaice example

Extract from section 9 of the WGNSSK 2005 report. ... *In the WGNSSK 2004 assessment, the discards time series was derived from Dutch discards observations for 1999-2003, while the discard time series for 1957-1998 was derived from a discard reconstruction (ICES CM 2005/ACFM:07 Section 9.2.3). To reconstruct the number of plaice discards at age, catch numbers at age are calculated from fishing mortality at age corrected for discard fractions, using a reconstructed population and selection and distribution ogives (ICES CM 2005/ACFM:07 Appendix 1). ...* A modified version of this approach was attempted on VIIa plaice, but gave no satisfactory results so far (ICES 2006b).

The *Nephrops* in FU 23-24 and FU 20-22 example

This method has been described in Annex 1 of this WG report and can be summarized as follows. For the years for which discard data are available, a regression is made between the mean length in the discards and the mean length in the landings. This regression is used to estimate the mean length in the discards from the mean length in the landings for those years for which no discard data exist. A probability density function is applied to estimate the length distribution of the discards.

The Working Group discussed the above examples and identified possible approaches to calculate 'historical' discard numbers (i.e. for years for which no discard estimates are available).

(a) Combine the survey catch numbers and the selection ogive for a certain fleet to estimate the relative catch for that fleet. Use the landing length distribution of the same fleet to estimate discard and catch numbers at length.

- When this methodology is used, the area covered by the survey should overlap with the fishing grounds of the fishing fleet.
- The survey might not always cover the entire population. For example, surveys designed for estimating younger age classes might only operate in the inshore area.
- The survey must go far enough back in time.
- The survey is a snapshot at a certain time in the year.
- The survey picks up variabilities in size at length between years.

(b) Calculate discard ogive for certain fleet from available discard sampling programmes. Combine the calculated discard ogive with the historical landing numbers of that fleet to estimate the historical discard and catch numbers at length.

- If possible do this by fleet, quarter and area.

Under the Data Collection Regulation, discard ogives are becoming more and more available, but the gathered data are not always on such a disaggregated level that discard ogives are available for all fleets, quarter and areas.

- The impact of changes in selectivity, year class strength, quota restrictions ... on the discard pattern are not automatically taken account for.
- When all fish of a certain length group are discarded, there are no landing numbers to apply the discard ogive to.

(c) Calculate regression between mean length of the discards and the mean length of the landings. Apply a density probability function to estimate the discard length distribution.

- Not necessary to calculate regression between means, can also be done between lengths at 95% confidence interval (e.g. the one regression might work better in a target fishery, the other when the species is caught as a by-catch).
- Might be difficult to find good probability density function to estimate the discard length distribution, e.g. for bimodal length distributions.

The Working Group recognizes that there always will be arguments to not incorporate historical discard data into the assessment (or the approach relies on a survey that does not cover the area of the fishing operations, or that goes not long enough back in time and etcetera), and that there often will have to be made many assumptions in order to finally get the discard numbers estimated. Another possibility is to just await until discard estimates are available for some five years and simply introduce these into the assessment, without including discard estimates for the historical part of the time series. This will obviously have an impact on the assessment, but may be accounted for in the analysis of the results.

Nevertheless the Working Group made a planning on 'including discard estimates into assessments' for those stocks with considerable discard rates and for which discard estimates are not yet included into the assessment (see further below). The Working Group further recommended to provide the data on a low disaggregated level, which makes it easier to combine data afterwards. The type of data that will help to make this exercise successful is distribution maps of surveys, fisheries, discard rates of fisheries, ...; selectivity ogives for different gears; ...

The Working Group briefly touched upon raising procedures, but did not go into a detailed discussion because this is beyond de remits of this group. The Working Group notes that at the 'Workshop on Discards' (Anon. 2003) it was advised to raise discard data by trip. Experience has shown that this raising procedure is not always the best option and results sometimes in unrealistic high total catch numbers. Instead, some countries started to raise by total landings (all species combined). The Working Group on Discard Raising Procedures (ICES, WKDRP, 2007), met in 2007 and worked out a key for raising discards. The Working Group could not advise on the best raising procedure for the stocks under the remit of WGSSDS (since this depends amongst other things on, on the chosen sampling strategy), but agreed that the raising procedure should remain the same for discard and landing samples. After all, when the landing samples of a certain stock from a certain fleet -in many cases gathered at the market- are raised by the total landings of that fleet and stock, and these estimates are combined with discard estimates from the same fleet and stock that were raised by the number of trips, this is like comparing apples with oranges.

The text table below summarizes for the assessed stocks of this WG if discarding is considered to be a problem, if discard sampling is currently in place and if discards are included in the assessment. In general, discarding of sole (a high value species) is minor. Discarding of plaice and *Nephrops* occurs mainly on fish below the minimum landing size. Substantial discarding levels of both haddock and whiting under and above the MLS have been seen. Discarding above the MLS is mainly driven by market and economical considerations and is referred to as high-grading. More discard information is given under the stock sections and can also be found in the Discards Study Group report (ICES, 2002a). For haddock VIIb-k and *Nephrops* in FU20-22 discards were included into the assessment while for cod VIIe-k, whiting VIIe-k and plaice VIIfg this was not the case. In 2006 possible approaches for including discard data into these assessments were given.

Cod VIIe-k planning

A pilot sampling plan of the French fleets discards has been set during the 2nd semester 2005 and is applied also in 2006. Statistical analysis has not been carried out yet in order to estimate associated CVs. Only after this stage, it will be possible to state between a qualitative examination of discarding data or a possible input in catch at age matrix without introducing more noise in the stock data files. The conclusions of the statistical analysis will not be available before the 2008 SSDS WG.

Whiting VIIe-k planning

For Whiting VIIe-k the methodology adopted by the Rockall Haddock approach is probably most appropriate. Ideally the surveys would overlap with the distribution of the fleets in the fishery, this may be the case for some surveys and fleets but not all. It was identified that in order to progress with this methodology the following information should be provided for each of the countries involved in the Whiting VIIe-k fishery

- Spatial and temporal distribution of surveys and fleets
- Selection patterns for each metier including information on mesh size and any anecdotal information on discarding practices

Plaice VIIfg planning

The WG considers that discarding of marketable fish due to TAC constraints is an important issue and is affecting the reliability of estimates of fishing mortality and SSB. The discarding of undersized mainly affects estimates of incoming recruitment (and not the F and SSB estimates), and unless thoroughly addressed in terms of covering major fleets for each season, gear and year generally only adds more variability to the assessment. But since it affects recruitment estimates, it also affects the stock recruitment (SR) relationship. This is worrisome since the precautionary reference points for some stocks rely on the SR relationship.

The impact of the (in)availability of discard data on the assessment and forecast is further discussed in section 2.4 and in the relevant stock sections.

Stock	Is discarding a major problem?	Fisheries that are (not) sampled	Is there a good temporal and spatial coverage of the sampled fisheries	Are the discard data used in the assessment	Why are discard data not used (a)
SOL VIIe	No	65% of the fishery is sampled for discarding	Yes	No	1
PLE VIIe	No	Major fisheries are sampled	Yes	No	1
COD VIIe-k	Yes	Major fisheries are sampled	Yes	No	2/4
WHG VIIe-k	Yes	Major fisheries are sampled.	Yes	No	2/4
SOL VIIfg	No	Major fisheries covered	Yes	No	1
PLE VIIfg	Yes	Major fisheries are sampled.	Yes	No	4
HAD VIIb-k	Yes	Major fisheries are sampled.	Yes	Yes	/
NEP FU 20-22	Yes	French discard estimates for 1990 and 1997. Irish for 2002 and onwards	Yes/No	Yes	/

(a) 1 is filled in when discards are considered to be an non-issue; 2 when data are not collected or incomplete to be of any use; 3 when data are collected but not released by data owners to be used by ICES; and 4 when data are not included but the WG has not yet been able to include them in assessments due to raising or data deficiency issues.

1.3.3 Biological sampling

Biological sampling levels by country and stock are summarised in Table 1.3.1. The sampling levels for 2006 are, in general, similar to those in 2005. Deficiencies in sampling (if any) are discussed in the relevant stock section.

1.3.4 Biological information

A summary of the sources of biological data for the stocks in the remit of WGSSDS is given in Table 1.3.2.

Natural mortality has generally been assumed, except for plaice stocks which all follow the natural mortality value used for VIIa plaice. This was based on an analysis of historical tagging information, and is described in the Northern Shelf Demersal WG reports, and in the plaice Stock Annexes.

Maturity-at-age is generally based on sample information (or by analogy with the same species in an adjacent area), except for Nephrops in FU20-22 and VIIb-k haddock, which use knife-edge maturity assumptions. Preliminary results from an analysis of biological samples from the French EVHOE survey in 2002, for both haddock, indicated that the actual maturity ogives were not significantly different from those assumed (Bellail, R., ICES CM 2004/ACFM:03, WD1, WD2). ACFM (October 2004) confirmed the use of these knife-edge ogives.

Weights-at-age are derived from a variety of sources, and may be smoothed by different techniques. WGSSDS appreciated previous guidance from ACFM on approaches to the derivation of mean weights-at-age for stock assessment purposes, particularly with respect to the use of smoothing functions, but was unable to recalculate the time series of weights at age for the stocks concerned.

1.3.5 Fleet and survey information

A list of the tuning fleets used in the stock assessments, and their acronyms, covered by the Working Group are presented in Table 1.3.3. The geographical areas covered by these fleets and surveys in relation to the stock assessment areas were shown in charts in the Southern Shelf WG report for 2000 (ICES CM 2001/ACFM:05). Such 'fishery' information is presently being incorporated into the Stock Annexes, which will eventually include descriptions of commercial fleet tuning series and survey series, including areas covered, sampling protocols and a time series of commercial vessel effort distribution for the main gears used in the fishery.

In 1997 Ireland commenced an IBTS fourth quarter Irish Sea & Celtic Sea survey aboard the RV Celtic Voyager (IR-ISCSGFS). This survey was superseded in 2003 by a new Irish groundfish survey with a substantially different design using Ireland's new 65m research vessel Celtic Explorer (IR-IGFS) (See: IBTS, 2007 for further details). In 2006 the WG used a swept area standardised index which integrated the new survey with the data from the previous Irish Sea Celtic Sea Ground fish survey in VIIg (1999-2002) for haddock and whiting (two of the most abundant species in the survey). This approach appears to provide an internally consistent tuning time series over an extended period. It is envisaged that the new IR-IGFS will become the Irish survey main tuning series once long enough.

Similarly, a new Q4 survey using the new UK(E+W) 74m research vessel CEFAS Endeavour commenced in 2003, and this survey should also eventually provide tuning data for some of the stocks assessed by this WG. These Q4 surveys are part of an internationally co-ordinated effort by France, Ireland, UK(Scotland), UK(England&Wales) and Spain to improve assessment, biological and distributional data for ICES Subarea VII. It is hoped that these developments will alleviate the Working Group's concerns about the lack of fishery-independent data in some assessments.

1.4 Methodology and software

The stocks within the remit of WGSSDS are tabulated in Table 1.3.4, along with the type of assessment carried out (see also section 1.6) and an indication of whether this reflects a change to previous practices. A summary of results from the assessments is presented in Table 1.3.5.

The main software and versions used are given in the text table below.

SOFTWARE	PURPOSE	PROGRAM/VERSION	FILE CREATION DATE
FLCORE	**FISHERIES LIBRARY IN R**	**1.4-3 (R VERSION 2.4.1)**	**02/2007**
FLEDA	Data screening	1.4-2	2007
FLXSA	**HISTORICAL ASSESSMENT**	**1.4-2**	**2007**
VPA suite (XSA; Separable VPA)	Historical assessment	VPA95.exe Version 3.2	8/6/1998
RETROSPECTIVE XSA	**RETROSPECTIVE ANALYSIS**	**RETVPA02.EXE VERSION 3.1**	**18/4/2002**
MFDP	Short-term forecast	Visual basic installation	Setup: 29/4/1996 Config: 28/6/2000
MFYPR	**YIELD-PER-RECRUIT**	**VISUAL BASIC INSTALLATION**	**SETUP: 29/4/1996 CONFIG: 28/6/2000**
PASoft (EXCEL add-in)	PA reference points estimation	Pasoft with Fishlab dll	June 1999
MAKEVCF	**HEADER FILE GENERATOR FOR STOCK (SENSITIVITY ETC.)**	**MAKEVCF90.EXE**	**20/5/2002**
INSENS	Input file generator for sensitivity and med-term	Insens90.exe	20/5/2002
WGFRANSW	**SENSITIVITY ANALYSIS**	**WGFRANSW.EXE**	**22/5/2001**
SURBA 3.0	Survey based analysis	Surba.exe	25/4/2006
RECRUIT	**S/R ESTIMATION**	**RECRUIT.EXE**	**4/2/2002**
RECRUIT2	S/R estimation – small stocks (but limited years)	Recruit2.exe	24/10/1996
WGMTERMC	**MEDIUM-TERM ANALYSIS**	**WGMTERMC.EXE**	**3/11/1999**
CS5 (an adaptation of CS4)	Harvest control rules and medium-term	CS5.exe	7/8/2003
MTMPLOT	**MEDIUM-TERM AND CONTOUR PLOTTING PROGRAM**	**MTMPLOT.EXE**	**2/12/1998**
Various other plotting routines (PAPLOT, WPAPLOT, PLOTCONV etc.)	SSB/F trajectory with reference points	e.g. Wpaplot.exe ; plotconv.exe etc.	4/2/2002; 20/11/2000;

1.4.1 Analytical assessments

XSA has been the major method used for VPA tuning in all final assessments. The procedures used to screen the data and to select the tuning options for Benchmark assessments were the same as in previous years, and these are described below.

Screening data

The procedure used to screen the catch-at-age matrix was to perform a separable VPA, using standard input parameters for each stock, in order to detect if large residuals or unusual patterns reveal anomalies in the data from year to year. For stocks where zero data values for an additional younger age had been inserted in the catch at age data, to allow survey estimates to be included (e.g. the use of age 0 in VIIe-k cod), the separable VPA was run on a data set excluding the inserted zero data. This was done to avoid the problems associated with the model trying to fit to the zero values, where high residuals in log catch ratios for the first pair of ages affect the pattern of residuals on the older ages.

FLEDA was also used for some stocks to screen the different input data. On the FLR website (http://flr-project.org/doku.php?id=pkg:fleda:howto) FLEDA is described as: *FLEDA is an R package, part of the FLR suite, for exploratory analysis of the data available for stock assessment, developed under the project IPIMAR/NeoMAv. It includes a combination of simple calculations and graphical representations aiming at data screening (checking for missing data, unusual values, patterns, etc), inspection of data consistency (within and between data series) and extracting signals from the basic data. Diagnostics include those recommended during the 2004 Methods Working Group meeting..*

Selection of tuning fleets, ages

As in previous years, possible age- and year-effects in catchability were investigated using XSA with the constant q model for all ages, and with a weak shrinkage (usually S.E.=1.5 or 2.5), taking each fleet individually, without taper weighting and using the full series of tuning data. Fleets or ages showing trends or very high residuals are discounted in subsequent runs, although an exception may be made where a power relationship between log q and population size is indicated, see below. Graphs showing the residuals for these individual analyses are not presented in this report but are available in ICES files. The graphs of residuals included in the report show the log q residuals resulting from the output of the final XSA.

Wherever possible, assessments have been carried out using the tuning options chosen last year. For some stocks, the inclusion in the tuning process of new fleets or major data revisions has required a more detailed exploration of the data and model parameters than is usual. WGSSDS has also considered the benefit of increasing the tuning period on the quality of estimates. The reduction (from WGSSDS 2001 to 2002) in the number of stocks handled by this working group has greatly increased the opportunities for examination of tuning fleet data and XSA diagnostics in detail, and has resulted in modifications to tuning data which are believed to have improved the assessments concerned (e.g. separation of tuning data series into more homogenous periods to avoid known or suspected catchability changes). Details of such changes are discussed in the text for each stock. The WG notes that tuning data for earlier periods, whilst not contributing to the estimation of current stock size and mortality, may be important for some stocks where historic SSB levels show a lack of convergence, e.g. VIIe sole where SSB trends were shown in the 2003 WG to be strongly influenced by the choice of the plus group age. These features are important considerations in cases where biomass limit points are based on Bloss.

Choice of catchability model

WGSSDS's approach to the choice of model was to use the same model as in previous assessments unless major changes in the catch-at-age data had been made, or the fleet composition had changed. For Update assessments the only model used was exactly as the previous assessment. The mean q model was always used in stocks for which there was only a short time-series of data, or when there was no clear indication from the XSA diagnostics that a power model might be appropriate. Where the data and diagnostics of preliminary XSA runs clearly indicated that the power model might be beneficial, the Group considered the graphs of log catchability residuals plotted against log stock numbers and judged the quality of the regression (whether or not the relationship is dominated by one or two extreme values), and if the slope of the regression was consistently greater than zero, for the most important fleets. Furthermore the Group considered the value of the slope of the regression of log CPUE against log N, as given by XSA, and the associated t-statistics for candidate ages (the slope must be significantly lower than one), the improvement of the standard errors, the consistency of survivors estimates and whether there was a significant improvement in the retrospective pattern, in making decisions on the range of ages for which catchability (q) might be dependent on abundance.

For some stocks, even though the fleets taken individually did not show any trend or pattern, it appeared that using them all together provided a different picture. This indicated that even though each fleet individually provided a reasonable fit, different signals were sent by these fleets when taken together, creating apparent trends. A poor performance of a fleet at this stage was no longer considered a decisive argument against the use of that fleet, if it had performed acceptably in the single fleet runs. However, log catchability residuals from the multi-fleet run were reviewed to ensure that strong year-effects or age-effects had not emerged as a result, and these were considered for rejection or retention on a stock-by-stock basis.

Some very high slopes, high standard errors or low r^2 are shown for some stocks in the XSA regression diagnostics. In most cases, these concerned stocks for which a constant q model was applied. In that case, a low value of R^2 indicated that log q was not well correlated with abundance and this did not mean that the mean q model did not fit well. Indication of the actual fit was given by the S.E.(log q) values associated with the mean q estimates. Regression diagnostics should be considered only when a power model is used, and only for the ages to which the power model was applied.

Tuning period and weighting

WGSSDS has generally taken the approach that full tuning time-series of data should be used wherever possible, unless data in earlier periods are considered less reliable, or a strong trend in q has been identified. In such instances the use of a time taper or separation of fleet data into more homogeneous periods was considered. When a power model regression is used, the removal of two degrees of freedom reduces the effective number of data values, especially if there are missing data, and a shortened tuning series may be problematic as the annual addition of an extra point in the series can have a marked effect. This is particularly true for a ten-year tuning window, the use of which has been discontinued by this Group.

The Hake, Monk and Megrim working group in 2002 carried out some useful trials on the effects of tuning period and F-shrinkage, with respect to the Northern Hake assessment, and results indicate that for this data set these choices can have a major impact on the historic perspective of SSB and fishing mortality (ICES CM 2003/ACFM:01).

Shrinkage

If considered necessary, additional tuning runs were carried out to investigate the influence of shrinkage on retrospective patterns in estimates of terminal F. In general, lighter shrinkage (i.e. s.e. >1.5) was preferred, due to the possibility of poorly-estimated F on younger ages having a strong influence on the estimates of survivors.

Any changes from last year's procedure are discussed in the relevant section.

Convergence of XSA

The XSA algorithm contains a feature in the fitting procedure, which is intended to reduce the risk of finding a local minimum, and is invoked for the first of each set of ten iterations chosen after the default of 30 have been completed. Results from XSA convergence on 31, 41, 51 etc. iterations should be viewed with caution, as occasionally the feature can have the opposite effect. Carrying out more than 30 iterations is usually unlikely to significantly improve the fit of the model.

The convergence test in XSA compares the sums of the changes in F across all ages in the last year between the last two iterations, and the difference is reported on screen if the model 'fails to converge'. If this difference is less than .001 then further iteration is probably unnecessary. The first page of output in the XSA diagnostics file compares F at age for the last two iterations, so that the magnitude of changes in F can be inspected.

Retrospective analysis

Retrospective analysis was carried out using the same options as defined for the final run of XSA, except for those stocks in which the tuning time-series for one or more fleets was too short. In such cases there were three possible alternatives:

1) If just one relatively unimportant fleet had a short time-series of data, then it was excluded from the retrospective analysis so that inspection for bias could be performed.
2) If a short fleet was influential in the XSA analysis, and it contained 5 or 6 years of data, then extra XSA runs were carried out, using the same parameters as the final XSA but selecting year (n-1 or n-2) as the final year for the analysis. This process allowed one or two comparisons of F, SSB and R-values in recent years.
3) Otherwise, no retrospective run was performed.

1.4.2 Short-term predictions

Short-term predictions were carried out using the MFDP software, and yield-per-recruit calculations using MFYPR.

As in previous years, SSB calculations for all stocks are at 1 January (proportion of F & M before spawning = 0).

Catches in the intermediate year

For some stocks, the predicted landings at status quo for the intermediate (current) year can be greater than the agreed TACs (if comparable due to possible differences between TAC area and the area covered by the given stock). In these cases, WGSSDS considered a TAC constraint as an alternative. The TAC constraint option was rejected if the WG considered that it was unlikely to have a restraining effect on fishing for the stock in question, or accepted if evidence indicated otherwise.

Replacement of recruits in predictions

As previously, the decision on whether to replace the XSA estimate of recruits in the last data year and the same year classes in the current year was based on how well tuning fleets appeared to contribute to this estimate, backed up by information on relative abundance of these year classes from catch-at-age data in landings and any surveys not used in tuning. If replacement by an average value was indicated, the geometric mean (GM) of the time-series was used where there was no obvious trend or change in the level of recruitment through the series. In other cases, in particular where several successive recent recruitments appear to have been at a higher or lower level than the rest of the series, a GM value for more recent years was used as described in the relevant stock sections.

When the value of the recruiting year class was considered very badly estimated, and therefore replaced (usually by GM), WGSSDS considered that the value of F given for this age and year should not be taken into account in the calculation of the mean for prediction. Fsq for this age is therefore the mean of the F values given for this age for the two (or three) preceding years.

This mean was also used to bring forward the replaced value of recruitment to give an estimate for survivors in the current year following the catch equation: N * exp –(Fsq + M).

***Status quo* F**

As in previous years, WGSSDS considered that the scaling procedure (which treats the final year estimate of F as exact) should be avoided. This procedure propagates any error into the prediction especially when a retrospective bias shows that estimates of the terminal year are consistently revised downwards or upwards in the following year's assessment. Therefore, the value chosen as *status quo* F to be used in short-term predictions was generally the un-scaled mean F at age for the last three years.

Where F on a stock has consistently increased or decreased over recent years, and there is supporting evidence that effort has also changed by a similar level, short-term advice based on status quo predictions using a three-year mean F value will reflect an exploitation level which may be considerably different from that in the last year of the assessment. A mean F at age for the last three years scaled to the mean F in the terminal year was considered appropriate in this case. The text for the short-term catch forecast for each stock describes the exploitation pattern used, and this is also repeated at the top of the forecast input table.

A detailed short-term prediction was made for each stock using the status quo F option, and the contribution of recent year classes to future SSB and yields was tabulated.

1.4.3 Sensitivity and risk analysis

Sensitivity analysis

The contribution of different sources of uncertainty to the variance of predicted SSB and yield was estimated where possible by means of sensitivity analysis. The sensitivity analysis program WGFRANSW (an update of WGFRAN4), the program used in previous years) gives estimates of the proportion of the total variance of predicted SSB and catch contributed by different inputs. Table 1.4.1. gives a description of the abbreviated variable names on the figures, which show the results of sensitivity analyses for each stock.

CVs of population numbers for the first age (recruits) are calculated by the INSENS program from the mean of the values at this age (usually GM over the full period except the last two years). In stocks where recent recruitment was replaced by a GM value, taken forward for survivors in the intermediate year (i.e. the year of the assessment) for the subsequent age, the associated CV provided by the program (the standard error of recruitment for the chosen time-series) was replaced by the CV on the next youngest age. WGSSDS considered that this CV should better reflect the fluctuation of population numbers over the considered period, as the CV on estimates of abundance of the youngest age is unlikely to be lower than that of the next youngest.

This year the WG noted that the CV calculation was incorrect for several stocks: the program was not correctly picking up the values from the XSA diagnostics file, and these had to be manually inserted. In addition, for VIIe sole, incorrect F values were also apparent, and these too had to be manually replaced. The WG again pleads for more efficient and reliable software to enable the group to meet its terms of reference effectively.

Risk analysis

Medium-term predictions were carried out for most stocks for which there was a Full analytical assessment, unless management plans were being proposed, in which case program CS5 was used instead. The program WGMTERMC was used, which reads the output data from the final XSA run and produces an age-structured forecast for a chosen number of years ahead (10 years for all stocks in this report), assuming uncertainty in the input parameters. The standard errors of the XSA survivors estimates were input, although the 1996 ICES Comprehensive Fishery Evaluation Working Group (ICES CM 1996/Assess:20) recognised that these are likely to over-estimate the precision of the assessment.

NB: All medium-term projections were run using population numbers at the start of 2008, so that short-term and medium-term forecasts were based on the same assumptions for the intermediate year (2007).

As last year, the Working Group used random bootstrapped recruitment for all stocks for which medium-term projections were performed, and the relevant year range for recruitment is noted in each section.

For the status quo projection, the results over the next 10 years showing the SSB, recruitment and yield are given for each stock. Additionally, the contour plot showing the 10th, 25th, 50th, 75th and 90th percentiles of the probability of SSB<Bpa (as defined by ACFM) is presented for each stock. WGSSDS noted the comment from the Methods WG (ICES CM 2003/D:03) that the extreme percentiles of predicted catch and SSB (5% and 95%) cannot be considered to be reliable, and therefore did not present these in the results for each stock.

For some stocks, where the SSB was at a level where stock-recruitment dynamics were unknown, the medium-term projection was presented but considered unreliable. This is discussed further in the relevant stock sections.

1.4.4 Selection of Precautionary Approach (PA) reference points and target reference points

1.4.4.1 Precautionary reference points

The procedures used by the Group to select candidate reference points made use of the full time-series of spawning stock, recruitment and fishing mortality estimates available for each stock. The annual assessments made by WGSSDS usually involve only the addition of a single year of data, and as a result would not normally result in a large change in the perception of the stock's dynamics unless the time-series is relatively short. Furthermore, it is desirable that once reference points are defined for a stock, they should remain stable, and should not be redefined without a firm basis for doing so. Nevertheless, it is useful to review reference points where there is a major change in assessment data or methodology or a substantial change in the perception of the relationship between spawning stock and recruitment. In 2004 Working Group carefully examined the stock-recruit relationships for the stocks under its remit, especially where recent strong recruitments have totally changed the stock-recruit pattern. For some stocks the previous basis for reference points has now become untenable, and the WG consequently considered that those reference points were no longer reliable. The WG had great difficulty in proposing any alternative reference points in the time available, and in some cases offered management plans instead (e.g. VIIe sole, Biscay sole).

The proposed changes were not accepted by ACFM. The WG still considers most reference points unreliable on the basis of the same grounds as last year (see text below, which has been taken over from last year's report) and therefore did not re-open the discussion on pa reference points. Instead the WG put more effort in to the development of alternative management strategies and long-term management reference points. (see section 1.4.4.2 and the relevant stock sections).

As in previous years, the general considerations used were as given below.

Biomass reference points

In cases where a biomass reference point has been set in relation to a specific historic biomass level (Bloss), the updating of an assessment can result in a change in the value of Bloss. This can be a particular problem when the stock is in continuous decline and the most recent SSB estimate becomes the new lowest-observed value. Under these circumstances the value of Blim would not be revised. The existing value remains a point associated with a high probability of recruitment failure or of unknown stock dynamics, and thus remains appropriate as a limit reference point. Furthermore, the fact that current SSB is estimated to be below Blim should highlight the need for urgent management action.

Fishing mortality reference points

Fishing mortality reference points are typically set based on the available series of stock-recruitment information. The addition of a single point to the series is unlikely to change perception of the stock-recruitment dynamics greatly unless it sheds light on the likely production of recruits at levels of spawning stock below those previously observed. In such a case the addition of a single point may mean that, e.g., Floss becomes better defined. This should result in clearer evidence by which to judge the appropriateness of existing fishing mortality reference points in relation to the possibility of stock collapse. Under these circumstances it might be appropriate to propose revised values for fishing mortality reference points. For example, in the case of Celtic Sea (VIIf,g) sole, the appearance of an exceptional year-class in recent years has resulted (or will result) in a poorly-defined Floss (Sections 4.3). This has major implications for the F-reference points.

The PA reference points have been calculated as in previous years, using the PA-soft Excel add-in developed at the behest of SGPAFM. F0.1, Fmax and F35%SPR were also calculated using the MFYPR software. The runs used the same population starting values as the short-term catch prediction (i.e., N in 2005, Fs and weights-at-age based on 3-year means). The default settings used this year were a value for the span of the LOWESS smoother of 1.0, and the resample of residuals. Attention must be paid to the number of iterations, since the default proposes 100, which has been found to be too small; for most of the stocks a value of at least 500 iterations was used. As noted by ACFM, for some stocks, the LOWESS fit line showed a concavity, especially when a very few points are well below the others. The LOWESS fit must not be interpreted as a “true” SSB-R, but as it is, a fit used to provide residuals giving the uncertainty when predicting recruitment. The software outputs provide diagnostics regarding the fits of LOWESS smoothers: the interpretation of these is not always clear-cut and further guidance would be useful.

Stock history considerations

Candidate values were also considered in the context of the historical development of the stock (i.e. their relation to trends in SSB or R), to investigate whether any specific values could be associated with e.g. stock stability or decline. Limit reference points could thus be seen when the SSB-F plot shows evidence of reducing SSB at higher Fs. Similarly, Biomass reference points may be seen from the S-R plot, and the Bpa proposed as the threshold below which there is evidence of reduced R. [WGSSDS notes that the PA Study Group (SGPA) (ICES CM 2002/ACFM:10) considered that this threshold should in some cases be more properly considered as Blim.]

Furthermore, in some cases, where revisions of reference points were considered, each candidate value for Fpa was examined regarding the following considerations:

The probability that SSB would fall below Bpa between five and ten years (derived from medium-term projections - see below). The medium-term projections give an indication of the performance of the candidate Fpa in relation to this criterion. It should be noted that these probabilities will tend to be lower for stocks currently at a low level, as they are not independent of the starting populations.

The proportion of years in the historical series when F has exceeded the candidate value of Fpa. This gives an indication of the frequency with which management intervention would have been required assuming action would have been triggered by F exceeding Fpa.

1.4.4.2 Long-term management reference points

ACFM requested that the WG consider suitable reference point for long-term management for the stocks assessed by the WGSSDS. The general approach taken by the WG can be summarised as follows:

The yield per recruit relationship is essentially based on two components. The first is the relationship between growth and natural mortality in the stock. There appears to be an inherent linkage between natural mortality and longevity in natural populations based on the trade-off between current reproduction and future reproduction depreciated for natural mortality. For fast growing, early-maturing species natural mortality tends to be higher, whilst slow growing later-maturing species tend to have slower growth rates and more moderate mortalities. The second important factor is the presence of a suitable dome-shaped stock recruit relationship. The presence of such a relationship implies a compensatory mechanism, that allows for proportionally greater recruitment success at intermediate stock sizes, whereas recruitment is limited at high stock sizes through density-dependent processes, whilst at low stock sizes recruitment is substantially impaired by the limited number of available eggs.

For most of the stocks assessed by WGSSDS, there is no stock recruit relationship apparent. This does not imply that there are no compensatory mechanisms functioning in these stocks (although generally for flatfish the degree of compensatory mechanisms appears to be small), but they have not been observed over the range of stock size documented for the fisheries. For these stocks the yield per recruit curves generally imply an almost constant yield over a large range of F values (flat-topped) with Fmax being poorly defined. Despite the poor definition of the Fmax values the WG feels that the error associated with these values is small compared to the errors in F, so that a suitable rationale would be to use Fmax as the long-term management reference point, particularly as most stocks are currently exploited at F levels in excess of the estimated Fmax levels without apparent impairment of recruitment, and equilibrium SSB is in excess of current SSB values and previously determined Bpa or Blim values. The use of F0.1 in these cases is excessively precautionary, since the steepness of the yield per recruit curve at the outset means F0.1 (to 10% of the slope at the origin) is not indicative of the response of the stock. Around 10% of the yield is forgone in the case of sole VIIe for example without the benefit of having a substantially more stable yield or stock.

Cod VII e-k is the exception for the WG in that it is the only stock that has seen apparent responses to recruitment over the range of stock sizes observed. In these cases F0.1 appears to be much closer to Fmax than for stocks where no stock recruit relationship is implied and F0.1 might be considered as a suitable candidate management target

Stocks with developing fisheries (unexploited stock biomass), where neither the compensatory responses nor the relationship between mortality and growth are well defined, are unlikely to have reasonable definitions of Fmax. In these cases the fishery should be restricted such that only small increases in F are allowed each year (to avoid an overcapacity of the fleets and a degradation of the stock) until Fmax and a possible stock recruit relationship become more defined. Biomass reference points based on the lowest previously observed biomass are inconsistent with maximising yield, as these will tend to impair a safe and sustainable expansion of the fishery.

Management plans for recruitment over-fished stocks (most flatfish stocks assessed by WGSSDS) should place more emphasis on the way that F is reduced rather than on the actual final value for long-term management. As F is reduced SSB will increase, so that by definition SSB will return to values previously observed and assessed as safe by the WG. Reductions in F should be stepwise, in order not to drastically reduce yields in the initial period of recovery and cause unnecessary hardship in the fishery. The increase in SSB resulting from the initial reduction in F will then tend to compensate for the further losses in yield associated with further decreases in F. The WG considers that the steps should be greater than the precision of F estimates in the assessment in order that changes in F and SSB can be verified by managers. The management scenarios performed by the 2006 WG for sole and plaice in VIIe, and sole and plaice in VIfg have assumed steps in F reduction of roughly 10%, but in order to avoid sharp decreases in yield, F levels have been held for a number of years to allow SSB to increase prior to the next stepped reduction.

1.4.5 Request/problems with Software

WGSSDS welcomes the development of the Fisheries Library in R (FLR) and is aware of the potentials in using the different FLR packages.

Meanwhile the WGSSDS acknowledges the progress made in recent years in improving the software tools available for forecasting and medium-term projections. However, some problems still remain with these programs, and these are summarized below:

1) The short-term forecast and yield-per-recruit programs (MFDP and MFYPR) are relatively easy to use, and produce the required output, but construction of the input files remains time-consuming when discard fleets are modelled.

2) The medium-term programs appear in a variety of versions, some of which work with only a limited range of years.

3) The source of the data for the SEN file is not clear as its contents are not always as expected; e.g. for several stocks the CVs of numbers-at-age had to be overwritten manually as these were incorrect. This problem was noted and reported in previous years.

4) The rounding of recruit values could be problematic for stocks with low levels of recruitment.

5) SURBA multifleet runs only work out when all fleets start at the same age.

1.5 Working Documents

WD 1 – Methodological aspects for calculation of discarded catches. Derivation applied on missing years. Example of the Nephrops stock in FU20-22 (Celtic Sea; Management Area M). Statistical formulation and validation on sampled years.

Author(s): Spyros Fifas, Ifremer, Centre de Brest, B.P. 70, 29280 Plouzané, France, FR. 14 p.

Summary

The sampling onboard of both fleets (French and Irish trawlers) operating on the Nephrops stock in Celtic Sea remains scarce (long French time series with poor samples, short Irish time series). As the estimation of discards is substantial for accurate indices of recruitment (high discard rate), a derivation method was tested combining s-shaped curves of hand-sorting onboard by quarter and density of probabilities of discards. Even if the overall procedure of extrapolation is not yet validated, this method should be further investigated.

WD 2 – Trends in French fishing effort in ICES Division VIIfg / Impact of the Trevose closure?

Author(s): Alain Biseau. Ifremer, Lorient laboratory, FR. 10p

Summary

French fishing effort (time fishing) has been dramatically reduced over the 1999-2006 period by around 65% for the gadoids métiers.This reduction is mostly due to a decrease in the number of vessels involved rather than to a reduction in the mean fishing time per vessel. It is indubitable that the closure of the cod box has been a strong incentive to this reduction in effort and especially to those vessels which target gadoids.

WD 3 – Effects of 2005-2007 Trevose cod closure on UK demersal fleets

Author(s):Mike Armstrong, Peter Robinson, Andy South and Tom Woods. Cefas, Lowestoft Laboratory; UK; 26 p

Summary

1. The Trevose cod closure affects a small fleet of UK vessels using otter trawls, beam trawls, nets and lines. Many are inshore vessels <10m long. The total annual effort of vessels that have fished in the closure area since 2000 represents about a third of the total vessel-days for UK vessels operating in VIIe-k. Their cod landings represent about half the UK total for VIIe-k.
2. The UK fisheries catch a diverse range of species in the Southwest. Cod made up only 5% of the demersal catches of otter trawl, beam trawl and fixed net vessels in VIIf&g during 2000 – 2007, and 2.5% in VIIe-k.
3. During 2000 – 2004 (prior to the introduction of the closure), the closed rectangles yielded only 4 – 10% of the reported UK cod landings from VIIe-k. The total annual UK cod landings from VIIe-k comprised 6 – 11% of the international cod landings in this period.
4. The cod closure in 2005 – 2007 displaced UK vessels away from spawning aggregations of cod and into surrounding areas with typically lower catch-rates of cod. This must have reduced the overall efficiency of these vessels for catching cod.
5. Many vessels (particularly by beam trawlers from the UK and Belgium) fished close to the borders of the closed rectangles during the closure, and fished intensively inside the rectangles when they were re-opened. In 2007 it was noted that catch rates of sole were initially high on reopening but fell off rapidly. This may reflect dispersal from spawning grounds as well as the effects of fishing. In 2006 & 2007, cod had already dispersed by the time the rectangles were re-opened in April, and catch rates were relatively low.
6. In 2006, ICES (ACFM) recommended measures should be put in place to prevent effort increasing outside the closure. However, there is no clear evidence for a general increase in fishing effort (days fished) of UK vessels during the non-closure period to make up any shortfall in cod catches during the closure in 2005-2007.
7. The closure is likely to have resulted in a small (although positive) benefit for managing UK fishing activities in line with the quotas for cod since 2005. However, it is difficult to disentangle the benefits from other factors affecting trends in the fisheries throughout VIIe-k.
8. The closure on its own does not exclude enough UK fishing effort to achieve the relative reduction in fishing mortality advised by ICES but could contribute to a broader package of measures. Analyses carried out by IFREMER show that the major impact of the closure on cod appears to have been on activities of French vessels which take three quarters of the international cod landings.

WD 4 – Impact of the temporal closure of ICES rectangles 30E4, 31E4 and 32E3 (Celtic Sea) on the Belgian fishery behaviour.

Author(s): Wim Demaré

Summary: The working document looked at the impact of the closure on the fishery behaviour in the Belgian fishery. The main changes in fishery behaviour since the early 2000s were:

Due to effort limitations in the Eastern English Channel in 2004 and 2005, the number of Belgian vessels operating in the Celtic Sea increased during these two years.

The average number of hours fished per vessel decreased since the introduction of the temporal box closure in 2005. Belgian effort was also displaced mainly to periods just after the closure.

9 Belgian vessels (accounting for approximately 17.6% of the total kWdays in the Celtic Sea) were decommissioned between August 2005 and November 2006.

WD 5 – Cefas Fisheries Science Partnership (2006/07). Programme 6. Western Channel sole and plaice

Author(s): Beatriz Roel et al

Summary: The fisheries science partnership conducted cooperatively between CEFAS and the UK industry has provided some evidence for the wide dispersal and wide-ranging age distribution for this stock (CEFAS Fisheries Science Partnership Report. The age composition of catches was similar to the ICES forecast, suggesting that survey CPUE can be seen as proportional to the catch rates of the fishery. The trends in SSB throughout the timeseries are similar to the recent trends given in ICES data, and there has been a constant distribution pattern.

WD 6 – UK(E+W) Annual Data File for Cod in ICES area VIIe-k – 2006

Author(s): M Etherton (Cefas)

Summary: Annual data file.

WD 7 – UK(E+W) Annual Data File for Haddock in ICES area VIIe-k – 2006

Author(s): P Robinson (Cefas)

Summary: Annual data file.

WD 8 – UK(E+W) Annual Data File for Plaice in ICES area VIIe – 2006

Author(s): I Holmes (Cefas)

Summary: Annual data file.

WD 9 – UK(E+W) Annual Data File for Plaice in ICES area VIIf,g – 2006

Author(s): R Bush (Cefas)

Summary: Annual data file.

WD 10 – UK(E+W) Annual Data File for Plaice in ICES area VIIh,j,k – 2006

Author(s): B Harley (Cefas)

Summary: Annual data file.

WD 11 – UK(E+W) Annual Data File for Sole in ICES area VIIe – 2006

Author(s): R Humphreys (Cefas)

Summary: Annual data file.

WD 12 – UK(E+W) Annual Data File for Sole in ICES area VIIfg – 2006

Author(s): M Brown (Cefas)

Summary: Annual data file.

WD 13 – UK(E+W) Annual Data File for Sole in ICES area VIIh-k – 2006

Author(s): I Holmes (Cefas)

Summary: Annual data file.

WD 14 – UK(E+W) Annual Data File for Whiting in ICES area VIIe-k – 2006

Author(s): J Keable (Cefas)

Summary: Annual data file.

WD 15 – A summary of the Irish Fishery and sampling of Haddock VIIb-k in 2006

Author(s): S. Beattie, R. Fitzgerald, D. Fee, K. Foley, H. Gerritsen, O. Hanniffy, I. Hehir, S. Hoey, H. McCormick, S. J. Moore, G. Ní Chonchuir, S. O’Connor, N. Slattery, T. Smith, D. Stokes, M. Sullivan and F. Woods.

Summary: Annual data file.

WD 16 – A summary of the Irish Fishery and sampling of Whiting VIIe-k in 2006

Author(s): S. Beattie, R. Fitzgerald, D. Fee, K. Foley, H. Gerritsen, O. Hanniffy, I. Hehir, S. Hoey, H. McCormick, S. J. Moore, G. Ní Chonchuir, S. O’Connor, N. Slattery, T. Smith, D. Stokes, M. Sullivan and F. Woods.

Summary: Annual data file.

WD 17 – A summary of the Irish Fishery and sampling of Cod VIIe-k in 2006

Author(s): S. Beattie, R. Fitzgerald, D. Fee, K. Foley, H. Gerritsen, O. Hanniffy, I. Hehir, S. Hoey, H. McCormick, S. J. Moore, G. Ní Chonchuir, S. O’Connor, N. Slattery, T. Smith, D. Stokes, M. Sullivan and F. Woods.

Summary: Annual data file.

WD 18 – A summary of the Irish Fishery and sampling of Plaice VIIfg in 2006

Author(s): S. Beattie, R. Fitzgerald, D. Fee, K. Foley, H. Gerritsen, O. Hanniffy, I. Hehir, S. Hoey, H. McCormick, S. J. Moore, G. Ní Chonchuir, S. O’Connor, N. Slattery, T. Smith, D. Stokes, M. Sullivan and F. Woods.

Summary: Annual data file.

WD 19 – A summary of the Irish Fishery and sampling of Plaice VIIh-k in 2006

Author(s): S. Beattie, R. Fitzgerald, D. Fee, K. Foley, H. Gerritsen, O. Hanniffy, I. Hehir, S. Hoey, H. McCormick, S. J. Moore, G. Ní Chonchuir, S. O’Connor, N. Slattery, T. Smith, D. Stokes, M. Sullivan and F. Woods.

Summary: Annual data file.

WD 20 – A summary of the Irish Fishery and sampling of Sole VIIfg in 2006

Author(s): S. Beattie, R. Fitzgerald, D. Fee, K. Foley, H. Gerritsen, O. Hanniffy, I. Hehir, S. Hoey, H. McCormick, S. J. Moore, G. Ní Chonchuir, S. O'Connor, N. Slattery, T. Smith, D. Stokes, M. Sullivan and F. Woods.

Summary: Annual data file.

WD 21 – A summary of the Irish Fishery and sampling of Sole VIIh-k in 2006

Author(s): S. Beattie, R. Fitzgerald, D. Fee, K. Foley, H. Gerritsen, O. Hanniffy, I. Hehir, S. Hoey, H. McCormick, S. J. Moore, G. Ní Chonchuir, S. O'Connor, N. Slattery, T. Smith, D. Stokes, M. Sullivan and F. Woods.

Summary: Annual data file.

WD 22 – A summary of pre-WGSSDS 2007 discussions with the Irish Fishing Industry representatives

Author(s): C. Lordan

1.6 Type of assessment and Stock Annexes

The assessments under the remit of this group were classified according to the following principles.

Benchmark assessment: Critical analysis of the relevant aspects of the assessment process:

- availability, derivation and quality of input data
- which data are to be used in the assessment process
- model choice and settings (e.g. different structural models)
- methods for projection in short and medium term,
- basis for reference points

A benchmark assessment can focus on some of the aspects of the above list, according to the priorities for that stock. The benchmark assessment should conclude with a description of current practice in the Stock annex.

Update asssessment: Follow the methodology set out in Stock Annex:

- update all relevant time series
- apply agreed assessment model including short and medium term forecasts as appropriate
- limited exploration to check consistency

An update assessment should not be accepted with closed eyes. If the input data give unusual large differences in the stock development estimates this has to be looked into more closely. This would move the assessment from an update type to a benchmark type assessment.

Exploratory (Experimental) assessment: When analytical assessment have not been possible or have not been accepted by ACFM or by the WG (typical for situations where time series are in the building-up phase), exploratory assessments should focus on trying to compile and update indicators of stock trends or exploitation; e.g. total catches, survey trends, mean age/length in the catches, fishing effort, etc.

Trends only assessment: Only reporting of trends in e.g. landings

The WGSSDS schedule of assessments (modified at this meeting) is given below.

YEAR OF WG	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
VIIe sole	B	U	B	U	U	B
VIIe plaice	B	U	U	B	U	U
VIIe-k cod	B	B	B	B	U	U
VIIe-k whiting	U	U	B	B/E	U	U
VIIf,g sole	B	U	B	U	B	U
VIIf,g plaice	U	B	U	U	B	U
VIIb-k haddock	B	B	E	E	E	E
VIIh-k sole	T	T	T	T	E	E
VIIh-k plaice	T	T	T	E	B/E	U/E
Nephrops FU 20-22		B/E	B/E	U/E	U/E	U/E
VIIb,c sole	T	T	T	T	T	T
VIIb,c plaice	T	T	T	T	T	T

B **Benchmark assessment (usually with, but could be without a medium-term forecast depending on data series, quality concerns or stability of results)**

U **Update assessment**

E **Exploratory/experimental assessment**

T **Trends only assessment**

Stock Annex

The WG provided draft stock annexes following the outlines proposed by ICES in the Quality Handbook proposals. Annexes have been drafted for most stocks, and these will be further developed inter-sessionally.

In addition to the information proposed by ICES in the Stock Annex, WGSSDS considers that the following information would also be useful:

1) Charts showing spawning and nursery areas (if available);

2) Charts showing a time series of main fleet effort distribution;

3) Charts showing station positions for surveys used in the assessment;

4) A time series of biological sampling levels (and associated CVs if available).

ICES should consider whether fishery-based information should be repeated in all Stock Annexes for species involved in the fishery/area, or whether the information should appear once and be referenced in the rest.

1.7 Requests and recommendations:

1) The working group very much appreciated the input from WGFTFB on technical issues, and is aware that WGFTFB is making attempts to provide more quantitative information on this issue. The working group reiterates that quantification is necessary in order to make better use of this information. This could be done in further dialogue between the WG chairs at the AMAWGC meeting.

2) Other useful information that might be provided from WGFTFB, are gear selection curves for stocks with high discard rates. An overview of such curves by gear and area would allow the working group to compare gear and onboard crew selection profiles (See also section 4.2 and 4.5 for an example). The stocks under the remit of this working group with high discard rates are cod VIIe-k, haddock VIIb-k, whiting VIIe-k, plaice VIIfg and Nephrops FU20-22.

3) That the ‘misreporting problem’ is tackled at a higher level and that a framework is created in consultation with ICES, the European Commission and stakeholders that provides clear guidelines on how to include and use data on misreporting,

and with legal guarantees that these data will not be mis-used (e.g to prosecute countries).

4) The working group welcomed the work produced by the IBTS working group and notes the substantial progress that was made over the last years with regard to the output. That made it possible for the working group to make better use of the survey information. The establishment of a communication line between the assessment working groups and the survey working groups could further improve the exchange of information between both types of working groups and could help to clarify the specific needs and requests of assessment working groups to the survey working groups.

1.8 InterCatch

On day one of the Working Group, Henrik Kjems-Nielsen of ICES gave a short presentation on Intercatch web-based data aggregation tool being developed for use by ICES Working group stock co-ordinators. All Working group delegates were encouraged to re-format all nations data provided for 'their' stock(s) for data year 2006 (both Age composition and Landings only data).

Over the course of the Working Group exercises were undertaken to upload catch at age data and carry out data aggregation using Intercatch for three stocks (Celtic sea sole and plaice and cod in area VIIe-k). The task of creating input data files did not cause too many difficulties but it was clear to the WG delegates involved that an 'automated' method of getting their data into Intercatch format would be beneficial. However as each institute's data is held in different databases, a 'generic' formatting program would probably be inappropriate and perhaps each institute should investigate creating their own formatting programs appropriate to their data.

The upload did not present any problems for any of the three stocks and the aggregation of the stock data to International level was successfully carried out for two of these. It should be noted that for the three stocks tested, the aggregations were not complicated (e.g. missing quarter information in age distributions or landings). This does not mean that complicated aggregations are not possible or that it is deemed likely to give higher differences to the aggregation software currently in use. It simply means that the testing carried out at this meeting did not test these or indeed all variations in aggregation.

For Celtic Sea plaice (VIIf,g) the input date for 2006 comprised of:

- Quarterly catch at age data from Belgium, UK(E+W) and Ireland
- Quarterly landings data from France
- UK(E+W) data was raised to include France at the quarterly level and then the resulting annual UK+France data combined with similar annual data for Belgium and Ireland.

For Celtic Sea sole (VIIf,g) the input date for 2006 comprised of:

- Catch at age data and landings for 4 quarters from Belgium
- Catch at age data and landings for 4 quarters from UK(E&W)
- Landings for 4 quarters from Ireland
- Landings for 4 quarters from France
- A landings value for misreporting covering the whole year.

For Celtic Sea cod (VIIe-k) the input date for 2006 comprised only a trial file:

- French catch at age data and landings for Quarter 1 2006 successfully load
- No aggregation was carried out for the VIIb-k cod stock.

The table below shows the differences found from the aggregation of the two Celtic Sea stocks using 2006 input data.

The Working Group does have a number of concerns about these results. Even though the % differences could be considered as small and have been described as ‘due to rounding’ differences between Intercatch and the traditional software used, the Working Group would like to see an explanation of where these rounding differences are occurring.

The Working Group delegates also commented on the usability of the Intercatch software in relation to the aggregation tasks they routinely have to carry out. Intercatch currently has no facility to use the resultant international ‘observed’ weights-at-age data to calculate ‘fitted’ and ‘smoothed’ catch and stock weights-at-age data required as inputs into most stock assessments. In addition, for the tested VIIf,g sole stock – there is currently no facility for aggregating data for a ‘single’ quarter to be run and subsequently used for stock weights-at-age calculation.

The facility to update ‘previous’ years datasets with revisions appears to require modification. It appears that in order to revise a data year for a stock, all data (not just the revised data) need to be formatted and uploaded again. Given the recent trend in moving assessment Working Groups to earlier in the calendar year, revisions to data will become more common-place. For this reason, the procedure for making revisions needs to become more ‘stream-lined” which would also would imply that the revision process should be logged and transparent. It was also noted that for the moment data has to be uploaded by country and by year separately which is, to a lesser extend also impractical.

The WG considered that to support the stock assessment process a suitably open data model be developed. Currently Intercatch is only suitable for data aggregated at a relatively high level. The WG is aware that several countries are investigating the use of fishframe which is populated with data at a lower level of aggregation. The most important consideration is that all data to support future assessment and advisory requirements are integrated in a relational database to avoid duplication and allow dynamic updating of data.

It was further decided that national datasets for the remaining stocks from WGSSDS will be uploaded into Intercatch after the this year’s meeting.

Plaice Celtic Sea

CATON

	XLRAISE2	InterCatch
	402.728	403

CANUM

Age	XLRAISE2	InterCatch	Diff %
1	12193	12191	0.02%
2	331085	331027	0.02%
3	457555	457553	0.00%
4	139388	139388	0.00%
5	133369	133369	0.00%
6	75316	75317	0.00%
7	50056	50052	0.01%
8	12180	12180	0.00%
9	6224	6222	0.04%
10	4576	4578	-0.04%
11	3355	3358	-0.09%
12	541	541	-0.05%
13	244	244	0.20%
14	24	24	-0.02%
15	123	122	1.08%

WECA	kg	g	
Age	XLRAISE2	InterCatch	Diff %
1	0.238	238	-0.01%
2	0.246	246	0.00%
3	0.291	291	0.00%
4	0.339	339	-0.02%
5	0.386	386	0.01%
6	0.513	513	0.01%
7	0.549	549	0.01%
8	0.637	637	0.02%
9	0.718	718	-0.02%
10	0.786	786	0.05%
11	0.976	975	0.03%
12	1.217	1217	0.00%
13	1.777	1777	0.01%
14	2.302	2302	0.01%
15	1.440	1444	-0.28%

Sole Celtic Sea

CATON

	Fishbase	InterCatch
	946.374	946

CANUM	000s		
Age	Fishbase	InterCatch	Diff %
1	28.437	28438	0.00%
2	697.305	697211	0.01%
3	1354.012	1353898	0.01%
4	728.115	728053	0.01%
5	586.065	585986	0.01%
6	165.549	165512	0.02%
7	150.563	150537	0.02%
8	180.841	180780	0.03%
9	44.375	44372	0.01%
10	23.114	23107	0.03%
11	10.449	10448	0.01%
12	5.913	5910	0.05%
13	4.178	4177	0.03%
14	2.010	2010	-0.02%
15	6.292	6288	0.06%

WECA	kg	g	
Age	Fishbase	InterCatch	Diff %
1	0.130	130	0.05%
2	0.149	148	0.85%
3	0.173	173	0.03%
4	0.246	246	0.11%
5	0.290	290	-0.15%
6	0.397	398	-0.19%
7	0.438	438	-0.06%
8	0.392	393	-0.17%
9	0.468	471	-0.59%
10	0.579	580	-0.16%
11	0.550	550	-0.08%
12	0.729	729	-0.02%
13	0.671	674	-0.52%
14	0.833	835	-0.21%
15	0.738	739	-0.15%

1.9 PGCCDBS – issues of relevance to WGSSDS

There major issues in the PGCCDS report that were of relevance to WGSSDS are summarized and commented on below.

- Comments on working group recommendations and relevant data deficiencies and needs for improvement of data (Table 3.4 in the PGCCDBS report) with regard to discard data collection and discard raising procedures.

  The working group was made aware of the WKDRP report on discard raising procedures.

  For most stocks under the remit of WGSSDS, a sampling programme for the collection of discard data has now been established (see also overview table under section 1.3.2 of this report).

  The main problem remains the inclusion of the discard data into the assessments.

- Table 4.1 gives details of the maturity data used by the AWGs. As is shown in the table, it is recommended for the AWGs to specify maturity data requirements that could be taken into account by PGCCDBS and the RCMs in order to make collected data available for the AWGs.

  WGSSDS uses a mixture of maturity ogives and knife-edge maturity for the assessment of the different stocks. For all stocks maturity remains fixed over time.

The impact of this assumption was not investigated during the working group. However, the incorrect use of maturity will affect the derivation and understanding of stock recruit relationships as well as affecting perception of the state of the spawning stock. Therefore, WGs should have an idea on the variability of maturity data. Additionally, one needs to consider how to incorporate variable maturity data in assessments. Once this exercise is carried out, one could analyse how frequently the maturity data need to be updated (e.g. annual, every five years, …)

- The need for further otolith exchanges and age reading workshops was reported by some AWGs, in order to resolve observed discrepancies in ageing data. PGCCDBS recommends the establishment and/or extension of several otolith exchanges and age reading workshops (Table 6.1). Please update this information for your AWG and send to us.

The working group notes that there have been otolith exchanges and/or are reading workshops for sole, plaice, cod, haddock and whiting recently. For sole, plaice and haddock the ageing performance was good, for whiting it was medium/good. The results of the Celtic Sea cod exchange are not available yet. All WGSSDS stocks for which age readings occur have been subject to intercalibration exercises recently. Therefore the working group does not feel a need for exchanges on any of the WGSSDS stocks for the immediate future.

Acknowledgements

The WG is grateful for the good facilities and arrangements of the new ICES headquarters, and thanks the ICES secretariat for compiling the report. The WG chair also thanks the WG participants for their sincere devotion to this working group.

Table 1.3.1. Biological sampling levels by stock and country		COD		WHG		NEP	PLE				SOL				HAD
		VIIb,c	VIIe–k	VIIb,c	VIIe–k	FU 20-22	VIIb,c	VIIe	VIIf,g	VII h-k	VIIb,c	VIIe	VIIf,g	VII h-k	VIIb–k
Belgium	No. lengths (landings)								4090				8730		
	No. ages (landings)								570				985		
	No. samples (landings)*														
	No. lengths (discards)														
	No. ages (discards)														
	No. samples (discards)'														
E & W (UK)	No. lengths (landings)		6645		7556			26961	6177			19711	8390		2813
	No. ages (landings)		1194		590			2645	1138			2971	1536		291
	No. samples (landings)*		116		74			179	57			144	56		32
	No. lengths (discards)		N/A		N/A			N/A	N/A			N/A	N/A		N/A
	No. ages (discards)		N/A		N/A			N/A	N/A			N/A	N/A		N/A
	No. samples (discards)'		N/A		N/A			N/A	N/A			N/A	N/A		N/A
France	No. lengths (landings)		2609		8089	8892		767				3177			2423
	No. ages (landings)		1136		1485							775			948
	No. samples (landings)*		34		27	47		11				87			12
	No. lengths (discards)		812		2010				426				0		16481
	No. ages (discards)		0		0				0				0		0
	No. samples (discards)'		128		72				47				61		140
Ireland	No. lengths (landings)	108	6326	164	17581	26745	128	0	7459	6237	0	0	4732	5907	13646
	No. ages (landings)	69	1796	46	1960		0	0	480	334	0	0	64	396	2359
	No. samples (landings)*	2	156	3	135		1	0	85	47	0	0	56	37	174
	No. lengths (discards)		32	221	136		5	0	2	60	2	0	0	3	423
	No. ages (discards)	0	7	54	56		0	0	1	64	0	0	0	1	289
	No. samples (discards)*	3	7	3	7		3		2	5	3		2	5	10
	No. lengths (catches)					20576									
	No. ages (catches)														
	No. samples (catches)*					26									
Total	No. lengths (landings)	108	15580	164	33226	35637	128	27728	17726	6237	0	22888	21852	5907	18882
	No. ages (landings)	69	4126	46	4035	0	0	2645	2188	334	0	3746	2585	396	3598

	No. lengths (discards)	0	N/A	221	N/A	0	5	N/A	N/A	N/A	2	N/A	N/A	N/A	N/A
	No. ages (discards)	0	N/A	54	N/A	0	0	N/A	N/A	N/A	0	N/A	N/A	N/A	16904
Annual number landed (Thousands)		N/A	1230	N/A	22500	150569	N/A	3160	1214	369	N/A	3065	3890	N/A	8129
% measured of annual number caught		N/A	1.27%	N/A	0.15%	0.02%	N/A	0.88%	1.46%	1.69%	N/A	0.75%	0.56%	N/A	0.23%
Annual number discarded (Thousands)		N/A	N/A	N/A	N/A	59671	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10082
% measured of annual number caught		N/A	N/A	N/A	N/A	0.00%	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.17%

* Number of vessels sampled, ** Number of categories sampled, ' Number of hauls sampled, N/A = not available

Table 1.3.2 Sources of biological data

Stock		natural mortality	maturity ogive	weight at age in catch	weight at age in stock
Cod	VIIb,c	-	-	-	-
	VIIe-k	assumed	research vessel	Qtrly (Cn-weighted mean)	Quarter 1 (or Q2 if data sparse)
Whiting	VIIb,c	-	-	-	-
	VIIe-k	assumed	research vessel (fixed vector)	Qtrly (Cn-wgtd mean, quad fit)	Quarter 1 (or Q2) CWTs smoothed 3 year average
Nephrops	FU 20-22	assumed	knife edge at 3	Age slicing	Age slicing
Plaice	VIIb,c	assumed	-	Qtrly (Cn-weighted mean)	Quarter1, quadratic smooth
	VIIe	estimated (VIIa)	research vessel VIIf,g	Qtrly (Cn-wgtd mean, quad fit)	Annual fitted (quadratic) interpltd to 1 jan
	VIIf,g	estimated (VIIa)	research vessel VIIf,g	Qtrly (Cn-wgtd mean, quad fit)	Annual fitted (quadratic) interpltd to 1 jan
	VII h-k	assumed	-	Qtrly (Cn-weighted mean)	Quarter 1 CWTs smoothed 3 year average
Sole	VIIb,c	assumed	-	Qtrly (Cn-weighted mean)	Quarter 1 (or Q2) CWTs smoothed 3 year average
	VIIe	assumed	research vessel VIIf,g	Qtrly (Cn-wgtd mean, quad fit)	Annual fitted (quadratic) interpltd to 1 jan
	VIIf,g	assumed	research vessel VIIf,g	Qtrly (Cn-wgtd mean, quad fit)	Quarter 1, quadratic smooth
	VII h-k	assumed	-	Qtrly (Cn-weighted mean)	Quarter1, quadratic smooth
Haddock	VIIb–k	assumed	knife edge at 2	Qtrly (Cn-weighted mean)	3-year running average

Table 1.3.3a Fleet acronyms (surveys)

Fleet	Acronym	Vessel	area	period	Target	Used for
UK West Coast Groundfish Survey (units of effort can vary from stocks to stocks)	UK-WCGFS	*Cirolana*	VIIe-j and VIIIa	March	Demersal + Pelagic	Cod VIIe-k Whiting VIIe-k Haddock VIIb-k
UK Bristol Channel & Celtic Sea Beam Trawl Survey (September)	UK-BCCSBTS-S	*Corystes*	VIIfg	September	Flatfish	Whiting VIIe-k Sole VIIfg Plaice VIIfg
UK Bristol Channel & Celtic Sea Beam Trawl Survey (March)	UK-BCCSBTS-M	*Corystes*	VIIfg	March	Flatfish	Not used
UK Western English Channel Beam Trawl Survey	UK-WECBTS	*Carhelmar (commercial)*	VIIe	September-October	Flatfish	Sole VIIe Plaice VIIe
	UK - FSP	*Commercial*	VIIe		Flatfish	Sole VIIe Plaice VIIe
Irish West Coast Groundfish Survey	IR-WCGFS	*Shauna Ann (commercial)*	VIa, VIIb and VIIj	October-November	Demersal + Pelagic	Haddock VIIb-k Sole VIIh-k
Irish Sea Celtic Sea Groundfish Survey	IR-ISCSGFS	*Celtic Voyager*	VIIa and VIIg	October-November	Demersal + Pelagic	Cod VIIe-k (only VIIg prime stations included), Haddock VIIb-k
Irish Groundfish Survey	IR-IGFS	*Celtic Explorer*	VIIa, VIIg, VIIj, VIIb, VIa	October-November	Demersal + Pelagic	Whiting VIIe-k Cod VIIe-k, Haddock VIIb-k, Plaice VIIh-k
Irish Groundfish Survey Swept Area	IR-IGFS Swept Area	*Celtic Voyager 99-2002* *Celtic Explorer after 2003*	VIIg,	October-November	Demersal + Pelagic	Whiting VIIe-k, Haddock VIIb-k
French EVHOE Survey	FR-EVHOE-S	*Thalassa*	VIIefghj+VIIIab	October-November	Demersal	Cod VIIe-k Whiting VIIe-k Haddock VIIb-k

Table 1.3.3b Fleet acronyms (commercial)

Fleet description	Acronym	Gear	Area	Target	Used for
UK (E+W) Inshore beam trawl fleet– historic (1973-87)	UK-Inshore-Commercial	Beam trawlers	VIIe	Flatfish	Sole VIIe
UK (E+W) Offshore beam trawl fleet– historic (1973-87)	UK-Offshore-Commercial	Beam trawlers	VIIe	Flatfish	Sole VIIe
UK(E+W) <24 Beam trawlers	UK-WEC<24BT	Beam trawlers	VIIe	Flatfish	Not used
UK(E+W) >24 Beam trawlers	UK-WEC>24BT	Beam trawlers	VIIe	Flatfish	Not used
UK (E+W) VIIe Otter trawlers	UK-WECOT	Otter trawlers	VIIe	Demersal	Plaice VIIe Sole VIIe Cod VIIe-k
UK (E+W) VIIe Otter trawlers – historic (1976-1987)	UK-WECOT-H	Otter trawlers	VIIe	Demersal	Plaice VIIe
UK (E+W) VIIf Otter trawlers	UK-CSOT	Otter trawlers	VIIf	Demersal	Plaice VIIfg
UK (E+W) VIIe Beam trawlers	UK-WECBT	Beam trawlers	VIIe	Flatfish	Plaice VIIe Sole VIIe
UK (E+W) VIIf Beam trawl	UK-CSBT	Beam trawlers	VIIf	Flatfish	Sole VIIfg Plaice VIIfg

Table 1.3.3b Continued

Belgium beam trawlers	BEL-BEAM	Beam trawlers	VIIfg	Flatfish	Sole VIIfg
Irish Otter Trawl	IR-OT	Otter trawlers	VIIb VIIj	Demersal	Sole VIIh-k
Irish VIIj Otter Trawl	IR-7J-OT	Otter trawlers	VIIj	Demersal	Cod VIIe-k
Irish Combined VIIb,j Otter Trawl	IR-7B&J-OT	Otter trawlers	VIIb,j	Demersal	Haddock VIIb-k
Irish Combined VIIg,j Otter Trawl	IR-7G&J-OT	Otter trawlers	VIIg,j	Demersal	Whiting VIIe-k Haddock VIIb-k
IR-Demersal Directed OLD OTB	IR-Demersal Directed OLD OTB	Otter trawlers (sub-set of older vessels)	VIIj	Demersal	Plaice VIIh-k
French Lorient gadoids trawlers	FR-LORIENT	Otter trawlers	VIIfg	Gadoids	Not used
French *Nephrops* trawlers St Guénolé & Loctudy	FR-St G & L	Otter trawlers	VIIfg	*Nephrops*	Whiting VIIe-k
French Gadoids trawlers	FR-GADOIDS	Otter trawlers	VIIfgh	Gadoids	Cod VIIe-k Whg VIIe-k Had VIIb-k
French *Nephrops* trawlers	FR-NEPHROPS	Otter trawlers	VIIfgh	Nephrops	Cod VIIe-k

Table 1.3.4 Summary of current and past assessment practices

Stock		2007	2006	2005	2004	2003	2002	2001
Cod	VIIb,c	none	None	none	none	none	none	none
	VIIe–k	XSA Benchmark	XSA Benchmark	XSA Benchmark	XSA Benchmark	XSA Benchmark	XSA Benchmark	XSA Benchmark
Whiting	VIIb,c	none	none	none	none	none	none	none
	VIIe–k	XSA Exploratory	XSA Benchmark	XSA Update	XSA Update	XSA Benchmark (-m/term)	XSA Benchmark	XSA Benchmark
Nephrops	FU 20-22	Update	Benchmark	C@A Benchmark				
Plaice	VIIb,c	none	none	none	none	none	XSA Tentative	XSA Tentative
	VIIe	XSA Benchmark	XSA Update	XSA Update	XSA Benchmark	XSA Update	XSA Update	XSA Benchmark
	VIIf,g	XSA Update	XSA Update	XSA Benchmark	XSA Update	XSA Update	XSA Benchmark	XSA Benchmark
	VII h-k	XSA Exploratory	none	none	none	none	XSA Tentative	XSA Tentative
Sole	VIIb,c	XSA	none	none	none	none	XSA Tentative	XSA Tentative
	VIIe	XSA Update	XSA Benchmark	XSA Benchmark	XSA Benchmark	XSA Benchmark	XSA Benchmark	XSA Benchmark
	VIIf,g	XSA Update	XSA Benchmark	XSA Update	XSA Benchmark	XSA Benchmark	XSA Benchmark	XSA Benchmark
	VII h-k	none	none	none	none	XSA Tentative	XSA Tentative	XSA Tentative
Haddock	VIIb–k	XSA Exploratory	XSA Benchmark/ tentative	XSA Benchmark (-m/term)	XSA Benchmark (-m/term)	XSA Benchmark (-m/term)	XSA Benchmark (-m/term)	XSA Benchmark as Tent

Table 1.3.5 SOUTHERN SHELF DEMERSAL WORKING GROUP : 2007

Summary of stock assessments and catch predictions

STOCK	ASSESSMENT				RECRUITMENT				LONG TERM				STATUS QUO PREDICTION						B_{pa}	F_{pa}
		2006			Year-class				AM	Fmed	Fmax	AM	Fsq	2007		2008		2009		
	BASIS	LAND'S	F	SSB	2004	2005	2006	2007	Rec			SSB		LAND'S	SSB	LAND'S	SSB	SSB		
SOLE VIIe	XSA	958	0.43	2308	4803	4373*	4373*	4373*	4587	~	0.29	3561	0.45	900	2270	928	2258	2201	2800	0.20
PLAICE VIIe	XSA	1261	0.76	1640	4981	4295	3906#	3906#	~	~	0.22	~	~	~	~	~	~	~	~	~
COD VIIe-k	XSA	3317	0.58	4228	2445	1371	1633#	1633#	4098		0.33	10223	0.75	3853	5154	3483	4611	4444	8800	0.68
WHITING VIIe-k	XSA	9515	0.68	23689	41469	46626	56700*	56700*	78930	~	~	36395	0.62	8616	23153	9035	2479	26554	21000	~
SOLE VIIf,g	XSA	946	0.33	2576	4685	3888	4913*	4913*	5185	~	0.23	3358	0.33	944	2871	916	2808	2698	2200	0.37
PLAICE VIIf,g	XSA	403	0.29	1110	3241	2242	3022#	3022#	4631	~	0.28	1940	0.41	587	1328	593	1413	1473	1800	~
HADDOCK VIIb-k	XSA	5378	0.67	17694	45604	65279	16861	~	~	~	~	~	~	~	~	~	~	~	~	~
SOLE VIIh-k ¬	—	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
PLAICE VIIh-k ¬	XSA	147.00	0.49	328.00	316.00	1146*	1146*	1146*	~	~	~	~	~	~	~	~	~	~	~	~
NEPHROPS FU 20-22	C@A	4256.00	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
COD VIIb.c	—	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
WHITING VIIb,c	—	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
SOLE VIIb,c ¬	—	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
PLAICE VIIb,c ¬	—	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~

Notes : Landings & SSB in tonnes, recruitment in thousands.

Recruitment : XSA values unless annotated :

* Assumed GM

\# GM over recent period

Table 1.4.1 Sensitivity analysis - key to variable names: numerals apply to age groups or, where relevant, years.

N1	population number at age 1
WS1	stock weights at age 1 in prediction
WH1	catch weights (landings) at age 1 in prediction
WD1	catch weights (discards) at age 1 in prediction
M1	natural mortality at age 1
MT1	proportion mature at age 1
sH1	selectivity (human consumption fleets) at age 1
sD1	selectivity (discards) at age 1
K06 – K07	year effect on natural mortality in predicted year (2006 and 2007)
HF06 – HF07	year effect on (landings and discards) fishing mortality in 2006 and 2007
R06 – R07	recruitment in 2006 and 2007

2 Overview

2.1 Fisheries

The stocks under the remit of this working group are cod, haddock, whiting, sole and plaice in ICES Divisions VIIbc,e-k, and *Nephrops* in FU20-22. These demersal stocks are mainly fished by beam trawlers, demersal seiners, gill netters and otter trawlers. The main countries exploiting these demersal stocks are Belgium, France, Ireland and the United Kingdom. Spain is also active in this region, but mainly targets other species such as hake, anglerfish and megrim. Therefore Spain is not included in this overview of the fisheries in ICES Divisions VIIbc,e-k. Consequently the effort descriptions that are given below are restricted to these four countries. More details on Spanish fisheries in the area can be found in the WGHMM report.

2.1.1 Effort

The major gears by ICES Division used by Belgium, France, Ireland and the United Kingdom are summarized in Table 2.1.1. The overview is restricted to the 5 main gears used in the area, i.e. beam trawlers (TBB), demersal seiners (SX), gill netters (GN), otter trawlers (OTX) and *Nephrops* trawlers (TBN). Other gears such pots and creels, longlines, etcetera are also operational in the area, but landings of WGSSDS stocks by these gears are negligible.

Effort series for the four countries are presented in Figures 2.1.1 – 2.1.13. Effort is always given in fishing hours. The working group decided not to present any gill net effort in these figures since there is no straightforward and common agreed method to calculate effort for gill netters.

Total effort by ICES division and gear since 1999, is presented in Figure 2.1.1. Since 1999 effort has mainly decreased in VIIfg and VIIjk. In the other areas effort increased or remained more or less stable. Fishing activity of demersal gears in the Southern Shelf area is the highest in ICES Divisions VIIfg and VIIe.

Figures 2.1.2 – 2.1.7 summarize the effort by gear type. The main gear type used in all ICES Divisions VIIbc,e-k is the otter trawler. Note that a considerable amount of effort could not be attributed to any type of gear (N_A in the figures). This is mainly coming from French vessels operating in VIIe. It is believed that these vessels use mostly otter trawlers. Beam trawlers operate predominantly in ICES Divisions VIIe and VIIfg, and to lesser extent in VIIh. The main fishing activity of *Nephrops* trawlers is in ICES Divisions VIIfg and to a lesser extent in Divisions VIIbc, VIIh and VIIjk. Effort of demersal seiners is low compared to the other gear types.

Figures 2.1.8 – 2.1.13 give the effort by country. Since 1999, French vessels fished between 0.9 and 1.1 million hours in ICES Divisions VIIbc,e-k, Ireland and the United Kingdom fished between 0.2 and 0.4 million hours and Belgium fished less than 0.1 million hours. The Belgian fleet is mainly active in Divisions VIIfg. French vessels operate over the entire area VIIbc,e-k, but mostly in Divisions VIIe, VIIfg and VIIh. Since 1999, French effort in VIIfg has declined. The current French effort in that area is now almost halved compared to 1999. Irish effort is divided over areas VIIbc, VIIfg and VIIjk. Since 2003, some Irish vessels that used to operate in Divisions VIIjk moved their effort partly to Divisions VIIfg. That explains the decrease in overall effort in VIIbc compared to the increase in effort in VIIfg since 2003. Finally, the UK is also active over the entire area, with the highest effort levels in Division VIIe.

2.1.2 WGFTFB comments

The WGFTFB report (ICES, WGFTFB 2007) “outlines a number of technical issues relating to fishing technology that may impact on fishing mortality and more general ecological impacts”. Specific issues with regard to certain fisheries are discussed in the relevant stock sections under 'recent trends in the fishery' and/or under 'management considerations'. General issues described by WGFTFB and applicable to this working group are given below.

Fleet Dynamics (taken over from the WGFTFB 2007 report)

The overall picture from the questionnaires in 2007 is that the strong signals on fuel cost and reduced days from last year are not as apparent as fleets seemed to have adapted to these. The trend now is one of many small-scale changes and initiatives, with a lot of evidence of fishermen trying out new fisheries. Specific examples of such changes in fleet dynamics include the following:

- Two of the largest Irish whitefish vessels have shifted effort from deepwater species in VIa and VIIb-k to the mixed demersal fisheries at Rockall (VIb). In addition 4–5 other Irish vessels have also increased effort in the Rockall fishery, moving from the mixed demersal fisheries in Areas VIIb-k.
- French vessels have switched from anchovy and tuna pelagic trawling to monkfish bottom trawling in recent years.
- Only Ireland seems to have a targeted decommissioning scheme currently in operation and in some countries, notably Sweden, numbers of vessels have actually increased.

Technology Creep

The effects of technological creep are still evident in many fisheries; with vessels becoming more efficient and targeted in their approach e.g. the use of new instrumentation on nets and in navigation have been introduced, notably for door attitude and for control of purse seines. These are believed to have given a small (10%) increase in efficiency. There is increased use of trawls with increased groundgear coverage in Scotland in Nephrops and whitefish fisheries using double bag trawls that give approximately 33% increases in catch efficiency. Similar trawls have been introduced into the Faeroese monkfish fishery with trawls with 50% more ground coverage. The concept of “negative” technological creep reported last year is still evident. There has been definite shift from beam trawling by Dutch and Belgium vessels to more fuel-efficient methods or alternative beam trawl riggings and particularly the use of “outrigger” trawls. An increase in the Swedish Nephrops creel fishery in the Eastern Skagerrak since trawling was banned in the area is also reported.

Technical Conservation Measures

In a number of fisheries there is some evidence of limited voluntary uptake of TCMs. Motives for uptake are mixed, including days at sea, national regulations, improved quality and local pressure but the overall impacts are probably still small. Specific examples include:

- The UK beam trawl fleet in the southwest is now using benthic release panels. Research shows that these release about 75% of benthic invertebrates from the catches and there are indications that they also release small monkfish.

Ecosystem Effects

Ghost fishing in a number of areas including the deepwater fisheries in Areas VIb and VII b,c and the Baltic remains a problem. There are also recent reports from Norway of a growing ghost net problem in the Tampen Bank Area of Area IVa. Retrieval surveys are now being carried out in these areas but the scale of the problem still remains unknown. There are also repeated claims by Irish fishermen of the widespread use of 100mm mesh gillnets for hake, which are illegal in Area VII but legal in Area VIII. Irish vessels have recovered many such nets and several vessels have been arrested.

A number of measures have been taken by Belgium and UK beam trawl fleets to reduce ecosystem impacts, through a combination of reduction in discards through the use of T90 codends; benthos bycatch from benthic release panels and reduced bottom impact from experimental roller gear, usage of outrigger trawls instead of beam trawls with chain mats. Research into low impacts gears is also reported in Norway, the Netherlands and the Faroe Islands and the motivation in many cases is due to increasing consumer and NGO demands specifically targeting trawling and beam trawling, and the development of low impact gears is likely to increase further.

Development of New Fisheries

As with last years report there are very few examples of new fisheries being developed given that most species are exploited to some degree, but there are several specific examples reported as follows:

- Beam trawlers from the UK are targeting cuttlefish (Sepia spp.) in mainly the Eastern English Channel. There has been an effort shift (<5%) of the fleet (rough estimates: 10 vessels). Landings in 2004: 974 tonnes; 2005: 694 tonnes; 2006: unknown but probably more than 2005. Best catches are expected in period November – February.
- One 24m Irish whitefish vessel targeted John Dory in ICES Area VIIg during July – August 2006 using standard rockhopper trawls. The vessel was catching up to 300–400kg of Dory per tow and landing up to 3–4 tonnes for 5–7 day trips with a mixture of lemon sole, mixed flatfish, hake.

2.1.3 Closure of ICES rectangles 30E4, 31E4 and 32E3.

Three working documents on the temporal closure of ICES rectangles 30E4, 31E4 and 32E3 were available at the time of the working group. Another document on this topic was send around just after the working group finished. These working documents looked at the impact of the closure on the behaviour of the Belgian, French, Irish and UK fleets, rather than at the impact on the status of the cod stock. Since there is lot of interest in knowing the effects of the closure, these working documents have been attached to the working group report as Appendixes 1 to 4. The text below is a summary of these documents, sometimes adjusted with extra information.

Introduction (copied from WD4, Demaré 2007)

In 2004 French, Irish and UK fisheries organisations sat together to work out a plan for the reduction of fishing mortality on Celtic Sea cod. There initial aim was to reduce fishing mortality on cod by 20% by means of temporal closures. After a round of consultations with scientists the industry proposed to close three rectangles in the Celtic Sea during the first quarter of 2005. On average these rectangles accounted for 18% of the Celtic Sea cod landings.

The European authorities welcomed the initiative from the industry and have introduced temporal closures in the Celtic Sea since. During the first quarter of 2005 three rectangles in the Celtic Sea (30E4, 31E4 and 32E3) were closed for fishing except for vessels using pots and creels, or nets with mesh size less than 55mm. During March 2005, derogation was also given to beam trawlers. During February and March 2006 and 2007, the same three rectangles in the Celtic Sea were closed for fishing except for vessels using pots and creels, or nets with mesh size less than 55mm.

Impact of the closure on the fishery behaviour

Effects on the Belgian beam trawl fleet (WD 4 and Appendix 3, Demaré, 2007)

The main changes in the Belgian fleet behaviour/structure in the Celtic Sea since the early 2000s are:

- Due to effort limitations in the Eastern English Channel in 2004 and 2005, the number of Belgian vessels operating (and the total effort) in the Celtic Sea increased during these two years.
- The average number of hours fished per year per vessel decreased since the introduction of the temporal box closure in 2005. Belgian effort was also displaced mainly to periods just after the closure.
- 9 Belgian vessels (accounting for approximately 17.6% of the total kWdays in the Celtic Sea) were decommissioned between August 2005 and November 2006.

The direct impact of the closure on the fishery behaviour of the Belgian beam trawl fleet is mainly the displacement in effort in space and (predominantly) in time (but not on the overall effort). After all two of the closed rectangles are major flatfish fishing grounds, the target species for the Belgian beam trawlers (See also point 5 under Effects on the UK demersal fleets).

Catch rates of cod for the Belgian beam trawlers are traditionally the highest in rectangle 30E4 in March. Closing that rectangle in March (as is the case since 2006), does have an impact on the efficiency of cod catches for the Belgian beam trawlers. But knowing that the Belgian beam trawlers account on average for < 5% of the total international cod landings, this will probably have only minor effect on the total fishing mortality of cod.

Effects on the French demersal fleets (WD2 and Appendix 1, Biseau, 2007)

French fishing effort (time fishing) has been dramatically reduced over the 1999-2006 period by around 65% for the gadoids métiers. This reduction is mostly due to a decrease in the number of vessels involved rather than to a reduction in the mean fishing time per vessel.

Although the effort reduction was already initiated before the closure was in place, it is indubitable that the closure of the cod box has been a strong incentive to a further reduction in effort and especially to those vessels which target gadoids.

Effects on the Irish demersal fleets (Appendix 4, Lordan, 2007)

A preliminary analysis of the impact of the closed rectangles in the Celtic Sea on Irish landings and effort showed that the closed rectangles have had limited impact on the Irish fishing activity since 2005. It was also evident that the relative importance of these rectangles to overall Irish landings has never been particularly high.

Effects on the UK demersal fleets (WD3 and Appendix 2, Armstrong et al. 2007)

1) The Trevose cod closure affects a small fleet of UK vessels using otter trawls, beam trawls, nets and lines. Many are inshore vessels <10m long. The total annual effort of vessels that have fished in the closure area since 2000 represents about a third of the total vessel-days for UK vessels operating in VIIe-k. Their cod landings represent about half the UK total for VIIe-k.

2) The UK fisheries catch a diverse range of species in the Southwest. Cod made up only 5% of the demersal catches of otter trawl, beam trawl and fixed net vessels in VIIf&g during 2000 – 2007, and 2.5% in VIIe-k.

3) During 2000 – 2004 (prior to the introduction of the closure), the closed rectangles yielded only 4 – 10% of the reported UK cod landings from VIIe-k. The total annual UK cod landings from VIIe-k comprised 6 – 11% of the international cod landings in this period.

4) The cod closure in 2005 – 2007 displaced UK vessels away from spawning aggregations of cod and into surrounding areas with typically lower catch-rates of cod. This must have reduced the overall efficiency of these vessels for catching cod.

5) Many vessels (particularly by beam trawlers from the UK and Belgium) fished close to the borders of the closed rectangles during the closure, and fished intensively inside the rectangles when they were re-opened. In 2007 it was noted that catch rates of sole were initially high on reopening but fell off rapidly. This may reflect dispersal from spawning grounds as well as the effects of fishing. In 2006 & 2007, cod had already dispersed by the time the rectangles were re-opened in April, and catch rates were relatively low.

6) In 2006, ICES (ACFM) recommended measures should be put in place to prevent effort increasing outside the closure. However, there is no clear evidence for a general increase in fishing effort (days fished) of UK vessels during the non-closure period to make up any shortfall in cod catches during the closure in 2005-2007.

7) The closure is likely to have resulted in a small (although positive) benefit for managing UK fishing activities in line with the quotas for cod since 2005. However, it is difficult to disentangle the benefits from other factors affecting trends in the fisheries throughout VIIe-k.

8) The closure on its own does not exclude enough UK fishing effort to achieve the relative reduction in fishing mortality advised by ICES but could contribute to a broader package of measures. Analyses carried out by IFREMER show that the major impact of the closure on cod appears to have been on activities of French vessels which take three quarters of the international cod landings.

Impact of the closure on the cod stock

As well as the impact of the closure on the fleet behaviour, it would also be interesting to have an idea of the impact of the closure on the cod stock. Such an analysis is not as straightforward and as repeated in several documents on this issue '*it is almost impossible to assess – a posteriori – the impact of a management measure since lots of other things may have changed simultaneously*' (Biseau, WD2 of WGSSDS 2007).

Before the introduction of the closure, the closed rectangles accounted on average for 18% of the cod landings. Biseau and Bellail (WD to WDSSDS2006) simulated the effect of the changes in behaviour of some fleets on the Celtic Sea cod landings and concluded that the closure has a potential of a 13% reduction of these landings. Therefore one could argue that the closure should have lead to a 13% reduction in fishing mortality. Besides the egg surveys carried out by Cefas in the 1990s showed a well defined spawning ground for cod off North Cornwall (Trevose), in the rectangles closed to fishing (WD3 and Appendix 2, *Amstrong et al.*, 2007). Consequently an analysis of the effect of the closure on the cod stock should start with analysing trends in landings, fishing mortality and recruitment. Note again that changes in any of these parameters from 2005 onwards cannot, by definition be attributed to the (in)direct effect of the closure alone since there are surrounding factors (e.g. changes in fleet behaviour, environmental changes, etcetera) that also influence these parameters.

Trends in landings

A time series of the international landings is given in Figure 4.1.1 (under section 4.1 on VIIe-k cod). In 2004, one year before the closure was introduced, a marked drop in landings occurred (-31% compared to 2003). In 2005 and 2006, landings were 15 and 10% lower compared to 2004.

Trends in fishing mortality

The trend in fishing mortality is given in Figure 4.1.8. The absolute estimate of fishing mortality in 2006 is considered to be unreliable because of the strong retrospective underestimation of fishing mortality and is therefore not further referred to. Fishing mortality decreased by 11% from 2003 to 2004. In 2005, the first year of the closure, fishing mortality decreased by 4% compared to 2004. Note that although the absolute levels of fishing mortality for 2003-2005 are probably underestimated, their relative change is more reliable.

Note that there are some indications from WD3 (Armstrong *et al*., 2007) that the largest cod are found in the densest aggregations within the area protected by the box. The average length of cod decreases from the centre of these aggregations. This might (have) change(d) the exploitation pattern on cod. It is too soon to draw any firm conclusions from this, but the possible change in exploitation pattern should be monitored in the future.

Trends in recruitment

In se, the closure is not designed for enhancing recruitment. After all, although the closed rectangles might protect cod during spawning, there are no measures so far to protect the recruiting cod. Nevertheless, recruitment has been very weak over the last years. The most recent estimates that are available are the estimates of the 2005 year class (born during the first year of the closure). The estimates indicate another weak year class.

Conclusions

There are different responses from the fisheries to the closure of ICES rectangles 30E4, 31E4 and 32E3. In the more eastern Celtic Sea fishing grounds, there has been some displacement of vessels away from spawning aggregations of cod (e.g. a number of UK vessels), but also some displacement in time (e.g. a number of Belgian vessels). The closed rectangles did probably only have limited impact on the Irish fishing activity, which is typically more in the western Celtic Sea. French fishing effort has decreased considerable since 1999. Although this effort reduction was already initiated before the first year of the closure, the closure has probably been a strong incentive to a further reduction in effort of vessels targeting gadoids.

The (in)direct of the cod closure on the cod stock is difficult to assess. Cod landings have declined in recent years. There are also indications from the VIIe-k cod stock assessment that fishing mortality has decreased recently, although fishing mortality remains still too high. But the same stock assessment shows also that recruitment in 2005 was weak again.

2.2 Stock summaries

Western Channel sole – Update assessment

The current assessment estimates SSB to have peaked in 1979 at around 5400t, then steadily declining to the series low of 2310 in 2006. A noticeable increase in landings beginning around 1979 reflected an increase in beam trawl effort in the fishery. Estimates of F first peaked in the late eighties, apparently declining, before rising again to similar levels of around 0.4 in 2004 to 2006. Recruitment appears to have been quite variable throughout the time period, with periods of lower recruitment in the early seventies and nineties.

Western Channel plaice – Benchmark assessment

Spawning stock biomass (SSB) was stable during the period 1981-1987, peaked around 4100 t during 1988-1990 following good recruitments in the mid-1980s, and then decreased to 1700 t in 1995-96, just above the series minimum. Since then SSB has hardly increased following the good 1996 year-class and is now estimated at the lowest level since 1979. Fishing mortality has shown a gradually increasing trend up until the mid 1990s, then a slight decline followed by a sharp increase over most recent years. However, the retrospective analysis indicates a strong tendency to overestimate F. Two periods of below-average recruitments in the period 1989-1994 and from 1998 onward have contributed to the decrease in yield and SSB.

Celtic Sea cod – Benchmark assessment

Fishing mortality generally increased up to 1991, then fluctuated around that level until 1999, and has declined thereafter. The 1986 year-class is the strongest observed in the series (16.6 million fish), about four times the average and was followed by a strong SSB increase in 1988-89. SSB decreased subsequently after high fishing mortalities and low recruitment in 1988 and 1989. More recently, the 2001 to 2005 year classes are estimated to be well below average and since 2004 SSB is estimated close to the lowest level for the series.

Celtic Sea whiting – Exploratory assessment

SSB is estimated to have decreased from 72,300 t since 1995. SSB is estimated to be 26,900 t in 2006. SSB shows a declining trend since 1995, that was temporarily halted by the strong 1999 year class.. Fishing mortality is estimated to fluctuate around a lower level since the early nineties. This year’s assessment indicates that recruitment since 1995 has been below average, with the exception of the relatively strong 1999 year-class.

Celtic Sea sole – Update assessment

Over the period (1978-1990) of fishing mortality increased considerable. Since then F is fluctuating around this higher level. Recruitment has fluctuated around 5 million recruits with occasional strong year classes. The 1998 year class is estimated to be the strongest in the time series. SSB is estimated to have declined continuously since 1971 to the lowest value of the time series in 1998. The exceptional year class 1998 has increased SSB to above the long term average, but as the influence of this year class on SSB wanes, SSB is declining again.

Celtic Sea plaice – Update assessment

Fishing mortality has fluctuated without trend since 1977, though there was a sharp decline between 1990 and 1993, and another decline in recent years to the series low in 2006. SSB rose to a high level throughout the 1980s, following a series of above-average recruitments, but has declined since 1990. SSB is estimated to have been below Bpa since 1997, and since 2000 has been around Blim. With the exception of 1995, all recruitments since 1989 have been below average.

Celtic Sea haddock – Benchmark/Exploratory assessment

Following good recruitment in 1999, 2001 and 2002 the SSB and catch increased, however due to the high discarding, the landings did not increase in line with the increased stock levels.

Celtic Sea Nephrops – Update assessment

Even if the 2007 WG did not carry out an analytical assessment, the WG provided enough information to have an idea of the relative stock state. The French trawlers LPUE and CPUE series both indicate a rise in stock abundance over the recent period suggesting that the stock is currently not recruitment overfished. The average landings have been stable since 2000 and there is little evidence to suggest significant changes in the status of this stock . However, it should be important to investigate whether the recent downwards trend of Irish LPUE corresponds to an actual signal for the stock.

Plaice in Southwest of Ireland – Exploratory assessment

Landings have declined since the beginning of the observed time series and are now at their lowest level. Recruitment, although not well estimated has also shown a decline in recent years. Overall there is a declining trend in F despite the peak in 2002. SSB also shows a declining trend over the time series.

Sole and plaice in Southwest of Ireland and sole in the West of Ireland – Tentative assessments

Due to the tentative nature of these stock assessments no stock summaries could be given for plaice and sole in Southwest of Ireland, and plaice and sole in the West of Ireland.

Key results of the assessments are summarized in Table 1.3.5.

2.3 Reference Points

Summary table providing the reference points as defined by ACFM.

STOCK	F_{LIM}	F_{PA}	B_{LIM}	B_{PA}
Sole VIIe	0.28	0.20	2.0	2.8
Plaice VIIe	-	0.45	1.3	2.5
Cod VIIe-k	0.90	0.68	6.3	8.8
Whiting VIIe-k	-	-	15.0	21.0
Sole VIIfg	0.52	0.37	-	2.2
Plaice VIIfg	-	-	1.1	1.8
Haddock VIIb-k	-	-	-	-

The 2003 WG considered most reference points unreliable and consequently rejected pa reference points for most stocks. Nevertheless, these rejections were not accepted by ACFM. The WG still considers most reference points unreliable on the basis of the same grounds as previous year and therefore did not re-open the discussion on pa reference points. Instead the WG put more effort into the development of alternative management strategies, and presents some management plans for the Western Channel plaice and sole stocks, and for the Celtic Sea plaice and sole stocks (see the relevant stock sections).

2.4 Quality of the assessments and forecasts

2.4.1 Biological lack of knowledge and need for studies

2.4.1.1 Growth

For some stocks assessed by this working group, catch and stock weights at age are derived from model fits. This practice is generally conducted because sampling levels are either currently, or have historically been, at low levels resulting in considerable variability in observed weight at age. A number of different approaches are taken to reduce variability in weight at age. For example, stock weights at age in Celtic Sea sole are derived from a Gompertz growth model fitted to first quarter catch weights. Catch and stock weights in Celtic Sea plaice are determined from in-year smoothing using a quadratic fit whereas those for VIIb-k Haddock have, until this year, been smoothed using a three year running average. For this year's working group, weights at age for the latter stock have been smoothed down the cohort using a constrained quadratic fit to first quarter catch weights.

Smoothers or growth models fitted along a cohort have the advantage to in-year smoothing of retaining cohort-specific information which would otherwise be lost. This methodology, however, raises interesting questions both with regard to the forward projection of catch and stock weights into the short term forecasts and the level of uncertainty introduced into estimates of SSB by the revision of model fits with the addition of an extra year of data.

The shapes of many growth model fits are heavily influenced by data points in the extreme ages. Projected weights for the younger age groups may be systematically under or over-estimated due to the lack of sufficient information in the fitted model for that cohort. Smoothing of weights across ages may overcome the problem of bias in the predicted weight at age carried forward to the forecast but will not be able to utilize cohort-specific information.

The most appropriate growth model to use is often unclear. The in-year quadratic fit as used for plaice stocks provides a good fit to the data and reduces noise at the older ages but lacks biological meaning. On the other hand, conventional growth models such as the Von Bertalanffy or Gompertz curve, whilst more biologically plausible, often perform poorly when fitted to only a few age groups and may provide unrealistic estimates of future weights at age in the cohort.

Concern regarding these issues prompted the 2004 working group to undertake a brief investigation of the retrospective properties of cohort-smoothed stock weights on estimates of SSB in VIIb-k haddock. This is described in appendix 1 of the WGSSDS 2004 report. The current practice of catch and stock weight derivation in many stocks is considered unsatisfactory, however, it is clear that further work is necessary before an appropriate alternative method can be proposed.

The WG requests that further work on the problem be initiated.

2.4.1.2 Maturity

Most stocks in the remit of this WG use maturity ogives derived from research vessel sampling. These more accurately reflect the development of maturity than knife edged ogives widely used in assessments. However, the ogives are applied to all years and do not take into account trends in growth over time which can significantly alter the proportion of the younger age groups which become mature. The incorrect use of maturity will affect the derivation and understanding of stock recruit relationships as well as affecting perception of the state of the spawning stock. Additionally, assessment WGs need to consider how to incorporate variable maturity data in assessments. Since the EU Data Collection Regulation will require maturity data to be collected routinely, there is a need to investigate the effect on reference points of using varying annual or tri-annual ogives, and to ensure that heterogeneous data sets from countries sampling in a co-ordinated manner, using common protocols, are provided.

The WG recommends that:

a) maturity sampling should be co-ordinated by a group such as a Regional Co-ordination meeting;

b) investigations on the appropriate use of varying maturity data should take place.

2.4.1.3 Discards

As part of the Data Regulation, all EU Member States have been called upon to implement a discard sampling program. Some of the Member States were already sampling discards in a more or less extensive way, some others have begun with pilot studies. It is therefore expected that a representative sampling protocol is, or will soon be, determined for future years. The first estimations provided to the Working Group indicate that, for stocks other than sole, discarding is far from being a minor component of total mortality.

The information contained in the discard data reflects a high source of variability. The discarding behaviour can change according to various parameters amongst which can be cited fleet, area, time and magnitude of a year class. This specificity points out the essential need for co-ordination between Member States to enable sampling to describe the discard behaviour with a minimum of bias and a maximum of precision. As long as a raising protocol to estimate the total volume of discards in a given stock is not harmonised and well established, the landed/discard length structure should only be provided to working groups raised at the sampled trips level.

The inclusion of discard data in stock assessments for some stocks is expected to provide more information on the current unknown fishing mortalities at younger ages. Signals coming from the surveys can be different from those coming from the commercial fleets and this difference is seen as noise by the model. It has already been reported, for example, that an apparently good year class of cod in the mid-1990s was heavily truncated (estimates consistently revised downwards in successive years) before coming to the catch-at-age matrix, the result being an estimation of this year class at a far lower level than expected.

After an initial period of discard data collection, there is a need to initiate reflection on the potential use of this information. As a first step, a sensitivity analysis on sample allocation and raising procedure should be carried out to provide feed-back to those in charge of the sampling programme. Because of its effect on recent trends, in relation to reference points and Fsq used in forecasts, it is not possible to simply include discard information in the final year's data. An appropriate group of experts should consider how and at what stage the discard data could best be included in the assessment process.

The WG requests that consideration be given to this problem.

2.4.1.4 Stock identity and interaction

The segregation of fish stocks into arbitrary management units that bear little relevance to the true distribution of the population may compromise the ability of existing assessment models to effectively determine the state of some stocks. This may be a particular problem for species which undergo seasonal migrations and may, therefore, be present in a management division for only part of the year. Such stocks may be subject to exploitation in two or more management areas at different times of the year. Management advice that does not take this into account may be inappropriate. Also, different trends in spatio-temporal effort may affect migratory stocks; isolated sub-stocks are more at risk from over-exploitation and age-related spawning migratory behaviour could result in varying reactions in the SSB. These, and other effects, are not accounted for at the current management/assessment spatial scales. Work is currently being undertaken to investigate alternative methods of simultaneously assessing groups of interacting populations that are currently treated on an individual (or spatially aggregated) basis. These problems may be more apparent for the plaice and gadoid stocks that are assessed by this WG.

2.4.2 Estimation of Recruit Indices

The contribution of the surveys to estimates of recruits in 2005, and of other information from commercial sampling (landings, discards), is summarised below, stock by stock:

STOCK	AGE	YEAR-CLASS	SURVEYS	COMMERCIAL FLEETS	SHRINKAGES
Sole VIIe*	1	2005	100%	0%	0%
Plaice VIIe	1	2005	93%	0%	7%
Cod VIIe-k	1	2005	31%	62%	7%
Whiting VIIe-k*	0	2006	100%	0%	0%
Sole VIIfg	1	2005	100%	0%	0%
Plaice VIIfg	1	2005	52%	0%	48%
Haddock VIIb-k	0	2006	100%	0%	0%

*** The XSA estimate was considered unreliable and was replaced by the long or short term GM**

2.4.3 Deficiencies in the assessments and forecasts

Retrospective bias in the estimates of F and SSB was still apparent in some of the assessments. Attempts were made in previous years to investigate its magnitude and the way it could be taken into account to correct the bias in forecasts. The inclusion of estimates of misallocated landings for VIIe sole and the use of new tuning data series last year (by gear, vessel size group and excluding trips where misallocation of landings was suspected) and the changes in the model settings this year have reduced the previous retrospective bias, and it is suggested that the remaining bias may be caused by under-reporting of overall landings. The underlying causes of retrospective bias are, however, not clearly understood, and this continues to be a concern for the WG.

Catch forecasts from the 2004 WG show some dependence on incoming recruitments, which are assumed GM, particularly for gadoids. The WG would still like to see improved estimation of recruiting year-classes from surveys (or other sources). The issue of surveys is discussed further in Section 1.3.5.

Other deficiencies are covered in the relevant stock sections under ‘comments on the assessments’.

2.5 Input from the industry

Input from the industry is summarized in the relevant stock sections (if applicable).

2.6 Ecosystem

This section was not on the priority list of WGSSDS 2007. Consequently it has not been updated. Above WGRED 2007 did not identify any obvious signals that should be considered in assessment of management in this area. For a more detailed description of the ecosystem the reader is referred to the WGRED report of 2007.

2.6.1 Input from WGRED

The Working Group for Regional Ecosystem Description (WGRED) provides information on the ecosystem to the assessment working groups (ICES 2006c). After all one of the TORs of WGRED is ‘*Identify and document any major environmental or anthropogenic events in each of the Eco-regions that should be taken into special account in ICES assessments and advice in 2006, and to the extent possible recommend ways in which this information could be used by Expert Groups and Advisory Committees*’. For this Southern Shelf Working Group, WGRED concluded that ‘*No obvious environmental signals were identified that should be considered in assessment or management in this area. The major trends in the ecosystem noted above are the steady warming of the area, particularly in the context of the slope current … The general and continuing reduction of copepod abundance is also of major concern given the major role of these organisms in the food web … The widespread and sudden increase in occurrence of non-commercial species such as Capros aper, particularly after 1990 (Pinnegar et al. 2003) might indicate some change in environmental conditions but mechanisms and consequences are poorly understood.*’

Amongst other things on WGRED recommended to the WGs that:

a) Assessment WGs should be required to include in their reports a brief description of the present state of the ecosystem, including recent changes and perceived trends. This could be based on the ecosystem descriptions from WGRED. If WGREDs descriptions are found lacking, they should give feedback to WGRED.

>>> A summary of the regional eco-system from the WGRED report that is applicable to this working group is given below.

b) The WGs should also be required to give a qualitative evaluation of whether those changes and trends are taken (sufficiently) into account in the assessments - and if not, to evaluate how the changes and trends can be expected to influence the assessments. In this evaluation they should particularly consider possible effects of the changes and trends on natural mortality and individual growth and recruitment, and how they may increase or decrease uncertainty in the estimates. Possible ways to carry out sensitivity analyses should be explored.

>>> WGRED did not identify any environmental signals that should be considered in assessment or management. WGSSDS had no information on the effect of the global warming

of the area on trends in natural mortality, individual growth and recruitment for the assessed stocks.

>>> The effect of the water flow from the river Loire on the recruitment of Bay of Biscay sole was briefly investigated, but no relationship could be found. However, the Working Group believed that the Loire flow has an impact on local recruitment, but could not be used as an indicator for recruitment over the whole area.

c) The assessment WGs should also be encouraged to try out software which can include ecosystem trends in the assessments in a quantitative way. If necessary, they must then request input about specific ecosystem variables from WGRED or appropriate WGs.

>>> It is the Working Group's believe that this step is currently beyond the remits of this Working Group. The workload at the Working Group does not allow for such exploratory analysis. Above, none of the Working Group members have experience in handling such models. Although the Working Group is convinced that this step must become an important part of the advisory process, it doubts that this is achievable under the current Working Group structure. ICES needs to seriously think on how to integrate points b) and c) into the advisory process without putting extra burden on the assessment Working Groups.

2.6.2 Broad scale climate and oceanic features in the Celtic Sea (summarized from WGRED)

Based on CPR greenness records for this area the spring bloom of phytoplankton occurs around April and collapses by October, although in recent years has continued into December. CPR data also suggest that there has been a steady increase in phytoplankton colour index across the whole area over at least the last 20 years. Details on the taxa involved have not been located but are assumed to be dominated by diatoms (at least in the spring bloom), but will also include dinoflaggelates. The overall zooplankton abundance in this area has declined in recent years.

The major commercial invertebrate species is *Nephrops*. Cuttlefish is also exploited. Major fisheries dredging for scallops and some smaller bivalves exist in the western Channel. Pot fisheries exploit the lobster *Homarus gamarus* and brown crab *Cancer pagurus* in the water around the Channel Islands, off France (French landing about 150 t/year), and the west of Scotland. Estimated landings of whelk (*Buccinum ondatum*) are as high as 12 000 t/year from at targeted pot fishery. In addition to major aquaculture activity for oysters and mussels, some beds of oysters and buried bivalves such as cockles *Cardium edule* are exploited by professional and recreational fisheries.

The benthos of the Celtic seas (northern shelf, Irish Sea and Celtic Sea) is largely influenced by shelf sea dynamic processes that generate areas with high levels of seabed stress and erosion. Over 340 species of invertebrate and fish were captured in a survey of the epibenthos in ICES area VIIf-h (Ellis et al., 2002), the most ubiquitous species being the hermit crab *Pagurus prideaux* and the spotted dragonet *Callionymus maculatus*, both of which are major prey items for commercial fish (Pinnegar et al., 2003). Two epibenthic assemblages predominate in the Celtic Sea. The first is dominated by the anemone *Actinauge richardi* (41.8% of faunal biomass) and occurs along the shelf edge and slope in waters 132-350m deep. The second assemblage is more widely distributed on the continental shelf (depth range: 66-232m) and *P. prideaux* dominates along with other mobile invertebrates (shrimps and echinoderms), although there are some spatial differences in assemblage structure and relative abundance.

Several studies for fish stomach contents and diets have concluded that the main predator species in the Celtic Sea (hake, megrim, monkfish, whiting, cod, saithe) are generalist feeders which exhibit size-dependent, temporal and spatial prey-switching behaviour (Pinnegar et al., 2003; Trenkel et al. 2005). Consequently, utilisation of a conventional multispecies assessment model such as MSVPA in such a system would be unlikely to yield useful insights.

Overall, there was general agreement between higher prey densities in the environment and higher occurrences of particular prey species in predator stomachs, which lead to distinct spatial and temporal feeding patterns (Trenkel, et al. 2005). Blue whiting was found more often in predator stomachs over the shelf edge during the summer months while mackerel and Triopterus spp were relatively more prevalent in stomachs sampled on the continental shelf during the winter half year. The general impression is one of a highly interlinked food web, where several predators feed on the same prey resources, i.e. their trophic niche overlaps substantially.

Fish taken from the shelf edge areas of the Celtic Seas tend overall to be less planktivorous and from a higher trophic level than those in the North and Baltic Seas (2005a). In the Celtic Sea zooplankton production accounts for only a small fraction of the secondary production demands of the fisheries. In the Celtic Seas benthos production can be seen as a bottom-up driver for fisheries production, which seems to be independent of variability in plankton production. As this situation is very different to the situation in the North Sea (see NS section), climate change and fishing pressures can be expected to influence these regional fisheries in very different ways. Overall, there appear to be strong spatial patterns in the fish food web structure and function, which should be important considerations in the establishment of regional management plans for fisheries (see Heath 2005). Heath (2005) argues that, because the blue-whiting fishery is conducted mainly off the continental shelf, there is no rationale for a foodweb connection between the bulk of the blue whiting catch and the other landed species from the Celtic Sea and west of Scotland. By contrast, Pinnegar et al. (2003) and Trenkel et al. (2005) have both highlighted the importance of this species as a prey for fish on the shelf-edge, notably for hake and megrim. For cod in the Irish Sea, the decapod Nephrops norvegicus is known to be an important prey item (Armstrong, 1982), whereas whiting, Norway-pout and Nephrops are known to be important for monkfish (Crozier 1985). In north-west of Scotland there have been additional studies focusing on inshore demersal assemblages (e.g. Gibson & Ezzi, 1987). Feeding relationships among deep-water species on the Wyville Thomson ridge have also been examined (du Buit 1978).

2.6.3 Impact of changes in fishing technology and behaviour (copied from WGFTFB 2006)

Bottom Impact: In several countries there has been major fleet re-structuring e.g. Ireland and Belgium, and under such programmes, which are usually government driven, fleets have moved from being composed of a large number of relatively inefficient vessels to a smaller number of highly efficient boats. It has not been properly assessed whether these switches have positive or negative implications on the marine habitat. In Belgium, vessel owners have been encouraged to replace smaller beam trawlers with one large vessel but it is debatable whether the fishing operations of these larger vessels, using heavier gear but over a narrower area, has a greater or lesser effect on benthic habitats than a larger number of smaller boats fishing over a wider area.

Development of New Fisheries: There are very few examples of new fisheries being developed given that most species are exploited to some degree, but there are documented cases of fleet displacement into fisheries for species not traditionally exploited by vessels of particular countries. For example, there has been a large expansion in the Moray Firth squid fishery in Scotland by small < 10m vessels, as well as larger whitefish vessels. In this case, given that these vessels use small codend mesh size (40 mm); this will result in high bycatch and discarding of haddock, cod and whiting.

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Table 2.1.1 - Overview of the effort series by country, gear and area available to WGSSDS .

Belgium	**VIIb**	**VIIc**	**VIIe**	**VIIf**	**VIIg**	**VIIh**	**VIIj**	**VIIk**	**Unit**
Beam trawl (TBB)	N	N	X	X	X	X	X	X	Fishing hours
Otter trawl (OTX)	N	N	X	X	X	X	X	X	Fishing hours
Nephrops otter trawl (TBN)	N	N	N	N	N	N	N	N	
Fixed net (GN)	N	N	N	N	N	N	N	N	
Demersal Seine (SX)	N	N	N	N	N	N	N	N	
England	**VIIb**	**VIIc**	**VIIe**	**VIIf**	**VIIg**	**VIIh**	**VIIj**	**VIIk**	**Unit**
Beam trawl	N	N	X	X	X	X	X	N	Fishing hours
Otter trawl	X	X	X	X	X	X	X	X	Fishing hours
Nephrops otter trawl	N	N	N	N	N	N	N	N	
Fixed net	X	X	X	X	X	X	X	N	Avg total length of net in use per day (m/10)
Demersal Seine	N	N	X	X	X	N	N	N	Fishing hours
France	**VIIb**	**VIIc**	**VIIe**	**VIIf**	**VIIg**	**VIIh**	**VIIj**	**VIIk**	**Unit**
Beam trawl	N	N	-	-	-	N	N	N	
Otter trawl	X	X	X	X	X	X	X	X	Fishing hours
Nephrops otter trawl	X	X	X	X	X	X	X	X	Fishing hours
Fixed net	-	-	-	N	-	-	-	-	
Demersal Seine	N	N	N	N	N	N	N	N	
Ireland	**VIIb**	**VIIc**	**VIIe**	**VIIf**	**VIIg**	**VIIh**	**VIIj**	**VIIk**	**Unit**
Beam trawl	X	X	X	X	X	X	X	X	Fishing hours
Otter trawl	X	X	X	X	X	X	X	X	Fishing hours
Nephrops otter trawl	X	X	X	X	X	X	X	X	Fishing hours
Fixed net	+	-	-	-	+	-	+	-	
Demersal Seine	X	X	X	X	X	X	X	X	Fishing hours

X: Effort data available

N: No fisheries

-: No effort data, but fisheries are minor

+: No effort data, but fisheries are major

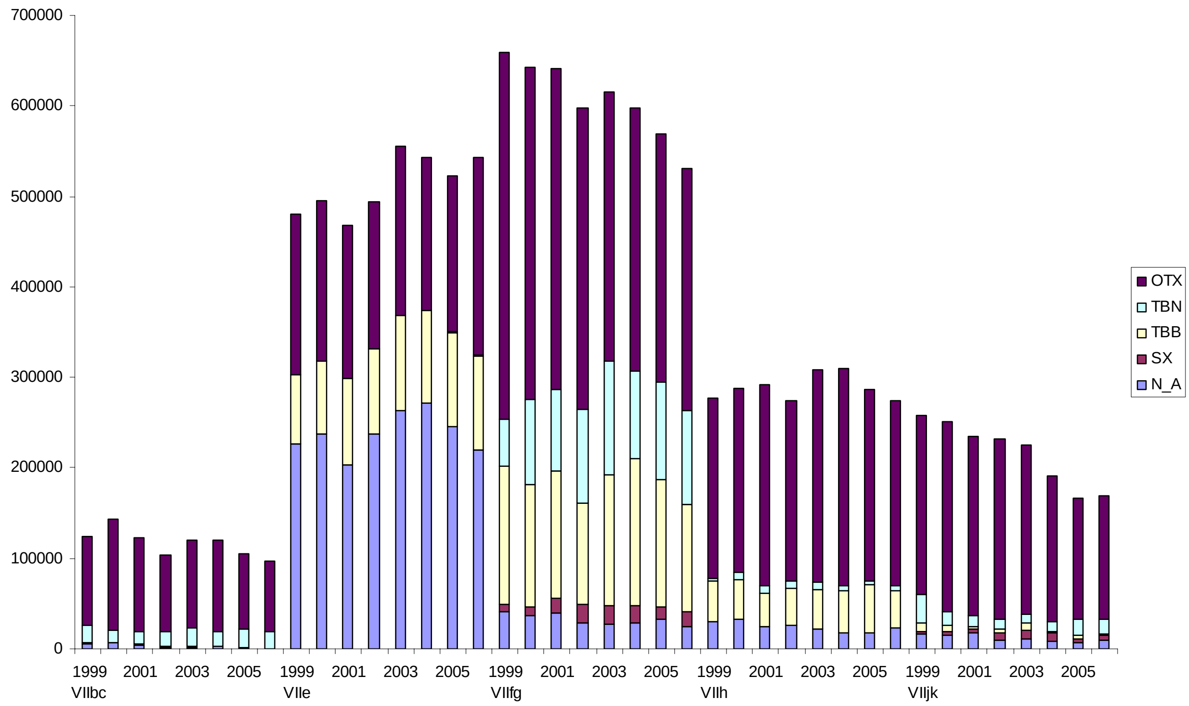

Figure 2.1.1 – Total effort (fishing hours) of otter trawlers (OTX), Nephrops trawlers (TBN), beam trawlers (TBB), demersal seiners (SX) and not defined gears (N_A) of Belgium, France, Ireland and the United Kingdom operating in ICES Divisions VIIbc, VIIe, VIIfg, VIIh and VIIjk since 1999.

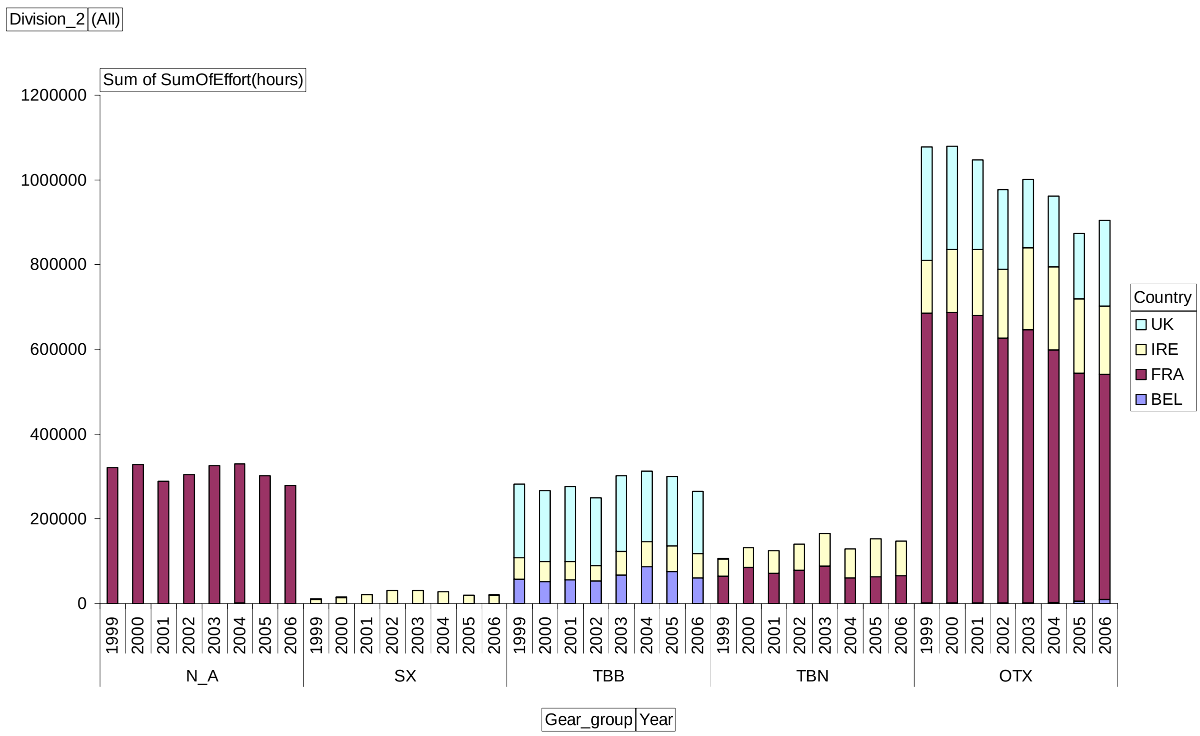

Figure 2.1.2 – Total effort (fishing hours) in ICES Divisions VIIbc,e-k by gear type for Belgium, France, Ireland and the United Kingdom.

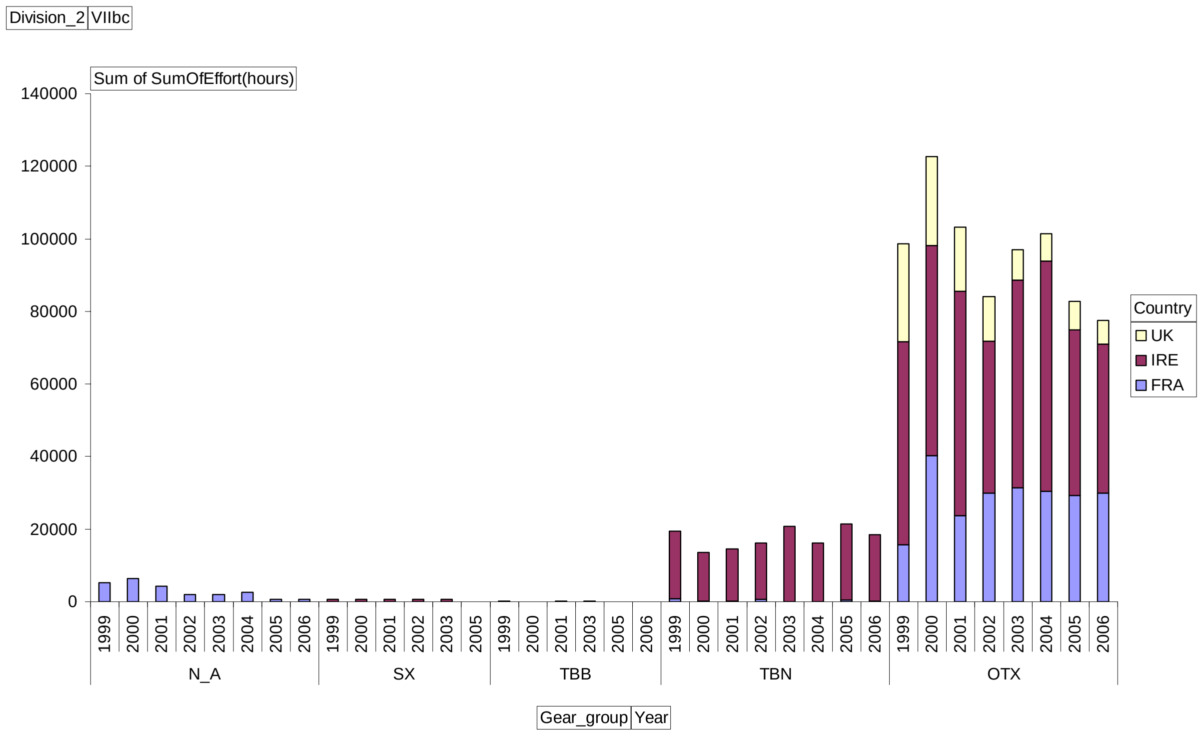

Figure 2.1.3 – Total effort (fishing hours) in ICES Divisions VIIbc by gear type for Belgium, France, Ireland and the United Kingdom.

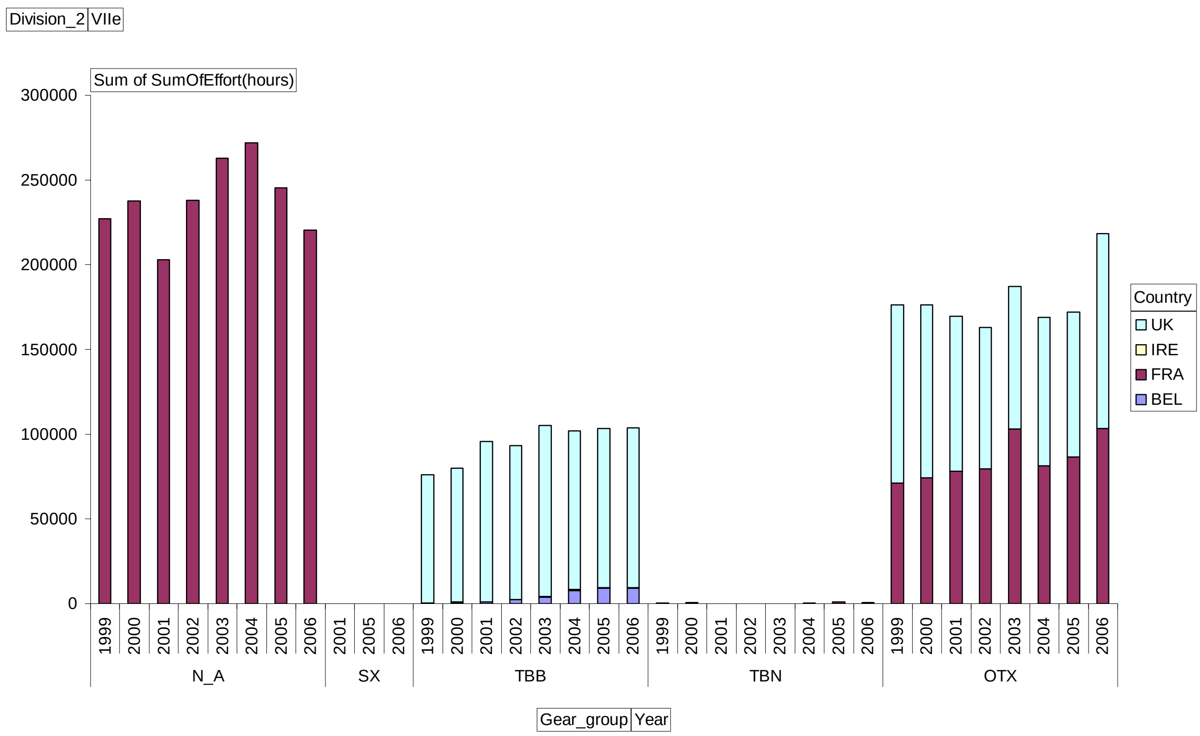

Figure 2.1.4 – Total effort (fishing hours) in ICES Division VIIe by gear group for Belgium, France, Ireland and the United Kingdom.

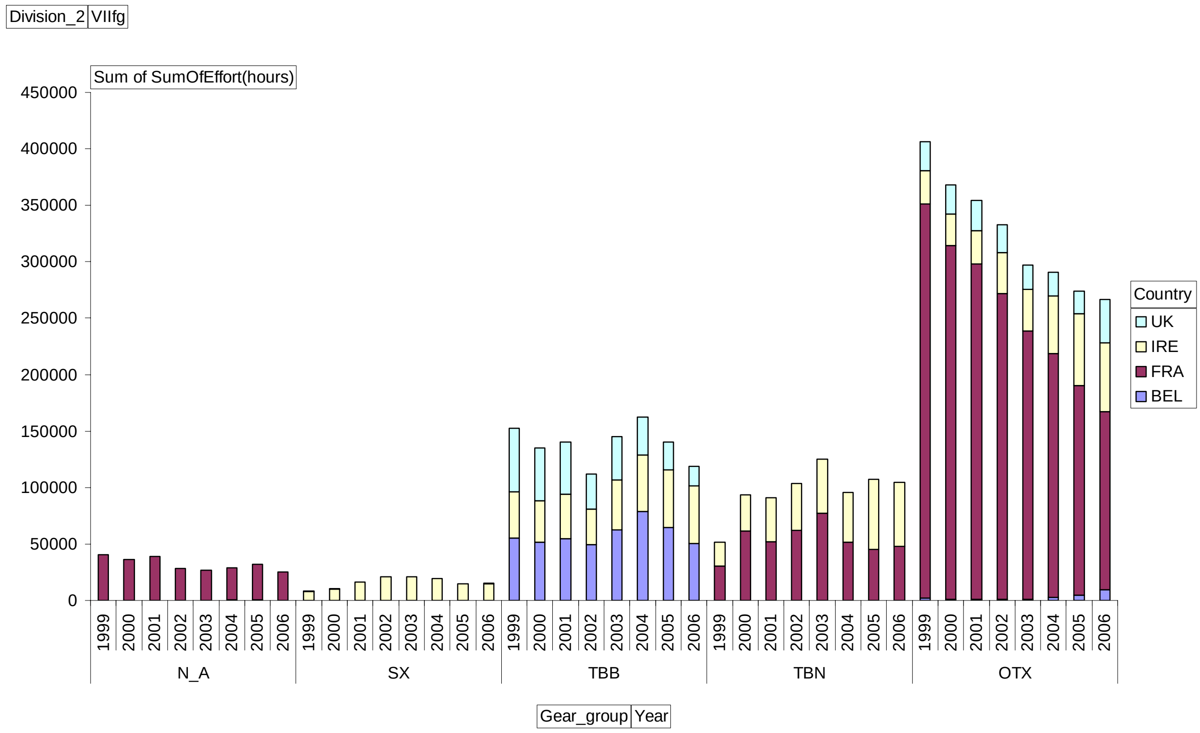

Figure 2.1.5 – Total effort (fishing hours) in ICES Divisions VIIfg by gear group for Belgium, France, Ireland and the United Kingdom.

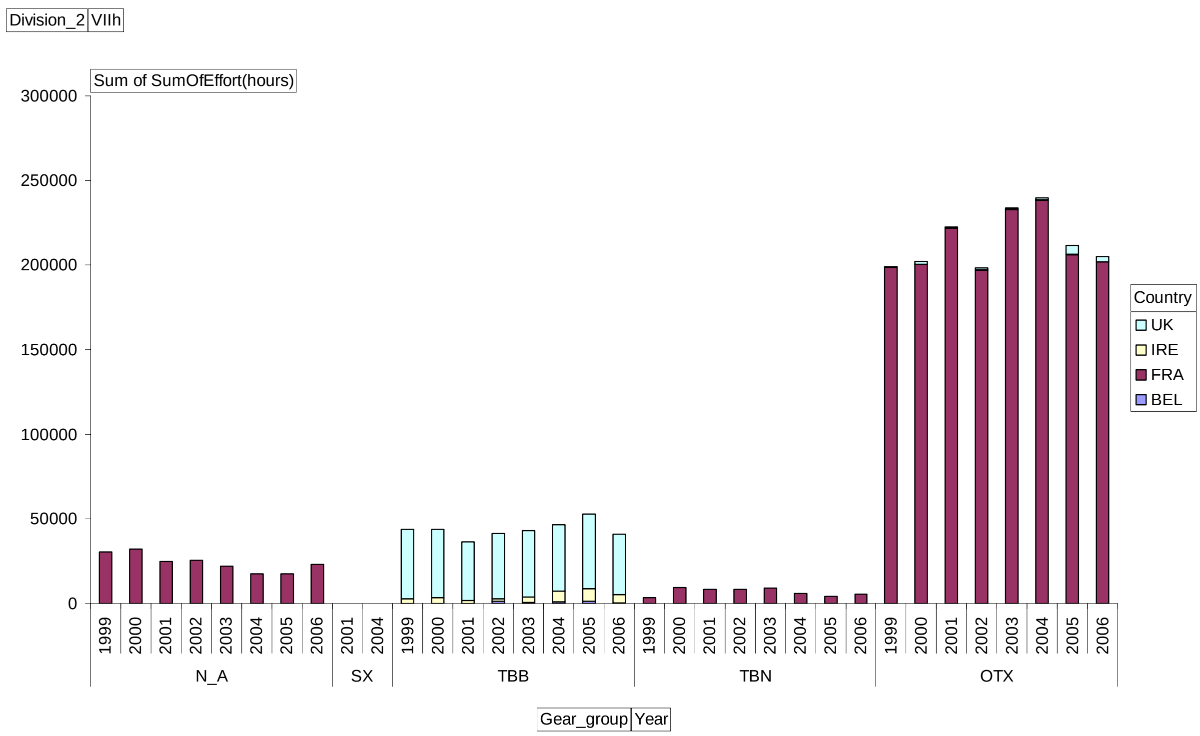

Figure 2.1.6 – Total effort (fishing hours) in ICES Division VIIh by gear group for Belgium, France, Ireland and the United Kingdom.

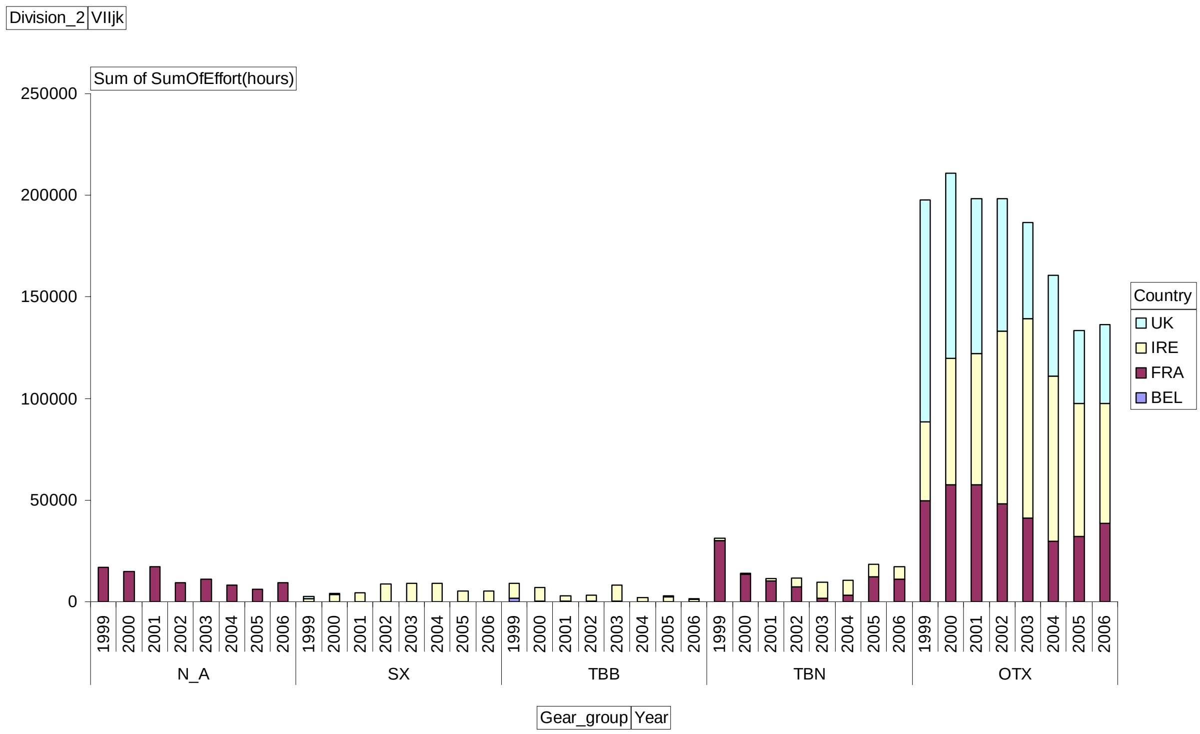

Figure 2.1.7 – Total effort (fishing hours) in ICES Divisions VIIjk by gear group for Belgium, France, Ireland and the United Kingdom.

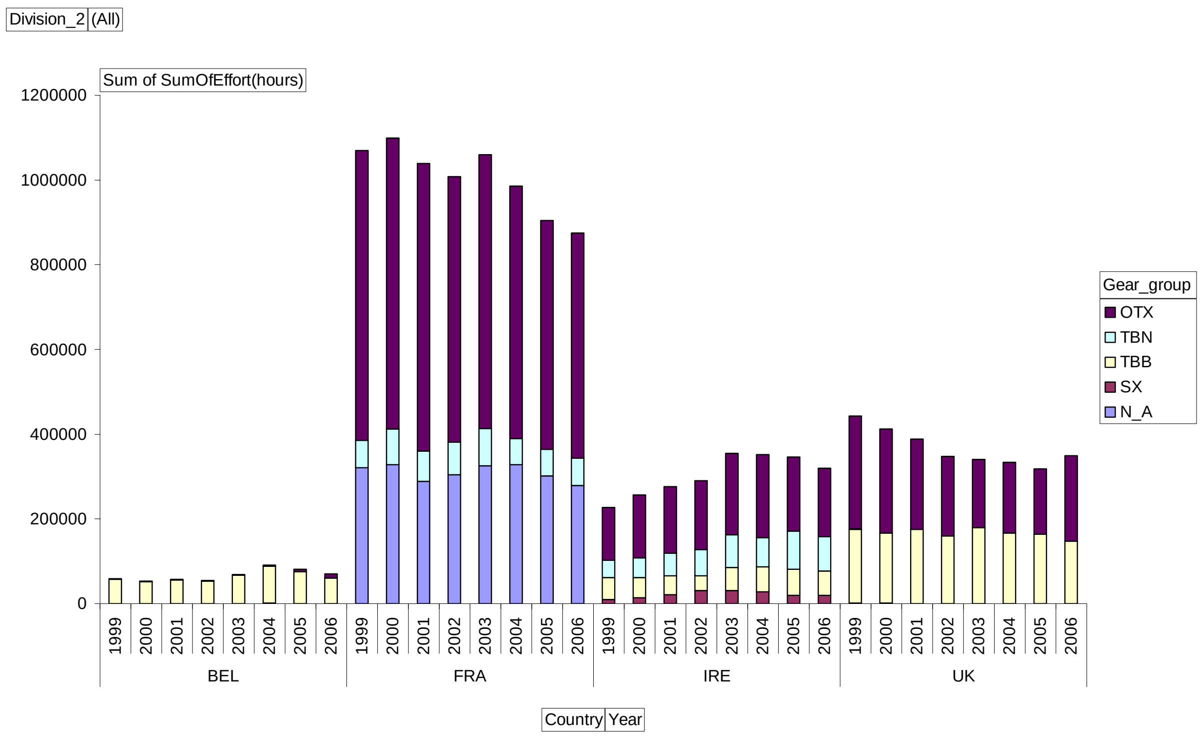

Figure 2.1.8 – Total effort (fishing hours) in ICES Divisions VIIbc,e-k by country for otter trawlers (OTX), Nephrops trawlers (TBN), beam trawlers (TBB), demersal seiners (SX) and not identified gear types (N_A).

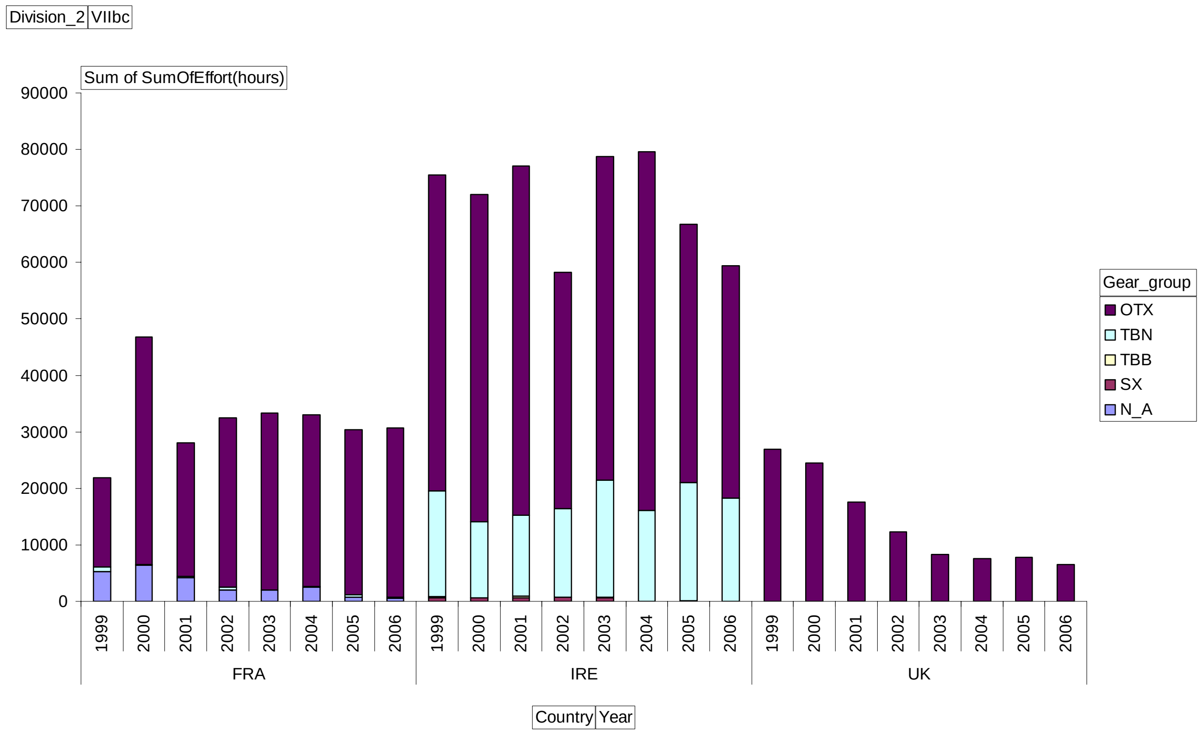

Figure 2.1.9 – Total effort (fishing hours) in ICES Divisions VIIbc by country for otter trawlers (OTX), Nephrops trawlers (TBN), beam trawlers (TBB), demersal seiners (SX) and not identified gear types (N_A).

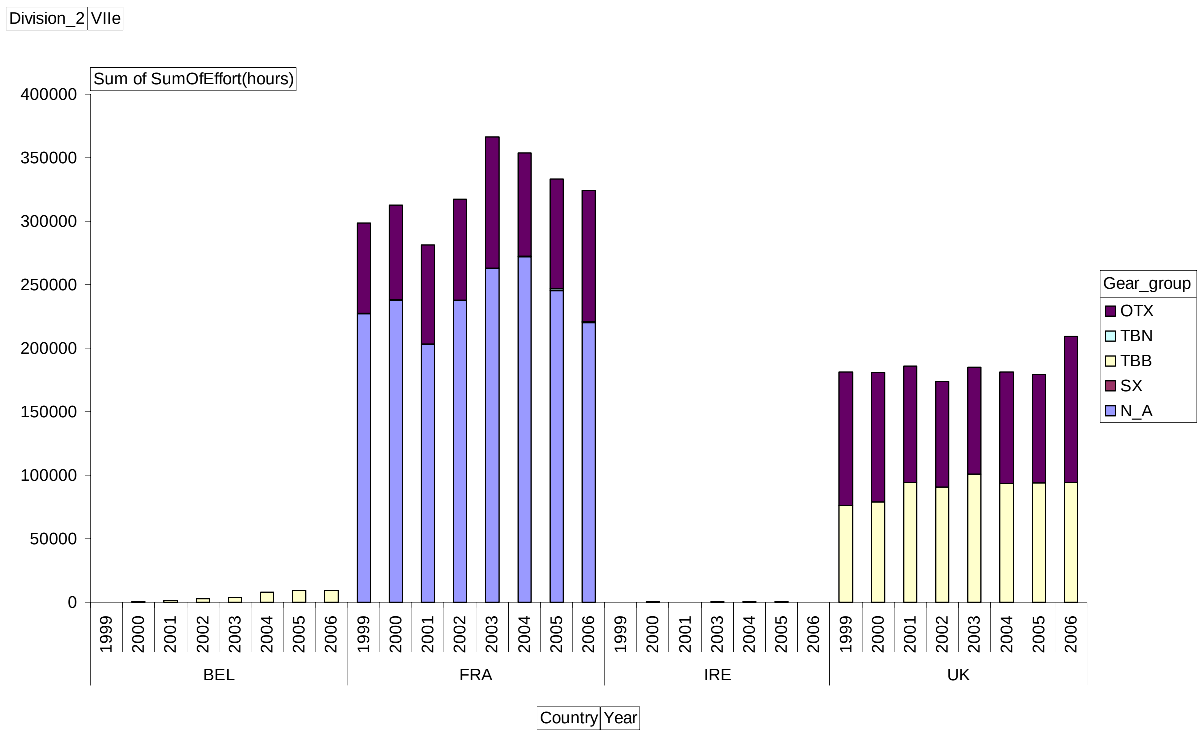

Figure 2.1.10 – Total effort (fishing hours) in ICES Divisions VIIe by country for otter trawlers (OTX), Nephrops trawlers (TBN), beam trawlers (TBB), demersal seiners (SX) and not identified gear types (N_A).

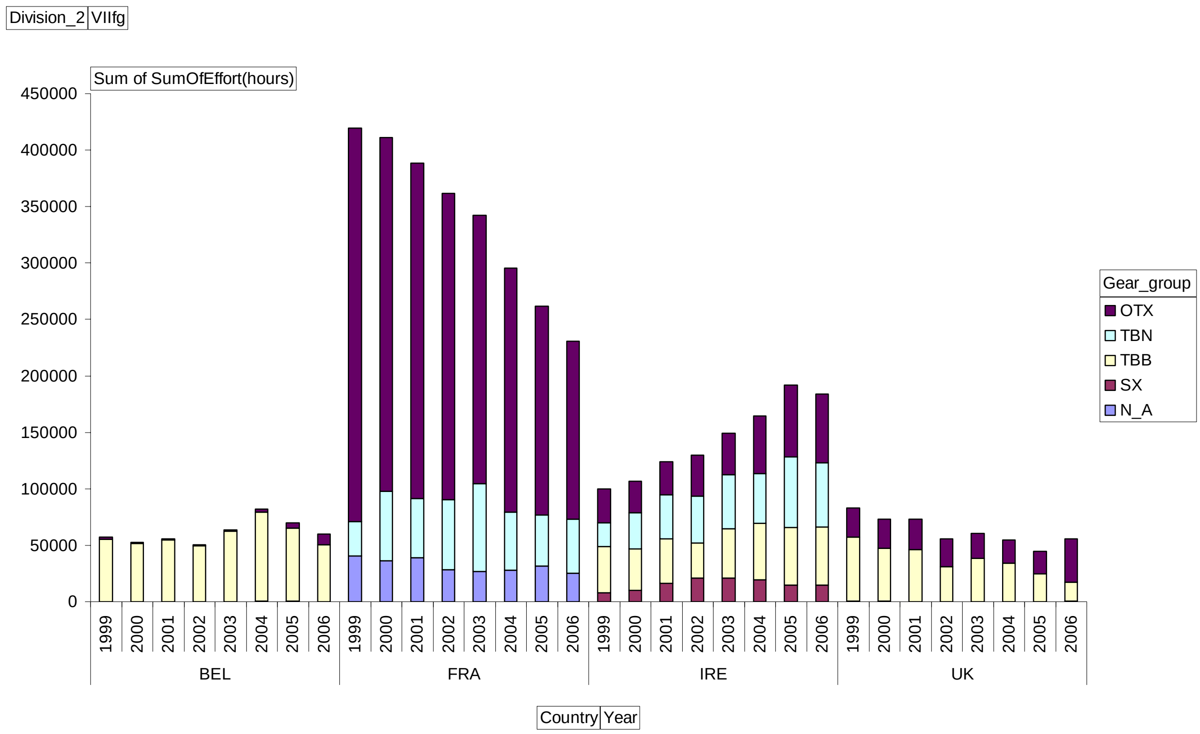

Figure 2.1.11 – Total effort (fishing hours) in ICES Divisions VIIfg by country for otter trawlers (OTX), Nephrops trawlers (TBN), beam trawlers (TBB), demersal seiners (SX) and not identified gear types (N_A).

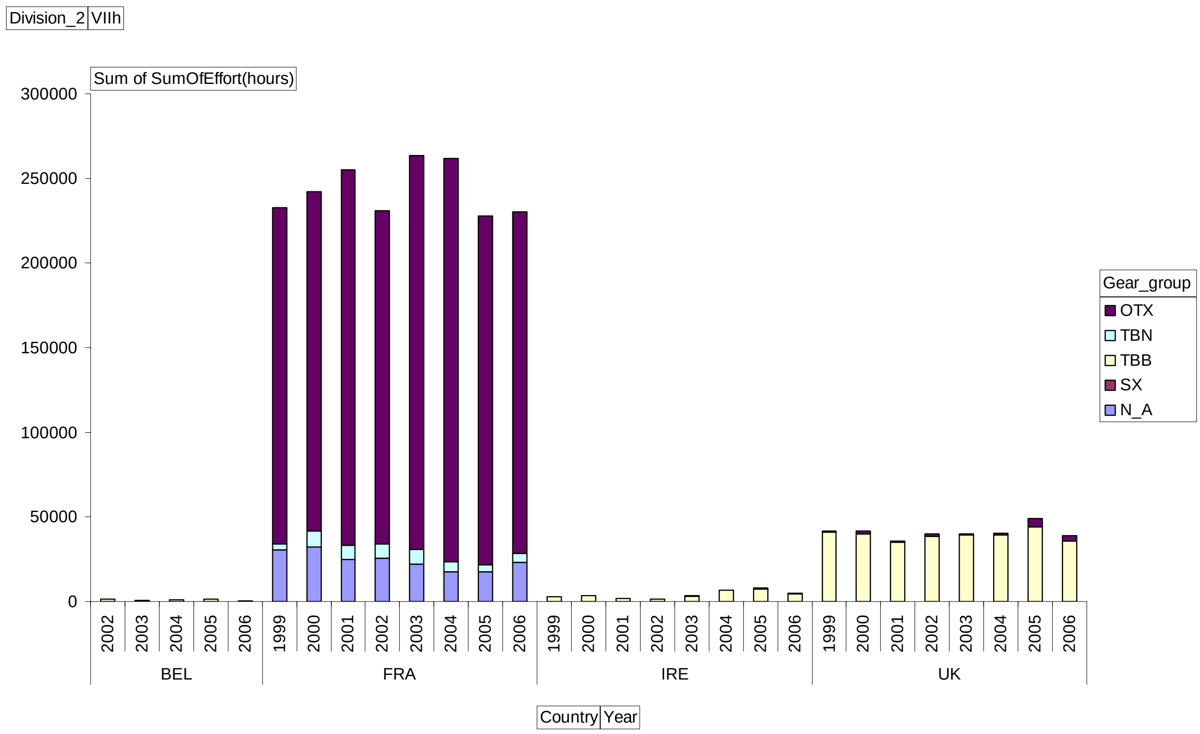

Figure 2.1.12 – Total effort (fishing hours) in ICES Divisions VIIh by country for otter trawlers (OTX), Nephrops trawlers (TBN), beam trawlers (TBB), demersal seiners (SX) and not identified gear types (N_A).

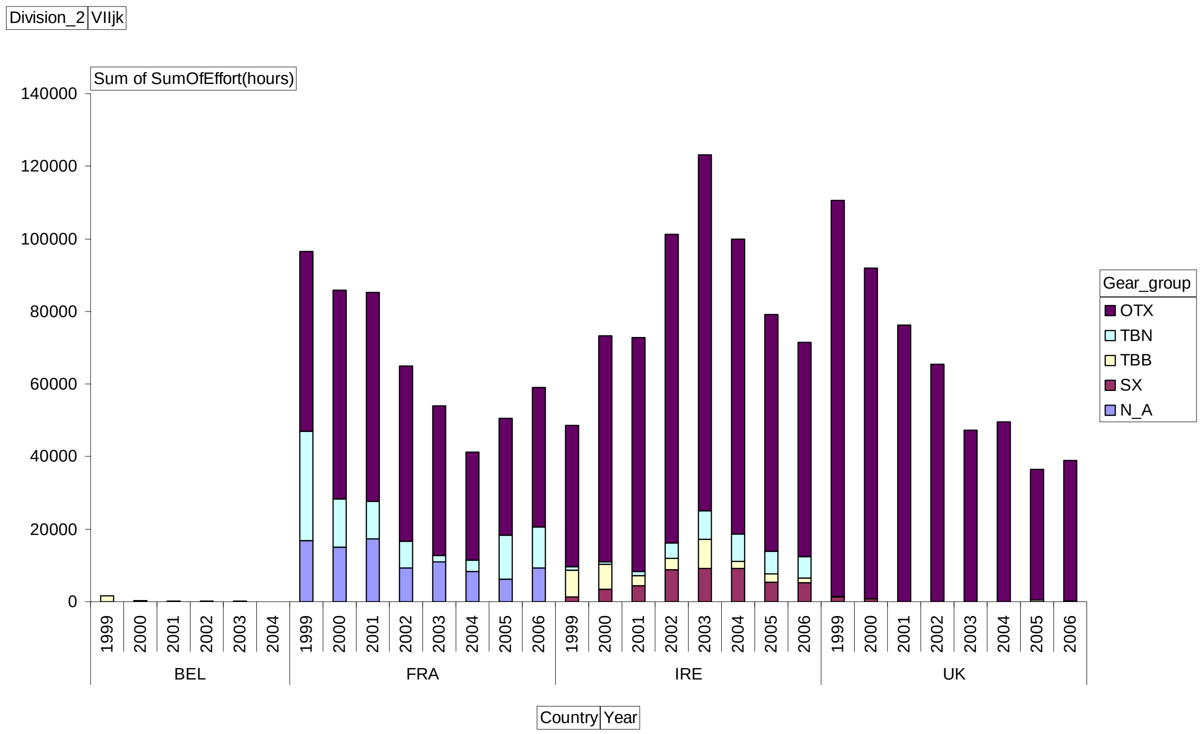

Figure 2.1.13 – Total effort (fishing hours) in ICES Divisions VIIjk by country for otter trawlers (OTX), Nephrops trawlers (TBN), beam trawlers (TBB), demersal seiners (SX) and not identified gear types (N_A)

3 Western Channel stocks

3.1 Sole in the Western Channel (Division VIIe)

Type of assessment in 2007: Update assessment

This stock was placed on the observational list in 2004 and has been subject to a full assessment in subsequent years. A management plan for this stock was agreed in May 2007 (Council Regulation (EC) No 509/2007). This report is an update assessment using last years assessment methods and settings.

One minor change made to the assessment was to increase the number of years to shrink over, from 4 to 5 due to the inclusion of 5 years of French age data.

Review group issues:

- *Table 3.1.3a could be broken down by quarter given that there seems to be seasonal differences in the LFDs as can be seen in the presentation of quarterly discard data. Furthermore the RG would like a sentence in the report clarifying how the annual length frequencies should be interpreted. – See section 3.1.2*
- *If catch is reallocated from on area to another are the effort data also corrected for this? - Answer is no, effort is not currently reallocated when reallocation of catch occurs.*
- *The practice of using an annual ALK to raise the French data could in extreme cases could create some bias this may or may not be the case. The RG suggest the WG should intersessionally examine raising options for this stock .– Please refer to WGSSDS 2004 section 3.1.5 for a discussion on the inclusion of French data. Thus far no additional intersessional work has been undertaken.*
- *There is a noticeable trend in catcability residuals over time for the beam trawl fleet. The WG might explore this further. – The WG re-examined the residuals this year and found them to be reasonably small with little trend. They were not considered to be problematic to the assessment.*
- *The divergence in the historical assessment observed with the inclusion and exclusion of historical tuning data should also be explored further to try and explain the differences observed. - Please refer to WGSSDS 2005 report section 3.1.2 for original discussion. No more exploration has been undertaken.*

3.1.1 The Fishery

Section in the Stock Annex.

ICES advice applicable to 2007

ICES advice on this stock was: *Rebuilding the stock above $\boldsymbol{B}_{pa}$ in just one year would require that fishing mortality to be reduced by at least 68%. This would correspond to landings of around 350 tonnes in 2007. If this reduction is not possible then ICES recommends that a recovery plan be implemented which ensures a safe and rapid rebuilding of SSB to levels above $\boldsymbol{B}_{pa}$.*

ICES advice applicable to 2006

ICES continues to recommend that a recovery plan be implemented which ensures a safe and rapid rebuilding of SSB to levels above $\boldsymbol{B}_{pa}$. Rebuilding the stock in the short term requires that fishing mortality should be reduced by at least 80%. This corresponds to landings of less than 230 tonnes in 2005.

Management applicable to 2006 and 2007

The agreed TAC in 2006 was set at 940t representing a 10% decrease in F with the increase in TAC due to the large estimate for the 2002 year class. Misallocation between VIId and VIIe has historically been a big problem, but has been mediated by the increased TAC's in 2005 and 2006. In 2007 the TAC was set to 900t representing another 10% decrease in F, and a multi-annual management plan was established for sole in the Western Channel, with the aim of achieving and maintaining a fishing mortality rate of 0.27 on appropriate age-groups (for details see council regulation (EC) No 509/2007).

The technical measures applied to this stock include a minimum landing size (24cm) and minimum mesh size of 80mm for beam trawlers. Local regulations restricting certain gear and vessel types are also in place.

Council Regulation EC No 51/2006, Annex IIc restricts the number of days at sea to 216 for beam trawlers of mesh size equal to or greater than 80 mm and for static demersal nets including gill nets, trammel nets and tangle nets, with an additional 12 days for the UK beam trawl fleet due to a reduction in capacity of the fleet.

Council Regulation (EC) No 509/2007 establishes a multi-annual plan for the sustainable exploitation of VIIe sole. Years 2007-2009 are deemed a recovery plan, with subsequent years being deemed management plan. For 2008 the TAC is required to be at a value whose application will result in a 20% reduction in F compared to Fbar (03-05). If this value exceeds a 15% change in TAC, a 15% change in TAC shall be implemented. Complementary fishing effort limitations given in Council Regulation (EC) No 41/2007 Annex IIc, restrict the number of days at sea to 192 for beam trawlers of mesh size equal to or greater than 80 mm, and for static nets including gill nets, trammel nets and tangle nets, with mesh size less than 220mm, with an additional 12 days for the UK beam trawl fleet due to a reduction in capacity of the fleet.

Recent trends in the fishery

National landings data reported to ICES and as used by the Working Group are given in Table 3.1.1 Total international landings in 2006 as used by the Working Group were 958t, a 2% overshoot of the TAC. France reported landings revisions this year for 2005 (12.6t) and 2004 (56.5t).

Comments relevant to VIIe sole from WGFTFB 2007 are reproduced below:

The UK beam trawl fleet, the major component of the fishery for this stock is currently undergoing restructuring with £5 million being allocated to reduce capacity in the UK SW beam trawl fleet. This is aimed primarily at vessels that traditionally target sole in the Celtic Sea and Channel. It is difficult to estimate how many vessels will be removed but on previous experience, it is likely to be sufficient to remove 4 or 5 vessels.

A number of measures have been taken by Belgium and UK beam trawl fleets to reduce ecosystem impacts, through a combination of reduction in discards through the use of T90 codends; benthos bycatch from benthic release panels and reduced bottom impact from experimental roller gear, usage of outrigger trawls instead of beam trawls with chain mats. Uptake is very minor at present so reduction in impact is minimal, but the motivation in many cases is due to increasing consumer and NGO demands, so the development of low impact gears is likely to increase further.

There is also evidence to suggest that Belgium beam trawlers and French trawlers are increasingly being equipped with 3D mapping sonar which has opened up new areas to fishing (close to wrecks).

Commercial fleet effort and LPUE

Effort for >24m beam trawlers has been increasing since 1999 and is currently at a time-series high, however the effort of <24m vessels has been decreasing from a high point in 2003. Otter trawl effort has been in continual decline since the early 1970's and is currently at a time-series low, at values roughly a third of those seen in the 1970's (Table 3.1.2). LPUE for both beam trawl fleets has slightly increased in 2006 over 2005, but they are still at low values. Otter trawl LPUE has however has decreased from the higher 2005 level to those more consistent with the low LPUE levels seen since the early 1990's. In recent years the UK industry contests the low CPUE in part due to the redirection of effort to cuttlefish and other species such as squid and angler fish. However sole, although not specifically targeted during the cuttlefish season, do comprise a substantial portion of the value of the catch during the cuttlefish fishery so that the WG felt justified in using the effort information as reported by the official UK landings statistics (Figure 3.1.1).

See stock annex for historic trends.

3.1.2 Age and length compositions and mean weights at age

Catch numbers for the UK, Belgian and Irish components of the stock were raised as described in the stock annex. French age data was included in the assessment for the first time in 2006 (landings 2002 to 2005), and revisions of these landings data were reported this year for 2005 (12.6t) and 2004 (56.5t), and revised quarterly split landings were supplied for 2002 and 2001.

Annual length compositions for 2006 are given for the three major fleets in Table 3.1.3 and total UK length distributions for the last 10 years are shown in Figure 3.1.2. These distributions show that there has been great consistency throughout the time series. The modal length ranges between 28-30cm in all years except 2005 where it is 32cm. The maximum length shows similar consistency in all years except in 2006, but the 308 fish at 68cm in 2006 are considered a mistake and will be revised for next year's assessment.

Figure 3.1.3 show's the length distributions for 2006 by quarter for UK beam trawl, UK all-bar-beam trawl and combined French gears. The UK beam trawl distributions seem consistent throughout the year, but with a slight lowering of the modal length in the 2nd and 3rd quarters, whereas the French distributions appear to show a definite decrease in modal length over the 3rd and 4th quarters. The UK All bar beam distributions appear relatively consistent throughout the year, but with less caught in the first two quarters. The total age compositions are listed in Table 3.1.5 and shown for the last 10 years in Figure 3.1.4.

Catch and stock weights were estimated as in previous years and described in the stock annex. The formula for 2006 was:

$$Wt = 0.036 + 0.0605*Age - 0.0007 * Age^2 \qquad (R^2 = 0.99)$$

where catch weights at age are mid-year values, and stock weights at age are 1 January values (Table 3.1.6 & 3.1.7; Figure 3.1.5).

Discards

UK data suggests that discarding is minor in this stock (Table 3.1.4) and although no French data exists for this stock data on other French sole stocks also suggests that discarding is negligible in the French fishery also.

3.1.3 Natural mortality and maturity at age.

As in earlier assessments, natural mortality was assumed constant over ages and years at 0.1 based on estimates of M in other sole stocks (Horwood 1991). This is consistent with the natural mortality estimates used for sole by other ICES working groups (WGNSSK: IV, VIId, WGNSDS: VIIa, WGSSDS: VIIfg, VIIIa,b). M is likely to be higher at ages 1 and 2, however, provided that the effect is limited to age 1 and 2 where F's are very low this will tend to result only in a rescaling of recruitment, but should not influence the trends in F or SSB, nor will it substantially alter the forecast. The relationship to reference points would change, but current values were set on the scale of the M=0.1 assumption so that they remain consistent with the current assessment.

The maturity ogive applied, as previously, is the combined sex ogive given below:

Age	1	2	3	4	5	6,7, …12+
Prop. mature	0.00	0.14	0.45	0.88	0.98	1.00

As in previous assessments, the proportion of F and M before spawning are both set to zero to reflect the SSB calculation date of 1 January.

Also see stock annex for derivations of M and maturity ogive.

3.1.4 Surveys and abundance indices

Survey abundance indices are given in Table 3.1.8. The survey shows good internal consistencies with regards to estimating year-class strength early in the time series (Figure 3.1.7), but due to vessel changes in 2002 and 2004 there are some questions regarding the constant catchability assumption in the data. The 2006WG examined the data carefully using SURBA, which indicated some sizeable year effects in the data since the change in vessel. Particularly dramatic were the results of the 2003 survey. This data was replaced by data collected on the original vessel in 2003 originally only intended for comparison purposes. From 2005 onwards the survey has been moved back to the original vessel as a result of intersessional investigations. Therefore the time series is now more consistent and only 2002 and 2004 data could contain vessel effects.

3.1.5 Catch at age analysis

General approaches and methods are described in Section 1.4.1.

Data screening

Data were screened using a separable VPA analysis. The residuals indicate no large abnormalities at ages greater than 1 and less than 10 (in ICES files). This is not unreasonable, because French landings are made up of two fleet components with very different selectivities and the percentage contribution of each to each year's landings varies. XSA can handle such changes in selectivity provided it does not occur in the tuning fleets and F-shrinkage is low.

Historic commercial tuning series were retained as they provide necessary stability to the assessment in the historic period (where precautionary reference points were set).

Several indicators pointed to a problem with the survey information, particularly with regards to the change in vessel for the UK beam trawl survey after 2002. Comparative data for the vessels was collected in 2003, but detailed analysis indicated it was not possible to derive a suitable correction procedure for 2002-2004 data. Instead 2003 data (Corystes used last year) was replaced with the data from the original vessel which has been used from 2005 onwards so that only 2002 and 2004 data remain with possible vessel effects.

Singlefleet SURBA Investigations:

SURBA analysis of the current tuning indices were carried out using version 3.0. The revised information for the UK beam trawl survey (UK-BTS), the UK beam (UK-CBT) and UK otter trawl fleets (UK-COT) all showed very consistent tracking of the 1989 YC as indicated by the means standardized abundance indices plotted by YC (Figure 3.1.7). The UK-COT was most variable and YC tracking generally poorer, particularly for YC's after 1990. The survey generally tracked YC much more consistently, however in the recent period only the intermediate ages (3-6) gave consistent estimates of YC strength. The UK-CBT tracked YC most consistently throughout the series with the pattern of abundances generally reflecting that of the more variable UK-BTS data. Catch curves (Figure 3.1.8) for the three indices support these conclusions, but also demonstrate substantial year effects in the UK-COT fleet in 1992 (negative) and 2005 (positive) which are offset by three years in the figures due to a fault in the plotting function.

Investigation of the current tuning fleets using single fleet runs gave little indication of persistent trends in Z over the time period 1988-2006 for any of the fleets (Figure 3.1.9 to 11). The UK-CBT fleet indicates a slow decline of SSB over the time period, while the UK-BTS shows a relatively consistent level of SSB since a dramatic drop at the beginning of the time-period in 1989. The UK-COT fleet also indicates a slow decline in SSB between 1994 and 2004, but much more variable levels of SSB in the early part of the time series and an increasing SSB since 2005. Estimates of recruitment are also relatively consistent between fleets.

Multifleet SURBA investigations

The multifleet SURBA run combines current fleets with historic fleets to attain a time-series of stock dynamics back to 1973 in a single multi-fleet run. In the long-term (since 1973) mortality is estimated to have been highly variable between years, but showing no trend throughout the period. SSB has been variable also, but has also declined slightly over the period, with recruitment being highly variable (Figure 3.1.12).

Residual plots for the current fleets (Figure 3.1.13) highlight the inconsistencies between the fleets. UK-CBT fleet residuals show a marked declining tendency through the period and the UK-COT residuals reflect the strong year effect in 1992 and 2005. There have been some questions as to the reliability of the UK-CBT tuning information due to anecdotal evidence of under reporting. The residual plots suggest this may be a problem with this fleet. The multi-fleet model has attributed these trends to the residuals, so that the estimates of SSB and Z should be representative of the overall stock dynamics. Similarly, the year effects in the UK-COT, attributed to changes in the stock numbers in the single fleet model have been correctly attributed to residuals in this fleet in the multi fleet run.

Problematic with the multi-fleet run is the discontinuity of the data in 1987-1988, the period of changeover from the historic fleets to the current fleets. This is most apparent in the estimates of Z, but also reflected by the apparent sharp rise and then fall of SSB in 1988 –1991. With no overlap in the periods of tuning it is unlikely that the trends are completely comparable between the two periods. A VPA based method should not suffer from these problems, because the catch at age matrix will bridge the two time periods.

XSA single fleet runs

Tuning data available from the three current tuning fleets (Table 3.1.8) were also examined for trends in catchability by carrying out single fleet XSA using the full range of tuning data, with low shrinkage and a high standard error threshold. This analysis was not carried out for the two historic tuning fleets. Residuals for all single fleet runs were generally small. Residuals for the UK-CBT fleet were small and indicated no trends (Figure 3.1.6). This consistency with the catch data is to be expected, since the catch at age composition is largely derived from the landings of this fleet. A consistent negative year-effect was observed for the otter trawl fleet in 1992 and 02-04, with a strong positive year-effect in 2005. The cause of this remains unclear, but the residuals, although consistent, were small enough not to warrant removal from the tuning series. The UK-BTS, although generally noisier than the other tuning fleets indicated no major trends in the residuals for older ages.

Final catch-at-age analysis

Being an update assessment the XSA settings used this year are based on those from the final assessment in 2006. The only difference this year is that the F shrinkage year range has been increased to 5 years. Previously this was reduced due to the short time series of French catch-at-age data.

Final settings used this year, and the configurations used in 2006 and 2007 are detailed below:

		2006 XSA	2007 XSA
Catch at age data		1969-2005, 1-12+	1969-2006, 1-12+
Fleets	UK-WECBTS - Survey	1988-05, 1-9	1988-06, 1-9
	UK-Inshore - Commercial	1973-1987	1973-1987, 2-14
	UK-Offshore - Commercial	1973-1987	1973-1987, 3-14
	UK Combined Beam Trawl - Commercial	1988-05, 3-11	1988-06, 3-11
	UK Otter trawl – Commercial	1988-05,3-11	1988-06,3-11
Taper		no	no
Ages catch dep. Stock size		none	none
q plateau		**8**	8
F shrinkage se		**1.0**	1.0
year range		**4**	**5**
age range		5	5
Fleet SE threshold		0.5	0.5
Catch data		Age 1 catches = 0	Age 1 catches = 0
Plus group		12	12
F Bar Range		F(3-7)	F(3-7)

The output diagnostics from this run are given in Table 3.1.9 and log catchability residuals from the final XSA fit are plotted for each fleet in Figures 3.1.14.

As in previous years, the XSA model fits well at most ages with low standard errors on the weighted final survivors estimates. The survey has high weights in the estimates of survivors at age 1-3 (100%, 85%, 52% respectively, Table 3.1.9). At ages older than 3 most of the weight is given to the commercial tuning series as in previous years although the survey influence has marginally decreased since last year.

A retrospective analysis was carried out back to 1999. The results, in Figure 3.1.15, show consistently biased retrospective pattern for both SSB (under estimate in the final year) and F (over estimation in the final year) over the last four years, and indicate a considerable uncertainty in recruitment estimation in the year of recruitment.

Fishing mortalities at age and numbers at age estimated by XSA can be found in Table 3.1.10 and 3.1.11.Estimates of F in 2005 have been revised downwards from 0.49 to 0.42 with F in 2006 being estimated at 0.43. SSB in 2005 and 2006 is estimated at 2760t and 2310t respectively with 2005 SSB having estimated to be 2530t by the 2006WG.

3.1.6 Estimating recruiting year class abundance

The **2004 year-class** is estimated to have been 4.8 million 1 year olds (85.4% from the survey 14.6% from F-shrinkage), which is 9% above the GM over the full time period 69-04.

The **2005 year-class** XSA estimate at age 1 (2.2 million) was replaced by GM recruitment depreciated for natural mortality, as it was given entirely by the survey, not thought to be very reliable at that age.

GM recruitment at age 1 (4.4 million) was assumed for the 2006 and subsequent year-classes as in last years assessment.

Working group estimates of year-class strength used for prediction can be summarised as follows:

Recruitment age 1					
Year class	Nos at age 1 (thousands)	Basis	Surveys	Commercial	Shrinkage
2004	4803	XSA	85.4%	-	14.6%
2005	4373	GM(69-04)		-	-
2006	4373	GM (69-04)			

3.1.7 Historic trends in biomass, fishing mortality and recruitment

The current assessment estimates SSB to have peaked in 1979 at 5,421t, then steadily declining to the series low of 2,308t in 2006.

Estimates of F first peaked in the late eighties, before apparently declining before rising again to the second highest point in the time series in 2006 (0.42). This assessment indicates that F_{sq} is still around this level (Table 3.1.12; Figure 3.1.10).

Recruitment appears to have been quite variable throughout the time period, with periods of low recruitment in the early 1970's and 1990's.

3.1.8 Short-term predictions

Input data for the catch predictions are given in Table 3.1.13. Stock numbers were taken to be the XSA estimated values for ages 3 and above, with age 2 estimates coming from GM (69-04) depreciated for M. GM (69-04) was used for age 1 recruitment as in previous years. The XSA estimate of age 1 in 2006 is 2199 thousand fish, and GM (69-04) is 4373 thousand fish. The XSA estimate is low compared to previous years, and has been doubled by replacing with the GM value. The justification for this replacement is that the XSA age 1 estimate was given entirely by the survey which is not thought to be very reliable at that age, especially since the catchability issues relating to the vessel changes in 2002 and 2004. The F-at-age vector was the unscaled mean for the period 2004-2006 (F_{sq} = F3-7 = 0.40). Weights at age in the catch and the stock were averaged over the last three years. Table 3.1.14 gives the management options and Table 3.1.15 the detailed output by age group for *status quo* F. The results are shown graphically in Figure 3.1.18.

The 2007 landings estimate for the forecast has been set as a catch constraint to 900t. The TAC constraint was used instead of the predicted value as compliance with the TAC has improved since the TAC was raised in 2005. Also, a large degree of compliance is expected due to the industry cooperation in the development of the management plan, and given the decommissioning scheme available for the UK fleet in 2008. In addition to this the F_{sq} short term forecast predicts a value very close to the TAC constraint (938t), uptake figures to date are inline with the TAC, and the buyers and sellers legislation should help data accuracy.

Estimates for 2008 landings are 928t at F *status quo*, and SSB is estimated to be 2,260 and 2,200t in 2008 and 2009 respectively.

The proportions that the 2003-2007 year classes will contribute to the landings in 2008, and to the SSB in 2009, are given in Table 3.1.16. 27% of the landings for 2008, and 40% of the SSB for 2009 rely on year classes for which GM recruitment has been assumed. The 2005 year class that has been replaced with GM (69-04) contributes to 19% of the landings in 2008 and 22% of the SSB in 2009.

The management plan for VIIe sole (Council Regulation (EC) No 509/2007) states that a 20% reduction in F should be sought for 2008. Table 3.1.14b shows that this would require a F multiplier of 0.72, which would achieve landings of 700 t and would equate to a 22% drop in TAC. The management plan states that if the change in TAC is greater than 15%, then a 15% change in TAC will be implemented. A 15% drop in TAC equates to 765 t in 2008. Table 3.1.14c shows that to achieve this would require a F value of 0.319, which equates to a 20% drop in the estimated Fbar (04-06) (0.401).

3.1.9 Yield and biomass per recruit

Input for the yield and biomass per recruit calculations is shown in Table 3.1.13 and are the same as for the short term forecast. Results for yield per recruit and SSB per recruit, conditional on the present exploitation pattern, are given in Table 3.1.17 and Figure 3.1.18. F_{max} is poorly defined (yield per recruit curve is flat-topped) at around 0.29. It is below F_{2006} (0.43) and F_{sq}(0.40). The stock-recruitment plot is shown in the reference points and medium term projection outputs Figures 3.1.19 & 3.1.20. No stock recruit relationship is apparent from the plot over the range of SSB range for this stock. $F_{0.1}$ is 0.11. Assuming *status quo* F and exploitation pattern and GM recruitment, long-term yield and SSB are estimated to be 870t and 2070t respectively.

3.1.10 Biological Reference points

The Working Group's approach to reference points is outlined in section 1.4.4. Reference points (Figure 3.1.19 & 3.1.20) were estimated using PASoft. The current and recent reference points for this stock are tabled below.

	WG(1998)/ACFM(1998)	since WG(2001)/ACFM (2001)	WG 2003-2005, and 2006 proposals
		Age range extended from 1-10+ to 1-12+	Uncertainty in the determination of appropriate reference points
F_{lim}	0.36 (F_{loss} WG98)	0.28 (F_{loss} WG01)	Rejected by 2004-2006 WG
F_{pa}	0.26 (F_{lim}*0.72)	0.20 (F_{lim}*0.72)	Rejected by 2004-2006 WG, as stock has persisted for 25 years at levels significantly higher than this
B_{lim}	1800t (B_{loss}= B_{73} WG98)	2000t (B_{loss}= B_{00} WG01)	Rejected by 2003 WG - 2006 WG
B_{pa}	2500t (B_{lim}*1.4)	2800t (Historical development)	Rejected by 2003 WG - 2006 WG and rated to be unreliable by ACFM 2003

Although the stock is currently below Bpa there is little evidence that the recruitment to the stock is impaired. F has been above Fpa since the early 1980's. This has decreased SSB substantially, but despite this there appears to be a healthy age structure in this stock compared to other sole stocks.

3.1.11 Sensitivity and risk analysis

The sensitivity of predictions made for yield in 2008 and SSB in 2009 was investigated using WGFRANWS (Section 1.4.3.). The input data are presented in Table 3.1.18 and results of the sensitivity analysis plotted in Figure 3.1.22. A description of the abbreviated variable names is given in Table 1.4.1

Probability profiles of expected yield and SSB are given in Figure 3.1.21. The approximate 90% confidence interval of the expected yield in 2007 is 700 t to 1150 t at *status quo* F.

The SSB in 2009 for this stock is forecast to be 2,200t, with a 90% confidence limit for this estimate ranging from 1,700t to 2,700t.

Figure 3.1.22 shows the delta profiles from the sensitivity analysis. They show that fish age 1 to 4 account for 4%, 21%, 27% and 8% respectively, of the variance for the yield estimate in 2008. It also shows that ages 1 to 4 account for 13%, 37%, 31% and 6% respectively, of the variance for the SSB estimate in 2009.

3.1.12 Comments on the assessment

Sampling

Age and length sampling for this stock is adequate. Age data from the largest two sectors prosecuting this fishery (UK and France, together about 95% of landings) are included in the assessment. Survey information, although restricted to a small part of the area of the stock, appears to track recruitment and changes in the abundance of the catch at age well, despite some reservations regarding year effects in the most recent time period. The use of commercial tuning data is unavoidable, as there is little information available for older ages from the survey. In 2006 a new survey time series (UK-Q1BEAM) was started, that covers the whole of the stock area and is likely to produce better information on older ages than the inshore based UK-BTS.

Discarding

There is currently little discarding of this stock. It is not anticipated to include discard information in the assessment unless discarding practices change.

Consistency

Figure 3.1.16 shows a comparison between 2007WG and historic assessments of VIIe sole. The plots show reasonably good consistency between WG2007 and WG2006 results, with a slight increase in SSB and decrease in F in the last few years of this year’s assessment. All years appear to show similar trends in SSB and F, but the years previous to 2006WG progressively diverge with age of assessment. The result is that SSB has been continuously upwardly revised to higher values, and that F has been continuously downwardly revised over the assessments. Historically recruitment appears to have been underestimated in comparison to 2007WG results, and shows less consistency with the timeseries trends. The setting used in each assessment will alter the scaling of these plots each year, and can explain some of the differences between the years. 2007WG and 2006WG show the greatest similarity over time, and share the same parameter settings.

The current settings, in conjunction with greater compliance (less misreporting) in recent years have improved the retrospective bias observed in previous assessments both for F and SSB (Figure 3.1.15). The large minimum standard error to shrink to in the assessment means there is only minimal reliance on the commercial information at the younger ages.

Misreporting

Misallocation, mainly to area VIId has continued in 2006, but at a much reduced rate due to the increase in the TAC's since 2005. All sole landings into rectangles 28E8 and 29E8 have been reattributed to VIIe, for the purposes of the WG. Estimates of unreported landings are not available so cannot be included in the assessment. Indications from the 2006WG analysis suggest that levels of underreporting appear to have declined following high levels of misreporting in the early 1990s.

Industry Input

The fisheries science partnership conducted cooperatively between CEFAS and the UK industry has provided some evidence for the wide dispersal and wide-ranging age distribution for this stock (CEFAS Fisheries Science Partnership Report, Working Document 5). The age composition of catches were similar to the ICES forecast, suggesting that survey CPUE can be seen as proportional to the catch rates of the fishery. The trends in SSB throughout the time series are similar to the recent trends given in ICES data, and there has been a constant distribution pattern.

Pre-WG UK(E&W) industry briefing meeting provided some additional anecdotal information on VIIe sole. The UK Industry believes that there is very little area misreporting now (ca. 10t). A lot of this is due to the fact that the TAC appears to be at a much more suitable level and the proposed management plan has afforded some stability in the fishery. Fishing for sole has been steady throughout the year, but last winters poor catches were due to adverse weather conditions.

The open beam trawl gear was used for the first time in several years during the summer of 2006. This gear is more efficient at catching younger fish than standard beam trawl gear, and was therefore not utilised within times of constrictive TAC's. Some of the inshore boats (twin rigs and netters) did very well on sole in 2006.

3.1.13 Management considerations

Although sole is the main target species in the beam trawl fishery, catches of cuttlefish, plaice, monkfish and lemon sole are also important. Management measures applied to sole must take account of management measures applied to the other quota species, particularly VIIe plaice and to a lesser degree VIIe-k cod.

The management plan for VIIe sole (Council Regulation (EC) No 509/2007) states that a 20% reduction in F should be sought for 2008. Table 3.1.14b shows that this would require a F multiplier of 0.72, which would achieve landings of 700 t and would equate to a 22% drop in TAC. The management plan states that if the change in TAC is greater than 15%, then a 15% change in TAC will be implemented. A 15% drop in TAC equates to 765 t in 2008. Table 3.1.14c shows that to achieve this would require a F value of 0.319, which equates to a 20% drop in the estimated Fbar (04-06) value (0.401).

No stock recruit relationship is apparent for this stock.

The short term forecast predictions this year use a GM (69-04) value for 2006 at age 1. The XSA estimate of this value is 2199 thousand fish, and GM (69-04) is 4373 thousand fish. The XSA estimate is low compared to previous years, and has been doubled by replacing with the GM value. The results from the short term forecast are sensitive to these values.

Council Regulation EC No 41/2007, Annex IIc restrict the number of days at sea to 192 for beam trawlers of mesh size equal to or greater than 80 mm, and for static nets including gill nets, trammel nets and tangle nets, with mesh size less than 220mm, with an additional 12 days for the UK beam trawl fleet due to a reduction in capacity of the fleet.

The UK beam trawl fleet, the major component of the fishery for this stock is currently undergoing restructuring with £5 million being allocated to reduce capacity in the UK SW beam trawl fleet. This is aimed primarily at vessels that traditionally target sole in the Celtic Sea and Channel. It is difficult to estimate how many vessels will be removed but on previous experience, it is likely to be sufficient to remove 4 or 5 vessels.

Table 3.1.1 Division VIIe Sole. Nominal landings (t), 1972–2006 used by Working Group.

Year	Belgium	France	UK (Engl & Wales)	Other	Total Reported	Unallocated [2]	Total used by WG
1972	6	230[3]	201	-	437	-	437
1973	2	263[3]	194	-	459	-	459
1974	6	237	181	-	424	3	427
1975	3	271	217	-	491	-	491
1976	4	352	260	-	616	-	616
1977	3	331	271	-	606	-	606
1978	4	384	453	20	861	-	861
1979	1	515	665	-	1,181	-	1,181
1980	45	447	764	13	1,269	-	1,269
1981	16	415	788	1	1,220	-5	1,215
1982	98	321	1,028	-	1,447	-1	1,446
1983	47	405	1,043	3	1,498	-	1,498
1984	48	421	901	-	1,370	-	1,370
1985	58	130	911	-	1,099	310	1,409
1986	62	467	840[2]	127	1,496	-77	1,419
1987	48	432	632[2]	-	1,112	168	1,280
1988	67	98	784[2]	-	949	495	1,444
1989	69	112	610[2]	6	797	593	1,390
1990	41	81	632[2]	-	754	561	1,315
1991	35	325	477[2]	-	837	15	852
1992	41	267	457[2]	9	774	121	895
1993	59	236	480[2]	18	793	111	904
1994	33	257	548[2]	-	838	-38	800
1995	21	294	565[2]	-	880	-24	856
1996	8	297	437[2]	-	742	91	833
1997	13	348	496[2]	1	858	91	949
1998	40	343	389[2]	-	772	108	880
1999	13	254	396[2]	-	663	294	957
2000	4	241	413[2]	-	658	256	914
2001	19	224	407[2]	-	650	419	1069
2002	33	198	309[2]	-	540	568	1108
2003	1	363	255[2]	1	620	458	1078
2004	7	302	185[2]	-	494	525	1019
2005	26	406	527[2]	-	959	67	1026
2006[1]	32	255	568[2]	-	855	103	958

[1]Provisional.

[2]UK total reported

Table 3.1.2 VIIe sole, LPUE and effective effort indices

	UK Otter			UK Beam < 24m			UK Beam > 24m			UK (E&W) BTS
Year	Effort	Landings	LPUE	Effort	Landings	LPUE	Effort	Landings	LPUE	CPUE
	[hr[1]]	[t]	[kg/hr[2]]	[hr[1]]	[t]	[kg/hr[2]]	[hr[1]]	[t]	[kg/hr[2]]	[kg/100km]
1972	64602	86.63	1.34							
1973	69543	85.44	1.23							
1974	50094	56.74	1.13							
1975	54688	70.07	1.28							
1976	56128	82.72	1.47							
1977	55404	68.55	1.24							
1978	48802	72.09	1.48							
1979	49918	78.08	1.56							
1980	49954	68.60	1.37							
1981	46884	47.90	1.02							
1982	38512	47.42	1.23							
1983	52592	56.86	1.08							
1984	52886	43.08	0.81							
1985	57685	44.28	0.77							103.41
1986	49521	43.89	0.89							130.24
1987	45112	30.23	0.67							95.70
1988	53402	31.10	0.58	46333	332.789	7.18	60896	441.988	7.26	74.24
1989	54707	30.60	0.56	35288	200.994	5.70	86799	520.433	6.00	69.36
1990	53050	27.55	0.52	36349	238.557	6.56	78512	474.064	6.04	43.72
1991	40789	13.58	0.33	27930	165.12	5.91	64936	296.011	4.56	72.58
1992	39909	12.38	0.31	29472	169.314	5.74	61955	291.498	4.70	78.13
1993	39240	14.57	0.37	31080	199.895	6.43	65312	281.748	4.31	49.63
1994	38768	18.39	0.47	34766	189.294	5.44	73472	317.871	4.33	40.66
1995	35453	13.14	0.37	31299	158.013	5.05	76803	328.926	4.28	37.78
1996	30541	12.48	0.41	33162	164.709	4.97	94912	300.93	3.17	48.72
1997	33281	14.82	0.45	34147	192.26	5.63	88683	332.089	3.74	63.11
1998	29802	11.08	0.37	43406	186.943	4.31	83089	306.698	3.69	65.83
1999	27516	12.60	0.46	42820	185.15	4.32	73173	271.41	3.71	54.50
2000	30493	10.58	0.35	49069	202.294	4.12	79577	250.023	3.14	51.94
2001	31900	13.30	0.42	65653	302.549	4.61	92418	300.742	3.25	74.67
2002	28346	8.86	0.31	61548	293.8	4.77	92186	298.57	3.24	43.18
2003	25052	7.33	0.29	67251	277.64	4.13	107010	329.5	3.08	50.30
2004	25584	5.68	0.22	56248	206.18	3.67	108640	239.23	2.20	57.99
2005	21129	11.91	0.56	51492	198.42	3.85	107655	255.16	2.37	35.67
2006	21058	7.68	0.36	50891	225.32	4.43	111175	238.81	2.15	49.10

[1] GRT - corrected hours fished
[2] kg/corrected hours

Table 3.1.3 Length distributions by country

Stock: VIIe SOLE

	UK (England & Wales)		France
Length (cm)	Beam trawl	All gears bar beam & dredge	Combined gears
21			
22	836	216	3109
23	13346	780	55864
24	45871	7014	121399
25	87239	10584	131642
26	109498	16356	141623
27	117441	22128	96690
28	133551	21847	89937
29	124113	21787	64860
30	115879	19601	66958
31	118380	17702	75329
32	110086	16350	53197
33	90947	13696	58760
34	78873	12778	44555
35	72281	9198	35187
36	60005	8636	36241
37	54930	6606	19561
38	43645	4424	31444
39	31454	4057	17002
40	29944	2719	16958
41	20592	2754	13940
42	16272	1581	6600
43	8911	1176	3960
44	6962	843	2640
45	4390	760	8559
46	3259	621	0
47	2467	466	0
48	1769	187	1320
49	762	130	0
50	491	95	0
51	0	60	0
52	237	39	0
53	9	39	1320
54	58	42	
55	0	0	
56	0	0	
57	0	0	
58	0	36	
59	55	0	
60		0	
61		0	
62		0	
63		0	
64		0	
65		0	
66		0	
67		0	
68		303	
Total	1504552	225612	1198658

Table 3.1.4 Discard Length Distributions for English Beamtrawl Fleet

Data raised to 79 sampled trips

	1st Quarter 2005		2nd Quarter 2005		3rd Quarter 2005		4th Quarter 2005	
	Retained	Discarded	Retained	Discarded	Retained	Discarded	Retained	Discarded
15								4
16								10
17								3
18								15
19								0
20								0
21			1					0
22	2	11	2	2	2	6		0
23	7	0	9	2	5	6	2	6
24	27	8	16	7	31	4	8	5
25	49		62	3	70		43	9
26	64		100	0	132		115	0
27	123		112	8	156		209	7
28	166		163	5	121		237	0
29	197		209	0	73		328	6
30	231		203	0	88		323	12
31	239		248	4	75		342	
32	268		255		68		340	
33	221		246		51		301	
34	240		239		42		276	
35	234		254		30		223	
36	190		236		29		208	
37	181		246		14		197	
38	150		177		16		169	
39	159		148		6		125	
40	104		142		9		101	
41	116		108		4		71	
42	99		78		6		44	
43	84		46		3		34	
44	44		54		3		34	
45	22		34		4		11	
46	21		40		1		3	
47	23		15		5		5	
48	8		6		0		5	
49	2		9		0		0	
50	7		2		1		1	
51	2		0				0	
52	0		3				1	
53	0		2				0	
54	1		0				3	
55	0		0					
56	0		2					
57	1							
58								
59								
60								
Total	3278	19	3464	31	1045	16	3755	77

Table 3.1.5 VIIe sole Catch numbers at age

Run title : W CHANNEL SOLE,2007 WG,1-15+,SEXES COMB,DEMARE. INDEX FILE.
At 22/06/2007 10:41

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

YEAR,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE								
1,	0,	0,	0,	0,	0,	0,	0,	0,
2,	89,	53,	51,	146,	71,	45,	82,	167,
3,	322,	232,	201,	412,	396,	349,	567,	419,
4,	80,	322,	246,	167,	433,	220,	170,	472,
5,	149,	90,	198,	115,	89,	178,	199,	161,
6,	210,	83,	65,	113,	99,	71,	115,	135,
7,	21,	112,	80,	14,	120,	80,	28,	92,
8,	50,	13,	156,	25,	17,	43,	53,	47,
9,	26,	35,	10,	134,	52,	32,	26,	59,
10,	20,	52,	35,	39,	30,	24,	22,	51,
11,	9,	22,	55,	54,	4,	55,	24,	14,
+gp,	63,	113,	113,	106,	136,	106,	171,	213,
TOTALNUM,	1037,	1127,	1207,	1323,	1446,	1202,	1456,	1830,
TONSLAND,	353,	391,	432,	437,	459,	427,	491,	616,
SOPCOF %,	100,	100,	100,	100,	100,	100,	98,	100,

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

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	426,	250,	227,	175,	245,	128,	91,	333,	287,	246,
3,	318,	1123,	803,	559,	806,	1451,	753,	663,	1700,	1618,
4,	384,	347,	811,	497,	651,	916,	1573,	826,	756,	971,
5,	206,	214,	250,	630,	467,	553,	583,	758,	469,	421,
6,	103,	189,	229,	126,	389,	352,	351,	325,	585,	321,
7,	70,	103,	174,	183,	179,	240,	267,	204,	179,	336,
8,	74,	72,	103,	140,	126,	136,	294,	129,	97,	84,
9,	10,	77,	90,	65,	76,	113,	119,	152,	103,	75,
10,	24,	38,	104,	56,	58,	81,	73,	54,	85,	90,
11,	32,	27,	28,	130,	55,	61,	37,	28,	29,	74,
+gp,	159,	203,	290,	342,	211,	294,	262,	255,	125,	127,
TOTALNUM,	1804,	2644,	3108,	2902,	3262,	4324,	4401,	3727,	4414,	4363,
TONSLAND,	606,	861,	1181,	1269,	1215,	1446,	1498,	1370,	1409,	1419,
SOPCOF %,	100,	99,	101,	100,	100,	101,	100,	101,	101,	100,

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

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	487,	443,	390,	341,	450,	316,	209,	97,	95,	365,
3,	809,	1438,	871,	902,	415,	1434,	704,	657,	308,	445,
4,	1091,	596,	1233,	581,	483,	417,	1107,	558,	629,	364,
5,	427,	728,	497,	553,	289,	297,	351,	558,	427,	298,
6,	204,	374,	509,	244,	220,	115,	219,	112,	411,	235,
7,	224,	153,	225,	265,	93,	112,	151,	106,	131,	257,
8,	229,	162,	110,	143,	111,	61,	78,	49,	101,	68,
9,	47,	109,	107,	103,	68,	74,	60,	57,	61,	61,
10,	50,	39,	113,	75,	37,	26,	56,	44,	33,	49,
11,	41,	50,	48,	85,	31,	23,	31,	50,	18,	37,
+gp,	162,	171,	214,	235,	145,	90,	79,	99,	142,	143,
TOTALNUM,	3771,	4262,	4316,	3525,	2341,	2964,	3045,	2388,	2356,	2321,
TONSLAND,	1280,	1444,	1390,	1315,	852,	895,	904,	800,	856,	833,
SOPCOF %,	100,	100,	100,	101,	100,	100,	100,	100,	100,	100,

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

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	216,	265,	280,	271,	145,	332,	598,	398,	258,	464,
3,	831,	606,	915,	631,	1401,	1251,	835,	1080,	469,	742,
4,	724,	536,	500,	839,	531,	843,	953,	448,	834,	436,
5,	325,	336,	398,	436,	497,	387,	645,	445,	449,	561,
6,	180,	209,	255,	265,	268,	322,	130,	526,	366,	228,
7,	194,	151,	114,	121,	178,	129,	74,	164,	293,	212,
8,	173,	80,	103,	56,	100,	105,	50,	116,	113,	178,
9,	44,	127,	54,	85,	55,	94,	58,	61,	80,	79,
10,	20,	35,	107,	63,	43,	33,	63,	54,	45,	51,
11,	40,	34,	25,	103,	42,	18,	14,	35,	24,	29,
+gp,	88,	162,	123,	110,	159,	85,	61,	85,	96,	84,
TOTALNUM,	2835,	2543,	2874,	2979,	3419,	3599,	3482,	3412,	3027,	3065,
TONSLAND,	949,	880,	957,	1018,	1069,	1106,	1078,	1075,	1039,	958,
SOPCOF %,	100,	100,	100,	100,	100,	100,	100,	100,	100,	101,

Table 3.1.6 VIIe sole Catch weights-at-age

Run title : W CHANNEL SOLE,2007 WG,1-15+,SEXES COMB,DEMARE. INDEX FILE.
At 22/06/2007 10:41

Table 2 Catch weights at age (kg)

YEAR	1969	1970	1971	1972	1973	1974	1975	1976
AGE								
1	.0000	.0000	.1130	.0000	.0000	.1440	.1420	.1390
2	.1880	.1870	.1510	.1940	.2030	.1830	.1810	.1700
3	.2450	.2230	.2220	.2270	.2240	.2240	.2140	.2170
4	.3320	.2940	.2960	.2720	.2620	.2810	.2990	.2860
5	.3290	.3140	.3670	.3690	.3100	.3790	.3580	.3230
6	.3670	.3540	.3500	.4080	.3810	.4340	.4030	.3900
7	.5220	.4340	.3590	.4580	.4140	.3720	.4350	.4540
8	.4550	.4980	.4310	.4950	.4590	.4640	.4970	.4130
9	.4630	.4420	.4550	.4020	.4660	.4750	.5910	.4750
10	.6060	.5120	.4760	.4540	.5370	.4870	.6510	.4780
11	.6470	.5280	.3880	.5080	.6540	.4740	.5350	.5830
+gp	.6600	.5935	.6535	.6003	.5608	.7310	.6763	.6276
SOPCOFAC	1.0008	1.0036	1.0002	1.0010	1.0016	1.0011	.9808	1.0029

Table 2 Catch weights at age (kg)

YEAR	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
AGE										
1	.1180	.0000	.0000	.0000	.0000	.1200	.0000	.0880	.0000	.1060
2	.1970	.1800	.1870	.1890	.1740	.2130	.1880	.2090	.1620	.1740
3	.2480	.2410	.2370	.2540	.2260	.2080	.2510	.2420	.2250	.2370
4	.3020	.3030	.3270	.3430	.3220	.2760	.2720	.3040	.2960	.2970
5	.3560	.3900	.4230	.3890	.3820	.3450	.3070	.3790	.3580	.3540
6	.3990	.4390	.4600	.5250	.4780	.4240	.3900	.3890	.3890	.4070
7	.5020	.3770	.4680	.5600	.5150	.4950	.4190	.4780	.4690	.4560
8	.4630	.4860	.4770	.6090	.5340	.5070	.4750	.5390	.5200	.5020
9	.5170	.4890	.5650	.6460	.5990	.5200	.5320	.5590	.5310	.5440
10	.4840	.4880	.5220	.6550	.6200	.5230	.6100	.6010	.5190	.5830
11	.5520	.5400	.5690	.6000	.7100	.5610	.5530	.7220	.5840	.6180
+gp	.6815	.6702	.7251	.7827	.6611	.6589	.6674	.6391	.8167	.7029
SOPCOFAC	1.0024	.9916	1.0093	1.0007	.9977	1.0056	.9961	1.0054	1.0064	1.0007

Table 2 Catch weights at age (kg)

YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
AGE										
1	.0980	.0910	.1100	.1580	.1050	.0880	.0000	.1220	.1330	.1640
2	.1740	.1700	.1670	.2160	.1820	.1660	.1460	.1830	.1920	.2140
3	.2450	.2440	.2220	.2700	.2550	.2380	.2090	.2410	.2480	.2620
4	.3100	.3120	.2750	.3220	.3230	.3050	.2680	.2950	.3010	.3080
5	.3700	.3750	.3260	.3700	.3860	.3660	.3240	.3470	.3510	.3540
6	.4250	.4320	.3750	.4160	.4450	.4230	.3760	.3960	.3970	.3990
7	.4740	.4840	.4220	.4580	.4990	.4740	.4250	.4420	.4410	.4420
8	.5180	.5310	.4670	.4980	.5490	.5200	.4700	.4840	.4810	.4840
9	.5570	.5720	.5100	.5340	.5940	.5610	.5130	.5240	.5180	.5240
10	.5900	.6080	.5510	.5670	.6340	.5970	.5510	.5610	.5520	.5640
11	.6180	.6390	.5900	.5970	.6690	.6270	.5870	.5950	.5830	.6020
+gp	.6650	.6938	.6915	.6642	.7417	.6839	.6715	.6709	.6516	.6946
SOPCOFAC	1.0006	1.0006	1.0005	1.0067	.9998	.9992	1.0002	.9997	1.0002	.9995

Table 2 Catch weights at age (kg)

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGE										
1	.0000	.0000	.1580	.1510	.0000	.1230	.1010	.1220	.1230	.1260
2	.1860	.1910	.2080	.2060	.2030	.1810	.1730	.1760	.1800	.1790
3	.2440	.2470	.2570	.2570	.2450	.2360	.2410	.2300	.2350	.2300
4	.3000	.3000	.3030	.3060	.2870	.2900	.3060	.2820	.2890	.2790
5	.3540	.3500	.3470	.3520	.3260	.3420	.3670	.3340	.3420	.3260
6	.4060	.3970	.3890	.3950	.3650	.3910	.4250	.3850	.3930	.3710
7	.4550	.4410	.4290	.4340	.4020	.4390	.4790	.4350	.4430	.4150
8	.5030	.4820	.4670	.4710	.4380	.4850	.5300	.4850	.4920	.4570
9	.5480	.5200	.5020	.5050	.4720	.5290	.5770	.5330	.5390	.4970
10	.5920	.5550	.5350	.5360	.5050	.5700	.6200	.5810	.5850	.5360
11	.6330	.5860	.5660	.5640	.5370	.6100	.6600	.6280	.6290	.5720
+gp	.7343	.6614	.6365	.6338	.6154	.7054	.7464	.7560	.7457	.6613
SOPCOFAC	.9993	.9999	1.0011	1.0019	1.0004	1.0006	.9999	1.0010	1.0022	1.0072

Table 3.1.7 VIIe sole Stock weights-at-age

Run title : W CHANNEL SOLE,2007 WG,1-15+,SEXES COMB,DEMARE. INDEX FILE.

At 22/06/2007 10:41

Table 3 Stock weights at age (kg)

YEAR,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE								
1,	.0400,	.0450,	.0300,	.0550,	.0350,	.0400,	.0710,	.0950,
2,	.1250,	.1200,	.0900,	.1300,	.1050,	.1250,	.1440,	.1460,
3,	.2000,	.1950,	.1700,	.2000,	.1700,	.2000,	.2210,	.1980,
4,	.2700,	.2550,	.2400,	.2650,	.2350,	.2650,	.2670,	.2470,
5,	.3300,	.3050,	.2950,	.3250,	.2900,	.3200,	.3270,	.2940,
6,	.3800,	.3550,	.3450,	.3800,	.3400,	.3700,	.3850,	.3380,
7,	.4250,	.3950,	.3900,	.4200,	.3900,	.4100,	.4350,	.3800,
8,	.4600,	.4300,	.4200,	.4600,	.4350,	.4550,	.4790,	.4170,
9,	.4900,	.4650,	.4450,	.4900,	.4750,	.4900,	.5160,	.4560,
10,	.5200,	.4900,	.4700,	.5200,	.5100,	.5150,	.5450,	.4910,
11,	.5500,	.5100,	.4900,	.5400,	.5400,	.5300,	.5690,	.5230,
+gp,	.6087,	.5407,	.5440,	.5577,	.5849,	.5714,	.6276,	.5946,

Table 3 Stock weights at age (kg)

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	.0860,	.0900,	.0640,	.0520,	.0380,	.0380,	.0400,	.0320,	.0950,	.0710,
2,	.1560,	.1560,	.1410,	.1250,	.1190,	.1170,	.1200,	.1080,	.1500,	.1400,
3,	.2210,	.2170,	.2160,	.2060,	.1970,	.1950,	.1950,	.1920,	.2040,	.2060,
4,	.2780,	.2760,	.2870,	.2880,	.2760,	.2650,	.2500,	.2680,	.2580,	.2680,
5,	.3320,	.3300,	.3520,	.3600,	.3580,	.3350,	.3070,	.3390,	.3110,	.3260,
6,	.3820,	.3800,	.4140,	.4360,	.4270,	.3980,	.3650,	.4000,	.3640,	.3810,
7,	.4250,	.4250,	.4630,	.5130,	.4900,	.4550,	.4200,	.4530,	.4160,	.4320,
8,	.4620,	.4630,	.5020,	.5750,	.5430,	.5060,	.4750,	.5010,	.4680,	.4800,
9,	.4970,	.4980,	.5390,	.6200,	.5820,	.5360,	.5200,	.5450,	.5200,	.5240,
10,	.5270,	.5260,	.5740,	.6500,	.6160,	.5620,	.5700,	.5770,	.5710,	.5640,
11,	.5530,	.5550,	.6080,	.6740,	.6450,	.5850,	.6150,	.6070,	.6210,	.6010,
+gp,	.6290,	.6299,	.7193,	.7140,	.6989,	.6317,	.7089,	.6959,	.7903,	.6915,

Table 3 Stock weights at age (kg)

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	.0580,	.0500,	.0810,	.1280,	.0650,	.0480,	.0000,	.0910,	.1030,	.1390,
2,	.1370,	.1310,	.1390,	.1870,	.1440,	.1280,	.1140,	.1530,	.1630,	.1890,
3,	.2100,	.2080,	.1950,	.2430,	.2190,	.2020,	.1780,	.2120,	.2210,	.2380,
4,	.2780,	.2780,	.2490,	.2960,	.2900,	.2720,	.2390,	.2680,	.2750,	.2850,
5,	.3410,	.3440,	.3000,	.3460,	.3550,	.3360,	.2960,	.3220,	.3260,	.3310,
6,	.3980,	.4040,	.3500,	.3930,	.4160,	.3950,	.3500,	.3720,	.3740,	.3760,
7,	.4500,	.4590,	.3980,	.4370,	.4730,	.4490,	.4010,	.4190,	.4190,	.4200,
8,	.4970,	.5080,	.4440,	.4780,	.5240,	.4980,	.4480,	.4630,	.4610,	.4630,
9,	.5380,	.5520,	.4880,	.5160,	.5720,	.5420,	.4920,	.5050,	.5000,	.5040,
10,	.5740,	.5910,	.5310,	.5510,	.6140,	.5800,	.5320,	.5430,	.5360,	.5440,
11,	.6050,	.6240,	.5710,	.5830,	.6520,	.6130,	.5700,	.5780,	.5680,	.5830,
+gp,	.6591,	.6870,	.6749,	.6544,	.7309,	.6773,	.6591,	.6586,	.6408,	.6774,

Table 3 Stock weights at age (kg)

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
AGE										
1,	.0000,	.0000,	.1320,	.1230,	.0000,	.0940,	.0630,	.0950,	.0940,	.0990,
2,	.1560,	.1620,	.1830,	.1790,	.1810,	.1520,	.1370,	.1490,	.1520,	.1530,
3,	.2150,	.2200,	.2330,	.2320,	.2240,	.2090,	.2070,	.2030,	.2080,	.2040,
4,	.2720,	.2740,	.2800,	.2820,	.2660,	.2630,	.2740,	.2560,	.2630,	.2540,
5,	.3270,	.3250,	.3260,	.3290,	.3070,	.3160,	.3370,	.3080,	.3160,	.3020,
6,	.3800,	.3740,	.3690,	.3740,	.3460,	.3670,	.3960,	.3600,	.3680,	.3490,
7,	.4310,	.4190,	.4100,	.4150,	.3840,	.4150,	.4520,	.4100,	.4190,	.3930,
8,	.4800,	.4620,	.4480,	.4530,	.4200,	.4620,	.5050,	.4600,	.4680,	.4360,
9,	.5260,	.5010,	.4850,	.4890,	.4550,	.5070,	.5540,	.5090,	.5160,	.4770,
10,	.5700,	.5370,	.5190,	.5210,	.4890,	.5500,	.5990,	.5570,	.5620,	.5170,
11,	.6120,	.5710,	.5510,	.5510,	.5210,	.5910,	.6410,	.6050,	.6070,	.5540,
+gp,	.7169,	.6502,	.6241,	.6250,	.6020,	.6885,	.7317,	.7341,	.7258,	.6455,

Table 3.1.8 VIIe sole, Data available for tuning (figures used in the assessment are shown in bold)

W CHANNEL SOLE 2007 WG, 1-14, SEXES COMBINED, DEMARE
105 Updated IDH 11/6/07
UK combined Beam Trawl (inc 29E8/28E8)(Thousand hours - GRT corrected; numbers in thousands)
1988 2006
1 1 0 1
3 14

107.23	**747.49**	**382.40**	**497.05**	**225.59**	**71.83**	**70.57**	**66.73**	**14.92**	**24.57**	15.09	31.15	7.87
122.09	**480.71**	**603.07**	**295.68**	**344.28**	**124.29**	**52.66**	**52.11**	**48.82**	**30.47**	18.98	21.01	12.79
114.86	**478.16**	**361.27**	**271.68**	**174.70**	**170.90**	**65.40**	**49.23**	**31.81**	**27.42**	14.67	24.04	12.60
92.87	**229.74**	**240.99**	**186.87**	**121.76**	**52.87**	**67.89**	**37.54**	**17.79**	**12.29**	22.67	5.38	9.83
91.43	**773.74**	**216.51**	**152.49**	**57.61**	**60.04**	**28.95**	**41.72**	**10.80**	**7.61**	7.45	7.99	7.08
96.39	**382.12**	**602.61**	**186.88**	**114.16**	**81.18**	**41.21**	**31.94**	**31.52**	**15.68**	4.58	11.85	8.02
108.24	**443.52**	**361.70**	**347.10**	**69.39**	**62.83**	**30.89**	**34.86**	**26.44**	**29.61**	14.09	10.91	5.74
108.10	**173.64**	**357.84**	**240.49**	**233.61**	**71.61**	**56.73**	**33.47**	**18.33**	**10.07**	22.33	9.28	6.44
128.07	**239.43**	**194.61**	**165.43**	**133.04**	**143.67**	**38.10**	**34.80**	**27.59**	**20.80**	22.58	20.66	8.37
122.83	**474.85**	**387.28**	**181.39**	**95.01**	**104.45**	**92.27**	**23.00**	**10.67**	**21.69**	8.71	10.14	7.52
126.50	**352.44**	**311.69**	**194.66**	**115.68**	**83.44**	**44.32**	**66.82**	**18.37**	**18.30**	15.18	16.05	7.08
115.99	**471.41**	**244.17**	**181.40**	**114.13**	**48.08**	**45.38**	**23.67**	**47.22**	**10.45**	17.65	5.01	5.30
128.65	**308.67**	**374.19**	**177.98**	**110.37**	**53.08**	**26.86**	**31.31**	**23.64**	**41.62**	4.51	6.91	2.95
158.07	**832.95**	**295.63**	**281.48**	**143.95**	**95.75**	**53.72**	**28.03**	**23.25**	**22.22**	25.86	9.65	7.28
153.74	**775.07**	**469.78**	**172.07**	**172.99**	**77.14**	**54.40**	**23.91**	**10.98**	**12.98**	7.28	13.62	6.31
174.26	**425.77**	**550.11**	**423.34**	**69.80**	**59.67**	**33.48**	**43.96**	**21.73**	**7.15**	6.69	10.92	9.19
164.89	**494.01**	**207.46**	**180.26**	**253.67**	**38.28**	**50.45**	**25.25**	**20.16**	**14.39**	7.15	3.98	6.39
159.15	**223.71**	**346.97**	**141.36**	**165.05**	**140.46**	**29.15**	**34.66**	**23.97**	**15.14**	8.83	6.32	5.14
162.07	**388.53**	**192.22**	**250.97**	**88.24**	**111.68**	**110.28**	**38.37**	**21.31**	**14.11**	14.03	6.88	3.08

UK OTTER TRAWL FLEET
1988 2006
1 1 0 1
3 14

53402	**33.38**	**16.95**	**20.78**	**9.30**	**2.75**	**2.75**	**1.98**	**0.38**	**0.82**	0.43	0.93	0.27
54707	**16.22**	**19.72**	**9.91**	**12.63**	**5.08**	**2.60**	**2.54**	**2.16**	**1.51**	1.20	1.07	0.70
53050	**19.09**	**13.10**	**9.60**	**6.35**	**5.76**	**2.17**	**1.91**	**1.16**	**0.94**	0.65	1.00	0.53
40789	**10.04**	**7.04**	**4.12**	**2.46**	**0.96**	**1.44**	**0.42**	**0.41**	**0.24**	0.27	0.08	0.18
39909	**26.15**	**5.98**	**3.59**	**1.19**	**1.14**	**0.48**	**0.65**	**0.17**	**0.09**	0.07	0.17	0.10
39240	**12.22**	**17.24**	**5.29**	**3.38**	**2.44**	**1.24**	**0.98**	**0.90**	**0.55**	0.13	0.32	0.29
38768	**12.67**	**11.69**	**12.60**	**2.55**	**2.65**	**1.25**	**1.38**	**1.05**	**1.20**	0.63	0.46	0.27
35453	**5.26**	**9.75**	**6.34**	**6.18**	**1.89**	**1.49**	**0.91**	**0.52**	**0.25**	0.59	0.32	0.18
30541	**9.46**	**6.52**	**4.36**	**3.14**	**3.53**	**0.95**	**0.75**	**0.67**	**0.45**	0.44	0.42	0.18
33281	**15.05**	**8.74**	**4.75**	**2.81**	**2.88**	**2.52**	**0.62**	**0.28**	**0.43**	0.31	0.26	0.27
29802	**8.50**	**7.38**	**4.14**	**2.42**	**1.49**	**0.90**	**1.43**	**0.31**	**0.43**	0.37	0.34	0.12
27516	**11.35**	**5.73**	**4.83**	**2.84**	**1.42**	**1.44**	**0.72**	**1.47**	**0.38**	0.56	0.19	0.19
30493	**6.40**	**8.07**	**3.87**	**2.53**	**1.19**	**0.57**	**0.77**	**0.59**	**0.95**	0.09	0.20	0.05
31900	**17.90**	**5.23**	**4.93**	**2.67**	**1.99**	**1.11**	**0.70**	**0.51**	**0.50**	0.65	0.24	0.22
28346	**9.77**	**6.05**	**2.36**	**2.64**	**1.26**	**0.81**	**0.33**	**0.20**	**0.24**	0.17	0.27	0.10
25060	**4.49**	**5.72**	**4.67**	**1.01**	**0.83**	**0.47**	**0.52**	**0.26**	**0.12**	0.15	0.22	0.17
25584	**5.98**	**2.55**	**2.20**	**3.21**	**0.45**	**0.57**	**0.29**	**0.24**	**0.18**	0.13	0.07	0.09
21129	**6.34**	**9.41**	**3.47**	**4.07**	**3.39**	**0.73**	**0.89**	**0.57**	**0.45**	0.25	0.19	0.14
21058	**6.85**	**3.24**	**4.08**	**1.34**	**1.61**	**1.73**	**0.59**	**0.30**	**0.20**	0.19	0.12	0.05

UK Beam trawl survey
1988 2006
1 1 0.75 0.8
1 9

128.2	**2**	**39**	**129**	**52**	**75**	**22**	**0**	**12**	**3**
165.7	**5**	**56**	**120**	**107**	**34**	**40**	**17**	**5**	**7**
175.7	**23**	**52**	**76**	**31**	**24**	**7**	**15**	**3**	**6**
171.7	**11**	**231**	**79**	**51**	**23**	**21**	**5**	**17**	**4**
196.6	**5**	**140**	**316**	**44**	**36**	**12**	**7**	**5**	**11**
189.2	**5**	**54**	**115**	**105**	**14**	**10**	**9**	**3**	**3**
205.9	**6**	**47**	**106**	**62**	**44**	**5**	**5**	**2**	**3**
187.2	**14**	**37**	**44**	**42**	**26**	**31**	**4**	**5**	**5**
184.4	**28**	**112**	**67**	**25**	**32**	**20**	**17**	**3**	**2**
184.7	**11**	**130**	**126**	**43**	**14**	**16**	**13**	**14**	**5**
185.5	**11**	**141**	**114**	**76**	**22**	**10**	**14**	**6**	**8**
187.9	**11**	**97**	**128**	**47**	**23**	**8**	**4**	**4**	**4**
180.4	**12**	**136**	**70**	**52**	**23**	**16**	**5**	**3**	**5**
178.0	**9**	**197**	**162**	**52**	**31**	**12**	**12**	**4**	**1**
180.0	**6**	**37**	**113**	**48**	**27**	**6**	**3**	**2**	**0**
170.7	**23**	**158**	**57**	**50**	**19**	**4**	**4**	**6**	**1**
164.9	**16**	**110**	**120**	**24**	**15**	**10**	**16**	**9**	**4**
186.6	**8**	**110**	**39**	**53**	**12**	**12**	**6**	**2**	**4**
184.7	**5**	**120**	**95**	**26**	**37**	**10**	**7**	**9**	**0**

Table 3.1.8 VIIe sole, Data available for tuning (continued)

UK Inshore fleet
1973 1987
1 1 0 1
2 14

15.76	**28.3**	**142.9**	**145.8**	**28.7**	**28.7**	**33.8**	**4.9**	**15.2**	**8.4**	**1.0**	8.4	12.7	1.2
12.58	**17.2**	**117.7**	**67.5**	**51.6**	**18.0**	**19.3**	**11.0**	**8.2**	**5.8**	**12.0**	3.1	4.8	2.9
12.84	**30.0**	**163.3**	**41.9**	**45.1**	**21.2**	**4.8**	**10.0**	**4.9**	**3.7**	**3.7**	7.0	3.8	5.2

```
12.58  63.6 137.5 139.9  44.9  32.6 21.4 11.4 14.4 11.7  2.9  3.7 16.0 4.6
14.01 169.7 106.7 114.5  57.4  24.3 15.8 18.1  2.5  5.3  6.4  3.5  4.5 8.2
22.31 117.8 449.7 124.4  72.1  54.5 28.5 21.1 22.5 10.4  6.7  5.8  5.9 3.5
31.15 114.2 342.9 310.5  89.6  70.2 51.1 32.4 28.1 30.2  7.3  6.8 17.3 3.6
42.40 131.4 322.7 221.1 257.7  36.9 46.3 37.1 18.1 13.7 32.5  9.2  7.6 8.9
46.36 161.9 478.9 320.6 190.5 123.1 52.6 37.8 22.1 15.7 12.1 11.3  3.4 3.7
51.68  86.0 857.6 442.0 215.7 113.5 70.6 43.0 33.6 22.2 16.7 10.3  8.2 7.6
51.09  76.8 353.4 623.5 210.6  80.1 78.3 94.1 33.8 26.4  5.3  6.5 34.8 5.1
48.21 177.7 280.2 309.0 257.0  88.6 43.9 39.6 38.1  8.5  5.9 13.9 17.5 4.0
54.87  57.7 598.4 320.7 168.7 198.1 37.2 29.9 45.9 32.4 17.7  7.6  4.2 5.6
53.46 103.2 823.1 361.7 111.3  82.9 87.1 23.2  9.3  7.6 17.8  4.2  5.1 9.4
35.61 116.6 183.2 269.3  93.4  17.1 16.7 32.0  5.9  9.0  3.6  7.8  4.5 5.2

UK Offshore fleet
1973  1987
1 1 0 1
3 14
 5.64  24.6  37.3   8.9  13.0  16.8   2.1  6.6  4.3  0.7  4.3  4.3  0.7
 6.72  30.3  25.7  23.8  12.2  14.4   7.1  5.4  4.5 11.3  2.3  2.4  2.4
13.94  85.2  32.5  42.1  29.2   7.3  13.1  6.4  5.8  6.9 10.8  3.8  8.7
 7.36  38.6  58.4  22.7  24.2  17.3   8.1 10.2  9.8  2.9  3.0  8.8  4.2
 9.88  36.1  57.7  34.9  21.7  15.5  15.3  2.1  5.3  7.9  3.5  3.0  8.8
14.50 140.5  57.7  40.4  44.9  25.8  16.6 17.9  9.7  7.7  5.3  3.6  3.5
20.38 107.9 145.1  50.6  58.2  46.4  25.5 22.4 28.3  8.3  6.3 10.6  3.7
28.18 103.1 104.9 147.7  31.1  42.7  29.7 14.7 13.0 37.9  8.8  4.7  9.0
28.75 142.8 142.1 101.9  96.6  45.3  28.2 16.7 13.9 13.1 10.0  2.0  3.5
39.85 317.9 243.4 143.3 110.7  75.7  39.9 31.6 24.5 22.5 11.3  5.9  9.0
66.45 104.1 433.6 167.6 116.5 100.9 104.4 47.8 27.7 19.8  9.2 18.7 10.2
49.07 152.8 234.7 214.8 133.2  69.9  22.9 54.3 28.5  7.8 29.7  8.2  6.7
47.15 245.2 130.3 110.8 211.1  75.6  26.7 31.6 15.5  7.1  0.0  7.9  6.8
34.66 425.5 215.7 100.2  79.1  70.0  15.2  7.9 30.1 28.6  5.3 13.7  7.6
47.41 158.4 344.2 138.8  53.3  50.7  95.7 22.7 19.0 26.1 13.8 14.2 14.6
```

Table 3.1.9 VIIe sole XSA Tuning Diagnostics

Lowestoft VPA Version 3.1

22/06/2007 10:39

Extended Survivors Analysis

W CHANNEL SOLE,2007 WG,1-15+,SEXES COMB,DEMARE. INDEX FILE.

CPUE data from file SOL7ETU2.DAT

Catch data for 38 years. 1969 to 2006. Ages 1 to 12.

Fleet,	First, year,	Last, year,	First, age ,	Last, age	Alpha,	Beta
UK combined Beam Tra,	1988,	2006,	3,	11,	.000,	1.000
UK OTTER TRAWL FLEET,	1988,	2006,	3,	11,	.000,	1.000
UK Beam trawl survey,	1988,	2006,	1,	9,	.750,	.800
UK Inshore fleet ,	1973,	2006,	2,	11,	.000,	1.000
UK Offshore fleet ,	1973,	2006,	3,	11,	.000,	1.000

Time series weights :

Tapered time weighting not applied

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 5 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 = .500

Prior weighting not applied

Tuning had not converged after 30 iterations

Total absolute residual between iterations
29 and 30 = .00113

Final year F values

Age ,	1,	2,	3,	4,	5,	6,	7,	8,	9,	10
Iteration 29,	.0000,	.1190,	.2709,	.3798,	.4556,	.5803,	.4423,	.3846,	.6095,	.3980
Iteration 30,	.0000,	.1190,	.2709,	.3798,	.4555,	.5802,	.4422,	.3844,	.6093,	.3978

Age ,	11
Iteration 29,	.3500
Iteration 30,	.3498

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
1,	.000,	.000,	.000,	.000,	.000,	.000,	.000,	.000,	.000,	.000
2,	.069,	.064,	.092,	.046,	.031,	.110,	.131,	.166,	.072,	.119
3,	.307,	.249,	.289,	.276,	.315,	.351,	.391,	.327,	.268,	.271
4,	.412,	.297,	.299,	.415,	.351,	.282,	.437,	.334,	.401,	.380
5,	.391,	.303,	.333,	.408,	.410,	.413,	.323,	.333,	.579,	.456
6,	.245,	.416,	.352,	.343,	.419,	.451,	.211,	.421,	.444,	.580
7,	.347,	.297,	.374,	.249,	.362,	.324,	.157,	.397,	.389,	.442
8,	.212,	.208,	.301,	.282,	.302,	.336,	.178,	.348,	.463,	.384
9,	.228,	.214,	.191,	.386,	.436,	.452,	.278,	.305,	.381,	.609
10,	.137,	.256,	.252,	.316,	.307,	.442,	.554,	.404,	.344,	.398
11,	.318,	.319,	.260,	.363,	.322,	.187,	.302,	.608,	.282,	.350

XSA population numbers (Thousands)

	AGE									
YEAR ,	1,	2,	3,	4,	5,	6,	7,	8,	9,	10,
1997 ,	4.99E+03,	3.42E+03,	3.30E+03,	2.26E+03,	1.06E+03,	8.71E+02,	6.97E+02,	9.49E+02,	2.25E+02,	1.68E+02,
1998 ,	3.68E+03,	4.51E+03,	2.89E+03,	2.20E+03,	1.35E+03,	6.46E+02,	6.17E+02,	4.46E+02,	6.94E+02,	1.62E+02,
1999 ,	6.97E+03,	3.33E+03,	3.83E+03,	2.04E+03,	1.48E+03,	9.03E+02,	3.86E+02,	4.15E+02,	3.27E+02,	5.07E+02,
2000 ,	5.59E+03,	6.31E+03,	2.75E+03,	2.60E+03,	1.37E+03,	9.59E+02,	5.75E+02,	2.40E+02,	2.78E+02,	2.45E+02,
2001 ,	3.70E+03,	5.06E+03,	5.45E+03,	1.89E+03,	1.55E+03,	8.22E+02,	6.15E+02,	4.05E+02,	1.64E+02,	1.71E+02,
2002 ,	5.67E+03,	3.35E+03,	4.44E+03,	3.60E+03,	1.20E+03,	9.33E+02,	4.89E+02,	3.88E+02,	2.71E+02,	9.60E+01,
2003 ,	3.02E+03,	5.13E+03,	2.71E+03,	2.83E+03,	2.46E+03,	7.20E+02,	5.37E+02,	3.20E+02,	2.51E+02,	1.56E+02,
2004 ,	4.32E+03,	2.74E+03,	4.07E+03,	1.66E+03,	1.65E+03,	1.61E+03,	5.28E+02,	4.15E+02,	2.43E+02,	1.72E+02,
2005 ,	4.80E+03,	3.91E+03,	2.10E+03,	2.66E+03,	1.08E+03,	1.07E+03,	9.56E+02,	3.21E+02,	2.65E+02,	1.62E+02,
2006 ,	2.20E+03,	4.35E+03,	3.29E+03,	1.45E+03,	1.61E+03,	5.45E+02,	6.22E+02,	5.86E+02,	1.83E+02,	1.64E+02,

Table 3.1.9 continued VIIe sole XSA Tuning Diagnostics

```
 Estimated population abundance at 1st Jan 2007
    ,        0.00E+00,  1.99E+03,  3.49E+03,  2.27E+03,  8.99E+02,  9.25E+02,  2.76E+02,  3.62E+02,  3.61E+02,
9.00E+01,

 Taper weighted geometric mean of the VPA populations:

    ,        4.31E+03,  3.91E+03,  3.28E+03,  2.23E+03,  1.49E+03,  1.02E+03,  6.90E+02,  4.91E+02,  3.58E+02,
2.61E+02,

 Standard error of the weighted Log(VPA populations) :

    ,          .3647,     .3592,     .3647,     .3768,     .3344,     .3497,     .4023,     .4128,     .4469,
.4943,

                                 AGE
 YEAR ,          11,

 1997 ,    1.55E+02,
 1998 ,    1.33E+02,
 1999 ,    1.14E+02,
 2000 ,    3.57E+02,
 2001 ,    1.61E+02,
 2002 ,    1.14E+02,
 2003 ,    5.58E+01,
 2004 ,    8.12E+01,
 2005 ,    1.04E+02,
 2006 ,    1.04E+02,

 Estimated population abundance at 1st Jan 2007

    ,     9.98E+01,

 Taper weighted geometric mean of the VPA populations:

    ,     1.84E+02,

 Standard error of the weighted Log(VPA populations) :

    ,        .5856,

 Log catchability residuals.

 Fleet : UK combined Beam Tra

  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,   .40,   .29,   .36,   .04,   .32,   .15,   .30,  -.30,  -.53
     4 , 99.99,   .31,   .42,   .35,   .15,   .16,   .23,   .16,   .31,  -.23
     5 , 99.99,   .37,   .41,   .30,   .33,   .10,   .40,  -.06,   .15,  -.21
     6 , 99.99,   .47,   .40,   .55,   .29,  -.41,   .24,  -.22,  -.02,  -.13
     7 , 99.99,   .07,   .35,   .32,   .09,   .08,   .33,   .03,   .29,  -.22
     8 , 99.99,   .25,   .18,   .40,   .09,  -.05,   .11,  -.30,   .43,   .01
     9 , 99.99,   .18,   .27,   .70,   .53,  -.11,   .33,   .15,   .07,   .19
    10 , 99.99,  -.36,   .12,   .32,   .43,  -.36,  -.19,   .41,  -.18,   .05
    11 , 99.99,   .57,   .62,   .09,   .02,   .01,   .28,  -.10,  -.21,   .09

  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 ,   .16,  -.07,   .05,  -.15,  -.03,   .14,  -.07,  -.30,  -.42,  -.34
     4 ,   .19,  -.09,  -.17,  -.03,  -.19,  -.37,  -.03,  -.46,  -.35,  -.37
     5 ,   .16,  -.09,  -.14,  -.15,  -.03,  -.24,  -.22,  -.61,  -.28,  -.18
     6 ,  -.28,   .26,  -.03,  -.23,   .02,   .12,  -.77,  -.13,  -.11,  -.01
     7 ,   .19,   .04,   .08,  -.38,  -.01,   .01,  -.54,  -.80,  -.06,   .14
     8 ,  -.17,  -.18,   .05,  -.05,  -.07,   .03,  -.46,  -.18,  -.38,   .29
     9 ,  -.12,  -.21,  -.42,   .01,   .24,  -.38,   .10,  -.35,  -.06,   .50
    10 ,  -.63,  -.03,  -.14,  -.18,  -.04,  -.13,  -.01,  -.19,   .05,  -.07
    11 ,   .24,   .20,  -.15,   .04,  -.02,  -.25,  -.20,   .32,   .01,  -.05

 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,         10,
11
 Mean Log q,   -6.7083,   -6.5145,   -6.4985,   -6.5748,   -6.6884,   -6.8182,   -6.8182,   -6.8182,   -
6.8182,
 S.E(Log q),      .2807,      .2774,      .2800,      .3248,      .3021,      .2481,      .3234,      .2701,
.2562,


 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,     .71,    1.970,      7.11,     .74,     19,     .19,   -6.71,
  4,     .83,     .862,      6.72,     .60,     19,     .23,   -6.51,
  5,    1.08,    -.295,      6.44,     .47,     19,     .31,   -6.50,
  6,     .84,     .821,      6.62,     .60,     19,     .27,   -6.57,
  7,     .92,     .358,      6.67,     .53,     19,     .28,   -6.69,
  8,     .84,    1.006,      6.70,     .70,     19,     .21,   -6.82,
  9,    1.33,   -1.223,      7.07,     .45,     19,     .41,   -6.73,
 10,    1.03,    -.160,      6.92,     .69,     19,     .28,   -6.88,
 11,     .92,     .628,      6.60,     .80,     19,     .23,   -6.74,
1
```

Table 3.1.9 continued VIIe sole XSA Tuning Diagnostics

Fleet : UK OTTER TRAWL FLEET

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	.32	.04	.25	.07	.10	-.06	.10	-.35	.01
4	99.99	.31	.22	.22	-.15	-.18	-.01	.17	.24	.23
5	99.99	.33	.26	.17	-.21	-.38	.18	.10	.07	.03
6	99.99	.41	.33	.44	-.37	-1.04	.05	-.07	-.11	-.01
7	99.99	-.06	.39	.14	-.66	-.62	.15	.32	.20	-.06
8	99.99	.12	.39	.19	-.52	-.90	-.08	-.06	.33	.17
9	99.99	-.22	.47	.64	-.73	-1.02	.16	.37	.00	.20
10	99.99	-.92	.23	.20	-.10	-1.26	-.42	.63	-.21	.19
11	99.99	.29	.83	-.09	-.68	-1.18	.25	.14	-.37	.11

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	.34	-.01	.09	-.26	.06	-.20	-.35	-.52	.37	.00
4	.12	.03	-.06	-.01	-.20	-.62	-.24	-.58	.48	.01
5	.27	-.04	.11	-.10	-.03	-.39	-.34	-.71	.48	.18
6	-.07	.27	.14	-.14	.06	.05	-.64	-.21	.64	.27
7	.34	-.11	.43	-.30	.15	.02	-.45	-.95	.67	.38
8	-.05	-.21	.45	-.04	.07	-.07	-.37	-.38	.37	.60
9	.00	-.19	-.06	.16	.57	-.56	.02	-.54	.72	.79
10	-.55	-.25	.25	-.01	.16	-.02	-.07	-.34	.75	.12
11	.05	.31	.39	.11	.20	-.13	.07	.22	.93	.15

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	10	11
Mean Log q	-15.9499	-15.8404	-15.8520	-15.9107	-16.0308	-16.1444	-16.1444	-16.1444	-16.1444
S.E(Log q)	.2447	.2834	.2961	.3903	.4267	.3705	.5048	.4916	.4794

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	.94	.342	15.45	.63	19	.24	-15.95
4	1.04	-.162	16.18	.47	19	.30	-15.84
5	1.05	-.201	16.31	.45	19	.32	-15.85
6	.88	.481	14.82	.48	19	.35	-15.91
7	.73	1.059	13.48	.48	19	.31	-16.03
8	.98	.064	15.96	.42	19	.37	-16.14
9	2.77	-2.129	34.58	.08	19	1.28	-16.10
10	.92	.284	15.39	.45	19	.46	-16.23
11	.92	.343	15.16	.52	19	.44	-16.06

1

Fleet : UK Beam trawl survey

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	99.99	-1.18	-.25	.29	.17	-.63	-.19	-.45	.31	1.18
2	99.99	-.45	-.34	-.19	.35	.31	-.49	-.33	-.84	.15
3	99.99	.29	.42	-.07	.14	.46	.07	.02	-.46	-.40
4	99.99	.42	.74	-.24	.25	.07	.09	.01	-.09	-.38
5	99.99	.82	.50	.01	.13	.39	-.32	-.28	-.11	.28
6	99.99	.73	.71	-.33	.65	-.05	-.12	-.79	.13	.34
7	99.99	99.99	.79	.17	-.20	-.15	.16	-.46	-.43	-.03
8	99.99	.97	.19	-.41	.71	.05	-.55	-1.07	.12	-.26
9	99.99	-.47	.63	.90	.33	.41	-.06	-.31	.25	-.38
10	No data for this fleet at this age									
11	No data for this fleet at this age									

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	-.03	.27	-.38	-.03	.11	-.74	1.29	.60	-.32	.00
2	.44	.24	.18	-.12	.47	-.73	.36	.69	.14	.16
3	.23	.22	.07	-.18	.02	-.12	-.22	.10	-.53	-.08
4	-.12	.38	-.03	-.04	.24	-.55	-.10	-.34	-.09	-.21
5	-.27	-.14	-.17	.00	.19	.30	-.78	-.58	-.31	.33
6	.24	.20	-.42	.25	.19	-.62	-.90	-.59	-.11	.50
7	.42	.58	-.16	-.39	.52	-.68	-.56	1.06	-.64	-.01
8	.16	.07	-.21	.07	-.13	-.77	.46	.77	-.51	.34
9	.58	-.09	-.06	.52	-.51	99.99	-1.01	.46	.31	99.99
10	No data for this fleet at this age									
11	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	8	9
Mean Log q	-11.2277	-8.8007	-8.3991	-8.6632	-8.8904	-9.1925	-9.2786	-9.3577	-9.3577
S.E(Log q)	.6056	.4326	.2759	.3085	.3920	.5005	.5101	.5292	.5133

Table 3.1.9 continued VIIe sole XSA Tuning Diagnostics

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,	1.44,	-.668,	12.51,	.12,	19,	.89,	-11.23,
2,	.68,	1.322,	8.63,	.49,	19,	.29,	-8.80,
3,	.65,	2.928,	8.29,	.81,	19,	.15,	-8.40,
4,	.87,	.573,	8.54,	.53,	19,	.27,	-8.66,
5,	1.04,	-.126,	8.96,	.33,	19,	.42,	-8.89,
6,	.78,	.787,	8.67,	.43,	19,	.39,	-9.19,
7,	.81,	.550,	8.75,	.35,	18,	.42,	-9.28,
8,	.62,	1.586,	8.10,	.51,	19,	.32,	-9.36,
9,	.98,	.069,	9.18,	.35,	17,	.51,	-9.27,

Fleet : UK Inshore fleet

Age	1973	1974	1975	1976
1	No data for this fleet at this age			
2	.18,	-.42,	.19,	1.05
3	.35,	.48,	.46,	.37
4	.28,	.09,	-.33,	.66
5	.13,	-.01,	.18,	.25
6	.20,	.47,	-.39,	.48
7	.57,	.38,	-.54,	-.04
8	-.46,	-.14,	-.12,	.52
9	.37,	.47,	-.81,	.48
10	-.56,	-.17,	-.13,	.26
11	-.24,	.20,	-.46,	-.16

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	No data for this fleet at this age									
2	1.10,	.62,	.33,	.06,	-.37,	-.57,	-.45,	.00,	-1.44,	-.20
3	.10,	.30,	.04,	-.28,	-.06,	-.14,	-.49,	-.43,	-.14,	-.05
4	.37,	.05,	-.07,	-.39,	-.07,	.14,	-.05,	-.21,	-.03,	-.10
5	.24,	-.01,	-.04,	.05,	-.03,	.12,	.19,	-.17,	-.26,	-.31
6	.10,	.33,	.27,	-.62,	-.08,	.07,	-.05,	.23,	.21,	-.21
7	.01,	.16,	.39,	.03,	.08,	-.29,	.28,	.01,	-.15,	-.01
8	-.16,	.01,	.20,	.09,	.08,	.12,	.37,	.04,	-.12,	-.22
9	-.91,	-.22,	.23,	-.42,	-.17,	.26,	.34,	-.04,	.44,	-.90
10	-.43,	.25,	-.03,	-.52,	-.38,	.10,	.50,	-.54,	.03,	-.88
11	-.25,	-.48,	-.18,	.06,	-.45,	-.10,	-.94,	-.54,	.42,	-.18

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	No data for this fleet at this age									
2	-.08,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
3	-.51,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
4	-.34,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
5	-.33,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
6	-1.01,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
7	-.87,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
8	-.21,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
9	-.86,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
10	-.15,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
11	-.75,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	No data for this fleet at this age									
2	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
3	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
4	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
5	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
6	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
7	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
8	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
9	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
10	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99
11	99.99,	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 ,	2,	3,	4,	5,	6,	7,	8,	9,	10,	11
Mean Log q,	-7.3110,	-5.7483,	-5.7346,	-5.9953,	-6.3342,	-6.4696,	-6.4441,	-6.4441,	-6.4441,	-6.4441,
S.E(Log q),	.6469,	.3401,	.2843,	.1932,	.4125,	.3654,	.2478,	.5546,	.4167,	.4496,

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,	2.15,	-1.100,	6.06,	.07,	15,	1.38,	-7.31,
3,	1.57,	-1.531,	4.34,	.36,	15,	.51,	-5.75,
4,	1.35,	-1.134,	4.98,	.44,	15,	.38,	-5.73,
5,	1.23,	-1.279,	5.67,	.70,	15,	.23,	-6.00,
6,	1.14,	-.343,	6.23,	.31,	15,	.49,	-6.33,
7,	.85,	.482,	6.51,	.45,	15,	.32,	-6.47,
8,	.91,	.467,	6.44,	.68,	15,	.23,	-6.44,
9,	.78,	.590,	6.45,	.36,	15,	.43,	-6.56,
10,	1.06,	-.211,	6.67,	.47,	15,	.41,	-6.62,
11,	.89,	.767,	6.58,	.78,	15,	.32,	-6.71,

Table 3.1.9 continued VIIe sole XSA Tuning Diagnostics

Fleet : UK Offshore fleet

Age	1973	1974	1975	1976
1	No data for this fleet at this age			
2	No data for this fleet at this age			
3	.34	.47	.45	.36
4	.29	.09	-.32	.67
5	.12	-.03	.17	.24
6	.14	.42	-.44	.43
7	.52	.34	-.57	-.09
8	-.41	-.09	-.06	.59
9	.43	.55	-.76	.54
10	-.34	.07	.10	.48
11	.30	.63	-.05	.24

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	.09	.29	.03	-.29	-.07	-.15	-1.25	-.34	-.16	.45
4	.37	.06	-.07	-.39	-.06	.15	-.33	-.15	-.43	.16
5	.22	-.02	-.05	.04	-.05	.10	-.17	-.23	-.40	.16
6	.05	.28	.22	-.67	-.13	.02	-.22	.34	.14	-.11
7	-.04	.11	.34	-.02	.03	-.33	-.11	.08	.33	-.17
8	-.11	.07	.25	.15	.13	.17	.08	-.66	-.22	-.34
9	-.87	-.15	.29	-.35	-.10	.33	.29	.16	.08	-.76
10	-.21	.48	.19	-.30	-.15	.32	.15	.52	-.69	.80
11	.17	-.05	.24	.48	-.02	.33	-.02	-.42	-.48	.60

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	-.22	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
4	-.04	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
5	-.09	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
6	-.44	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
7	-.42	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
8	.47	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
9	.07	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
10	.18	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
11	.81	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99

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	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
4	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
5	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
6	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
7	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
8	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
9	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
10	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
11	99.99	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	3	4	5	6	7	8	9	10	11
Mean Log q	-6.4704	-6.0786	-6.1283	-6.0461	-6.0939	-6.3108	-6.3108	-6.3108	-6.3108
S.E(Log q)	.4501	.3062	.1762	.3335	.3048	.3270	.4745	.4078	.4140

Regression statistics :

Ages with q independent of year class strength and constant w.r.t. time.

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	1.42	-.891	5.74	.26	15	.64	-6.47
4	1.33	-.980	5.49	.41	15	.41	-6.08
5	1.37	-2.190	5.66	.73	15	.21	-6.13
6	1.33	-.869	5.71	.35	15	.45	-6.05
7	1.06	-.175	6.06	.44	15	.33	-6.09
8	.83	.734	6.32	.60	15	.28	-6.31
9	.94	.156	6.31	.33	15	.46	-6.33
10	1.77	-1.625	6.48	.26	15	.66	-6.20
11	.87	.864	6.04	.78	15	.32	-6.13

1

Table 3.1.9 continued VIIe sole XSA Tuning Diagnostics

```
 Terminal year survivor and F summaries :
 Age  1   Catchability constant w.r.t. time and dependent on age

 Year class = 2005

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
      ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 UK combined Beam Tra,         1.,   .000,       .000,    .00,   0,  .000,     .000
 UK OTTER TRAWL FLEET,         1.,   .000,       .000,    .00,   0,  .000,     .000
 UK Beam trawl survey,      1990.,   .621,       .000,    .00,   1, 1.000,     .000
 UK Inshore fleet    ,         1.,   .000,       .000,    .00,   0,  .000,     .000
 UK Offshore fleet   ,         1.,   .000,       .000,    .00,   0,  .000,     .000

   F shrinkage mean  ,         0.,   1.00,,,,                        .000,     .000

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      1990.,       .62,      .00,    1,    .000,   .000

1
 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
 UK combined Beam Tra,         1.,   .000,       .000,    .00,   0,  .000,     .000
 UK OTTER TRAWL FLEET,         1.,   .000,       .000,    .00,   0,  .000,     .000
 UK Beam trawl survey,      3395.,   .390,       .236,    .61,   2,  .854,     .122
 UK Inshore fleet    ,         1.,   .000,       .000,    .00,   0,  .000,     .000
 UK Offshore fleet   ,         1.,   .000,       .000,    .00,   0,  .000,     .000

   F shrinkage mean  ,      4110.,   1.00,,,,                        .146,     .102

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      3491.,       .36,      .16,    3,    .448,   .119

 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
 UK combined Beam Tra,      1622.,   .500,       .000,    .00,   1,  .206,     .361
 UK OTTER TRAWL FLEET,      2271.,   .500,       .000,    .00,   1,  .206,     .271
 UK Beam trawl survey,      2671.,   .307,       .186,    .60,   3,  .521,     .235
 UK Inshore fleet    ,         1.,   .000,       .000,    .00,   0,  .000,     .000
 UK Offshore fleet   ,         1.,   .000,       .000,    .00,   0,  .000,     .000

   F shrinkage mean  ,      1798.,   1.00,,,,                        .067,     .331

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      2270.,       .23,      .12,    6,    .547,   .271

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

 Year class = 2002

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
      ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 UK combined Beam Tra,       609.,   .357,       .028,    .08,   2,  .262,     .520
 UK OTTER TRAWL FLEET,      1060.,   .357,       .177,    .50,   2,  .262,     .330
 UK Beam trawl survey,      1026.,   .266,       .377,   1.42,   4,  .421,     .340
 UK Inshore fleet    ,         1.,   .000,       .000,    .00,   0,  .000,     .000
 UK Offshore fleet   ,         1.,   .000,       .000,    .00,   0,  .000,     .000

   F shrinkage mean  ,       951.,   1.00,,,,                        .054,     .362

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       899.,       .18,      .17,    9,    .958,   .380
```

Table 3.1.9 continued VIIe sole XSA Tuning Diagnostics

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

 Year class = 2001

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 UK combined Beam Tra,       711.,   .301,       .053,    .18,   3,  .285,     .560
 UK OTTER TRAWL FLEET,      1040.,   .301,       .258,    .86,   3,  .285,     .414
 UK Beam trawl survey,      1014.,   .247,       .162,    .66,   5,  .378,     .423
 UK Inshore fleet    ,         1.,   .000,       .000,    .00,   0,  .000,     .000
 UK Offshore fleet   ,         1.,   .000,       .000,    .00,   0,  .000,     .000

   F shrinkage mean  ,      1044.,   1.00,,,,                        .052,     .413

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       925.,       .16,      .10,   12,    .609,   .456
```

1

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

 Year class = 2000

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 UK combined Beam Tra,       234.,   .279,       .101,    .36,   4,  .298,     .657
 UK OTTER TRAWL FLEET,       303.,   .279,       .228,    .82,   4,  .298,     .540
 UK Beam trawl survey,       270.,   .245,       .194,    .79,   6,  .344,     .590
 UK Inshore fleet    ,         1.,   .000,       .000,    .00,   0,  .000,     .000
 UK Offshore fleet   ,         1.,   .000,       .000,    .00,   0,  .000,     .000

   F shrinkage mean  ,       455.,   1.00,,,,                        .060,     .390

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       276.,       .16,      .10,   15,    .655,   .580
```

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

 Year class = 1999

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 UK combined Beam Tra,       337.,   .254,       .136,    .53,   5,  .310,     .468
 UK OTTER TRAWL FLEET,       413.,   .254,       .243,    .96,   5,  .310,     .397
 UK Beam trawl survey,       325.,   .232,       .104,    .45,   7,  .335,     .482
 UK Inshore fleet    ,         1.,   .000,       .000,    .00,   0,  .000,     .000
 UK Offshore fleet   ,         1.,   .000,       .000,    .00,   0,  .000,     .000

   F shrinkage mean  ,       521.,   1.00,,,,                        .046,     .327

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       362.,       .14,      .09,   18,    .621,   .442
```

1

```
 Age  8   Catchability constant w.r.t. time and dependent on age

 Year class = 1998

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 UK combined Beam Tra,       364.,   .237,       .100,    .42,   6,  .318,     .382
 UK OTTER TRAWL FLEET,       462.,   .237,       .210,    .88,   6,  .318,     .312
 UK Beam trawl survey,       274.,   .224,       .167,    .75,   8,  .323,     .481
 UK Inshore fleet    ,         1.,   .000,       .000,    .00,   0,  .000,     .000
 UK Offshore fleet   ,         1.,   .000,       .000,    .00,   0,  .000,     .000

   F shrinkage mean  ,       439.,   1.00,,,,                        .041,     .326

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       361.,       .14,      .10,   21,    .729,   .384
```

Table 3.1.9 continued VIIe sole XSA Tuning Diagnostics

```
 Age  9   Catchability constant w.r.t. time and age (fixed at the value for age)  8

 Year class = 1997

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 UK combined Beam Tra,        77.,   .230,       .211,    .92,   7,  .357,     .682
 UK OTTER TRAWL FLEET,        96.,   .231,       .267,   1.16,   7,  .349,     .579
 UK Beam trawl survey,        88.,   .220,       .255,   1.16,   8,  .238,     .617
 UK Inshore fleet    ,         1.,   .000,       .000,    .00,   0,  .000,     .000
 UK Offshore fleet   ,         1.,   .000,       .000,    .00,   0,  .000,     .000

   F shrinkage mean  ,       168.,   1.00,,,,                        .057,     .371

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
        90.,       .14,      .13,   23,    .957,   .609


1
 Age 10   Catchability constant w.r.t. time and age (fixed at the value for age)  8

 Year class = 1996

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 UK combined Beam Tra,        88.,   .219,       .067,    .30,   8,  .362,     .440
 UK OTTER TRAWL FLEET,       107.,   .221,       .148,    .67,   8,  .354,     .375
 UK Beam trawl survey,       109.,   .220,       .172,    .78,   9,  .242,     .370
 UK Inshore fleet    ,         1.,   .000,       .000,    .00,   0,  .000,     .000
 UK Offshore fleet   ,         1.,   .000,       .000,    .00,   0,  .000,     .000

   F shrinkage mean  ,        96.,   1.00,,,,                        .042,     .411

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       100.,       .13,      .07,   26,    .557,   .398


 Age 11   Catchability constant w.r.t. time and age (fixed at the value for age)  8

 Year class = 1995

 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 UK combined Beam Tra,        58.,   .208,       .064,    .31,   9,  .386,     .388
 UK OTTER TRAWL FLEET,        71.,   .210,       .148,    .70,   9,  .381,     .329
 UK Beam trawl survey,        80.,   .216,       .155,    .72,   9,  .194,     .298
 UK Inshore fleet    ,         1.,   .000,       .000,    .00,   0,  .000,     .000
 UK Offshore fleet   ,         1.,   .000,       .000,    .00,   0,  .000,     .000

   F shrinkage mean  ,        44.,   1.00,,,,                        .039,     .484

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
        66.,       .13,      .07,   28,    .562,   .350
```

Table 3.1.10 VIIe sole Fishing Mortality

Run title : W CHANNEL SOLE,2007 WG,1-15+,SEXES COMB,DEMARE. INDEX FILE.

At 22/06/2007 10:40

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE								
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0425,	.0387,	.0150,	.0583,	.0317,	.0143,	.0284,	.0632,
3,	.1486,	.1340,	.1787,	.1457,	.1990,	.1920,	.2264,	.1778,
4,	.1122,	.1953,	.1838,	.1988,	.2013,	.1451,	.1209,	.2662,
5,	.1552,	.1593,	.1585,	.1106,	.1384,	.1067,	.1698,	.1445,
6,	.1402,	.1091,	.1495,	.1140,	.1172,	.1409,	.0839,	.1497,
7,	.1269,	.0933,	.1315,	.0399,	.1533,	.1173,	.0670,	.0806,
8,	.0908,	.0946,	.1621,	.0491,	.0537,	.0675,	.0958,	.1381,
9,	.0400,	.0763,	.0877,	.1827,	.1236,	.1250,	.0478,	.1313,
10,	.0719,	.0965,	.0914,	.5075,	.0512,	.0712,	.1056,	.1137,
11,	.0941,	.0941,	.1246,	.1790,	.0810,	.1120,	.0840,	.0818,
+gp,	.0941,	.0941,	.1246,	.1790,	.0810,	.1120,	.0840,	.0818,
0 FBAR 3- 7,	.1366,	.1382,	.1604,	.1218,	.1618,	.1404,	.1336,	.1638,

Table 8 Fishing mortality (F) at age

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0709,	.0590,	.0579,	.0402,	.0323,	.0290,	.0257,	.0605,	.0431,	.0696,
3,	.1473,	.2410,	.2427,	.1765,	.2338,	.2420,	.2134,	.2362,	.4335,	.3210,
4,	.2191,	.2122,	.2452,	.2083,	.2860,	.4018,	.3976,	.3404,	.4086,	.4193,
5,	.1588,	.1639,	.2084,	.2723,	.2750,	.3723,	.4269,	.3009,	.2936,	.3719,
6,	.1159,	.1922,	.2359,	.1382,	.2403,	.3055,	.3801,	.3974,	.3559,	.2986,
7,	.0965,	.1472,	.2420,	.2676,	.2646,	.2047,	.3571,	.3520,	.3519,	.3169,
8,	.0778,	.1225,	.1922,	.2801,	.2675,	.2945,	.3684,	.2609,	.2521,	.2472,
9,	.0366,	.0970,	.1988,	.1592,	.2142,	.3606,	.4003,	.2931,	.3031,	.2815,
10,	.0649,	.1674,	.1656,	.1639,	.1876,	.3304,	.3702,	.2852,	.2353,	.4199,
11,	.0861,	.0892,	.1585,	.2859,	.2140,	.2716,	.2208,	.2146,	.2159,	.2958,
+gp,	.0861,	.0892,	.1585,	.2859,	.2140,	.2716,	.2208,	.2146,	.2159,	.2958,
0 FBAR 3- 7,	.1475,	.1913,	.2348,	.2126,	.2599,	.3053,	.3550,	.3254,	.3687,	.3455,

1

Table 3.1.10 continued VIIe sole Fishing Mortality

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0919,	.1308,	.1167,	.1341,	.0683,	.0868,	.0647,	.0444,	.0300,	.1000,
3,	.3029,	.3766,	.3623,	.3804,	.2141,	.2859,	.2530,	.2635,	.1733,	.1720,
4,	.3313,	.3397,	.5678,	.3886,	.3197,	.3081,	.3320,	.2909,	.3847,	.2836,
5,	.2921,	.3421,	.4664,	.4763,	.3023,	.2961,	.4083,	.2474,	.3361,	.2813,
6,	.2761,	.3980,	.3785,	.3893,	.3124,	.1684,	.3301,	.1961,	.2596,	.2779,
7,	.3121,	.3066,	.3935,	.3070,	.2242,	.2320,	.3105,	.2342,	.3278,	.2292,
8,	.3293,	.3462,	.3347,	.4114,	.1816,	.2009,	.2244,	.1409,	.3243,	.2520,
9,	.1911,	.2302,	.3597,	.5279,	.3123,	.1588,	.2753,	.2279,	.2318,	.2971,
10,	.2715,	.2135,	.3507,	.4076,	.3235,	.1676,	.1556,	.3002,	.1757,	.2627,
11,	.3048,	.4218,	.3883,	.4282,	.2591,	.3053,	.2751,	.1828,	.1756,	.2716,
+gp,	.3048,	.4218,	.3883,	.4282,	.2591,	.3053,	.2751,	.1828,	.1756,	.2716,
0 FBAR 3- 7,	.3029,	.3526,	.4337,	.3883,	.2745,	.2581,	.3268,	.2464,	.2963,	.2488,

Table 8 Fishing mortality (F) at age

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,	FBAR **-**
AGE											
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0688,	.0637,	.0925,	.0462,	.0306,	.1102,	.1308,	.1658,	.0719,	.1190,	.1189,
3,	.3074,	.2493,	.2888,	.2761,	.3148,	.3512,	.3913,	.3268,	.2677,	.2709,	.2885,
4,	.4116,	.2966,	.2985,	.4146,	.3508,	.2825,	.4374,	.3339,	.4005,	.3798,	.3714,
5,	.3910,	.3032,	.3328,	.4081,	.4100,	.4126,	.3230,	.3326,	.5787,	.4555,	.4556,
6,	.2446,	.4159,	.3522,	.3430,	.4188,	.4513,	.2111,	.4209,	.4441,	.5802,	.4818,
7,	.3468,	.2975,	.3736,	.2495,	.3617,	.3240,	.1574,	.3965,	.3889,	.4422,	.4092,
8,	.2125,	.2085,	.3011,	.2816,	.3019,	.3358,	.1779,	.3481,	.4632,	.3844,	.3986,
9,	.2277,	.2142,	.1907,	.3864,	.4358,	.4516,	.2779,	.3052,	.3805,	.6093,	.4317,
10,	.1366,	.2559,	.2520,	.3165,	.3070,	.4422,	.5538,	.4036,	.3436,	.3978,	.3817,
11,	.3176,	.3185,	.2601,	.3628,	.3225,	.1867,	.3017,	.6082,	.2816,	.3498,	.4132,
+gp,	.3176,	.3185,	.2601,	.3628,	.3225,	.1867,	.3017,	.6082,	.2816,	.3498,	
0 FBAR 3- 7,	.3403,	.3125,	.3292,	.3383,	.3712,	.3643,	.3040,	.3622,	.4160,	.4257,	

Table 3.1.11 VIIe sole Stock Numbers

Run title : W CHANNEL SOLE,2007 WG,1-15+,SEXES COMB,DEMARE.   INDEX FILE.

At 22/06/2007 10:40

Terminal Fs derived using XSA (With F shrinkage)

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

YEAR,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,
AGE								
1,	1635,	3958,	2989,	2648,	3647,	3401,	3176,	7231,
2,	2242,	1480,	3581,	2704,	2396,	3300,	3077,	2873,
3,	2448,	1944,	1288,	3192,	2308,	2101,	2943,	2706,
4,	790,	1909,	1539,	975,	2497,	1712,	1569,	2124,
5,	1086,	639,	1421,	1158,	723,	1847,	1340,	1258,
6,	1685,	841,	493,	1097,	938,	570,	1502,	1023,
7,	187,	1325,	683,	384,	886,	755,	448,	1250,
8,	601,	149,	1093,	542,	334,	688,	608,	379,
9,	685,	497,	123,	841,	467,	286,	582,	500,
10,	304,	595,	416,	102,	634,	373,	229,	502,
11,	104,	256,	489,	344,	55,	545,	314,	186,
+gp,	737,	1322,	1010,	679,	1837,	1051,	2224,	2846,
0 TOTAL,	12505,	14916,	15124,	14667,	16722,	16628,	18011,	22878,

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

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	5074,	4698,	5169,	8952,	5178,	4154,	6594,	7898,	4259,	6450,
2,	6543,	4591,	4251,	4677,	8100,	4685,	3758,	5966,	7147,	3854,
3,	2441,	5515,	3916,	3630,	4065,	7097,	4118,	3315,	5081,	6194,
4,	2050,	1906,	3922,	2780,	2753,	2912,	5041,	3010,	2368,	2980,
5,	1473,	1490,	1395,	2777,	2042,	1871,	1763,	3065,	1938,	1424,
6,	985,	1137,	1144,	1025,	1914,	1404,	1167,	1041,	2053,	1307,
7,	797,	794,	849,	818,	808,	1362,	936,	722,	633,	1301,
8,	1043,	655,	620,	603,	566,	561,	1004,	592,	459,	403,
9,	299,	873,	524,	463,	412,	392,	378,	629,	413,	323,
10,	396,	260,	717,	389,	357,	301,	247,	229,	424,	276,
11,	405,	336,	199,	550,	299,	268,	196,	155,	156,	303,
+gp,	2019,	2500,	2074,	1440,	1149,	1295,	1385,	1384,	677,	519,
0 TOTAL,	23524,	24754,	24779,	28103,	27643,	26300,	26587,	28006,	25608,	25335,

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Table 3.1.11 continued VIIe sole Stock Numbers

Run title : W CHANNEL SOLE,2007 WG,1-15+,SEXES COMB,DEMARE. INDEX FILE.

At 22/06/2007 10:40

Terminal Fs derived using XSA (With F shrinkage)

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,	4196,	4114,	3160,	7926,	4409,	3883,	2601,	3726,	4457,	3777,
2,	5836,	3796,	3722,	2860,	7172,	3989,	3513,	2354,	3371,	4033,
3,	3253,	4817,	3014,	2997,	2263,	6061,	3309,	2980,	2037,	2960,
4,	4065,	2174,	2991,	1898,	1854,	1653,	4121,	2325,	2072,	1550,
5,	1773,	2641,	1400,	1534,	1165,	1218,	1099,	2675,	1573,	1276,
6,	888,	1198,	1697,	795,	862,	779,	820,	661,	1890,	1017,
7,	878,	610,	728,	1052,	487,	571,	596,	533,	492,	1319,
8,	858,	581,	406,	444,	700,	352,	410,	395,	382,	321,
9,	285,	558,	372,	263,	267,	528,	261,	296,	310,	250,
10,	221,	213,	401,	235,	140,	176,	408,	179,	213,	223,
11,	164,	152,	156,	256,	141,	92,	135,	316,	120,	162,
+gp,	648,	520,	696,	705,	667,	357,	343,	619,	922,	631,
0 TOTAL,	23064,	21375,	18745,	20965,	20127,	19661,	17615,	17059,	17839,	17518,

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 69-**	AMST 69-**
AGE													
1,	4989,	3683,	6973,	5593,	3698,	5669,	3023,	4317,	4803,	2199,	0,	4373,	4647,
2,	3417,	4514,	3333,	6310,	5061,	3346,	5130,	2735,	3906,	4346,	1990,	3897,	4159,
3,	3302,	2887,	3833,	2749,	5451,	4441,	2712,	4073,	2097,	3289,	3491,	3317,	3540,
4,	2255,	2197,	2036,	2598,	1888,	3600,	2828,	1659,	2658,	1452,	2270,	2248,	2406,
5,	1056,	1352,	1478,	1367,	1553,	1203,	2456,	1652,	1075,	1611,	899,	1502,	1588,
6,	871,	646,	903,	959,	822,	933,	720,	1609,	1072,	545,	925,	1032,	1094,
7,	697,	617,	386,	575,	615,	489,	537,	528,	956,	622,	276,	686,	740,
8,	949,	446,	415,	240,	405,	388,	320,	415,	321,	586,	362,	494,	537,
9,	225,	694,	327,	278,	164,	271,	251,	243,	265,	183,	361,	367,	404,
10,	168,	162,	507,	245,	171,	96,	156,	172,	162,	164,	90,	268,	301,
11,	155,	133,	114,	357,	161,	114,	56,	81,	104,	104,	100,	190,	223,
+gp,	339,	623,	563,	379,	606,	526,	247,	195,	411,	297,	256,		
0 TOTAL,	18425,	17956,	20868,	21649,	20595,	21076,	18437,	17680,	17830,	15399,	11019,		

Table 3.1.12 VIIe sole summary table

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

,	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 3- 7,
1969,	1635,	3403,	2794,	353,	.1263,	.1366,
1970,	3958,	3671,	3070,	391,	.1274,	.1382,
1971,	2989,	3354,	2814,	432,	.1535,	.1604,
1972,	2648,	3627,	2790,	437,	.1567,	.1218,
1973,	3647,	4027,	3393,	459,	.1353,	.1618,
1974,	3401,	4069,	3281,	427,	.1302,	.1404,
1975,	3176,	5240,	4216,	491,	.1164,	.1336,
1976,	7231,	5779,	4367,	616,	.1411,	.1638,
1977,	5074,	6103,	4414,	606,	.1373,	.1475,
1978,	4698,	6759,	4989,	861,	.1726,	.1913,
1979,	5169,	6877,	5421,	1181,	.2179,	.2348,
1980,	8952,	6750,	5254,	1269,	.2415,	.2126,
1981,	5178,	6428,	4856,	1215,	.2502,	.2599,
1982,	4154,	6304,	4809,	1446,	.3007,	.3053,
1983,	6594,	6055,	4799,	1498,	.3121,	.3550,
1984,	7898,	5951,	4677,	1370,	.2929,	.3254,
1985,	4259,	6041,	4059,	1409,	.3471,	.3687,
1986,	6450,	5656,	3928,	1419,	.3613,	.3455,
1987,	4196,	5441,	3987,	1280,	.3210,	.3029,
1988,	4114,	5163,	3888,	1444,	.3714,	.3526,
1989,	3160,	4544,	3422,	1390,	.4062,	.4337,
1990,	7926,	5230,	3277,	1315,	.4012,	.3883,
1991,	4409,	4540,	3020,	852,	.2821,	.2745,
1992,	3883,	4207,	2846,	895,	.3145,	.2581,
1993,	2601,	3657,	2864,	904,	.3156,	.3268,
1994,	3726,	4305,	3217,	800,	.2487,	.2464,
1995,	4457,	4559,	3301,	856,	.2593,	.2963,
1996,	3777,	4710,	3080,	833,	.2704,	.2488,
1997,	4989,	3841,	2912,	949,	.3259,	.3403,
1998,	3683,	4030,	2971,	880,	.2962,	.3125,
1999,	6973,	4989,	2974,	957,	.3217,	.3292,
2000,	5593,	5040,	2933,	1018,	.3471,	.3383,
2001,	3698,	4414,	2885,	1069,	.3706,	.3712,
2002,	5669,	4641,	3039,	1106,	.3639,	.3643,
2003,	3023,	4196,	2983,	1078,	.3613,	.3040,
2004,	4317,	3977,	2700,	1075,	.3981,	.3622,
2005,	4803,	4055,	2762,	1039,	.3762,	.4160,
2006*,	**4373**,	3521,	2308,	958,	.4150,	.4257,
Arith. Mean ,	4587,	4873,	3561,	963,	.2760,	.2788,
0 Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

* Recruits replaced with GM (69-04). Original XSA estimated value = 2199.

Table 3.1.13 VIIe sole, Input to short-term projection

MFDP version 1a
Run: STF1
Time and date: 11:02 22/06/2007
Fbar age range: 3-7

Input F's are mean 04-06 unscaled
Catch & Stock weights are mean 04-06
Recruits age 1 are long-term GM(69-04)
N at age 2 are depreciated GM recruitment
N at age 3 and above are XSA survivors

2007

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
1	4373	0.1	0	0	0	0.10	0.00	0.12
2	3957	0.1	0.14	0	0	0.15	0.12	0.18
3	3491	0.1	0.45	0	0	0.21	0.29	0.23
4	2270	0.1	0.88	0	0	0.26	0.37	0.28
5	899	0.1	0.98	0	0	0.31	0.46	0.33
6	925	0.1	1	0	0	0.36	0.48	0.38
7	276	0.1	1	0	0	0.41	0.41	0.43
8	362	0.1	1	0	0	0.45	0.40	0.48
9	361	0.1	1	0	0	0.50	0.43	0.52
10	90	0.1	1	0	0	0.55	0.38	0.57
11	100	0.1	1	0	0	0.59	0.41	0.61
12	256	0.1	1	0	0	0.70	0.41	0.65

2008

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
1	4373	0.1	0	0	0	0.10	0.00	0.12
2	.	0.1	0.14	0	0	0.15	0.12	0.18
3	.	0.1	0.45	0	0	0.21	0.29	0.23
4	.	0.1	0.88	0	0	0.26	0.37	0.28
5	.	0.1	0.98	0	0	0.31	0.46	0.33
6	.	0.1	1	0	0	0.36	0.48	0.38
7	.	0.1	1	0	0	0.41	0.41	0.43
8	.	0.1	1	0	0	0.45	0.40	0.48
9	.	0.1	1	0	0	0.50	0.43	0.52
10	.	0.1	1	0	0	0.55	0.38	0.57
11	.	0.1	1	0	0	0.59	0.41	0.61
12	.	0.1	1	0	0	0.70	0.41	0.65

2009

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
1	4373	0.1	0	0	0	0.10	0.00	0.12
2	.	0.1	0.14	0	0	0.15	0.12	0.18
3	.	0.1	0.45	0	0	0.21	0.29	0.23
4	.	0.1	0.88	0	0	0.26	0.37	0.28
5	.	0.1	0.98	0	0	0.31	0.46	0.33
6	.	0.1	1	0	0	0.36	0.48	0.38
7	.	0.1	1	0	0	0.41	0.41	0.43
8	.	0.1	1	0	0	0.45	0.40	0.48
9	.	0.1	1	0	0	0.50	0.43	0.52
10	.	0.1	1	0	0	0.55	0.38	0.57
11	.	0.1	1	0	0	0.59	0.41	0.61
12	.	0.1	1	0	0	0.70	0.41	0.65

Input units are thousands and kg - output in tonnes

Table 3.1.14 VIIe sole, Prediction with management option table

MFDP version 1a
Run: CatConNorm
s7eSTFMFDP Index file 22/707 mph
Time and date: 16:42 01/07/2007
Fbar age range: 3-7

With catch constraint of 900t in 2007

2007				
Biomass	**SSB**	**FMult**	**FBar**	**Landings**
3674	2270	0.9515	0.3818	900

2008						
Biomass	**SSB**	**FMult**	**FBar**	**Landings**	**Biomass**	**SSB**
3636	2258	0	0	0	4526	3085
.	2258	0.1	0.0401	109	4414	2980
.	2258	0.2	0.0803	213	4306	2880
.	2258	0.3	0.1204	314	4202	2783
.	2258	0.4	0.1605	412	4101	2690
.	2258	0.5	0.2006	506	4005	2601
.	2258	0.6	0.2408	596	3911	2515
.	2258	0.7	0.2809	684	3821	2432
.	2258	0.8	0.321	768	3735	2352
.	2258	0.9	0.3612	849	3651	2275
.	2258	1	0.4013	928	3570	2201
.	2258	1.1	0.4414	1004	3493	2130
.	2258	1.2	0.4815	1077	3418	2061
.	2258	1.3	0.5217	1147	3345	1995
.	2258	1.4	0.5618	1215	3275	1931
.	2258	1.5	0.6019	1281	3208	1870
.	2258	1.6	0.642	1345	3143	1811
.	2258	1.7	0.6822	1406	3080	1754
.	2258	1.8	0.7223	1465	3020	1699
.	2258	1.9	0.7624	1522	2961	1646
.	2258	2	0.8026	1578	2905	1595

Input units are thousands and kg - output in tonnes

Table 3.1.14b VIIe sole, Prediction with management option table

MFDP version 1a
Run: CatConNorm
s7eSTFMFDP Index file 22/707 mph
Time and date: 16:42 01/07/2007
Fbar age range: 3-7

With catch constraint of 900t in 2007

2007				
Biomass	**SSB**	**FMult**	**FBar**	**Landings**
3674	2270	0.9515	0.3818	900

2008						
Biomass	**SSB**	**FMult**	**FBar**	**Landings**	**Biomass**	**SSB**
3636	2258	1	0.2849	692	3813	2424
.	2258	0.711	0.2853	693	3812	2423
.	2258	0.712	0.2857	694	3811	2422
.	2258	0.713	0.2861	695	3810	2421
.	2258	0.714	0.2865	696	3809	2420
.	2258	0.715	0.2869	697	3808	2420
.	2258	0.716	0.2873	697	3807	2419
.	2258	0.717	0.2877	698	3806	2418
.	2258	0.718	0.2881	699	3806	2417
.	2258	0.719	0.2885	700	3805	2416
.	2258	0.72	0.2889	701	3804	2415
.	2258	0.721	0.2893	702	3803	2415
.	2258	0.722	0.2897	703	3802	2414
.	2258	0.723	0.2901	703	3801	2413
.	2258	0.724	0.2905	704	3800	2412
.	2258	0.725	0.2909	705	3799	2411
.	2258	0.726	0.2913	706	3799	2411
.	2258	0.727	0.2917	707	3798	2410
.	2258	0.728	0.2921	708	3797	2409
.	2258	0.729	0.2925	709	3796	2408
.	2258	0.73	0.2929	709	3795	2407

Input units are thousands and kg - output in tonnes

= Equates to a 20% drop in F.

Table 3.1.14c VIIe sole, Prediction with management option table

MFDP version 1a
Run: CatConNorm
s7eSTFMFDP Index file 22/707 mph
Time and date: 16:42 01/07/2007
Fbar age range: 3-7

With catch constraint of 900t in 2007

2007 Biomass	SSB	FMult	FBar	Landings
3674	2270	0.9515	0.3818	900

2008 Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
3636	2258	1	0.317	760	3743	2360
.	2258	0.791	0.3174	761	3742	2359
.	2258	0.792	0.3178	761	3741	2358
.	2258	0.793	0.3182	762	3741	2357
.	2258	0.794	0.3186	763	3740	2357
.	2258	0.795	0.319	764	3739	2356
.	2258	0.796	0.3194	765	3738	2355
.	2258	0.797	0.3198	766	3737	2354
.	2258	0.798	0.3202	766	3736	2353
.	2258	0.799	0.3206	767	3736	2353
.	2258	0.8	0.321	768	3735	2352
.	2258	0.801	0.3214	769	3734	2351
.	2258	0.802	0.3218	770	3733	2350
.	2258	0.803	0.3222	771	3732	2350
.	2258	0.804	0.3226	771	3731	2349
.	2258	0.805	0.323	772	3730	2348
.	2258	0.806	0.3234	773	3730	2347
.	2258	0.807	0.3238	774	3729	2346
.	2258	0.808	0.3242	775	3728	2346
.	2258	0.809	0.3246	776	3727	2345
.	2258	0.81	0.325	776	3726	2344

Input units are thousands and kg - output in tonnes

= Equates to a 15% drop in TAC.

Table 3.1.15 VIIe sole, Single option prediction detailed output

MFDP version 1a
Run: CatConNorm
Time and date: 16:42 01/07/2007
Fbar age range: 3-7

Catch constraint of 900t for 2007

Year:	2007	F multiplier	0.9515	Fbar:	0.3818				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	0	0	4373	420	0	0	0	0
2	0.1131	403	72	3957	599	554	84	554	84
3	0.2745	799	185	3491	716	1571	322	1571	322
4	0.3534	645	183	2270	585	1998	515	1998	515
5	0.4335	302	101	899	277	881	272	881	272
6	0.4583	325	124	925	332	925	332	925	332
7	0.3893	85	37	276	112	276	112	276	112
8	0.3792	109	52	362	165	362	165	362	165
9	0.4107	116	61	361	181	361	181	361	181
10	0.3631	26	15	90	49	90	49	90	49
11	0.3931	31	19	100	59	100	59	100	59
12	0.3931	79	52	256	180	256	180	256	180
Total		2921	900	17360	3674	7374	2270	7374	2270

Year:	2008	F multiplier	1	Fbar:	0.4013				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	0	0	4373	420	0	0	0	0
2	0.1189	423	75	3957	599	554	84	554	84
3	0.2885	764	177	3197	655	1439	295	1439	295
4	0.3714	711	201	2401	619	2113	544	2113	544
5	0.4556	504	168	1443	445	1414	436	1414	436
6	0.4817	193	74	527	189	527	189	527	189
7	0.4092	170	73	529	216	529	216	529	216
8	0.3986	53	25	169	77	169	77	169	77
9	0.4317	75	39	224	112	224	112	224	112
10	0.3817	66	37	217	118	217	118	217	118
11	0.4132	18	11	57	33	57	33	57	33
12	0.4132	70	46	217	153	217	153	217	153
Total		3047	928	17311	3636	7460	2258	7460	2258

Year:	2009	F multiplier	1	Fbar:	0.4013				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	0	0	4373	420	0	0	0	0
2	0.1189	423	75	3957	599	554	84	554	84
3	0.2885	760	176	3179	652	1431	293	1431	293
4	0.3714	642	182	2168	559	1908	492	1908	492
5	0.4556	524	175	1498	462	1468	453	1468	453
6	0.4817	302	116	828	297	828	297	828	297
7	0.4092	95	41	295	120	295	120	295	120
8	0.3986	100	48	318	145	318	145	318	145
9	0.4317	34	18	103	51	103	51	103	51
10	0.3817	40	23	132	72	132	72	132	72
11	0.4132	43	26	134	79	134	79	134	79
12	0.4132	53	35	164	115	164	115	164	115
Total		3015	914	17148	3570	7334	2201	7334	2201

Input units are thousands and kg - output in tonnes

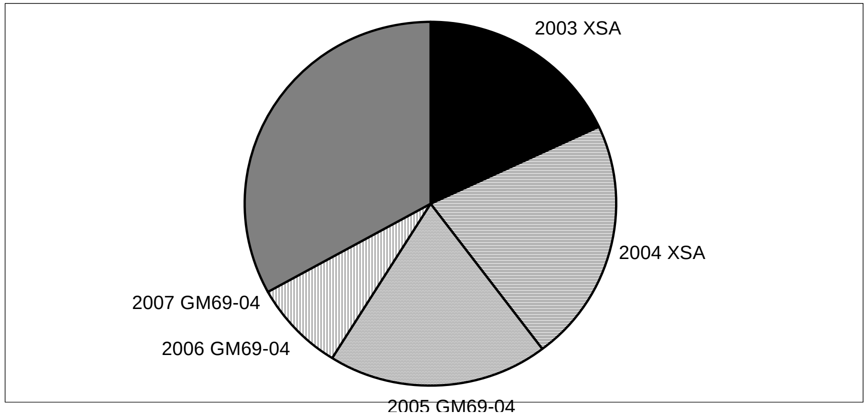
Table 3.1.16 Sole in VIIe. Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes.

Year-class			2003	2004	2005	2006	2007
Stock No. (thousands)			4317	4803	4373	4373	4373
of	1	year-olds					
Source			XSA	XSA	GM69-04	GM69-04	GM69-04
Status Quo F:							
% in	2007	landings	20.3	20.5	8.0	0.0	-
% in	2008		18.1	21.7	19.1	8.1	0.0
% in	2007	SSB	22.7	14.2	3.7	0.0	-
% in	2008	SSB	19.3	24.1	13.1	3.7	0.0
% in	2009	SSB	13.5	20.6	22.4	13.3	3.8

GM : geometric mean recruitment

Sole in VIIe : Year-class % contribution to

a) 2008 landings



b) 2009 SSB

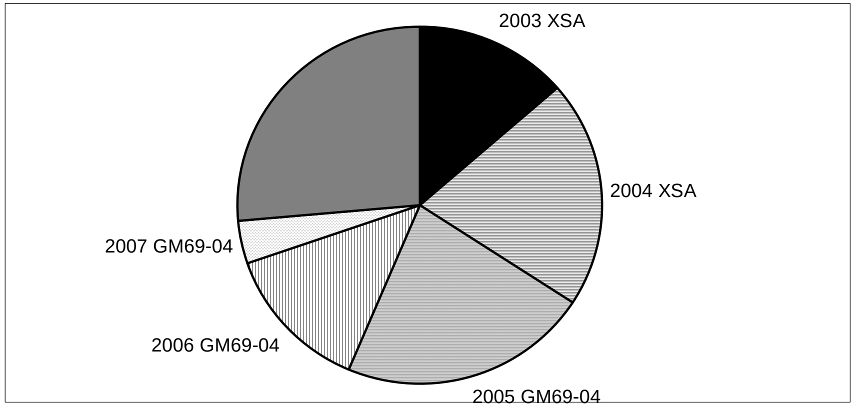


Table 3.1.17 VIIe sole, Yield-per recruit summary

MFYPR version 2a

Run: ypr1

Time and date: 11:15 22/06/2007

Yield per results

FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0.0000	0.0000	0.0000	0.0000	10.5083	4.5837	8.1776	4.2506	8.1776	4.2506
0.1000	0.0401	0.2415	0.1098	8.0961	3.0499	5.7752	2.7191	5.7752	2.7191
0.2000	0.0803	0.3738	0.1574	6.7756	2.2568	4.4643	1.9282	4.4643	1.9282
0.3000	0.1204	0.4574	0.1803	5.9424	1.7853	3.6404	1.4589	3.6404	1.4589
0.4000	0.1605	0.5151	0.1916	5.3684	1.4792	3.0755	1.1549	3.0755	1.1549
0.5000	0.2006	0.5573	0.1972	4.9488	1.2680	2.6647	0.9457	2.6647	0.9457
0.6000	0.2408	0.5896	0.1997	4.6283	1.1153	2.3528	0.7950	2.3528	0.7950
0.7000	0.2809	0.6151	0.2004	4.3752	1.0007	2.1081	0.6824	2.1081	0.6824
0.8000	0.3210	0.6359	0.2003	4.1700	0.9122	1.9110	0.5958	1.9110	0.5958
0.9000	0.3612	0.6531	0.1996	4.0000	0.8421	1.7489	0.5275	1.7489	0.5275
1.0000	0.4013	0.6676	0.1986	3.8566	0.7854	1.6133	0.4725	1.6133	0.4725
1.1000	0.4414	0.6801	0.1975	3.7338	0.7386	1.4981	0.4275	1.4981	0.4275
1.2000	0.4815	0.6909	0.1963	3.6274	0.6994	1.3990	0.3900	1.3990	0.3900
1.3000	0.5217	0.7005	0.1952	3.5341	0.6662	1.3129	0.3583	1.3129	0.3583
1.4000	0.5618	0.7089	0.1940	3.4515	0.6375	1.2373	0.3313	1.2373	0.3313
1.5000	0.6019	0.7165	0.1929	3.3777	0.6127	1.1704	0.3080	1.1704	0.3080
1.6000	0.6420	0.7233	0.1918	3.3114	0.5908	1.1108	0.2876	1.1108	0.2876
1.7000	0.6822	0.7294	0.1907	3.2513	0.5715	1.0572	0.2698	1.0572	0.2698
1.8000	0.7223	0.7351	0.1897	3.1966	0.5543	1.0089	0.2539	1.0089	0.2539
1.9000	0.7624	0.7402	0.1888	3.1465	0.5388	0.9651	0.2399	0.9651	0.2399
2.0000	0.8026	0.7450	0.1879	3.1004	0.5248	0.9251	0.2272	0.9251	0.2272

Reference point	F multiplier	Absolute F
Fbar(3-7)	1.0000	0.4013
FMax	0.7252	0.291
F0.1	0.2895	0.1162
F35%SPR	0.2923	0.1173

Weights in kilograms

Table 3.1.18 VIIe sole, Input to sensitivity analysis and medium term projection

Number at age in

	2005 senisitivity analysis	2006 medium term proj.	cv
N1	4373		0.36
N2	3957		0.36
N3	3491		0.36
N4	2270		0.23
N5	899		0.18
N6	925		0.16
N7	276		0.16
N8	362		0.14
N9	361		0.14
N10	89		0.14
N11	99		0.13
N12	256		0.13

Weight at age in the catch

	kg	cv
WH1	0.124	0.02
WH2	0.178	0.01
WH3	0.232	0.01
WH4	0.283	0.02
WH5	0.334	0.02
WH6	0.383	0.03
WH7	0.431	0.03
WH8	0.478	0.04
WH9	0.523	0.04
WH10	0.567	0.05
WH11	0.61	0.05
WH12	0.721	0.07

Fishing mortality at age

		cv
sH1	0	0
sH2	0.119	0.47
sH3	0.288	0.21
sH4	0.371	0.04
sH5	0.456	0.21
sH6	0.482	0.13
sH7	0.409	0.08
sH8	0.399	0.11
sH9	0.432	0.3
sH10	0.382	0.15
sH11	0.413	0.51
sH12	0.413	0.51

Weight at age in the stock

	kg	cv
WS1	0.096	0.03
WS2	0.151	0.01
WS3	0.205	0.01
WS4	0.258	0.02
WS5	0.309	0.02
WS6	0.359	0.03
WS7	0.407	0.03
WS8	0.455	0.04
WS9	0.501	0.04
WS10	0.545	0.05
WS11	0.589	0.05
WS12	0.702	0.07

Natural mortality

		cv
M1	0.1	0.1
M2	0.1	0.1
M3	0.1	0.1
M4	0.1	0.1
M5	0.1	0.1
M6	0.1	0.1
M7	0.1	0.1
M8	0.1	0.1
M9	0.1	0.1
M10	0.1	0.1
M11	0.1	0.1
M12	0.1	0.1

Proportion mature

		cv
MT1	0	0.1
MT2	0.14	0.1
MT3	0.45	0.1
MT4	0.88	0.1
MT5	0.98	0.1
MT6	1	0.1
MT7	1	0
MT8	1	0
MT9	1	0
MT10	1	0
MT11	1	0
MT12	1	0

F multiplier in years 2006, 07 and 08

		cv
'HF07'	1	0.09
'HF08'	1	0.09
'HF09'	1	0.09

Year effect for natural mortality

		cv
'K07'	1	0.1
'K08'	1	0.1
'K09'	1	0.1

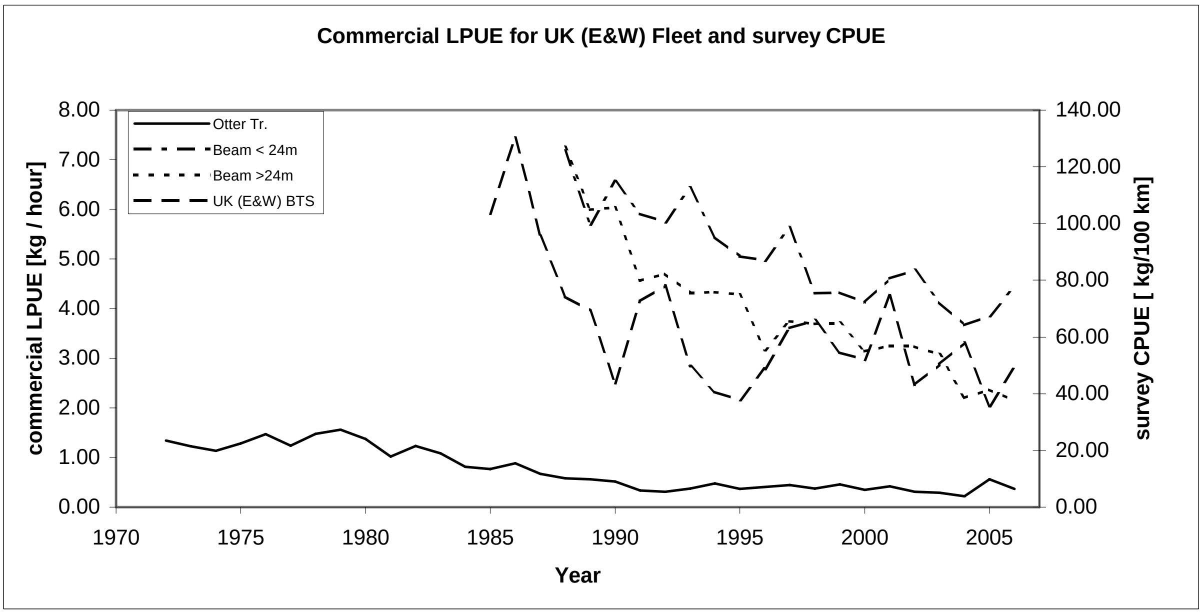
Recruitment in 2006, 2007

		cv
R03	4373	0.36
R04	4373	0.36

Proportion of M before spawning	0
Proportion of F before spawning	0

Stock numbers are vpa survivors, except age 1 which is GM 1969-2004
and age 2 which is GM 1969-2004 down weighted for mortality.

Figure 3.1.1 Western Channel sole catch-per-unit-effort and effort timeseries



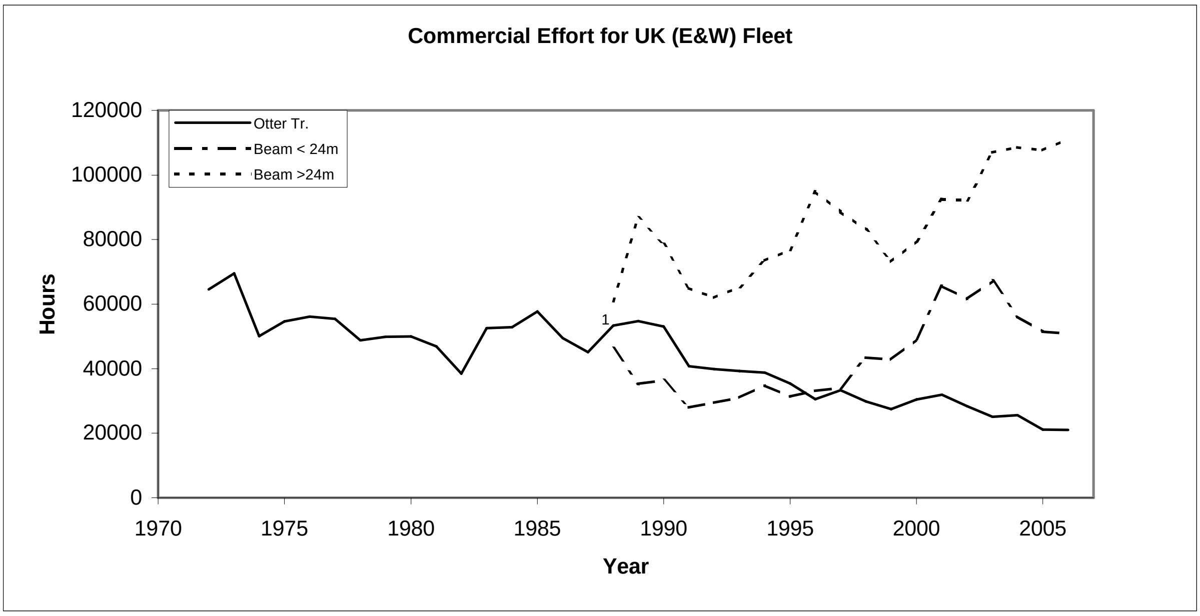
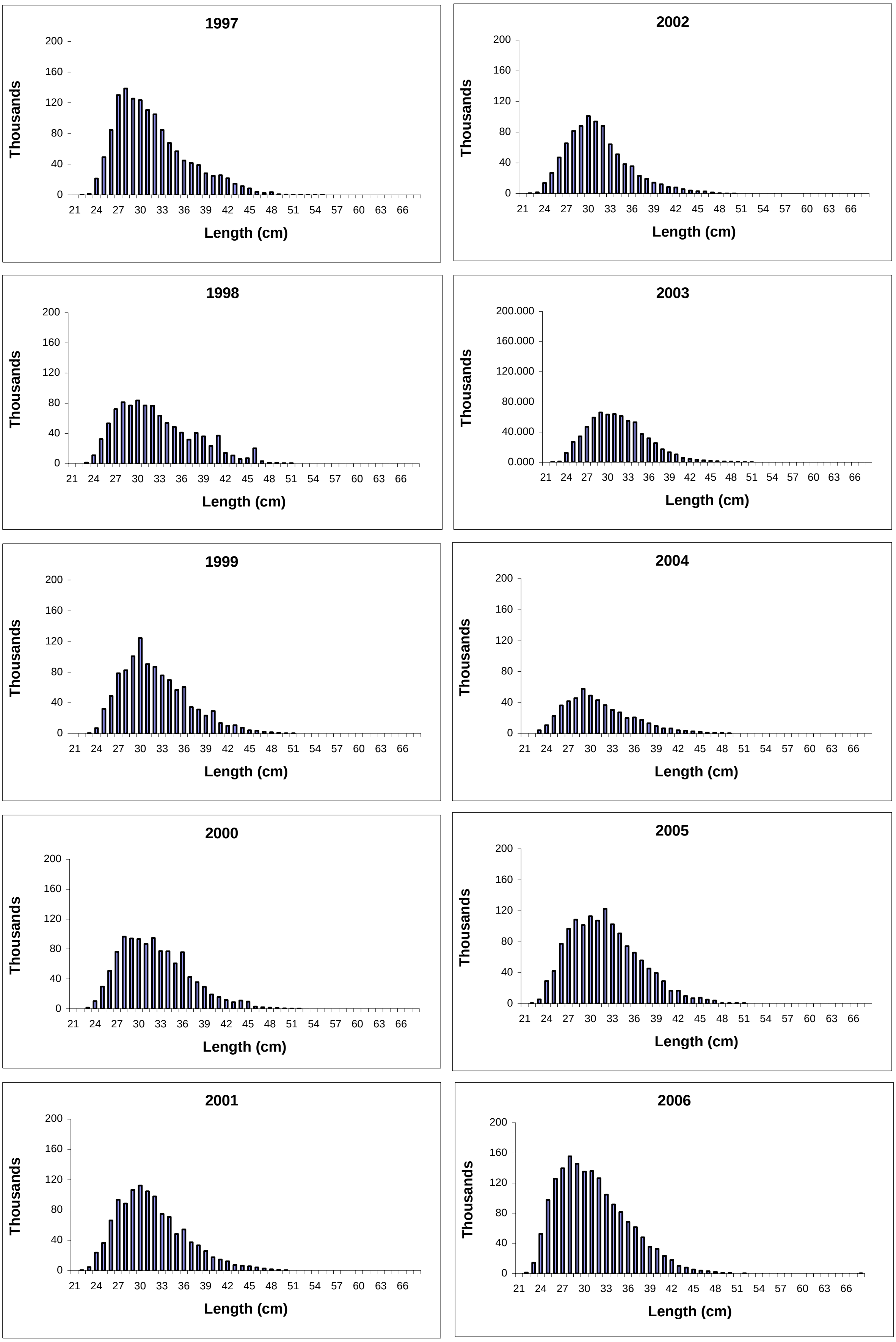


Figure 3.1.2 Length Compositions

Sole in Division VIIe
Length distributions of UK (England & Wales) landings from 1997 to 2006



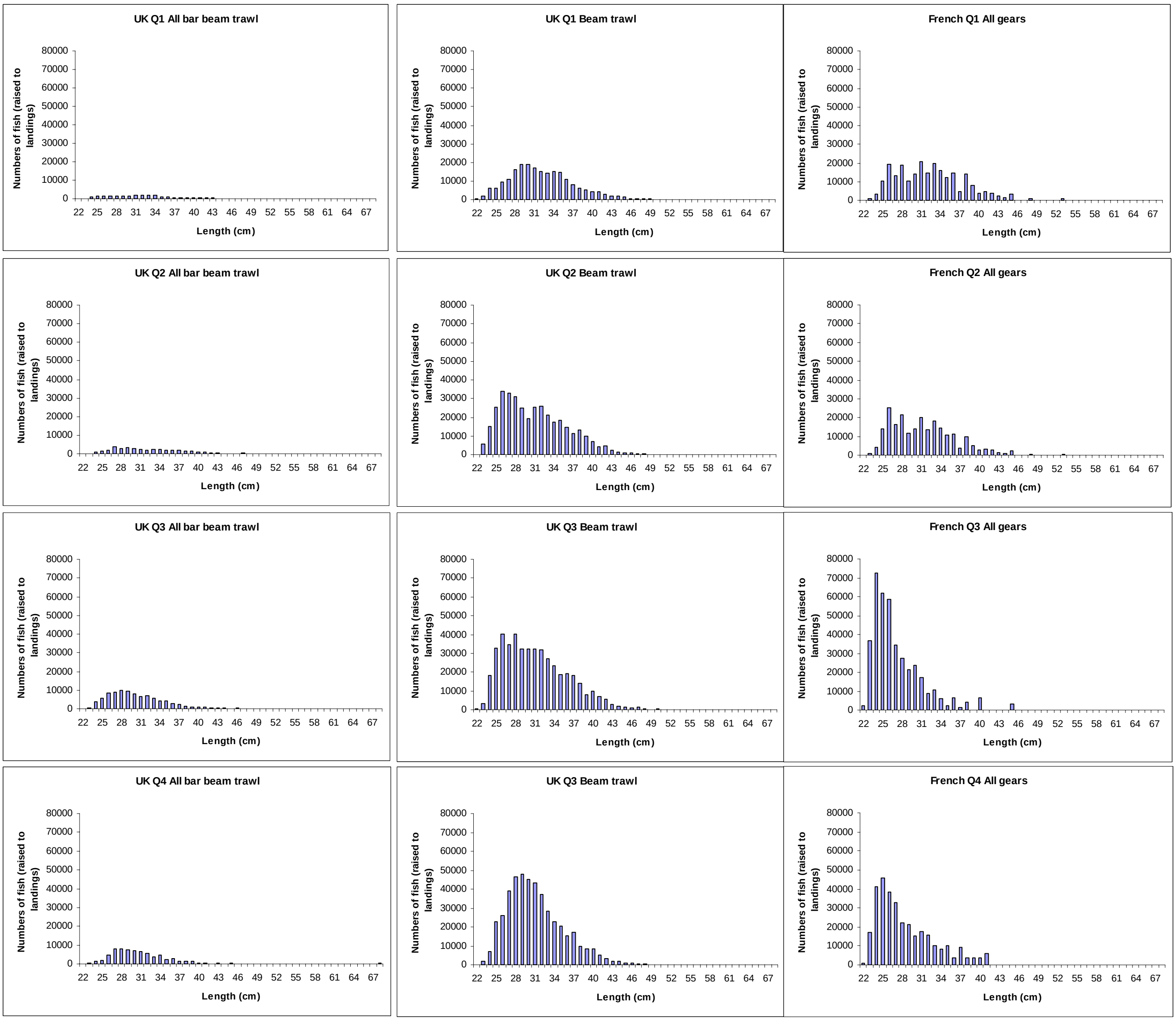


Figure 3.1.3 Sole length distributions by country and quarter for 2006

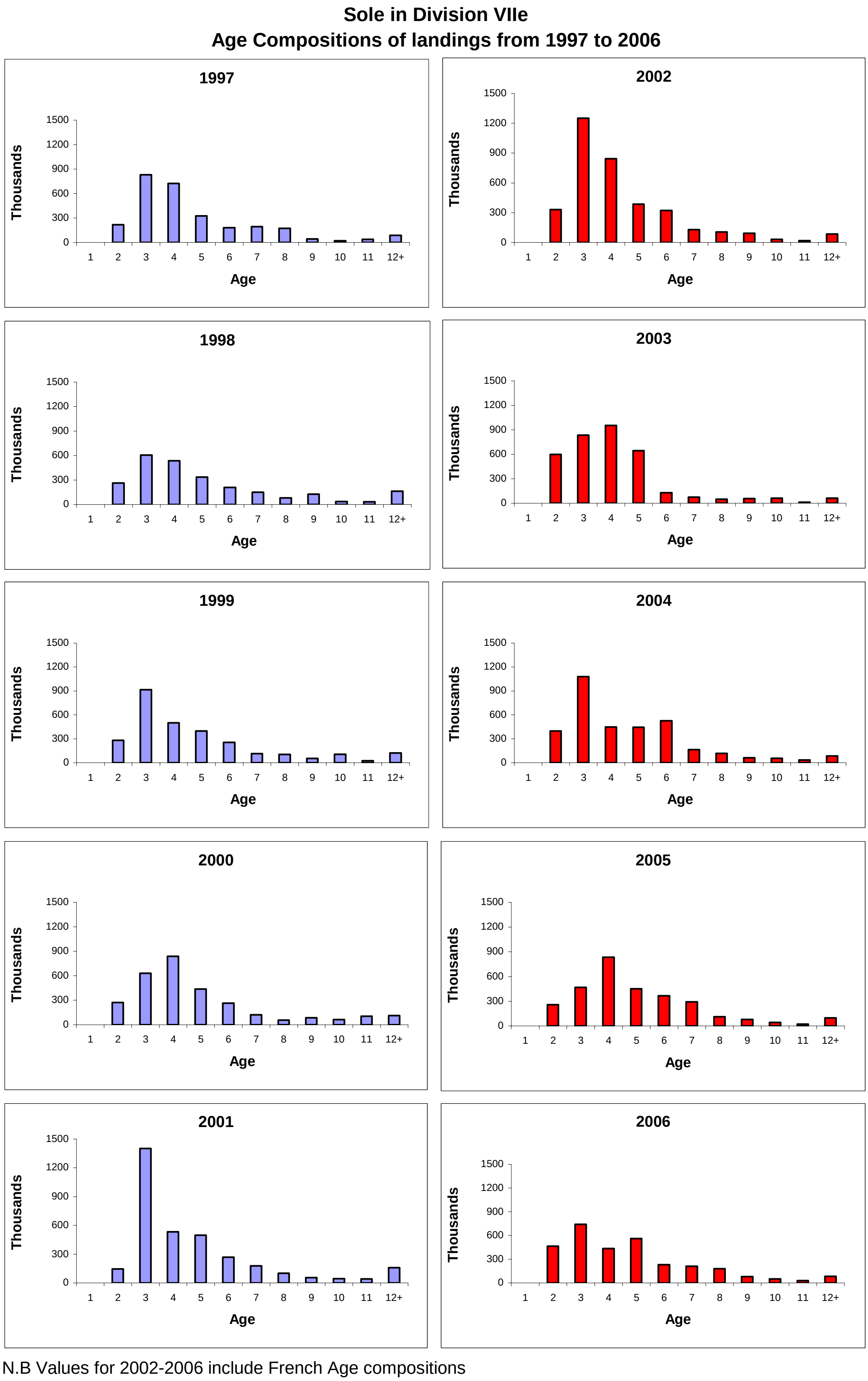
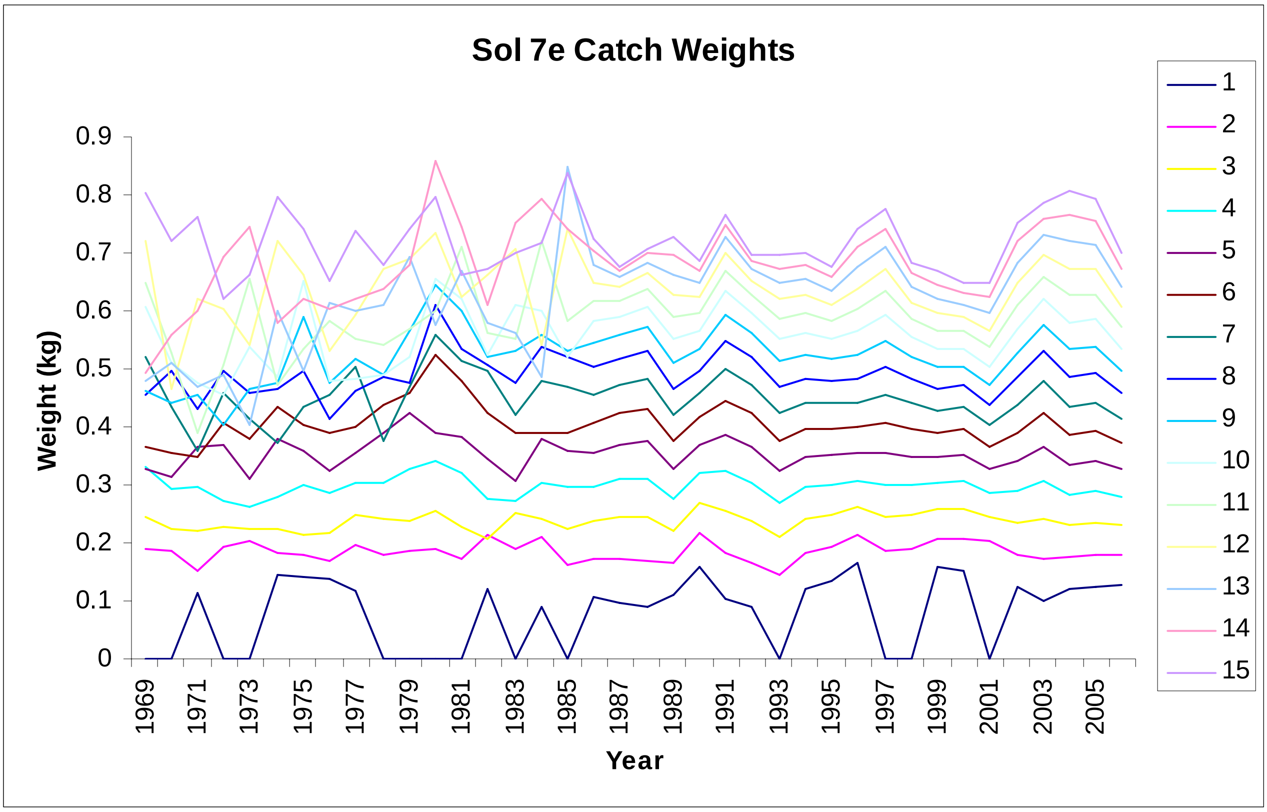


Figure 3.1.4 Age Compositions



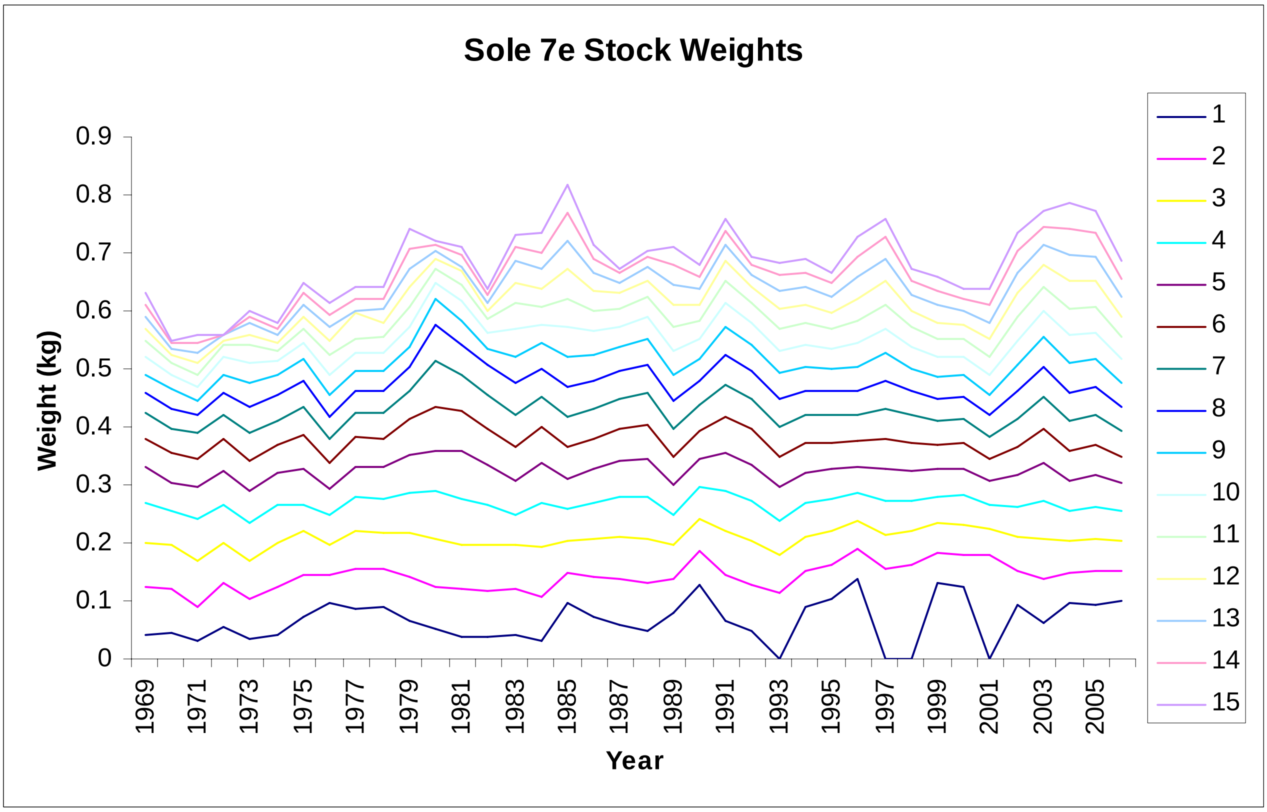


Figure 3.1.5 VIIe sole, trends in catch weights for ages 1-11.

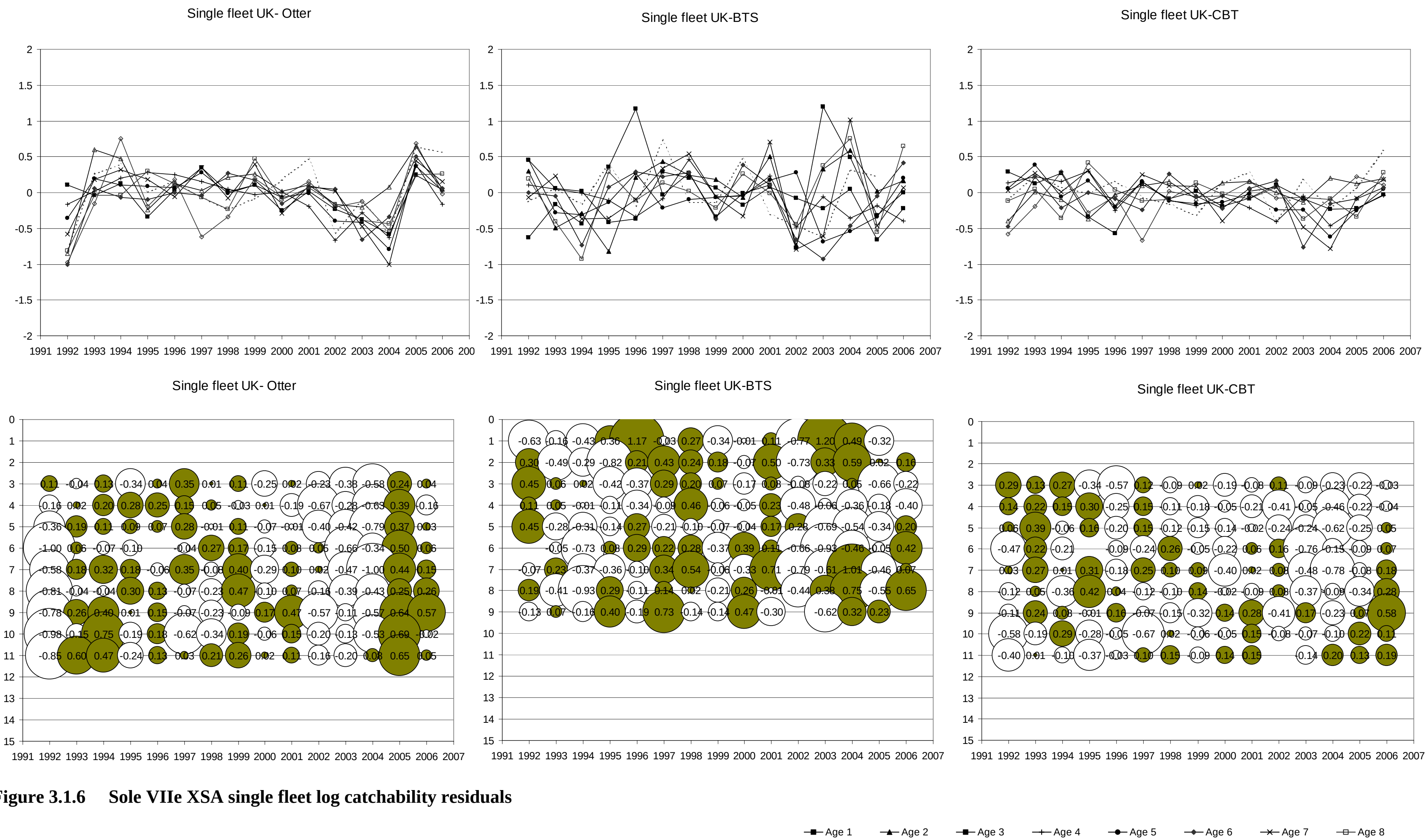


Figure 3.1.6 Sole VIIe XSA single fleet log catchability residuals

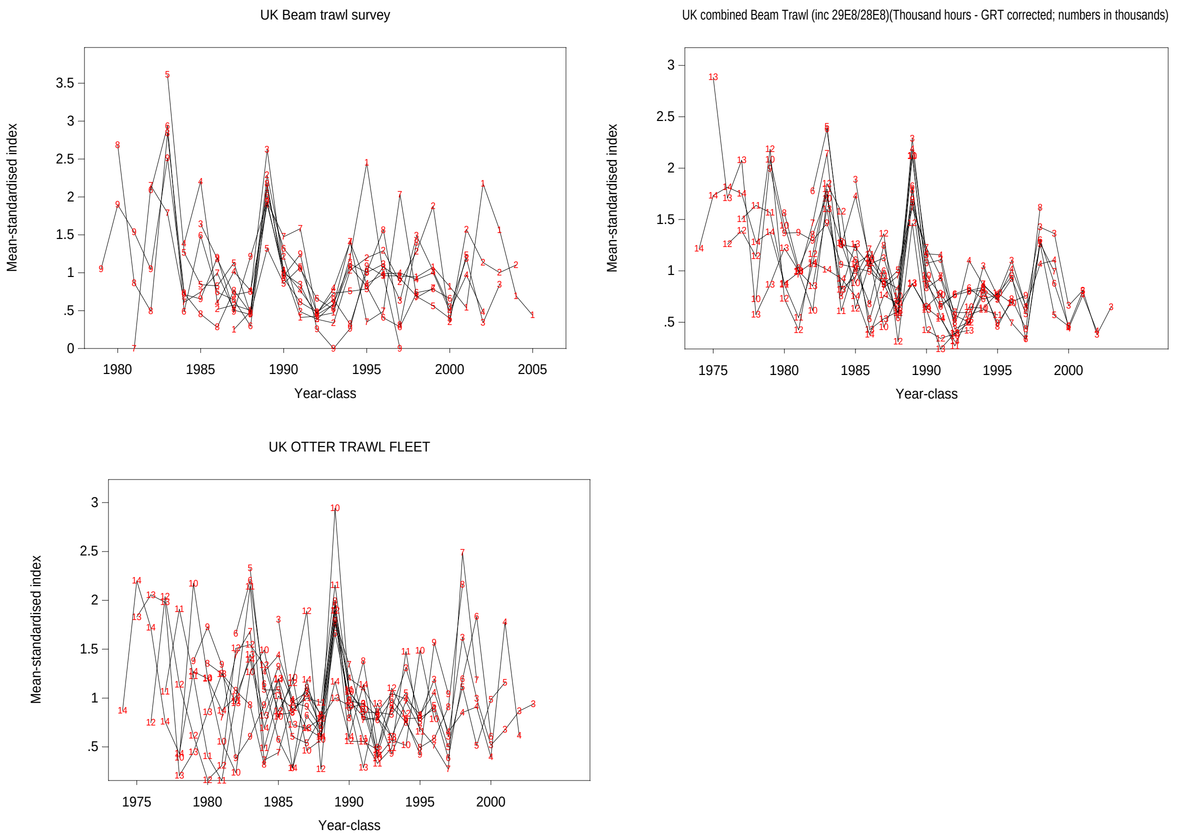


Figure 3.1.7 Current tuning fleet means standardised index by cohort

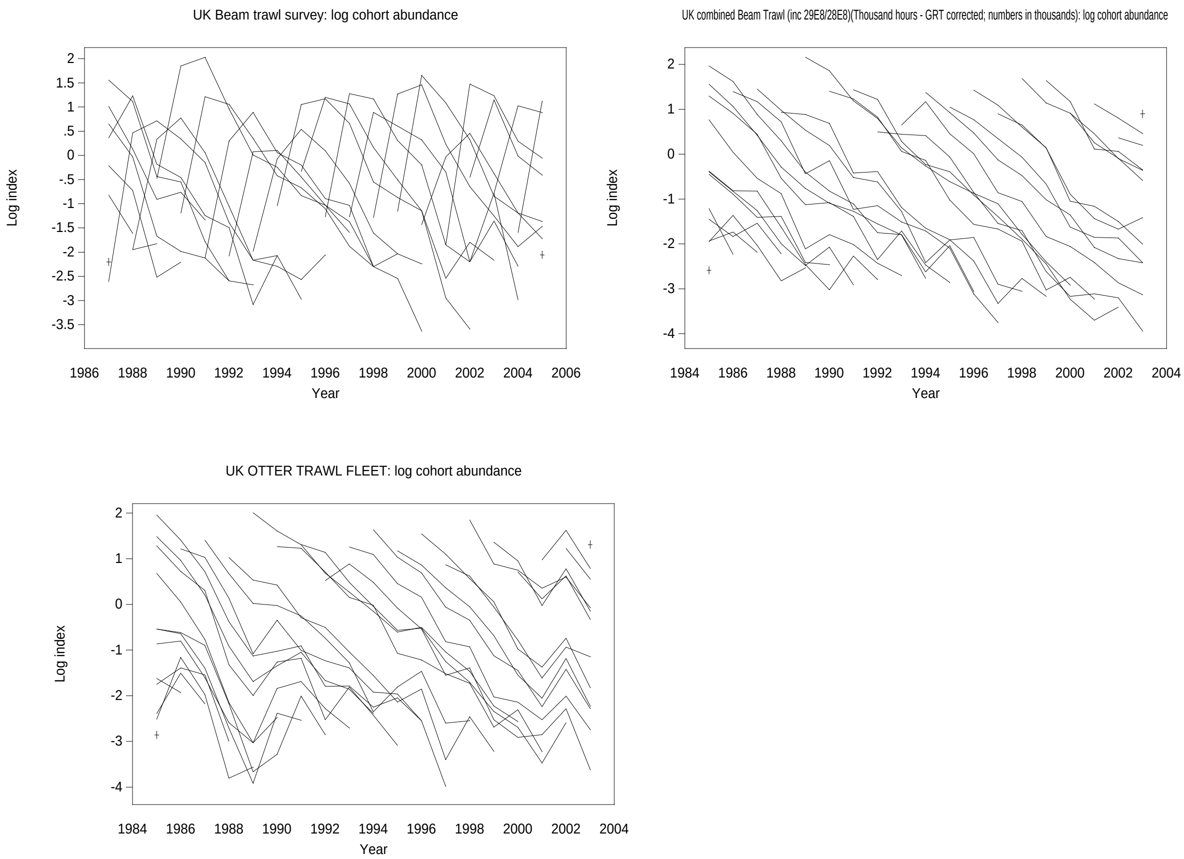


Figure 3.1.8 Current tuning fleet log CPUE by year

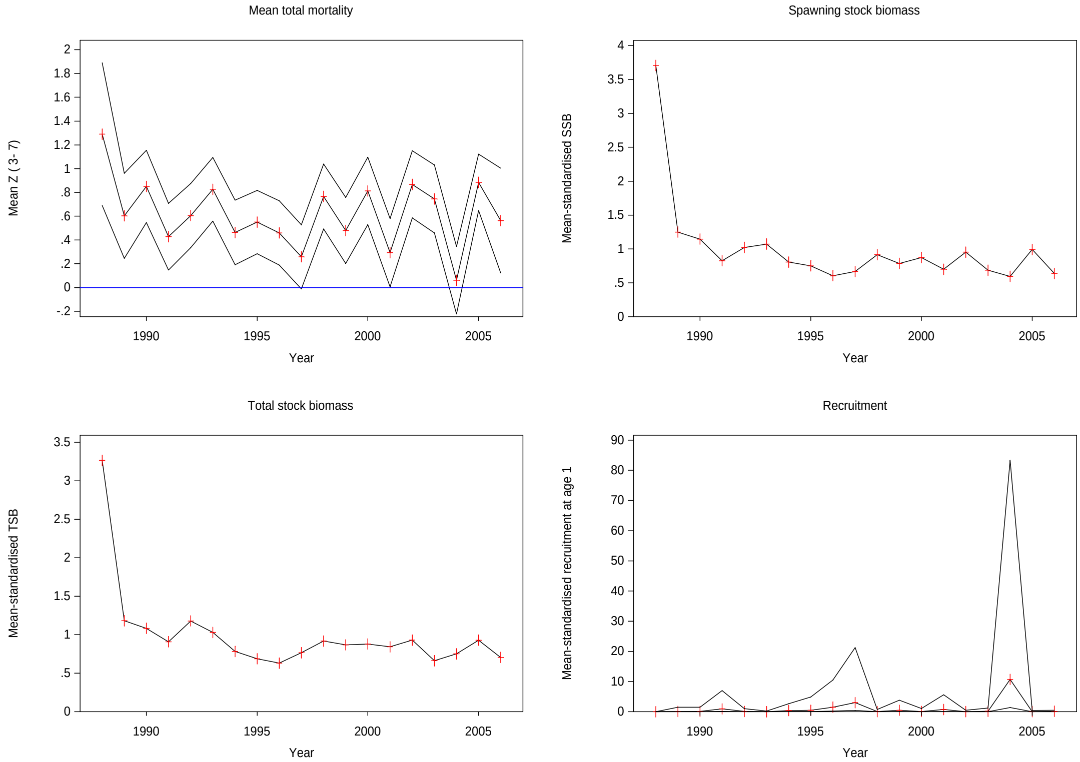


Figure 3.1.9 Single fleet SURBA run for UK-BTS

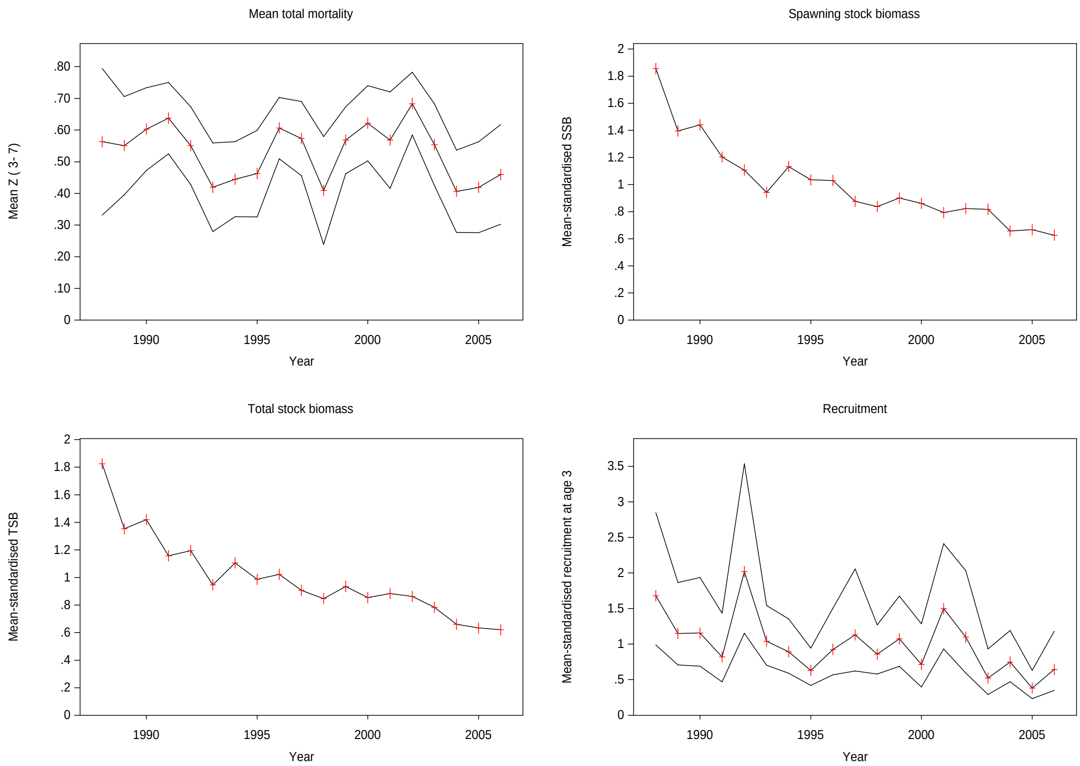


Figure 3.1.10 Single fleet SURBA run for UK-CBT

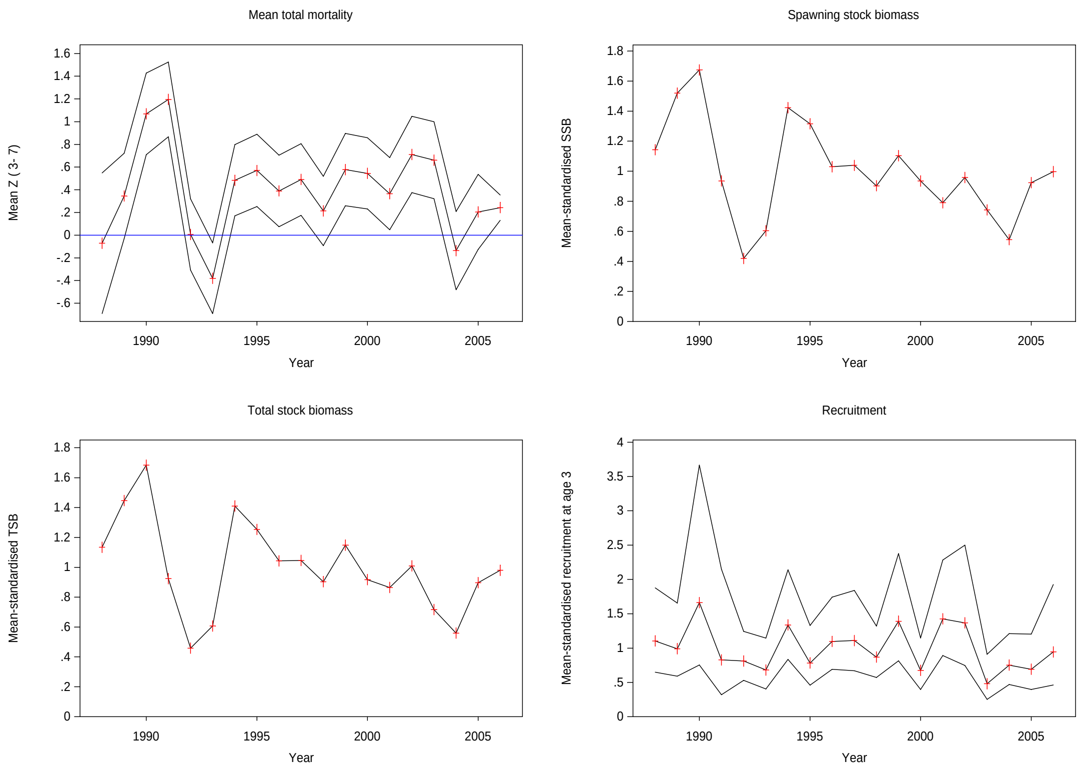


Figure 3.1.11 Single fleet SURBA run for UK-COT

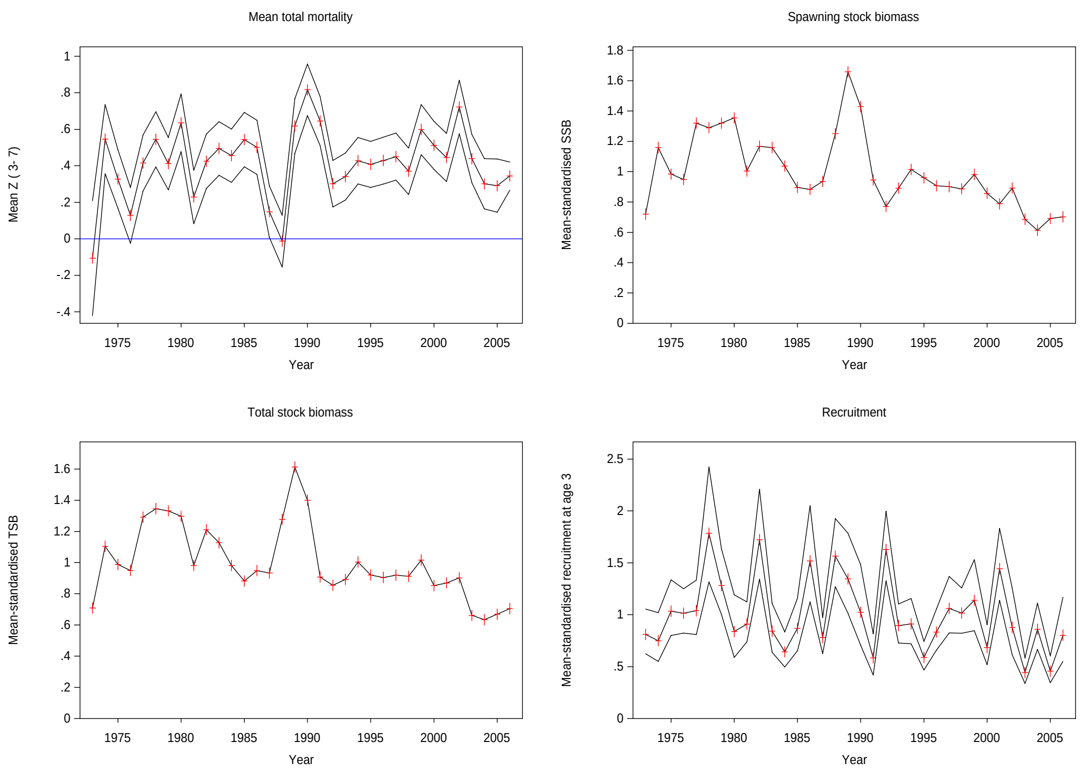


Figure 3.1.12 Multi-fleet SURBA run summary including historic tuning indices

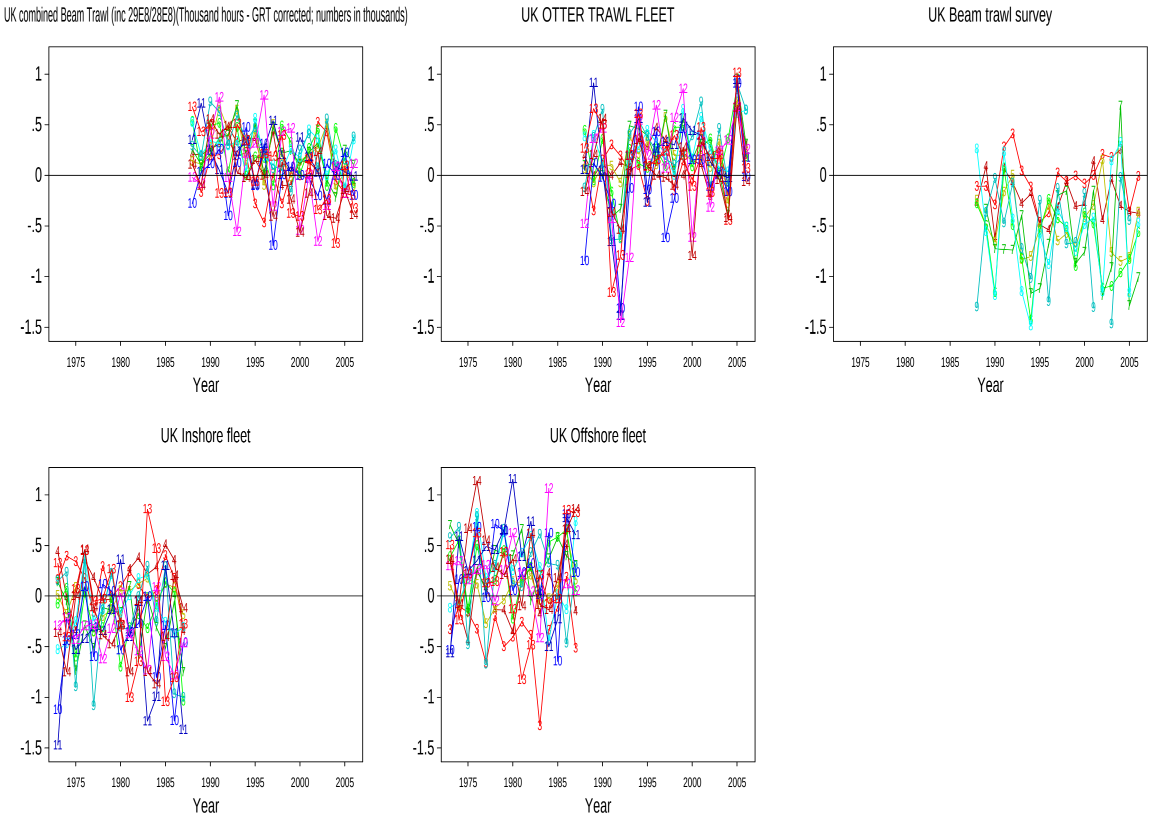


Figure 3.1.13 Multi-fleet SURBA residuals

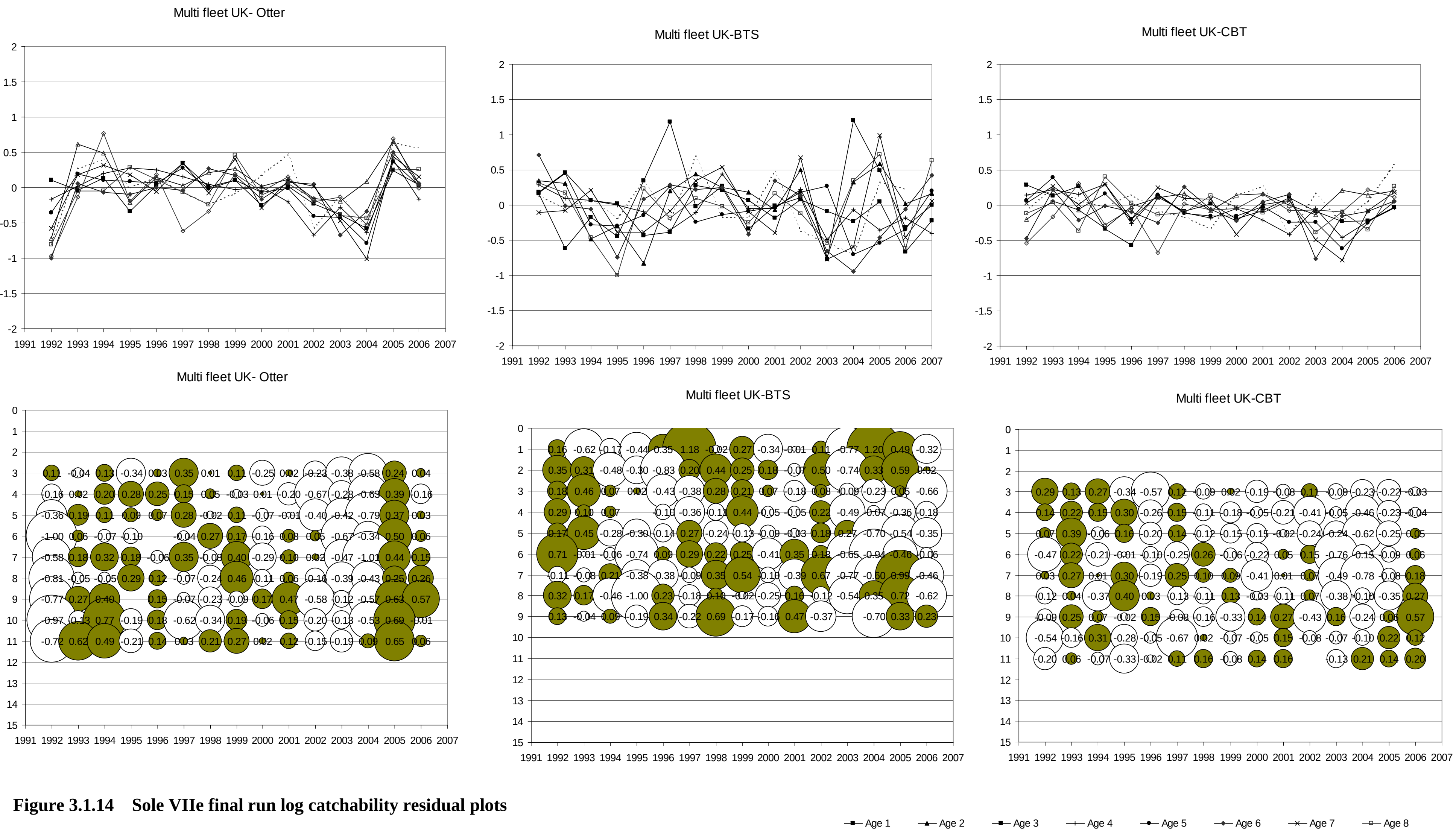
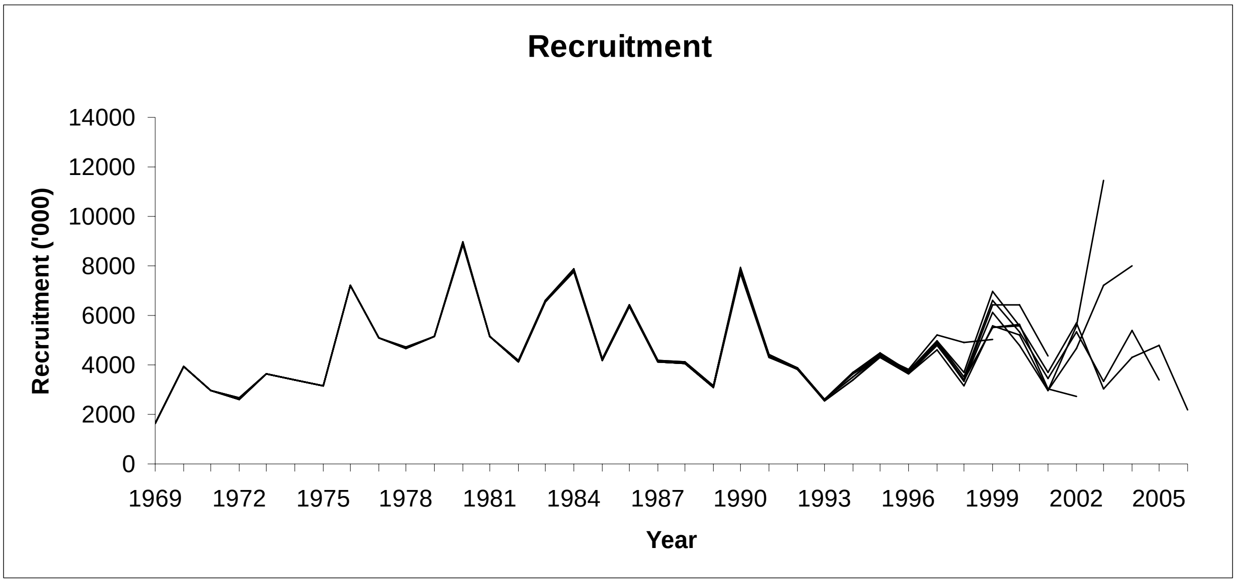
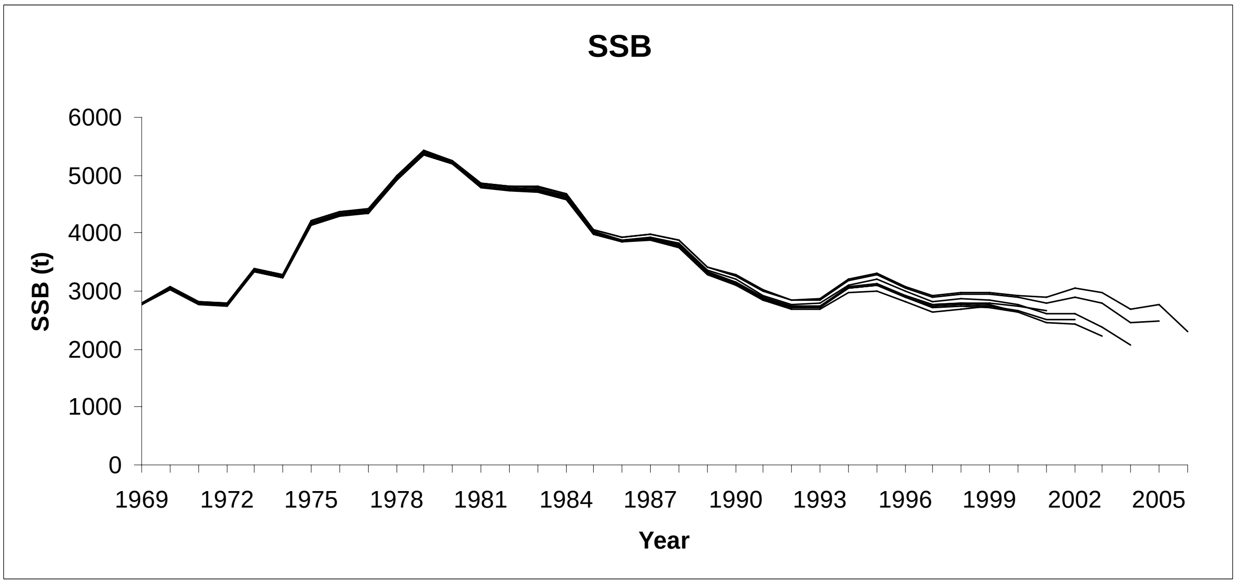


Figure 3.1.14 Sole VIIe final run log catchability residual plots





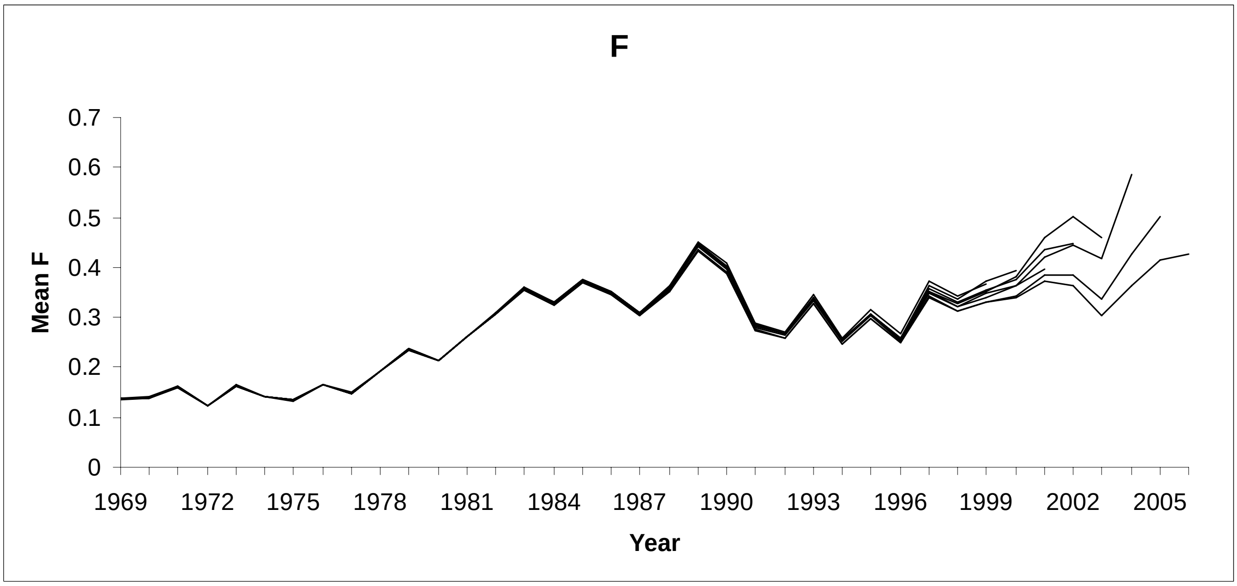


Figure 3.1.15 VIIe sole, retrospective analysis. Shrinkage = 1.0, std.err = 0.5

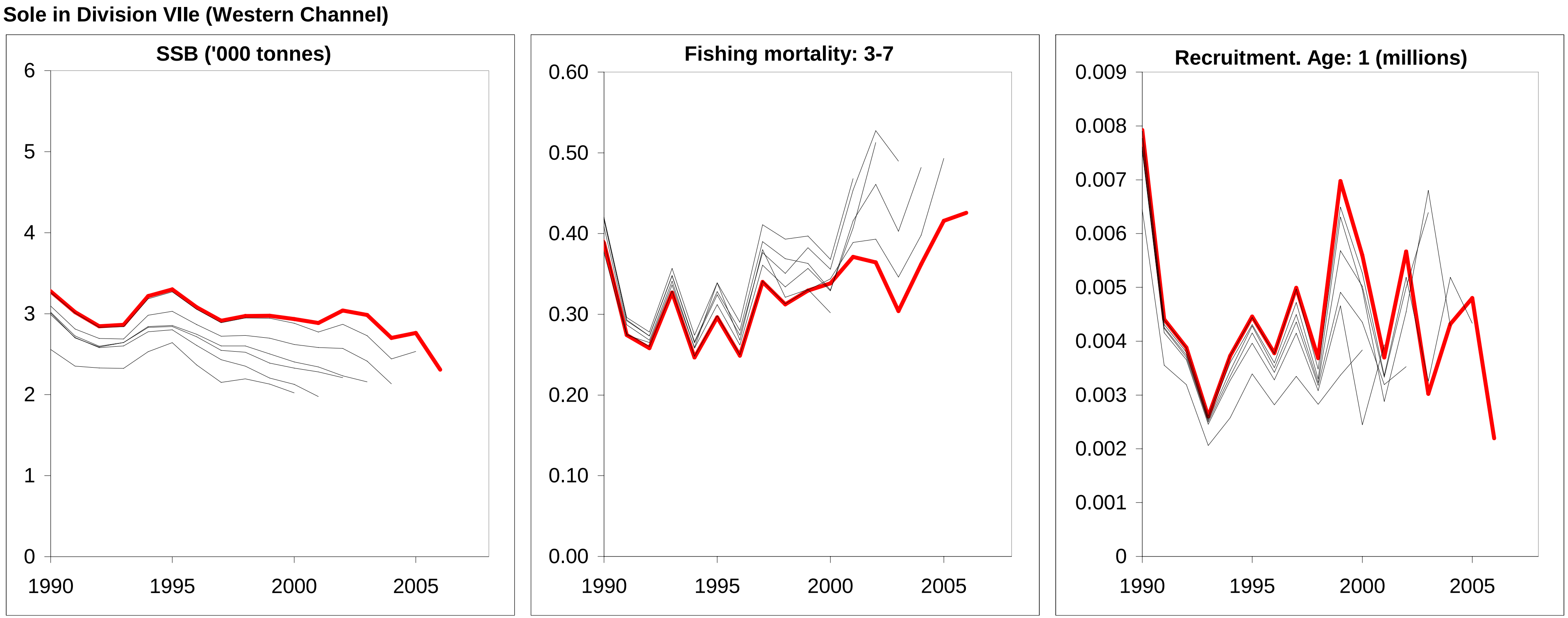


Figure 3.1.16 Comparison with historic WG assessments

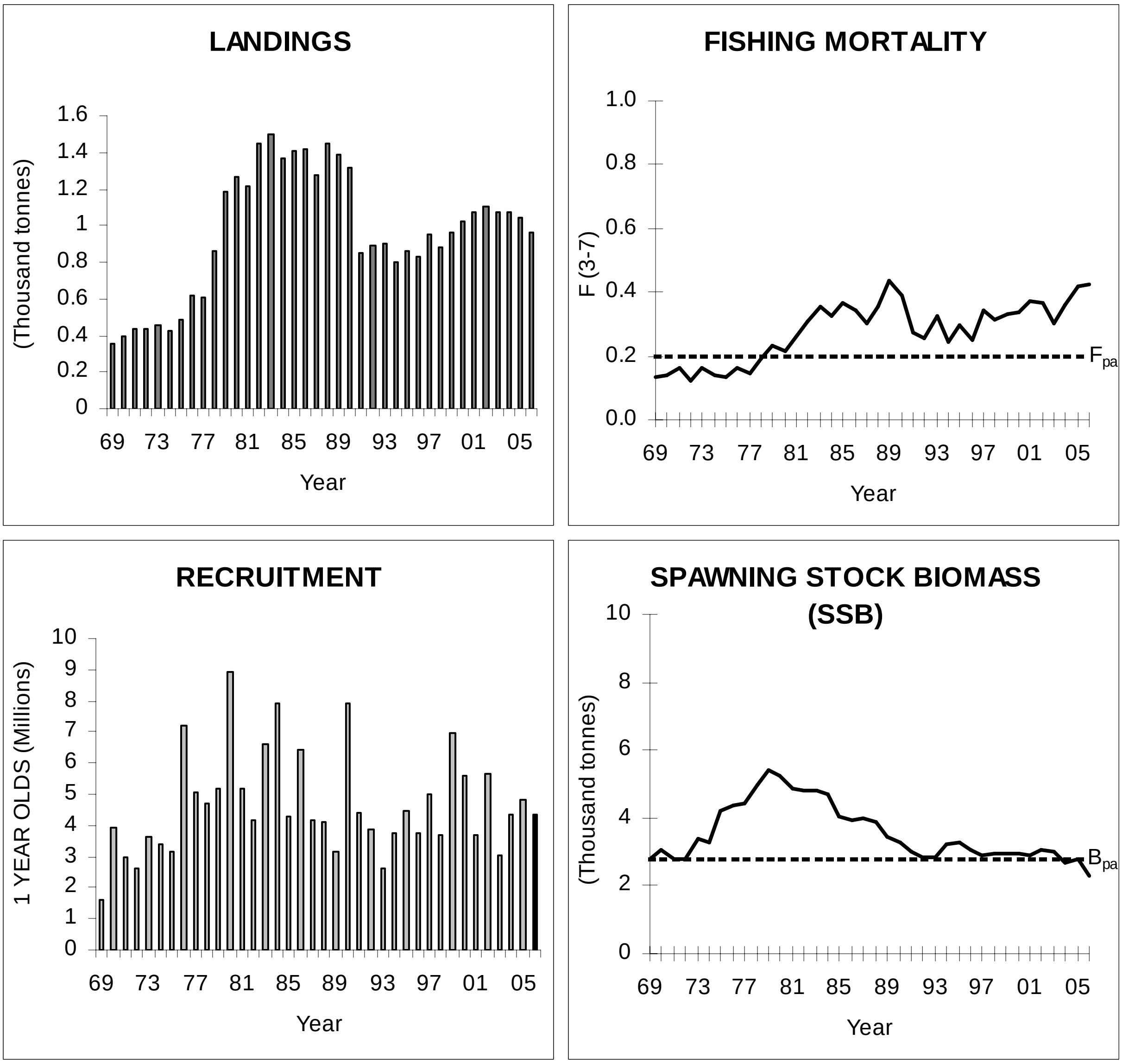
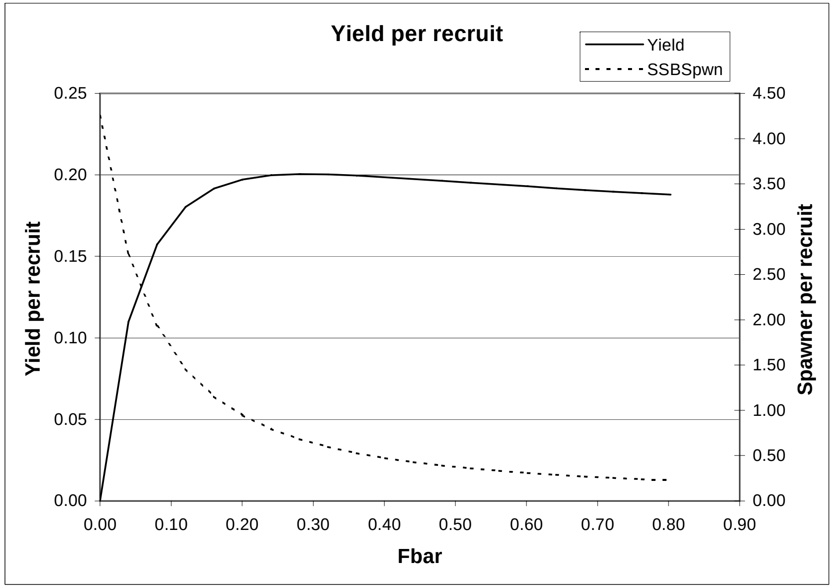
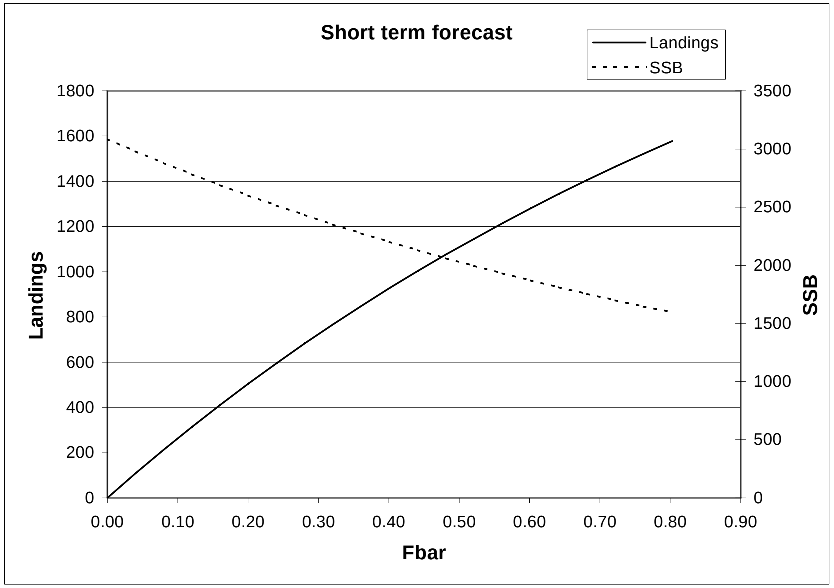


Figure 3.1.17 Sole in Division VIIE Summary





MFYPR version 2a
Run: ypr1
Time and date: 11:15 22/06/2007

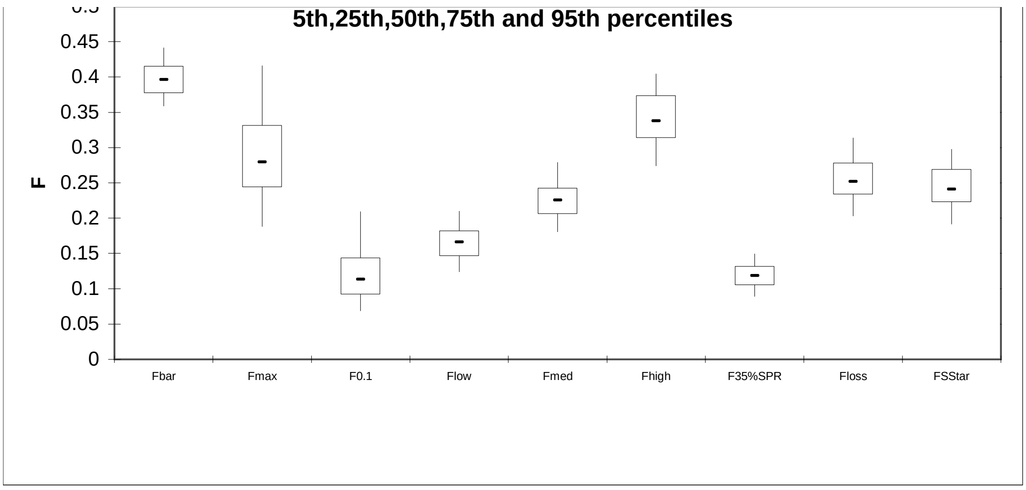
Reference point	F multiplier	Absolute F
Fbar(3-7)	1.0000	0.4013
FMax	0.7252	0.2910
F0.1	0.2895	0.1162
F35%SPR	0.2923	0.1173

Weights in kilograms

MFDP version 1a
Run: CatConNorm
s7eSTFMFDP Index file 22/707 mph
Time and date: 16:42 01/07/2007
Fbar age range: 3-7

Input units are thousands and kg - output in tonnes

Figure 3.1.18 VIIe Sole yield per recruit and short term forecast



Reference point	Deterministic	Median	75th percentile	95th percentile	Hist SSB < ref pt %
MedianRecruits	4288	4302	4391	4636	
MBAL	0				0.00
Bloss	2308				
SSB90%R90%Surv	3892	3628	3863	4197	65.79
SPR%ofVirgin	11.12	10.75	12.34	13.46	
VirginSPR	4.25	4.18	4.71	5.45	
SPRloss	0.71	0.74	0.77	0.83	
S*	5421	4229	4972	5421	97.37
	Deterministic	**Median**	**25th percentile**	**5th percentile**	**Hist F > ref pt %**
FBar	0.40	0.40	0.38	0.36	7.89
Fmax	0.27	0.28	0.24	0.19	57.89
F0.1	0.11	0.11	0.09	0.07	100.00
Flow	0.17	0.17	0.15	0.12	76.32
Fmed	0.25	0.23	0.21	0.18	65.79
Fhigh	0.35	0.34	0.31	0.27	26.32
F35%SPR	0.12	0.12	0.11	0.09	100.00
Floss	0.27	0.25	0.23	0.20	57.89
FS*	0.25	0.24	0.22	0.19	68.42

For estimation of Gloss and Floss:
A LOWESS smoother with a span of 1 was used.
Stock recruit data were log-transformed
A point representing the origin was included in the stock recruit data.
For estimation of the stock recruitment relationship used in equilibrium calculations:
A LOWESS smoother with a span of 1 was used.
Stock recruit data were log-transformed
A point representing the origin was included in the stock recruit data.

Western Channel Sole

Steady state selection provided as input
FBar averaged from age 3 to 7

Number of iterations = 100
Random number seed = -99
Stock recruitment data Monte Carloed using residuals from the equilibrium LOWESS fit

Data source:
C:\MediumTerm\SOLVIIE.SEN
C:\MediumTerm\SOLVIIE.SUM

FishLab DLLs used
FLVB32.DLL built on May 6 1999 at 12:54:28

PASoft2 Feb 2003
07/03/2007 10:09

Figure 3.1.19 VIIe sole, PASoft Reference points

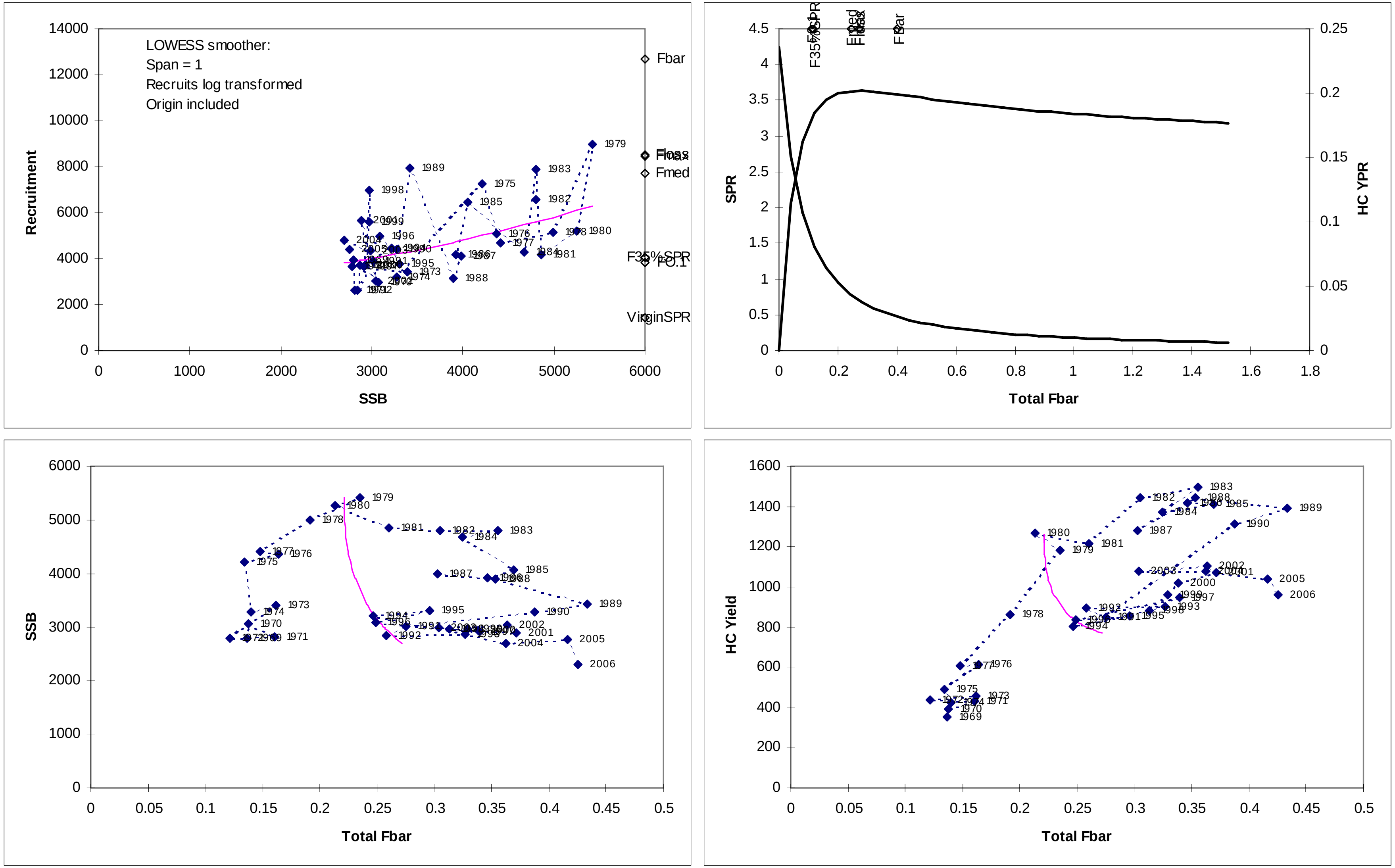


Figure 3.1.20 VIIe sole, PASoft Equilibrium Curves

Figure Sole,Western Channel. Probability profiles for short term forecast.

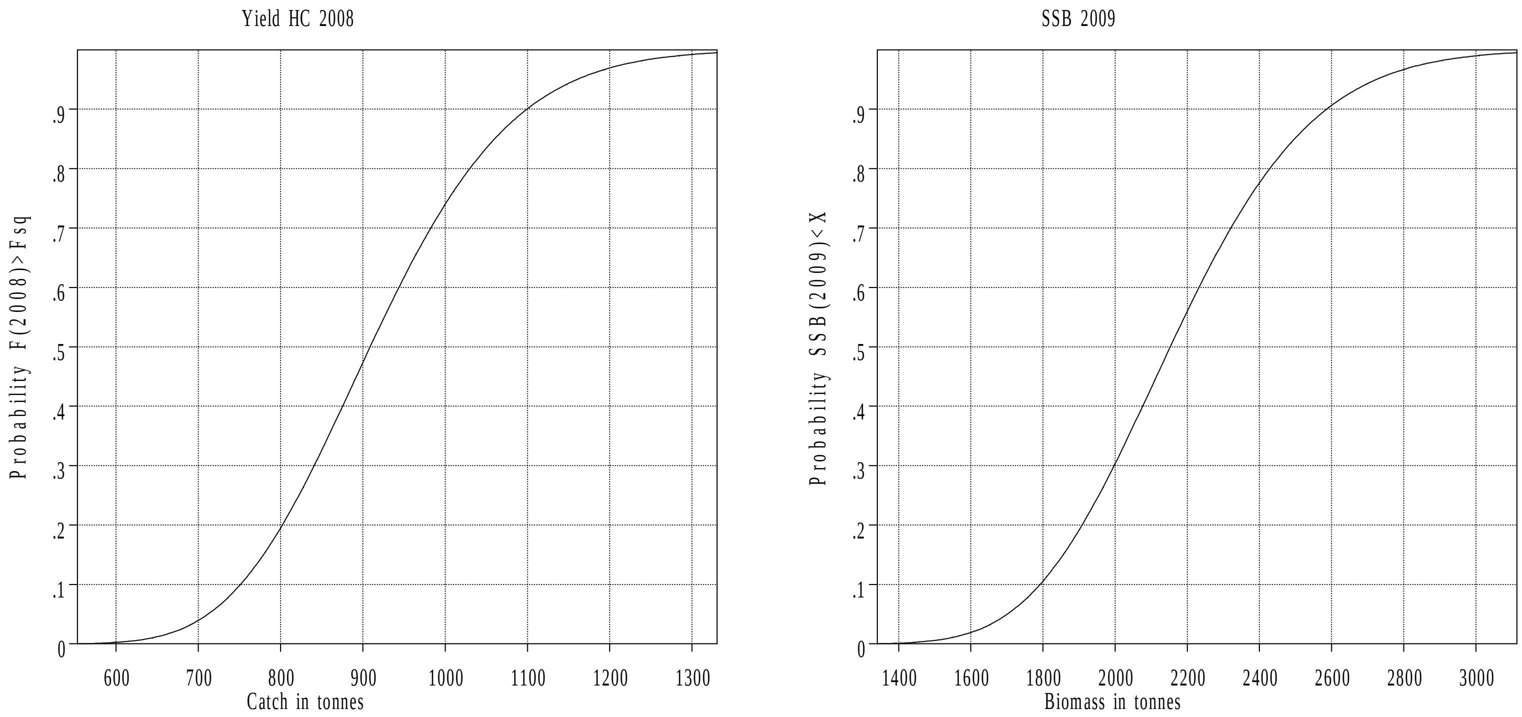


Figure 3.1.21 Sole in VIIe Short-term forecast probability profiles

Data from file:C:\MediumTerm\SOLVIIE.SEN on 02/07/2007 at 18:15:25

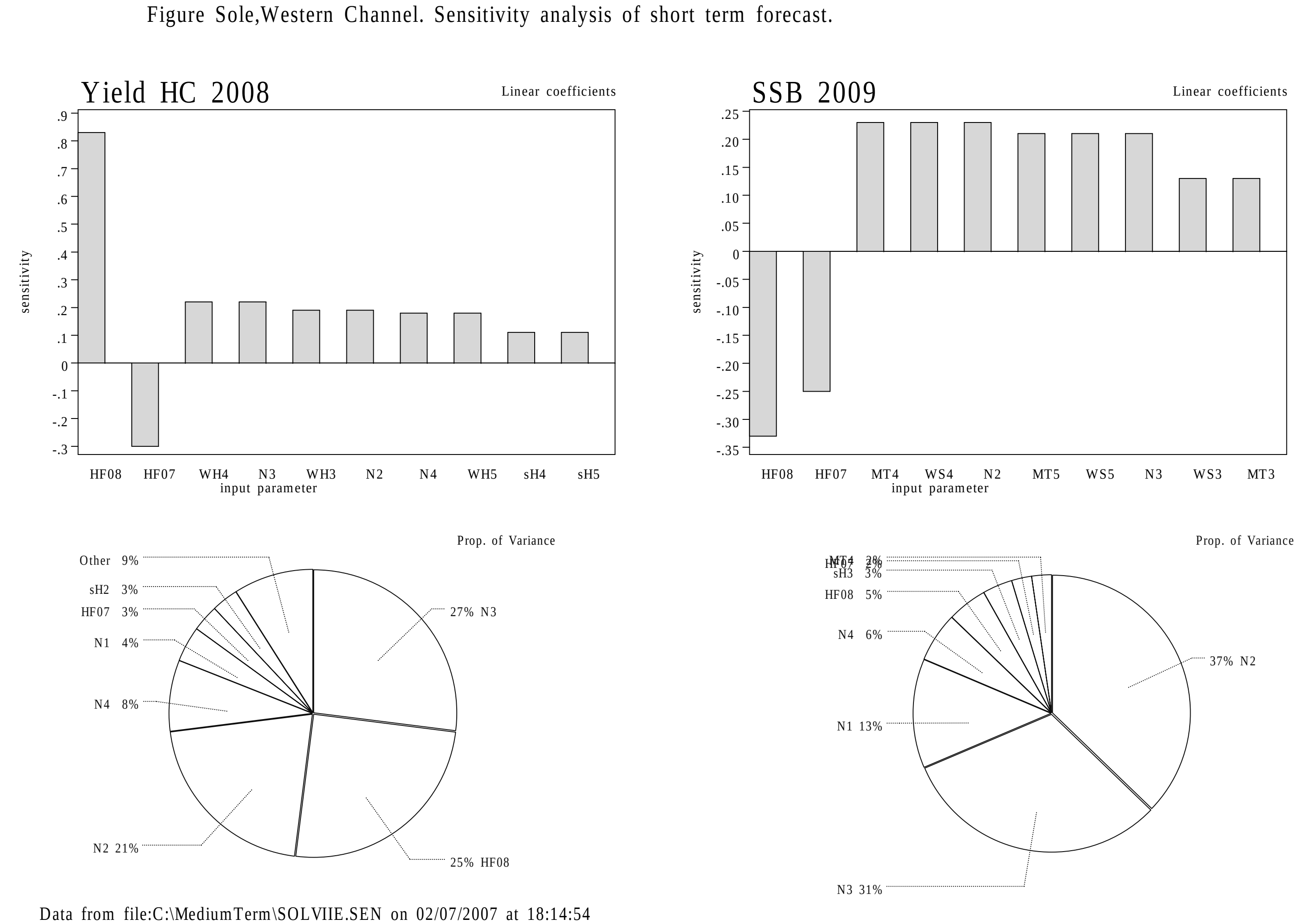


Figure 3.1.22 Sole in VIIe Delta profiles from Sensitivity Analysis.

3.2 Plaice in the Western Channel (ICES Divisions VIIe)

Type of assessment in 2007: Benchmark assessment (see section 1.6).

Main changes: Inclusion of a new tuning fleet based on the Fisheries Science Partnership (UK-FSP) surveys for sole and place conducted by CEFAS in cooperation with the UK industry. The review group made various comments on last years assessment: (i) the stock structure should be carefully investigated with a view to possibly combining VIIe and VIId stocks. (See sections 3.2.5 & 3.2.12).

3.2.1 The fishery

A description of the fishery is provided in the Stock Annex, section A2.

ICES advice applicable to 2007.

Exploitation boundaries in relation to precautionary limits: *Given the low stock size, recent poor recruitment, high fishing mortality, the uncertainty in the assessment, and the inability to reliably forecast catch, ICES recommends a substantial reduction in catch until the estimate of SSB is above* $\boldsymbol{B}_{lim}$ *or other strong evidence of rebuilding is observed.*

ICES advice applicable to 2006.

Exploitation boundaries in relation to precautionary limits: *Given the low stock size, recent poor recruitment, increasing fishing mortality, the uncertainty in the assessment, and the inability to reliably forecast catch, ICES recommends a substantial reduction in catch until the estimate of SSB is above* $\boldsymbol{B}_{lim}$ *or other strong evidence of rebuilding is observed.*

Management applicable to 2006 and 2007

The catch of VIIe plaice is managed by a TAC applied to VIId (Eastern Channel) and VIIe combined. This was set at 5151 t for 2006 and 5050t for 2007. There are also technical measures including a minimum 80mmm mesh size and a MLS (27 cm) for this species.

Council Regulation EC No 41/2007, Annex IIc restricts the number of days at sea to 192 for beam trawlers of mesh size equal to or greater than 80 mm and for static demersal nets including gill nets, trammel nets and tangle nets, with an additional 12 days per year for the UK beam trawl fleet due to a reduction in fleet capacity.

Council Regulation EC No 51/2006, Annex IIc restricts the number of days at sea to 216 for beam trawlers of mesh size equal to or greater than 80 mm and for static demersal nets including gill nets, trammel nets and tangle nets, with an additional 12 days for the UK beam trawl fleet due to a reduction in capacity of the fleet.

Recent trends in the fishery

National landings data reported to ICES, and estimates of total landings used by the Working Group, are given in Table 3.2.1.

Estimated total international landings in 2006 were 1260t, more than 55% higher than the value predicted by last year's assessment (800 t at status quo F). Landings increased during the latter half of the 1980s, when the stock benefited from a series of good recruitments in 1986 - 1988, but have recently returned to the 1979-80 level of around 1200 t.

The effort control regime introduced in 2004 as part of the cod recovery plan in the North Sea and VIId has led to a redistribution of Belgian effort, particularly beam trawl effort to other areas including VIIe. This continued in 2005, but in 2006 the days at sea restriction for beam trawlers in the VIId was relaxed leading to a return to a more historic effort distribution. The sharp increase in the cost of fuel during the latter half of 2005 and continued high prices in 2007 may decrease the distance travelled in any one trip by the fleet, potentially reducing CPUE, but this may be counter acted by the greater reluctance to fish under poorer weather conditions when catches generally are lower.

Comments relevant to VIIe plaice, from the 2007 Working Group on Fishing Technology and Fish Behaviour (WGGTFB) are reproduced below.

£5 million has recently been allocated to reduce capacity in the SW beam trawl fleet, aimed primarily at vessels that traditionally target sole in the Celtic Sea and Channel. (UK-England; Sole catch reduction; It is difficult to estimate how many vessels will be removed but on previous experience, it is likely to be sufficient to remove 4 or 5 vessels).

The UK beam trawl fleet in the south-west is now using benthic release panels. Research shows that these release about 75% of benthic invertebrates from the catches and there are indications that they also release small monkfish. With increasing consumer and NGO demands specifically targeting this fishing method, the use of these panels is likely to increase further. Full square mesh codends are also been tested on a small number of vessels, these reduce the capture of benthos further and improve the selection profile on gadoids. Due to increasing pressure from NGOs and fish buyers. Uptake is approximately 20% (10 vessels). (UK-England; Voluntary use of TCM)

Discards

Discards estimates, from the UK(E&W) and French discard sampling programme, are available for the period 2002 - 2006 (Annual Data Files in ICES Files) and indicate that discarding in this fishery is low compared to other plaice stocks. Although discards appear to be higher in quarter 1, this corresponds to a period of lower catches and effort. Quarterly profiles of numbers landed and discarded at length, in 2006, are given in Figure 3.2.2a. No discard data was available for Belgium in 2006, although previous data also indicated that the proportion of discards was low.

Commercial fleet effort and LPUE

The UK(E+W) CPUE output file shows the individual fleets that make up the composite of all otter trawl and all beam trawl fleets that are used in the commercial tuning data sets. Trends in LPUE and effort are given in Table 3.2.2 and Figure 3.2.1; more detailed information on the distribution of effort by area and trends in the fishery can be found in the Stock Annex. LPUE in the North of VIIe reached a peak in 1988-1990, fell sharply to 1995 and is now at stable but low levels. Survey CPUE (Beam trawl survey in the North of VIIe) has shown a similar but slightly earlier trend in the early years but indicates a more pronounced temporary increase in catches during 2000 and 2001 compared to the commercial series. Commercial LPUE in the South and West of VIIe shows a general decline from 1990 to 2006.

Effort (fishing power corrected, using GRT) by UK(E&W) beam trawlers shows an increasing trend from 1992, and is estimated to have been at a series high since 2003. In contrast, effort by otter trawlers continues to decline slowly.

3.2.2 Age and length compositions and mean weights at age

Length compositions of the landings in 2006 are provided for two UK fleets and total French landings (Table 3.2.3). The French data has large raising factors due to low sampling effort so the LDs were not used in the raising procedure but are presented here for comparison only. Length distributions of UK (E&W) landings from 1992 to 2006 as used by the WG are illustrated in Figure 3.2.2b.

Quarterly age compositions for landings in 2006 were available from UK(England and Wales) sampling, which accounted for roughly three quarters of the total international landings. The total international age composition was obtained by raising the UK(England and Wales) age composition to include the landings of the Channel Isles, France and Belgium. This follows the standard protocol for this stock as described in the Stock Annex. Numbers at age landed annually are given in Table 3.2.4 and plotted for 1992 to 2006 in Figure 3.2.3.

Total international catch and stock weights at age for 2006 were calculated following the standard protocol (described in the Stock Annex) and are given in Tables 3.2.5 and 3.2.6.

There were a number of revisions to French landings information, some of which altered the catch numbers at age as far back as 2002 due to the interaction with quarterly ALKs (ICES files)

The fit with an R^2 of 0.945 for the catch weights that was used in 2006 is :

$$w= 0.0028age^2 + 0.0627age + 0.1132$$

3.2.3 Natural mortality and maturity at age

Natural mortality was assumed to be 0.12 for all ages and years and the combined-sex maturity-at-age ogive (as in previous years) was:

Age	1	2	3	4	5+
Maturity	0.00	0.26	0.52	0.86	1.00

The proportions of F and M before spawning were both set to zero.

Derivations and sources are presented in the Stock Annex.

3.2.4 Surveys and abundance indices

Table 3.2.7 gives abundance indices as numbers caught per 100 km for age groups 1 to 9 as obtained by UK-WECBTS. Strong and weak year classes have been well tracked by this survey in the past (see section 3.2.6).

Up to 2001, the survey vessel was a chartered commercial beam trawler. For 2002, 2003 and 2004, the RV CORYSTES is used, with the survey returning to the FV Carhelmar in 2005. Detailed information on the survey protocols and area coverage can be found in the Stock Annex.

Since 2003 the fisheries science partnership (CEFAS, UK industry cooperative project) has been conducting a surveys using two commercial vessels with scientific observers and following a standardised sampling procedure over a grid of stations extending from the Scilly Isles to Lime Bay. The survey covers a substantially larger area than the current survey and is thought to be more representative of the stock in UK waters. A more detailed description of the survey is presented in WD 5. This data is now included in the 2007 assessment, see section (3.2.5 exploratory analysis).

3.2.5 Catch-at-age analysis

See section 1.4.1 for the general approach adopted at the WG for this benchmark type of assessment. The details of the previous standard assessment approach for this stock can be found in the Stock Annex.

The age range for the analysis was 1-10+, as standard.

Data Screening

For catch data screening, a separable VPA was carried out using a reference age of 4, F of 0.7 and S set to 0.8, as in previous years. Figure 3.2.4 shows the separable residuals scaled to abundance (rather than q-residuals). The results show few unusual patterns of residuals above age 4, with a slight tendency of decreasing selectivity at the younger ages. This could be associated with discarding, but the discard information does not support this notion. It is more likely that there is a special expansion of the younger ages onto the fishing grounds when year class abundance is high. At the currently lower levels of recruitment selectivity decreases indicating some negative residuals.

The tuning data available for this assessment are the same as last year and are presented in Table 3.2.7. The figures in bold indicate the data used for the final run.

Experimental catch-at-age analysis

In addition to the work conducted during an update assessment (section 1.6) this year work was undertaken to re-examine the tuning information and its effect on the assessment as well as investigate the use of an additional tuning fleet provided by the UK-fisheries science partnership. Particular attention was also paid to the review group concerns regarding the persistent retrospective pattern observed in the assessment in previous years.

Tuning information available to the 2007WG consisted of 5 fleets, three UK commercial series, UK otter historic, UK otter trawl, UK beam trawl and two UK survey series UK-WEC-BTS, and UK (E+W) FSP. The latter presents a new tuning fleet representing data from for ages 1-10+ in years 2003-06. A full description of the survey design and implementation is presented as WD 5. Details of the derivation for the other tuning fleets are presented in the stock Annex (Appendix X)

Tuning indices were examined for inconsistencies using log(CPUE) plots plotted by year class and year (Figure 3.2.5 and 3.2.6). All tuning indices indicate highly consistent year class estimates, and plots of index by year do not indicate substantial year effects in the tuning data. The new UK (E+W) FSP survey although short illustrates an analogous pattern to the other fleets for ages greater than 1. Additional plots were carried out for the tuning fleets to examine if independent estimates of F could be estimated from the rates of decline of catches (Figure 3.2.7). Although it is difficult to estimate levels of F statistically because of year class variation a line of Z=0.85 (fitted by eye) has been added to the survey plots and indicates good agreement with the estimates of decline in abundance with time for both surveys. Commercial data estimates Z at 0.375, much lower than the surveys.

However, there is little indication of misreporting or bias in the tuning data, which in any case to give the consistent results would have to be highly size selective. The surveys are conducted in the area of the main fishery for sole and as such should be reflective of the catches, however they are temporarily restricted to August and September. It may therefore be that difference in F's reflects a temporal separation and that the fishery operates in part on a migratory subcomponent not seen in the surveys. One of these may be the VIId stock or offshore stocks that migrate into the area of the fishery during their winter spawning migration. The UK has started a beam trawl survey in 2006 in VIIe, which covers the whole of VIIe during March (the spawning season) and may provide some answers to these questions.

XSAs tuned by individual fleets were conducted for all fleets and residual and summary plots are shown in Figures 3.2.8 and 3.2.9. The commercial fleets both indicate some trends in residuals (declining for the otter trawl fleet and sinusoidal for the beam trawl fleet). However, the overall range of residuals is small for both commercial fleets as one might expect for fleets contributing significantly to the catch data.UK-WEC-BTS indices are noisier, particularly during the early part of the series and at the older ages. Last year this index was used only to age 5, but there seems to be a good source of information available up to age 8 particularly for the stronger year classes. The new FSP survey has a very short time series and consequently the residuals are very small at ages greater than 1. There seems to be little information available at age 1 and abundance at age 1 is a poor predictor of abundance at age 2. Summary information for all single fleet runs indicate reasonable agreement regarding the trends in F, SSB and recruitment, although the FSP survey does suggest that F may be lower.

Combining the fleets into a single assessment curiously alters the estimate of F in the final year (Figure 3.2.10) from those estimated by the single fleet runs, despite their consistency. This is because shrinkage is given more weight in the single fleet runs, particularly so for the short FSP series. This effect can be recreated in the final assessment by increasing F-shrinkage to unrealistic levels (Fshk = 0.2, Run 1). Other setting had very little effect on the stock trends, and only slightly changed the weighting between fleets. Therefore last years settings were used for all further runs used to look at the effects of tuning fleets. Run 2 represents the SPALY run, Run 3 add the older ages for the UK-WEC-BTS up to age 8, Run 4 adds the FSP survey and Run 5 removes age 1 from the FSP survey, Run 6 uses only survey tuning information.

There is little difference in summary plots or residual plots for Runs 2-5, mainly because the fleets are in such good agreement. However the weights do change. Including older ages in the UK-WECBTS, gives it slightly greater weight at the older ages and reduces reliance on commercial data. Adding the UK (E+W) FSP further decreases the reliance on commercial data, taking weight from both commercial and other survey data. Age 1 weight is shared equally between the two surveys, but there is little information in the FSP at age 1 and it is because of the short tuning series that this weight and inverse variance weighting that the assessment gives too much credence to estimates at age 1. Removing age 1 results in a balanced assessment sharing weighting roughly equally between commercial and survey data at the older ages and reducing the reliance on a single tuning fleet to provide estimates of recruitment. Variance in the UK (E+W) FSP series is likely an underestimate, because of its short timeseries, so its influence was reduced by increasing the minimum standard error to shrink to in Run 5 to 0.5.

Removing commercial tuning information all together results in changes to the stock dynamics. The run differs from the single fleet runs for surveys, because almost no weighting is given to F-shrinkage and produces higher levels of F when F is stable over time. This suggests that there is some bias in the commercial information (tuning and catch), which is consistent with the observed retrospective pattern (this cannot be tested, because of the short time series available for the UK (E+W) FSP. It is not possible to correct for this bias in the catch data and leaving out commercial tuning information places very heavy reliance on a short time series with likely underestimates of its variance because of this.

XSA weights for the different runs are shown in Figure 3.2.11. Run 1 places all the weight on F shrinkage, the other runs are more balanced towards the tuning series with the commercial fleets taking about half the weight at the older ages.

The WG decided to use Run 5 as the final assessment, as it presents the best compromise given the understanding of the behaviour of stock and fishery. The settings used for the final run are shown in the table. The full assessment history is given in the Stock Annex.

Final catch-at-age analysis

The settings used for the final run are shown in the table. The full assessment history is given in the Stock Annex.

		2006 XSA	2007 XSA
Catch at age data		1976-2005, 1-10+	1976-2006, 1-10+
Fleets	UK-WECBTS – Survey	1986-05, 1-5	1986-06, 1-**8**
	UK WECOT – Commercial	1988-05, 3-9	1988-06, 3-9
	UK WECOT – Commercial historic	1976-87, 2-9	1976-87, 2-9
	UK WECBT – Commercial	1989-05, 3-9	1989-06, 3-9
	UK E+W FSP - Survey		**2003-06, 2-9**
Taper		no	No
Taper range		-	-
Ages catch dep. Stock size		None	None
q plateau		7	7
F shrinkage se		2.5	2.5
year range		5	5
age range		4	4
Fleet SE threshold		0.3	**0.5**
Prior weighting		-	-
Plus group		10	10
F Bar Range		F(3-7)	F(3-7)

Table 3.2.9 presents the diagnostics for the XSA run. Catchability residuals are plotted in Figure 3.2.12. Some patterns can be seen for UK-WECBT and a year effect can be seen in the UK-WECBTS for 2004 probably associated with a change in vessel effect. The commercial fleets indicate some trends over the period, but generally are small. Retrospective analysis (Figure 3.2.14) was run with out the short UK (E+W) FSP tuning series and indicates a strong downward revision of the 2001 year class strength, going from the third strongest year class in history to a value close to long term GM. Over the last few years there is a sequential downwards revision of F strongest in the most recent years, but converges mostly within 4 to 5 years. There is a commensurate revision in SSB. The addition of the new survey is likely to reduce this bias, but this could not be examined due to the short timeseries. The bias continues to be a problem for this assessment. The reasons for this are the difference in the estimation of F between the commercial and survey information. Even removing the commercial fleets entirely from the assessment cannot solve this problem and does introduce greater potential for poor forecasts due to increased variability in the assessment.

Estimates for the younger ages are almost entirely determined by the surveys. The commercial fleets provide roughly 50% of the weight of ages 3 and greater. The contribution of F-shrinkage is minor for all ages. Fishing mortalities and population numbers estimated from the final run are given in Tables 3.2.9 and 3.2. 10, and summarized in Table 3.2.11. Last year, fishing mortality and SSB in 2005 were estimated to be 0.8 and 1562t, this year’s estimates for 2005 are 0.71 and 1756t, a revision of 11 and 10% respectively. Fishing mortality in 2006 is estimated to have been the highest in the series (0.76), and SSB is estimated to have decreased to 1640t.

3.2.6 Estimating recruiting year class abundance

The 2004 year-class is estimated at 5.0 million at age 1, which is more than twice last years estimate (2.3 million). The UK-WEC-BTS survey takes 39% of the weight, the UK (E+W) FSP 59% of the weight and the remaining 2% comes from shrinkage, so that the yearclass to 98% is estimated from surveys.

The 2005 year-class is estimated to be 4.3 million, 93% of the weight coming from the UK-WEC-BTS. This is 10% above the $GM_{89\text{-}05}$.

2006 and subsequent year-classes : In line with last years assessment, the choice of the geometric mean over the period 1989 – 2005 was seen as more representative of the most recent period of recruitment values.

Working group estimates of year-class strength can be summarised as follows:

Year class	XSA	GM 76-03	GM 89-05	Proposed estimate
2004	4981			XSA
2005	4295			XSA
2006 & subsequent	-	4570	3906	GM 89-05

3.2.7 Historic trends in biomass, fishing mortality and recruitment

A summary of the final assessment is given in Table 3.2.12 and Figure 3.2.13. Spawning stock biomass (SSB) was stable during the period 1981-1987, peaked above 4,000 t during 1988-1990 following good recruitments in the mid-1980s, and then decreased to 1700 t in 1995-96, just above the series minimum. Since then SSB has slightly increased following the good 1996 year-class but is now estimated at the lowest level since 1979.

Fishing mortality has shown a gradually increasing trend up until the mid 1990s, then a slight decline followed by a sharp increase over the last five years. However, the retrospective analysis indicates a strong tendency to overestimate F, in the most recent years. It is likely that the true F has been variable without trend since the mid 1990’s.

Two periods of below-average recruitments in the period 1989-1994 and from 1998 onward have contributed to the decrease in yield and SSB. This years assessment estimates that 2 year classes have been above the long-term $GM_{77\text{-}04}$ (4583) since 2000, suggesting there may be some improvement in recruitment, but not to levels previously observed.

3.2.8 Short-term catch predictions

The assessment for this stock suffers from a consistent bias in the estimation of F in the final two to three years. Therefore it is not possible to produce accurate short-term forecasts, since the degree of retrospective bias is not predictable. In the past the WG has produced these forecasts, but they have been judged to be unhelpful in management by the review group. A careful examination of the available data and methodology suggests that the bias originates from the catch at age matrix and cannot be corrected, but the WG believes that the assessment is representative of the long-term trends in stock dynamics and recent recruitment, and that mainly the recent estimates of F and hence SSB are affected. Therefore the WG did not produce a forecast this year, but the inputs are available, if a suitable F_{sq} can be determined.

3.2.9 Yield and Biomass per recruit

Results for yield and SSB per recruit, conditional on the recent exploitation pattern, are given in Table 3.2.17 and Figure 3.2.17. Fmax is equal to 0.29, and is 41% of F_{sq} (0.71). Long term yield and SSB (at status quo F and assuming $GM_{89\text{-}05}$ recruitment) are given as ca. 1090 t and 1430 t respectively (at status quo F). The current assessment indicates therefore that long-term SSB is estimated to be around 43% below B_{pa} (2500t). The stock and recruitment scatterplot from the PA software is shown in Figure 3.2.18. There is no evidence of reduced recruitment at low stock levels.

If Fmax (0.23) was used to estimate long term yield and SSB (assuming GM recruitment) they would give values of ca. 1130 t and 3800 t respectively. This would give an estimate of long-term SSB around 52% above B_{pa}. There are some fluctuations in the recent F-at-age, possibly associated with the retrospective pattern in F, but changes are mainly in the older ages which do not contribute the bulk of either landings or SSB at current stock levels, but may do so at greater stock size.

3.2.10 Risk and sensitivity analyses and medium-term projections

No short-term forecast or stochastic projections (CS5) was carried out.

3.2.11 Comments on the assessment

Consistency of assessments

This year the WG carried out a benchmark assessment, but found little reason to change the settings or fleets in the assessment other than the addition of a new survey tuning fleet. Unfortunately, there continues to be bias in the retrospective analysis caused by the catch data, without a reasonable way to compensate for this, even by exclusion of the commercial tuning data as this results in sharp increases in variability of parameter estimates. Given the addition of the new survey tuning series this may be possible in the future, but the length of the current timeseries is insufficient. Estimates of F and SSB have been slightly revised compared to last year’s assessment and differs slightly from the SPALY run, but only in the last two to three years (Figure 3.2.13). XSA weights are now more evenly shared between survey and commercial tuning data at the older ages and reliance on the UK-WEC-BTS to estimate age 2 has been reduced. Figure 3.2.16.

A longer historic timeseries of assessment results (rather than retrospective analysis) is shown in Figure 3.2.15. The fact that the assessment settings have not changed drastically in recent history is reflected by the fact that the picture looks very similar to the retrospective plot Figure 3.2.14. Historic stock trends are strongly converged, but recent estimates tend to overestimate F and underestimate SSB. Inaccuracies in the assessment mostly reflect bias and there is little in the way of variability.

Sampling

Sampling data for countries receiving the majority of the TAC for this stock are considered satisfactory (Table 1.3.1). French landings are mainly in the first quarter and length compositions by quarter are available for the first time in 2005. The catch data appears to biased, but there appears to be little information as to how one might correct for this.

Discards

UK Discard data indicate that discarding of plaice is variable but low. In 2005 and 2006, the apparent high level of discarding in quarter 1 (ca. 30%) corresponds to a period of relatively low landings (18% of the annual landings for UK). The full extent of discarding in other fleets of this fishery remains unclear. As the time series of data expands, the WG will be able to better determine how to include this data in the assessment appropriately.

Survey information

The UK-WEC_BTS and the UK (E&W) FSP fleets have provided stable estimates of recent year class strength and mostly these are consistent with the commercial tuning fleets (Figure 3.2.5). This consistency is reflected by the weight given to these fleets in the current assessment and by the balanced weighting overall. Both these surveys are however spatially restricted to the same area as the commercial tuning fleets and little information exists on stock dynamics on the French coast.

Industry information

There was no additional information on VIIe plaice provided by the fishing industry representatives at the UK(E&W) pre-WG briefing.

At the pre-industry briefing representatives of the fishing industry noted that large plaice have decreased in abundance, consistent with a decreasing abundance. F seems to have been stable for a long time, so this is likely to be caused by a reduction in past recruitment possibly due to environmental effects. Some changes in the behaviour of plaice have been observed in the southern NS and this may directly or indirectly affect the recruitment in the western channel.

The fisheries science partnership conducted cooperatively between CEFAS and the UK industry has provided some evidence for the wide dispersal and wide-ranging age distribution for this stock. The distribution of plaice has shown a consistent pattern over the period of the surveys since 2003. The FSP age compositions for plaice show similar patterns to the international fishery landings in 2004 and the ICES forecast for 2005. (CEFAS Fisheries Science Partnership Summary Report (WD 5).

CEFAS organised a “clean fishing” competition designed to aid in the development of more selective and less destructive fishing gears. The Lady T Emiel (a Brixham beam trawler) skippered by Mike Sharp won the competition and prize for the development of benthic panels with a large square mesh. This reduces the impact of beam trawlers on the benthos but may also reduce selectivity for some commercial species.

3.2.12 Management considerations

Council Regulation EC No 41/2007, Annex IIc restricts the number of days at sea to 192 for beam trawlers of mesh size equal to or greater than 80 mm and for static demersal nets including gill nets, trammel nets and tangle nets, with an additional 12 days for the UK beam trawl fleet due to a reduction in capacity of the fleet.

Council Regulation (EC) No 509/2007 establishes a multi-annual plan for the sustainable exploitation of VIIe sole. Years 2007-2009 are deemed a recovery plan, with subsequent years being deemed management plan. For 2008 the TAC is required to be at a value whose application will result in a 20% reduction in F compared to Fbar (03-05). If this value exceeds a 15% change in TAC, a 15% change in TAC shall be implemented.

Plaice are taken as a by-catch in the beam trawl fishery mainly targeting sole, and as part of a mixed demersal fishery by otter trawlers. Therefore the restrictions under the management plan for sole should also benefit the plaice stocks as proposed by the WG2006. In addition to the days at sea regulations there is also a £ 5 million decommissioning scheme in operation which is likely to take a number of beam trawlers out of the UK south west fleet.

The assessment is unable to accurately estimate recent trends in F and hence SSB although historic trends are estimated with some certainty. Consequently, comparisons of the most recent estimates with biological reference points are not appropriate. In any case since WGSSDS 2004 the WG has considered the biological reference points for this stock as unreliable for the following reasons:

- *The stock recruitment relation shows no evidence of reduced recruitment at low stock levels.*
- *The basis for **B**pa is weak, and heavily dependent on two consecutive points (1985 and 1986)*
- ***F**pa is based on **B**pa, and then this reference point is also rejected.*

It is clear that this stock has been below 2500 t (B_{pa}) since 1992 and increases to SSB have been observed since then despite this recruitment does not appear to be limited at current SSB levels. Current levels of biomass are low, but there is some indication from the surveys and the assessment as a whole that recent recruitment has been improving although nowhere near the levels observed in 86 and 87.

F has been between 0.5 and 0.7 for almost the entire time series, well above F_{pa}., without apparent stock collapse. Therefore comparisons with the current biological reference points are considered unreliable even for more historic estimates.

The retrospective trend in the assessment caused by the difference in the mortality signals between commercial and survey information remains unresolved. The most plausible explanation for the difference is incomplete mixing or migration. It is known that plaice undergo spawning and feeding migrations, and one possibility is that the survey fleets are estimating F only in the resident stock, whilst the commercial fleets operate throughout the year possibly estimating F on an additional migratory component that enters VIIe to spawn.

It is interesting to note that the VIId assessment has the opposite retrospective pattern (i.e. underestimates F), unfortunately because the stocks are assessed in different WGs, despite being the same management unit the effect has not been examined in any detail. Tis should be done prior to the next North Sea WG

The 2004 year class is now estimated to be above the long-term GM and estimates for the 2005 yc close to the GM at 4295, so given currently stable F, SSB should rise.

The stock unit (Division VIIe) does not correspond with the management unit (Divisions VIId and VIIe). This hampers effective management of plaice in the Western English Channel.

Table 3.2.1 Plaice VIIe Nominal landings (t) as used by the WG

Year	Belgium	France	Guernsey	Ireland	UK E and W	Other	Total re-ported	Un allo-cated	Total
1976	5	323	1		311		640		640
1977	3	336			363		702		702
1978	3	314	2		465		784		784
1979	2	458	1		514	0	976	2	977
1980	23	325	1		608		957	122	1079
1981	27	537	1		952		1517	-16	1501
1982	81	363	0		1109		1554	134	1688
1983	20	371	0		1194	1	1586	-92	1495
1984	24	278	5		1136	3	1446	101	1547
1985	39	197	9		1110	3	1358	83	1441
1986	26	276	6		1381	2	1691	119	1810
1987	68	435	6		1411	2	1922	36	1958
1988	90	584	8		1644	2	2328	130	2458
1989	89		3		1708	2	1802	556	2358
1990	82		5		1885	3	1975	618	2593
1991	57		3		1323		1383	465	1848
1992	25	419	8		1102	14	1568	56	1624
1993	56	284			1078	26	1444	-27	1417
1994	10	277			996	2	1285	-129	1156
1995	13	288	2		855		1158	-127	1031
1996	4	279			829	26	1138	-94	1044
1997	6	329	6	1	1019	13	1374	-51	1323
1998	22	327	2	1	876	14	1242	-111	1131
1999	12		4		924	19	959	340	1299
2000	4	360	9		907	10	1290	-10	1281
2001	12	303	3		784	10	1112	-6	1106
2002	27	242	2		967	9	1247	10	1257
2003	39	216	2	1	978	5	1241	36	1277
2004	46	184	3	0	907	2	1142	70	1212
2005	48	198	3		882	2	1133	70	1203
2006	52	133		0	962	2	1149	111	1260

Table 3.2.2 Plaice VIIe effort & CPUE data

Year	LPUE OT west	LPUE BT west	LPUE OT north	LPUE BT north	LPUE OT south	LPUE BT south	Effort OT	Effort BT	Landings OT	Landings BT	SurveyCPUE
1972	2.31		4.50		0.00		64.60			194.36	
1973	2.25		3.85		0.00		69.54			200.45	
1974	1.65		3.47		2.94		50.09			121.03	
1975	1.78		3.53		2.54		54.69			132.95	
1976	1.89		3.62		4.14		56.13			144.56	
1977	1.37		3.10		4.96		55.40			117.72	
1978	1.61	5.41	3.63	10.35	4.24	11.84	48.80	22.09	204.69	114.02	
1979	1.84	4.16	4.58	7.37	1.64	6.58	49.92	39.38	233.81	142.52	
1980	2.02	3.15	5.82	6.06	0.67	6.45	49.95	62.16	335.16	150.69	
1981	2.61	4.44	10.98	8.35	7.30	8.33	46.88	65.29	471.20	257.28	
1982	3.28	4.43	10.77	9.23	0.00	7.69	38.51	81.59	611.52	249.60	
1983	2.57	2.76	11.03	9.64	8.10	5.71	52.59	103.06	612.16	303.04	
1984	2.96	4.08	10.92	10.38	2.43	7.80	52.89	87.63	575.22	281.94	
1985	2.60	3.79	8.81	9.00	0.09	6.38	57.69	92.19	540.61	255.86	152.06
1986	3.25	6.30	10.94	12.21	10.17	6.85	49.52	78.33	602.07	315.08	164.62
1987	3.56	5.37	11.02	9.69	3.63	7.45	45.11	87.05	672.81	329.97	205.89
1988	3.90	3.50	15.38	6.51	5.04	4.85	53.40	103.36	564.72	433.20	253.39
1989	2.69	6.50	10.87	14.25	1.42	6.88	54.71	109.95	900.19	315.73	147.96
1990	2.95	6.52	7.77	15.64	3.55	10.17	53.05	100.95	990.05	268.81	116.00
1991	2.80	6.16	5.08	13.24	0.41	7.47	40.79	83.57	721.46	152.93	87.25
1992	1.92	6.30	3.51	10.61	3.06	9.69	39.91	80.86	695.70	105.41	74.46
1993	1.39	6.14	3.03	11.04	5.46	7.17	39.17	83.92	655.48	81.77	61.63
1994	1.46	4.62	2.48	9.17	2.11	6.47	38.77	100.42	650.99	63.67	56.98
1995	1.61	4.60	1.99	6.29	2.36	5.40	35.45	100.80	531.06	60.20	51.35
1996	2.00	3.09	2.49	6.66	11.62	4.39	30.54	116.45	482.18	64.83	59.72
1997	2.69	3.50	3.08	7.16	1.56	5.58	33.28	108.39	561.74	99.05	98.22
1998	1.65	2.97	4.13	6.10	1.85	3.03	29.80	111.17	459.22	73.30	87.39
1999	1.39	3.49	3.60	8.55	1.11	4.59	27.52	103.56	576.76	59.67	84.20
2000	0.81	2.98	4.00	6.63	1.25	3.72	30.49	118.83	541.33	61.82	113.14
2001	0.89	2.30	3.03	5.45	3.14	3.61	31.90	143.27	527.38	48.82	105.58
2002	0.90	2.90	4.18	6.52	0.56	3.45	28.35	139.83	651.04	57.44	80.49
2003	0.96	3.26	2.10	8.18	0.50	2.89	25.06	159.95	743.07	36.88	79.57
2004	0.88	3.38	2.01	6.16	0.19	2.80	25.58	158.68	701.17	37.98	45.30
2005	0.88	2.62	2.13	8.20	3.48	2.75	21.13	157.81	691.27	29.44	70.21
2006	0.96	2.68	3.41	6.98	1.71	2.49	21.06	161.75	664.95	28.57	74.75

Table 3.2.3 Plaice VIIe Landings Length Frequency Distributions

Length	UK BeamTrawl	UK other	French
22	0	166	2116
23	242	294	5290
24	2411	773	10581
25	14665	4727	17079
26	44603	14559	26664
27	84696	45597	26803
28	135746	64382	28054
29	149296	80049	26853
30	157449	92154	30167
31	190768	77902	28470
32	146319	71936	22309
33	151261	58276	20303
34	106276	44158	16135
35	82459	32114	12965
36	85597	20733	17568
37	60448	19752	15260
38	56474	15407	9596
39	36988	9715	11547
40	28224	8974	4892
41	23109	4624	3669
42	18138	6083	5582
43	14055	3427	1223
44	12769	2811	1223
45	10051	2782	1223
46	8740	3095	0
47	6747	1709	1223
48	6842	985	1223
49	4597	1002	0
50	3932	420	0
51	2016	498	1223
52	2001	257	1223
53	1282	348	2446
54	1543	439	0
55	875	120	1223
56	857	92	0
57	523	82	0
58	788	2	0
59	329	76	0
60	164	14	0
61	79	0	0
62	94	34	0
63	38	126	0
64	0	0	0
65	0	0	0
66	0	0	0
67	9	84	0
68	21	0	0
Total	1653521	690778	354133

Table 3.2.4 Plaice VIIe Catch Numbers at Age

Age	1976	1977	1978
1	25	6	46
2	106	621	242
3	620	304	914
4	156	266	103
5	110	84	136
6	58	50	49
7	59	31	29
8	37	46	26
9	14	15	21
+gp	79	59	66
Total	1264	1482	1632
Landings	640	702	784

Table 3.2.4 Plaice VIIe Catch Numbers at Age continued

Age	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
1	20	19	41	72	3	77	3	10	74	12
2	519	743	657	273	708	920	573	894	1029	1797
3	697	712	1854	1710	698	1419	1228	2104	1846	4033
4	543	205	381	1131	1184	455	971	642	1103	731
5	70	188	95	198	514	372	122	364	550	369
6	75	56	89	71	84	150	201	67	195	108
7	35	59	16	74	33	71	127	106	50	76
8	23	19	43	11	38	20	19	61	37	28
9	14	13	14	26	2	30	4	27	36	16
+gp	82	130	80	115	92	43	48	59	46	40
Total	2078	2144	3270	3681	3356	3557	3296	4334	4966	7210
Landings	977	1079	1501	1688	1495	1547	1441	1810	1958	2458

Table 3.2.5 Plaice VIIe Catch Weights at Age

Age	1976	1977
1	0.186	0.199
2	0.285	0.305
3	0.383	0.409
4	0.479	0.512
5	0.575	0.615
6	0.669	0.716
7	0.763	0.816
8	0.855	0.915
9	0.947	1.014
+gp	1.284	1.368

Table 3.2.5 Plaice VIIe Catch Weights at Age continued

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	0.198	0.195	0.248	0.154	0.198	0.115	0.152	0.107	0.181	0.257
2	0.302	0.299	0.337	0.287	0.291	0.241	0.287	0.234	0.271	0.294
3	0.406	0.401	0.427	0.417	0.384	0.360	0.384	0.358	0.365	0.344
4	0.508	0.502	0.518	0.543	0.477	0.471	0.500	0.477	0.462	0.411
5	0.610	0.603	0.611	0.666	0.568	0.576	0.616	0.593	0.563	0.490
6	0.710	0.702	0.705	0.785	0.660	0.672	0.732	0.704	0.667	0.584
7	0.809	0.800	0.800	0.900	0.749	0.762	0.848	0.812	0.775	0.693
8	0.908	0.897	0.897	1.013	0.839	0.845	0.964	0.914	0.887	0.816
9	1.005	0.994	0.995	1.121	0.927	0.920	1.080	1.014	1.003	0.953
+gp	1.403	1.320	1.403	1.485	1.298	1.119	1.556	1.369	1.507	1.417

Table 3.2.5 Plaice VIIe Catch Weights at Age continued

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	0.143	0.168	0.248	0.206	0.250	0.214	0.218	0.226	0.184	0.209
2	0.229	0.234	0.280	0.261	0.291	0.271	0.280	0.296	0.283	0.288
3	0.323	0.308	0.323	0.326	0.346	0.335	0.349	0.374	0.383	0.371
4	0.426	0.388	0.377	0.401	0.414	0.408	0.423	0.454	0.484	0.458
5	0.538	0.475	0.442	0.485	0.497	0.488	0.503	0.537	0.586	0.549
6	0.660	0.570	0.518	0.580	0.593	0.576	0.588	0.623	0.688	0.645
7	0.790	0.671	0.606	0.684	0.703	0.672	0.680	0.714	0.790	0.744
8	0.929	0.780	0.704	0.798	0.826	0.775	0.777	0.808	0.893	0.848
9	1.077	0.896	0.814	0.921	0.964	0.887	0.880	0.906	0.997	0.956
+gp	1.448	1.211	1.132	1.299	1.361	1.211	1.210	1.117	1.244	1.235

Table 3.2.5 Plaice VIIe Catch Weights at Age continued

Age	1998	1999	2000	2001	2002	2003	2004	2005	2006	mean 04-06
1	0.194	0.121	0.132	0.173	0.206	0.156	0.263	0.235	0.212	0.218
2	0.259	0.221	0.231	0.239	0.262	0.265	0.303	0.299	0.285	0.289
3	0.318	0.318	0.328	0.316	0.326	0.373	0.354	0.369	0.364	0.365
4	0.445	0.411	0.424	0.398	0.396	0.477	0.414	0.444	0.448	0.445
5	0.569	0.501	0.519	0.485	0.475	0.580	0.484	0.525	0.538	0.530
6	0.690	0.588	0.613	0.578	0.560	0.679	0.564	0.611	0.633	0.618
7	0.808	0.672	0.706	0.677	0.652	0.777	0.654	0.702	0.734	0.711
8	0.923	0.752	0.797	0.781	0.752	0.871	0.753	0.798	0.841	0.807
9	1.036	0.829	0.887	0.892	0.859	0.964	0.862	0.900	0.953	0.909
+gp	1.378	1.072	1.164	1.318	1.212	1.304	1.230	1.153	1.203	1.229

Table 3.2.6 Plaice VIIe Stock Weights at Age

Age	1976	1977
1	0.109	0.116
2	0.215	0.230
3	0.320	0.342
4	0.422	0.452
5	0.524	0.560
6	0.622	0.666
7	0.719	0.770
8	0.814	0.872
9	0.908	0.972
+gp	1.241	1.322

Table 3.2.6 Plaice VIIe Stock Weights at Age continued

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	0.115	0.114	0.114	0.126	0.108	0.116	0.111	0.112	0.096	0.068
2	0.228	0.226	0.227	0.250	0.214	0.228	0.222	0.222	0.195	0.145
3	0.339	0.335	0.338	0.373	0.318	0.335	0.334	0.331	0.297	0.232
4	0.448	0.443	0.447	0.492	0.419	0.436	0.446	0.438	0.401	0.326
5	0.556	0.549	0.554	0.609	0.517	0.532	0.560	0.543	0.507	0.429
6	0.660	0.653	0.660	0.725	0.615	0.623	0.673	0.647	0.615	0.539
7	0.763	0.755	0.764	0.838	0.710	0.710	0.788	0.749	0.727	0.659
8	0.864	0.854	0.867	0.949	0.802	0.791	0.903	0.849	0.840	0.788
9	0.963	0.953	0.967	1.057	0.893	0.867	1.018	0.948	0.955	0.924
+gp	1.355	1.275	1.351	1.435	1.255	1.094	1.498	1.329	1.442	1.347

Table 3.2.6 Plaice VIIe Stock Weights at Age continued

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	0.103	0.138	0.236	0.182	0.235	0.188	0.188	0.191	0.134	0.171
2	0.184	0.200	0.262	0.232	0.269	0.241	0.248	0.262	0.233	0.248
3	0.275	0.270	0.300	0.292	0.317	0.302	0.314	0.336	0.333	0.329
4	0.373	0.347	0.349	0.362	0.378	0.371	0.385	0.413	0.434	0.414
5	0.481	0.431	0.408	0.442	0.454	0.447	0.462	0.495	0.535	0.503
6	0.598	0.522	0.479	0.531	0.543	0.531	0.545	0.580	0.637	0.596
7	0.723	0.620	0.561	0.631	0.646	0.623	0.633	0.668	0.739	0.694
8	0.858	0.725	0.654	0.740	0.763	0.723	0.728	0.760	0.842	0.795
9	1.002	0.837	0.758	0.858	0.893	0.830	0.828	0.856	0.945	0.901
+gp	1.383	1.143	1.064	1.223	1.274	1.145	1.150	1.064	1.191	1.176

Table 3.2.6 Plaice VIIe Stock Weights at Age continued

Age	1998	1999	2000	2001	2002	2003	2004	2005	2006	mean 04-06
1	0.169	0.069	0.082	0.139	0.180	0.100	0.246	0.205	0.177	0.184
2	0.225	0.171	0.181	0.204	0.233	0.211	0.282	0.266	0.248	0.253
3	0.254	0.270	0.279	0.277	0.293	0.319	0.327	0.334	0.324	0.327
4	0.382	0.365	0.376	0.356	0.360	0.425	0.383	0.406	0.405	0.405
5	0.507	0.457	0.472	0.441	0.435	0.529	0.448	0.484	0.492	0.487
6	0.629	0.545	0.567	0.531	0.516	0.630	0.523	0.567	0.585	0.573
7	0.749	0.631	0.660	0.627	0.605	0.728	0.608	0.656	0.683	0.664
8	0.866	0.712	0.752	0.729	0.701	0.824	0.702	0.749	0.787	0.758
9	0.980	0.791	0.842	0.836	0.805	0.918	0.807	0.849	0.896	0.858
+gp	1.326	1.040	1.122	1.253	1.148	1.263	1.160	1.095	1.140	1.173

Table 3.2.7 Plaice VIIE available tuning data

105	IDH													
UK-WEC-BTS														
1988	2006													
1	1	0.75	0.8											
1	8													
147.68	91	128	249	95	35	4	18	2	0					
134.34	536	148	140	73	37	29	14	8	8					
128.23	139	371	340	97	22	11	10	4	6					
165.66	31	70	281	188	23	11	14	8	6					
175.66	25	38	220	87	75	2	6	1	6					
171.68	22	27	63	79	62	41	9	0	1					
196.6	152	44	72	24	40	20	17	3	5					
189.19	21	70	60	24	13	25	13	11	2					
205.87	34	32	98	30	10	2	9	13	8					
187.15	50	46	45	48	12	4	5	6	1					
184.37	33	106	30	17	25	5	13	7	0					
184.74	53	122	197	24	6	12	7	1	1					
185.49	81	125	125	85	9	6	7	4	0					
187.89	38	40	185	50	29	3	2	6	5					
180.37	48	63	125	179	38	22	1	2	5					
177.98	32	64	51	111	97	25	13	0	3					
179.74	138	102	87	23	23	40	5	2	0					
182	29	137	60	50	5	18	27	7	0					
164	11	33	59	23	10	3	1	10	0					
187	30	75	91	70	13	3	3	5	2					
187.74	55	102	103	30	31	3	4	0	5					
UK(E+W)Otter trawl														
1984	2006													
1	1	0	1											
1	14													
52.686	17.8	160.7	293.4	96.9	81.4	28.4	12.4	3.4	5.6	0.9	0.9	0.6	0.4	0.5
57.685	0.6	125.4	258.1	193.8	23.1	32.2	14.6	2.2	0.5	1.6	0.3	1	0.4	0.3
49.521	1.9	190.6	427.3	130.1	50.2	9.4	15.3	7.3	4.2	1.1	1.1	0.3	0.9	0.4
45.112	11.2	194.3	381.1	222.7	99.7	25.3	6	2.7	4.7	2.5	0.4	0.5	0	0.1
53.402	2.4	391.7	754.5	116.9	51.5	15.1	10	3.4	1.9	3.2	0.2	0.2	0.2	0.6
54.707	2.3	43.3	494	359.7	77	26.5	7	5.9	0.8	3.9	1.2	0.4	0.1	0.4
53.05	5.1	21.8	347.1	265.9	85.3	18.4	11.3	6	2.8	1.7	1.4	0.4	0.1	0.1
40.789	2.2	28.1	89.5	134.9	64.8	30.3	6.3	2.7	1.9	1.5	0.4	0.8	0.3	0.1
39.909	1.6	26	71.7	46.3	40.1	25.5	12.9	3.9	1.3	1.4	1.1	0.5	0.2	0.1
39.24	1.9	39.7	76.1	33.1	12	12.2	9.8	7.7	1.7	1.3	1.4	0.5	0.1	0.2
38.768	1.1	22.7	86.1	37.1	9.8	3.5	4.4	2.4	2.7	0.4	0.1	0.5	0.2	0
35.453	0.6	27.9	47.8	48.8	10.8	5.7	1.3	2.7	2.2	1.3	0.4	0.2	0.3	0.1
30.541	2	87.5	39.8	16.3	14.5	4	2	1	1.2	1.5	0.9	0.3	0.1	0.1
33.281	0.4	75.4	180.1	14.6	5.5	4.3	1.6	0.6	0.3	0.6	0.6	0.4	0.4	0.1
29.802	0	47.8	96.2	61.3	6.4	2.4	1.6	0.4	0.5	0.1	0.4	0.3	0.2	0
27.516	0.8	31.3	90.1	34.6	14.3	2.8	1.1	0.9	0.3	0.2	0.1	0.2	0.1	0.1
30.493	1.6	17.1	49.6	64.4	13.3	6.5	1.3	0.5	0.8	0.4	0.5	0.2	0.3	0.1
31.9	0	29.2	31.3	29.3	31.5	4.4	2.6	0.5	0.3	0.4	0.2	0	0.1	0.2
28.346	4.8	51.9	57.1	17.9	12.6	15.6	3.3	1.4	0.5	0.3	0.3	0.1	0	0
25.06	0.7	32.6	33.2	15.8	5.1	3.5	4.3	1.2	0.6	0.1	0.1	0.1	0	0
25.584	0.9	17.9	50.7	18.2	10.5	2.8	1.4	2.1	1.1	0.4	0.1	0.1	0	0
21.129	0.7	24.6	24.1	17.6	5.7	2.6	0.8	0.8	0.8	0.3	0.2	0	0	0
21.058	0.4	24.8	32.4	9.9	6.5	1.9	1	0.4	0.3	0.4	0.1	0	0	0

Table 3.2.7 Plaice VIIE available tuning data continued

UK(E+W)Beam trawl

1984	2006													
1	1	0	1											
1	14													
87.631	24.2	337	511.1	149.1	129.7	57.7	24.9	7.6	10.3	2.5	2.5	1.4	1.8	1.6
92.188	3.2	218.2	460.8	359.8	45.2	65.1	45.9	7.5	1.6	5.2	1	1.8	1.6	0.7
76.331	2.7	241.1	656	228.3	116.8	24	39.2	19.6	10.6	3.4	4.7	0.8	2.9	2.6
87.049	27.2	307.6	492.6	305.1	175.8	82	22.1	19.8	15.1	9.6	3.5	2.8	0.9	0.7
103.36	2	228.9	825.2	197	117.7	33.9	25.7	10.1	5.8	9.4	1.1	0.8	0.7	1.8
109.947	2.7	94.5	**922.6**	**784.7**	**210.1**	**96.9**	**48.9**	**35.2**	**7.5**	16.3	10.1	2.5	1.3	2.5
100.947	17.6	104.4	**1053.9**	**826.9**	**326.5**	**77.2**	**54.4**	**23.5**	**13.1**	12	7	2.7	0.8	0.8
83.574	11.2	157.5	**365.7**	**641.3**	**355.6**	**159.9**	**35.7**	**11.3**	**8.1**	4.1	2.1	3.8	1.1	0.9
80.865	17.9	146.7	**465.5**	**308**	**293.7**	**172**	**89.2**	**25.9**	**9.7**	4.8	5.5	2.2	1.3	0.3
83.918	16.5	317.4	**543.6**	**248.2**	**102.7**	**114.7**	**89.6**	**66.6**	**14.3**	11.8	7.2	6.1	0.9	1.9
100.415	65	161.3	**659**	**312.7**	**104.4**	**43.1**	**53.3**	**34.7**	**38**	9.8	3.6	3.7	3.5	1
100.797	2.9	124.1	**285.7**	**343.6**	**101.6**	**51.4**	**18.9**	**34.3**	**33.5**	23.8	7.6	2.8	3.7	2.8
116.446	4	400.1	**221.8**	**115**	**126.4**	**41.1**	**21.5**	**12.6**	**19.2**	16.8	10.9	6.2	2.3	1.6
108.388	4.4	329.6	**683.6**	**76.7**	**43.9**	**46.9**	**20.7**	**9.6**	**5.4**	12.4	14	10.4	4.9	1.5
111.171	0	153	**413.3**	**297.9**	**48.6**	**26.1**	**26.7**	**8.8**	**8.8**	2.6	6.2	8.6	4.7	0.7
103.555	10.8	296.5	**747.8**	**274.5**	**135.3**	**40**	**14.4**	**16**	**8**	3	2.1	4.3	3.7	3.3
118.833	29	158.3	**388.4**	**529.8**	**111.8**	**54.7**	**11**	**5.4**	**6.8**	5	3.6	2	2.6	1.3
143.272	0	165.6	**248.7**	**283.6**	**393.2**	**61**	**35**	**7.4**	**4**	3.5	3.2	0.4	1.4	1.2
139.832	133	471	**497.3**	**164.6**	**148.5**	**197.6**	**46.8**	**19.2**	**4.5**	4.4	7.3	2	0.4	1
159.894	15.6	489.2	**495.5**	**260.2**	**95**	**81.9**	**116.1**	**26.8**	**22.9**	2.7	2	5.8	0.7	0.8
158.681	12.4	256.3	**690**	**299.6**	**168.3**	**49.9**	**40.1**	**51.6**	**24.9**	9.7	2.4	1.3	1.7	1.3
157.812	13.5	470.4	**464.1**	**355.3**	**136.4**	**71.6**	**24.9**	**23**	**27.3**	9.4	7.1	1.9	0.9	0.8
161.745	10.7	501.4	**598.8**	**202**	**159.3**	**52.5**	**27.5**	**11.2**	**8.3**	13.1	3.6	2	0.7	1.1

UK otter historic

1976	1987							
1	1	0	1					
2	9							
22.771	**13.7**	**80.4**	**20.2**	**14.2**	**7.5**	**7.7**	**4.8**	**1.8**
21.194	**60.1**	**29.4**	**25.8**	**8.1**	**4.8**	**3**	**4.5**	**1.4**
16.823	**18.8**	**71.1**	**8**	**10.6**	**3.8**	**2.3**	**2**	**1.6**
16.981	**42.5**	**57.1**	**44.5**	**5.7**	**6.1**	**2.9**	**1.9**	**1.2**
13.647	**53.1**	**50.8**	**14.7**	**13.4**	**4**	**4.2**	**1.4**	**1**
15.172	**76.6**	**216.2**	**44.4**	**11**	**10.3**	**1.8**	**5**	**1.6**
14.422	**27**	**169.1**	**111.9**	**19.5**	**7.1**	**7.3**	**1.1**	**2.6**
19.117	**103.7**	**102.2**	**173.4**	**75.3**	**12.4**	**4.8**	**5.5**	**0.3**
15.8	**100.5**	**155**	**49.7**	**40.6**	**16.3**	**7.7**	**2.2**	**3.2**
17.545	**60.5**	**129.6**	**102.4**	**12.9**	**21.2**	**13.4**	**2.1**	**0.4**
20.758	**108.3**	**254.8**	**77.8**	**44.1**	**8.2**	**12.9**	**7.4**	**3.3**
17.995	**116.3**	**208.7**	**124.7**	**62.2**	**22**	**5.6**	**4.2**	**4.1**

UK (E+W) FSP

2003	2006								
1	1	0.75	0.8						
1	9								
1	0.029	**0.406**	**0.331**	**0.16**	**0.059**	**0.039**	**0.059**	**0.015**	**0.011**
1	0.01	**0.33**	**0.59**	**0.227**	**0.134**	**0.023**	**0.035**	**0.047**	**0.019**
1	0.015	**0.315**	**0.38**	**0.243**	**0.087**	**0.042**	**0.01**	**0.016**	**0.033**
1	0.033	**0.528**	**0.4**	**0.179**	**0.103**	**0.039**	**0.024**	**0.006**	**0.009**

Text in bold indicate values used by the 2007 WG

Table 3.2.8 Plaice VIIe XSA detailed survivor diagnostics

FLR XSA Diagnostics 2007-07-04 19:22:08

CPUE data from index.final
Catch data for 31 years. 1976 to 2006. Ages 1 to 10.

fleet	first age	last age	first year	last year	alpha	beta
UK-WEC-BTS	1	8	1986	2006	0.75	0.8
UK WECOT	3	9	1988	2006	0	1
UK WECBT	3	9	1989	2006	0	1
UK WECOT historic	2	9	1976	1987	0	1
UK (E+W) FSP	2	9	2003	2006	0.75	0.8

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 = 2.5

Regression weights
Year

1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	1	1	1	1	1	1	1	1	1

Estimated population abundance at 1st Jan 2007
Age

1	2	3	4	5	6	7	8	9	10
0	3793	3009	895	342	273	79	51	15	18

Table 3.2.8 Plaice VIIe XSA detailed survivor diagnostics for UK-WEC-BTS

Fleet q-residuals

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	-0.330	1.669	0.701	-0.139	-0.512	-0.708	0.988	-0.159	0.303	-0.427	-0.554	-0.562	0.516	0.289	0.131	-0.328	0.918	0.084	-1.298	-0.665	0.083
2	0.320	-0.216	0.963	-0.753	-0.441	-0.805	-0.520	-0.142	-0.204	0.333	-0.038	0.388	-0.186	-0.487	0.442	0.016	0.541	0.671	-0.265	0.170	0.214
3	0.591	0.170	0.301	-0.025	0.005	-0.247	-0.208	-0.397	-0.205	0.003	-0.353	0.352	0.047	-0.334	0.191	-0.138	-0.026	0.052	-0.481	0.345	0.356
4	0.394	0.236	0.403	0.167	-0.490	-0.172	-0.494	-0.450	-0.283	-0.004	-0.187	-0.004	0.296	-0.150	0.241	0.737	-0.300	0.112	-0.410	0.304	0.054
5	0.181	0.560	-0.073	-0.316	0.068	0.108	-0.024	-0.024	-0.515	-0.133	0.349	-0.403	-0.228	0.142	0.377	0.494	0.039	-0.545	-0.484	-0.064	0.490
6	-0.404	0.916	0.192	-0.073	-1.855	0.333	-0.230	0.491	-1.030	-0.353	-0.030	0.487	0.479	-0.342	0.767	0.744	0.557	0.779	-0.351	-0.705	-0.372
7	0.871	1.230	0.107	0.494	-0.228	-0.023	-0.382	-0.175	-0.297	0.323	-1.261	0.716	0.249	-0.173	-0.988	0.616	-0.542	0.822	-1.599	0.094	0.146
8	-0.931	0.637	0.557	0.216	-1.542	NA	-0.706	-0.154	0.226	-0.022	0.516	-0.721	0.668	0.682	0.446	NA	-0.706	0.580	0.427	0.713	NA

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

	Age1	Age2	Age3	Age4	Age5	Age6	Age7	Age8
Mean Logq	-9.5792	-8.9185	-7.9675	-7.9243	-8.0909	-8.3385	-8.0973	-8.0973
S.E.Logq	0.6901	0.471	0.2892	0.3398	0.337	0.6884	0.7091	0.6842

Table 3.2.8 Plaice VIIe XSA detailed survivor diagnostics for UK WECOT

Fleet q-residuals

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
3	0.548	0.270	0.212	0.106	-0.084	-0.059	-0.102	0.254	0.274	0.504	0.200	-0.481	-0.352	-0.316	-0.030	-0.348	-0.213	-0.257	-0.125
4	0.112	0.500	0.363	0.334	0.275	-0.013	0.110	0.210	0.135	-0.144	0.355	-0.065	-0.375	-0.281	-0.102	-0.521	-0.230	-0.330	-0.332
5	0.323	0.585	0.042	0.233	0.197	0.061	-0.215	0.052	0.214	-0.104	-0.062	-0.034	-0.226	-0.267	-0.076	-0.317	0.011	-0.129	-0.289
6	0.068	0.507	0.173	0.110	0.217	-0.047	-0.186	0.249	0.144	-0.184	0.010	0.079	-0.051	-0.607	0.058	-0.308	0.010	-0.124	-0.117
7	0.117	-0.014	0.624	0.161	0.033	0.159	-0.244	-0.273	0.275	0.017	-0.304	0.186	0.123	-0.198	-0.035	-0.186	-0.348	-0.049	-0.043
8	0.368	0.082	0.495	0.090	0.239	0.120	-0.664	-0.083	0.249	-0.411	-0.693	-0.226	-0.068	-0.238	-0.124	-0.333	-0.222	0.038	0.143
9	-0.369	-0.439	0.005	0.224	-0.117	-0.004	-0.312	-0.130	-0.141	-0.391	0.174	-0.298	0.175	0.077	0.624	-0.081	0.309	-0.304	-0.138

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

	Age3	Age4	Age5	Age6	Age7	Age8	Age9
Mean Logq	-6.7536	-6.7386	-6.9498	-7.1516	-7.3519	-7.3519	-7.3519
S.E Logq	0.2971	0.2964	0.2339	0.2368	0.2367	0.321	0.2758

Table 3.2.8 Plaice VIIe XSA detailed survivor diagnostics for UK WECBT

Fleet q-residuals

Age	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
3	-0.442	0.041	0.158	0.442	0.508	0.343	0.358	0.015	0.018	-0.297	-0.329	-0.293	-0.384	-0.100	-0.137	-0.066	0.051	0.114
4	-0.194	0.078	0.400	0.687	0.465	0.514	0.340	-0.026	-0.442	-0.157	-0.096	-0.404	-0.289	-0.258	-0.349	-0.030	-0.112	-0.131
5	-0.071	-0.221	0.257	0.520	0.486	0.238	0.287	0.079	-0.169	-0.313	-0.074	-0.419	-0.207	-0.167	-0.208	-0.002	0.074	-0.091
6	-0.009	-0.150	-0.057	0.305	0.320	0.259	0.290	0.021	-0.089	-0.034	0.299	-0.395	-0.594	-0.112	-0.122	-0.049	0.067	0.050
7	-0.029	0.292	-0.083	0.000	0.351	0.038	0.098	0.051	0.135	-0.066	0.172	-0.363	-0.381	-0.240	-0.004	-0.079	0.117	-0.028
8	-0.091	-0.044	-0.456	0.165	0.257	-0.205	0.153	0.183	-0.080	-0.179	0.066	-0.309	-0.306	-0.363	-0.341	-0.106	0.125	0.176
9	-0.160	-0.356	-0.304	-0.074	0.105	0.120	0.287	0.032	0.058	0.464	0.399	-0.306	-0.096	-0.036	0.447	0.342	-0.045	-0.117

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

	Age3	Age4	Age5	Age6	Age7	Age8	Age9
Mean Logq	-6.115	-5.9624	-5.988	-6.0379	-6.0911	-6.0911	-6.0911
S.E Logq	0.287	0.3401	0.2664	0.2446	0.1913	0.2231	0.2592

Table 3.2.8 Plaice VIIe XSA detailed survivor diagnostics for UK WECOT historic

Fleet q-residuals

Age	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
2	-0.168	0.104	-0.225	0.201	-0.231	0.098	0.017	0.278	0.551	-0.340	0.126	-0.412
3	-0.083	-0.145	-0.311	0.148	-0.217	0.215	0.079	0.212	0.004	-0.126	0.104	0.119
4	-0.314	-0.547	-0.569	-0.106	-0.198	0.171	0.314	0.566	0.419	0.156	-0.214	0.322
5	-0.003	-0.476	-0.543	-0.205	-0.293	0.158	0.174	0.563	0.231	-0.184	-0.012	0.590
6	-0.037	-0.322	-0.382	-0.531	0.523	-0.061	0.523	0.114	-0.018	0.238	-0.193	0.147
7	-0.101	-0.437	-0.394	-0.218	-0.304	0.333	0.041	0.482	0.309	0.153	0.140	-0.004
8	0.294	0.061	-0.029	-0.022	-0.181	0.305	0.602	-0.027	0.655	-0.580	0.001	-0.290
9	0.003	-0.169	-0.025	0.163	0.240	0.442	0.320	-0.367	0.134	-0.499	0.207	0.144

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

	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9
Mean Logq	-7.0146	-5.7235	-5.7254	-5.8823	-6.0074	-5.9319	-5.9319	-5.9319
S.E Logq	0.2822	0.1737	0.3777	0.3641	0.332	0.2984	0.3539	0.2774

Table 3.2.8 Plaice VIIe XSA detailed survivor diagnostics for UK (E+W) FSP

Fleet q-residuals

Age	2003	2004	2005	2006
2	-0.131	0.160	-0.144	0.115
3	-0.271	0.054	0.136	0.081
4	-0.409	0.172	-0.030	0.267
5	-0.268	0.233	0.088	-0.053
6	-0.294	-0.242	0.135	0.401
7	-0.222	0.211	-0.318	0.328
8	-0.512	0.230	0.260	0.102
9	0.285	0.606	0.589	0.423

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

	Age2	Age3	Age4	Age5	Age6	Age7	Age8	Age9
Mean Logq	-8.8487	-8.0077	-8.024	-8.02	-8.2185	-8.1606	-8.1606	-8.1606
S.E Logq	0.1598	0.1836	0.2993	0.2131	0.3286	0.3177	0.3612	0.1515

Table 3.2.8 Plaice VIIe XSA detailed survivor diagnostics continued

Year Class 2005 at terminal Age 1

Source	1
fsbk	1355
	0.1600
UK-WEC-BTS	4120
	1.9956
UK (E+W) FSP	1
	0.0000
UK WECBT	1
	0.0000
UK WECOT	1
	0.0000

Source	Survivors	int s.e.	ext s.e.	Var Ratio	N	Scaled W	F est.
fsbk	1355	2.500	NA	NA	1	0.074	0.012
UK-WEC-BTS	4120	0.706	NA	0.000	1	0.926	0.004
UK (E+W) FSP	NaN	NA	NA	NA	0	NA	0.000
UK WECBT	NaN	NA	NA	NA	0	NA	0.000
UK WECOT	NaN	NA	NA	NA	0	NA	0.000

term. Surv.	int s.e.	ext s.e.	N	Var. Ratio	F
3793	0.68	0.30	2	0.446	0.004

Table 3.2.8 Plaice VIIe XSA detailed survivor diagnostics continued

Year Class 2004 at terminal Age 2

Source	1	2
fshk	1	3186
	0.0000	0.1600
UK-WEC-BTS	1547	3726
	1.5393	3.0867
UK (E+W) FSP	1	3377
	0.0000	3.0867
UK WECBT	1	1
	0.0000	0.0000
UK WECOT	1	1
	0.0000	0.0000

Source	Survivors	int s.e.	ext s.e.	Var Ratio	N	Scaled W	F est.
fshk	3186	2.500	NA	NA	1	0.020	0.246
UK-WEC-BTS	2781	0.408	0.414	1.01	2	0.588	0.277
UK (E+W) FSP	3377	0.500	0.000	0.000	1	0.392	0.233
UK WECBT	NaN	0.000	NA	NA	0	NA	0.000
UK WECOT	NaN	0.000	NA	NA	0	NA	0.000

term. Surv.	int s.e.	ext s.e.	N	Var. Ratio	F
3009	0.310	0.190	4	0.609	0.258

Table 3.2.8 Plaice VIIe XSA detailed survivor diagnostics continued

Year Class 2004 at terminal Age 2

Source

	1	2
fshk	1	3186
	0.0000	0.1600
UK-WEC-BTS	1547	3726
	1.5393	3.0867
UK (E+W) FSP	1	3377
	0.0000	3.0867
UK WECBT	1	1
	0.0000	0.0000
UK WECOT	1	1
	0.0000	0.0000

Source	Survivors	int s.e.	ext s.e.	Var Ratio	N	Scaled W	F est.
fshk	3186	2.500	NA	NA	1	0.020	0.246
UK-WEC-BTS	2781	0.408	0.414	1.01	2	0.588	0.277
UK (E+W) FSP	3377	0.500	0.000	0.000	1	0.392	0.233
UK WECBT	NaN	0.000	NA	NA	0	NA	0.000
UK WECOT	NaN	0.000	NA	NA	0	NA	0.000

term. Surv.	int s.e.	ext s.e.	N	Var. Ratio	F
3009	0.310	0.190	4	0.609	0.258

Table 3.2.8 Plaice VIIe XSA detailed survivor diagnostics continued

Year Class 2003 at terminal Age 3

Source	1	2	3
fshk	1	1	1427
	0.0000	0.0000	0.1600
UK-WEC-BTS	244	1060	1278
	0.6569	1.3184	1.7427
UK (E+W) FSP	1	775	970
	0.0000	1.3184	1.7427
UK WECBT	1	1	1003
	0.0000	0.0000	1.7427
UK WECOT	1	1	790
	0.0000	0.0000	1.7427

Source	Survivors	int s.e.	ext s.e.	Var Ratio	N	Scaled W	F est.
fshk	1427	2.500	NA	NA	1	0.015	0.592
UK-WEC-BTS	893	0.319	0.428	1.340	3	0.357	0.827
UK (E+W) FSP	881	0.357	0.111	0.310	2	0.294	0.835
UK WECBT	1003	0.500	0.000	0.000	1	0.167	0.764
UK WECOT	790	0.500	0.000	0.000	1	0.167	0.898

term. Surv.	int s.e.	ext s.e.	N	Var. Ratio	F
895	0.200	0.140	8	0.720	0.826

Table 3.2.8 Plaice VIIe XSA detailed survivor diagnostics continued

Year Class 2002 at terminal Age 4

Source

	1	2	3	4
fshk	1	1	1	460
	0.0000	0.0000	0.0000	0.1600
UK-WEC-BTS	372	262	483	361
	0.3843	0.7734	0.9569	1.8439
UK (E+W) FSP	1	401	392	447
	0.0000	0.7734	0.9569	1.8439
UK WECBT	1	1	360	300
	0.0000	0.0000	0.9569	1.8439
UK WECOT	1	1	265	246
	0.0000	0.0000	0.9569	1.8439

Source	Survivors	int s.e.	ext s.e.	Var Ratio	N	Scaled W	F est.
fshk	460	2.500	NA	NA	1	0.012	0.623
UK-WEC-BTS	365	0.288	0.116	0.400	4	0.298	0.736
UK (E+W) FSP	422	0.310	0.043	0.140	3	0.269	0.664
UK WECBT	319	0.371	0.086	0.230	2	0.211	0.807
UK WECOT	252	0.371	0.035	0.100	2	0.211	0.945

term. Surv.	int s.e.	ext s.e.	N	Var. Ratio	F
342	0.170	0.070	12	0.406	0.770

Table 3.2.8 Plaice VIIe XSA detailed survivor diagnostics continued

Year Class 2001 at terminal Age 5

Source

	1	2	3	4	5
fshk	1	1	1	1	312
	0.0000	0.0000	0.0000	0.0000	0.1600
UK-WEC-BTS	683	534	169	370	445
	0.1982	0.4120	0.5263	0.9746	1.9255
UK (E+W) FSP	1	239	288	265	269
	0.0000	0.4120	0.5263	0.9746	1.9255
UK WECBT	1	1	255	244	249
	0.0000	0.0000	0.5263	0.9746	1.9255
UK WECOT	1	1	220	196	204
	0.0000	0.0000	0.5263	0.9746	1.9255

Source	Survivors	int s.e.	ext s.e.	Var Ratio	N	Scaled W	F est.
fshk	312	2.500	NA	NA	1	0.011	0.660
UK-WEC-BTS	390	0.282	0.178	0.630	5	0.271	0.559
UK (E+W) FSP	262	0.294	0.027	0.090	4	0.258	0.748
UK WECBT	248	0.324	0.011	0.030	3	0.230	0.776
UK WECOT	204	0.324	0.026	0.080	3	0.230	0.886

term. Surv.	int s.e.	ext s.e.	N	Var. Ratio	F
273	0.150	0.080	16	0.511 Ratio	0.727

Table 3.2.8 Plaice VIIe XSA detailed survivor diagnostics continued

Year Class 2000 at terminal Age 6

Source	1	2	3	4	5	6
fshk	1	1	1	1	1	118
	0.0000	0.0000	0.0000	0.0000	0.0000	0.1600
UK-WEC-BTS	57	135	83	52	74	54
	0.0817	0.1634	0.2285	0.4045	0.8275	0.9012
UK (E+W) FSP	1	1	60	93	86	117
	0.0000	0.0000	0.2285	0.4045	0.8275	1.7898
UK WECBT	1	1	69	76	85	83
	0.0000	0.0000	0.2285	0.4045	0.8275	1.7898
UK WECOT	1	1	56	63	69	70
	0.0000	0.0000	0.2285	0.4045	0.8275	1.7898

Source	Survivors	int s.e.	ext s.e.	Var Ratio	N	Scaled W	F est.
fshk	118	2.500	NA	NA	1	0.013	0.597
UK-WEC-BTS	65	0.307	0.112	0.370	6	0.208	0.904
UK (E+W) FSP	101	0.312	0.114	0.370	4	0.260	0.673
UK WECBT	81	0.312	0.032	0.100	4	0.260	0.782
UK WECOT	68	0.312	0.038	0.120	4	0.260	0.885

term. Surv.	int s.e.	ext s.e.	N	Var. Ratio	F
79	0.160	0.060	19	0.355	0.800

Table 3.2.8 Plaice VIIe XSA detailed survivor diagnostics continued

Year Class 1999 at terminal Age 7

Source	1	2	3	4	5	6	7
fshk	1	1	1	1	1	1	65
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1600
UK-WEC-BTS	58	51	49	57	31	25	59
	0.0627	0.1268	0.1484	0.2676	0.4571	0.4879	0.9663
UK (E+W) FSP	1	1	1	34	64	58	70
	0.0000	0.0000	0.0000	0.2676	0.4571	0.9690	2.0361
UK WECBT	1	1	46	36	50	54	49
	0.0000	0.0000	0.1484	0.2676	0.4571	0.9690	2.0361
UK WECOT	1	1	49	30	51	45	48
	0.0000	0.0000	0.1484	0.2676	0.4571	0.9690	2.0361

Source	Survivors	int s.e.	ext s.e.	Var Ratio	N	Scaled W	F est.
fshk	65	2.500	NA	NA	1	0.011	0.560
UK-WEC-BTS	43	0.330	0.114	0.400	7	0.178	0.750
UK (E+W) FSP	63	0.311	0.110	0.360	4	0.263	0.573
UK WECBT	49	0.299	0.049	0.160	5	0.274	0.684
UK WECOT	46	0.299	0.062	0.210	5	0.274	0.716

term. Surv.	int s.e.	ext s.e.	N	Var. Ratio	F
51	0.160	0.050	22	0.337	0.672

Table 3.2.8 Plaice VIIe XSA detailed survivor diagnostics continued

Year Class 1998 at terminal Age 8

Source	1	2	3	4	5	6	7	8
fshk	1	1	1	1	1	1	1	27
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1600
UK-WEC-BTS	20	24	13	11	9	11	17	1
	0.0331	0.0665	0.0802	0.1356	0.2423	0.2209	0.4051	0.0000
UK (E+W) FSP	1	1	1	1	12	12	11	17
	0.0000	0.0000	0.0000	0.0000	0.2423	0.4388	0.8537	1.7250
UK WECBT	1	1	10	12	12	15	17	18
	0.0000	0.0000	0.0802	0.1356	0.2423	0.4388	0.8537	1.7250
UK WECOT	1	1	11	14	11	15	15	18
	0.0000	0.0000	0.0802	0.1356	0.2423	0.4388	0.8537	1.7250

Source	Survivors	int s.e.	ext s.e.	Var Ratio	N	Scaled W	F est.
fshk	27	2.500	NA	NA	1	0.014	0.550
UK-WEC-BTS	13	0.308	0.121	0.390	7	0.102	0.927
UK (E+W) FSP	14	0.305	0.113	0.370	4	0.282	0.883
UK WECBT	16	0.287	0.066	0.230	6	0.301	0.794
UK WECOT	16	0.287	0.063	0.220	6	0.301	0.821

term. Surv.	int s.e.	ext s.e.	N	Var. Ratio	F
15	0.160	0.040	24	0.278	0.836

Table 3.2.8 Plaice VIIe XSA detailed survivor diagnostics continued

Year Class 1997 at terminal Age 9

Source	1	2	3	4	5	6	7	8	9
fshk	1	1	1	1	1	1	1	1	12
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1600
UK-WEC-BTS	30	11	21	37	18	38	4	36	1
	0.0251	0.0502	0.0618	0.1005	0.1834	0.1680	0.2913	0.5274	0.0000
UK (E+W) FSP	1	1	1	1	1	13	22	23	27
	0.0000	0.0000	0.0000	0.0000	0.0000	0.3336	0.6138	1.0483	1.3839
UK WECBT	1	1	13	13	15	16	16	20	16
	0.0000	0.0000	0.0618	0.1005	0.1834	0.3336	0.6138	1.0483	2.2478
UK WECOT	1	1	12	13	16	13	12	18	15
	0.0000	0.0000	0.0618	0.1005	0.1834	0.3336	0.6138	1.0483	2.2478

Source	Survivors	int s.e.	ext s.e.	Var Ratio	N	Scaled W	F est.
fshk	12	2.500	NA	NA	1	0.011	0.763
UK-WEC-BTS	19	0.325	0.346	1.060	8	0.100	0.537
UK (E+W) FSP	23	0.321	0.118	0.370	4	0.239	0.467
UK WECBT	17	0.282	0.045	0.160	7	0.325	0.602
UK WECOT	15	0.282	0.052	0.190	7	0.325	0.638

term. Surv.	int s.e.	ext s.e.	N	Var. Ratio	F
18	0.160	0.070	27	0.451	0.574

Table 3.2.9 Plaice VIIe Fishing Mortality at Age

Age	1976	1977
1	0.007	0.003
2	0.134	0.219
3	0.531	0.624
4	0.421	0.414
5	0.493	0.382
6	0.419	0.395
7	0.420	0.377
8	0.629	0.615
9	0.474	0.512
+gp	0.474	0.512
F_{bar3-7}	0.400	0.405

Table 3.2.9 Plaice VIIe Fishing Mortality at Age continued

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	0.016	0.003	0.003	0.017	0.013	0.001	0.012	0.000	0.001	0.007
2	0.156	0.229	0.136	0.129	0.134	0.155	0.226	0.106	0.175	0.095
3	0.521	0.792	0.506	0.530	0.519	0.531	0.477	0.481	0.626	0.590
4	0.402	0.612	0.512	0.507	0.656	0.756	0.723	0.639	0.453	0.722
5	0.351	0.476	0.400	0.430	0.489	0.644	0.511	0.387	0.474	0.808
6	0.366	0.303	0.800	0.304	0.603	0.359	0.353	0.522	0.346	0.457
7	0.381	0.439	0.377	0.502	0.406	0.568	0.530	0.517	0.524	0.427
8	0.567	0.536	0.412	0.472	0.704	0.342	0.740	0.237	0.457	0.316
9	0.575	0.623	0.602	0.551	0.530	0.235	0.452	0.284	0.558	0.487
+gp	0.575	0.623	0.602	0.551	0.530	0.235	0.452	0.284	0.558	0.487
F_{bar3-7}	0.391	0.464	0.435	0.399	0.458	0.383	0.448	0.346	0.417	0.439

Table 3.2.9 Plaice VIIe Fishing Mortality at Age continued

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	0.001	0.003	0.016	0.011	0.021	0.018	0.045	0.001	0.003	0.001
2	0.199	0.036	0.119	0.186	0.218	0.184	0.200	0.211	0.211	0.228
3	0.580	0.429	0.638	0.607	0.697	0.717	0.612	0.718	0.657	0.717
4	0.444	0.654	0.765	0.780	0.825	0.754	0.844	0.781	0.683	0.451
5	0.509	0.761	0.574	0.588	0.647	0.739	0.567	0.638	0.681	0.500
6	0.322	0.603	0.546	0.451	0.553	0.559	0.536	0.629	0.584	0.456
7	0.294	0.472	0.639	0.392	0.414	0.573	0.405	0.441	0.571	0.518
8	0.410	0.519	0.562	0.362	0.444	0.530	0.305	0.483	0.607	0.379
9	0.200	0.712	0.516	0.415	0.405	0.459	0.427	0.538	0.485	0.435
+gp	0.200	0.712	0.516	0.415	0.405	0.459	0.427	0.538	0.485	0.435
F_{bar3-7}	0.316	0.490	0.489	0.421	0.463	0.499	0.437	0.498	0.497	0.412

Table 3.2.9 Plaice VIIe Fishing Mortality at Age continued

Age	1998	1999	2000	2001	2002	2003	2004	2005	2006	arith mean 04-06
1	0.002	0.009	0.013	0.002	0.040	0.009	0.006	0.005	0.004	0.005
2	0.081	0.207	0.187	0.157	0.335	0.245	0.213	0.279	0.259	0.249
3	0.539	0.390	0.487	0.525	0.590	0.571	0.616	0.656	0.831	0.695
4	0.709	0.614	0.499	0.601	0.580	0.535	0.716	0.681	0.774	0.723
5	0.481	0.587	0.508	0.585	0.599	0.594	0.751	0.771	0.731	0.751
6	0.524	0.673	0.509	0.375	0.593	0.610	0.666	0.743	0.804	0.735
7	0.416	0.597	0.492	0.476	0.478	0.610	0.535	0.703	0.675	0.633
8	0.360	0.499	0.419	0.555	0.429	0.460	0.545	0.763	0.841	0.705
9	0.734	0.633	0.504	0.787	0.711	0.933	0.848	0.607	0.576	0.667
+gp	0.734	0.633	0.504	0.787	0.711	0.933	0.848	0.607	0.576	0.667
F_{bar3-7}	0.458	0.484	0.412	0.485	0.507	0.550	0.574	0.581	0.607	0.588

Table 3.2.10 Plaice VIIe Stock Numbers at Age

Age	1976	1977	1978	1979
1	3809	2015	3090	6993
2	897	3355	1782	2697
3	1597	695	2390	1352
4	482	832	330	1259
5	300	281	488	196
6	180	163	170	305
7	183	105	97	105
8	84	106	64	59
9	39	40	51	32
+gp	221	155	159	187
Total	7791	7748	8622	13185

Table 3.2.10 Plaice VIIe Stock Numbers at Age continued

Age	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
1	6511	2858	5971	5443	6873	6686	13617	11989	8545	3420
2	6183	5757	2319	5228	4824	6023	5909	12068	10563	7567
3	1904	4785	4487	1800	3970	3412	4803	4399	9734	7676
4	543	1018	2497	2370	939	2185	1870	2278	2163	4836
5	606	289	544	1150	987	404	1023	1054	982	1230
6	108	360	167	296	536	525	243	565	417	523
7	199	43	235	81	183	334	276	153	317	268
8	60	121	23	139	41	96	177	145	88	210
9	31	35	67	10	88	17	67	99	94	52
+gp	303	199	295	465	125	206	146	126	234	178
Total	16448	15265	16606	16981	18565	19867	28131	32875	33137	25960

Table 3.2.10 Plaice VIIe Stock Numbers at Age continued

Age	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
1	3815	4162	4642	2094	2006	6502	4957	7996	4143	2420
2	3024	3330	3653	4032	1823	1700	5761	4382	7085	3668
3	6472	2380	2451	2605	2975	1324	1221	4139	3093	5796
4	4435	3033	1151	1083	1127	1430	573	561	1792	1600
5	2230	1831	1233	447	452	430	581	256	317	782
6	510	1114	902	573	189	227	202	261	138	174
7	254	262	629	460	290	98	107	100	147	73
8	148	119	157	369	230	172	56	54	53	86
9	111	75	73	89	193	150	94	27	33	33
+gp	144	131	130	212	125	177	223	228	95	89
Total	21143	16436	15022	11964	9410	12211	13774	18005	16895	14719

Table 3.2.10 Plaice VIIe Stock Numbers at Age continued

Age	2000	2001	2002	2003	2004	2005	2006	2007	arith mean 03-06	geom mean 03-06
1	3744	3965	5023	2884	3914	4981	4296	0	4375	4397
2	2128	3277	3511	4278	2536	3451	4397	3793	3376	3462
3	2646	1565	2484	2227	2970	1818	2316	3009	2321	2368
4	3481	1442	821	1222	1116	1423	837	895	1099	1125
5	768	1875	701	408	634	484	639	342	581	586
6	386	410	927	342	200	265	198	273	219	221
7	79	206	250	454	165	91	112	79	119	123
8	35	43	113	137	219	86	40	51	91	115
9	46	21	22	65	77	113	35	15	67	75
+gp	116	63	72	59	63	93	93	33	82	83
Total	13428	12865	13924	12076	11894	12804	12962			

Table 3.2.11 Plaice VIIe Summary Table

Year	Recruitment	TSB	SSB	Landings	YieldperSSB	Fbar
1976	3808	2101	1269	640.44	0.50	0.457
1977	2015	2302	1331	701.92	0.53	0.439
1978	3090	2497	1431	784.10	0.55	0.404
1979	6993	3121	1577	976.79	0.62	0.525
1980	6511	4082	1958	1079.18	0.55	0.519
1981	2658	4970	2644	1500.42	0.57	0.455
1982	5970	4614	2770	1687.23	0.61	0.534
1983	5442	4940	2993	1494.45	0.50	0.571
1984	6873	4949	2698	1547.50	0.57	0.519
1985	6665	5350	2937	1441.32	0.49	0.509
1986	13617	5927	2977	1810.53	0.61	0.485
1987	11988	5561	2857	1957.63	0.69	0.601
1988	8544	7746	4030	2458.32	0.61	0.430
1989	3419	7104	4282	2358.29	0.55	0.584
1990	3814	6812	4177	2591.34	0.62	0.632
1991	4161	5200	3384	1851.41	0.55	0.564
1992	4642	5092	2841	1623.73	0.57	0.627
1993	2094	3928	2381	1417.34	0.60	0.669
1994	2005	3163	1942	1156.37	0.60	0.593
1995	6501	3581	1713	1032.55	0.60	0.642
1996	4956	3581	1694	1042.54	0.62	0.635
1997	7996	4736	1879	1327.18	0.71	0.529
1998	4143	4325	1972	1137.53	0.58	0.534
1999	2419	3620	2155	1299.27	0.60	0.572
2000	3743	3568	2438	1279.87	0.52	0.499
2001	3964	3467	2141	1106.83	0.52	0.512
2002	5022	3859	1959	1257.51	0.64	0.568
2003	2884	3430	2060	1276.69	0.62	0.584
2004	3913	3854	1836	1211.88	0.66	0.657
2005	4981	3829	1756	1202.19	0.68	0.711
2006	4295	3615	1640	1260.90	0.77	0.763

Table 3.2.12 Plaice VIIe Yield per Recruit analysis

MFYPR version 2a
Run: ple7eypr07
Time and date: 16:37 03/07/2007
Yield per results

FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0.0000	0.0000	0.0000	0.0000	8.8433	5.9439	6.7118	5.3975	6.7118	5.3975
0.1000	0.0711	0.3041	0.2083	6.3136	3.4299	4.2007	2.8904	4.2007	2.8904
0.2000	0.1421	0.4459	0.2674	5.1367	2.3701	3.0416	1.8369	3.0416	1.8369
0.3000	0.2131	0.5278	0.2848	4.4592	1.8184	2.3808	1.2912	2.3808	1.2912
0.4000	0.2841	0.5810	0.2887	4.0199	1.4936	1.9573	0.9720	1.9573	0.9720
0.5000	0.3551	0.6185	0.2878	3.7121	1.2855	1.6645	0.7693	1.6645	0.7693
0.6000	0.4262	0.6463	0.2855	3.4844	1.1435	1.4510	0.6323	1.4510	0.6323
0.7000	0.4972	0.6678	0.2829	3.3090	1.0416	1.2891	0.5351	1.2891	0.5351
0.8000	0.5682	0.6850	0.2805	3.1695	0.9654	1.1625	0.4635	1.1625	0.4635
0.9000	0.6392	0.6991	0.2782	3.0558	0.9065	1.0611	0.4089	1.0611	0.4089
1.0000	0.7103	0.7108	0.2763	2.9612	0.8598	0.9781	0.3662	0.9781	0.3662
1.1000	0.7813	0.7208	0.2746	2.8811	0.8218	0.9091	0.3321	0.9091	0.3321
1.2000	0.8523	0.7295	0.2731	2.8123	0.7903	0.8510	0.3042	0.8510	0.3042
1.3000	0.9234	0.7370	0.2718	2.7525	0.7637	0.8013	0.2811	0.8013	0.2811
1.4000	0.9944	0.7437	0.2706	2.6999	0.7409	0.7584	0.2617	0.7584	0.2617
1.5000	1.0654	0.7497	0.2696	2.6532	0.7212	0.7211	0.2452	0.7211	0.2452
1.6000	1.1364	0.7550	0.2687	2.6115	0.7039	0.6883	0.2310	0.6883	0.2310
1.7000	1.2075	0.7599	0.2678	2.5739	0.6886	0.6592	0.2186	0.6592	0.2186
1.8000	1.2785	0.7643	0.2670	2.5398	0.6750	0.6334	0.2078	0.6334	0.2078
1.9000	1.3495	0.7683	0.2663	2.5086	0.6628	0.6102	0.1983	0.6102	0.1983
2.0000	1.4205	0.7720	0.2657	2.4801	0.6517	0.5893	0.1898	0.5893	0.1898

Reference point	F multiplier	Absolute F
Fbar(3-7)	1.0000	0.7103
FMax	0.4173	0.2964
F0.1	0.1807	0.1283
F35%SPR	0.193	0.1371

Weights in kilograms

Figure 3.2.1 Plaice VIIe LPUE and effort

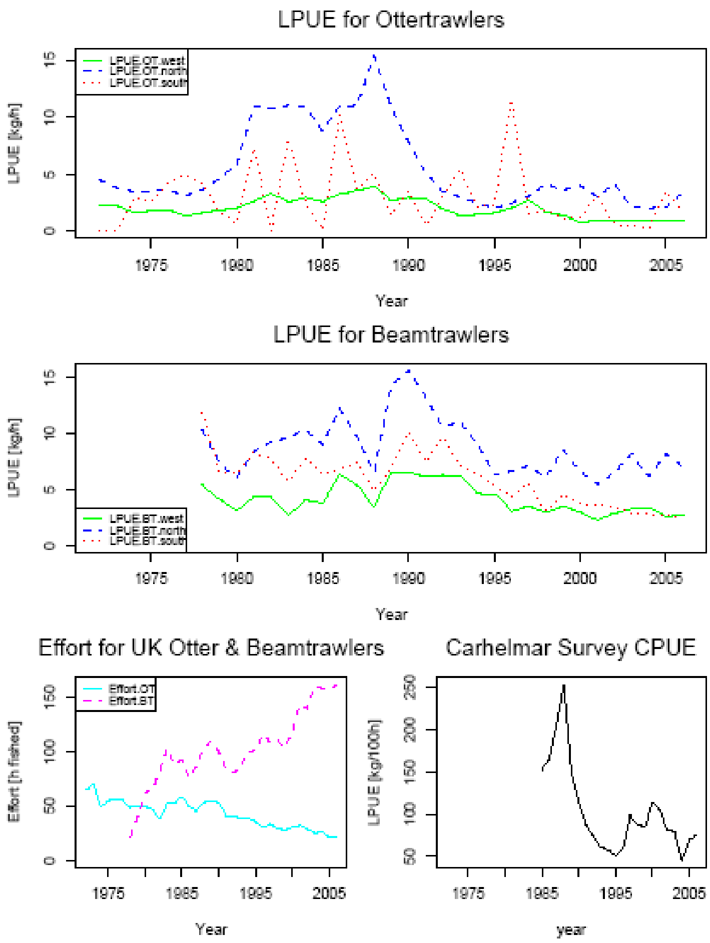


Figure 3.2.2a Plaice VIIe UK Landings Length Frequencies

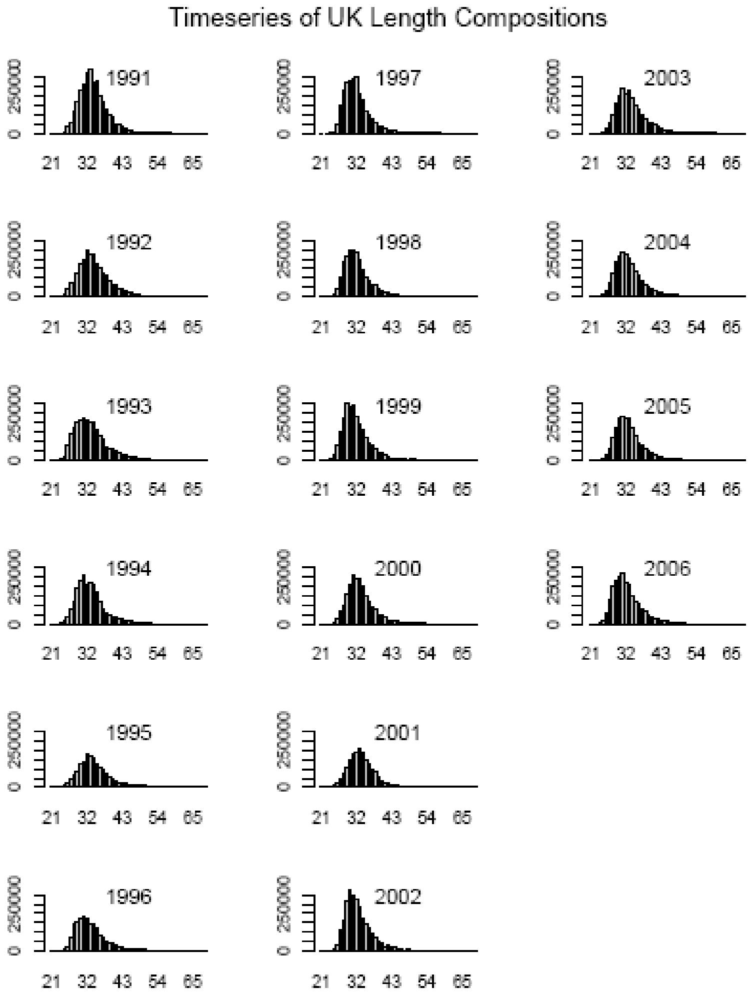


Figure 3.2.2b Plaice VIIe Discards by Quarter, Fleet

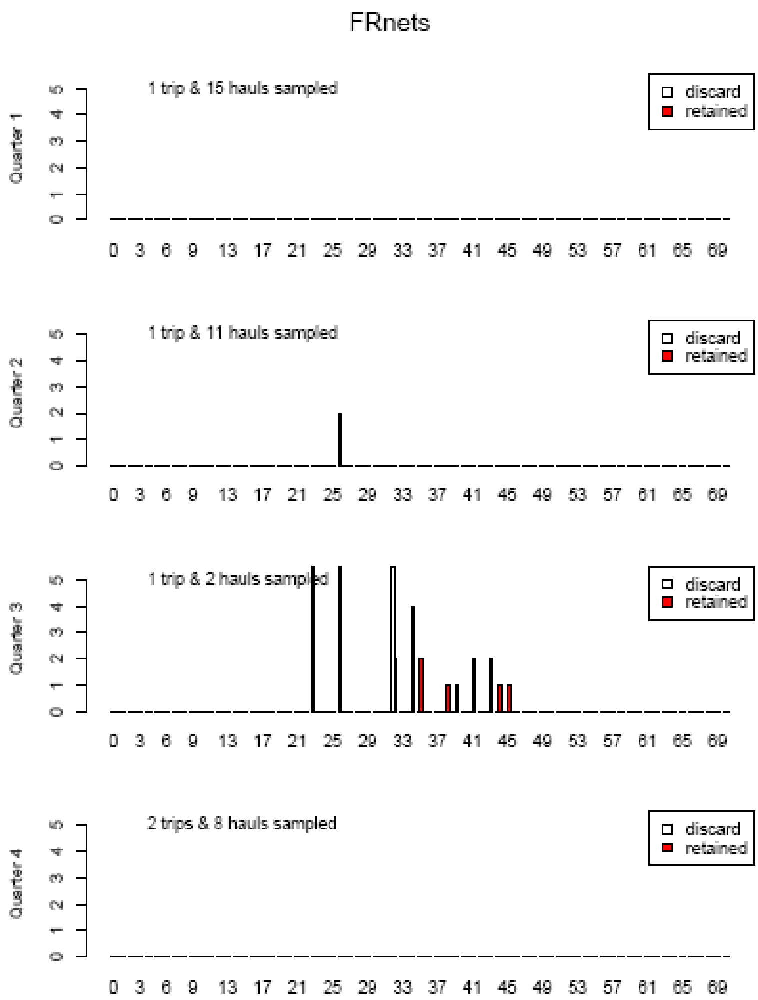


Figure 3.2.2b Plaice VIIe Discards by Quarter, Fleet continued

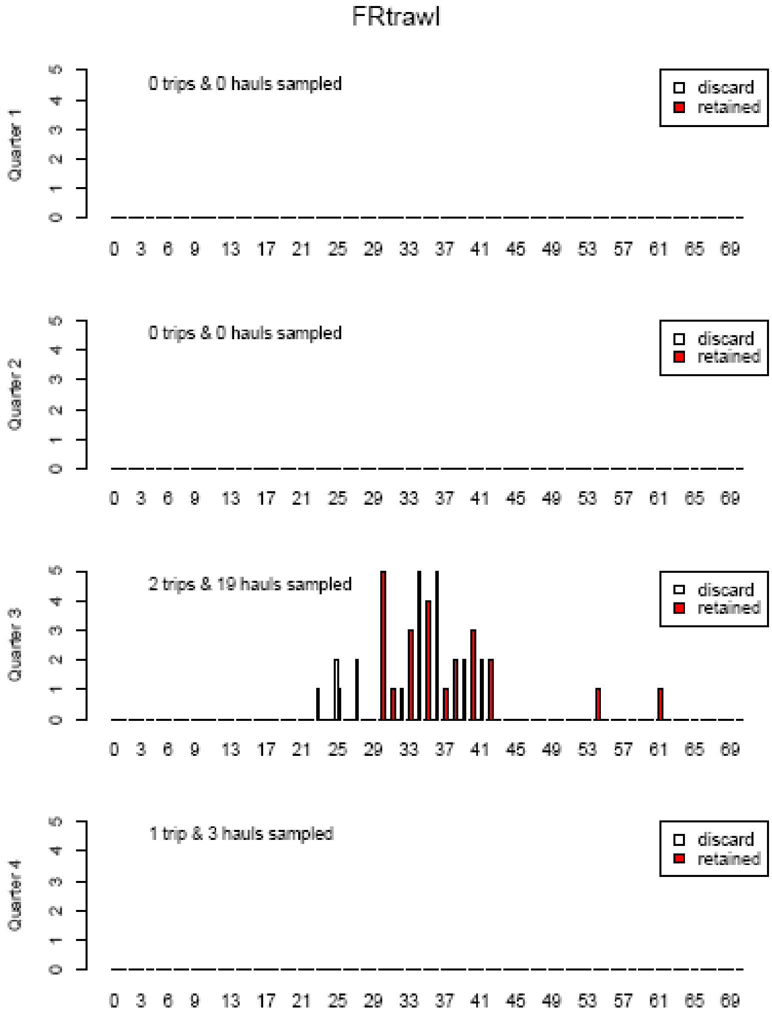


Figure 3.2.2b Plaice VIIe Discards by Quarter, Fleet continued

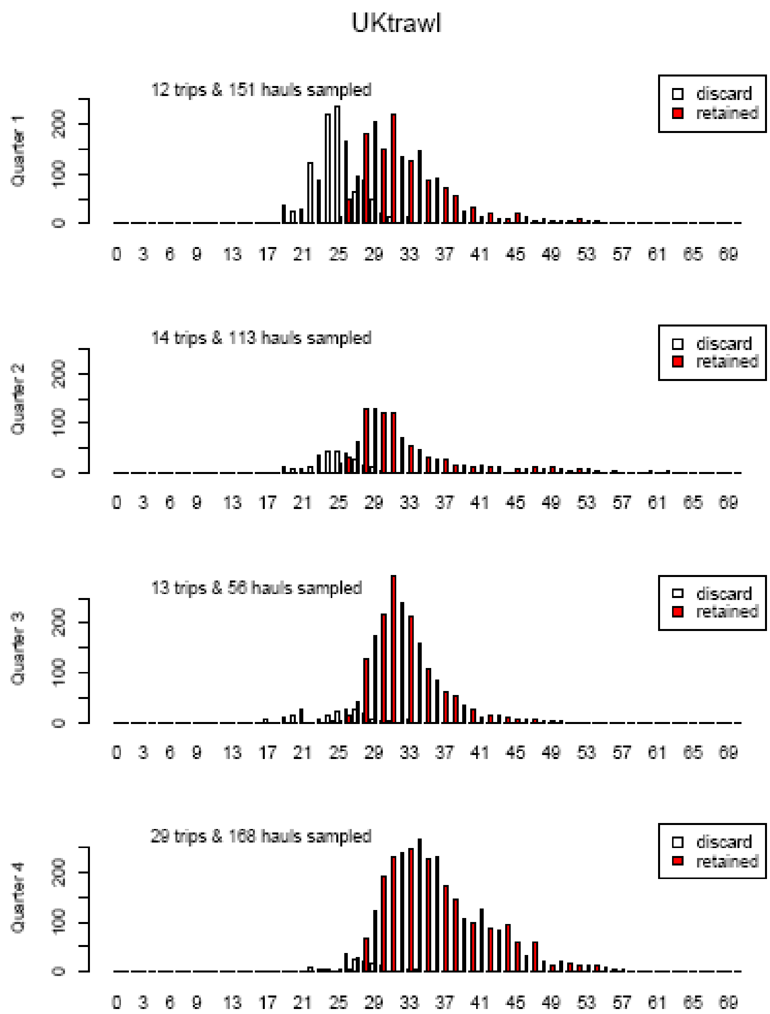


Figure 3.2.3 Plaice VIIe Timeseries of Int. Age Comps

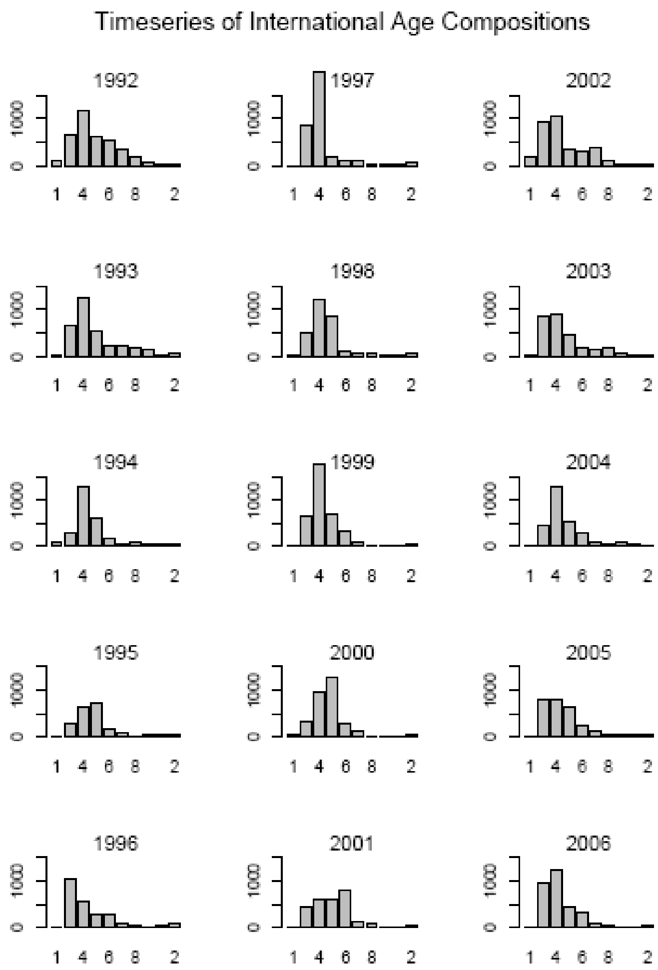


Figure 3.2.4 Plaice VIIe Seperable Residuals

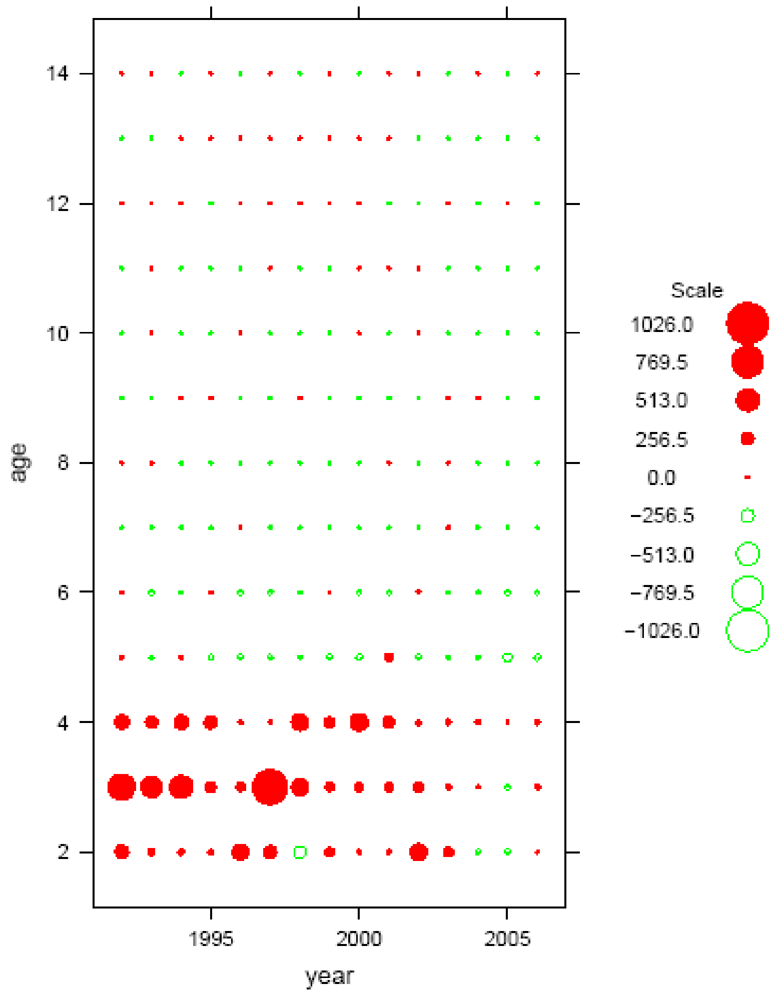


Figure 3.2.5 Plaice VIIe Log CPUE by Yearclass

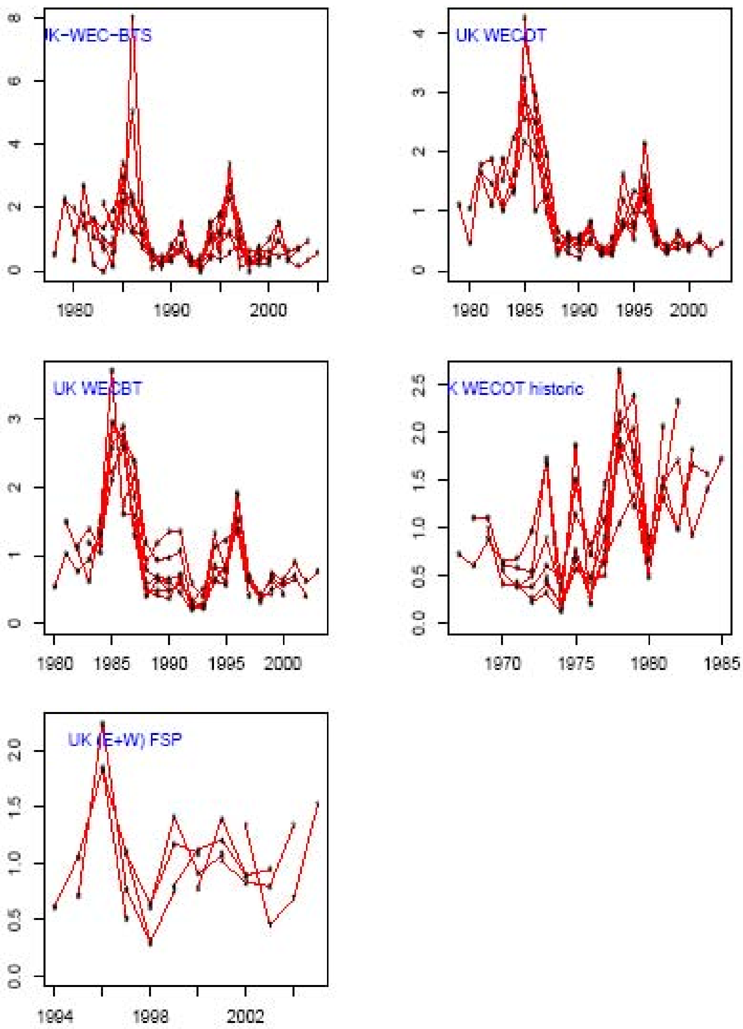


Figure 3.2.6 Plaice VIIe Log CPUE by Year

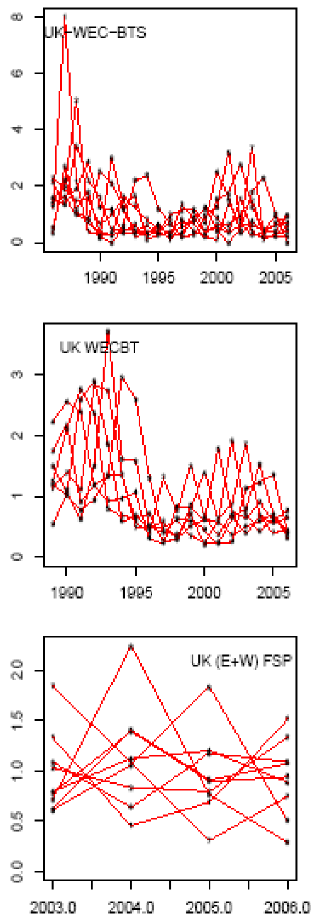


Figure 3.2.7 Estimation of Z from tuning data

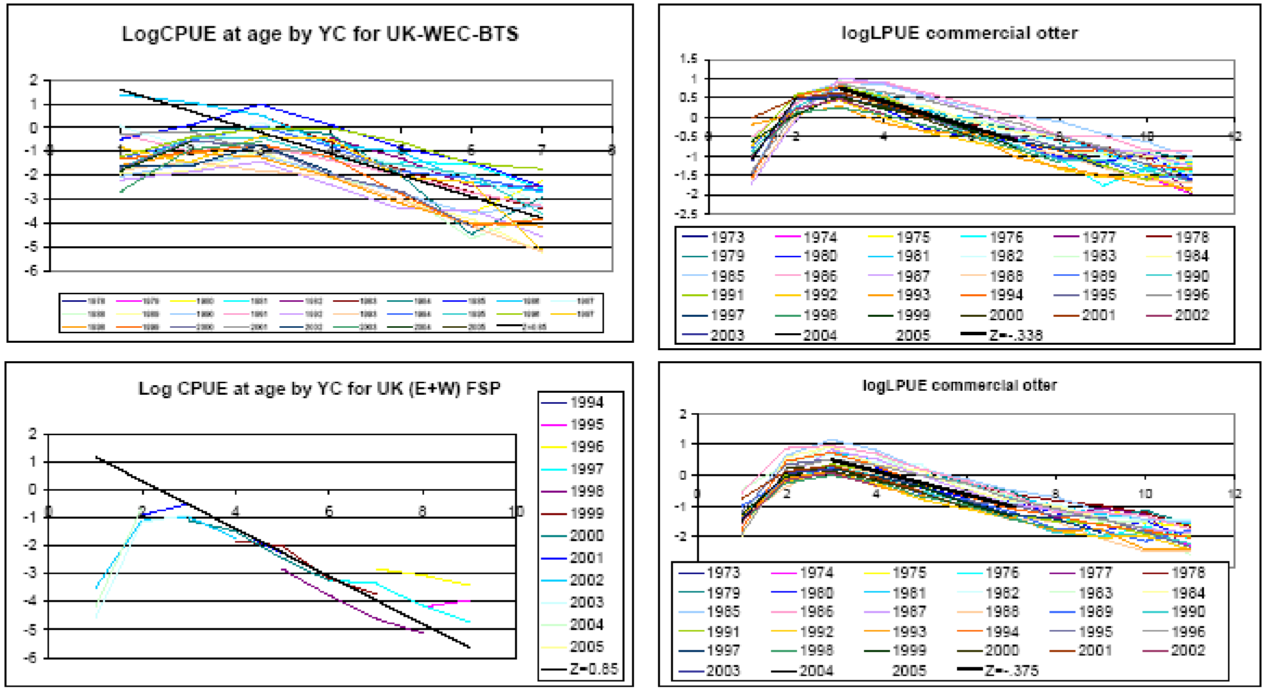


Figure 3.2.8 Plaice VIIe Single Fleet Residuals

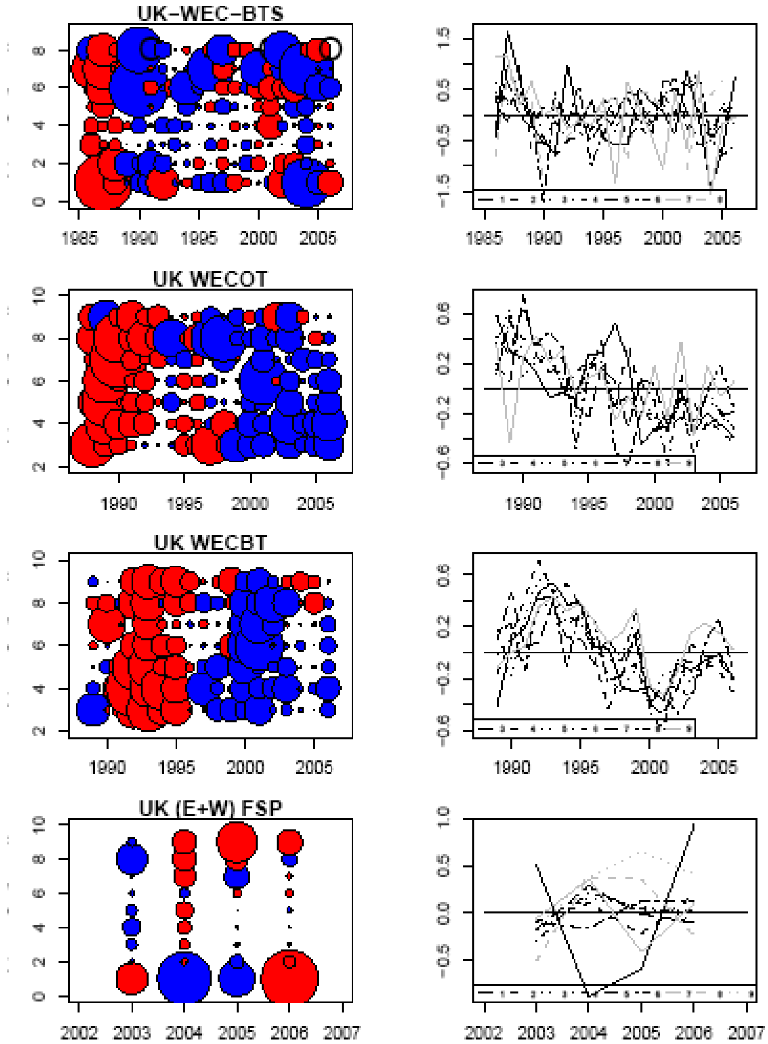


Figure 3.2.9 Plaice VIIe Single Fleet Summary

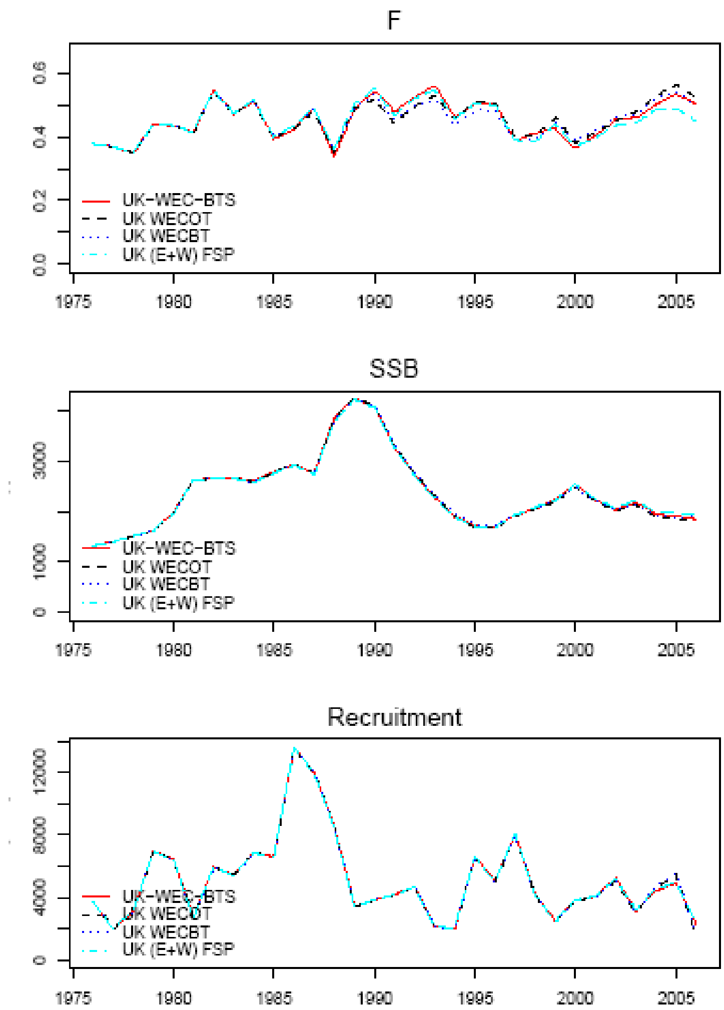


Figure 3.2.10 Plaice VIIe Experimental XSA Summary

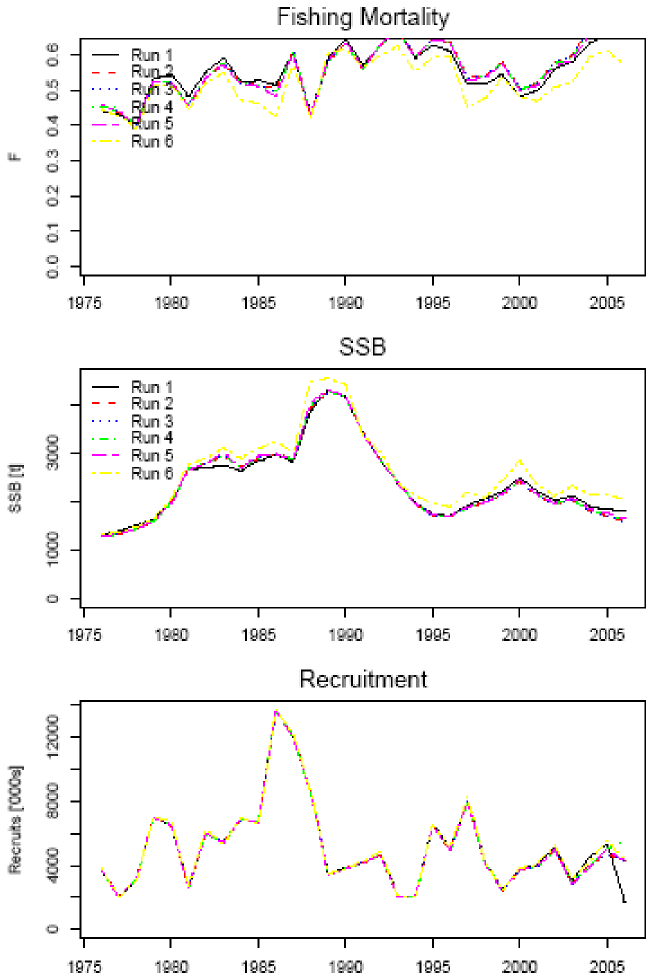


Figure 3.2.11 Plaice VIIe Experimental XSA Survivor Weights

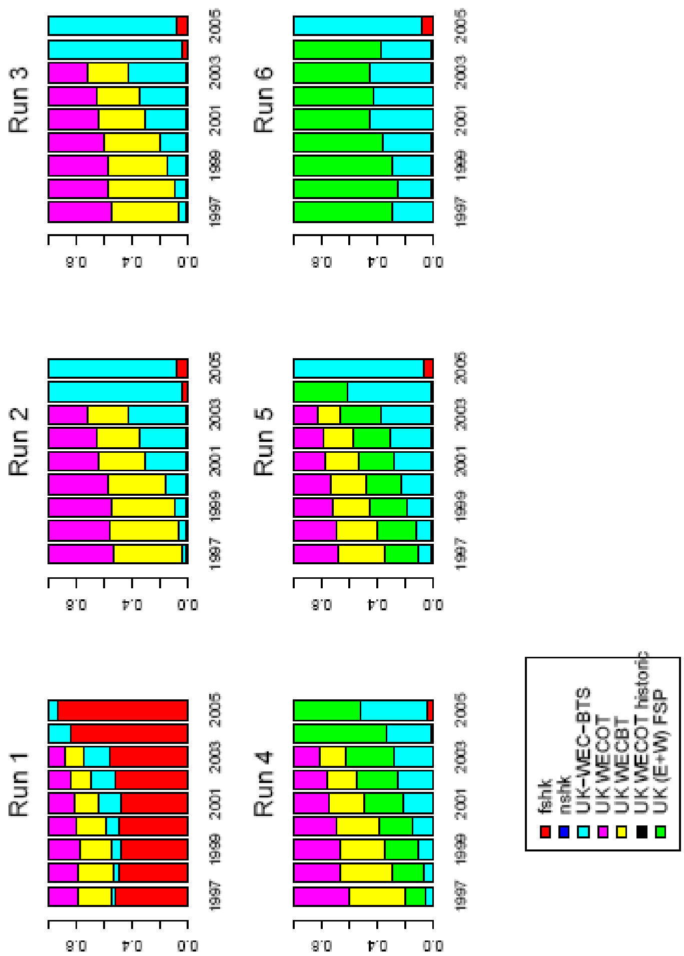


Figure 3.2.12 Plaice VIIe Final XSA Residuals

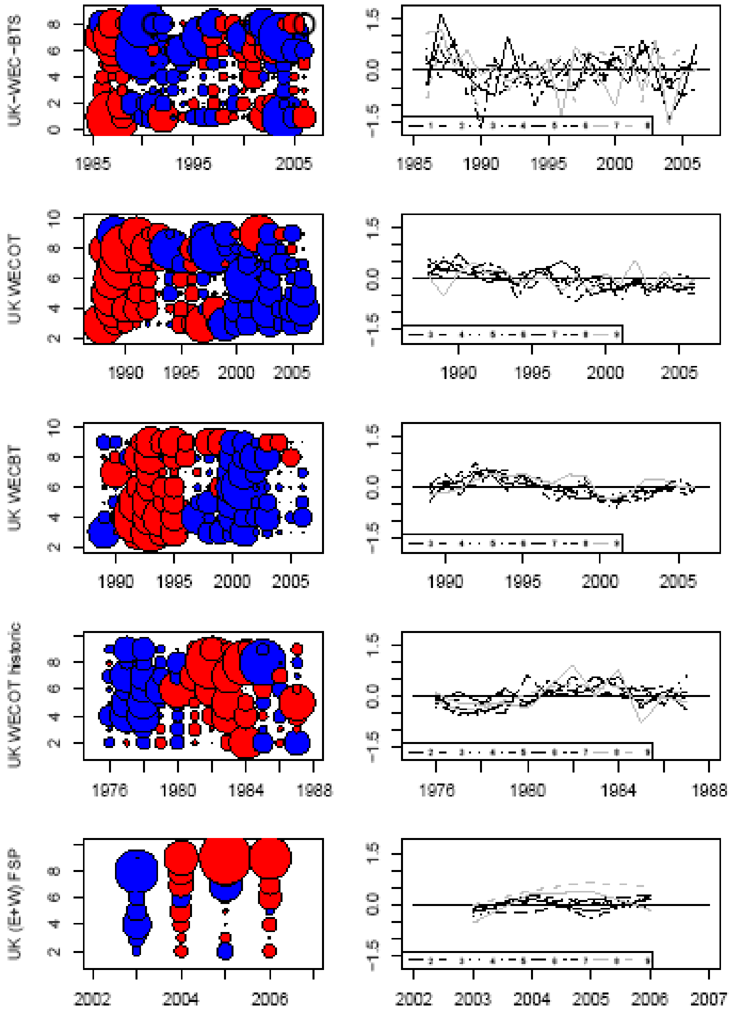


Figure 3.2.13 Plaice VIIe Final XSA and previous XSAs

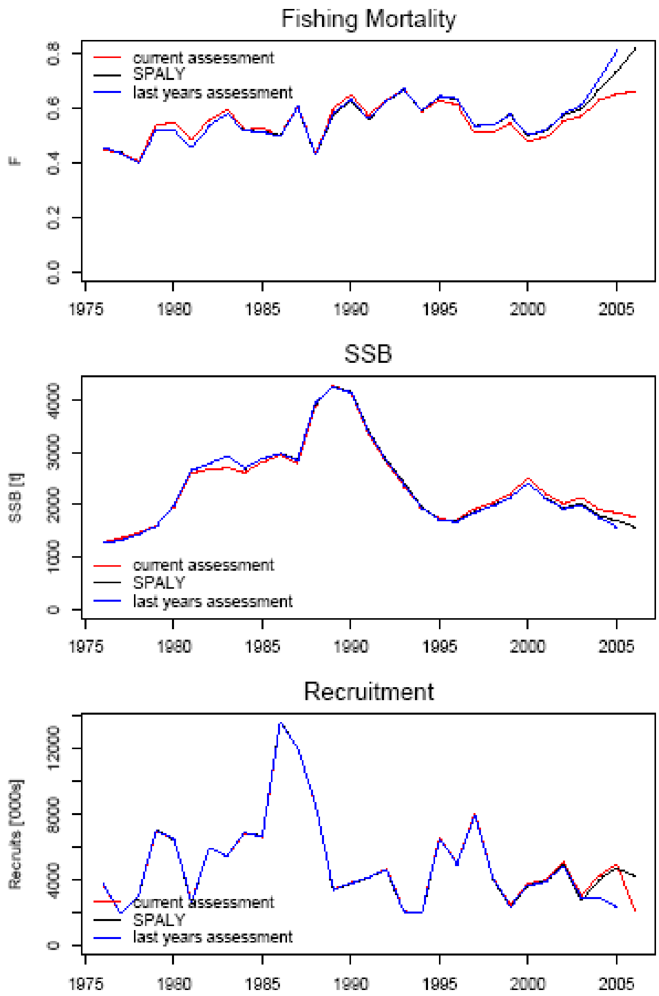


Figure 3.2.14 Plaice VIIe XSA Retrospective Plots

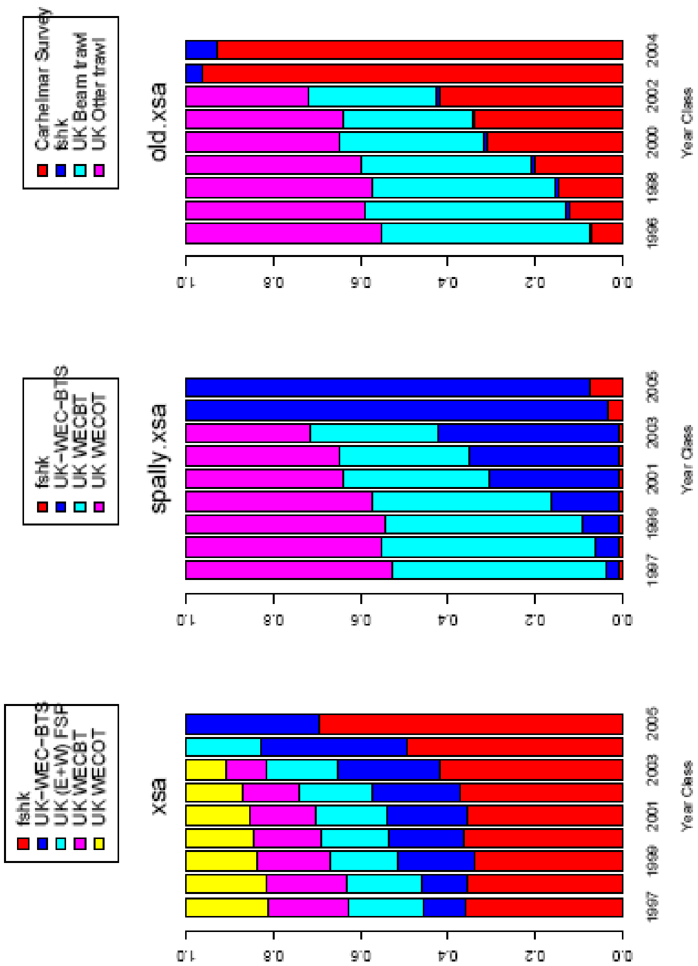


Figure 3.2.15 Plaice VIIe Final Assessment weights

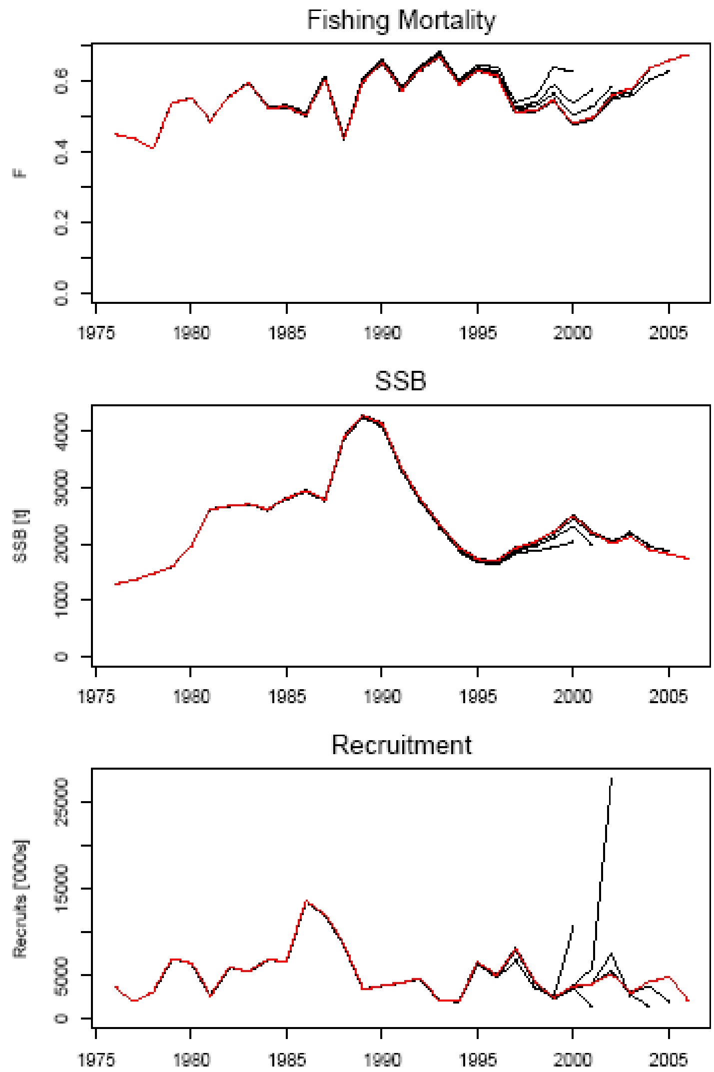
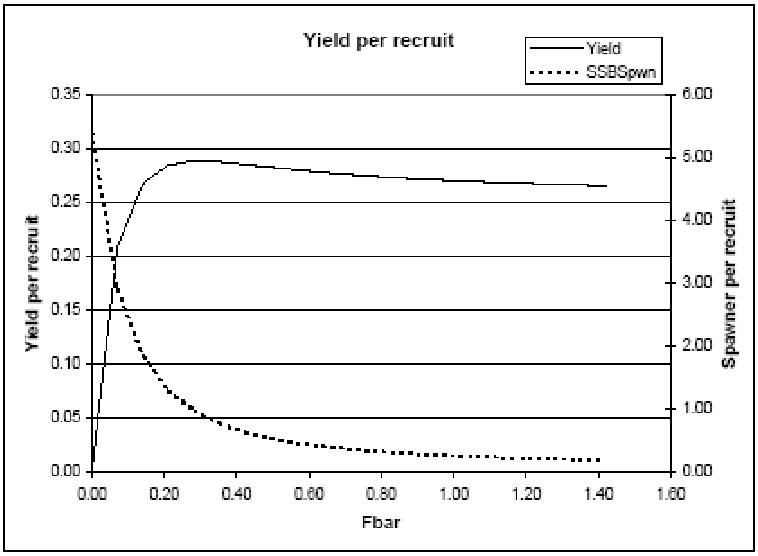


Figure 3.2.16 Plaice in VIIe. Yield per recruit figures

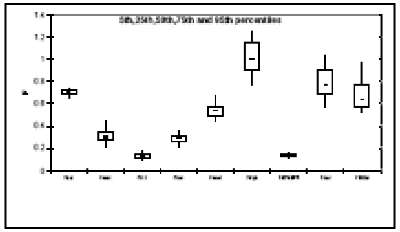


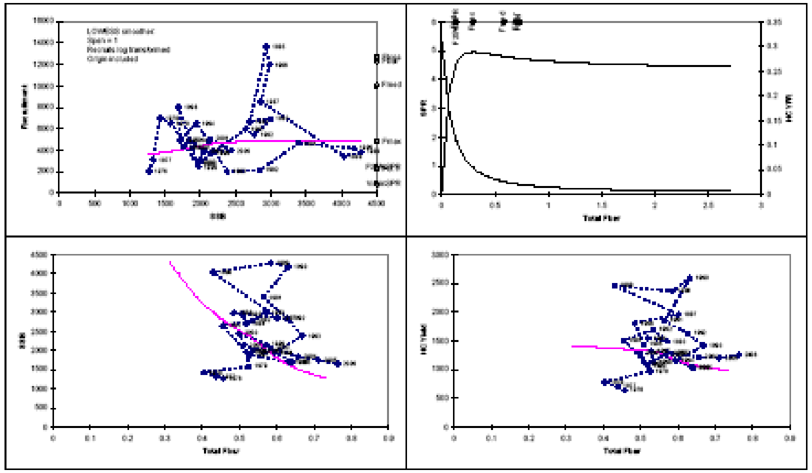
MFYPR version 2a
Run: ple7eypr07
Time and date: 16:37 03/07/2007

Reference point	F multiplier	Absolute F
Fbar(3-7)	1.0000	0.7103
FMax	0.4173	0.2964
F0.1	0.1807	0.1283
F35%SPR	0.1930	0.1371

Weights in kilograms

Figure 3.2.17 Plaice VIIe PASoft Output





Reference	Determini	Median	75th perce	95th perce	Hist SSB < ref pt %
MedianRe	4296	4296	4957	5023	
MBAL	0				0.00
Bloss	1270				
SSB90%R	1931	2157	2372	2833	32.26
SPR%ofVi	6.78	6.83	7.63	8.44	
VirginSPR	5.40	5.31	5.66	7.37	
SPRloss	0.35	0.33	0.37	0.45	
S*	2594	2060	2435	3294	61.29
	Determini	Median	25th perce	5th percer	Hist F > ref pt %
FBar	0.71	0.71	0.69	0.65	6.45
Fmax	0.30	0.30	0.27	0.22	100.00
F0.1	0.13	0.13	0.12	0.09	100.00
Flow	0.25	0.29	0.26	0.22	100.00
Fmed	0.59	0.54	0.50	0.45	32.26
Fhigh	1.09	1.00	0.90	0.77	0.00
F35%SPR	0.14	0.14	0.13	0.11	100.00
Floss	0.73	0.77	0.69	0.58	3.23
FS*	0.57	0.64	0.57	0.52	38.71

For estimation of Gloss and Floss:
A LOWESS smoother with a span of 1 was used.
Stock recruit data were log-transformed
A point representing the origin was included in the stock recruit data.
For estimation of the stock recruitment relationship used in equilibrium calculations:
A LOWESS smoother with a span of 1 was used.
Stock recruit data were log-transformed
A point representing the origin was included in the stock recruit data.

Western Channel Plaice

Steady state selection provided as input
FBar averaged from age 3 to 7

Number of iterations = 100
Random number seed = -99
Stock recruitment data Monte Carloed using residuals from the equilibrium LOWESS fit

Data source:
D:\WPA\Asst\PLEVIIE.SEN
D:\WPA\Asst\PLEVIIE.SUM

FishLab DLLs used
FLVB32.DLL built on May 6 1999 at 12:54:28

PASoft2 Feb 2000
########

4 Celtic Sea Stocks

4.1 Cod in divisions VIIe-k

Type of assessment in 2007: benchmark assessment

There are no changes to the assessment methodology compared to last year's Working Group. The major revision that was made was the updating of French landings since 1999 and the input of estimated French high-grading data since 2003 to 2005 in stock data files and then in French commercial tuning fleets. A more detailed description and explanation can be found under sections 4.1.5 'Data screening/Exploratory runs'.

Technical consideration

Benchmark Assessment: Accepted by the RG as indicative of some trends

Forecast: Rejected by the RG

The WGSSDS 2006 Review Group considered that the procedure to estimate the French high grading may be overestimate the level of smaller fish. up to 50 cm.

It also wished an explanation about the differences between the Irish and other fleets in more recent years.

It noted quite large variations around the estimates and conflicting signals.

The RG advised that it may be worth reducing the F at age to 2-4 for this stock.

The addresses of the WG are given in the relevant sections 4.1.1, 4.1.2 and 4.1.5.

4.1.1 The fishery

A detailed description of the fishery on VIIe-k cod can be found in the **Stock Annex**.

ICES advice applicable to 2006

Exploitation boundaries in relation to precautionary limits: "*Last year, ICES recommended a 17% reduction in F in order to bring SSB above $\boldsymbol{B_{pa}}$ in 2006. This year, due to the uncertainty on the current levels of F and SSB no forecast was carried out. ICES recommends that fishing effort should not be allowed to increase.*"

ICES advice applicable to 2007

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects: "*Fishing mortalities close to $\boldsymbol{F_{max}}$ = 0.33 can be considered as candidate target reference points, which are consistent with taking high long-term yields and achieving a low risk of depleting the productive potential. The present fishing mortality (0.81) is above the candidate reference point.*"

Exploitation boundaries in relation to precautionary limits: "*Given the low stock size, high fishing mortalities and recent poor recruitment, it is not possible to identify any non-zero catch which will be compatible with the Precautionary Approach. The forecast indicates that a zero catch in 2007 allows SSB to achieve $\boldsymbol{B_{lim}}$, but not $\boldsymbol{B_{pa}}$ in 2008.*"

Management applicable to 2006 and 2007

A TAC is in place for ICES areas VII b-k, VIII, IX, X, and CECAF 34.1.1(1), which does not correspond to the stock area (VII e-k). In 2006 and 2007 TACs were set respectively at 5 580 t and 4 743 t.

Technical measures applied to this stock are a minimum mesh size for beam and otter trawlers in Sub-area VII and a minimum landing size (MLS) of 35 cm. The MLS for Belgian trawlers is 40 cm.

Council Regulation (EC) No 1954/2003 established measures for the management of fishing effort in a ‘biologically sensitive area’ in areas of VIIb, VIIj, VIIg and VIIh. Effort exerted within the ‘biologically sensitive area’ by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998-2002).

Council Regulation (EC) No 51/2006, Annex III, part A 4.2 prohibited fishing in ICES rectangles 30E4, 31E4 and 32E3 during February and March 2006 with derogations for vessels using pots, creels or nets with less than 55 mm mesh size. The prohibition does not apply within 6 nautical miles from the base line.

Council Regulation (EC) No 41/2006, Annex III, part A 7.2 prohibited fishing in ICES rectangles 30E4, 31E4 and 32E3 during February and March 2007 with derogations for vessels using pots, creels or nets with less than 55 mm mesh size. The prohibition does not apply within 6 nautical miles from the base line.

Recent trends in the fishery

The series of national landings of cod in Divisions VIIe-k used by the Working Group are shown in **Table 4.1.1**. Since 1999 French landings have been revised using the new database Harmonie, downward for years 1999 and 2000, onwards in 2002 and with minor changes for the other years as shown in table text below.

1999	2000	2001	2002	2003	2004	2005
-20%	-9%	+2%	+9%	+4%	0%	+1%

Irish landings have been slightly revised in 2005. In 2006 total international landings have increased to 3 300 t but still around the lowest observed throughout the time series. Only Belgian landings have decreased from 2005. Since 1988, French landings account in average for ~70% of the international landings but have declined to around 55% in the two last years. Irish landings account on average at 14% but represented around 27% in 2005 and 2006. UK and Belgium have contributed on average to 9% and 4% respectively.

There is no information on the absolute level of misreporting for this stock but it might have increased from 2002 when quotas became restrictive. Landings data have been corrected for some area misreporting with 108 t in 2004, 54 t in 2005 and 103 t in 2006 misallocated into VIIa and have been used by the WG in Division VIIg.

Using the same method as last year, French high grading has been re estimated for the series 2003-2005 in the area where the bulk of landings is harvested and sampled (VII f,g,h). Calculation spreadsheets are in **ICES File**. Estimated French high grading in VII e-k from 2003 to 2005 are 199 t, 149 t and 77 t respectively, lower than last year’s estimate.

Three rectangles in the Celtic Sea (30E4, 31E4 and 32E3) were closed during the first quarter of 2005, in February-March 2006 and 2007. A derogation has permitted beam trawlers to fish in March 2005. This measure of closure was expected to reduce mainly French landings through its effect on French fleets.

In 2006, ICES (ACFM) recommended measures should be put in place to prevent effort increasing outside the closure. However, there is no clear evidence for a general increase in fishing effort (days fished) of UK vessels during the non-closure period to make up any shortfall in cod catches during the closure in 2005-2007.

Working Document **WD2** examines trends in French fishing effort in ICES Division VIIfg / Impact of the Trevose closure. Working Document **WD 3** – Effects of 2005-2007 Trevose cod closure on UK demersal fleets. Working Document **WD4** examines the impact of the temporal closure of ICES rectangles 30E4, 31E4 and 32E3 (Celtic Sea) on the Belgian fishery behaviour. The results are summarized in Section 2.1.

Analyses carried out by IFREMER show that the major impact of the closure on cod appears to have been on activities of French vessels which take in average around three quarters of the international cod landings.

The closure is likely to have resulted in a small (although positive) benefit for managing UK fishing activities in line with the quotas for cod since 2005. However, it is difficult to disentangle the benefits from other factors affecting trends in the fisheries throughout VIIe-k.

The closure on its own does not exclude enough UK fishing effort to achieve the relative reduction in fishing mortality advised by ICES but could contribute to a broader package of measures.

Due to effort limitations in the Eastern English Channel in 2004 and 2005, the number of Belgian vessels operating in the Celtic Sea increased during these two years. The average number of hours fished per vessel decreased since the introduction of the temporal box closure in 2005. Belgian effort was also displaced mainly to periods just after the closure.

9 Belgian vessels (accounting for approximately 17.6% of the total kWdays in the Celtic Sea) were decommissioned between August 2005 and November 2006.

Discards

Since 2003 discarding studies in the area assessed have been carried out on UK (E+W) fisheries under the EU Data Collection Regulation. In 2005 and 2006, Ireland and France have also provided discarding data from otter trawlers. The results from the sampled hauls are summarized in the text table below. Discarding was more important in 2005 than in 2006. The reduction of discarding in 2006 in France can also be partialy explained by the stopping of high grading. More details can be found in the **ICES files**.

	UK	FR	IRL	UK	FR*	IRL
Year	2005[1]	2005*	2005	2006[1]	2006	2006
Number of sampled trips	63	16	11	97	16	2
% discards VIIe-k (number)	45 %	49 %		34%	38%	
% discards VIIg (number)			65%			35%

[1] mainly sampled on beam trawlers fleet

* sampling only in Q3 and Q4

In 1997, discards for the French fleets operating in the Celtic Sea were estimated to be around 8% (SGDBI, 2001). Discarding practises in the French fleet have changed recently. Discarding occurred in the last quarter of 2002 when the French fishery was closed for cod. In 2003, fishermen started high grading in order to prevent a new closure. This practise continued in the following years though fishermen were encouraged to avoid catching small cod, especially during the 2nd semester when small fish are recruited to the fishery. High grading was more scarce in 2006 as most of the trips sampled at fishmarkets have landed the smaller commercial category and in 2007 only one French professional Organisation is continuing this practice. A discard sampling programme for the fleets has started in the 2nd semester of 2005 under the EU Data Collection Regulation.

Sampling results 2006 from observations at sea are summarized in **figure 4.1.1a&b**. UK and French quarterly data refer to hauls sampled for length. Belgium data were not available at the time of the Working Group. Annual Irish data are estimated data using effort ratios to raise the sampling datasets. Discarding practice shown by UK data has occurred all over the year but is more important in quarters 2 & 3 for small fish and some bigger damaged fish were also discarded all the year. The French Gadoids fleet (FU05) has discarded small fish in the 2nd semester and the Nephrops fleet (FU08) mainly during quarters 2&3. Modal length of French discards data was around 35 cm.

Commercial fleets effort and LPUE

Two French commercial fleets are used for tuning: the French trawlers targeting Gadoids in Divisions VIIf,g,h (FR-GADOIDS) and the French *Nephrops* trawlers in VIIf,g,h (FR-NEPHROPS), for which cod is generally a by-catch. Both these fleets account in average for 33% of the international landings from 1988. Other commercial fleets are the English West Coast otter trawlers (UK-WECOT) and the Irish 7J otter trawlers (IR-7J-OT).

Table 4.1.2a&b shows the landings, fishing effort and LPUE data series for five French fleets, three UK fleets and height Irish fleets. **Figure 4.1.2** a&b shows their trends. One can note that the new series built at last year's WG and excluding the 1st quarter have been updated for the FR-GADOIDS and the FR-NEPHROPS fleets for consistency with the effect of the box closure, and annual series are also available in **ICES File**. Ireland has provided 2 new series, for seiners and landings of gillnetters in VIIg and VIIj (**table 4.1.2b**).

Overall the fleets but especially from the 1990s up to 2003-2004, there is a general decreasing trend of LPUEs to the lowest values observed and then some fluctuations at low values. In 2005, a small increase can be noted for the UK and French otter trawlers in VIIe, the French Gadoids fleet in VII f,g,h and for the Irish beam trawlers.

Effort of the French fleets operating in VIIf,g,h has declined, and the effort of the French otter trawlers fishing in VIIe has increased as a part of the effort usually devoted to VII f,g,h has been partly devoted to VIIe (note that the lack of effort data for 1998 causes the drop in effort in the figure with all French otter trawlers combined).

Fishing effort for the UK otter trawlers has decreased over time and remains relatively low, while the effort of the UK beam trawlers has increased substantially and is for ten years about ten times higher than in the late seventies. However the landings of this fleet takes account for less than 5% of the total international landings.

Effort of Irish otter trawlers in Division VIIj was highly variable and decreased in the 3 most recent years while the effort of the otter and beam trawlers in VIIg tend to increase over the period. Effort of beam trawlers in VIIj has remained at low values.

4.1.2 Age and length compositions and mean weights at age

Revisions were made to the French data since 1999 and as a result in international data sets.

Data raising procedures were as before except for 2005 and 2006 for which quarterly UK, FR and IRL data sets for VIIe-k were added and raised to international landings. The raising procedure for previous years can be found in the **Stock annex** and detailed results are in the **ICES file**.

The RG had considered that high grading values estimated last year might be overestimated. The procedure has used a ratio UK frequency/FR frequency from length compositions Using a landings ratio could result in three times these values. Anyway the results give only an indication that high grading was important in 2003 and 2004 when Fishermen Organisations partly managed the quotas by discarding the smaller commercial category in order to avoid a closure of the fishery as in 2002. High grading was at lower level in 2005 maybe both because fishermen have tried to avoid areas where they knew there was a lot of smaller fish or because there was few small fish.

For the years 2003 to 2005, high grading calculation values from VII f,g,h have been raised to French landings in VIIe-k and the results added to stock data sets. SOP at each step of calculation was 100%. In addition, estimated high grading for the French commercial fleets used in the assessment have been calculated using landings ratios.

In 2006, the regulation by high grading has been reduced and most of the trips sampled for length and age have shown landings of the smaller commercial category. Then it has been considered that there has not been high grading in 2006.

Length compositions of landings from countries are shown in **table 4.1.3** and in. **figures 4.1.3 a, b** . Results from Ireland show a greater proportion of small fish in landings as in previous years which may be explained by fishing in other areas than the other countries and also in other periods. 13 years series of length distributions of the main French fleets show that the adding of estimated high grading from 2003 to 2005 has resulted in a downward revision of mean lengths in that years. The original data sets of these two fleets are in **ICES file**.

The catch numbers at age are shown in **Table 4.1.4** and **Figure 4.1.4**. The input of French high grading mainly affects age 1, age 2 and at a minor scale age 3.

The method used to derive catch and stock weights at age was as standard and is described in the **stock annex**. Results are shown in **Tables 4.1.5** and **4.1.6**. Decreasing mean catch weights in the +group can be explained by the decreased low abundance of the older ages in the +group. In 2005, there was no French catch at ages 7 and older in the 1st semester and catch weight at age 7+ was mainly driven by Irish data which gave lower catch weights at age. Stock weight at age are values at the first quarter.

Indication of the precision levels of some national catch at age data in 2006 are given in the **Stock annex.**

4.1.3 Natural mortality and maturity ogive

As in earlier assessments, natural mortality is assumed to be constant (M=0.2) for the whole range of ages and years.

The combined sex maturity ogive used is given below, and the sources are described in the **stock annex**.

Age	1	2	3	4	5+
Maturity	0.00	0.39	0.87	0.93	1.00

As in previous years, SSB is computed at 1 January of each year.

4.1.4 Abundance indices

Table 4.1.7 shows the abundance indices in raw number per hour fishing for the UK-WCGFS and the FR-EVHOE survey. In 2004 the UK-WCGFS was carried out with another vessel, the CEFAS Endeavour and the series was discontinued in that year. Previously an Irish survey was conducted in VIIj and VIIg, but the series was discontinued in 2002. In 2003 a new Irish survey was set up with the RV Celtic Explorer in VIIg and VIIj (IrGFS) and the short series of interim indices is presented in Table 4.1.7.

Because of the low cod abundance, the calculated abundance indices for both the UK and French surveys are based on very few cod caught (In 2003 and 2004, 19 and 29 one year olds were caught in the UK survey and 1 and 4 one year olds in the French survey). Therefore, one should be careful when drawing firm conclusions out of these series. Nevertheless, both surveys give some indication of year class strength since 1992. Both EVHOE survey and the short series of the Irish survey (4 years) indicate that the year class 2004 looks higher than the 2003 and 2002 year classes.

SURBA 3.0 has been used to screen the survey data independently of the commercial fleets. Results are shown in **figures 4.1.5 a&b**. For the FR-EVHOE survey mean standardised indices by year, by year-class, scatter-plots of indices within year classes and catch curves showed that despite the small number of cod caught this series is able to track the above average year classes 1999 and 2000 though there are some inconsistencies through year and year classes. For UK-WCGFS data set (discontinued after 2004), the trends of the index are dome-shaped and index look to match better from 1992 when the design of this survey changed, expecting to provide better indices for gadoid fish. As in previous years, the shorter series 1992-2004 has been used in further analysis.

4.1.5 Catch at age analysis

Section 1.4.1 outlines the general approach adopted at this year's Working Group meeting. All relevant tuning and XSA outputs not included in this report are available in **ICES files**.

Data screening

As in previous years, the age range used for data screening was 1-7+ and mean F was estimated over the ages 2-5.

The results of a separable VPA with a reference age 3, Terminal F = 0.99 and S=0.54 (based on a preliminary XSA) were used to screen the quality of the international catch at age data. The largest residuals were found at ages ½ as in earlier years. No anomalies were apparent in the other residuals.

Table 4.1.8 shows the data sets for the available tuning fleets. Since there are no new data points for the Irish survey (IR-ISCSGFS was discontinued in 2002), this series is not presented. A new short series of IrGFS survey combining VIIg and j and standardized is also presented and used.

Plots of log-catchability residuals for the single fleet runs (no taper, mean q with low shrinkage (se = 2.5) over 5 years and 3 ages), over the whole range of ages and years are available in the **ICES file**.

As last year and for consistency with the main influence on the FR-GADOID fleet of the box closure in the 1st quarter 2005 and in February-March 2006, it was considered more reliable to maintain a time series for this fleet excluding quarter 1 data sets (FR-GADOIDQ2+3+4). A small change of catchability can be suspected up to earlier 90s but not so important to split this fleet.

The FR-NEPHROPS fleet showed some year effects in 2003 and 2004 and year class effects in tracking the good year classes 1999 and 2000.

The structure and dynamics of these fleets has changed over the long time series (vessels decommissioned and new vessels with expected higher fishing power) and also their increasing ability to target other species, however their residuals patterns did not show any sudden change to indicate a suitable breakpoint. The good fit of these fleets is not surprising since they composed a large part of the French catch at age matrix in VII f,g,h. This generally represents the bulk of international landings in the area assessed.

Catchabilities were more noisy in 1988 for the UK-WECOT commercial fleet and a 1996 year class effect was still observed. As last year it was decided to start this series in 1989. The IR-7J-OT fleet gives some higher residuals at ages 4 and 5 in recent years and some year effects in recent years. This fleet operates in an area which provides a marginal contribution to the landings from the stock. The UK-WCGFS survey residuals are dome shaped. To get rid of this pattern the series was as in previous assessments truncated at 1992 and used in further analysis though its contribution will be reduced to the older ages. The FR-EVHOE survey didn’t show any unusual pattern but did not catch any 4 year old cod in 2002 and 2005.

With only four years, the new IrGFS survey series was not examined but incorporated in further analysis to provide some indications at ages.

Exploratory XSA runs

In order to estimate the impact of the strong revision of French data since 1999, a comparative analysis was carried out using the same settings as last year’s final run. These settings are summarized in the table below together with the final settings for this year.

	Fleets series	Avail.	2006 XSA		**2007** XSA	
Catch data range			71-05		71-**06**	
Age range of the assessment		1-10	1-7+		1-7+	
Commercial tuning series:						
	FR-GADOIDQ2+3+4	83-06	1-6	83-05	1-6	83-06
	FR-NEPHROPS	87-06	1-6	87-05	1-6	87-06
	UK-WECOT	88-06	1-6	89-05	1-6	89-06
	IR-7J-OT	95-06	1-6	95-05	1-6	95-06
Survey tuning series:						
	UK-WCGFS	86-04	1-5	92-04	1-5	92-04
	FR-EVHOE	97-06	1-5	97-05	1-5	97-06
	IrGFS VIIg,j	**03-06**			**1-5**	**03-06**
Taper			no		no	
Ages catch dep. Stock size			none		none	
q plateau			5		5	
F shrinkage se			1.0		1.0	
year range			5		5	
age range			3		3	
age range of mean F			2-5		2-5	

The series of F and recruitment have been impacted back to 1996 and SSB back to 1997. Depending on the year, F, SSB and R have been revised respectively in the range –6% to +6%, -9% to +7% and –8% to +7%. A figure in the **Stock Annex shows** the comparison results.

The problem of the high grading of the French fleets has been fairly crudely overcome and investigation on the power model was considered inappropriate. Therefore the mean q model has been used and numbers at ages 1 and 2 of the French commercial fleets were used.

Another XSA run using all the fleets but with a prior weighting of the UK survey set to 0.0 has been compared with a run using full weight to this fleet gave similar results. Though this fleet was discontinued in 2004, the Working group has considered that it contributed to stabilize the q values and increased the certainty in catchabilities.

A preliminary XSA run using the combined fleets has been carried out. In diagnostics, the French commercial fleets operating in Divisions VII f,g,h did not show residuals patterns with trends and large residuals but only a small year effect in recent years. The UK and Irish commercial fleets which operates in areas VIIe and VIIj respectively, had shown some higher residuals and some small trends (UK-WECOT dome shaped and year class 1996 effect, IR-7J-OT year effect in 2003 and 2004) which can be explained by fishing other components of the stock than those fished by the French commercial fleets. The UK-WCGFS survey which showed a reasonable pattern of residuals but also dome-shaped was expected to provide a small contribution to the estimate of survivors. FR-EVHOE survey revealed some higher residuals but in a reasonable range of values and a year effect in 2003 and also in the two last years. Because of the very short series of the new IrGFS survey, it is premature to consider some pattern of the residuals.

The RG advised that it may be worth reducing the F at age to 2-4 for this stock considering that numbers at older ages were smaller in recent period. This situation has also been observed in the past and the WG has considered that in the perspective of possible management plans for this stock it was not so relevant to change such a reference parameter used to understand the history of this stock.

Given that the level of the improvement of the quality of both stock data files and tuning fleets data sets has remained at the same level reached last year and that the main impact is the revision of French data since 1999, the WG has considered that further analysis was not necessary. This XSA run was considered as the final run.

Final XSA run

Tuning diagnostics are given in **Table 4.1.9** and **Figure 4.1.6 a&b**.

The French commercial fleets get high weights at the older ages. Ages 1 is mainly determined by the 4 commercial fleets. The commercial fleets operate in different parts of the assessed area and provide rather consistent estimates except the Irish fleet which operated in VIIj. The Irish and French surveys have provided rather consistent estimates. Consistent estimates at age 2 are provided by all the fleets and surveys and some of them has given similar estimates. At age 3 and older, the commercial fleets contribute to ~80% to estimate the survivors.

A retrospective analysis back to 2001 was carried out without the Irish survey given the short time series and the results are given in **Figure 4.1.7**. It shows a strong trend to underestimate F in recent years with a marginal influence in overestimating SSB.

Fishing mortalities, stock numbers at age and SSB results for Divisions VIIe-k obtained in the final XSA are shown in **Table 4.1.10-12** and in **Figure 4.1.7** or **4.1.8**.

Fishing mortality has been revised upwards back to 2001 and downward in the late 90' mainly as an effect of the revision of French data but keeping rather the same decreasing trend. F in 2005 is now estimated at 0.81 instead of the last year's estimate at 0.75. Fishing mortality in 2006 is estimated at 0.58. SSB is estimated to be 4 700 t in 2004 (instead of a last year estimate of 5 100 t) and 3 800 t in 2005 instead of 4 000 t estimated last year. The SSB in 2006 is estimated at 4 200 t.

4.1.6 Estimating recruiting year class abundance

The 2004 year class (2.4 million fish) is estimated by the commercial fleets to be well below the historic mean. The XSA estimate was kept for the prediction.

The 2005 year class (1.4 million fish) is estimated to be weak by the fleets except the Irish fleet as explained above. The XSA estimate was used for further predictions.

The GM recruitment over the full time series (1971-04) is 3.16 million fish and is not considered reliable with the lower values observed since 2002. The 2006 and subsequent year-classes has been set at GM (2002-2005) at 1.6 million fish.

The Working Group estimates of year-class strength can be summarised as follows:

Recruitment at age 1:

Year class	Thousands	Basis	Surveys	Commercial	Shrinkage
2004	2445	XSA	23%	73%	4%
2005	1371	XSA	31%	62%	7%
2006 & onwards	1633	GM 02-05			

4.1.7 Historical trends in biomass, fishing mortality and recruitment

Fishing mortality generally increased up to 1991, then fluctuated around that level until 2002, and has declined thereafter (**Table 4.1.12 and Figure 4.1.8**). F is estimated to have been 0.58 in 2006, the lowest observed since 1985.

The 1986 year class is the strongest observed in the series (16.6 million fish), about four times the average and was followed by a strong SSB increase in 1988-89. SSB decreased subsequently after high fishing mortalities and low recruitment in 1988 and 1989. The last good recruitments were the 1999 and 2000 year classes. More recently, the 2001 to 2005 year classes are estimated to be well below average and SSB since 2004 is estimated the lowest observed.

4.1.8 Short-term predictions

Input data for the predictions are given in **Table 4.1.13**.. The exploitation pattern is based on the fishing mortalities averaged over 2004-2006, not scaled ($F_{2\text{-}5}$=0.75). Unscaled F was used because the retrospective pattern showed a tendency to underestimate F. In 2007, a part of the Celtic Sea was again temporally closed for all fishing gears in February and March. Mean weights at age were the mean of 2004-2006.

Table 4.1.14 is the management option table and **Figure 4.1.9** gives the short-term yield and SSB forecasts.

Assuming *status quo* F, catches are predicted to be around 3 850 t in 2007 and 3 500 t in 2008 (**Table 4.1.15**). SSB is predicted to remain at low values, increasing slightly at 4 600 t in 2008 and decreasing to 4 400 t in 2009.

Estimates of the relative contribution of recent year classes to the 2008 landings and 2009 SSB are shown in **Table 4.1.16**. The assumed GM recruitment accounts for 38% of the landings in 2008 and 49% of the SSB in 2009.

There are some dangers using such a short period over which to calculate mean recruitment, particularly as better recruitment is sporadic. The pessimistic assumptions presented in the short term forecast are highly susceptible to sudden increases in recruitment. Using an assumption of the long term GM landings are predicted at 4 000 t and 4 700 t in 2007/08 with SSB rising to 5 200 t and 6 500 t in 2008/09. These data are presented here only to illustrate the sensitivity of the short term forecast the the recruitment assumption. Some indications might be available at the end of September from the 2nd quarter of the current year. Over the years, landings of age 1 cod over MLS generally begin during the 2nd quarter in VIIfg.

4.1.9 Yield and biomass per recruit

Results of a yield per recruit analysis (**Table 4.1.17 and Figure 4.1.9**) indicate that F_{max} (0.33) is 44% of *status quo* F (0.75). This value is the same as last year's estimate and well defined as shown by the curve shape. Assuming *status quo* F, the current exploitation pattern, and recruitment at GM(02-05), long-term yield is estimated to be 3 300 t and SSB is at 4 200 t.

The stock recruitment scatter plot is given in **Figure 4.1.11**.

4.1.10 Biological reference points

The Working Group's current approach to reference points is outlined in Section 1.4.4. The table below summarizes the reference point proposals and technical basis to date:

Ref. point	ACFM 1998	WG 1999*	ACFM 1999	WG 2004	ACFM 2004
F_{lim}	0.90 (F_{loss} WG_{98})	0.90 (history WG_{99})	0.90 (history WG_{99})		0.90 (history WG_{99})
F_{pa}	0.68 (5th perc F_{loss} WG_{98})	0.65 (F_{lim}*0.72)	0.68 (5th perc F_{loss} WG_{98})		0.68 (5th perc F_{loss} WG_{98})
B_{lim}	4,500t (B_{loss} =B_{76} WG_{98})	5,400t(B_{loss}=B_{76} WG_{99})	5,400t (B_{loss}=B76 WG_{99})	6,300t (B_{loss}=B76 WG_{04})	6,300t (B_{loss}=B76 WG_{04})
B_{pa}	8,000t (B_{lim}*1.65)	9,000t (B_{lim}*1.65)	10,000t (history)	Reject – no SR relation	8,800 t (B_{pa} = B_{lim} * 1.4)

***The maturity ogive was changed in the WG of 1999**

Results from the PA Software Excel add-in are shown in **Figures 4.1.10 and 4.1.11** and diagnostics are in ICES files.

The SSB/Fbar plot, in **Figure 4.1.12** indicates the historical pattern of the stock in relation to the present Reference points. Current SSB is estimated well below B_{lim}.

There is no evidence of a change in recruitment regime in the stock history.

A general discussion on target reference points is given in section 1.4.4.

4.1.11 Sensitivity and Risk Analysis

A sensitivity analysis (method in Section 1.4.3) was carried out to examine the contribution of different sources of uncertainty to the variance of predicted SSB and yield.

Input data are shown in **Table 4.1.18**. As explained in section 1.4.3, CVs of numbers at ages are the SEs of the survivors estimates. Table 1.4.1 gives a description of the abbreviated variable names on **Figure 4.1.13**, which presents the results of the analysis. Estimates are less sensitive to the assumed recruitment than in previous assessment. The large CV (0.81) reflects the high variable values of recruitment for the historical time series.

The approximate 90% confidence intervals of the expected *status quo* yield in 2008 are 2 000t- and 4 500 t. There is a high probability (~90%) that SSB in 2008 will remain below the $\mathbf{B_{lim}}$ of 6 300 t as shown in **Figure 4.1.14**.

Medium-term predictions were not conducted taking into account the still too strong contribution of assumed GM recruitment for the incoming year classes compared to the low level of the other year classes present in the stock. Medium term predictions were last conducted at the 2005 WG but rejected.

4.1.12 Comments on the assessment

Sampling

This assessment is based on a long time series of landings and annual LPUE series of four commercial fleets, which operate in various parts of the area and three surveys time series. Sampling levels of the landed catch for recent years are considered to be sufficient to support current assessment approaches (Table 4.1.3) and associated CVs of some national catch at age data sets are available for 2005 and 2006 in the **Stock annex.**

Since 1988, French landings account in average for ~70% of the total international landings and are the major contributor to the catch matrix but only ~55% in the last two years. Changed discard practises from 2003 to 2005 on ages 1 and 2 have made it difficult to sample these ages. As last year, estimated French high grading for the series 2003-2005 has been input in datasets used in the assessment. Therefore younger ages have been maintained in the French tuning fleets which contribute on average ~30% of the international landings.

Discards

A major problem for the assessment of this stock is the behavioural change of French fishermen with regard to discarding. The current assessment accounts partly for this through the input of high grading but. discarding also occurred in the last quarter of 2002 when the quota was fished out .

Previous Irish discards studies suggest that discarding of cod is low. Sampling data available for both countries since 2005 have shown that in number, discarded fish can be high but seems to have decreased in 2006 in both Irish and UK fisheries. In French fishery, le lower level of discarding in 2006 may be also due to the stopping of high grading by some Fishermen Organisations in that year. These data are not accounted for in the assessment.

Surveys

UK-WCGFS, FR-EVHOE and the new IrGFS VIIg,j combined gave poor estimation of abundance in the assessment but the French and the Irish survey have generally given consistent estimates.

Consistency

There are no major changes to the assessment methodology compared to last year's Working Group. Data revisions include the revisions of landings data since 1999 and the input of French high grading between 2003 and 2005 allowing the use of estimates at age 1 and 2 of the French commercial fleets as in last year's assessment. This has resulted in F being revised upwards in the most recent years but the decreasing trend of F since 2002 remains.

The results of this assessment are consistent with those of last year in terms of trends of fishing mortality, SSB and recruitment (Figure 4.1.15). For the most recent years F is revised upwards with a small influence on SSB.

The predictions are always heavily depend on assumed recruitment and the 2005 year class, for which short term GM recruitment (1,6 million fish) was used last year, is now estimated to 1,4 million fish.

Misreporting

There is no information on the absolute level of misreporting for this stock but it may be suspected when TACs became more restrictive since 2002. This will be particularly true for countries with more restrictive quotas. Misallocated landings from VII a have been input in VII g each year since 2004.

Industry input

Section 2.5 gives a general overview of the different inputs of relevance for the stocks and fisheries in the Southern Shelf given by the industry.

Information from some French Fishermen Organisations in a pre-WG meeting indicates that more small cod are currently fished in VIIe and cod also occur in areas where they were scarce before (Parsons Bank). As in previous years there will be a post meeting after the Working Group.

A pre-WG meeting was held with the Federation of Irish Fishermen (FIF) and all the POs have had reports from their members that cod were extremely abundant and widespread in the Celtic Sea in spring 2007 and the spring fishery was the best seen in many years. The WG examined preliminary landings data for Q1 2007 for Irish vessel which indicated that reported landings were around 70% higher than in Q1 2006 but were 15% lower than for Q1 2005. The Irish industry expressed concern that the reported landings may not reflect the true abundance of cod seen by their members due to discarding, limiting quotas and other factors. The Irish industry questioned the accuracy of recent recruitment estimates in the 2006 WG assessment. They reported that the 2007 fishery seemed to consist of a broad length range of fish suggesting not only that the 2005 year class was strong but also that the 2004 and 2003 year-classes were also better than estimated in last years assessment. The industry also wanted the WG to examine the effects of the box closures in the Celtic Sea which is carried out in **Section 2.1**.

Management considerations

Landings, fishing mortality and SSB of cod in Divisions VIIe-k have fluctuated considerably, depending on the strength of year classes. In 2006 landings were around 3 300 t, which is amongst the lowest observed in the time series.

Cod in this area is a fast growing and early maturing fish, and the predicted SSBs are highly dependent on the assumed value of recruitment for the incoming year classes. This has sensitivity increased because five consecutive weak year classes (2001-2005) will contribute little to the landings in 2007 and the SSB in 2008.

In 2005, part of the Celtic Sea was temporally closed during the 1st quarter for fishing though some derogations were set . In 2006 and 2007, the closure was set only in February-March for all vessels and gear (except within the 6 miles from the base line).The actual impact of the closure on the fishing mortality cannot be quantified but the decreasing French effort of trawlers targeting cod since 1999 mainly due to a reduction of the number of vessels may be result in the decreasing trend of F since 2002. The slope of this trend can be revised year after year but the trend remains. There has not been a reduction of effort by a regulation way but a reduction has been achieved.

As mentioned in **WD2**, it is almost impossible to assess –*a posteriori*- the impact of a management measure sine other things have changed simultaneously. Furthermore, when excpected a 13% decrease, this should be looked at in relative terms, which means a 13% decrease compared to what might have been the landings (F) without closure. A synthesis of the possible impact of the box closure is presented in **Section 2.1**.

Current TAC management for VIIe-k include cod in VIId. However, cod in VIId is assessed together with cod in the North Sea. If TAC management measures are implemented, they must be consistent with the assessment area.

To be sure that the current box closure in the Celtic Sea provides a reduction in fishing mortality, it should be accompanied by measures to ensure that fishing effort and effective landings will not increase in other areas or period.

Management of quotas by high grading has few benefits for the status of the stock (difficulties to estimate the level of high grading and then recruitment in recent years) even though it may have a dissuasive effect (avoiding areas where it is known that small fish are). Management of quotas by discarding is also a bad practice.

Table 4.1.1. **Nominal landings of Cod in Divisions VII e-k used by the Working Group**

Year	Belgium	France	Ireland	UK	Others	Total	Highgrading FR	Total
1971						5782		
1972						4737		
1973						4015		
1974						2898		
1975						3993		
1976						4818		
1977						3058		
1978						3647		
1979						4650		
1980						7243		
1981						10596		
1982						8766		
1983						9641		
1984						6631		
1985						8317		
1986						10475		
1987						10228		
1988	554	13863	1480	1292	2	17191		
1989	910	15801	1860	1223	15	19809		
1990	621	9383	1241	1346	158	12749		
1991	303	6260	1659	1094	20	9336		
1992	195	7120	1212	1207	13	9747		
1993	391	8317	766	945	6	10425		
1994	398	7692	1616	906	8	10620		
1995	400	8321	1946	1034	8	11709		
1996	552	8981	1982	1166	0	12680		
1997	694	8662	1513	1166	0	12035		
1998	528	8096	1718	1089	0	11431		
1999	326	5488	1883	897	0	8594		
2000	208	4281	1302	744	0	6535		
2001	347	6033	1091	838	0	8309		
2002	555	7489	694	618	0	9356		
2003	136	5222	517	346	0	6221	199	6420
2004	153	2425	663	282	0	3523	149	3672
2005	186	1686	870	309	0	3051	77	3128
2006*	103	1889	958	367	0	3317	0	3317

*** provisional**

Scaled landings 1971-1987 (SSDS WG 1999)

Table 4.1.2a Cod in Divisions VII e-k. Series of landings, effort and LPUE

	France															UNITED KINGDOM (England + Wales)								
	Fr gadoid trawlers VIIfgh			Fr Nephrops trawlers VIIfgh			Fr Otter trawlers VIIe-k			Fr Otter trawlers VII f,g,h			Fr Otter trawlers VII e			Uk Otter trawlers VIIe-k			Uk Beam trawlers VIIe-k			Uk Otter trawlers VIIe		
Year	Landings	Effort	LPUE	Landings	Effort	LPUE	Landings	Effort	LPUE	Landings	Effort	LPUE	Landings	Effort	LPUE	Landings	Effort	LPUE	Landings	Effort	LPUE	Landings	Effort	LPUE
1972																355	117.1	3.0				80	64.6	1.2
1973																223	118.5	1.9				58	69.5	0.8
1974																192	91.6	2.1				55	50.1	1.1
1975	Q2+Q3+Q4 for			Q2+Q3+Q4 for												136	100.3	1.4				38	54.7	0.7
1976	consistency with			consistency with												97	88.2	1.1				32	56.1	0.6
1977	box closure			box closure												119	88.5	1.3				78	55.4	1.4
1978	during Q1 2005			during Q1 2005												116	83.2	1.4	6	24.7	0.3	70	48.8	1.4
1979	and Feb-March 2006			and Feb-March 2006												130	73.5	1.8	14	44.0	0.3	74	49.9	1.5
1980																228	85.6	2.7	39	76.7	0.5	84	50.0	1.7
1981																324	104.3	3.1	63	87.6	0.7	76	46.9	1.6
1982																362	104.7	3.5	84	115.0	0.7	65	38.5	1.7
1983	1453	75.0	19.4	630	190.5	3.3	5443	904.3	6.0	4902	688.0	7.1	472	210.6	2.2	163	82.1	2.0	84	135.3	0.6	73	52.6	1.4
1984	2002	60.6	33.1	671	170.5	3.9	4881	654.9	7.5	4561	520.2	8.8	189	118.4	1.6	237	86.7	2.7	129	131.5	1.0	77	52.9	1.5
1985	1667	73.4	22.7	1023	150.7	6.8	6262	847.6	7.4	5648	653.6	8.6	351	154.1	2.3	249	90.3	2.8	145	152.5	1.0	64	57.7	1.1
1986	2086	85.3	24.5	774	132.6	5.8	8046	932.0	8.6	7469	668.5	11.2	431	220.4	2.0	233	84.7	2.8	164	135.7	1.2	80	49.5	1.6
1987	2804	107.8	26.0	778	145.7	5.3	8215	886.0	9.3	7169	666.8	10.8	835	167.6	5.0	221	84.3	2.6	246	177.1	1.4	96	45.1	2.1
1988	6243	184.4	33.9	1726	144.1	12.0	13739	963.6	14.3	12013	719.3	16.7	1320	199.4	6.6	270	89.1	3.0	248	194.9	1.3	155	53.4	2.9
1989	5171	166.3	31.1	1496	157.7	9.5	15715	1066.0	14.7	14254	805.6	17.7	983	217.4	4.5	186	84.1	2.2	230	198.2	1.2	105	54.7	1.9
1990	3045	155.2	19.6	1138	206.3	5.5	9018	1073.3	8.4	8364	832.3	10.0	383	198.6	1.9	314	99.5	3.2	307	207.6	1.5	128	53.1	2.4
1991	2096	127.1	16.5	690	186.2	3.7	5878	1013.2	5.8	5429	775.6	7.0	335	177.7	1.9	243	76.7	3.2	258	203.2	1.3	84	40.8	2.0
1992	2304	133.0	17.3	1223	226.2	5.4	6709	1060.6	6.3	6182	789.7	7.8	325	179.1	1.8	232	86.4	2.7	256	196.1	1.3	81	39.9	2.0
1993	2566	155.5	16.5	1236	205.3	6.0	8302	1095.6	7.6	7864	776.5	10.1	295	238.4	1.2	181	61.9	2.9	220	208.4	1.1	43	39.2	1.1
1994	1725	121.8	14.2	1245	225.1	5.5	7353	959.7	7.7	6930	698.9	9.9	306	185.1	1.7	79	53.7	1.5	174	220.0	0.8	41	38.8	1.1
1995	2598	128.2	20.3	1606	200.5	8.0	8248	1010.8	8.2	7545	723.1	10.4	520	215.2	2.4	115	52.3	2.2	239	243.1	1.0	55	35.5	1.5
1996	2455	123.0	20.0	1450	181.6	8.0	8667	954.6	9.1	7996	690.0	11.6	460	188.5	2.4	120	60.5	2.0	303	260.8	1.2	59	30.5	1.9
1997	2830	168.2	16.8	1246	152.6	8.2	8307	1057.5	7.9	7575	707.8	10.7	584	258.3	2.3	149	66.7	2.2	299	264.8	1.1	79	33.3	2.4
1998	1707	139.3	12.3	805	111.1	7.2	5765	743.383*	7.76*	5521	611.8	9.0	150*	28.2*	5.33*	119	62.1	1.9	265	254.6	1.0	62	29.8	2.1
1999	1271	138.8	9.2	546	114.6	4.8	5445	1047.3	5.2	4723	652.3	7.2	647	298.4	2.2	90	98.4	0.9	257	251.4	1.0	47	27.5	1.7
2000	938	115.3	8.1	711	125.3	5.7	4254	1051.9	4.0	3636	653.5	5.6	542	312.5	1.7	111	104.1	1.1	187	259.0	0.7	52	30.5	1.7
2001	1911	138.5	13.8	916	141.7	6.5	5957	1010.4	5.9	5220	643.8	8.1	584	281.3	2.1	110	85.3	1.3	256	272.7	0.9	59	31.9	1.8
2002	2458	121.8	20.2	1083	147.6	7.3	7389	974.8	7.6	6589	592.6	11.1	654	317.4	2.1	80	82.7	1.0	130	249.5	0.5	34	28.3	1.2
2003	1110	92.0	12.1	972	169.9	5.7	5157	1025.7	5.0	4474	605.6	7.4	619	366.2	1.7	58	72.3	0.8	103	282.1	0.4	24	25.1	1.0
2004	469	83.1	5.6	462	128.2	3.6	2379	952.1	2.4	2169	557.4	3.9	193	353.6	0.5	44	75.7	0.6	96	273.9	0.4	15	25.6	0.6
2005	501	79.2	6.3	343	113.3	3.0	1637	873.4	1.7	1356	489.7	2.8	265	333.1	0.8	41	76.4	0.5	102	270.3	0.4	17	21.1	0.8
2006*	428	55.3	7.7	371	105.8	3.5	1809	844.6	2.1	1430	461.2	3.1	354	324.3	1.1	55	83.2	0.7	91	252.1	0.4	13	21.1	0.6

Units: landings in Tonnes live weight, Effort in 000s hours fished, LPUE in Kg/hour fished

* unreliable

Table 4.1.2b Cod in Divisions VII e-k. Series of landings, effort and LPUE

	IRELAND			IRELAND			IRELAND			IRELAND			IRELAND			IRELAND			IRELAND			IRELAND		
	Ir Otter trawlers VIIj			Ir Beam trawlers VIIj			Ir Scottish seiners VIIj			Ir Gillnet VIIj			Ir Otter trawlers VIIg			Ir Beam trawlers VIIg			Ir Scottish seiners VIIg			Ir Gillnet VIIg		
	Landings	Effort	LPUE	Landings	Effort	LPUE	Landings	Effort	LPUE	Landings	Effort	LPUE	Landings	Effort	LPUE	Landings	Effort	LPUE	Landings	Effort	LPUE	Landings	Effort	LPUE
1972																								
1973																								
1974																								
1975																								
1976																								
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1994																								
1995	338.5	93.7	3.6	0.1	0.2	0.2	75.52	5.26	14.4	179.57			429.9	63.6	6.8	85.8	20.8	4.1	111.27	6.43	17.3	114.92		
1996	326.4	70.2	4.6	8.7	1.5	5.9	124.55	8.15	15.3	64.96			569.3	60.0	9.5	112.6	26.8	4.2	164.87	9.73	16.9	338.84		
1997	352.8	83.2	4.2	3.4	1.8	1.9	115.81	10.73	10.8	45.47			401.9	65.1	6.2	131.6	28.3	4.7	215.24	16.13	13.3	52.81		
1998	262.3	89.6	2.9	19.2	5.2	3.7	103.37	6.61	15.6	59.13			450.6	72.3	6.2	166.9	35.3	4.7	264.14	14.94	17.7	87.32		
1999	76.7	40.6	1.9	27.6	7.4	3.7	9.57	1.41	6.8	24.01			300.9	51.7	5.8	190.6	40.9	4.7	64.59	8.01	8.1	211.92		
2000	95.5	64.6	1.5	21.2	6.9	3.1	23.71	3.49	6.8	13.98			279.4	60.6	4.6	180.7	37.0	4.9	106.04	9.90	10.7	157.03		
2001	140.4	67.7	2.1	10.4	3.0	3.5	27.95	4.42	6.3	12.69			339.5	69.4	4.9	96.6	39.7	2.4	111.09	16.33	6.8	107.99		
2002	150.1	90.4	1.7	5.4	3.1	1.7	24.65	8.87	2.8	12.23			213.0	77.7	2.7	57.9	31.6	1.8	70.84	20.86	3.4	34.13		
2003	78.5	111.3	0.7	8.8	9.0	1.0	14.72	9.15	1.6	6.17			167.4	86.8	1.9	57.1	49.3	1.2	38.07	20.91	1.8	31.17		
2004	36.1	92.0	0.4	2.5	2.2	1.2	11.57	9.18	1.3	4.21			190.2	97.0	2.0	74.3	54.9	1.4	54.86	19.38	2.8	60.65		
2005	40.6	73.9	0.5	4.7	2.4	1.9	17.76	6.09	2.9	3.30			919.45*	124.4		118.7	49.7	2.4	66.13	14.81	4.5	77.697		
2006	82.6	65.3	1.3	2.0	1.5	1.3	15.64	5.33	2.9	7.21			388.2	118.4	3.3	128.6	60.4	2.1	90.98	14.79	6.2	63.73		

*unreliable due to a large landings figure for Q1 2005 in the official logbook database

Table 4.1.3 Cod in Divisions VIIe-k. 2006 Landings in numbers at leng

Length	France VIIfgh gadoid trawlers	France VIIfgh Nephrops trawl.	France VII e-k	UK VII e-k	Ireland VII e-k	International VIIe-k
24					137	141
25					0	0
26					137	141
27					0	0
28					1071	1105
29					1072	1106
30					3025	3120
31					2992	3086
32					4923	5079
33					6173	6368
34					9232	9523
35				139	9515	9958
36	254		605	211	8799	9919
37	249		594	471	14816	16382
38	1096		2582	926	22235	26556
39	3436	61	8344	791	22612	32749
40	2611	87	6354	1944	13152	22127
41	4075	43	9743	1515	14813	26895
42	2721	447	7382	1631	12869	22573
43	2192	490	6094	1865	12316	20915
44	941	539	3142	1668	7697	12901
45	2324	699	5894	2123	8360	16894
46	4440	1531	10956	2295	13165	27250
47	6786	2413	16405	2893	9941	30162
48	5094	1735	12646	3395	12301	29236
49	7937	2500	18120	2988	12070	34225
50	4803	2972	13245	3196	11014	28321
51	9262	2696	21572	2936	12986	38678
52	5381	5545	19417	4199	16143	41013
53	9132	5217	26293	3738	11346	42684
54	6396	6347	23451	4848	10304	39822
55	7780	5063	24339	5491	9400	40468
56	8129	5106	24887	4759	14478	45516
57	5176	6629	22507	5180	9188	38039
58	8062	6419	26907	4954	13111	46390
59	7387	5286	24284	5009	7374	37824
60	6083	4811	21056	4137	7667	33896
61	6490	2101	16434	4288	8133	29766
62	4570	3792	16395	3736	6630	27605
63	3699	4117	14084	2452	5488	22719
64	3184	2721	11786	2772	4240	19391
65	3143	1205	8469	2502	5597	17091
66	3511	1547	9050	2933	3312	15779
67	2880	970	7273	2377	6639	16804
68	3546	2569	10917	2447	6379	20365
69	2390	1557	6907	1940	4529	13798
70	3677	2405	10505	2334	3627	16986
71	1722	1402	5625	2193	6783	15062
72	3019	1773	7856	1511	4659	14469
73	2983	2418	9326	1924	3894	15621
74	2949	2265	9098	1962	4493	16045
75	1761	1377	5481	2307	5450	13656
76	2728	1568	7092	2611	4229	14371
77	2297	1306	6287	1831	5341	13884
78	1605	1772	6055	2087	4814	13365
79	2014	2006	7084	1737	4945	14201
80	1637	1957	6194	1451	1565	9501
81	1680	1614	5666	1387	2289	9637
82	1812	1783	6559	899	949	8673
83	1247	1040	4271	815	2203	7519
84	1392	1214	4647	350	1185	6377
85	1394	515	3297	489	1066	5005
86	985	808	3305	380	619	4439
87	847	666	2879	358	1268	4647
88	390	222	1228	207	1315	2838
89	588	872	2574	238	867	3795
90	762	659	2573	245	1133	4075
91	476	155	1052	299	505	1914
92	625	510	1789	211	439	2515
93	844	742	2677	202	403	3386
94	143	516	1151	112	778	2106
95	595	368	1647	175	110	1993
96	524	277	1352	255	174	1838
97	388	963	2209	137	176	2602
98	336	417	1386	138	110	1685
99	480	579	1750	157	724	2713
100	313	511	1419	147	110	1728
101	329	768	1852	90	38	2044
102	389	118	885	135	128	1184
103	205	380	1051	41	274	1410
104	0	456	776	74	304	1190
105	131	413	888	89	274	1291
106	78	66	237	76	0	322
107	154	322	811	5	0	842
108	94	64	260	58	38	367
109	223	250	804	67	0	899
110	299	98	656	0	0	677
111	50	28	149	0		154
112	35		84	0		87
113				0		0
114				0		0
115				34		35
116				31		32
117						
118						
119						
120						
Total	199360	124858	600620	128598	464662	1231564
Tw	596	449.0	1888.7	367.0	957.9	3316.9
Mean length	60.5	64.8	61.6	60.9	52.8	58.1
Mean Weigh	2.990	3.596	3.145	2.854	2.061	2.693
	OK	OK	OK	OK	OK	OK

Table 4.1.4 Cod in VII e-k Catch numbers at age

Run title : Cod in Divisions VIIe-k,southern 07,index file

At 28/06/2007 15:38

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

YEAR,	1971,	1972,	1973,	1974,	1975,	1976,
AGE						
1,	725,	4,	332,	1,	673,	51,
2,	461,	774,	239,	224,	136,	1456,
3,	557,	110,	346,	40,	185,	61,
4,	96,	205,	60,	118,	61,	107,
5,	35,	45,	74,	38,	105,	11,
6,	17,	26,	17,	37,	20,	22,
+gp,	11,	17,	11,	36,	33,	7,
0 TOTALNUM,	1902,	1181,	1079,	494,	1213,	1715,
TONSLAND,	5782,	4737,	4015,	2898,	3993,	4818,
SOPCOF %,	100,	100,	100,	100,	100,	100,

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

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	25,	197,	438,	609,	315,	76,	1285,	737,	726,	651,
2,	416,	497,	357,	1213,	3086,	1157,	529,	1210,	1245,	1303,
3,	236,	129,	263,	285,	811,	888,	540,	134,	465,	673,
4,	15,	116,	68,	175,	153,	169,	424,	97,	61,	254,
5,	60,	20,	104,	52,	41,	36,	77,	94,	40,	30,
6,	2,	34,	19,	55,	20,	19,	21,	22,	47,	31,
+gp,	17,	20,	32,	14,	12,	5,	11,	5,	15,	17,
0 TOTALNUM,	771,	1013,	1281,	2403,	4438,	2350,	2887,	2299,	2599,	2959,
TONSLAND,	3059,	3647,	4650,	7243,	10597,	8766,	9641,	6631,	8317,	10475,
SOPCOF %,	100,	100,	100,	100,	100,	101,	100,	100,	101,	100,

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Run title : Cod in Divisions VIIe-k,southern 07,index file

At 28/06/2007 15:38

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

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	2741,	1830,	666,	360,	1377,	1434,	274,	1340,	823,	617,
2,	946,	5443,	2639,	846,	1034,	2601,	2371,	692,	3320,	2248,
3,	448,	320,	2483,	1006,	229,	329,	928,	1199,	310,	1199,
4,	250,	133,	149,	663,	330,	64,	79,	258,	284,	134,
5,	62,	46,	77,	79,	203,	70,	24,	27,	73,	95,
6,	20,	21,	18,	21,	48,	53,	19,	10,	13,	43,
+gp,	15,	8,	11,	16,	14,	17,	16,	17,	5,	4,
0 TOTALNUM,	4482,	7801,	6043,	2991,	3235,	4568,	3711,	3543,	4828,	4340,
TONSLAND,	10228,	17191,	19809,	12749,	9336,	9747,	10425,	10620,	11709,	12681,
SOPCOF %,	98,	100,	100,	99,	100,	100,	100,	100,	100,	100,

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

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
AGE										
1,	1184,	639,	496,	1693,	1091,	233,	122,	357,	298,	156,
2,	1870,	2545,	1141,	464,	2373,	2104,	589,	307,	681,	772,
3,	951,	641,	756,	419,	136,	891,	826,	175,	141,	246,
4,	297,	254,	158,	169,	98,	66,	211,	167,	53,	24,
5,	48,	99,	59,	44,	70,	33,	15,	58,	46,	14,
6,	22,	36,	36,	17,	19,	12,	9,	8,	12,	13,
+gp,	6,	8,	14,	14,	19,	11,	6,	7,	2,	5,
0 TOTALNUM,	4378,	4222,	2660,	2820,	3806,	3350,	1778,	1079,	1233,	1230,
TONSLAND,	12035,	11431,	8594,	6536,	8308,	9356,	6420,	3672,	3128,	3317,
SOPCOF %,	100,	100,	100,	100,	100,	100,	100,	100,	100,	100,

Table 4.1.5 Cod in VII e-k Catch weights at age

Run title : Cod in Divisions VIIe-k,southern 07,index file

At 28/06/2007 15:38

Table 2 Catch weights at age (kg)

YEAR,	1971,	1972,	1973,	1974,	1975,	1976,
AGE						
1,	.9080,	.9080,	.9080,	.9080,	.9080,	.9080,
2,	2.1930,	2.1930,	2.1930,	2.1930,	2.1930,	2.1930,
3,	4.8310,	4.8310,	4.8310,	4.8310,	4.8310,	4.8310,
4,	7.4640,	7.4640,	7.4640,	7.4640,	7.4640,	7.4640,
5,	9.6690,	9.6690,	9.6690,	9.6690,	9.6690,	9.6690,
6,	11.7840,	11.7840,	11.7840,	11.7840,	11.7840,	11.7840,
+gp,	14.8159,	14.4792,	14.6675,	14.9506,	14.5262,	15.1279,
0 SOPCOFAC,	1.0006,	.9972,	.9982,	.9966,	1.0011,	1.0029,

Table 2 Catch weights at age (kg)

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	.9080,	.9080,	.9080,	.9080,	.9450,	.9450,	.9790,	.9810,	1.0010,	1.0540,
2,	2.1930,	2.1930,	2.1930,	2.1930,	1.5490,	2.2420,	2.5250,	2.6450,	2.6370,	2.5540,
3,	4.8310,	4.8310,	4.8310,	4.8310,	4.3850,	4.4740,	4.9610,	5.2840,	5.5210,	5.3980,
4,	7.4640,	7.4640,	7.4640,	7.4640,	7.5650,	7.7970,	7.4570,	7.8280,	8.0820,	7.4400,
5,	9.6690,	9.6690,	9.6690,	9.6690,	9.0600,	10.2500,	9.9650,	9.7580,	10.4070,	10.7820,
6,	11.7840,	11.7840,	11.7840,	11.7840,	12.7500,	12.4650,	12.0100,	11.6720,	11.4690,	12.3960,
+gp,	15.7144,	15.2267,	14.3395,	13.8620,	14.7237,	15.4408,	16.4710,	15.3396,	14.3697,	13.5580,
0 SOPCOFAC,	1.0004,	.9974,	1.0006,	1.0003,	1.0002,	1.0146,	1.0006,	.9984,	1.0092,	1.0000,

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Run title : Cod in Divisions VIIe-k,southern 07,index file

At 28/06/2007 15:38

Table 2 Catch weights at age (kg)

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	.9090,	.9060,	.8440,	.8800,	.9050,	.8150,	.8710,	.8740,	.8060,	.7870,
2,	2.5040,	2.1870,	2.0130,	2.3000,	2.1350,	1.9160,	2.0430,	2.0000,	1.9730,	1.8770,
3,	5.2640,	5.3180,	4.7060,	4.6240,	4.9870,	4.9160,	4.5080,	4.4920,	4.5890,	4.6390,
4,	8.0890,	7.9970,	7.6380,	7.1880,	6.7380,	7.3590,	6.8660,	7.9260,	7.5600,	6.9970,
5,	10.4470,	10.6490,	9.4380,	9.0450,	8.8650,	9.7440,	8.4310,	10.0920,	9.7500,	9.8540,
6,	13.5740,	12.4860,	12.9170,	11.7130,	10.8090,	11.4980,	10.9420,	12.2120,	11.1520,	11.4070,
+gp,	15.3490,	14.6217,	13.3935,	14.8144,	14.1344,	12.6295,	12.3344,	14.0578,	14.0814,	12.3707,
0 SOPCOFAC,	.9844,	.9997,	1.0003,	.9900,	1.0000,	1.0000,	1.0009,	1.0000,	.9999,	1.0000,

Table 2 Catch weights at age (kg)

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
AGE										
1,	.7710,	.8530,	.9930,	.8630,	.7940,	.7570,	.8660,	.8780,	.7750,	.8200,
2,	2.0390,	1.8960,	2.0980,	2.5410,	2.0290,	1.8790,	1.8320,	2.2180,	2.1100,	1.9460,
3,	4.5160,	4.4610,	4.4950,	4.6290,	5.1120,	4.7230,	4.2680,	4.4260,	3.9220,	4.7020,
4,	7.3890,	6.8810,	7.3260,	7.0420,	7.8580,	6.7330,	6.6620,	7.0460,	6.1760,	7.3800,
5,	9.7190,	9.3290,	8.9450,	9.5020,	9.8320,	9.3380,	9.4080,	9.3470,	9.2130,	9.1600,
6,	11.8200,	11.2160,	11.2550,	10.6600,	11.4230,	10.6710,	11.0430,	10.7930,	11.5650,	11.6350,
+gp,	14.3670,	14.0713,	14.6309,	12.1360,	13.8977,	13.1823,	12.1975,	12.8589,	10.0360,	12.3822,
0 SOPCOFAC,	1.0006,	1.0012,	1.0017,	.9995,	.9991,	.9992,	.9985,	1.0022,	.9991,	1.0035,

Table 4.1.6 Cod in VII e-k Stock weights at age

Run title : Cod in Divisions VIIe-k,southern 07,index file

At 28/06/2007 15:38

Table 3 Stock weights at age (kg)

YEAR	1971	1972	1973	1974	1975	1976
AGE						
1	.6620	.6620	.6620	.6620	.6620	.6620
2	1.7090	1.7090	1.7090	1.7090	1.7090	1.7090
3	4.4440	4.4440	4.4440	4.4440	4.4440	4.4440
4	7.3210	7.3210	7.3210	7.3210	7.3210	7.3210
5	9.5290	9.5290	9.5290	9.5290	9.5290	9.5290
6	11.6050	11.6050	11.6050	11.6050	11.6050	11.6050
+gp	14.5404	14.1778	14.3755	14.5822	14.2402	14.8683

Table 3 Stock weights at age (kg)

YEAR	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
AGE										
1	.6620	.6620	.6620	.6620	.4600	.7040	.4460	.5120	.5810	.5280
2	1.7090	1.7090	1.7090	1.7090	1.5490	1.4880	1.9450	1.9510	2.0700	1.9020
3	4.4440	4.4440	4.4440	4.4440	2.2840	3.8760	4.4670	4.9280	5.3330	5.2860
4	7.3210	7.3210	7.3210	7.3210	7.8060	7.4070	7.3530	7.4330	8.3760	7.3820
5	9.5290	9.5290	9.5290	9.5290	10.5440	9.6240	9.7520	9.5520	10.8510	10.6890
6	11.6050	11.6050	11.6050	11.6050	11.4390	12.3160	11.2230	12.1800	11.5850	12.3930
+gp	15.3589	14.9079	14.0056	13.5130	14.6123	15.7394	17.4511	15.2018	14.9743	14.4820

1

Run title : Cod in Divisions VIIe-k,southern 07,index file

At 28/06/2007 15:38

Table 3 Stock weights at age (kg)

YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
AGE										
1	.5220	.9060	.8440	.6130	.5390	.6630	.7030	.6050	.6120	.6730
2	1.9470	1.6210	1.4630	1.7740	1.5380	1.3180	1.3850	1.7540	1.4440	1.2830
3	4.8770	4.8870	4.5140	4.3900	4.7910	4.6000	4.2780	4.1890	4.3460	4.4710
4	7.9460	7.7770	7.6150	7.1860	6.5240	6.5580	6.5740	7.7200	7.4520	6.7470
5	10.3080	10.3020	9.4380	8.4860	8.6310	9.3420	8.0660	9.7220	9.1400	9.8770
6	14.4190	11.7860	12.6920	10.7030	10.6720	11.2850	10.8150	12.1010	10.6460	11.4240
+gp	15.4457	13.4600	14.1533	14.6578	13.8090	12.4660	12.1295	13.9081	14.0514	12.8480

Table 3 Stock weights at age (kg)

YEAR	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGE										
1	.4700	.4210	.7780	.5610	.6300	.3510	.4840	.6610	.5880	.7010
2	1.4100	1.3140	1.5420	1.6960	1.4550	1.2560	1.3260	1.5470	1.6850	1.3140
3	4.0790	4.3400	4.2520	4.2230	4.9040	4.4500	4.1070	3.6150	4.0870	4.2320
4	7.1120	6.6760	7.1260	6.6270	7.8720	7.0420	6.6010	6.7320	5.9580	6.7910
5	9.0440	9.3030	8.7000	9.3260	10.1920	9.3920	9.1860	9.2310	9.0530	8.8320
6	11.1560	11.1720	11.1420	10.5050	11.6130	10.6150	10.6330	10.1610	11.3540	11.4740
+gp	13.7300	12.8280	15.2226	11.4651	13.8257	13.7048	12.6878	12.5850	11.4870	11.6556

1

Table 4.1.7 Abundance indices of cod from surveys in Celtic sea in number per hour for all series

UK-WCGFS (in VIIe-j and VIIIa)				IrGFS-7g (in VIIg)*					IrGFS-7j (in VIIj)*				FR-EVHOE (in VIIf-j)			
Age	**1**	**2**	**3**	**Age**	**0**	**1**	**2**	**3**	**Age**	**1**	**2**	**3**	**Age**	**1**	**2**	**3**
1986	0.10	0.14	0.24													
1987	0.31	0.20	0.17													
1988	0.06	0.50	0.06													
1989	0.00	0.23	0.43													
1990	0.02	0.07	0.35													
1991	0.21	0.26	0.07													
1992	0.45	1.13	0.06													
1993	0.08	1.21	0.81													
1994	2.32	0.19	1.00													
1995	1.95	2.53	0.15													
1996	0.21	1.10	1.38													
1997	0.58	0.50	0.53										**1997**	0.43	0.19	0.49
1998	0.29	0.41	0.33										**1998**	0.42	1.04	0.41
1999	0.03	0.24	0.05										**1999**	0.31	0.37	0.57
2000	0.44	0.00	0.06										**2000**	2.10	0.08	0.24
2001	0.24	0.18	0.16										**2001**	1.43	0.36	0.06
2002	0.04	0.97	0.52										**2002**	0.07	0.63	0.30
2003	0.00	0.15	0.81	**2003**	0.00	0.43	0.72	0.74	**2003**	0.23	0.15	0.15	**2003**	0.10	0.08	0.28
2004	0.50	0.00	0.07	**2004**	0.37	0.98	0.37	0.12	**2004**	0.08	0.00	0.00	**2004**	0.11	0.23	0.14
2005				**2005**	0.14	2.04	0.56	0.07	**2005**	1.83	0.00	0.07	**2005**	0.51	0.24	0.11
2006				**2006**	0.06	2.18	0.63	0.11	**2006**	0.20	0.13	0.00	**2006**	0.35	2.78	0.00

CEFAS Endeavour in 2004 discontinued in 2005

*Interim indices for new Celtic Explorer series

Table 4.1.8 Cod in VII e-k Tuning fleets available

Data in **bold** have been used.
High grading input in French commercial fleets since 2003 to 2005
Cod in Divisions VIIe-k, tuning fleets, southern 07
107
FR-GADOIDQ2+3+4 trawlers in VIIfgh (effort hours fished, n° individuals)

1983 2006
1 1 0.25 1
1 7

74992	**260899**	**98470**	**83167**	**51148**	**8708**	**2115**	**702**	572	104	0
60554	**264776**	**384489**	**34198**	**25074**	**19906**	**5260**	**935**	437	0	0
73397	**164991**	**240550**	**91883**	**13287**	**7830**	**9379**	**1514**	913	0	0
85302	**148440**	**222666**	**130804**	**49043**	**8106**	**5991**	**4158**	40	0	0
107781	**1316826**	**279848**	**110620**	**18501**	**7118**	**1708**	**1275**	810	69	0
184408	**611840**	**2024182**	**84860**	**41087**	**8973**	**5934**	**559**	178	1109	0
166279	**207852**	**813228**	**548423**	**29672**	**15390**	**5014**	**1389**	784	526	0
155175	**138846**	**311610**	**222389**	**124462**	**16526**	**6539**	**744**	99	99	0
127064	**362141**	**301828**	**35757**	**53178**	**34282**	**8598**	**1315**	1087	0	0
132970	**607817**	**492100**	**68181**	**9279**	**8984**	**5550**	**1371**	89	0	0
155514	**109856**	**674880**	**92481**	**17324**	**4642**	**4335**	**2188**	633	134	0
121829	**266023**	**117323**	**153569**	**30545**	**4085**	**1183**	**1013**	369	0	0
128219	**154493**	**617967**	**54352**	**54795**	**18932**	**4101**	**360**	1064	0	0
123025	**129647**	**526800**	**179949**	**18438**	**12552**	**4950**	**835**	0	0	0
168156	**154549**	**489043**	**185037**	**56522**	**12127**	**8228**	**1443**	180	0	0
139326	**131195**	**401923**	**81432**	**23640**	**9972**	**3497**	**908**	753	262	131
138767	**71952**	**142275**	**93463**	**22704**	**6301**	**4502**	**1186**	1229	0	141
115310	**340457**	**77158**	**33382**	**16050**	**3556**	**1798**	**1272**	198	128	0
138521	**297665**	**563912**	**19119**	**11523**	**8243**	**2818**	**1230**	531	0	0
121814	**66307**	**651738**	**171972**	**13667**	**4672**	**2006**	**419**	980	430	281
91951	**30658**	**187864**	**130361**	**31516**	**1855**	**1498**	**744**	151	66	0
83130	**62322**	**54047**	**34034**	**13601**	**5483**	**524**	**51**	0	0	47
79213	**24921**	**123956**	**8888**	**5136**	**7364**	**2361**	**281**	55	195	0
55293	**21762**	**110460**	**20040**	**2739**	**1418**	**997**	**599**	0	0	0

FR-NEPHROPS trawlers in VIIfgh (effort in hours fished, n° individuals)

1987 2006
1 1 0 1
1 7

191020	**171757**	**81278**	**52746**	**23485**	**6513**	**3474**	**2209**	572	0	0
172625	**65228**	**505300**	**58116**	**18370**	**4627**	**2818**	**462**	272	448	0
180285	**34563**	**188872**	**192486**	**20017**	**10775**	**2101**	**1149**	212	150	0
230684	**21416**	**89684**	**91512**	**58839**	**7705**	**3522**	**1244**	59	0	0
226146	**75858**	**112496**	**25967**	**28891**	**14338**	**3934**	**1735**	958	0	0
278998	**111808**	**343353**	**57068**	**7023**	**9674**	**6450**	**1780**	0	0	0
270056	**8018**	**329369**	**114425**	**14046**	**2239**	**3051**	**2477**	624	174	0
260993	**252260**	**72275**	**124690**	**27001**	**4607**	**998**	**1276**	112	0	0
240953	**68020**	**496186**	**35291**	**33012**	**13081**	**2259**	**630**	277	0	0
220922	**55213**	**312231**	**123538**	**15095**	**10286**	**4442**	**1069**	0	0	0
188417	**66023**	**246609**	**100660**	**26480**	**6035**	**2803**	**379**	0	0	0
155789	**21185**	**199640**	**62447**	**22498**	**9037**	**2518**	**526**	293	88	0
151470	**30026**	**126600**	**50043**	**11822**	**3977**	**3592**	**479**	454	0	0
194560	**182011**	**46785**	**59385**	**22741**	**5160**	**1237**	**1394**	376	0	0
171813	**181989**	**288579**	**11628**	**12475**	**6849**	**2298**	**1209**	548	0	0
172969	**17408**	**295819**	**85715**	**6785**	**4737**	**1475**	**1051**	192	47	47
200830	**8323**	**75174**	**157206**	**41895**	**3331**	**1985**	**2252**	390	0	0
161277	**40909**	**48567**	**31177**	**29642**	**9297**	**1325**	**533**	572	0	0
149785	**20574**	**87134**	**11083**	**5094**	**10502**	**1972**	**102**	33	16	0
105798	**2468**	**76926**	**24045**	**3306**	**1905**	**1668**	**676**	0	0	0

UK-WECOT (E+W) Otter trawlers in VIIe, effort in 000's hours, numbers at age in 000's

Table 4.1.8 continued

1988	2006					
1	1	0	1			
1	6					
53.402	59.047	38.995	0.728	0.178	0.076	0.194
54.707	**3.49**	**12.604**	**11.944**	**0.835**	**0.75**	**0**
53.05	**4.783**	**3.591**	**11.303**	**5.755**	**1.245**	**0**
40.789	**27.281**	**3.388**	**1.789**	**2.664**	**2.547**	**1.022**
39.909	**14.758**	**29.177**	**1.993**	**0.636**	**0.468**	**0.923**
39.174	**0.73**	**10.494**	**3.703**	**0.25**	**0.141**	**0.102**
38.768	**18.196**	**1.402**	**3.165**	**1.208**	**0.166**	**0.063**
35.453	**10.755**	**24.948**	**1.959**	**0.647**	**0.098**	**0.013**
30.541	**4.259**	**14.297**	**4.475**	**0.42**	**0.095**	**0.103**
33.281	**30.644**	**7.783**	**4.526**	**1.656**	**0.462**	**0.027**
29.802	**3.882**	**13.999**	**3.394**	**1.297**	**0.3172**	**0.102**
27.516	**2.297**	**3.1**	**6.927**	**0.865**	**0.247**	**0.136**
30.493	**19.065**	**2.024**	**1.858**	**1.946**	**0.526**	**0.305**
31.9	**7.713**	**16.733**	**1.027**	**0.365**	**0.622**	**0.107**
28.346	**1.151**	**8.922**	**3.165**	**0.136**	**0.135**	**0.059**
25.052	**0.312**	**2.679**	**3.268**	**0.536**	**0.046**	**0.024**
25.584	**1.005**	**1.019**	**0.872**	**0.793**	**0.189**	**0.035**
21.129	**0.75**	**4.031**	**0.423**	**0.213**	**0.17**	**0.083**
21.129	**0.605**	**2.934**	**1.011**	**0.054**	**0.061**	**0.022**

IR-7J-OT Irish otter trawlers in VIIj, effort in 000s hours, N in 000s

1995	2006						
1	1	0	1				
1	6						
93.688	**30.597**	**121.744**	**9.697**	**7.883**	**0.505**	**0.222**	0.044
70.237	**23.109**	**54.566**	**49.072**	**5.6**	**1.197**	**0.787**	0
83.187	**26.433**	**69.525**	**30.08**	**8.289**	**0.997**	**0.115**	0
89.61	**17.685**	**77.44**	**10.809**	**7.534**	**2.833**	**1.147**	0.236
40.609	**0.992**	**9.714**	**7.894**	**2.783**	**0.394**	**0.187**	0.099
64.625	**21.299**	**6.65**	**5.494**	**3.23**	**0.982**	**0.267**	0.102
67.658	**21.418**	**51.569**	**2.569**	**1.76**	**0.428**	**0.107**	0
90.446	**10.898**	**44.185**	**10.786**	**1.392**	**0.22**	**0.109**	0
111.267	**1.935**	**8.802**	**11.822**	**0.884**	**0.218**	**0.026**	0
91.956	**6.154**	**11.877**	**1.622**	**0.859**	**0.054**	**0**	0
73.919	**10.613**	**12.326**	**3.143**	**0.739**	**0.383**	**0**	0
65.346	**23.638**	**28.711**	**4.551**	**1.621**	**0.868**	**0.061**	0081

UK-WCGFS West Coast March survey, effort in mn towed, numbers *10**2, final survey in 2004

1986	2004				
1	1	0.15	0.25		
1	5				
1744	300	400	700	400	0
2747	1400	900	800	0	100
2869	300	2400	300	0	0
3323	0.01	1300	2400	1800	300
3257	100	400	1900	1100	600
3493	1200	1500	400	100	500
3774	**2800**	**7100**	**400**	**200**	**200**
3602	**500**	**7250**	**4850**	**1230**	**100**
1915	**7400**	**600**	**3180**	**1130**	**300**
3439	**11200**	**14520**	**880**	**1400**	**700**
3695	**1300**	**6800**	**8500**	**1000**	**800**
3826	**3700**	**3200**	**3400**	**700**	**100**
3744	**1800**	**2500**	**2000**	**700**	**500**
3823	**200**	**1500**	**300**	**400**	**100**
4092	**3000**	**0**	**410**	**200**	**200**
3700	**1450**	**1100**	**1000**	**100**	**100**
3387	**200**	**5450**	**2960**	**430**	**100**
2326	**0**	**579**	**3154**	**410**	**100**
1689	**1400**	**0**	**200**	**1000**	**200**

FR-EVHOE Groundfish Oct-Nov survey in VIIf,g,h,j, numbers per 30 mn

Table 4.1.8 continued

1997	2006				
1	1	0.75	1		
1	5				
1	**0.213**	**0.095**	**0.246**	**0.117**	**0.048**
1	**0.212**	**0.52**	**0.207**	**0.045**	**0.045**
1	**0.155**	**0.184**	**0.283**	**0.015**	**0.03**
1	**1.046**	**0.041**	**0.118**	**0.064**	**0.013**
1	**0.716**	**0.18**	**0.029**	**0.038**	**0.018**
1	**0.033**	**0.313**	**0.148**	**0**	**0.015**
1	**0.052**	**0.041**	**0.142**	**0.061**	**0.008**
1	**0.056**	**0.115**	**0.072**	**0.053**	**0.017**
1	**0.255**	**0.12**	**0.055**	**0**	**0.026**
1	**0.125**	**0.139**	**0**	**0.048**	**0.045**

IrGFS-VIIgj combined: Irish Groundfish Survey (IBTS 4th Qtr) - Cod number per 30 mn haul (Interim indices for new Celtic Explorer series)

2003	2006				
1	1	0.79	0.92		
1	5				
1	**0.167**	**0.223**	**0.229**	**0.075**	**0.000**
1	**0.300**	**0.106**	**0.035**	**0.018**	**0.018**
1	**0.967**	**0.138**	**0.035**	**0.000**	**0.000**
1	**0.632**	**0.200**	**0.031**	**0.000**	**0.000**

Table 4.1.9 Cod in VII e-k XSA diagnostics

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 Lowestoft VPA Version 3.1

   28/06/2007  15:36

 Extended Survivors Analysis

 Cod in Divisions VIIe-k,southern 07,index file

 CPUE data from file tuningfleets8.txt

 Catch data for  36 years. 1971 to 2006. Ages  1 to   7.

      Fleet,            First, Last, First, Last, Alpha,  Beta
                    ,    year, year,  age ,  age
 FR-GADOIDQ2+3+4 traw,   1983, 2006,   1,     6,   .250,  1.000
 FR-NEPHROPS trawlers,   1987, 2006,   1,     6,   .000,  1.000
 UK-WECOT (E+W) Otter,   1989, 2006,   1,     6,   .000,  1.000
 IR-7J-OT Irish otter,   1995, 2006,   1,     6,   .000,  1.000
 UK-WCGFS West Coast ,   1992, 2006,   1,     5,   .150,   .250
 FR-EVHOE Groundfish ,   1997, 2006,   1,     5,   .750,  1.000
 IrGFS-VIIgj combined,   2003, 2006,   1,     5,   .790,   .920


 Time series weights :

      Tapered time weighting not applied


 Catchability analysis :

      Catchability independent of stock size for all ages

      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 =   1.000

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

      Prior weighting not applied


 Tuning converged after   19 iterations

1


 Regression weights
       , 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000


 Fishing mortalities
    Age,  1997,  1998,  1999,  2000,  2001,  2002,  2003,  2004,  2005,  2006

      1,  .222,  .243,  .415,  .300,  .226,  .181,  .160,  .213,  .145,  .134
      2,  .955, 1.056,  .913,  .888,  .914,  .907,  .953,  .760,  .808,  .678
      3, 1.141, 1.108, 1.141, 1.107,  .717, 1.156, 1.233,  .863, 1.017,  .796
      4,  .885, 1.185,  .942,  .871,  .865,  .973,  .994,  .917,  .707,  .457
      5,  .594,  .865, 1.034,  .761, 1.215,  .833,  .610,  .847,  .704,  .403
      6,  .646, 1.356,  .944, 1.016,  .920,  .686,  .567,  .793,  .411,  .435
```

Table 4.1.9 continued

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XSA population numbers (Thousands)

YEAR	AGE 1	2	3	4	5	6
1997	6.58E+03	3.36E+03	1.54E+03	5.59E+02	1.19E+02	5.11E+01
1998	3.28E+03	4.31E+03	1.06E+03	4.04E+02	1.89E+02	5.36E+01
1999	1.61E+03	2.11E+03	1.23E+03	2.86E+02	1.01E+02	6.51E+01
2000	7.22E+03	8.71E+02	6.92E+02	3.21E+02	9.13E+01	2.95E+01
2001	5.97E+03	4.38E+03	2.94E+02	1.87E+02	1.10E+02	3.49E+01
2002	1.55E+03	3.90E+03	1.44E+03	1.17E+02	6.45E+01	2.67E+01
2003	9.13E+02	1.06E+03	1.29E+03	3.70E+02	3.63E+01	2.30E+01
2004	2.05E+03	6.37E+02	3.35E+02	3.07E+02	1.12E+02	1.61E+01
2005	2.45E+03	1.36E+03	2.44E+02	1.16E+02	1.01E+02	3.94E+01
2006	1.37E+03	1.73E+03	4.95E+02	7.23E+01	4.66E+01	4.07E+01

Estimated population abundance at 1st Jan 2007

0.00E+00	9.81E+02	7.20E+02	1.83E+02	3.75E+01	2.55E+01

Taper weighted geometric mean of the VPA populations:

3.07E+03	2.08E+03	7.93E+02	2.90E+02	1.15E+02	4.82E+01

Standard error of the weighted Log(VPA populations) :

.8039	.7696	.7330	.6163	.5839	.6171

1

Log catchability residuals.

Fleet : FR-GADOIDQ2+3+4 traw

Age	1983	1984	1985	1986
1	.81	1.01	.46	.41
2	.22	.79	-.01	.00
3	.42	.48	.29	.49
4	.12	.49	.25	.80
5	-.15	.26	-.16	.44
6	.02	.15	-.14	.01

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	.69	.14	.40	-.11	.05	.49	-.21	-.43	-.68	-.54
2	.13	-.07	-.04	.43	.30	-.27	-.23	-.66	-.22	-.05
3	.33	-.54	.13	.12	-.09	.21	-.70	-.06	-.38	.04
4	-.21	-.12	-.52	.17	.42	-.20	-.07	-.24	.28	-.33
5	-.15	-.20	.08	-.08	.50	.01	.13	-.28	.32	.16
6	-.56	.01	.24	.17	.59	-.12	.15	.21	.49	.09

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	-.96	-.22	-.01	.16	-.01	-.06	-.04	.00	-1.09	-.29
2	-.10	-.30	-.70	-.26	-.06	.33	.70	-.05	.10	.02
3	.05	-.22	-.21	-.50	-.61	.38	.54	.43	-.46	-.12
4	-.06	-.25	-.08	-.39	-.37	.45	.43	-.16	-.23	-.18
5	-.07	-.38	-.12	-.56	.17	.05	-.15	.05	.42	-.28
6	.42	.11	-.06	.04	.08	.00	.07	-.40	.04	-.48

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
Mean Log q	-7.6583	-6.2572	-6.4995	-6.7059	-6.8555	-6.8555
S.E(Log q)	.5206	.3528	.3852	.3393	.2665	.2729

Table 4.1.9 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
1,	.89,	.787,	7.72,	.71,	24,	.47,	-7.66,
2,	1.12,	-1.015,	6.07,	.77,	24,	.39,	-6.26,
3,	.91,	.843,	6.53,	.81,	24,	.35,	-6.50,
4,	.91,	.915,	6.62,	.83,	24,	.31,	-6.71,
5,	.87,	1.500,	6.59,	.87,	24,	.23,	-6.86,
6,	.98,	.196,	6.75,	.83,	24,	.27,	-6.81,

1

Fleet : FR-NEPHROPS trawlers

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	-.05,	-.17,	.37,	-.50,	-.22,	-.08,	-1.50,	.63,	-.25,	-.11
2	-.46,	-.19,	-.40,	-.05,	-.09,	-.18,	-.29,	-.68,	.11,	.04
3	-.13,	.05,	-.19,	-.34,	-.15,	.12,	-.21,	-.22,	-.56,	-.11
4	.14,	-.08,	-.21,	-.26,	-.09,	-.47,	-.07,	-.39,	-.13,	-.35
5	-.18,	-.16,	.26,	-.59,	-.38,	-.06,	-.53,	-.26,	-.04,	-.03
6	.22,	-.02,	-.07,	-.18,	-.20,	-.12,	-.12,	-.15,	-.09,	-.02

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	-.06,	-.30,	.87,	.87,	1.15,	.12,	-.25,	.78,	-.04,	-1.24
2	.27,	.04,	.27,	-.10,	.24,	.37,	.17,	.38,	.31,	.23
3	.13,	.21,	-.12,	.36,	-.45,	.13,	.73,	.53,	-.05,	.27
4	-.20,	.27,	-.09,	.17,	.23,	.12,	.65,	.68,	-.11,	.16
5	-.22,	.02,	-.08,	-.08,	.33,	.33,	.31,	.53,	.77,	.05
6	-.12,	.20,	.22,	-.27,	.26,	-.02,	.23,	.50,	-.09,	.07

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
Mean Log q,	-9.5785,	-7.5998,	-7.5031,	-7.5979,	-7.6230,	-7.6230,
S.E(Log q),	.6629,	.2987,	.3200,	.3085,	.3425,	.1980,

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,	.84,	.963,	9.37,	.67,	20,	.56,	-9.58,
2,	1.08,	-.823,	7.58,	.85,	20,	.33,	-7.60,
3,	1.05,	-.494,	7.54,	.83,	20,	.34,	-7.50,
4,	1.06,	-.496,	7.71,	.81,	20,	.33,	-7.60,
5,	1.15,	-.870,	8.05,	.67,	20,	.39,	-7.62,
6,	1.13,	-1.266,	8.14,	.83,	20,	.22,	-7.61,

1

Table 4.1.9 continued

Fleet : UK-WECOT (E+W) Otter

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	99.99	99.99	-.23	-.04	.96	.34	-1.47	.40	.32	-.20
2	99.99	99.99	-.49	-.38	-.46	.72	-.38	-1.30	.46	.35
3	99.99	99.99	-.48	.33	.18	.00	-.42	-.70	-.25	-.16
4	99.99	99.99	-.73	.35	.71	.54	-.70	-.12	-.68	-.48
5	99.99	99.99	.20	.46	1.01	.26	.04	-.27	-1.61	-1.33
6	99.99	99.99	99.99	99.99	1.57	1.28	-.18	.40	-1.92	-.40

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	1.41	.16	.50	.96	.17	-.29	-.95	-.59	-.90	-.54
2	-.03	.46	-.31	.03	.50	.10	.34	-.22	.61	.00
3	.05	.24	.90	.04	.10	-.07	.23	.09	-.07	.00
4	.23	.54	.47	1.03	-.15	-.51	-.15	.37	.14	-.87
5	.35	-.27	.25	.90	1.01	-.01	-.49	-.12	.01	-.38
6	-1.63	.05	.06	1.59	.28	-.02	-.70	.11	.10	-1.25

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
Mean Log q	-10.0754	-9.0205	-8.7931	-9.0659	-9.0270	-9.0270
S.E(Log q)	.7357	.5073	.3493	.5682	.6970	1.0158

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	.58	3.894	9.25	.84	18	.31	-10.08
2	.84	1.104	8.82	.74	18	.42	-9.02
3	1.14	-1.113	9.06	.81	18	.39	-8.79
4	.79	1.368	8.36	.73	18	.44	-9.07
5	.87	.514	8.44	.48	18	.62	-9.03
6	.75	.671	7.70	.33	16	.77	-9.07

1

Fleet : IR-7J-OT Irish otter

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	.01	.28
2	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	.30	.09
3	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-.03	.99
4	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	.25	.68
5	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-.81	.50
6	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	.08	.93

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	-.04	.19	-1.11	-.06	.05	.41	-1.00	-.44	.12	1.61
2	.48	.30	-.32	-.29	.10	-.23	-.73	.19	-.29	.38
3	.62	-.11	.23	-.04	-.14	-.41	-.39	-.98	.28	-.03
4	.33	.60	.65	.19	.07	.06	-1.74	-1.43	-.47	.80
5	.33	.95	.46	.90	.02	-.55	-.29	-2.52	-.29	1.28
6	-.96	1.50	.12	.84	-.33	-.43	-1.98	99.99	99.99	-1.22

Table 4.1.9 continued

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
Mean Log q	-9.6912	-8.2546	-8.3850	-8.4681	-9.1612	-9.1612
S.E(Log q)	.6975	.3653	.5061	.8199	1.0193	1.0782

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	.91	.341	9.53	.57	12	.66	-9.69
2	.82	1.590	8.16	.89	12	.28	-8.25
3	.77	1.466	7.98	.80	12	.37	-8.39
4	1.18	-.384	9.00	.31	12	1.01	-8.47
5	1.13	-.179	9.75	.16	12	1.20	-9.16
6	.43	1.577	6.11	.49	10	.43	-9.31

1

Fleet : UK-WCGFS West Coast

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	99.99	99.99	99.99	99.99	99.99	-.20	-.67	1.29	1.48	-.48
2	99.99	99.99	99.99	99.99	99.99	.39	.40	-.36	.97	.46
3	99.99	99.99	99.99	99.99	99.99	-.89	.60	.66	-.28	.95
4	99.99	99.99	99.99	99.99	99.99	-.35	1.21	.71	.31	.42
5	99.99	99.99	99.99	99.99	99.99	-.39	-.06	1.25	.60	.74
6	No data for this fleet at this age									

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	.22	.23	-1.25	-.13	-.58	-1.14	99.99	1.23	99.99	99.99
2	-.04	-.49	-.34	99.99	-1.35	.46	-.10	99.99	99.99	99.99
3	.27	.13	-1.93	-1.12	.66	.33	.89	-.27	99.99	99.99
4	-.58	-.17	-.46	-1.35	-1.40	.64	-.18	1.20	99.99	99.99
5	-1.10	.11	-.86	-.18	-.87	-.33	.58	.51	99.99	99.99
6	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
Mean Log q	-8.9645	-8.0278	-7.4625	-7.2303	-7.1568
S.E(Log q)	.9244	.6312	.8665	.8460	.7124

Table 4.1.9 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
1,	.60,	1.631,	8.71,	.63,	12,	.52,	-8.96,
2,	.72,	1.040,	8.05,	.61,	11,	.46,	-8.03,
3,	.71,	1.033,	7.29,	.54,	13,	.62,	-7.46,
4,	1.10,	-.189,	7.39,	.24,	13,	.97,	-7.23,
5,	1.16,	-.322,	7.57,	.27,	13,	.86,	-7.16,

1

Fleet : FR-EVHOE Groundfish

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	-.68	.03	.58	.89	.63	-1.13	-.17	-.86	.42	.28
2	-.82	.72	.27	-.37	-.48	.18	-.51	.86	.19	-.02
3	.07	.25	.44	.11	-.77	-.35	-.21	.13	.31	99.99
4	.17	-.20	-1.17	.11	.12	99.99	.02	.00	99.99	.95
5	.28	-.01	.36	-.62	-.08	-.06	-.31	-.48	-.07	.99
6	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
Mean Log q,	-9.2909,	-8.6431,	-7.6509,	-7.6932,	-7.4030,
S.E(Log q),	.6908,	.5480,	.3803,	.5805,	.4594,

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,	.78,	.851,	8.98,	.66,	10,	.55,	-9.29,
2,	1.14,	-.447,	8.79,	.57,	10,	.65,	-8.64,
3,	.94,	.320,	7.59,	.81,	9,	.38,	-7.65,
4,	1.92,	-1.464,	9.60,	.30,	8,	1.03,	-7.69,
5,	1.22,	-.536,	8.03,	.44,	10,	.58,	-7.40,

1

Fleet : IrGFS-VIIgj combined

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	99.99	99.99	99.99	99.99	99.99	99.99	-.37	-.55	.39	.53
2	99.99	99.99	99.99	99.99	99.99	99.99	.52	.12	-.33	-.31
3	99.99	99.99	99.99	99.99	99.99	99.99	.67	-.18	.27	-.75
4	99.99	99.99	99.99	99.99	99.99	99.99	.65	-.65	99.99	99.99
5	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
6	No data for this fleet at this age									

Table 4.1.9 continued

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
Mean Log q,	-7.9285,	-8.0031,	-8.0768,	-8.1378,	.0000,
S.E(Log q),	.5394,	.4057,	.6086,	.9239,	.0000,

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,	.79,	.312,	7.81,	.53,	4,	.51,	-7.93,
2,	2.19,	-.986,	9.17,	.26,	4,	.89,	-8.00,
3,	.75,	.605,	7.60,	.75,	4,	.51,	-8.08,
4,	.00,	.000,	.00,	.00,	0,	.00,	.00,
5,	.00,	.000,	.00,	.00,	0,	.00,	.00,

1

Terminal year survivor and F summaries :

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

Year class = 2005

Fleet,	Estimated,	Int,	Ext,	Var,	N,	Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	,	Weights,	F
FR-GADOIDQ2+3+4 traw,	733.,	.531,	.000,	.00,	1,	.234,	.176
FR-NEPHROPS trawlers,	284.,	.679,	.000,	.00,	1,	.143,	.404
UK-WECOT (E+W) Otter,	573.,	.756,	.000,	.00,	1,	.115,	.220
IR-7J-OT Irish otter,	4927.,	.726,	.000,	.00,	1,	.125,	.028
UK-WCGFS West Coast ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FR-EVHOE Groundfish ,	1299.,	.725,	.000,	.00,	1,	.126,	.103
IrGFS-VIIgj combined,	1671.,	.603,	.000,	.00,	1,	.181,	.081
F shrinkage mean ,	691.,	1.00,,,,				.075,	.186

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
981.,	.26,	.33,	7,	1.295,	.134

1

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-GADOIDQ2+3+4 traw,	537.,	.299,	.501,	1.68,	2,	.211,	.833
FR-NEPHROPS trawlers,	871.,	.279,	.097,	.35,	2,	.246,	.589
UK-WECOT (E+W) Otter,	553.,	.430,	.406,	.94,	2,	.102,	.817
IR-7J-OT Irish otter,	1002.,	.337,	.105,	.31,	2,	.168,	.529
UK-WCGFS West Coast ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FR-EVHOE Groundfish ,	825.,	.451,	.212,	.47,	2,	.092,	.614
IrGFS-VIIgj combined,	663.,	.363,	.329,	.91,	2,	.142,	.720
F shrinkage mean ,	497.,	1.00,,,,				.039,	.878

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
720.,	.14,	.11,	13,	.807,	.678

Table 4.1.9 continued

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

Year class = 2003

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FR-GADOIDQ2+3+4 traw,	176.,	.260,	.070,	.27,	3,	.210,	.818
FR-NEPHROPS trawlers,	250.,	.231,	.079,	.34,	3,	.278,	.637
UK-WECOT (E+W) Otter,	196.,	.294,	.198,	.67,	3,	.188,	.760
IR-7J-OT Irish otter,	154.,	.310,	.106,	.34,	3,	.138,	.896
UK-WCGFS West Coast ,	628.,	.962,	.000,	.00,	1,	.007,	.303
FR-EVHOE Groundfish ,	155.,	.453,	.494,	1.09,	2,	.038,	.889
IrGFS-VIIgj combined,	106.,	.351,	.135,	.38,	3,	.100,	1.129
F shrinkage mean ,	128.,	1.00,,,,				.042,	1.009

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
183.,	.12,	.08,	19,	.648,	.796

1

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-GADOIDQ2+3+4 traw,	30.,	.246,	.073,	.30,	4,	.260,	.541
FR-NEPHROPS trawlers,	43.,	.220,	.078,	.35,	4,	.323,	.410
UK-WECOT (E+W) Otter,	23.,	.306,	.228,	.75,	4,	.138,	.658
IR-7J-OT Irish otter,	53.,	.350,	.257,	.73,	4,	.086,	.345
UK-WCGFS West Coast ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FR-EVHOE Groundfish ,	71.,	.333,	.202,	.61,	4,	.118,	.268
IrGFS-VIIgj combined,	41.,	.346,	.165,	.48,	3,	.042,	.428
F shrinkage mean ,	15.,	1.00,,,,				.033,	.901

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
37.,	.12,	.09,	24,	.772,	.457

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-GADOIDQ2+3+4 traw,	21.,	.211,	.126,	.60,	5,	.344,	.466
FR-NEPHROPS trawlers,	27.,	.208,	.096,	.46,	5,	.316,	.382
UK-WECOT (E+W) Otter,	24.,	.321,	.125,	.39,	5,	.107,	.424
IR-7J-OT Irish otter,	23.,	.399,	.468,	1.17,	5,	.059,	.433
UK-WCGFS West Coast ,	18.,	.526,	.237,	.45,	3,	.010,	.526
FR-EVHOE Groundfish ,	51.,	.359,	.294,	.82,	4,	.118,	.221
IrGFS-VIIgj combined,	30.,	.421,	.350,	.83,	2,	.017,	.357
F shrinkage mean ,	9.,	1.00,,,,				.030,	.851

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
26.,	.12,	.09,	30,	.747,	.403

Table 4.1.9 continued

1

Age 6 Catchability constant w.r.t. time and age (fixed at the value for age) 5

Year class = 2000

Fleet,	Estimated,	Int,	Ext,	Var,	N,	Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	,	Weights,	F
FR-GADOIDQ2+3+4 traw,	18.,	.200,	.183,	.92,	6,	.401,	.495
FR-NEPHROPS trawlers,	30.,	.205,	.146,	.71,	6,	.381,	.334
UK-WECOT (E+W) Otter,	17.,	.410,	.295,	.72,	6,	.064,	.536
IR-7J-OT Irish otter,	9.,	.545,	.222,	.41,	6,	.040,	.815
UK-WCGFS West Coast ,	56.,	.592,	.252,	.43,	4,	.009,	.190
FR-EVHOE Groundfish ,	20.,	.349,	.050,	.14,	5,	.066,	.457
IrGFS-VIIgj combined,	20.,	.696,	.656,	.94,	2,	.006,	.459
F shrinkage mean ,	16.,	1.00,,,,				.033,	.557

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
22.,	.12,	.08,	36,	.674,	.435

1

Table 4.1.10 Cod in VII e-k Fishing mortality at age

1

Run title : Cod in Divisions VIIe-k,southern 07,index file

At 28/06/2007 15:40

Table 8 Fishing mortality (F) at age

YEAR,	1971,	1972,	1973,	1974,	1975,	1976,
AGE						
1,	.3018,	.0078,	.2489,	.0022,	.2123,	.0480,
2,	.8089,	.6151,	.8558,	.2652,	.4590,	.9806,
3,	.7095,	.4510,	.6236,	.3238,	.3657,	.3843,
4,	.6012,	.6242,	.4775,	.4472,	1.2459,	.3739,
5,	.3938,	.6386,	.4815,	.6413,	.9491,	.7882,
6,	.5730,	.5761,	.5318,	.4744,	.8626,	.5196,
+gp,	.5730,	.5761,	.5318,	.4744,	.8626,	.5196,
0 FBAR 2- 5,	.6284,	.5822,	.6096,	.4194,	.7549,	.6318,

Table 8 Fishing mortality (F) at age

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	.0163,	.1379,	.1209,	.0889,	.1095,	.0649,	.3673,	.2085,	.2302,	.2518,
2,	.6737,	.5073,	.3964,	.5707,	.8571,	.7319,	.8431,	.7143,	.6509,	.8377,
3,	.4003,	.4528,	.5571,	.6432,	.9900,	.6475,	.9547,	.5268,	.6722,	.9305,
4,	.1517,	.3503,	.4601,	.9312,	.8960,	.5629,	.7576,	.4316,	.4871,	1.0203,
5,	.3718,	.3103,	.6149,	.7889,	.5797,	.5390,	.5457,	.3665,	.3173,	.4732,
6,	.3097,	.3736,	.5485,	.7957,	.8304,	.5881,	.7111,	.2921,	.3151,	.4361,
+gp,	.3097,	.3736,	.5485,	.7957,	.8304,	.5881,	.7111,	.2921,	.3151,	.4361,
0 FBAR 2- 5,	.3994,	.4052,	.5071,	.7335,	.8307,	.6203,	.7753,	.5098,	.5319,	.8154,

Run title : Cod in Divisions VIIe-k,southern 07,index file

At 28/06/2007 15:40

Table 8 Fishing mortality (F) at age

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	.2021,	.2837,	.3507,	.1630,	.2281,	.2302,	.1424,	.1807,	.1573,	.1538,
2,	.7099,	.7835,	.8620,	1.0550,	.9704,	.8944,	.7398,	.6388,	.9147,	.8401,
3,	.7998,	.5571,	1.0863,	1.0130,	.9647,	1.0132,	.9944,	1.1292,	.6719,	1.0787,
4,	1.1932,	.5875,	.5517,	1.0225,	1.2131,	.8083,	.7227,	.8635,	.9303,	.7047,
5,	.7527,	.7265,	.8330,	.6477,	1.0957,	.9480,	.8435,	.5843,	.6424,	.9868,
6,	.6786,	.6246,	.7140,	.5677,	1.1275,	1.0079,	.7422,	1.1209,	.6289,	1.0450,
+gp,	.6786,	.6246,	.7140,	.5677,	1.1275,	1.0079,	.7422,	1.1209,	.6289,	1.0450,
0 FBAR 2- 5,	.8639,	.6636,	.8333,	.9345,	1.0610,	.9160,	.8251,	.8040,	.7898,	.9026,

Table 8 Fishing mortality (F) at age

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,	FBAR 04-06
AGE											
1,	.2219,	.2426,	.4155,	.3001,	.2257,	.1815,	.1597,	.2134,	.1447,	.1344,	.1642,
2,	.9553,	1.0563,	.9134,	.8880,	.9140,	.9073,	.9529,	.7598,	.8081,	.6783,	.7488,
3,	1.1405,	1.1077,	1.1411,	1.1073,	.7175,	1.1562,	1.2330,	.8632,	1.0170,	.7957,	.8920,
4,	.8847,	1.1853,	.9424,	.8714,	.8647,	.9727,	.9939,	.9173,	.7073,	.4572,	.6939,
5,	.5936,	.8652,	1.0341,	.7609,	1.2153,	.8329,	.6100,	.8472,	.7042,	.4032,	.6516,
6,	.6462,	1.3563,	.9441,	1.0159,	.9197,	.6862,	.5675,	.7930,	.4108,	.4352,	.5463,
+gp,	.6462,	1.3563,	.9441,	1.0159,	.9197,	.6862,	.5675,	.7930,	.4108,	.4352,	
0 FBAR 2- 5,	.8935,	1.0536,	1.0078,	.9069,	.9279,	.9673,	.9475,	.8469,	.8092,	.5836,	

Table 4.1.11 Cod in VII e-k Stock numbers at age
1

Run title : Cod in Divisions VIIe-k,southern 07,index file

At 28/06/2007 15:40

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

	YEAR,	1971,	1972,	1973,	1974,	1975,	1976,
	AGE						
	1,	3075,	565,	1665,	500,	3889,	1202,
	2,	919,	1862,	459,	1063,	408,	2575,
	3,	1212,	335,	824,	160,	667,	211,
	4,	235,	488,	175,	362,	95,	379,
	5,	119,	105,	214,	89,	189,	22,
	6,	43,	66,	46,	108,	38,	60,
	+gp,	28,	42,	29,	104,	62,	19,
0	TOTAL,	5630,	3464,	3412,	2385,	5349,	4468,

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

	YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
	AGE										
	1,	1714,	1690,	4249,	7910,	3357,	1338,	4620,	4327,	3903,	3232,
	2,	938,	1380,	1206,	3083,	5925,	2464,	1026,	2620,	2876,	2538,
	3,	791,	391,	681,	664,	1426,	2059,	970,	362,	1050,	1228,
	4,	118,	434,	204,	319,	286,	434,	882,	306,	175,	439,
	5,	214,	83,	250,	105,	103,	95,	202,	339,	163,	88,
	6,	8,	121,	50,	111,	39,	47,	46,	96,	192,	97,
	+gp,	70,	70,	83,	28,	23,	12,	24,	22,	61,	53,
0	TOTAL,	3852,	4170,	6722,	12220,	11160,	6449,	7770,	8071,	8419,	7675,

Run title : Cod in Divisions VIIe-k,southern 07,index file

At 28/06/2007 15:40

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,	16555,	8189,	2488,	2645,	7461,	7707,	2282,	8958,	6249,	4784,
	2,	2057,	11074,	5049,	1434,	1840,	4863,	5012,	1620,	6122,	4371,
	3,	899,	828,	4142,	1746,	409,	571,	1628,	1958,	700,	2008,
	4,	397,	331,	388,	1144,	519,	128,	170,	493,	518,	293,
	5,	130,	98,	151,	183,	337,	126,	47,	67,	170,	167,
	6,	45,	50,	39,	54,	78,	92,	40,	16,	31,	73,
	+gp,	33,	19,	24,	40,	22,	29,	33,	27,	12,	7,
0	TOTAL,	20116,	20589,	12280,	7247,	10667,	13515,	9211,	13140,	13802,	11704,

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 04-**	AMST 71-04*
	AGE													
	1,	6575,	3278,	1612,	7218,	5968,	1552,	913,	2053,	2445,	1371,	0,	3164,	4227,
	2,	3359,	4312,	2106,	871,	4378,	3899,	1060,	637,	1358,	1732,	981,	2117,	2806,
	3,	1545,	1058,	1228,	692,	294,	1437,	1288,	335,	244,	495,	720,	833,	1053,
	4,	559,	404,	286,	321,	187,	117,	370,	307,	116,	72,	183,	311,	361,
	5,	119,	189,	101,	91,	110,	65,	36,	112,	101,	47,	37,	119,	138,
	6,	51,	54,	65,	29,	35,	27,	23,	16,	39,	41,	26,	49,	58,
	+gp,	14,	12,	25,	24,	34,	24,	15,	14,	7,	16,	30,		
0	TOTAL,	12221,	9307,	5423,	9246,	11005,	7120,	3706,	3475,	4309,	3774,	1977,		

Table 4.1.12

1
Run title : Cod in Divisions VIIe-k,southern 07,index file
,

At 28/06/2007 15:40

Table 16 Summary (without SOP correction)

,	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 2- 5,
1971,	3075,	12742,	8928,	5782,	.6476,	.6284,
1972,	565,	10984,	8225,	4737,	.5759,	.5822,
1973,	1665,	9815,	7669,	4015,	.5236,	.6096,
1974,	500,	9128,	7412,	2898,	.3910,	.4194,
1975,	3889,	10064,	6630,	3993,	.6023,	.7549,
1976,	1202,	10100,	6304,	4818,	.7643,	.6318,
1977,	1714,	10321,	7691,	3059,	.3977,	.3994,
1978,	1690,	11631,	8625,	3647,	.4229,	.4052,
1979,	4249,	13512,	8945,	4650,	.5199,	.5071,
1980,	7910,	18457,	9459,	7243,	.7657,	.7335,
1981,	3357,	18083,	10360,	10597,	1.0228,	.8307,
1982,	1338,	17496,	13055,	8766,	.6714,	.6203,
1983,	4620,	17774,	13478,	9641,	.7153,	.7753,
1984,	4327,	16115,	10391,	6631,	.6382,	.5098,
1985,	3903,	20188,	13458,	8317,	.6180,	.5319,
1986,	3232,	19171,	13449,	10475,	.7789,	.8154,
1987,	16555,	22678,	10803,	10228,	.9468,	.8639,
1988,	8189,	33846,	14771,	17191,	1.1639,	.6636,
1989,	2488,	33388,	24145,	19809,	.8204,	.8333,
1990,	2645,	22772,	18027,	12749,	.7072,	.9345,
1991,	7461,	16252,	10013,	9336,	.9324,	1.0610,
1992,	7707,	17564,	8145,	9747,	1.1966,	.9160,
1993,	2282,	17837,	11016,	10425,	.9464,	.8251,
1994,	8958,	21504,	13018,	10620,	.8158,	.8040,
1995,	6249,	21617,	11735,	11709,	.9978,	.7898,
1996,	4784,	22358,	14412,	12681,	.8799,	.9026,
1997,	6575,	19934,	12857,	12035,	.9361,	.8935,
1998,	3278,	16842,	11220,	11431,	1.0188,	1.0536,
1999,	1612,	13745,	9689,	8594,	.8870,	1.0078,
2000,	7218,	12009,	6530,	6536,	1.0009,	.9069,
2001,	5968,	15043,	7108,	8308,	1.1689,	.9279,
2002,	1552,	13882,	9462,	9356,	.9888,	.9673,
2003,	913,	10352,	8194,	6420,	.7835,	.9475,
2004,	2053,	6997,	4736,	3672,	.7753,	.8469,
2005,	2445,	6844,	3832,	3128,	.8162,	.8092,
2006,	1371,	6885,	4228,	3317,	.7845,	.5836,
Arith. Mean ,	4098,	16054,	10223,	8238,	.7951,	.7581,
0 Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

1

Table 4.1.13 **Cod in VII e-k** **Input values for the predictions**

MFDP version 1a
Run: COD
Time and date: 19:28 28/06/2007
Fbar age range: 2-5

Input: F mean 04-06 unscaled
Catch and stock weights are mean 04-06
Recruits age 1 in 2007, 2008 and 2009 = GM (02-05)

2007

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
1	1633	0.2	0	0	0	0.650	0.164	0.824
2	981	0.2	0.39	0	0	1.515	0.749	2.091
3	720	0.2	0.87	0	0	3.978	0.892	4.350
4	183	0.2	0.93	0	0	6.494	0.694	6.867
5	37	0.2	1	0	0	9.039	0.652	9.240
6	26	0.2	1	0	0	10.996	0.546	11.331
7	30	0.2	1	0	0	11.909	0.546	11.759

2008

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
1	1633	0.2	0	0	0	0.650	0.164	0.824
2 .		0.2	0.39	0	0	1.515	0.749	2.091
3 .		0.2	0.87	0	0	3.978	0.892	4.350
4 .		0.2	0.93	0	0	6.494	0.694	6.867
5 .		0.2	1	0	0	9.039	0.652	9.240
6 .		0.2	1	0	0	10.996	0.546	11.331
7 .		0.2	1	0	0	11.909	0.546	11.759

2009

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
1	1633	0.2	0	0	0	0.650	0.164	0.824
2 .		0.2	0.39	0	0	1.515	0.749	2.091
3 .		0.2	0.87	0	0	3.978	0.892	4.350
4 .		0.2	0.93	0	0	6.494	0.694	6.867
5 .		0.2	1	0	0	9.039	0.652	9.240
6 .		0.2	1	0	0	10.996	0.546	11.331
7 .		0.2	1	0	0	11.909	0.546	11.759

Input units are thousands and kg - output in tonnes

Table 4.1.14 Cod in VII e-k. Management option table

MFDP version 1a
Run: COD
TestProjection index file 15/3/99.
Time and date: 19:28 28/06/2007
Fbar age range: 2-5

2007				
Biomass	SSB	FMult	FBar	Landings
7578	5154	1	0.7465	3853

2008					2009	
Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
7027	4611	0	0	0	11677	8758
.	4611	0.1	0.0747	467	11021	8168
.	4611	0.2	0.1493	903	10411	7622
.	4611	0.3	0.224	1309	9844	7114
.	4611	0.4	0.2986	1687	9317	6643
.	4611	0.5	0.3733	2040	8826	6206
.	4611	0.6	0.4479	2370	8370	5800
.	4611	0.7	0.5226	2677	7946	5422
.	4611	0.8	0.5972	2964	7551	5072
.	4611	0.9	0.6719	3233	7183	4747
.	4611	1	0.7465	3483	6840	4444
.	4611	1.1	0.8212	3717	6520	4163
.	4611	1.2	0.8959	3936	6222	3902
.	4611	1.3	0.9705	4141	5945	3659
.	4611	1.4	1.0452	4333	5686	3433
.	4611	1.5	1.1198	4513	5444	3223
.	4611	1.6	1.1945	4681	5218	3028
.	4611	1.7	1.2691	4839	5007	2846
.	4611	1.8	1.3438	4987	4810	2676
.	4611	1.9	1.4184	5126	4626	2518
.	4611	2	1.4931	5256	4454	2371
F=Fpa	**4611**	**0.911**	**0.68**	**3261**	**7144**	**4712**

Input units are thousands and kg - output in tonnes

F multiplier corresponding to Fpa = 0.911
Bpa= 8 800 t

Table 4.1.15 **Cod in VII e-k. Single option table**

MFDP version 1a
Run: COD
Time and date: 19:28 28/06/2007
Fbar age range: 2-5

Year:	2007	F multiplier:	1	Fbar:	0.7465				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0.1642	225	185	1633	1061	0	0	0	0
2	0.7487	474	992	981	1487	383	580	383	580
3	0.892	391	1700	720	2864	626	2492	626	2492
4	0.6939	84	577	183	1188	170	1105	170	1105
5	0.6515	16	150	37	334	37	334	37	334
6	0.5463	10	113	26	286	26	286	26	286
7	0.5463	12	136	30	357	30	357	30	357
Total		1212	3853	3610	7578	1272	5154	1272	5154

Year:	2008	F multiplier:	1	Fbar:	0.7465				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0.1642	225	185	1633	1061	0	0	0	0
2	0.7487	549	1147	1135	1719	442	671	442	671
3	0.892	206	897	380	1511	330	1315	330	1315
4	0.6939	111	761	242	1569	225	1459	225	1459
5	0.6515	33	303	75	677	75	677	75	677
6	0.5463	6	69	16	174	16	174	16	174
7	0.5463	10	120	27	316	27	316	27	316
Total		1140	3483	3506	7027	1115	4611	1115	4611

Year:	2009	F multiplier:	1	Fbar:	0.7465				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0.1642	225	185	1633	1061	0	0	0	0
2	0.7487	549	1147	1135	1719	442	671	442	671
3	0.892	238	1037	439	1748	382	1520	382	1520
4	0.6939	58	402	127	828	119	770	119	770
5	0.6515	43	401	99	893	99	893	99	893
6	0.5463	12	139	32	351	32	351	32	351
7	0.5463	8	91	20	239	20	239	20	239
Total		1134	3402	3485	6840	1094	4444	1094	4444

Input units are thousands and kg - output in tonnes

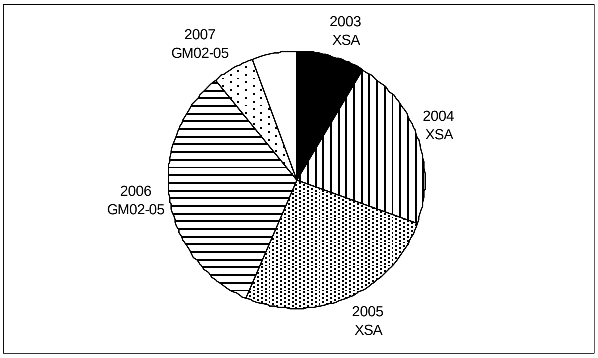
Table 4.1.16 **Cod in VII e-k**
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class			2003	2004	2005	2006	2007
Stock No. (thousands) of 1 year-olds			2053	2445	1371	1633	1633
Source			XSA	XSA	XSA	GM02-05	GM02-05
Status Quo F:							
% in	2007	landings	15.0	44.1	25.7	4.8	-
% in	2008		8.7	21.9	25.8	32.9	5.3
% in	2007	SSB	21.4	48.4	11.3	0.0	-
% in	2008	SSB	14.7	31.6	28.5	14.5	0.0
% in	2009	SSB	7.9	20.1	17.3	34.2	15.1

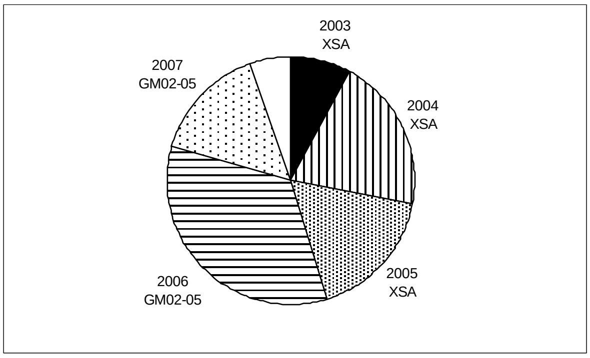
GM : geometric mean recruitment

Cod in VII e-k : Year-class % contribution to

a) 2008 landings



b) 2009 SSB



XSA	XSA	XSA	GM02-05	GM02-05
2003	2004	2005	2006	2007

Table 4.1.17 **Cod in VII e-k** **Yield per recruit summary table**

MFYPR version 2a
Run: yrs
Time and date: 20:10 28/06/2007
Yield per results

FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0	0	0	0	5.5167	36.0158	3.8917	34.0129	3.8917	34.0129
0.1	0.0747	0.2204	1.3769	4.4196	24.4204	2.8167	22.5012	2.8167	22.5012
0.2	0.1493	0.3569	1.9892	3.7423	17.6121	2.1597	15.7671	2.1597	15.7671
0.3	0.224	0.4484	2.2486	3.2895	13.303	1.7255	11.5238	1.7255	11.5238
0.4	0.2986	0.5136	2.3351	2.969	10.4268	1.4222	8.7063	1.4222	8.7063
0.5	0.3733	0.5619	2.3349	2.7323	8.4278	1.2014	6.7599	1.2014	6.7599
0.6	0.4479	0.5991	2.2919	2.5512	6.9927	1.0352	5.3719	1.0352	5.3719
0.7	0.5226	0.6285	2.2291	2.4088	5.934	0.9067	4.3559	0.9067	4.3559
0.8	0.5972	0.6524	2.1587	2.2941	5.1348	0.8051	3.5952	0.8051	3.5952
0.9	0.6719	0.6721	2.0874	2.1998	4.5189	0.7231	3.0144	0.7231	3.0144
1	0.7465	0.6888	2.0184	2.121	4.0355	0.6559	2.5632	0.6559	2.5632
1.1	0.8212	0.703	1.9534	2.054	3.65	0.5999	2.2069	0.5999	2.2069
1.2	0.8959	0.7153	1.8931	1.9964	3.3377	0.5527	1.9217	0.5527	1.9217
1.3	0.9705	0.7261	1.8375	1.9462	3.0814	0.5125	1.6903	0.5125	1.6903
1.4	1.0452	0.7356	1.7866	1.902	2.8683	0.4778	1.5004	0.4778	1.5004
1.5	1.1198	0.7442	1.74	1.8628	2.6891	0.4476	1.3427	0.4476	1.3427
1.6	1.1945	0.7519	1.6974	1.8276	2.5368	0.4212	1.2105	0.4212	1.2105
1.7	1.2691	0.7589	1.6584	1.7959	2.4062	0.3978	1.0986	0.3978	1.0986
1.8	1.3438	0.7653	1.6226	1.767	2.293	0.377	1.0031	0.377	1.0031
1.9	1.4184	0.7712	1.5897	1.7406	2.1942	0.3584	0.9209	0.3584	0.9209
2	1.4931	0.7766	1.5594	1.7164	2.1073	0.3417	0.8497	0.3417	0.8497

Reference poi	F multiplier	Absolute F
Fbar(2-5)	1	0.7465
FMax	0.4468	0.3336
F0.1	0.2733	0.204
F35%SPR	0.2891	0.2158

Weights in kilograms

Table 4.1.18 Cod in VII e-k
Input data for linear sensitivity

Label	Sens Value 2007	CV	Label	Value	CV
Number at age			Weight in the stock		
'N1'	1633	0.33	'WS1'	0.65	0.09
'N2'	981	0.14	'WS2'	1.515	0.12
'N3'	719	0.12	'WS3'	3.978	0.08
'N4'	183	0.12	'WS4'	6.494	0.07
'N5'	36	0.12	'WS5'	9.039	0.02
'N6'	25	0.12	'WS6'	10.996	0.07
'N7'	29	0.12	'WS7'	11.909	0.05
H.cons selectivity			Weight in the H.c. catch		
'sH1'	0.164	0.17	'WH1'	0.824	0.06
'sH2'	0.749	0.13	'WH2'	2.091	0.07
'sH3'	0.892	0.15	'WH3'	4.35	0.09
'sH4'	0.694	0.17	'WH4'	6.867	0.09
'sH5'	0.652	0.18	'WH5'	9.24	0.01
'sH6'	0.546	0.29	'WH6'	11.331	0.04
'sH7'	0.546	0.29	'WH7'	11.759	0.13
Natural mortality			Proportion mature		
'M1'	0.2	0.1	'MT1'	0	0.1
'M2'	0.2	0.1	'MT2'	0.39	0.1
'M3'	0.2	0.1	'MT3'	0.87	0.1
'M4'	0.2	0.1	'MT4'	0.93	0.1
'M5'	0.2	0.1	'MT5'	1	0.1
'M6'	0.2	0.1	'MT6'	1	0
'M7'	0.2	0.1	'MT7'	1	0
Relative effort in H.c. fishery			Year effect for natural mortality		
'HF07'	1	0.19	'K07'	1	0.1
'HF08'	1	0.19	'K08'	1	0.1
'HF09'	1	0.19	'K09'	1	0.1
Recruitment in 2007 and 2008					
'R08'	1633	0.81			
'R09'	1633	0.81			

Proportion of F before spawning = 0.0
Proportion of M before spawning = 0.0

Stock numbers in 2007 are VPA survivors.
These are overwritten at Age 1 (GM 02-05)

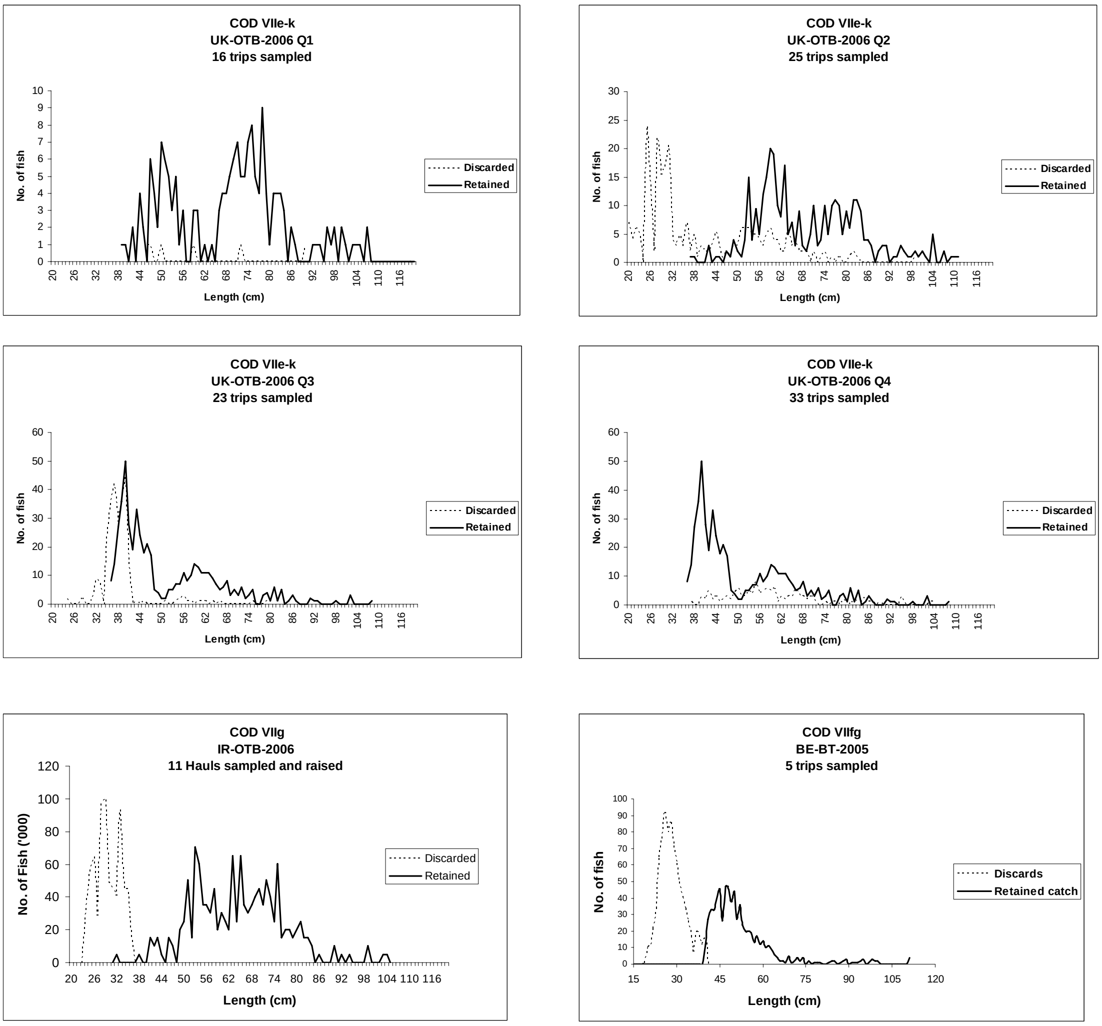


Figure 4.1.1.a Cod in Divisions VII e-k

2006 Quarterly or annual length compositions of UK, Irish discards

Raised using effort ratio for Irish data, from hauls sampled for UK

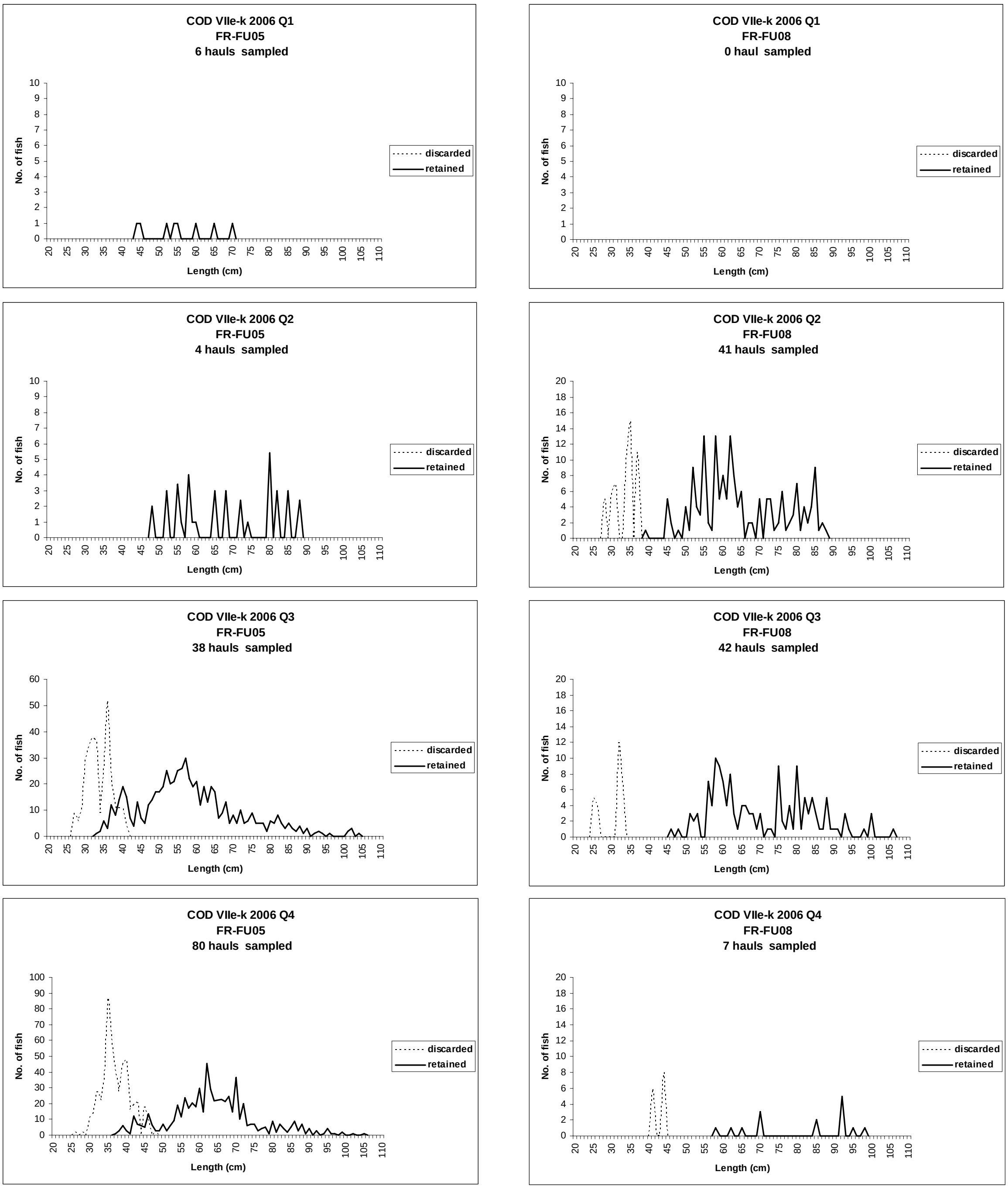


Figure 4.1.1.b **Cod in Divisions VII e-k**

2006 Quarterly length compositions of French discards, from hauls sampled

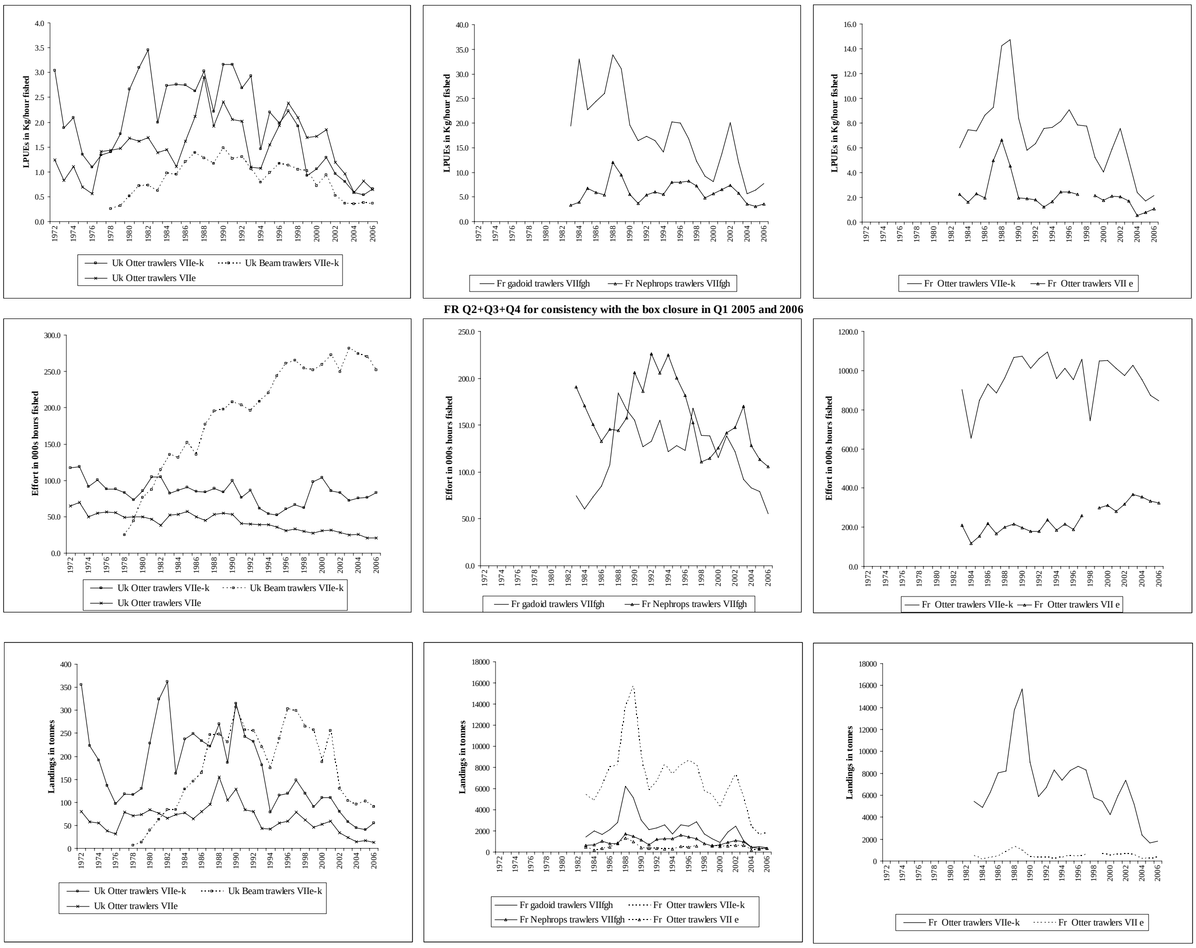


Figure 4.1.2 a Cod in VIIe-k LPUE, fishing effort and landings of some commercial fleets

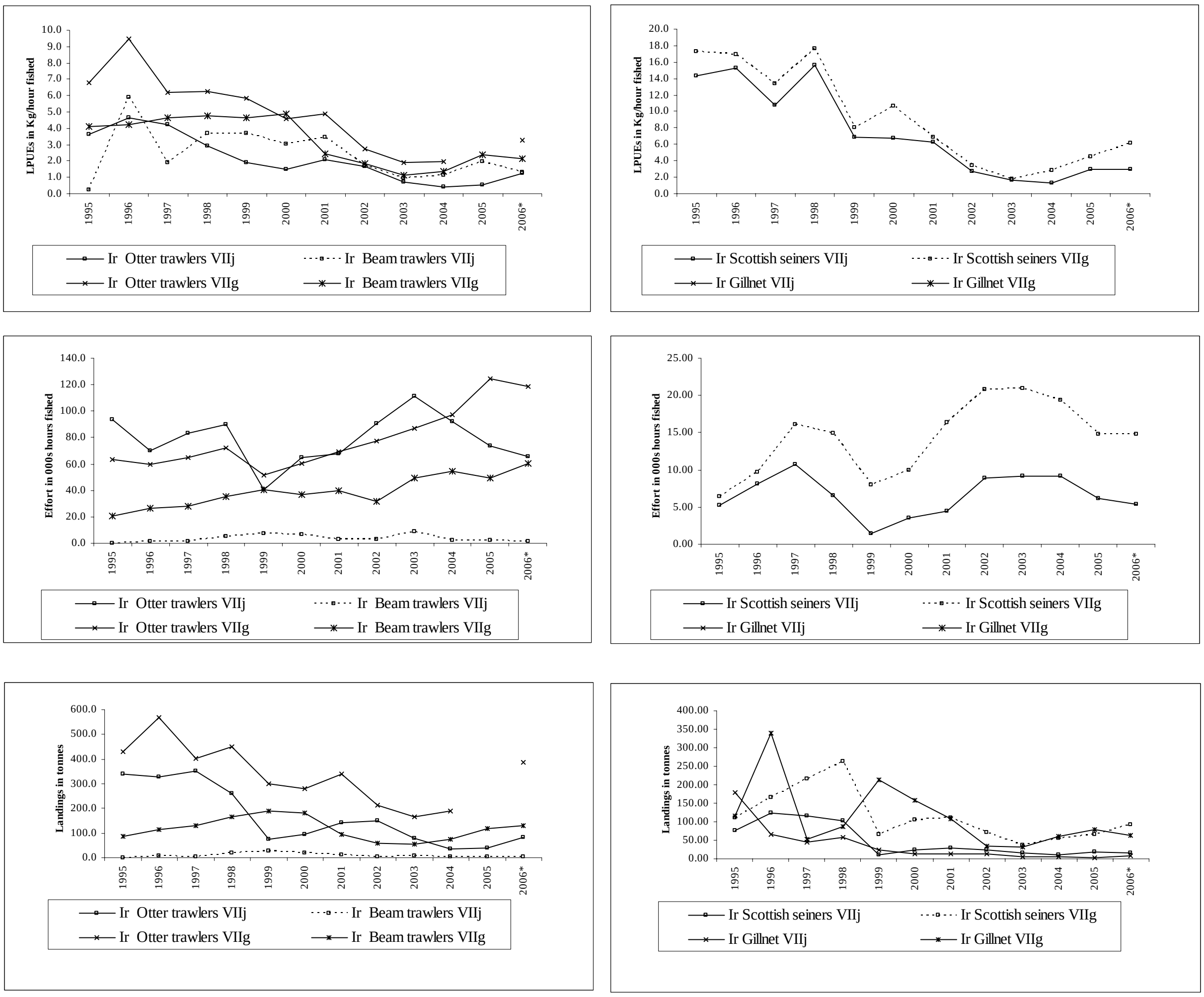


Figure 4.1.2 b Cod in VIIe-k LPUE, fishing effort and landings of some commercial fleets

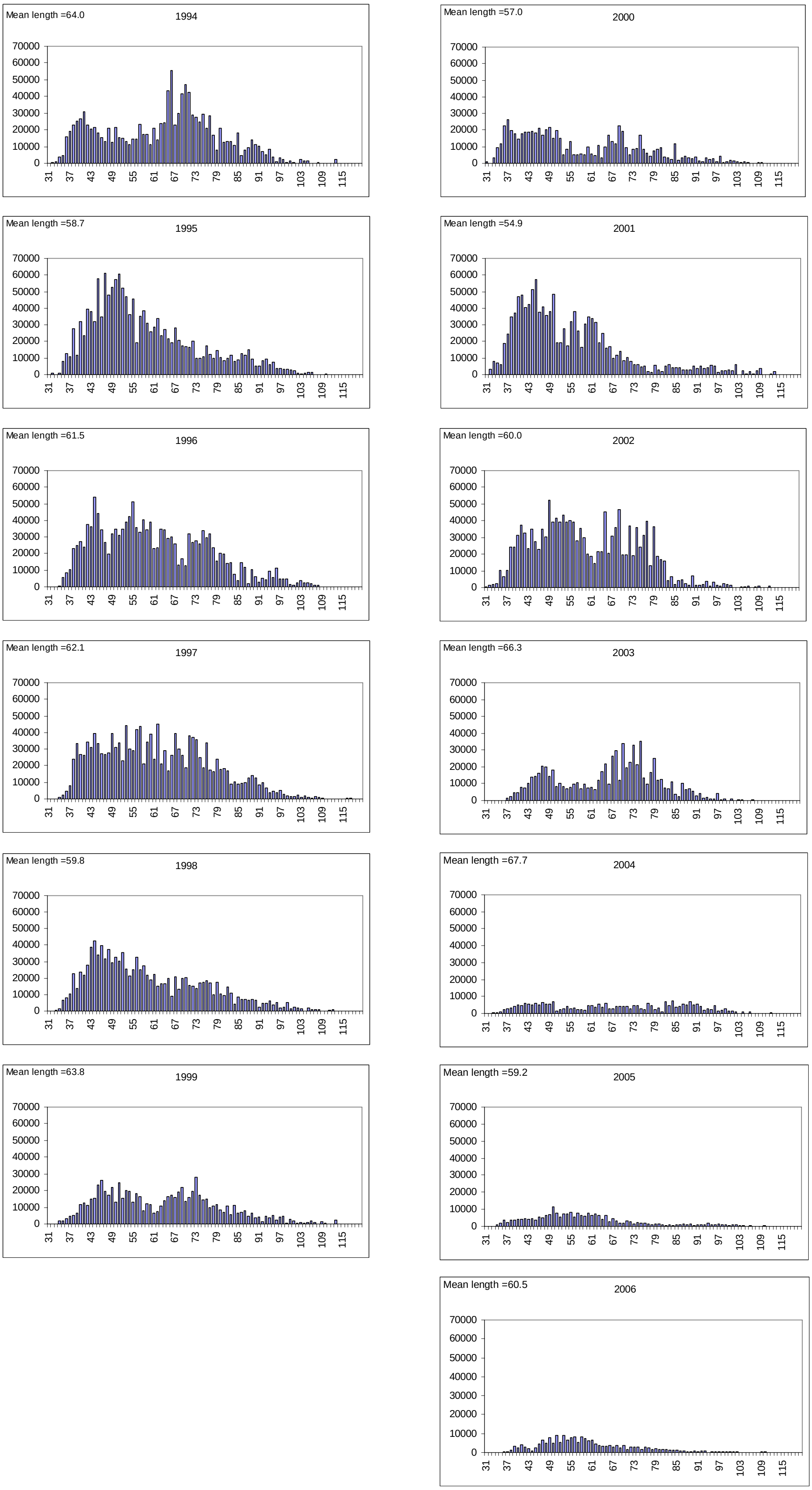


Figure 4.1.3 a Cod in Divisions VII-e-k Length distribution of FR-GADOID trawlers

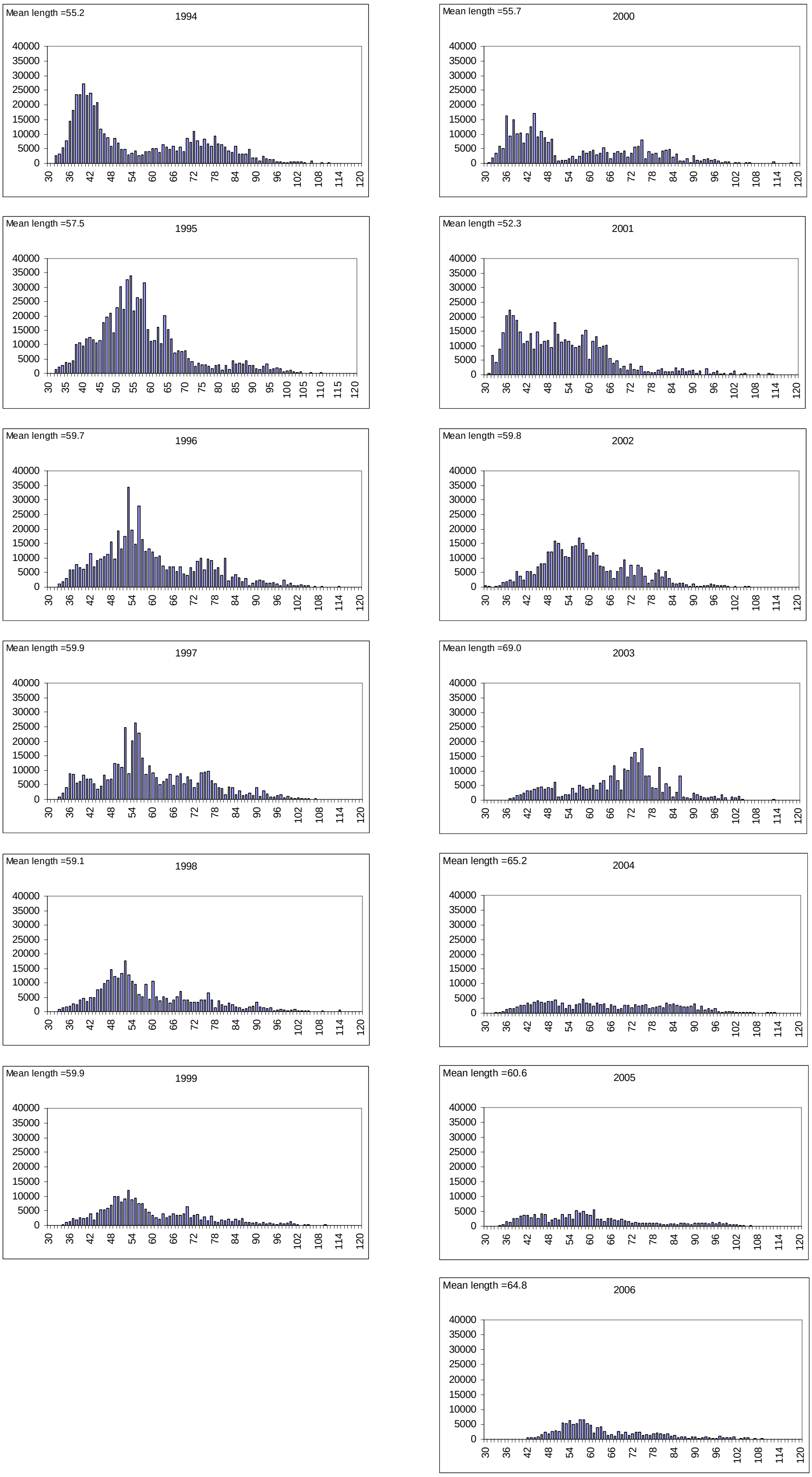


Figure 4.1.3b Cod in Divisions VIIe-k Length distribution of FR-NEPHROPS trawlers

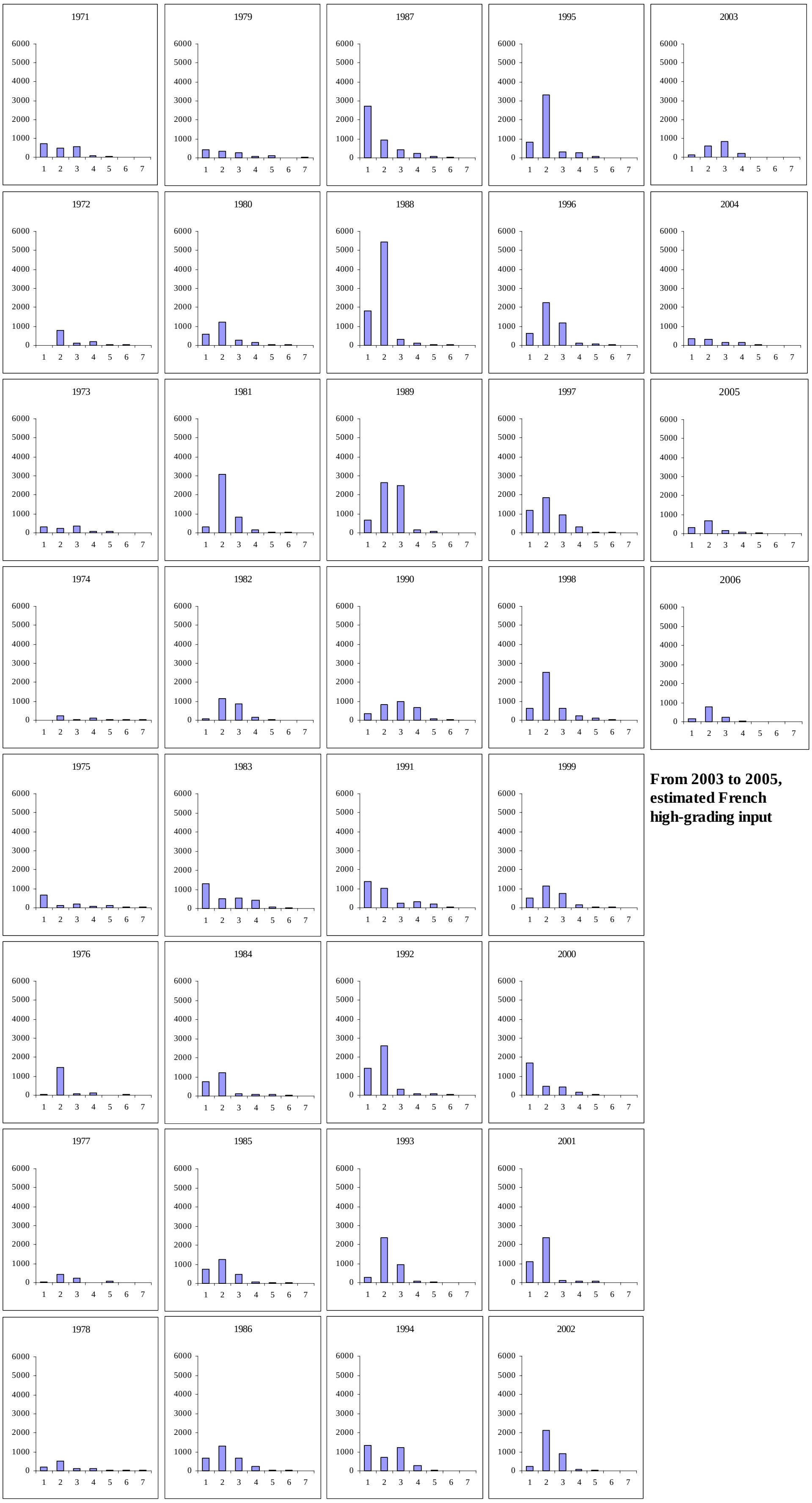


Figure 4.1.4 Cod VII e-k Catch numbers at age Numbers x10-3**

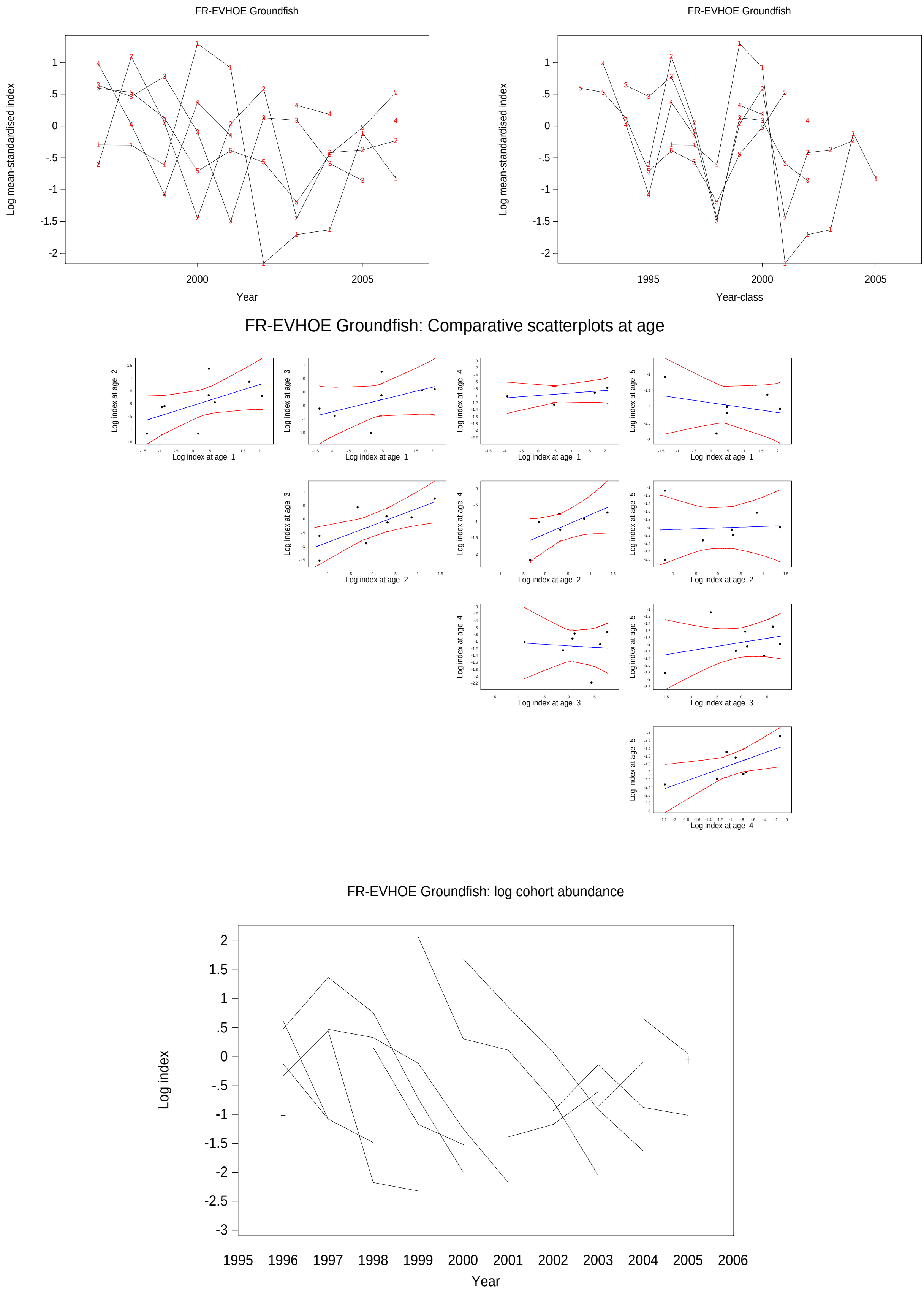
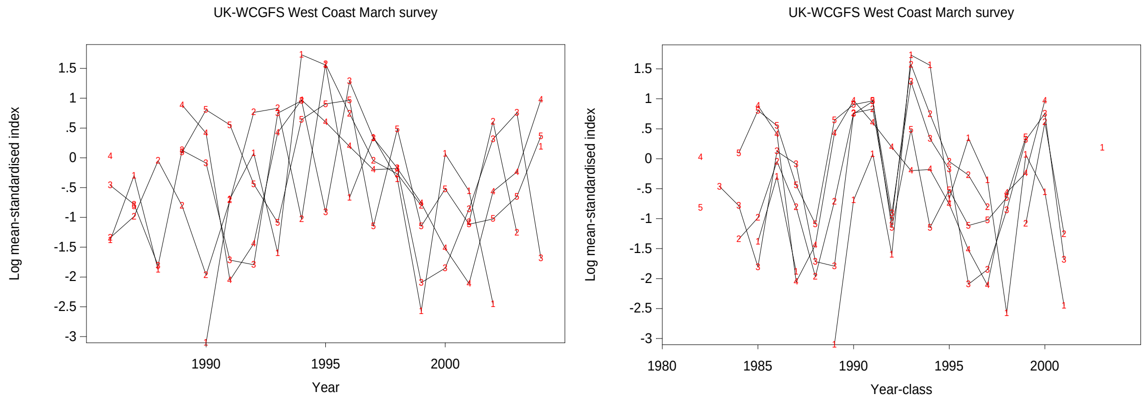
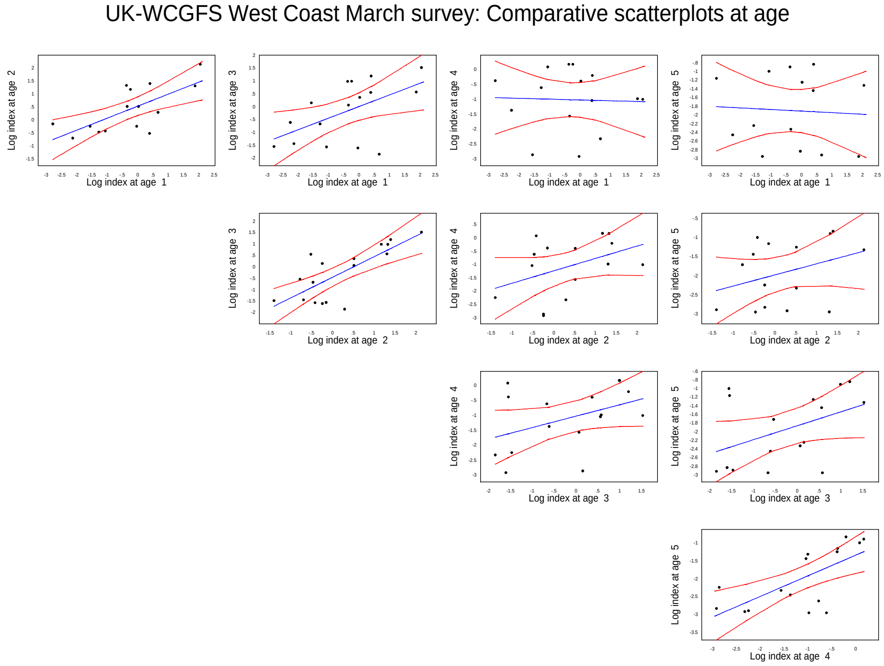


Figure 4.1.5(a). Cod in VII e-k. SURBA v3.0 plots for FR-EVHOE survey, age groups 1-5. Log mean-standardised indices by year and age-class; scatter plots and catch curves.





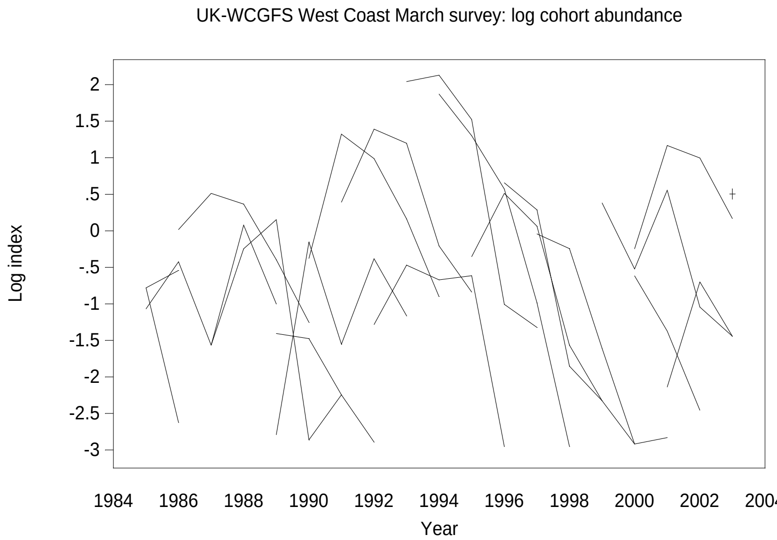


Figure 4.1.5(b). Cod in VII e-k. SURBA v3.0 plots for UK-WCGFS survey, age groups 1-5. Log mean-standardised indices by year and age-class; scatter plots and catch curves.

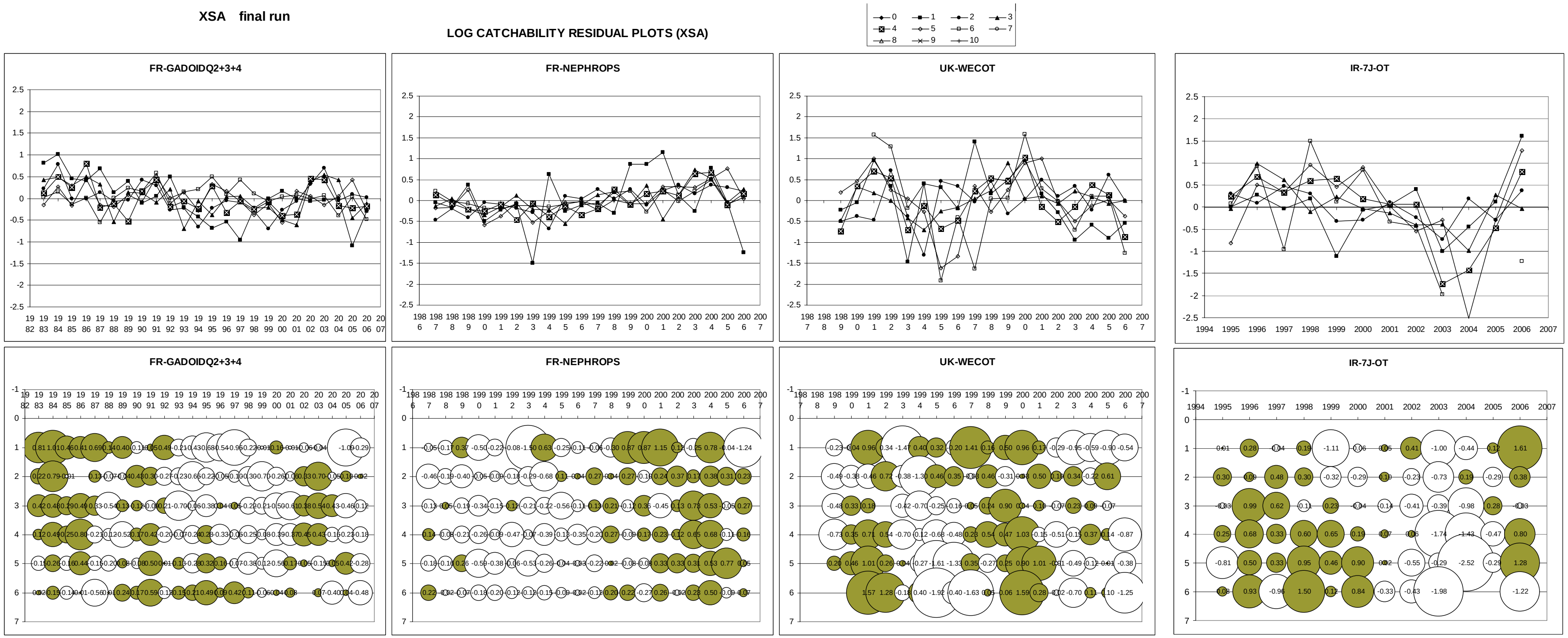


Figure 4.1.6 a **Cod in Divisions VII e-k**

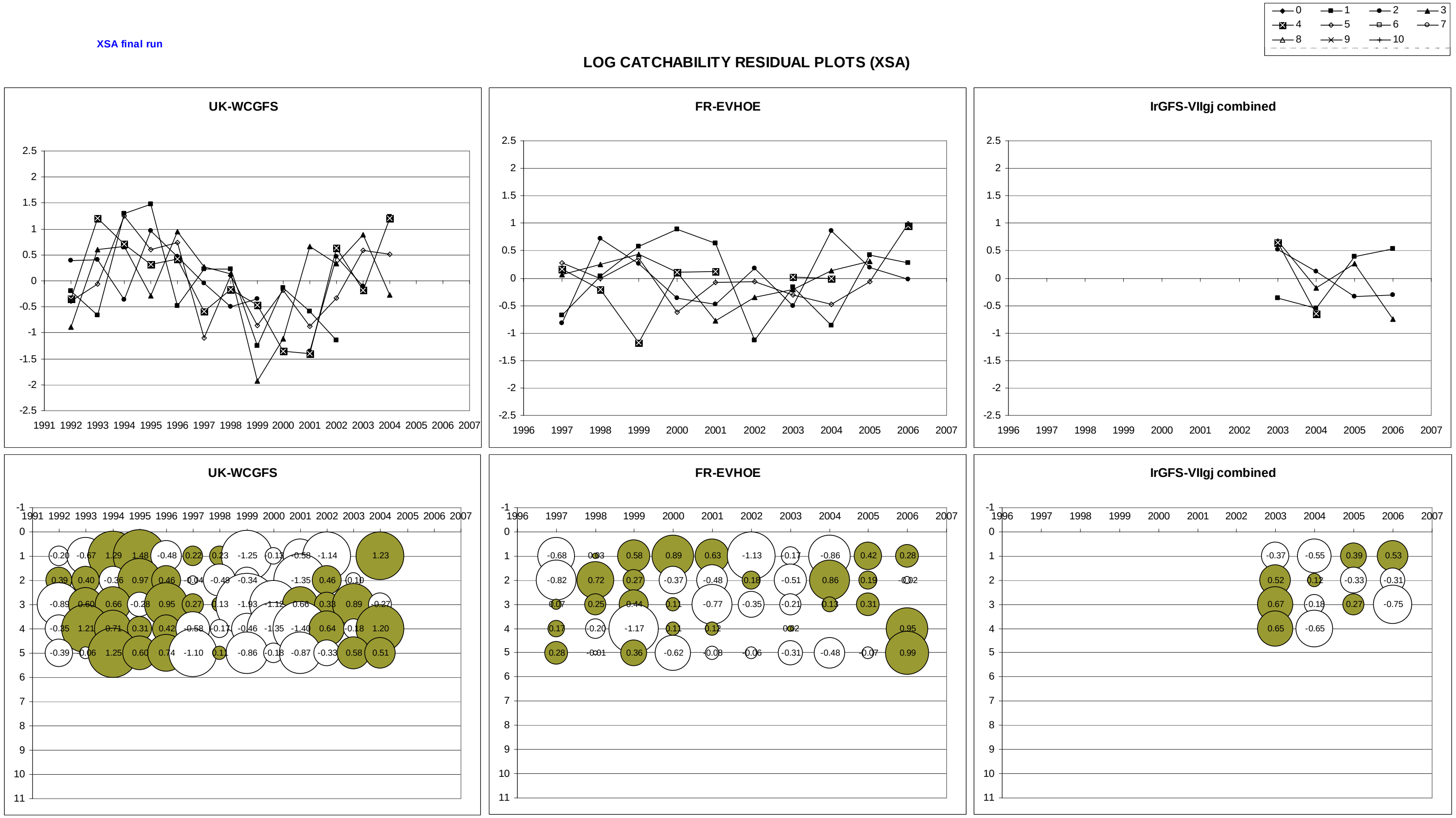


Figure 4.1.6 b **Cod in VIIe-k**

(Shrinkage SE=1.0) P-shrinkage OFF
Mean Q model xsa final run (4 years IrGFS surveyseries excluded

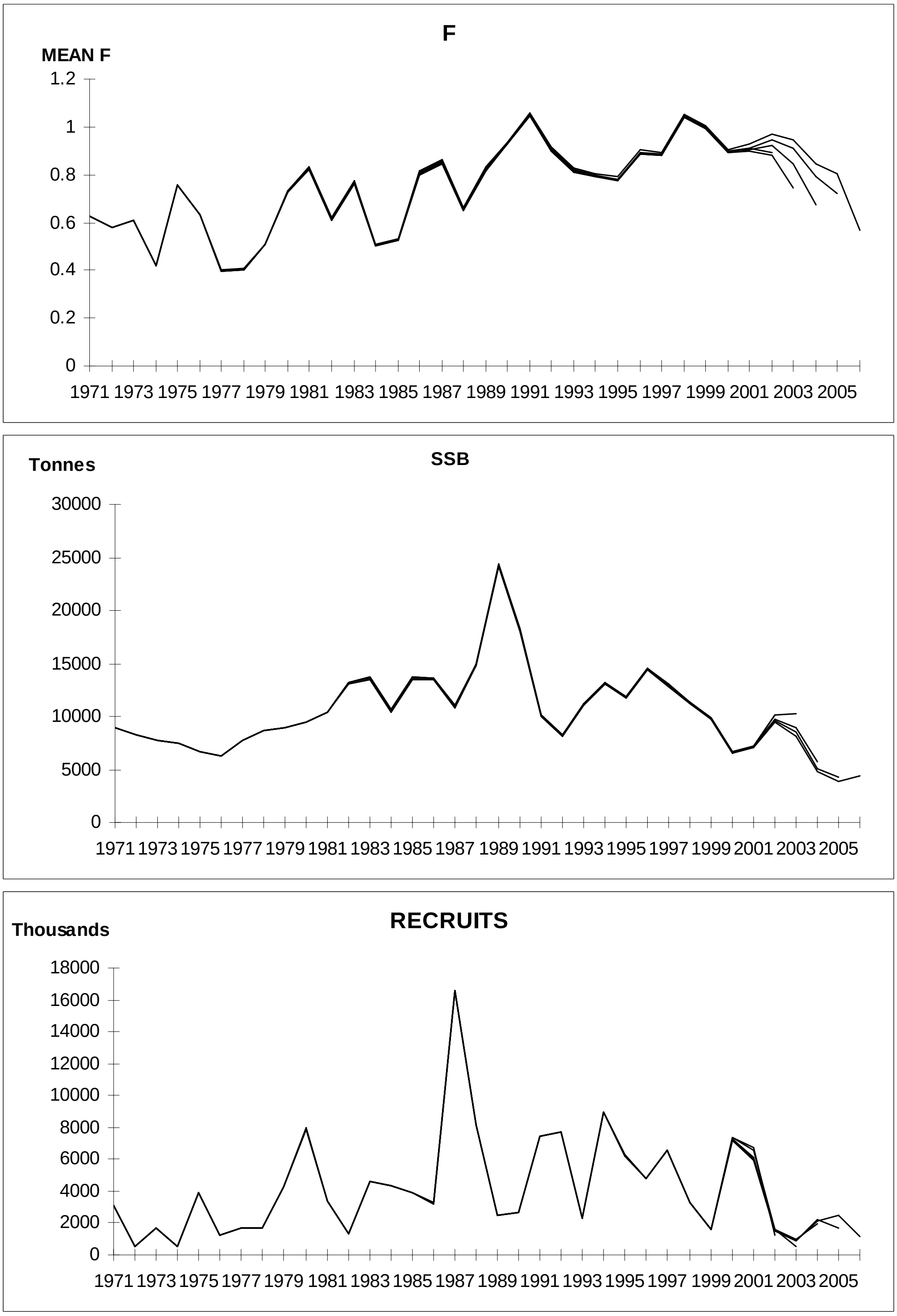


Figure 4.1.7. **COD in VII e-k RETROSPECTIVE XSA**

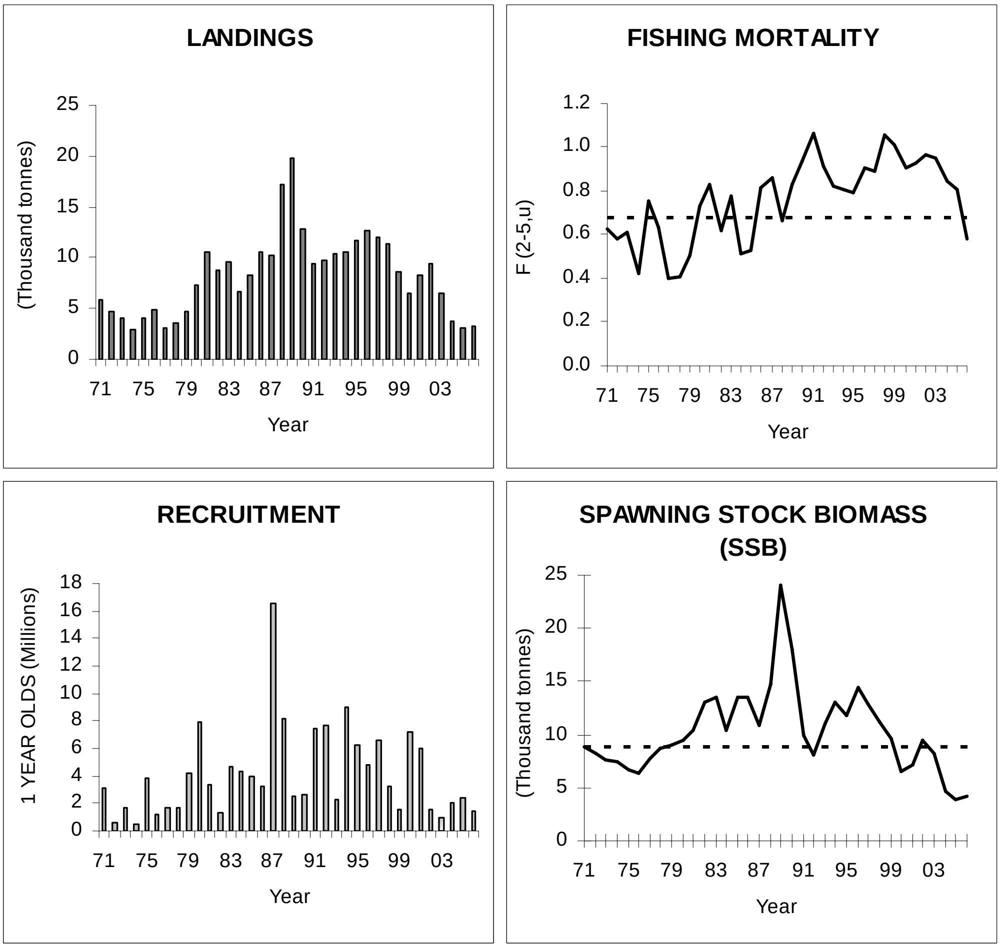
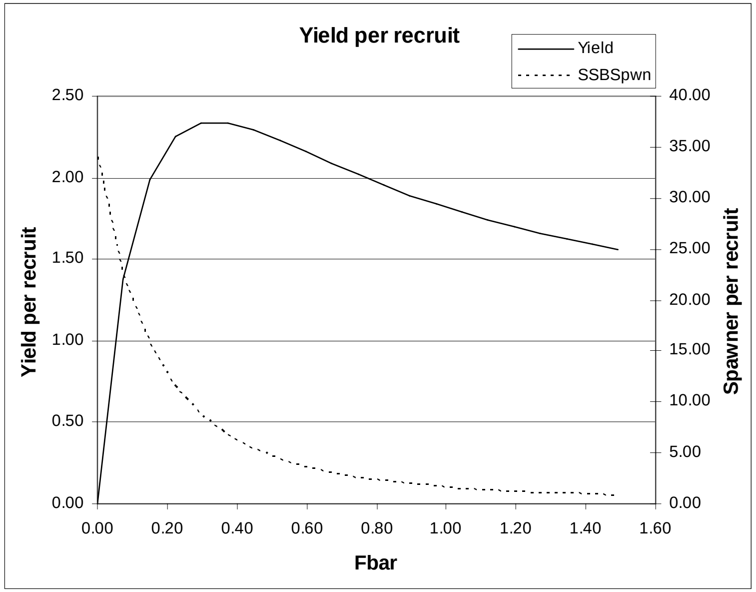
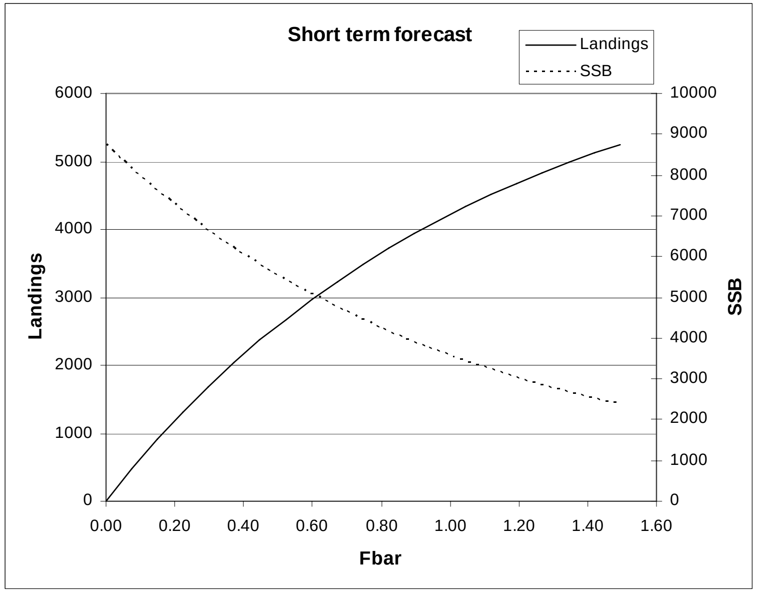


Figure 4.1.8 **Cod in Divisions VII e-k**





MFYPR version 2a
Run: yrs1
Time and date: 11:55 29/06/2007

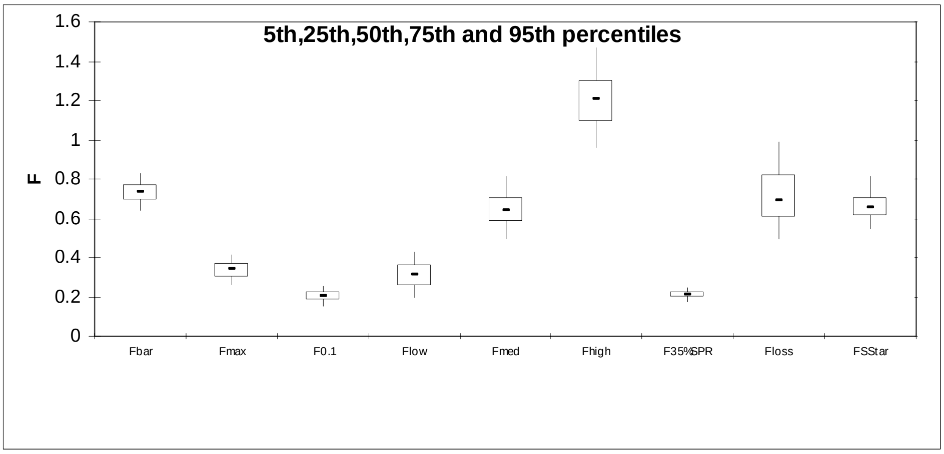
Reference point	F multiplier	Absolute F
Fbar(2-5)	1.0000	0.7465
FMax	0.4468	0.3336
F0.1	0.2733	0.2040
F35%SPR	0.2891	0.2158

Weights in kilograms

MFDP version 1a
Run: COD
TestProjection index file 15/3/99.
Time and date: 19:28 28/06/2007
Fbar age range: 2-5

Input units are thousands and kg - output in tonnes

Figure 4.1.9 Cod in VII e-k



Reference point	Deterministic	Median	75th percentile	95th percentile	Hist SSB < ref pt %
MedianRecruits	3255	3255	3599	4251	
MBAL	0				0.00
Bloss	3840				
SSB90%R90%Surv	9841	10706	11925	13225	52.78
SPR%ofVirgin	7.53	7.55	8.31	9.53	
VirginSPR	34.01	34.17	36.95	46.14	
SPRloss	2.70	2.70	3.33	4.69	
S*	13454	18791	24155	24155	83.33
	Deterministic	**Median**	**25th percentile**	**5th percentile**	**Hist F > ref pt %**
FBar	0.75	0.74	0.69	0.64	61.11
Fmax	0.33	0.34	0.30	0.26	100.00
F0.1	0.20	0.20	0.18	0.15	100.00
Flow	0.30	0.31	0.26	0.19	100.00
Fmed	0.70	0.64	0.58	0.49	63.89
Fhigh	1.17	1.21	1.09	0.96	0.00
F35%SPR	0.22	0.21	0.20	0.18	100.00
Floss	0.72	0.69	0.61	0.50	63.89
FS*	0.67	0.65	0.61	0.55	63.89

For estimation of Gloss and Floss:
A LOWESS smoother with a span of 1 was used.
Stock recruit data were log-transformed
A point representing the origin was included in the stock recruit data.
For estimation of the stock recruitment relationship used in equilibrium calculations:
A LOWESS smoother with a span of 1 was used.
Stock recruit data were log-transformed
A point representing the origin was included in the stock recruit data.

in VII e-k Cod

Steady state selection provided as input
FBar averaged from age 2 to 5

Number of iterations = 100
Random number seed = -99
Stock recruitment data Monte Carloed using residuals from the equilibrium LOWESS fit

Data source:
C:\MLA\EXEC\COD7EK.SEN
C:\MLA\EXEC\COD7EK.SUM

FishLab DLLs used
FLVB32.DLL built on May 6 1999 at 12:54:28

PASoft2 Feb 2003
07/03/2007 08:29

Figure 4.1.10 Cod in VII e-k Computation of reference points

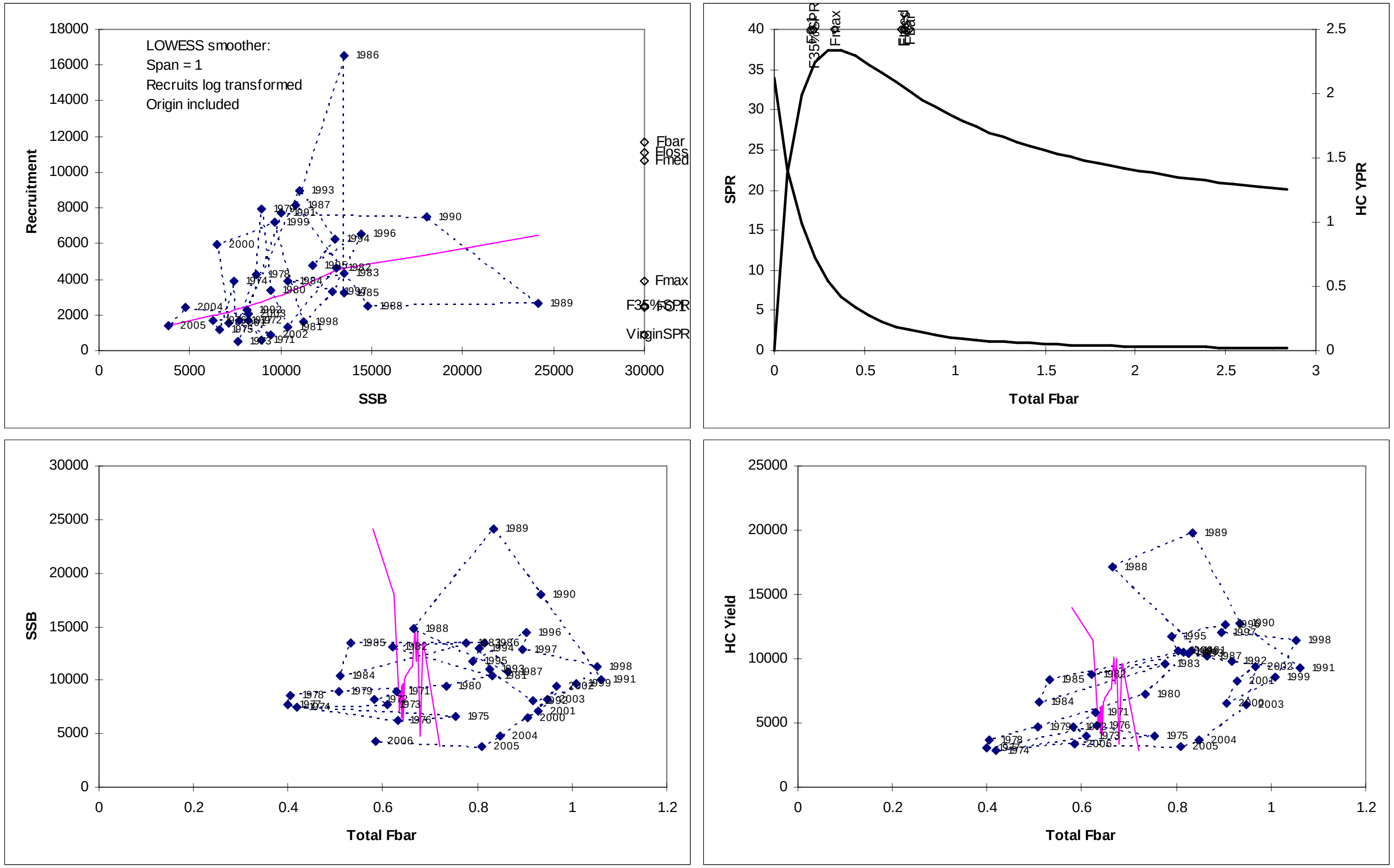
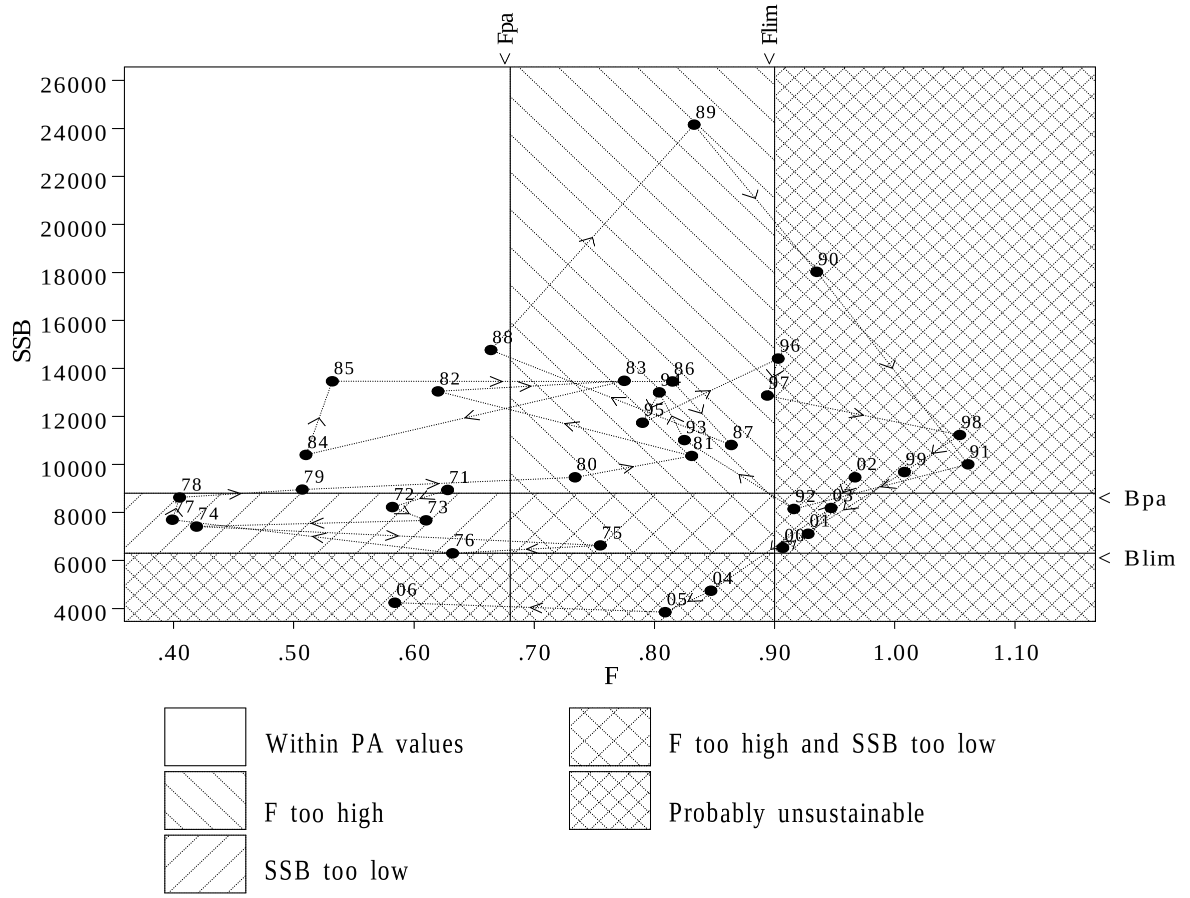


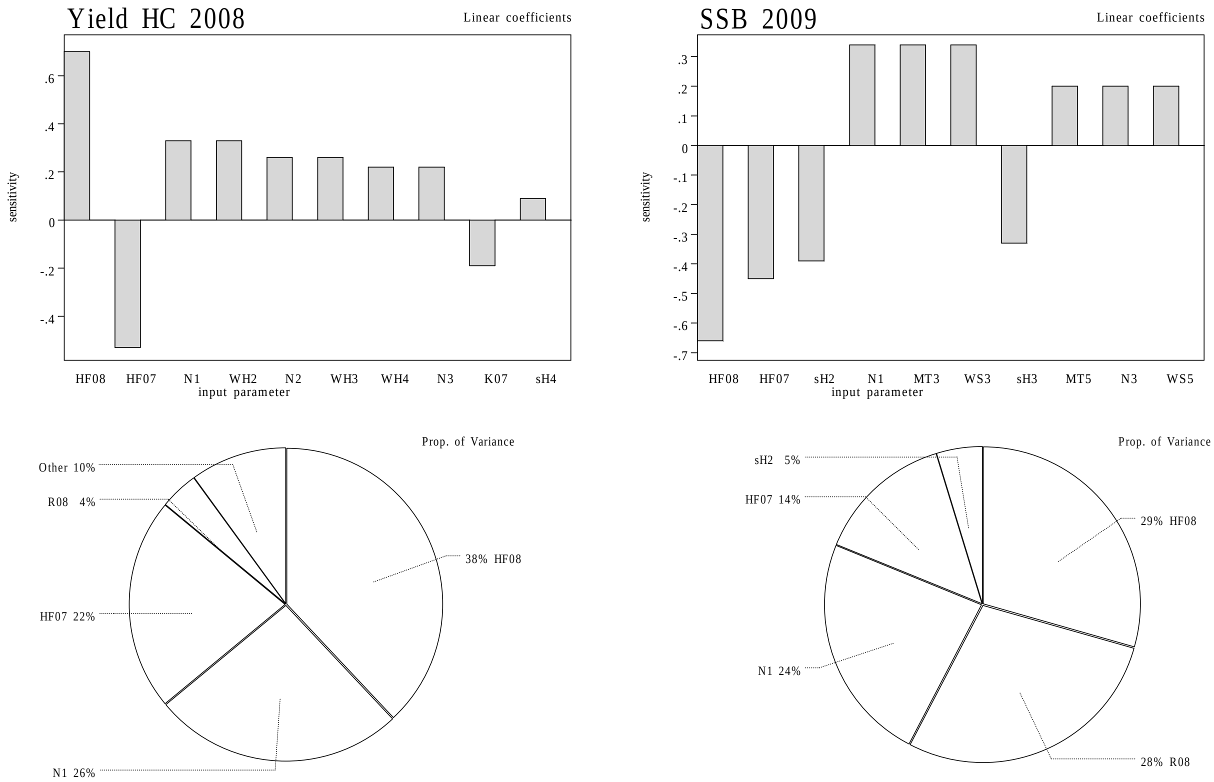
Figure 4.1.11 **Cod in VII e-k** **PA soft equilibrium plots**

Figure 4.1.12 Cod in VII e-k SSB/F history



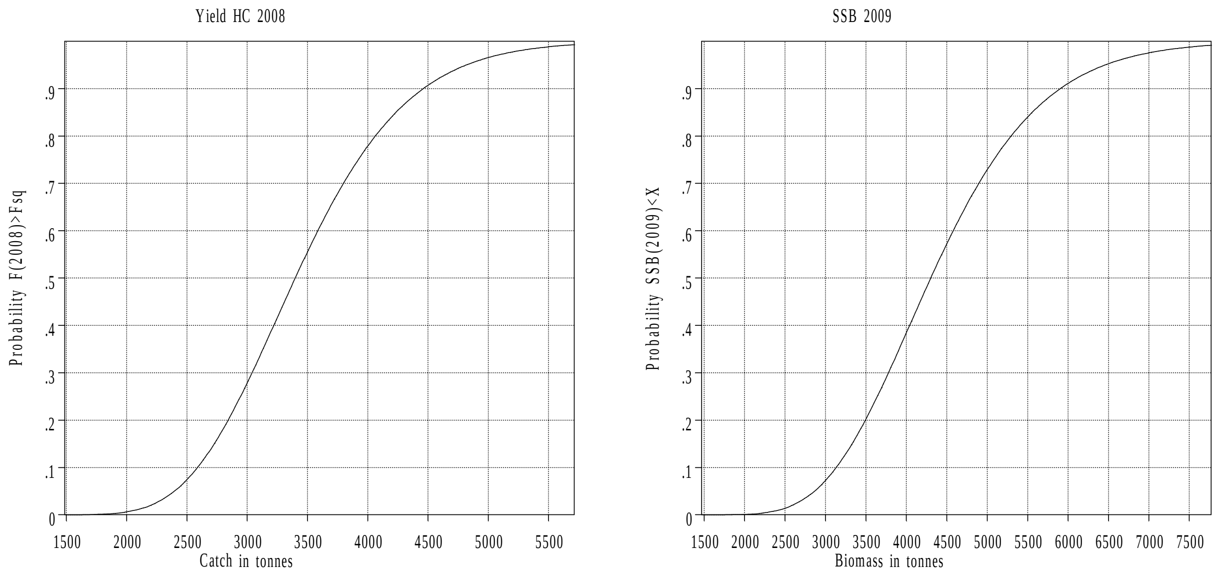
Data file(s):C:\MLA\EXEC\COD7EK.pa;C:\MLA\EXEC\COD7EK.SUM
Plotted on 30/06/2007 at 10:12:30

Figure 4.1.13 Cod,in VII e-k. Sensitivity analysis of short term forecast.



Data from file:C:\MLA\EXEC\COD7EK.SEN on 03/07/2007 at 08:06:03

Figure 4.1.14 Cod,in VII e-k. Probability profiles for short term forecast.



Data from file:C:\MLA\EXEC\COD7EK.SEN on 03/07/2007 at 08:08:27

Cod in Division VII e-k

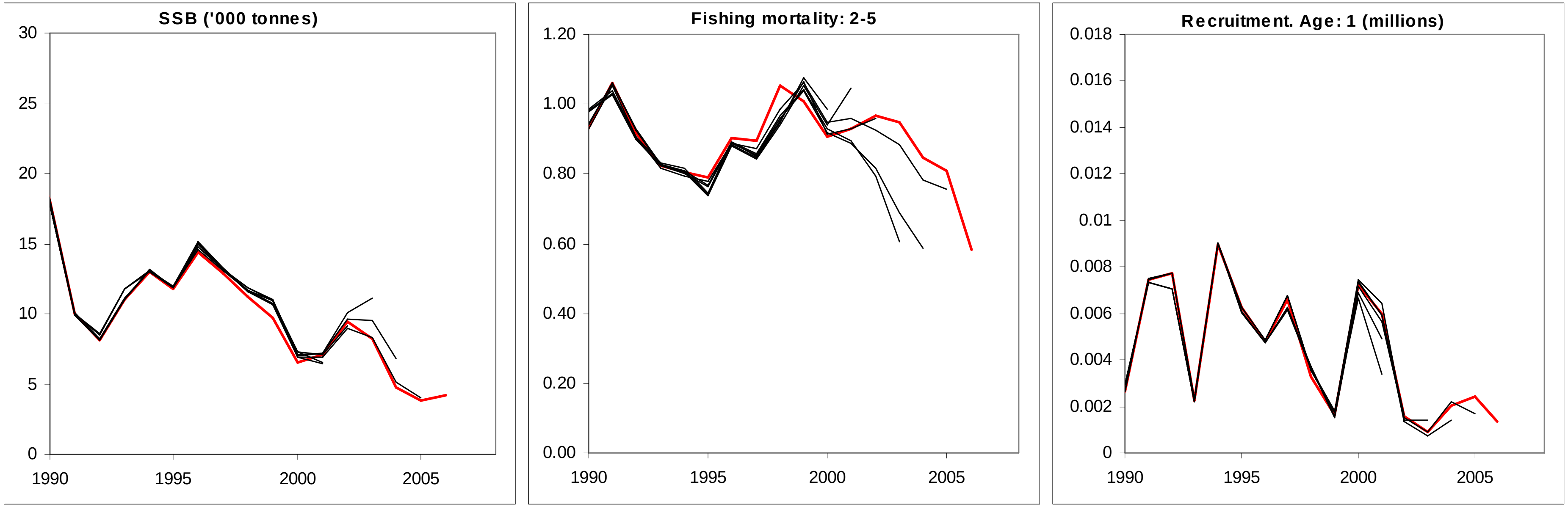


Figure 4.1.15 **Comparison of WG results**

4.2 Whiting in the Celtic Sea (ICES Divisions VIIe-k)

Type of assessment at WGSSDS2007: Exploratory

Last years assessment was accepted by the review group as indicative of trends only and short term forecast was rejected. Various concerns were expressed in relation to the input data and here we give a summary of the WGs actions to try and improve the situation.

Last year the RG noted that discarding is substantial and is not included in the catch-at-age matrix and that information on the age ranges of discards would be useful. The available discard data is summarised in section 4.2.1. Given that discard data is only available for the most recent years and not the whole time series it may not be possible to adequately reconstruct discarding patterns in the past. Ideally, the WG would use an assessment method that allows the recent discard data to be used but doesn't require a full time series of discard data. The WG notes that many stocks are in a similar situation and that the methods WG have been asked to investigate approaches which can make use of improved recent discard data but little progress has been made to date.

The RG commented that the tuning fleets appear to show conflicting signals, particularly the commercial fleets and this may be related to changing targeting practices over time. After some exploration the WG truncated the time series of commercial tuning data to 1993 for the French fleets and removed the Irish commercial fleet (Section 4.2.5). A conflict remains between the surveys and commercial fleets which can be explained by discarding of strong year classes before they enter the fishery. The survey data remains fairly variable the RG commented that a survey only assessment may be appropriate, This is discussed further in section 4.2.4. But truncating the data to the time period of the recent survey data would mean that the longer term perspective might be lost.

4.2.1 The Fishery

A general description of the fishery is provided in the Stock Annex.

ICES advice applicable to 2006 and 2007

The ICES advice for 2006 was:

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects

The current fishing mortality, estimated at 0.51, is above a fishing mortality that would lead to high long-term yields ($\boldsymbol{F}_{0.1}$ = 0.18) ($\boldsymbol{F}_{max}$ is not well defined). Fishing at a lower mortality would lead to higher SSB and therefore lower the risk of observing the stock outside precautionary limits.

Exploitation boundaries in relation to precautionary limits

No $\boldsymbol{F}_{pa}$ has been defined for this stock. As there is no long-term gain in yield, which will result in a reduction in the spawning stock, fishing mortality should not increase, corresponding to landings of, at the most, 10 800 t in 2006.

The ICES for 2007 was:

Exploitation boundaries in relation to high long-term yield, low risk of depletion of production potential and considering ecosystem effects:

Although uncertain it is likely that the current fishing mortality is above a fishing mortality that would lead to high long-term yields ($\boldsymbol{F}_{0.1}$). Fishing at a lower mortality would lead to higher SSB and therefore lower the risk of bringing the stock outside precautionary limits.

Exploitation boundaries in relation to precautionary limits:

Although the current estimates of F and SSB are uncertain, F in recent years has been reduced and SSB is probably above $\mathbf{B}_{pa}$. In this context the stock should be managed by ensuring that the effort is not allowed to increase.

Management applicable to 2006 and 2007

There are no explicit management objectives for this stock. The stock is managed by a TAC and technical measures. The TAC for whiting is set for Divisions VIIb,c,d,e,f,g,h,j and k (although VIIj is missing from Council Regulation (EC) No 41/2007 see table below). The TAC for whiting in Division VIIb-k in 2006 and 2007 was 19,940 t. This assessment area does not correspond to the TAC area, whiting in VIIb,c are not assessed and whiting in VIId are included in the WDNSSK assessment of the North Sea stock.

Species: Whiting *Merlangius merlangus*		**Zone:** VIIb, VIIc, VIId, VIIe, VIIf, VIIg, VIIh and VIIk WHG/7X7A.
Belgium	195	
France	11 964	
Ireland	5 544	
The Netherlands	97	
United Kingdom	2 140	
EC	19 940	
TAC	19 940	Precautionary TAC Article 3 of Regulation (EC) No 847/96 applies. Article 4 of Regulation (EC) No 847/96 does not apply. Article 5(2) of Regulation (EC) No 847/96 applies.

Technical measures applied to this stock are a minimum landing size (≥ 27 cm) and the minimum mesh sizes applicable to the mixed demersal fisheries. These measures are set depending on areas and years by several regulations.

Council Regulation (EC) No 51/2006, Annex III, part A 4.2 prohibited fishing in ICES rectangles 30E4, 31E4 and 32E3 during February-March 2006 for all vessels and gears (except within 6 nautical miles from the baseline).

Annex IIIa of from Council Regulation (EC) No 41/2007 states; "From 1 February 2007 until 31 March 2007, it shall be prohibited to conduct any fishing activity in the following ICES rectangles: 30E4, 31E4, 32E3. This prohibition shall not apply within 6 nautical miles from the baseline."

Council Regulation (EC) No 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in areas of VIIb, VIIj, VIIg and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998-2002).

Recent trends in the fishery

Officially reported landings for Divisions VIIe–k and landings as used by the working group are given in Table 4.2.1. The WG landings for 2006 (~9,500 t) are 1,100 t more than the landings predicted by the 2006 Working Group at status quo fishing mortality (8,600 t). The level of mis-reporting of this stock is not known and under-reporting has previously been considered unlikely to have been a significant source of unaccounted mortality of whiting in the assessment because the TAC has been in excess of recent landings. However, there is some recent information of over-reporting (where haddock were reported as whiting) in some fleets for some years when haddock quotas were restrictive. It is not possible for the WG to evaluate the scale of this problem currently but the introduction of buyers and sellers legislation may improve future landings statistics.

The spatial distribution of landings by country in 2006 indicates that the majority of the French and Irish landings are from a similar area with the highest catches coming from 31E3 (Figure 4.2.1). There are some temporal differences with the Irish landings from 31E3 mainly occurring in Q4 where as the French landings are mainly from Q3. The majority of UK landings are from otter trawlers in VIIe.

The 2007 WGFTFB report identifies a number of issues in relation to the fleets fishing in the Celtic sea:

There is evidence of French demersal vessels concentrating effort around the edges of the cod box closures (30E4, 31E4, 32E3). Also some French vessels have switched from targeting cod to monkfish (France; Changes in Fleet Dynamics).

A Decommissioning Scheme was launched in Ireland October 2005 and continued in 2006. To date, a total of 36 (includes one in 2005) vessels have been decommissioned in respect of 35 vessels in 2006. 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 quota restrictions, high levels of control and enforcement, increased fuel costs and a major review of the Irish industry, during 2006 and the first quarter of 2007 around 23 new or modern secondhand vessels have entered the Irish demersal fleets. This has been driven by the imminent introduction of the new safety regulations for vessels between 15m and 24m, accelerated as a consequence of the tragic sinking of 4 vessels in the Celtic Sea in 2007. These regulations will prove onerous and are likely to be similar to the Torrmelinos Convention rules for vessels over 24m. In anticipation of these changes a number of skippers are looking for more modern vessels. The tonnage being taken out to introduce these new vessels is largely inefficient or inactive (< 2 years) tonnage and the Irish whitefish fleet, while reducing in size by numbers has increased in terms of efficiency. This will almost certainly mean that quotas will become even more restrictive, particularly quotas for Nephrops (all areas), Rockall mixed fishery, mackerel and herring dry-hold quotas and mixed whitefish (mainly haddock and cod in Area VIIb-k). (Ireland; Increased effort).

Several French vessels have reverted from Nephrops twin trawling to single rig trawling in the Celtic Sea due to high fuel and difficulties finding crew. (France; change in fishing metod)

Several French vessels working in the English Channel (VIId &e) have converted from trawling to Danish seine to reduce fuel costs). (France, fuel costs; several vessels).

Discards

Discard data are available from the Irish fishery since 1994 (ICES: SGDBI, 2002), from French sampling in 1991, 1997, 2005 and 2006 and for the UK (E&W) fisheries from 2001-2006. These data have not been used in the assessment for the following reasons:

- Sampling data is not available for the full time series of landings at-age-data.
- The historically sampled fleets may not be representative of the main fleets involved in the fishery.
- Further work is required to examine and agree best raising practice for the various fleets.

- Discard rates are high and variable and it is not clear if current sampling intensity will obtain precise enough annual estimates to support an assessment method where catch numbers are assumed to be exact as in XSA.

A summary of the 2006 discard sampling and discard rates is presented in Table 4.2.2. This indicates fairly similar discard rates for the UK fleets and the French gadoid fleet (~45% by number and 33% by weight). The discarding rates of the French *Nephrops* fleet are lower ~18% by number and 5% by weight. Irish discard sampling intensity was substantial reduced in 2006 due to the non-cooperation of vessels with the sampling programme. Irish data for VIIj indicates lower discards in number for 2006 (~32%) compared with 37% in 2005 and 46% in 2004. The Irish data for VIIg indicates high discards in 2006 (~61% by number and 43% by weight) but this is based on only one trip.

The 2006 length distribution of whiting discarded by Irish and French otter trawlers and all UK gears were made available to the WG (Figure 4.2.2). The available data indicate that discarding rates are substantial and that discarding occurs above the MLS (27cm). The L_{50}'s for most countries/fleets is between 30-35cm. Age compositions for Irish discard data was provided for Otter trawlers in VIIg and VIIj for 2003-2006 showing substantial discards at ages 1 and 2 for most years (Figure 4.2.3). Discard numbers-at-age have not yet been calculated for other fleets.

Commercial fleet effort and LPUE

Estimates of commercial LPUE, from 1995 to 2006, were available for the Irish otter trawl and Scottish seine and beam trawl fleets operating in Divisions VIIg and VIIj (Table 4.2.3 and Figure 4.2.4). The effort series is raw effort in hours uncorrected for changes in vessel power or changes in targeting (i.e. metier compositions). Effort in both Irish otter board fleets has increased in 2002 and in recent years the effort in VIIj has declined while effort in VIIg has increased. This increase has been associated with the displacement, and subsequent relocation of effort in response to restrictive management in other areas particularly VIa and VIIa. LPUE for these fleets had remained relatively stable in the Division VIIg fleet but increased markedly from 2003-2006. LPUE has declined in the Division VIIj fleet. There is a sharp decline in LPUE for the IR-7G-SSC and IR-7J-SSC for the available time series. Effort and LPUE data for the Irish beam trawls (TBB) operating in VIIg and VIIj is also included in Table 4.2.3 but is not plotted as catches are minimal. These show an increase for effort and a decline in LPUE for IR-7G-TBB. LPUE data for the IR-7J-TBB fleet has declined since 2001, this is a small component of the Irish fishery for Whiting VIIe-k. All Irish fleets show a slight decline in LPUE in 2006 compared to 2005.

Estimates of commercial LPUE, up to and including 2006, were also available for French gadoid trawlers and French *Nephrops* trawlers operating in Divisions VIIf,g (Table 4.2.3 and Figure 4.2.4). Fishing effort in the FR-GADOID fleet has been declining since 1989, while the effort in the FR-NEPHROPS has declined since 1992. The FR-GADOID fleet's LPUE increased to an historic high in 1995 but has declined since. There was a sharp increase in LPUE for the French gadoid fleet in 2005 but LPUE decreases again in 2006. LPUE for the FR-NEPHROPS fleet has declined since the mid-1990s. Limited LPUE data from France are available for Divisions VIIj–k, but they are not considered reliable. The commercial tuning fleets available to the assessment are given in Table 4.2.9.

4.2.2 Age and length compositions and mean weights at age

The sampling levels for the landings are presented in Table 1.3.1. Data for the areas VIIe, VIfg,h and VIIj,k were aggregated using the same procedures as in previous WGs (described in the Stock Annex). Revisions were made back to 1999 to take account of revised French Landings statistics. The 2005 data was also revised due to minor changes in landings from other countries.

The length compositions from various fleets for 2006 are shown in Table 4.2.4 and Figure 4.2.5. There are some notable differences particularly the Irish VIIg seine fleet which caught smaller fish than normal in 2006. The beam trawl fleet mainly lands larger fish. The landings length distributions of the Irish otter trawl, UK and French fleets which account for the majority of the landings are rather similar.

The international catch numbers at age are given in Table 4.2.5 and Figure 4.2.6. Age group 0 was included in the assessment data to allow inclusion of 0-group indices in the XSA, although no landings at this age were recorded in most years. Very small landings of 0-group whiting were not included in the catch-at-age data-file to avoid spurious F-shrinkage effects at this age. Mean weights-at-age in the catch and stock were derived as previously and the methodology is described in the stock annex. (Tables 4.2.6 and 4.2.7). The stock weights are shown in Figure 4.2.7. There is some variability over particularly at the older ages. There some indication of an increasing trend in landing and stock weight, particularly at the older ages in the the last few years. This is probably not sufficient in invalidate a 3-year mean assumption in the forecast.

4.2.3 Natural mortality and maturity at age

As in previous assessments of this stock, natural mortality was assumed to be 0.2 over all age groups and years. Available data on maturity at age are described in the Stock Annex. Last year the knife edge maturity ogive was replaced with new indices calculated based on data from the UK WCGFS but a fixed vector is still used. Recent maturity sampling by Ireland and the UK on dedicated surveys confirms the use of this oogive but is in-sufficient to provide annual data.

Age	0	1	2	3	4	5+
Maturity	0	0.39	0.90	0.99	0.99	1.00

The proportions of F and M before spawning were both set to zero to reflect the SSB calculation date of January 1st.

4.2.4 Abundance indices

The time series of abundance indices for ages 0-3 from research surveys are shown in Table 4.2.8. Four fishery independent survey tuning indices were available to the WG. Further details of these surveys are given in Table 1.3.3. The strong 1999 year-class is evident in all surveys. The complete time series of tuning fleet information available to the Working Group is given in Table 4.2.9.

The FLEDA package (Ver. 1.4-2) of FLR (Ver. 1.4-3) was used to examine each of the surveys separately using R Ver. 2.4.1. Figure 4.2.8 is a pair wise scatter plots for the log numbers at age for the main tuning fleets to examine internal constancy of the indices baring in mind that the correlations may be impacted by changes in fishing mortality. Figure 4.2.9 is the mean standardised plots of indices by age and year to examine year effects. Figure 4.2.10 is the mean standardised plots of indices by age and cohort to examine cohort tracking. Catch plots and mean standardised plots for the full year and age ranges of all available tuning data are available in the ICES files only those used in the assessment are presented. Preliminary screening of ages and years of tuning data confirmed the recent choices of ages and year ranges used by the WG, therefore other years and ages were not re-considered.

For the FR-EVHOE survey the log indices scatter-plots show reasonable positive correlation with adjacent ages but show some noise up to age 4. The mean standardised indices by year show what maybe a year effect in 2006 and by cohort shows good tracking of stronger year classes. The UK-WCGFS also showed inconsistencies between years in the log-index scatter plots but reasonably consistent catch-curves. The mean standardised index by year showed some evidence of positive catchability in the last three years of the survey (2002-2004) and although cohort tracking in the mean standardised index up to then was very noisey in the last 3 years. Indices for the UK-BCCSBTS are only available for ages 0 and 1 there is little evidence of a positive correlation in this survey. Historically the UK-BCCSBTS showed strong internal consistency between indices at ages 0 and 1. However, between 2003 and 2004 catches at age 1 have been particularly low and poorly correlated with indices at age 0. For this reason this fleet was excluded from further analysis.

A new Irish GFS series began on RV Celtic Explorer in 2003. Last year the WG used a swept area standardised index which integrated the new survey with the data from the previous Irish Sea Celtic Sea Ground fish survey in VIIg (1999-2002). The log-indices for this integrated survey series are positively correlated. The mean standardised index by year showed some slight year effects in 1999 and 2003 (the first years of both series). The mean standardised index by year showed good tracking of the strong 99 year class out to age 7 with the exception of age 4 in 2003. Although the source data was checked this is probably an anomaly of the year effect in 2003 so during exploratory runs it was decided to remove this point to ensure the survey gets higher scaled weight in further runs. This compromise is not ideal but given the short time series of the survey and apparently good performance otherwise the WG considered that the survey should be a good index for this stock.

Abundance indices at age were available for three commercial fleets. The IROTB-7bg previously used in the assessment was not considered due to poor cohort tracking and *a priori* concerns about changes in targeting practice and fishing power due to recent fleet changes since 2002. The French commercial indices show very good internal consistency and tracking of year classes.

4.2.5 Catch-at-age analyses

The general approach to data screening and analysis followed that outlined in Section 1.4.1.

Data Screening

The first step was to evaluate the impact of the changes in French landings on the 2006 WG assessment. The results are shown in the text table below. Although overall differences in landings were minor there were some changes in the quarterly distribution of the landings that lead to downward revisions in recruitment up to 25% and some smaller changes in SSB and F.

Years	Landings	Recruitment age 0	SSB	Fbar 2-5
1999	0.00%	-4%	-5%	3%
2000	0.30%	0%	-8%	0%
2001	0.56%	3%	0%	4%
2002	-1.48%	-9%	1%	-2%
2003	-1.40%	-18%	0%	1%
2004	0.00%	-24%	2%	1%
2005	0.38%	-6%	12%	2%

A SPALY update was then carried out with FLXSA. The assessment suffered from the same problems as last year with a strong trend in catchability of the commercial fleets in the earlier period (up to 1993). This is partially explainable by the increased targeting of whiting by the main French gadoid fleet during this period. In more recent years this fleet has also focused more on haddock which was not previously abundant in the Celtic Sea. The WG considered it prudent to truncate the tuning period for both commercial fleets to 1993. The impact of this was an upward revision of F (~10%) in the historical period (82-87) of the assessment compared to last year and a slight downward revision (~10%) of F and an upward revision of SSB (~5%) in more recent years (1993-2003).

Next a series of single fleet XSA runs were preformed to examine trends in catchability of the tuning fleets in relation to the catch at age data independently (no taper; using moderate-weak shrinkage (1.5), and all other parameters as in last year's assessment). The catachability residuals for these runs is shown in Figure 4.2.11 and the comparative results are shown in Figure 4.2.12. The commercial fleets show very small residuals which still have a "wavey" pattern to them noted last year. This may be associate with changes in discarding or targeting over time. The surveys are "noisy" but without trend. As expected the year effect in the EVHOE survey shows a large negative residual in the final year where a year effect is evident.

The results of the single fleet runs are shown in Figure 4.2.13. The trends are very consistent owing to the convergence of the VPA. The divergence in the last few years is fairly small. The only major differences are in the recruit estimates given by the survey fleets.

Exploratory XSA runs

The main objective of the exploratory analysis was to produce an assessment that minimised the potential bias. The lack of discard data in the catch at age matrix and the variability in the survey estimates means that variability will remain a problem in the assessment. As last year, the Working Group included data for age 0 even though no commercial catch at that age was reported. The following settings were explored in FLR followed by the conclusion made.

Power model at age 0; this was tested at age 0 but there is no indication that a power model is required.

q-plateau; This was previously set at 4 but releasing it to 5 seemed justified since not all fleets had a stable q plateau's at 4. Setting it at 5 more balanced catchability residuals in the older ages as the commercial fleets get higher weighting in final survivor estimates.

F shrinkage; Various levels of shrinkage were tested from 0.5 to 1.5. Shrinkage had little impact on the catchability residual, retrospectives or final estimates. However, higher shrinkage whilst stabilising the assessment may not be desirable given reducing effort and targeting of whiting as the overall abundance of the stock declines. Weak shrinkage would be undesirable given the noise in the assessment so a compromise of 1.0 was adopted for the final run.

Survivor estimates SE threshold; was increased to 0.5 to try and weight out the survivors estimates across all the fleets and ages.

The final settings used for the 2006 and 2007 WG assessments are given below. Changes to the settings used at the 2007 WG (except for the addition of the 2006 data year) are shown in bold type.

			2006 XSA			**2007 XSA**
Year range of catch data:			82-05			82-06
Age range of catch data:			0-7+			0-7+
F bar age range:			2-5			2-5
Commercial tuning series:	FR-GADOID	83-05	FR-GADOID	FR-GADOID	**93-06**	3-6
	FR-NEPHROPS	87-05	FR-NEPHROPS	FR-NEPHROPS	**93-06**	3-6
	IR-7G&J-OT	95-05	IR-7G&J-OT	**IR-7G&J-OT not used**		
Survey tuning series:	FR-EVHOE	97-05	FR-EVHOE	FR-EVHOE	97-06	0-4
	UK-WCGFS	92-04	UK-WCGFS	UK-WCGFS	92-04	1-6
	UK-BCCSBTS	88-05	UK-BCCSBTS	**UK-BCCSBTS not used**		
	IR-IGFS Swept Area	99-05	IR-IGFS Swept Area	IR-IGFS Swept Area	99-06	0-6
Taper applied:			No			No
Ages catch dependent on stock size:			-			-
q plateau (ages ≥):			4			**5**
F shrinkage s.e.:			1.5			**1.0**
F shrinkage year range:			5			5
F shrinkage age range:			3			3
Fleet s.e. threshold:			0.5			0.5

Final XSA run

The full diagnostics for the final XSA are given in Table 4.2.10. As expected there are substantially different estimates of survivors of the 2006 year class (age 0) given by the FR-EVHOE and IR-IGFS-Swept Area tuning series. For the older ages the estimates were noisy but with the exception of the FR gadoid fleet were without a particular bias. The gadoid fleet consistently gives higher estimates that the others. Figure 4.2.13. shows the scaled weights received by each fleet in the

The log catchability residuals from the final XSA fit are plotted for each tuning series in Figure 4.2.14. These are very similar to the single fleet runs. There are some year effects and noise in the short time series of data. The retrospective pattern is shown in Figure 4.2.15. The retrospective bias around the 1999 year-class remains but in recent years the retrospective is rather consistent.

Estimates of fishing mortality and stock numbers from the final XSA are given in Tables 4.2.11 and 4.2.12 and are summarised in Table 4.2.13 and Figure 4.2.14. Fishing mortality in 2005 was revised upwards by 10% by the current assessment (0.76). The WGSSDS2006 estimated SSB in 2006 to be 36,460 t the current assessment revises that down by 35% to 23,689 t.

4.2.6 Estimating recruiting year class abundance

The 2006 year-class is estimated to be 29,131, the lowest in the time series. As already discussed the two IBTS surveys have very different estimates. The spatial distribution of 0-group catches on the Irish-GFS in 2006 and the EVHOE were examined using the IBTS report (ICES, 2007). The high recruitment index for the Irish-GFS is mainly caused by large numbers of 0-group whiting over several stations in the Celtic Sea deep. Although, the EVHOE survey also had a number of stations in this area it didn't see any elevated catches. The WG therefore decided to replace the 2006 year-class estimate with geometric mean recruitment for the period 1995-2005 (GM95-05). This was discounted by natural mortality in the forecast. This period was chosen because recruitment seem to be at a similar level during this period (this shorted GM period leads to an estimate 21% below the GM for the full period). The recruitment assumptions in the forecast are text table below:

YEAR CLASS	MILLIONS	BASIS	SURVEYS	COMMERCIAL	SHRINKAGE
2004	41.5	XSA	96%	0%	4%
2005	46.5	XSA	96%	0%	4%
2006	56.7	GM_{95-05}			
2007	56.7	GM_{95-05}			

4.2.7 Historical trends in biomass, fishing mortality and recruitment

Trends in landings, F(2–5), SSB and recruitment are presented in Table 4.2.13 and Figure 4.2.16. SSB is estimated to have decreased from 72,300 t since 1995. SSB is estimated to be 26,900 t in 2006 which is above Bpa. SSB shows a declining trend since 1995, that was temporarily halted by the strong 1999 year class. Fishing mortality is estimated to have declined generally until 1996, to have increased in 1998-2002 before declining again in 2003 and 2004. Fishing mortality has increased again more recently.

This year's assessment indicates that recruitment since 1995 has been below average, with the exception of the relatively strong 1999 year-class. The relationship between SSB and recruitment is poorly defined (Figure 4.2.17) and there is no evidence of reduced recruitment at lower levels of SSB.

4.2.8 Short-term catch predictions

The F-at-age vector was the mean for the period 2004–2006, unscaled. The average of the last three years (2004–2006) was used for weight-at-age in the catch and the stock. Due to inconsistency in survivor estimates the WG decided to replace the 2006 year-class estimate with geometric mean recruitment for the period 1995-2005. The estimate at age 1 in 2006 was therefore also replaced by applying natural mortality to the GM estimate for 2006 at age 0. Stock numbers at ages 2 and above in 2007 were taken from the XSA estimates.

Table 4.2.14 gives the short-term predictions for various management options and Table 4.2.15 gives the detailed prediction by age group for status quo F. This prediction gives landings of ~8,600 t in 2007 and 9,000 t in 2008 (Table 4.2.16). The SSB is predicted to be 25,000 t in 2008 and 27,000 t in 2009.

The proportions which the 2004–2008 year classes will contribute to the landings in 2007, and to the SSB in 2008, are given in Table 4.2.17. The year classes for which GM recruitment has been assumed contribute 28% of the landings in 2008 and 73% of the SSB in 2009.

4.2.9 Yield and biomass per recruit

Long-term yield and SSB per recruit conditional on the present exploitation pattern are given in Table 4.2.18 and shown in Figure 4.2.18. F_{Max} is not well defined. At equilibrium long-term yield and SSB were estimated to be about 10,000 t and 25,000 t, respectively.

4.2.10 Reference Points

The Working Groups current approach to reference points is outlined in Section 1.4.4. A summary of reference point proposals to date and their technical basis is given in the Stock Annex. Currently adopted reference points and their basis are:

F_{LIM}	No Proposal
F_{PA}	No Proposal
B_{LIM}	15,000 t ($B_{LIM} = B_{LOSS\ 1983}$, $ACFM_{1998}$)
B_{PA}	21,000 t ($B_{PA} = B_{LOSS\ 1983}$ x 1.4)

The 2006 Working Group examined the computation of reference points using the PA software Excel add-in. Given that last years analysis led to poorly defined F reference points and did not alter the biomass reference points. Therefore it was not re-examined again.

4.2.11 Sensitivity and Risk Analysis

A sensitivity analysis (method in Section 1.4.3) was conducted to examine the contribution of different sources of uncertainty to the variance of predicted yield in 2008 and SSB in 2009. The input data are presented in Table 4.2.19 and the sensitivity plots are shown in Figure 4.2.19. Table 1.4.1 gives a description of the abbreviated variable names in Figure 4.2.19. The results indicate that the forecasted yield in 2008 is most sensitive to the assumed recruitment at age 1 (39%) and to fishing mortality in 2008 (32%). Forecasted SSB in 2009 is most sensitive to assumed recruitment at age 1 (69%).

Probability profiles of expected yield and SSB are given in Figure 4.2.20. The approximate 90% confidence intervals of the expected status quo yield in 2008 are about 5,000 t and 14,000 t. There is around 25% probability that SSB in 2009 will fall below B_{PA} (21,000t).

Medium term predictions were not conducted. Medium term predictions were last conducted at the 2002 WG.

4.2.12 Comments on the assessment

Sampling

The sampling levels for those countries supplying data for 2006 are given in Table 1.3.1. Sampling levels of the landed catch for recent years are considered to be sufficient to support current assessment approaches. Sampling levels were not available by fishery/métier and the WG was therefore unable to evaluate whether or not current sampling levels are sufficient to support fishery/métier dis-aggregated assessment approaches. The strong recent cohorts passing through the fishery indicates that age estimation is very consistent throughout the age range used in the assessment, although some under-estimation does occur at older ages.

Discard Data

Discarding is a major feature of most fisheries catching whiting in the North-eastern Atlantic. The non-inclusion of discard data in the assessment could explain some of the retrospective bias problems and changing catchabilities in commercial fleets observed throughout the assessment period. The available discard data has improved in the most recent years since the implementation of the DCR sampling programmes. Data for the main French fleets is now available for 2 years and data for other countries is available for longer periods. It is recognised that further work is required to compile a complete time series of discard data and evaluate raising options and uncertainty levels. There have been problems discard sampling in Ireland due to the non-cooperation of certain sectors of the fishing industry with discard sampling programmes since late 2005.

Various options have been considered by the WG to reconstruct a time series of discard sampling for whiting but none seem entirely satisfactory. There is no substitute for improved on-board sampling of discards in all the main fleets in the Celtic Sea. The WG will continue to explore alternative methods to allow the inclusion of recent discard data.

Surveys

Currently, there are two IBTS surveys (French and Irish) covering the Celtic Sea. Although these surveys normally catch large quantities of whiting they seem prone to year effects as has been observed for this species in other areas (e.g. Irish Sea, North Sea). These surveys give very different estimates of the 2006 year-class. This is one of the most important factors in the short-term development of the stock. If the strong recruitment as seen by the Irish survey is confirmed the forecast may be overly pessimistic in the short term.

Consistency

Inter-annual comparison between the results of this year's and last year's assessments (Figure 4.2.21) show consistent estimates of F and SSB trends. SSB has been rescaled upwards slightly in the past when the full time series of commercial tuning data was included in the assessment. More recently there were some problems with recruitment and SSB estimates as the very strong 1999 year-class passed through the fishery and was discarded heavily. During this period the forecast of stock development were overly optimistic. Assessments for the last few years have been reasonably consistent for F although SSB has been revised upwards slightly and the most recent recruit estimates always remains problematic.

Mis-reporting

The level of mis-reporting of this stock is not known and under-reporting has previously been considered unlikely to have been a significant source of unaccounted mortality of whiting in the assessment because the TAC has been in excess of recent landings. There is some recent evidence of over-reporting in some fleets but the WG was not able to quantify whether this has occurred over an extended period, or in all fleets.

Industry Input

Meetings with representatives of the fishing industry were held prior to WGSSDS2006 in Ireland, UK and France. No specific concerns were raised about the state of this stock or its assessment.

4.2.13 Management considerations

This assessment area (VIIe-k) does not correspond to the TAC area(VIIb-k), whiting in VIIb,c are not assessed and whiting in VIId are included in the WDNSSK assessment of the North Sea stock.

Whiting are caught in directed gadoid trip and in mixed fisheries throughout the Celtic Sea. Discard rates are high due to the low market value of the species particularly at smaller sizes. High-grading above the MLS is also prevalent in most fisheries. The current assessment doesn't include discard estimates. Figure 4.2.22 shows that current cod-end selection characteristics of all fleets (based on experimental observations for the North Sea) are inconsistent with the fishermen's retention profiles (based on discard sampling provided to the WG). In Celtic Sea fisheries some fleets are using 80 mm mesh to target *Nephrops*, 90 mm mesh in mixed fisheries and 100 mm to target gadoids and other species. In order to minimise discards, it would be preferable to match the selection characteristics of gears used with onboard selection. Clearly, there is a need to increase the selectivity characteristics of the gears through technical measures such as an increase in mesh size or manipulation to the position and mesh size of the mandatory square mesh panel. These technical measures would need to be evaluated in the context of other species caught in the mixed fisheries.

Catches and SSB in VIIe–k whiting fluctuate considerably depending on the strength of year classes. The current assessment indicates that year-classes since 2000 are all estimated to be below average. The forecasts using an assumed status quo F and using the $GM_{95\text{-}05}$ recruitment indicated that SSB will increase from current levels (SSB2007 ≈ 23,000 t) to about 25,000 t in 2009 and 26,500 t in 2009.

A closure of the three rectangles in the Celtic Sea was in place during the first quarters of 2005, 2006 and 2007 to protect the cod stock The impact of this on whiting remains unclear but the spatial distribution of landings in 2006 suggest that landings from the closed rectangles are minimal.

There is some recent information of over-reporting (where haddock were reported as whiting) in some fleets for the years when haddock quotas were restrictive. It is not possible for the WG to evaluate the scale of this problem and the assessment is largely based on landings as reported in log-books. The recent introduction of buyers and sellers legislation may improve future landings statistics.

There have been major changes in fleet dynamics over the period of the assessment. Effort in the French gadoid fleet has been declining since 1999. Irish otter trawl effort in VIIg,j has been stable over the last 4 years but there has been a shift in effort from VIIj to VIIg. During this period there has been a fleet modernisation and a decommissioning scheme in Ireland. A further decommissioning scheme is imminent which aims to remove 40% of the capacity in the whitefish sector nationally.

Table 4.2.1 WHITING in Divisions VIIe-k. Nominal Landings (t) as reported to ICES, and total landings as used by the Working Group.

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2,004	2,005	2006a
Belgium	135	161	167	107	111	159	296	308	292	107	145	228	205	268	449	479	448	194	171	149	129	180	218	130
Denmark																								
France	8,982	7,171	7,820	7,647	10,054	11,410	12,171	10,464	9,956	9,165	10,771	12,634	13,400	9,936	11,370	11,711[a]	16,418[b]	9,077[a]	7,203[a]	7,435[a]	5,897	4,811	5,784	3,866
Germany										14														
Ireland	1,487	1,301	2,241	1,309	1,452	398	2,817	1,478	1,258	1,691	3,631	5,618	6,077	6,115	6,893	5,226	5,807	4,795	5,008	5,332	4093	4,215	5,709	4,509
Netherlands		398		124										8		1			5	4	9	18	60	40
Spain													4	31	24	53	21	11	9	12		76	56	
UK (E/W/N	1,177	954	610	765	1,035	1,598	1,252	1,782	1,969	1,379	1,756	1,548	1,804	1,728	1,742	1,709	1,346	1,252	946	844	762	586	471	408
UK(Scotland)						1	5	74	33	8	17	6	23	34	42	68	3	2	11	12	5	7	0	
United Kingdom																								
Total	11,781	9,985	10,838	9,952	12,652	13,566	16,541	14,106	13,508	12,364	16,320	20,034	21,513	18,120	20,520	19,247	24,043	15,331	13,353	13,788	10,895	9,893	12,298	8,952
Unallocated	0	0	0	0	0	1,562	0	0	0	0	0	0	1,165	140	12	-2	-4,126	-466	-569	-509	-312	78	207	563
Total as used by Working Group	11,781	9,985	10,838	9,952	12,652	15,128	16,541	14,106	13,508	12,364	16,320	20,034	22,678	18,260	20,532	19,245	19,917	14,865	12,784	13,279	10,583	9,971	12,505	9,515

Revised 2007

[a]: Preliminary

[b]: Preliminary, Reported as VIIb-k

Table 4.2.2 WHITING in Divisions VIIe-k. Summary of discard data in 2006 provided the Working Group

				Sampling							Discard Rates	
Country	Year	Quarter	Gear/Fleet	Trips	Hauls	Numbers Landed	Weight Landed	Number Discarded	Weight Discarded	Units	Number	Weight
France	2006	2	FU08 - Nephrops	1	41	460	304	137	25	No. & KG Sampled	23%	8%
France	2006	3	FU08 - Nephrops	1	45	302	226	17	4	No. & KG Sampled	5%	2%
France	2006	4	FU08 - Nephrops	1	11	0	0	8	1	No. & KG Sampled	100%	100%
France	2006	All	FU08 - Nephrops	3	97	762	530	162	29	No. & KG Sampled	18%	5%
France	2006	1	FU05 - Gadoid	2	44	253	369	169	45	No. & KG Sampled	40%	11%
France	2006	2	FU05 - Gadoid	2	15	239	85	233	39	No. & KG Sampled	49%	32%
France	2006	3	FU05 - Gadoid	4	69	7318	2464	4729	1099	No. & KG Sampled	39%	31%
France	2006	4	FU05 - Gadoid	5	132	636	347	1249	249	No. & KG Sampled	66%	42%
France	2006	All	FU05 - Gadoid	13	260	8446	3265	6380	1433	No. & KG Sampled	43%	30%
UK	2006	1	All Gears	16	213	3502	2046	2685	794	Raised No. & KG Sampled	43%	28%
UK	2006	2	All Gears	25	243	1116	404	1585	588	Raised No. & KG Sampled	59%	59%
UK	2006	3	All Gears	23	189	1122	437	3146	556	Raised No. & KG Sampled	74%	56%
UK	2006	4	All Gears	33	182	5654	2136	2335	560	Raised No. & KG Sampled	29%	21%
UK	2006	All	All Gears	97	827	11394	5024	9751	2498	Raised No. & KG Sampled	46%	33%
Ireland	2006	All	Otter Trawls VIIg	1	11	2174	1100	3361	823	o. '000s & tonnes raised to Fle	61%	43%
Ireland	2006	All	Otter Trawls VIIj	5	27	2287	580	1085	190	o. '000s & tonnes raised to Fle	32%	25%

Table 4.2.3 WHITING in Divisions VIIe-k.

Landings, Effort and LPUE by fleet

	FR-Gadoid VII fg French gadoid trawlers			FR-*Nephrops* VII fg French *Nephrops* trawlers			IR-OTB-7G Irish otter trawlers VIIg			IR-OTB-7J Irish otter trawlers VIIj			UK (E&W) in VIIe-k Beam	UK (E&W) in VIIe-k Otter
Year	Landings	Effort[4]	LPUE[3]	Landings	Effort[4]	LPUE[3]	Landings	Effort[4]	LPUE[3]	Landings	Effort[4]	LPUE[3]	Effort[4]	Effort[4]
1983	5,742	109	53	470	207	2							135	82
1984	4,598	84	55	340	173	2							131	87
1985	4,514	89	51	651	185	4							152	90
1986	5,049	116	44	374	146	3							136	85
1987	6,859	137	50	588	177	3							177	84
1988	7,921	200	40	844	156	5							195	89
1989	8,974	231	39	891	159	6							198	84
1990	7,897	188	42	671	196	3							208	99
1991	7,525	167	45	527	187	3							203	77
1992	6,460	173	37	1,153	234	5							196	86
1993	7,815	201	39	1,356	223	6							208	62
1994	9,236	171	54	1,565	223	7							220	54
1995	9,186	171	54	1,446	202	7	829	64	13	1,305	94	14	243	52
1996	6,028	152	40	1,230	179	7	906	60	15	803	70	11	261	61
1997	7,218	195	37	1,393	149	9	1,066	65	16	783	83	9	265	67
1998	9,102	172	53	881	125	7	813	72	11	545	90	6	255	62
1999	9,102	191	48	1,190	130	9	946	52	18	247	41	6	251	98
2000	6,053	157	38	869	161	5	990	61	16	517	65	8	259	104
2001	4,624	174	27	548	137	4	1,286	69	19	942	68	14	273	85
2002	4,841	165	29	550	142	4	1,004	78	13	758	90	8	249	83
2003	2,975	125	24	543	161	3	1,051	87	12	494	111	4	282	72
2004	2,589	107	24	435	127	3	1,932	97	20	312	92	3	274	76
2005	3,787	93	41	378	114	3	3,445	124	28	285	74	4	270	76
2006	2,783	74	37	172	104	2	2,754	118	23	251	65	4	252	83

	IR-SSC-7J Irish Scottish Seiners			IR-SSC-7G Irish Scottish Seiners			IR-TBB-7J Irish Beam Trawls			IR-TBB-7G Irish Beam Trawls		
Year	Landings	Effort[4]	LPUE[3]	Landings	Effort[4]	LPUE[3]	Landings	Effort[4]	LPUE[3]	Landings	Effort[4]	LPUE[3]
1995	1,008	5	192	1,123	6	175	0	0	1	63	21	3
1996	1,100	8	135	1,534	10	158	5	1	3	33	27	1
1997	806	11	75	2,654	16	165	3	2	2	44	28	2
1998	467	7	71	2,502	15	167	5	5	1	46	35	1
1999	77	1	55	1,378	8	172	8	7	1	47	41	1
2000	187	3	54	1,187	10	120	8	7	1	64	37	2
2001	236	4	53	1,005	16	62	6	3	2	79	40	2
2002	409	9	46	1,971	21	94	6	3	2	60	32	2
2003	371	9	41	1,560	21	75	13	9	1	55	49	1
2004	314	9	34	1,038	19	54	1	2	1	33	55	1
2005	253	6	41	1,004	15	68	1	2	1	24	50	0
2006	192	5	36	912	15	62	1	2	0	19	60	0

1 = LPUE calculated as landings in kg/h fishing, power corrected.
2 = Effort in hours fishing, power corrected
3 = LPUE calculated as landings in kg/h fishing.
4 = Effort in 000 hours fishing.

Table 4.2.4 WHITING in Divisions VIIe-k. Raised length distributions for 2006 by country and fleet (Numbers in '000s)

Length (cm)	France VII fgh	UK (E+W) Beam trawl VIIe-k	UK (E+W) All gears (exc beam) VIIe-k	Ireland Scottish Seine VIIg	Ireland Otter trawl VIIg	Ireland Beam trawl VIIg	Ireland Otter trawl VIIj
20	0	0	0	0	0	0	0
21	0	0	0	52	0	0	0
22	0	0	0	66	1	0	0
23	0	0	0	83	0	0	1
24	0	0	0	96	0	0	2
25	0	0	0	62	4	0	10
26	0	0	2	82	17	0	16
27	4	0	8	164	71	1	40
28	20	2	9	197	162	1	83
29	64	4	33	183	307	2	108
30	206	9	38	156	436	1	121
31	412	9	65	217	502	3	127
32	694	9	64	233	577	2	90
33	826	12	74	188	528	4	68
34	867	9	76	165	519	4	44
35	923	10	65	137	474	4	35
36	616	9	52	119	391	5	28
37	647	8	49	82	442	4	26
38	410	8	36	83	394	4	18
39	385	7	27	81	368	3	14
40	247	5	23	62	288	3	18
41	204	3	17	53	204	2	13
42	150	4	17	37	209	2	9
43	110	3	9	39	122	1	10
44	89	2	8	26	103	1	7
45	66	1	7	27	85	0	5
46	55	1	6	16	63	0	3
47	44	1	4	20	61	0	4
48	44	0	5	20	38	0	3
49	28	1	5	13	39	0	2
50	20	1	4	13	32	0	2
51	23	0	4	7	31	0	2
52	16	1	3	8	38	0	0
53	9	0	3	3	39	0	1
54	8	0	5	9	36	0	1
55	3	1	3	4	14	0	1
56	4	0	3	2	18	0	1
57	3	0	2	2	16	0	0
58	3	0	3	0	9	0	0
59	1	0	2	3	6	0	0
60	1	0	1	0	3	0	0
61	1	0	1	0	1	0	0
62	1	0	0	0	1	0	0
63	0	0	1	0	1	0	0
64	1	0	0	0	0	0	0
65	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0
Total N.	**7204**	**118**	**830**	**2809**	**6650**	**48**	**915**

Table 4.2.5 WHITING in Divisions VIIe-k. Landings numbers-at-age

Run title : Whiting in the Celtic Sea (VIIe-k), WGSSDS 2007, COMBSEX (Updated by SJM 08/06/0
At 2/07/2007 20:18

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

YEAR,	1982,	1983,	1984,	1985,	1986,
AGE					
0,	0,	0,	0,	0,	0,
1,	2624,	5867,	2854,	3698,	3769,
2,	12523,	9981,	18645,	15538,	15157,
3,	9862,	9059,	4697,	8005,	6465,
4,	4564,	3393,	1815,	1380,	2091,
5,	880,	1319,	618,	289,	553,
6,	41,	195,	128,	96,	60,
+gp,	23,	10,	28,	33,	45,
0 TOTALNUM,	30517,	29824,	28785,	29039,	28140,
TONSLAND,	11225,	11781,	9985,	10838,	9952,
SOPCOF %,	100,	100,	100,	100,	100,

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

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
0,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
1,	5977,	2315,	602,	3270,	8339,	4964,	2304,	1272,	540,	1345,
2,	19376,	26780,	17057,	9249,	11997,	20513,	22277,	14110,	15062,	7473,
3,	8825,	11400,	24243,	19509,	5578,	9198,	17939,	25384,	21854,	17783,
4,	2467,	1962,	3459,	8654,	11742,	1420,	2829,	6165,	14142,	12850,
5,	587,	409,	339,	749,	2700,	1275,	526,	1019,	2242,	5486,
6,	112,	70,	63,	62,	143,	435,	382,	135,	310,	775,
+gp,	60,	21,	25,	21,	3,	39,	172,	177,	92,	114,
0 TOTALNUM,	37404,	42957,	45788,	41514,	40502,	37844,	46429,	48262,	54242,	45826,
TONSLAND,	12652,	15128,	16541,	14106,	13508,	12364,	16320,	20034,	22678,	18260,
SOPCOF %,	100,	100,	100,	100,	100,	100,	100,	100,	102,	100,

1

Run title : Whiting in the Celtic Sea (VIIe-k), WGSSDS 2007, COMBSEX (Updated by SJM 08/06/0

At 2/07/2007 20:18

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

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
AGE										
0,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
1,	609,	1182,	4163,	3575,	337,	1070,	462,	1213,	771,	1361,
2,	4451,	6680,	10223,	9357,	11660,	6002,	3599,	4150,	6358,	6332,
3,	11734,	10938,	12444,	10328,	11087,	19884,	8264,	5972,	8372,	7621,
4,	21209,	12758,	8406,	5468,	5138,	5807,	11530,	6762,	5298,	3668,
5,	7322,	13240,	8733,	2351,	2061,	1080,	1675,	5984,	4731,	1762,
6,	2787,	2865,	6479,	1993,	746,	279,	264,	496,	3597,	1146,
+gp,	720,	882,	1465,	2388,	613,	114,	42,	73,	165,	610,
0 TOTALNUM,	48832,	48545,	51913,	35460,	31642,	34245,	25836,	24650,	29292,	22500,
TONSLAND,	20532,	19245,	19917,	14865,	12784,	13279,	10583,	9971,	12505,	9515,
SOPCOF %,	101,	101,	100,	99,	100,	100,	100,	100,	100,	100,

1

Table 4.2.6 WHITING in Divisions VIIe-k. Landings weights-at-age

Run title : Whiting in the Celtic Sea (VIIe-k), WGSSDS 2007, COMBSEX (Updated by SJM 08/06/0

At 2/07/2007 20:18

Table 2 Catch weights at age (kg)

YEAR,	1982,	1983,	1984,	1985,	1986,
AGE					
0,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.2450,	.2730,	.2270,	.2330,	.1980,
2,	.2790,	.3280,	.2860,	.3350,	.2770,
3,	.3950,	.4410,	.4570,	.4330,	.4930,
4,	.5570,	.5450,	.6560,	.6310,	.5850,
5,	.6470,	.6780,	.8080,	1.0080,	.7810,
6,	1.1930,	.7310,	1.0600,	1.1570,	1.4690,
+gp,	1.5930,	1.6520,	1.5140,	.9800,	1.6800,
0 SOPCOFAC,	.9996,	1.0007,	.9990,	1.0000,	1.0001,

Table 2 Catch weights at age (kg)

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.2220,	.2240,	.2010,	.2260,	.2200,	.2080,	.2050,	.2490,	.1900,	.2300,
2,	.2840,	.3030,	.2820,	.2600,	.2910,	.2890,	.2860,	.3000,	.2750,	.2660,
3,	.3980,	.4170,	.3760,	.3280,	.3550,	.3880,	.3760,	.4040,	.3800,	.3460,
4,	.6580,	.6280,	.5930,	.4520,	.3950,	.4720,	.5920,	.6370,	.5240,	.4590,
5,	.8770,	.9770,	.9800,	.7220,	.5340,	.6230,	.8420,	.9160,	.8440,	.5980,
6,	.8970,	1.3220,	1.4440,	1.0830,	.8340,	.7390,	.9730,	.9820,	1.0990,	.6160,
+gp,	.9900,	1.3740,	1.8770,	1.7210,	1.6950,	1.0840,	1.3610,	1.2210,	1.1970,	1.0580,
0 SOPCOFAC,	1.0010,	.9992,	.9984,	1.0005,	.9998,	1.0005,	1.0005,	1.0010,	1.0168,	1.0018,

1

Run title : Whiting in the Celtic Sea (VIIe-k), WGSSDS 2007, COMBSEX (Updated by SJM 08/06/0

At 2/07/2007 20:18

Table 2 Catch weights at age (kg)

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
AGE										
0,	.0000,	.0000,	.0000,	.1010,	.0000,	.0820,	.0000,	.0860,	.1010,	.1120,
1,	.2050,	.1880,	.2220,	.2500,	.2650,	.2180,	.2110,	.2190,	.2460,	.2320,
2,	.2810,	.2700,	.2980,	.3260,	.2860,	.2930,	.2810,	.3030,	.3180,	.2990,
3,	.3290,	.3340,	.3520,	.4190,	.3930,	.3630,	.3690,	.3770,	.3970,	.4140,
4,	.4010,	.3960,	.4260,	.5100,	.5210,	.5180,	.4470,	.4330,	.5060,	.5450,
5,	.5310,	.4520,	.4410,	.5730,	.6230,	.6800,	.6030,	.4920,	.5100,	.5850,
6,	.7070,	.5670,	.4970,	.5850,	.7610,	.8070,	.8310,	.5230,	.4880,	.5860,
+gp,	.9700,	.8960,	.6330,	.5970,	.8200,	1.0170,	1.1490,	.7550,	.5890,	.7060,
0 SOPCOFAC,	1.0115,	1.0060,	.9993,	.9911,	.9978,	.9989,	.9994,	1.0010,	1.0019,	1.0020,

1

Table 4.2.7 WHITING in Divisions VIIe-k. Stock weights-at-age

Run title : Whiting in the Celtic Sea (VIIe-k), WGSSDS 2007, COMBSEX (Updated by SJM 08/06/0

At 2/07/2007 20:18

Table 3 Stock weights at age (kg)

YEAR,	1982,	1983,	1984,	1985,	1986,
AGE					
0,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.1570,	.1670,	.1920,	.1790,	.1830,
2,	.2700,	.2760,	.2820,	.2720,	.2590,
3,	.3450,	.3630,	.3710,	.3890,	.3700,
4,	.4740,	.4980,	.5210,	.5340,	.5430,
5,	.6070,	.6320,	.7090,	.7380,	.7560,
6,	.8430,	.8260,	.8470,	1.0300,	1.0200,
+gp,	1.4030,	1.3130,	1.1880,	1.1870,	1.2230,

Table 3 Stock weights at age (kg)

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.1710,	.1860,	.1730,	.1660,	.1510,	.1740,	.1660,	.1750,	.1080,	.1350,
2,	.2530,	.2520,	.2490,	.2470,	.2480,	.2530,	.2510,	.2540,	.2590,	.2560,
3,	.3670,	.3420,	.3310,	.3170,	.3170,	.3270,	.3400,	.3400,	.3460,	.3280,
4,	.5330,	.5310,	.4770,	.4270,	.3960,	.4210,	.4700,	.4870,	.4760,	.4300,
5,	.7520,	.7840,	.7600,	.6510,	.5530,	.5510,	.6370,	.7150,	.7110,	.6260,
6,	1.0590,	1.0500,	1.1140,	1.0070,	.8150,	.7360,	.7790,	.9060,	.8610,	.8200,
+gp,	1.2610,	1.3220,	1.4390,	1.5240,	1.3100,	1.1330,	1.0340,	1.0770,	.9940,	.9420,

1

Run title : Whiting in the Celtic Sea (VIIe-k), WGSSDS 2007, COMBSEX (Updated by SJM 08/06/0

At 2/07/2007 20:18

Table 3 Stock weights at age (kg)

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.1100,	.1480,	.1120,	.1430,	.1820,	.1930,	.1870,	.1670,	.1630,	.1020,
2,	.2450,	.2380,	.2450,	.2540,	.2600,	.2480,	.2440,	.2550,	.2580,	.2550,
3,	.3070,	.2930,	.3200,	.3550,	.3700,	.3640,	.3340,	.3340,	.3480,	.3810,
4,	.3960,	.3780,	.4150,	.4610,	.4930,	.4870,	.4460,	.4500,	.4850,	.5480,
5,	.5250,	.4530,	.4810,	.5440,	.6070,	.6330,	.5670,	.5420,	.5360,	.6050,
6,	.6450,	.5850,	.5040,	.5950,	.6650,	.7980,	.6970,	.6500,	.5790,	.6670,
+gp,	.8300,	.7470,	.6650,	.6950,	.8590,	1.0780,	.9590,	.8670,	.7400,	.9000,

1

Table 4.2.8 WHITING in Divisions VIIe-k. Survey abundance indices of age groups 0-3

Year	UK-WCGFS			UK-BCCSBTS-S		FR-EVHOE				IR-WCGFS				IR-ISCSGFS				IR-GFS-7g&j				IR-GFS-7g-Swept Area			
	1-gp	2-gp	3-gp	0-gp	1-gp	0-gp	1-gp	2-gp	3-gp	0-gp	1-gp	2-gp	3-gp	0-gp	1-gp	2-gp	3-gp	0-gp	1-gp	2-gp	3-gp	0-gp	1-gp	2-gp	3-gp
1987	0.36	1.61	0.16																						
1988	0.24	0.23	0.06	0.1	0.9																				
1989	0.25	0.73	0.49	0.9	1.1																				
1990	0.02	0.06	0.25	5.2	0.5																				
1991	0.21	0.01	0.01	4.4	1.4																				
1992	1.31	0.53	0.11	6.7	1.3																				
1993	4.88	0.92	0.27	10.0	1.7					1.2	2.8	4.7	5.3												
1994	8.99	1.33	0.92	2.7	1.5					16.7	0.2	0.5	0.5												
1995	0.59	5.52	1.43	2.3	1.5					23.9	2.7	0.4	0.4												
1996	0.52	1.51	1.39	4.6	1.5					0.6	0.9	0.3	0.1												
1997	0.73	0.56	0.18	10.7	0.5	31	24	9	8.5	0.4	0.1	0.3	0.0	21	38	70	223								
1998	1.19	0.77	0.53	5.3	0.5	48	15	7.9	1.2	1.8	0.6	0.1	0.0	1605	1430	300	79								
1999	0.84	0.50	0.15	15.1	1.0	261	62	18	5.1	18.1	2.4	0.1	0.0	6389	507	120	38					24175	7307	1881	633
2000	14.91	0.93	0.29	1.2	3.1	31	77	23	2.9	0.2	2.1	0.6	0.0	6062	687	104	4					6077	15835	3116	190
2001	2.49	1.35	0.24	1.7	0.5	23	35	49	8	0.4	2.1	2.9	0.3	1661	1549	838	9					4650	2836	13871	1849
2002	3.35	1.80	3.04	5.3	0.3	39	15	11	10	5.3	7.4	2.5	0.7	312	298	102	77					2468	3664	1719	1252
2003	3.20	2.51	2.48	3.9	0.1	47	58	27	20	Survey discontinued				Survey discontinued				127	21	13	8	6061	2219	1027	413
2004	2.00	1.80	0.99	10.3	0.1	28	108	31	14									295	10	15	6	9778	3444	655	321
2005	Survey discontinued			6.4	0.0	44	16	5	2									83	38	8	10	1202	3330	1649	442
2006				1.9	0.1	15	10	3	1									373	13	9	6	15578	6006	2220	722

Table 4.2.9 WHITING in Divisions VIIe-k. Available commercial and survey tuning series ages and years used in the assessment are highlighted in bold

Whiting in the Celtic Sea, VIIe-k, Tuning data, WGSSDS 2007 (Updated by CL 03/07/07)
112
FR-NEPHROPS : French Nephrops trawlers (FU8) - Effort, # whiting/age/1000 h fished, Yr, Live wt (t) UPADTED 1999-2006 for WGSSDS 2007
1987 2006
1 1 0 1
1 11

1000	917	3681		2247	761	176	23	18	2	6	0	0	#1987	588t
1000	632	7960		3610	918	165	39	11	0	0	0	0	#1988	844t
1000	131	4874		6866	1294	128	31	5	1	0	0	0	#1989	891t
1000	321	1139		3596	2297	279	27	8	5	0	0	0	#1990	671t
1000	1048	2312		982	1745	498	33	6	0	0	0	0	#1991	527t
1000	1542	6078		3348	478	571	171	14	0	0	0	0	#1992	1153t
1000	766	6928		**5695**	**1001**	**163**	**86**	74	1	2	0	0	#1993	1356t
1000	184	6145		**8313**	**1840**	**214**	**17**	16	5	2	0	0	#1994	1565t
1000	29	2217		**7580**	**4802**	**697**	**91**	20	0	3	3	0	#1995	1446t
1000	2	979		**5599**	**4992**	**2359**	**305**	55	4	1	7	0	#1996	1230t
1000	0	737		**3511**	**10406**	**4124**	**1231**	275	23	1	0	0	#1997	1393t
1000	58	1042		**2567**	**4299**	**5925**	**1236**	239	46	2	0	0	#1998	881t
1000	1253	4408		**4764**	**3762**	**3867**	**3563**	575	136	8	0	0	#1999	1190
1000	277	2381		**3085**	**2213**	**923**	**836**	959	232	23	0	0	#2000	869
1000	104	2948		**3131**	**1531**	**557**	**213**	106	95	36	8	0	#2001	548
1000	27	747		**4007**	**1455**	**462**	**170**	69	13	14	7	0	#2002	550
1000	5	311	1	**708**	**3944**	**574**	**95**	27	7	1	0	2	#2003	543
1000	47	748		**1090**	**2045**	**2726**	**233**	49	6	0	0	0	#2004	435
1000	104	1285		**1926**	**1133**	**1266**	**1283**	54	2	0	0	0	#2005	378
1000	45	794		**1311**	**599**	**304**	**191**	104	12	0	0	0	#2006	172

FR-GADOID : French Gadoid trawlers (FU5) - Effort, # whiting/age/1000 h fished, Yr, Live wt (t) 1999-2005 UPDATED for WGSSDS 2007
1983 2006
1 1 0 1
1 11

1000	18355	41600	38639	15402	6194	887	51	0	0	0	0	#1983	5742t
1000	13779	97659	25223	9993	3362	688	82	46	22	0	0	#1984	4598t
1000	14948	75447	37539	6687	1506	540	189	9	0	0	0	#1985	4514t
1000	13417	66679	29328	9073	2310	266	183	20	3	2	0	#1986	5049t
1000	25446	79928	33683	10141	2358	518	161	30	36	0	0	#1987	6859t
1000	6738	71192	30313	5029	1040	184	45	4	2	0	0	#1988	7921t
1000	1539	41365	58078	7808	843	161	30	12	0	0	0	#1989	8974t
1000	10547	29023	60936	24967	2297	148	49	18	2	0	0	#1990	7897t
1000	31392	41485	18143	40085	8616	352	15	0	0	0	0	#1991	7525t
1000	15843	65677	28694	4589	4435	1226	132	0	0	0	0	#1992	6460t
1000	4736	57675	**35630**	**5286**	**825**	**883**	469	40	20	6	0	#1993	7815t
1000	448	26922	**65786**	**18395**	**2948**	**289**	454	125	80	0	0	#1994	9236t
1000	86	10737	**43840**	**34895**	**7662**	**1360**	248	0	28	32	0	#1995	9186t
1000	8	2509	**34872**	**31293**	**13650**	**1708**	328	32	31	29	0	#1996	6028t
1000	0	3641	17743	**45915**	**14168**	**4338**	**721**	63	12	0	0	#1997	7218t
1000	617	8649	**23781**	**33693**	**40109**	**7642**	1050	207	9	0	0	#1998	7674t
1000	3457	15689	**29265**	**22945**	**27790**	**19723**	2967	570	168	0	0	#1999	9102
1000	4987	23934	**29232**	**15124**	**6851**	**7110**	5976	1306	132	10	0	#2000	6053
1000	213	23745	**25724**	**9253**	**3440**	**1465**	593	539	114	57	0	#2001	4624
1000	406	9675	**48551**	**13160**	**2419**	**825**	138	60	27	25	0	#2002	4841
1000	13	2004	**15027**	**33581**	**3776**	**542**	94	48	67	13	3	#2003	2975
1000	238	4747	**10190**	**18892**	**20570**	**1688**	269	17	0	0	0	#2004	2589
1000	278	12024	**24564**	**16497**	**18363**	**16369**	426	58	0	0	0	#2005	3787
1000	289	16886	**35247**	**15551**	**7893**	**5416**	2189	142	6	0	0	#2006	2783

FR-EVHOE : Thalassa Survey - #@ age/30 min, Yr (All indices revised in 2005 by JC Mahé)
1997 2006
1 1 0.75 1.0
0 8

1	**30.82**	**23.85**	**8.93**	**8.47**	10.38	1.93	0.24	0.00	0.00	#1997
1	**48.10**	**15.15**	**7.88**	**1.23**	1.67	0.55	0.18	0.02	0.00	#1998
1	**260.66**	**62.15**	**17.64**	**5.09**	1.92	1.67	1.18	0.15	0.13	#1999
1	**30.62**	**76.50**	**23.18**	**2.85**	1.17	0.33	0.18	0.50	0.06	#2000
1	**22.77**	**35.46**	**48.80**	**8.12**	0.79	0.14	0.11	0.02	0.04	#2001
1	**38.50**	**15.33**	**11.00**	**9.58**	0.82	0.00	0.00	0.00	0.00	#2002
1	**46.62**	**58.30**	**27.11**	**19.94**	14.74	0.05	0.01	0.00	0.00	#2003
1	**28.23**	**108.11**	**31.11**	**14.36**	6.98	3.98	0.00	0.00	0.00	#2004
1	**44.14**	**15.85**	**5.19**	**1.89**	1.15	0.63	0.16	0.00	0.00	#2005
1	**14.60**	**9.53**	**3.45**	**1.18**	0.30	0.03	0.00	0.01	0.00	#2006

```
UK-WCGFS : UK (Eng+Wales) PHHT Groundfish Survey in VIIf&g - Effort mins towed, #@
age, Yr, Vessel
1987    2004
1       1       0.15    0.25
1       7
360       129.0  580.0    57.0    8.0     6.0     4.0    1.0    #1987   Cirolana
540       129.0  125.0    31.0    3.0     3.0     0.0    0.0    #1988   Cirolana
540       137.0  393.0    67.0   21.0     4.0     2.0    0.0    #1989   Cirolana
540        11.0   31.0   137.0   55.0     9.0     1.0    0.0    #1990   Cirolana
482        99.0    6.0     3.0   11.0     9.0     1.0    0.0    #1991   Cirolana
840      1097.0  441.0    94.0   28.0    22.0     6.0    1.0    #1992   Cirolana
840      4101.0  772.0   229.0   29.0     4.0     8.0    3.0    #1993   Cirolana
535      4809.0  713.0   490.0   70.0    17.0     1.0    3.0    #1994   Cirolana
1320      777.4 7282.9  1891.2  595.0    82.2    18.6   11.3    #1995   Cirolana
1475      773.0 2225.0  2050.0  391.0   148.0    11.0    2.0    #1996   Corystes
1519     1113.0  852.0   280.0  646.0   226.0    60.0    5.0    #1997   Cirolana
900      1071.5  691.5   477.0  343.3   104.8    13.3   12.5    #1998   Cirolana
900       760.2  453.9   139.4   52.1    47.8    90.2   30.5    #1999   Cirolana
1038    15471.8  962.8   296.4  118.9    47.2    51.0   50.6    #2000   Cirolana
880      2195.3 1186.5   206.8   35.4     2.0     7.6    1.0    #2001   Cirolana
762      2551.5 1368.9  2313.6  155.9     75.7    1.2    4.4    #2002   Cirolana
863      2765.7 2169.9  2138.8  1665.8  157.9     0.0    0.0    #2003   Cirolana
860      1716.8 1548.2   852.1   203.6  184.3     2.0    0.0    #2004   CEFAS Endeavour
UK-BCCSBTS : UK (E&W) Autumn Beam Trawl Survey (Sept) - Prime stations only (VIIf)
Effort (km towed), #@ age (/km towed), Yr
1988    2006
1       1       0.75    0.85
0       1
74.12      6     66     #1988   Tows 15 minute duration - raised here to 30 minutes
91.91     80    104     #1989   Tows 15 minute duration - raised here to 30 minutes
69.86    363     37     #1990
123.41   540    175     #1991
125.08   839    164     #1992
127.67  1279    213     #1993
120.82   330    182     #1994
104.14   240    154     #1995
122.11   557    188     #1996
115.63  1238     56     #1997
104.70   553     49     #1998
117.11  1770    116     #1999
105.99   128    333     #2000
118.22   204     56     #2001
113.03   602     36     #2002
111.92   442      6     #2003
101.92  1053      6     #2004
119.11   760      5     #2005
120.63   232     27     #2006
IR-GFS-7G Swept Area : Swept Area Method
1999    2006
1       1       0.75    0.92
0       7
1       24175    7307    1881    633    292     110      85     40      #1999
1        6077   15835    3116    190     35      27       8      0      #2000
1        4650    2836   13871   1849    222      18      22      6      #2001
1        2468    3664    1719   1252    127       3       9      0      #2002
1        6061    2219    1027    413     22      10       0      0      #2003
1        9778    3444     655    321    147     123       1      0      #2004
1        1202    3330    1649    442    178     109     171      0      #2005
1        15578   6006    2220    722     69       0      29      0      #2006
IR-7G&J-OT : Irish Otter Trawl Fleet (Areas VIIg&j) - Effort in h, #@ age, Yr, Live wt
(t)
1995    2006
1       1       0       1
1       4
157085  679     2281    1889    1333    #                       1995
130257  164     1549    1889     905    #                       1996
148276  170      756    1488    1247    #                       1997
161909  180      933     980     736    #                       1998
 92195  388      960     962     449    #                       1999
125229  619     1042    808      500    # 228   103      65     2000    1506.6t
137086   91     2224    1538    1046    # 412   125      48     2001    2227.9t
168134  291     1140    2615     613    #  86    13       6     2002    1761.4t
198059  147      878    1640    1195    # 155     8       0     2003    1544.6t
188948  133      626    1756     995    # 424    42       2     2004    2243.8t
198315   97     1751    2862    1233    #1167   747      31     2005    3730.4 t
183710  188     1898    2067     949    # 427   283     127     2006    3004.4 t       27
```

```
IR-ISCSGFS : Irish Sea Celtic Sea GFS (VIIg) - Whiting #/30 min towed (Prime stations
only)
1997    2002
1       1       0.8     0.9
0         5
1         21      38      70     223     113     23
1       1605    1430    300     79      135     16
1       6389     507    120     38      17      6.3
1       6062     687    104     4.2     0.2     0.1
1       1661    1549    838     8.8     0.4     0.5
1        312     298    102     77      9.1     0.2
IR-WCGFS : Irish Autumn WCGFS  (VIIj) - Effort min. towed, #@ age, Yr
1993    2002
1       1       0.75    0.79
0       6
323     372     912     1529    1722    352     0       0       #1993
673     11235   123     304     344     25      0       0       #1994
651     15564   1736    229     285     29      0       0       #1995
671     406     618     189     42      59      0       0       #1996
1232    478     171     345     59      22      21      12      #1997
1310    2384    758     159     34      65      7       2       #1998
1281    23133   3013    175     45      12      2       2       #1999
1190    203     2445    664     44      6       0       0       #2000
595     218     1253    1709    169     12      2       0       #2001
606     3239    4489    1538    438     61      5       1       #2002
IR-GFS-7G : Irish Groundfish Survey in VIIg (IBTS 4th Qtr) - Whiting no. @ age
(Interim indices: New Celtic Explorer series)

2003    2006
1       1       0.79    0.92
0       6
832     6598    2571    1189    466     23      11      0       #2003
980     12662   4470    853     417     191     159     2       #2004
845     4078    4776    1745    483     178     107     182     #2005
1046    22967   8854    3273    1064    102     0       43      #2006
IR-GFS-7J : Irish Groundfish Survey in VIIj (IBTS 4th Qtr) - Whiting no. @ age
(Interim indices: New Celtic Explorer series)

2003    2006
1       1       0.79    0.92
0       6
780     227     2121    883     146     67      3       0       #2003
720     3864    1230    1675    155     27      6       4       #2004
881     455     1001    234     121     17      4       9       #2005
901     727     1141    403     31      15      3       3       #2006
IR-GFS-7G&J : Irish Groundfish Survey in VIIg&j (IBTS 4th Qtr) - Whiting no. @ age
(Interim indices: New Celtic Explorer series)

2003    2006
1       1       0.79    0.92
0       6
1612    6836    4714    2064    582     96      12      0       #2003
1700    16710   5405    2733    570     170     115     10      #2004
1726    4761    6085    1655    573     142     75      101     #2005
1947    24194   10418   3250    637     100     3       25      #2006
```

Table 4.2.10 WHITING in Divisions VIIe-k.

```
 Lowestoft VPA Version 3.1

    2/07/2007  20:16

 Extended Survivors Analysis

 Whiting in the Celtic Sea (VIIe-k), WGSSDS 2007, COMBSEX (Updated by SJM 08/06/0

 CPUE data from file whg7ektuall.txt

 Catch data for  25 years. 1982 to 2006. Ages  0 to   7.

      Fleet,            First, Last, First, Last, Alpha,  Beta
                    ,    year, year,  age ,  age
 FRGAD               ,   1993, 2006,   3,     6,   .000,  1.000
 FRNEP               ,   1993, 2006,   3,     6,   .000,  1.000
 FREVHOE             ,   1997, 2006,   0,     4,   .750,  1.000
 UKWCGFS             ,   1987, 2006,   1,     6,   .150,   .250
 IRGFS7G             ,   1999, 2006,   0,     6,   .750,   .920


 Time series weights :

      Tapered time weighting not applied


 Catchability analysis :

      Catchability independent of stock size for all ages

      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 =   1.000

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

      Prior weighting not applied


 Tuning converged after   28 iterations

1


 Regression weights
       , 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000



 Fishing mortalities
    Age,  1997,  1998,  1999,  2000,  2001,  2002,  2003,  2004,  2005,  2006

      0,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000
      1,  .014,  .028,  .089,  .036,  .007,  .036,  .016,  .033,  .025,  .040
      2,  .127,  .211,  .364,  .294,  .159,  .167,  .164,  .194,  .239,  .299
      3,  .287,  .524,  .767,  .781,  .681,  .445,  .365,  .448,  .751,  .503
      4,  .503,  .582, 1.039,  .965, 1.270,  .980,  .505,  .579,  .946,  .913
      5,  .806,  .691, 1.077,  .977, 1.377, 1.070,  .883,  .538, 1.110, 1.022
      6,  .897,  .897,  .904,  .776, 1.027,  .673,  .848,  .719,  .742,  .921


1
```

Table 4.2.10 (cont'd)

XSA population numbers (Thousands)

YEAR	AGE 0	1	2	3	4	5	6
1997	5.68E+04	4.80E+04	4.11E+04	5.20E+04	5.93E+04	1.46E+04	5.20E+03
1998	6.62E+04	4.65E+04	3.87E+04	2.97E+04	3.20E+04	2.93E+04	5.35E+03
1999	1.36E+05	5.42E+04	3.70E+04	2.57E+04	1.44E+04	1.46E+04	1.20E+04
2000	6.48E+04	1.11E+05	4.06E+04	2.11E+04	9.76E+03	4.17E+03	4.08E+03
2001	4.07E+04	5.31E+04	8.77E+04	2.48E+04	7.90E+03	3.05E+03	1.28E+03
2002	3.94E+04	3.33E+04	4.31E+04	6.12E+04	1.03E+04	1.82E+03	6.29E+02
2003	5.10E+04	3.23E+04	2.63E+04	2.99E+04	3.21E+04	3.16E+03	5.10E+02
2004	4.15E+04	4.17E+04	2.60E+04	1.83E+04	1.70E+04	1.59E+04	1.07E+03
2005	4.66E+04	3.40E+04	3.31E+04	1.75E+04	9.57E+03	7.80E+03	7.59E+03
2006	2.91E+04	3.82E+04	2.71E+04	2.13E+04	6.77E+03	3.04E+03	2.10E+03

Estimated population abundance at 1st Jan 2007

	0.00E+00	2.39E+04	3.00E+04	1.65E+04	1.06E+04	2.22E+03	8.97E+02

Taper weighted geometric mean of the VPA populations:

	6.89E+04	5.69E+04	4.43E+04	2.47E+04	9.18E+03	2.64E+03	6.27E+02

Standard error of the weighted Log(VPA populations) :

	.5197	.5074	.5142	.6534	.9150	1.1835	1.4943

1

Log catchability residuals.

Fleet : FRGAD

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	.35	.21	-.20	-.91
4	99.99	99.99	99.99	99.99	99.99	99.99	-.25	.20	-.13	-.34
5	99.99	99.99	99.99	99.99	99.99	99.99	-.28	.00	.16	-.38
6	99.99	99.99	99.99	99.99	99.99	99.99	-.04	.06	.21	-.32

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	-.99	-.03	.42	.63	.29	-.08	-.57	-.43	.62	.68
4	-.60	-.26	.34	.28	.13	.10	-.30	-.21	.38	.66
5	-.45	-.15	.34	.15	-.07	-.02	-.21	-.27	.56	.62
6	-.56	-.02	.12	.13	-.19	-.20	-.34	.00	.32	.58

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	-6.7564	-6.2285	-6.0300	-6.0300
S.E(Log q)	.5584	.3519	.3326	.2946

Table 4.2.10 (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

  3,    2.44,   -2.424,      1.43,     .19,     14,    1.16,   -6.76,
  4,    1.54,   -3.614,      4.36,     .79,     14,     .39,   -6.23,
  5,    1.04,    -.398,      5.93,     .90,     14,     .36,   -6.03,
  6,     .96,     .546,      6.10,     .95,     14,     .29,   -6.05,

 Fleet : FRNEP

  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,   .68,   .30,   .21,  -.58
     4 , 99.99, 99.99, 99.99, 99.99, 99.99, 99.99,   .18,   .00,  -.02,  -.07
     5 , 99.99, 99.99, 99.99, 99.99, 99.99, 99.99,   .15,  -.56,  -.18,  -.08
     6 , 99.99, 99.99, 99.99, 99.99, 99.99, 99.99,  -.31,  -.71,  -.43,   .01

  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 ,  -.45,  -.10,   .77,   .54,   .35,  -.41,  -.58,  -.50,   .24,  -.45
     4 ,   .01,  -.22,   .63,   .46,   .42,   .00,  -.35,  -.34,  -.20,  -.50
     5 ,   .38,  -.01,   .42,   .21,   .17,   .38,  -.03,  -.23,  -.05,  -.57
     6 ,   .24,   .22,   .47,   .05,  -.06,   .28,  -.02,   .08,  -.16,  -.71

 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,   -8.9167,   -8.3257,   -8.0894,   -8.0894,
 S.E(Log q),     .4941,     .3288,     .3159,     .3650,

 Regression statistics :


 Ages with q independent of year class strength and constant w.r.t. time.

 Age, Slope , t-value , Intercept, RSquare, No Pts, Reg s.e,  Mean Q

  3,    1.27,    -.823,      8.51,     .44,     14,     .63,   -8.92,
  4,    1.12,    -.835,      8.17,     .80,     14,     .37,   -8.33,
  5,     .96,     .457,      8.11,     .92,     14,     .31,   -8.09,
  6,     .86,    2.215,      8.06,     .95,     14,     .27,   -8.17,

 Fleet : FREVHOE

  Age  ,  1997,  1998,  1999,  2000,  2001,  2002,  2003,  2004,  2005,  2006
     0 ,  -.33,  -.03,   .94,  -.46,  -.30,   .26,   .20,  -.10,   .23,  -.41
     1 ,  -.33,  -.74,   .57,   .01,  -.04,  -.39,   .96,  1.34,  -.38, -1.00
     2 ,  -.60,  -.59,   .39,   .51,   .37,  -.41,   .99,  1.16,  -.83,  -.99
     3 ,  -.31, -1.47,   .30,  -.07,   .73,  -.22,  1.16,  1.40,  -.32, -1.20
     4 ,   .26,  -.88,   .46,   .28,   .37,  -.11,  1.23,  1.18,   .27, -3.06
     5 , No data for this fleet at this age
     6 , 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
 Mean Log q,   -7.0180,   -7.0888,   -7.5470,   -7.9843,   -8.2979,
 S.E(Log q),     .4252,     .7445,     .7757,     .9318,    1.2294,
```

Table 4.2.10 (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
0,	.61,	2.225,	8.50,	.81,	10,	.22,	-7.02,
1,	.97,	.040,	7.19,	.20,	10,	.77,	-7.09,
2,	1.14,	-.155,	7.14,	.14,	10,	.93,	-7.55,
3,	1.59,	-.477,	6.67,	.08,	10,	1.55,	-7.98,
4,	.63,	1.046,	8.80,	.50,	10,	.77,	-8.30,

1

Fleet : UKWCGFS

Age	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
0 ,	No data for this fleet at this age									
1 ,	-1.22,	-1.40,	-.18,	-3.20,	-1.56,	-.13,	1.32,	1.61,	-.52,	-.10
2 ,	1.34,	-1.28,	.05,	-1.28,	-3.28,	-.21,	-.16,	.32,	1.40,	.69
3 ,	.56,	-.86,	.40,	-.21,	-2.38,	-.12,	.04,	.55,	1.02,	.57
4 ,	.04,	-1.12,	.19,	.08,	-1.37,	.64,	-.10,	.44,	.73,	.13
5 ,	1.13,	.10,	.60,	.72,	-.45,	.39,	-.31,	.67,	.54,	-.06
6 ,	1.44,	99.99,	.96,	.56,	.23,	.11,	.59,	.14,	.87,	-.55

Age	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006
0 ,	No data for this fleet at this age									
1 ,	.31,	.83,	.34,	2.48,	1.43,	99.99,	99.99,	99.99,	99.99,	99.99
2 ,	.26,	.65,	.30,	.81,	.38,	99.99,	99.99,	99.99,	99.99,	99.99
3 ,	-.87,	.79,	-.24,	.57,	.19,	99.99,	99.99,	99.99,	99.99,	99.99
4 ,	-.02,	.50,	-.50,	.56,	-.21,	99.99,	99.99,	99.99,	99.99,	99.99
5 ,	.20,	-.76,	-.78,	.30,	-2.30,	99.99,	99.99,	99.99,	99.99,	99.99
6 ,	-.07,	-1.09,	.02,	.36,	-.17,	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 ,	1,	2,	3,	4,	5,	6
Mean Log q,	-11.3527,	-11.3952,	-11.5819,	-11.6800,	-11.4941,	-11.4941,
S.E(Log q),	1.4615,	1.1902,	.8638,	.6100,	.8440,	.6878,

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,	.59,	.869,	11.29,	.26,	15,	.88,	-11.35,
2,	.55,	1.325,	11.20,	.40,	15,	.64,	-11.40,
3,	.59,	2.196,	11.07,	.69,	15,	.45,	-11.58,
4,	.91,	.585,	11.46,	.75,	15,	.57,	-11.68,
5,	1.36,	-1.585,	12.76,	.59,	15,	1.09,	-11.49,
6,	1.34,	-2.510,	12.78,	.82,	14,	.73,	-11.25,

1

Table 4.2.10 (cont'd)

Fleet : IRGFS7G

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	99.99	99.99	.39	-.26	-.06	-.66	-.02	.67	-1.55	1.49
1	99.99	99.99	.34	.36	-.65	.10	-.39	-.19	-.03	.46
2	99.99	99.99	.01	.36	.97	-.40	-.42	-.83	-.12	.43
3	99.99	99.99	.23	-.77	1.26	-.23	-.69	-.38	.24	.33
4	99.99	99.99	.57	-1.22	1.09	.03	99.99	-.66	.41	-.22
5	99.99	99.99	.36	.13	.37	-1.16	-.66	-.06	1.01	99.99
6	99.99	99.99	.16	-1.23	1.15	.67	99.99	-2.02	1.18	.84

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	6
Mean Log q	-1.9443	-2.1076	-2.5170	-3.1250	-3.4385	-4.1892	-4.1892
S.E(Log q)	.9021	.3920	.5746	.6614	.7819	.7180	1.2567

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	1.28	-.280	-.58	.14	8	1.24	-1.94
1	.78	.738	3.96	.66	8	.32	-2.11
2	.50	2.399	6.52	.79	8	.22	-2.52
3	1.24	-.291	1.42	.19	8	.88	-3.13
4	1.96	-.459	-2.15	.04	7	1.65	-3.44
5	.67	1.550	5.64	.82	7	.43	-4.19
6	.89	.229	4.48	.49	7	1.22	-4.08

1

Terminal year survivor and F summaries :

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

Year class = 2006

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FRGAD	1.	.000	.000	.00	0	.000	.000
FRNEP	1.	.000	.000	.00	0	.000	.000
FREVHOE	15898.	.500	.000	.00	1	.785	.000
UKWCGFS	1.	.000	.000	.00	0	.000	.000
IRGFS7G	105328.	.957	.000	.00	1	.215	.000
F shrinkage mean	0.	1.00				.000	.000

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
23850.	.44	.78	2	1.752	.000

Table 4.2.10 (cont'd)

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

Year class = 2005

Fleet,		Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FRGAD	,	1.,	.000,	.000,	.00,	0,	.000,	.000
FRNEP	,	1.,	.000,	.000,	.00,	0,	.000,	.000
FREVHOE	,	26457.,	.421,	.557,	1.32,	2,	.479,	.045
UKWCGFS	,	1.,	.000,	.000,	.00,	0,	.000,	.000
IRGFS7G	,	30889.,	.443,	.823,	1.86,	2,	.433,	.039
F shrinkage mean	,	51819.,	1.00,,,,				.088,	.023

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
30022.,	.29,	.35,	5,	1.185,	.040

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

Year class = 2004

Fleet,		Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FRGAD	,	1.,	.000,	.000,	.00,	0,	.000,	.000
FRNEP	,	1.,	.000,	.000,	.00,	0,	.000,	.000
FREVHOE	,	11536.,	.374,	.247,	.66,	3,	.438,	.403
UKWCGFS	,	1.,	.000,	.000,	.00,	0,	.000,	.000
IRGFS7G	,	20733.,	.358,	.193,	.54,	3,	.478,	.244
F shrinkage mean	,	28134.,	1.00,,,,				.084,	.185

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
16458.,	.25,	.18,	7,	.719,	.299

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

Year class = 2003

Fleet,		Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FRGAD	,	20890.,	.578,	.000,	.00,	1,	.130,	.285
FRNEP	,	6739.,	.511,	.000,	.00,	1,	.166,	.705
FREVHOE	,	10594.,	.351,	.489,	1.39,	4,	.284,	.501
UKWCGFS	,	1.,	.000,	.000,	.00,	0,	.000,	.000
IRGFS7G	,	10319.,	.321,	.121,	.38,	4,	.349,	.512
F shrinkage mean	,	9581.,	1.00,,,,				.072,	.542

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
10560.,	.20,	.18,	11,	.880,	.503

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
FRGAD	,	4257.,	.399,	.015,	.04,	2,	.236,	.576
FRNEP	,	1696.,	.379,	.343,	.90,	2,	.253,	1.084
FREVHOE	,	2052.,	.358,	.681,	1.90,	5,	.167,	.962
UKWCGFS	,	1.,	.000,	.000,	.00,	0,	.000,	.000
IRGFS7G	,	1584.,	.324,	.173,	.53,	5,	.235,	1.130
F shrinkage mean	,	2414.,	1.00,,,,				.109,	.865

Table 4.2.10 (cont'd)

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
2225.,	.20,	.19,	15,	.969,	.913

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
FRGAD	,	1394.,	.348,	.236,	.68,	3,	.312,	.763
FRNEP	,	559.,	.338,	.110,	.33,	3,	.322,	1.349
FREVHOE	,	1084.,	.345,	.337,	.98,	5,	.097,	.905
UKWCGFS	,	1.,	.000,	.000,	.00,	0,	.000,	.000
IRGFS7G	,	852.,	.308,	.159,	.52,	5,	.132,	1.055
F shrinkage mean	,	918.,	1.00,,,,				.138,	1.007

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
897.,	.21,	.12,	17,	.571,	1.022

1

Age 6 Catchability constant w.r.t. time and age (fixed at the value for age) 5

Year class = 2000

Fleet,		Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, ,	Scaled, Weights,	Estimated F
FRGAD	,	1039.,	.334,	.203,	.61,	4,	.338,	.692
FRNEP	,	406.,	.329,	.153,	.46,	4,	.344,	1.269
FREVHOE	,	695.,	.342,	.335,	.98,	5,	.053,	.913
UKWCGFS	,	2863.,	1.509,	.000,	.00,	1,	.002,	.309
IRGFS7G	,	759.,	.385,	.308,	.80,	7,	.130,	.862
F shrinkage mean	,	815.,	1.00,,,,				.132,	.821

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
686.,	.21,	.12,	22,	.584,	.921

Table 4.2.11 WHITING in Divisions VIIe-k.

Fishing mortality (F) at age

Run title : Whiting in the Celtic Sea (VIIe-k), WGSSDS 2007, COMBSEX (Updated by SJM 08/06/0

At 2/07/2007 20:18

Table 8 Fishing mortality (F) at age

YEAR,	1982,	1983,	1984,	1985,	1986,
AGE					
0,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.1051,	.1365,	.0796,	.0970,	.0738,
2,	.6225,	.7233,	.8390,	.8013,	.7128,
3,	1.0477,	1.4397,	.9415,	1.1684,	.9789,
4,	1.2361,	1.5044,	1.5504,	.8238,	1.2285,
5,	1.3851,	1.9812,	1.5092,	1.2808,	.9836,
6,	1.2381,	1.6641,	1.3509,	1.1040,	1.0764,
+gp,	1.2381,	1.6641,	1.3509,	1.1040,	1.0764,
0 FBAR 2- 5,	1.0728,	1.4121,	1.2101,	1.0186,	.9760,

Table 8 Fishing mortality (F) at age

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0626,	.0301,	.0249,	.0836,	.1098,	.0420,	.0222,	.0089,	.0068,	.0292,
2,	.6563,	.4358,	.3214,	.6400,	.4956,	.4288,	.2677,	.1837,	.1381,	.1222,
3,	1.3447,	1.0984,	.9263,	.7541,	1.0800,	.9181,	.8482,	.5573,	.4804,	.2402,
4,	1.4890,	1.4713,	1.3509,	1.0935,	1.7574,	.9281,	.8328,	.8222,	.7084,	.5850,
5,	1.7626,	1.1879,	1.2309,	1.4134,	1.4118,	1.0112,	1.1780,	.8483,	.8361,	.6701,
6,	.5347,	1.2147,	.5603,	.7800,	1.2916,	.9434,	1.0216,	1.2196,	.6858,	.8029,
+gp,	.5347,	1.2147,	.5603,	.7800,	1.2916,	.9434,	1.0216,	1.2196,	.6858,	.8029,
0 FBAR 2- 5,	1.3132,	1.0483,	.9574,	.9752,	1.1862,	.8215,	.7817,	.6029,	.5407,	.4044,

Run title : Whiting in the Celtic Sea (VIIe-k), WGSSDS 2007, COMBSEX (Updated by SJM 08/06/0

At 2/07/2007 20:18

Table 8 Fishing mortality (F) at age

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,	FBAR **-**
AGE											
0,	.0000,	.0000,	.0000,	.0000,	.0000,	.0003,	.0000,	.0000,	.0000,	.0000,	.0000,
1,	.0141,	.0285,	.0887,	.0362,	.0070,	.0361,	.0160,	.0327,	.0254,	.0402,	.0328,
2,	.1274,	.2114,	.3641,	.2937,	.1590,	.1669,	.1639,	.1942,	.2389,	.2987,	.2439,
3,	.2867,	.5237,	.7670,	.7809,	.6813,	.4445,	.3646,	.4476,	.7508,	.5026,	.5670,
4,	.5033,	.5816,	1.0386,	.9647,	1.2695,	.9800,	.5049,	.5792,	.9460,	.9130,	.8127,
5,	.8060,	.6908,	1.0775,	.9770,	1.3770,	1.0701,	.8828,	.5384,	1.1100,	1.0216,	.8900,
6,	.8971,	.8967,	.9035,	.7765,	1.0271,	.6732,	.8485,	.7190,	.7418,	.9210,	.7939,
+gp,	.8971,	.8967,	.9035,	.7765,	1.0271,	.6732,	.8485,	.7190,	.7418,	.9210,	
0 FBAR 2- 5,	.4308,	.5019,	.8118,	.7541,	.8717,	.6654,	.4790,	.4398,	.7614,	.6840,	

Table 4.2.12 WHITING in Divisions VIIe-k.

Run title : Whiting in the Celtic Sea (VIIe-k), WGSSDS 2007, COMBSEX (Updated by SJM 08/06/0
At 2/07/2007 20:18

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

YEAR,	1982,	1983,	1984,	1985,	1986,
AGE					
0,	62052,	50325,	54017,	71471,	133051,
1,	29069,	50804,	41202,	44225,	58516,
2,	29867,	21425,	36286,	31151,	32863,
3,	16787,	13122,	8510,	12838,	11445,
4,	7109,	4821,	2546,	2717,	3267,
5,	1297,	1691,	877,	442,	976,
6,	64,	266,	191,	159,	101,
+gp,	35,	13,	41,	53,	74,
0 TOTAL,	146280,	142466,	143670,	163058,	240292,

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

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
0,	105435,	33070,	55028,	108252,	163078,	141740,	194266,	107837,	63183,	58625,
1,	108933,	86323,	27076,	45053,	88629,	133517,	116047,	159052,	88290,	51730,
2,	44498,	83778,	68580,	21623,	33927,	65018,	104823,	92926,	129070,	71797,
3,	13191,	18900,	44360,	40715,	9334,	16922,	34671,	65665,	63314,	92045,
4,	3521,	2815,	5159,	14383,	15682,	2595,	5532,	12155,	30793,	32063,
5,	783,	650,	529,	1094,	3945,	2215,	840,	1969,	4373,	12415,
6,	299,	110,	162,	127,	218,	787,	660,	212,	690,	1552,
+gp,	158,	32,	64,	42,	4,	69,	292,	272,	202,	225,
0 TOTAL,	276818,	225678,	200958,	231289,	314819,	362864,	457131,	440087,	379915,	320451,

1

Run title : Whiting in the Celtic Sea (VIIe-k), WGSSDS 2007, COMBSEX (Updated by SJM 08/06/0
At 2/07/2007 20:18

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 82-**	AMST 82-**
AGE													
0,	56824,	66237,	135629,	64823,	40706,	39404,	50969,	41469,	46626,	29131,	0,	72780,	82500,
1,	47998,	46524,	54231,	111043,	53073,	33327,	32253,	41730,	33952,	38174,	23850,	59186,	67332,
2,	41136,	38746,	37021,	40633,	87680,	43147,	26318,	25989,	33068,	27100,	30022,	45848,	52535,
3,	52020,	29652,	25679,	21060,	24801,	61236,	29895,	18291,	17523,	21321,	16458,	25259,	31498,
4,	59269,	31973,	14379,	9764,	7897,	10274,	32144,	16999,	9572,	6771,	10560,	9285,	14255,
5,	14624,	29335,	14634,	4167,	3046,	1817,	3157,	15884,	7799,	3043,	2225,	2498,	5250,
6,	5201,	5348,	12037,	4079,	1284,	629,	510,	1069,	7590,	2104,	897,	534,	1555,
+gp,	1322,	1620,	2677,	4817,	1036,	254,	80,	155,	343,	1101,	1045,		
0 TOTAL,	278394,	249434,	296286,	260387,	219524,	190088,	175326,	161585,	156472,	128745,	85057,		

Table 4.2.13 WHITING in Divisions VIIe-k.

Run title : Whiting in the Celtic Sea (VIIe-k), WGSSDS 2007, COMBSEX (Updated by SJM 08/06/0,

At 2/07/2007 20:18

Table 16 Summary (without SOP correction)

,	RECRUITS, Age 0	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 2- 5,
1982,	62052,	22680,	18998,	11225,	.5909,	1.0728,
1983,	50325,	22867,	17029,	11781,	.6918,	1.4121,
1984,	54017,	23459,	17565,	9985,	.5684,	1.2101,
1985,	71471,	23388,	17647,	10838,	.6142,	1.0186,
1986,	133051,	26160,	18717,	9952,	.5317,	.9760,
1987,	105435,	37708,	25153,	12652,	.5030,	1.3132,
1988,	33070,	45795,	33810,	15128,	.4474,	1.0483,
1989,	55028,	39579,	34843,	16541,	.4747,	.9574,
1990,	108252,	32772,	27485,	14106,	.5132,	.9752,
1991,	163078,	33331,	24235,	13508,	.5574,	1.1862,
1992,	141740,	48186,	32303,	12364,	.3827,	.8215,
1993,	194266,	61313,	46787,	16320,	.3488,	.7817,
1994,	107837,	81575,	61954,	20034,	.3234,	.6029,
1995,	63183,	83433,	73908,	22678,	.3068,	.5407,
1996,	58625,	78597,	72060,	18260,	.2534,	.4044,
1997,	56824,	66928,	62305,	20532,	.3295,	.4308,
1998,	66237,	54508,	49178,	19245,	.3913,	.5019,
1999,	135629,	44215,	39461,	19917,	.5047,	.8118,
2000,	64823,	46220,	35381,	14865,	.4201,	.7541,
2001,	40706,	49119,	40817,	12784,	.3132,	.8717,
2002,	39404,	46352,	41085,	13279,	.3232,	.6654,
2003,	50969,	38996,	34432,	10583,	.3074,	.4790,
2004,	41469,	36793,	31742,	9971,	.3141,	.4398,
2005,	46626,	33635,	29298,	12505,	.4268,	.7614,
2006,	(29131)*,	26874,	23689,	9515,	.4017,	.6840,
Arith. Mean ,	78930,	44179,	36395,	14343,	.4336,	.8288,
0 Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

* replaced with GM 1995-2005 (56,675)

Table 4.2.14 WHITING in Divisions VIIe-k. Prediction input data

MFDP version 1a
Run: whg7e-k
Time and date: 10:40 04/07/2007
Fbar age range: 2-5

Input : F mean 04-06
Catch and stock weights are mean 04-06
Recruits age 2 in 2007 GM(95-05) at age 1 minus Nat.Mort.
Recruits age 1 in 2007,08 and 09 GM(95-05)

2007

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
0	56675	0.2	0	0	0	0.000	0.000	0.100
1	46402	0.2	0.39	0	0	0.144	0.033	0.232
2	30022	0.2	0.90	0	0	0.256	0.244	0.307
3	16458	0.2	0.99	0	0	0.354	0.567	0.396
4	10560	0.2	0.99	0	0	0.494	0.813	0.495
5	2225	0.2	1	0	0	0.561	0.890	0.529
6	897	0.2	1	0	0	0.632	0.794	0.532
7	1045	0.2	1	0	0	0.836	0.794	0.683

2008

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
0	56675	0.2	0	0	0	0.000	0.000	0.100
1	.	0.2	0.39	0	0	0.144	0.033	0.232
2	.	0.2	0.90	0	0	0.256	0.244	0.307
3	.	0.2	0.99	0	0	0.354	0.567	0.396
4	.	0.2	0.99	0	0	0.494	0.813	0.495
5	.	0.2	1	0	0	0.561	0.890	0.529
6	.	0.2	1	0	0	0.632	0.794	0.532
7	.	0.2	1	0	0	0.836	0.794	0.683

2009

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
0	56675	0.2	0	0	0	0.000	0.000	0.100
1	.	0.2	0.39	0	0	0.144	0.033	0.232
2	.	0.2	0.90	0	0	0.256	0.244	0.307
3	.	0.2	0.99	0	0	0.354	0.567	0.396
4	.	0.2	0.99	0	0	0.494	0.813	0.495
5	.	0.2	1	0	0	0.561	0.890	0.529
6	.	0.2	1	0	0	0.632	0.794	0.532
7	.	0.2	1	0	0	0.836	0.794	0.683

Input units are thousands and kg - output in tonnes

Table 4.2.15 WHITING in Divisions VIIe-k. Detailed Results

MFDP version 1a
Run: whg7e-k
Time and date: 19:31 04/07/2007
Fbar age range: 2-5

Year:	2007	F multiplier:	1	Fbar:	0.6284				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
0	0	0	0	56675	0	0	0	0	0
1	0.0328	1356	315	46402	6682	18097	2606	18097	2606
2	0.2439	5914	1814	30022	7686	27020	6917	27020	6917
3	0.567	6516	2580	16458	5832	16293	5773	16293	5773
4	0.8127	5396	2669	10560	5220	10454	5168	10454	5168
5	0.89	1206	638	2225	1248	2225	1248	2225	1248
6	0.7939	451	240	897	567	897	567	897	567
7	0.7939	526	359	1045	873	1045	873	1045	873
Total		21366	8616	164284	28108	76031	23153	76031	23153

Year:	2008	F multiplier:	1	Fbar:	0.6284				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
0	0	0	0	56675	0	0	0	0	0
1	0.0328	1356	315	46402	6682	18097	2606	18097	2606
2	0.2439	7242	2221	36766	9412	33089	8471	33089	8471
3	0.567	7625	3020	19259	6824	19067	6756	19067	6756
4	0.8127	3906	1932	7643	3778	7567	3740	7567	3740
5	0.89	2079	1100	3836	2152	3836	2152	3836	2152
6	0.7939	376	200	748	473	748	473	748	473
7	0.7939	362	247	719	601	719	601	719	601
Total		22947	9035	172048	29922	83122	24799	83122	24799

Year:	2009	F multiplier:	1	Fbar:	0.6284				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
0	0	0	0	56675	0	0	0	0	0
1	0.0328	1356	315	46402	6682	18097	2606	18097	2606
2	0.2439	7242	2221	36766	9412	33089	8471	33089	8471
3	0.567	9338	3698	23586	8357	23350	8274	23350	8274
4	0.8127	4571	2261	8944	4421	8855	4377	8855	4377
5	0.89	1505	796	2776	1557	2776	1557	2776	1557
6	0.7939	649	345	1290	815	1290	815	1290	815
7	0.7939	273	187	543	454	543	454	543	454
Total		24934	9823	176981	31699	87999	26554	87999	26554

Table 4.2.16 WHITING in Divisions VIIe-k. Management option table

MFDP version 1a
Run: whg7e-k
whg7e-kMFDP Index file 04/07/2007
Time and date: 19:31 04/07/2007
Fbar age range: 2-5

2007 Biomass	SSB	FMult	FBar	Landings
28108	23153	1.0000	0.6284	8616

2008 Biomass	SSB	FMult	FBar	Landings	2009 Biomass	SSB
29922	24799	0.0000	0.0000	0	41367	36134
.	24799	0.1000	0.0628	1146	40129	34906
.	24799	0.2000	0.1257	2228	38962	33749
.	24799	0.3000	0.1885	3251	37863	32659
.	24799	0.4000	0.2514	4218	36825	31631
.	24799	0.5000	0.3142	5132	35846	30660
.	24799	0.6000	0.3771	5998	34921	29744
.	24799	0.7000	0.4399	6819	34047	28879
.	24799	0.8000	0.5027	7597	33221	28060
.	24799	0.9000	0.5656	8335	32439	27286
.	24799	1.0000	0.6284	9035	31699	26554
.	24799	1.1000	0.6913	9701	30997	25860
.	24799	1.2000	0.7541	10333	30332	25202
.	24799	1.3000	0.8169	10935	29701	24578
.	24799	1.4000	0.8798	11508	29102	23986
.	24799	1.5000	0.9426	12053	28533	23424
.	24799	1.6000	1.0055	12573	27992	22890
.	24799	1.7000	1.0683	13069	27478	22382
.	24799	1.8000	1.1312	13543	26988	21899
.	24799	1.9000	1.1940	13995	26522	21438
.	24799	2.0000	1.2568	14427	26077	21000

Input units are thousands and kg - output in tonnes

Table 4.2.17 WHITING in Divisions VIIe-k.

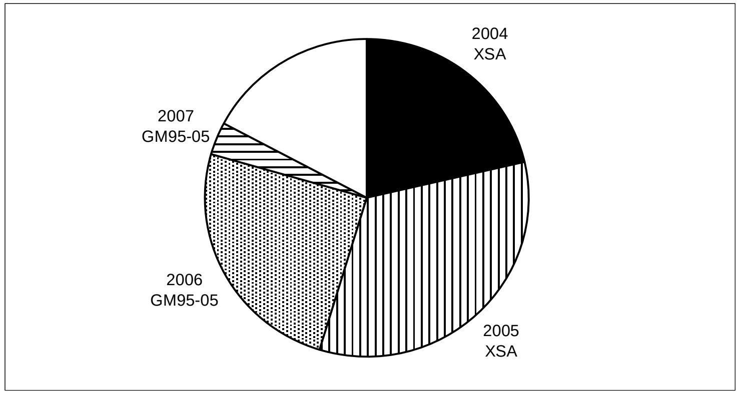
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class	2004	2005	2006	2007	2008
Stock No. (thousands) of 0 year-olds	41469	46626	56675	56675	56675
Source	XSA	XSA	GM95-05	GM95-05	GM95-05
Status Quo F:					
% in 2007 landings	29.9	21.1	3.7	0.0	-
% in 2008 landings	21.4	33.4	24.6	3.5	0.0
% in 2007 SSB	24.9	29.9	11.3	0.0	-
% in 2008 SSB	15.1	27.2	34.2	10.5	0.0
% in 2009 SSB	5.9	16.5	31.2	31.9	9.8

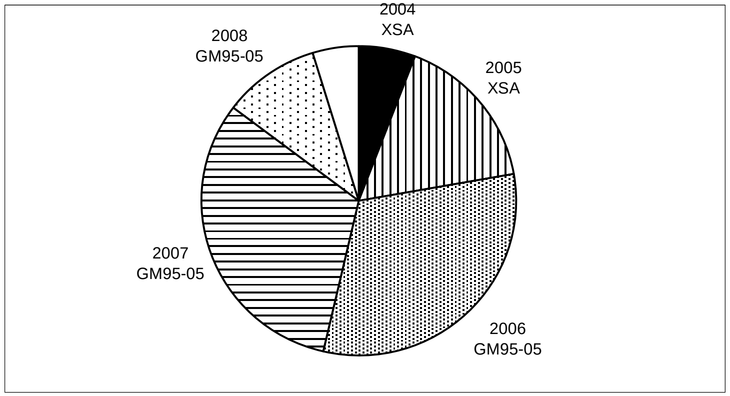
GM : geometric mean recruitment

Whiting VIIe-k : Year-class % contribution to

a) 2008 landings



b) 2009 SSB



XSA	XSA	GM95-05	GM95-05	GM95-05
2004	2005	2006	2007	2008

Table 4.2.18 WHITING in Divisions VIIe-k. Yield per recruit summery table

MFYPR version 2a
Run: whg7e-k
Time and date: 19:36 04/07/2007
Yield per results

FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0.0000	0.0000	0.0000	0.0000	5.5167	2.2396	3.9402	2.1464	3.9402	2.1464
0.1000	0.0628	0.1634	0.0857	4.7032	1.6100	3.1275	1.5171	3.1275	1.5171
0.2000	0.1257	0.2552	0.1274	4.2480	1.2730	2.6730	1.1803	2.6730	1.1803
0.3000	0.1885	0.3143	0.1504	3.9557	1.0667	2.3814	0.9743	2.3814	0.9743
0.4000	0.2514	0.3558	0.1643	3.7511	0.9290	2.1774	0.8369	2.1774	0.8369
0.5000	0.3142	0.3868	0.1732	3.5990	0.8314	2.0259	0.7395	2.0259	0.7395
0.6000	0.3771	0.4110	0.1792	3.4808	0.7590	1.9083	0.6672	1.9083	0.6672
0.7000	0.4399	0.4305	0.1834	3.3859	0.7031	1.8139	0.6116	1.8139	0.6116
0.8000	0.5027	0.4467	0.1863	3.3075	0.6588	1.7361	0.5675	1.7361	0.5675
0.9000	0.5656	0.4604	0.1885	3.2413	0.6228	1.6704	0.5316	1.6704	0.5316
1.0000	0.6284	0.4722	0.1901	3.1845	0.5928	1.6141	0.5019	1.6141	0.5019
1.1000	0.6913	0.4825	0.1913	3.1350	0.5675	1.5651	0.4768	1.5651	0.4768
1.2000	0.7541	0.4916	0.1921	3.0913	0.5458	1.5219	0.4552	1.5219	0.4552
1.3000	0.8169	0.4998	0.1928	3.0524	0.5269	1.4834	0.4365	1.4834	0.4365
1.4000	0.8798	0.5071	0.1933	3.0173	0.5103	1.4488	0.4200	1.4488	0.4200
1.5000	0.9426	0.5138	0.1936	2.9855	0.4955	1.4174	0.4054	1.4174	0.4054
1.6000	1.0055	0.5200	0.1939	2.9564	0.4823	1.3887	0.3923	1.3887	0.3923
1.7000	1.0683	0.5256	0.1940	2.9297	0.4704	1.3624	0.3805	1.3624	0.3805
1.8000	1.1312	0.5309	0.1942	2.9051	0.4595	1.3381	0.3698	1.3381	0.3698
1.9000	1.1940	0.5357	0.1942	2.8822	0.4496	1.3156	0.3600	1.3156	0.3600
2.0000	1.2568	0.5403	0.1942	2.8608	0.4405	1.2946	0.3510	1.2946	0.3510

Reference point	F multiplier	Absolute F
Fbar(2-5)	1.0000	0.6284
FMax	1.9965	1.2546
F0.1	0.3673	0.2308
F35%SPR	0.4861	0.3055

Weights in kilograms

Table 4.2.19 WHITING in Divisions VIIe-k. Sensitivity analysis input

Whiting VIIe-k-sensitivity analysis
Data from file:C:\Pie & profile\WHGVIIE.SEN on 04/07/2007 at 11:38:49
Input Values

name	value	uncertainty			
N0	56674	0.35	M0	0.2	0.1
N1	46402	0.78	M1	0.2	0.1
N2	30021	0.35	M2	0.2	0.1
N3	16457	0.25	M3	0.2	0.1
N4	10559	0.2	M4	0.2	0.1
N5	2225	0.2	M5	0.2	0.1
N6	896	0.21	M6	0.2	0.1
N7	1045	0.21	M7	0.2	0.1
sH0	0	0	MT0	0	0.1
sH1	0.033	0.34	MT1	0.39	0.1
sH2	0.244	0.17	MT2	0.9	0.1
sH3	0.567	0.14	MT3	0.99	0.1
sH4	0.813	0.06	MT4	0.99	0.1
sH5	0.89	0.16	MT5	1	0.1
sH6	0.794	0.21	MT6	1	0
sH7	0.794	0.21	MT7	1	0
WH0	0.1	0.13	R08	56674	0.35
WH1	0.232	0.06	R09	56674	0.35
WH2	0.307	0.03	HF07	1	0.23
WH3	0.396	0.05	HF08	1	0.23
WH4	0.495	0.11	HF09	1	0.23
WH5	0.529	0.09	K07	1	0.1
WH6	0.532	0.09	K08	1	0.1
WH7	0.683	0.12	K09	1	0.1
WS0	0	0			
WS1	0.144	0.25			
WS2	0.256	0.01			
WS3	0.354	0.07			
WS4	0.494	0.1			
WS5	0.561	0.07			
WS6	0.632	0.07			
WS7	0.836	0.1			

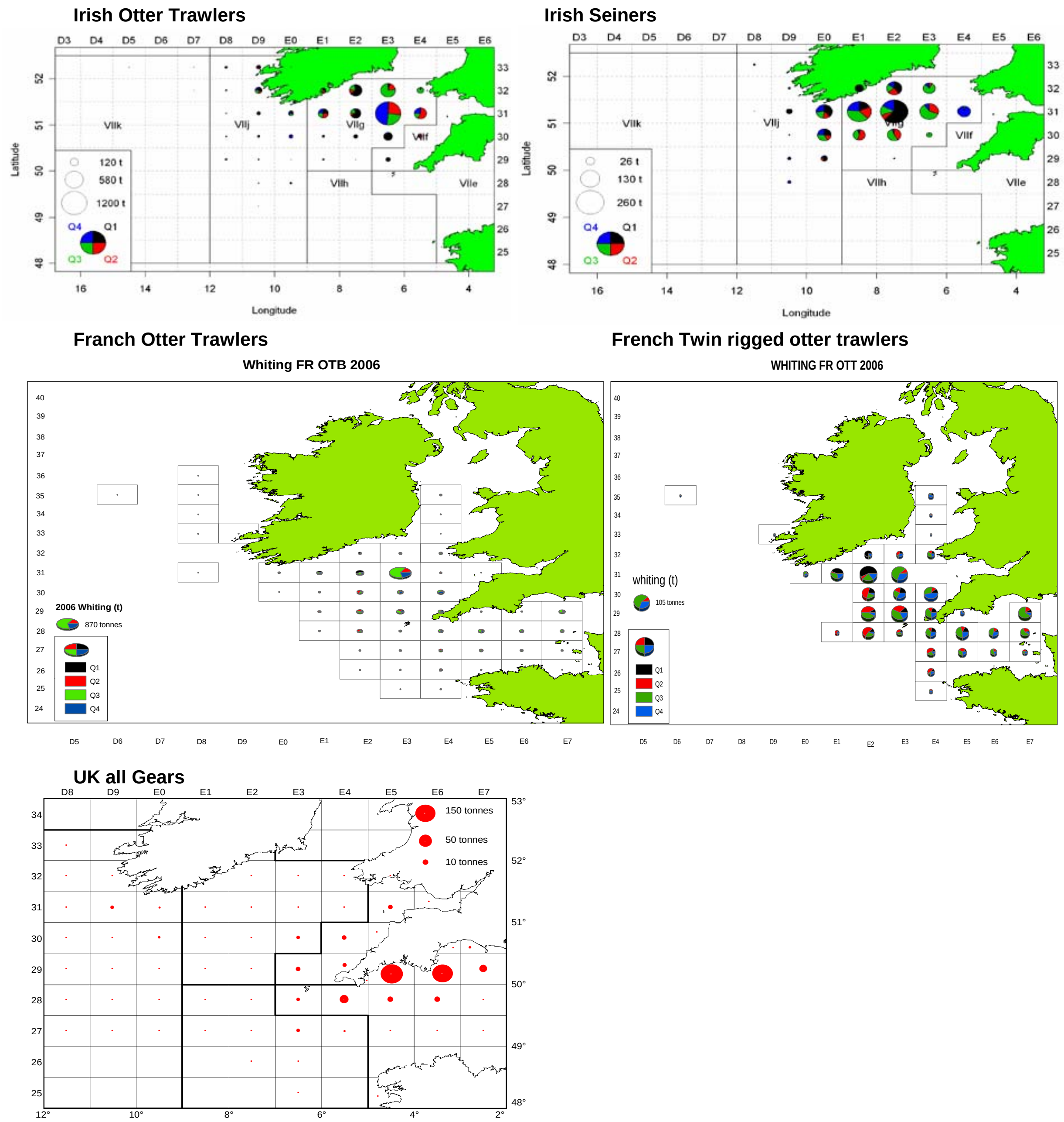


Figure 4.2.1 **Whiting in VIIe-k (Celtic Sea).**

The spatial and temporal distribution of landings data in 2006 available to the WG

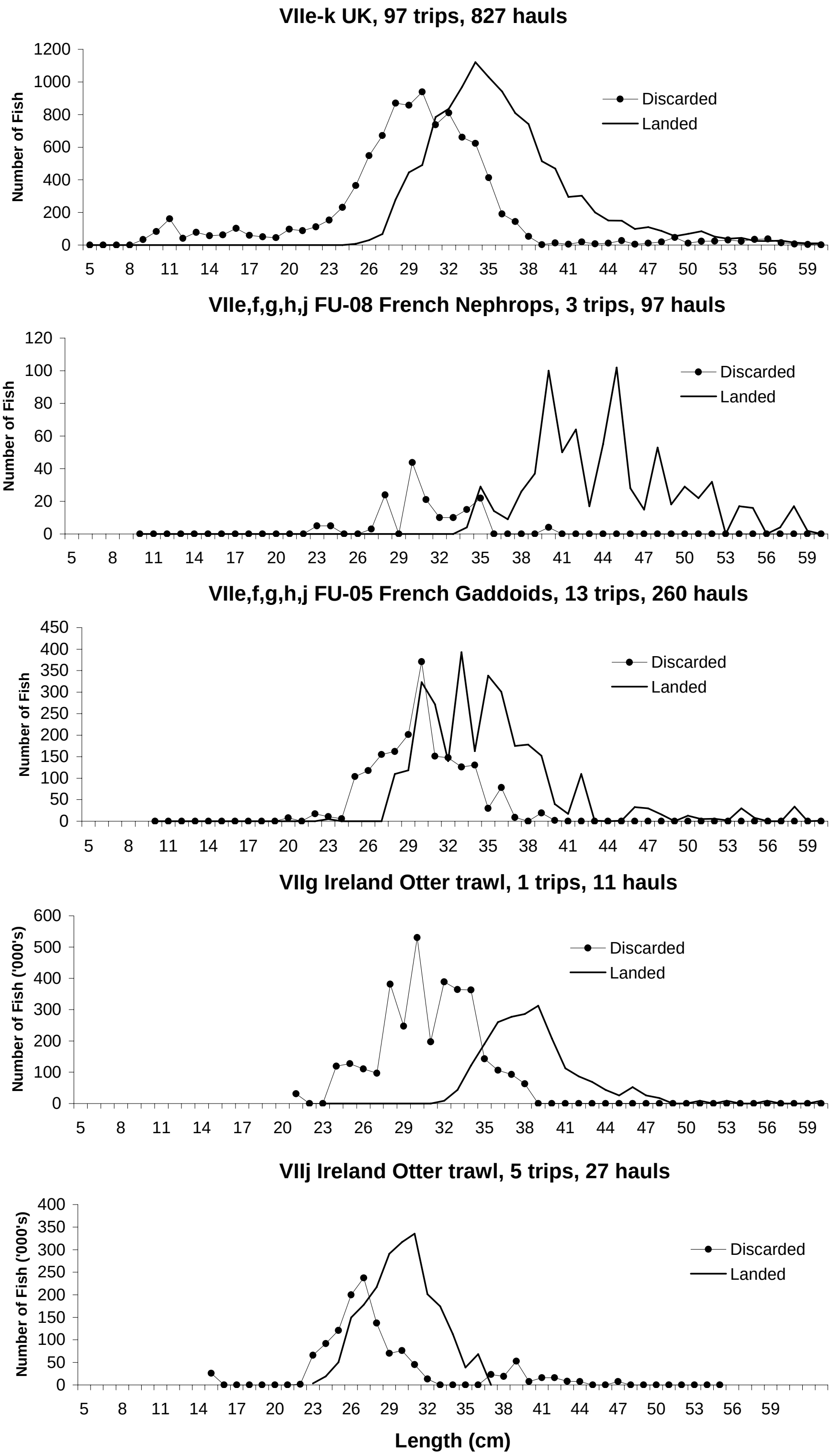


Figure 4.2.2 **Whiting in VIIe-k (Celtic Sea).**

2006 Annual length compositions of Irish, UK French discards. Numbers are raised to the sampled catch for the UK and are raised by trip to the fleet for Ireland and are unraised sampled lengths for France.

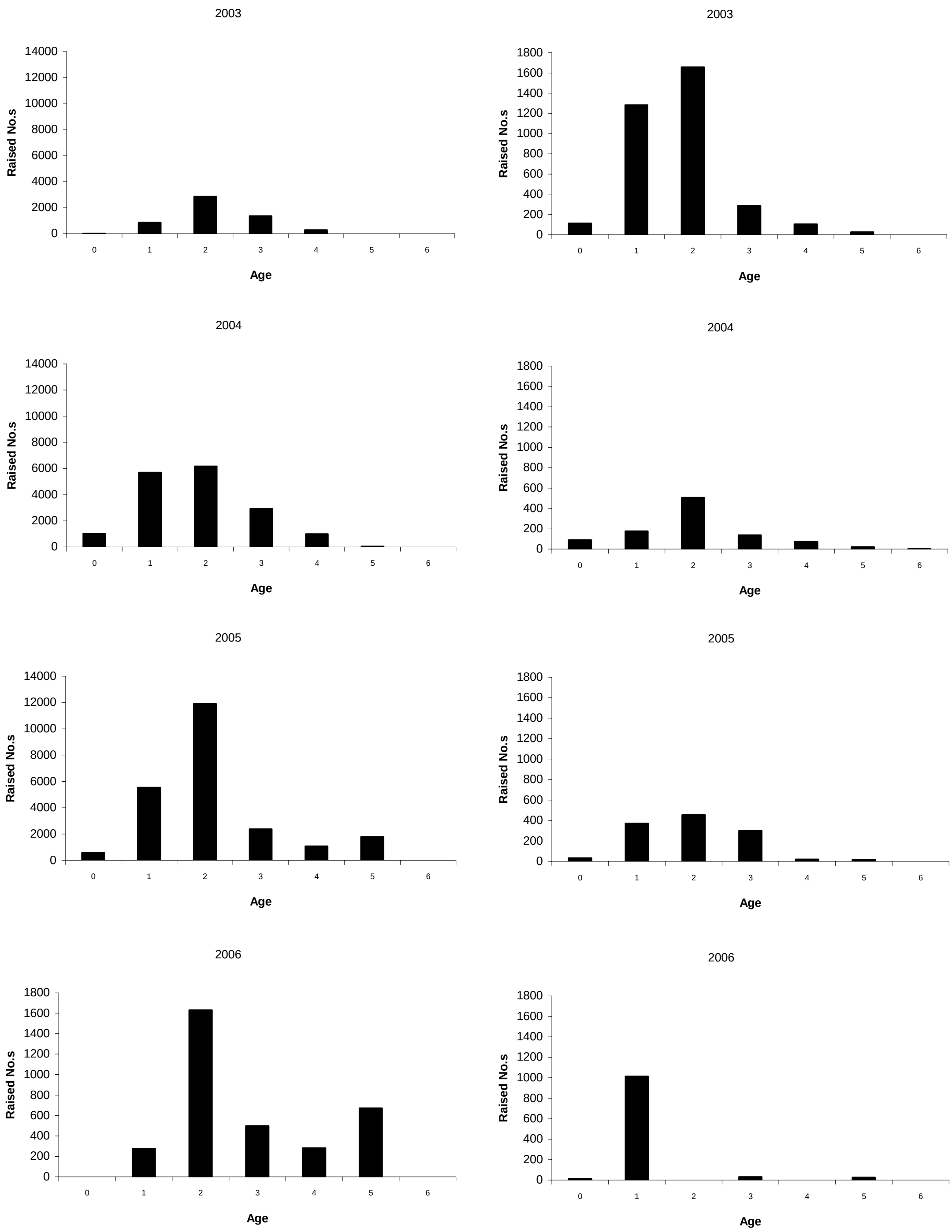


Figure 4.2.3 Whiting in VIIe-k (Celtic Sea).

Age Composition of Discards from Irish Otter board trawlers 2003-2005 in VIIg (left) and VIIj (right)

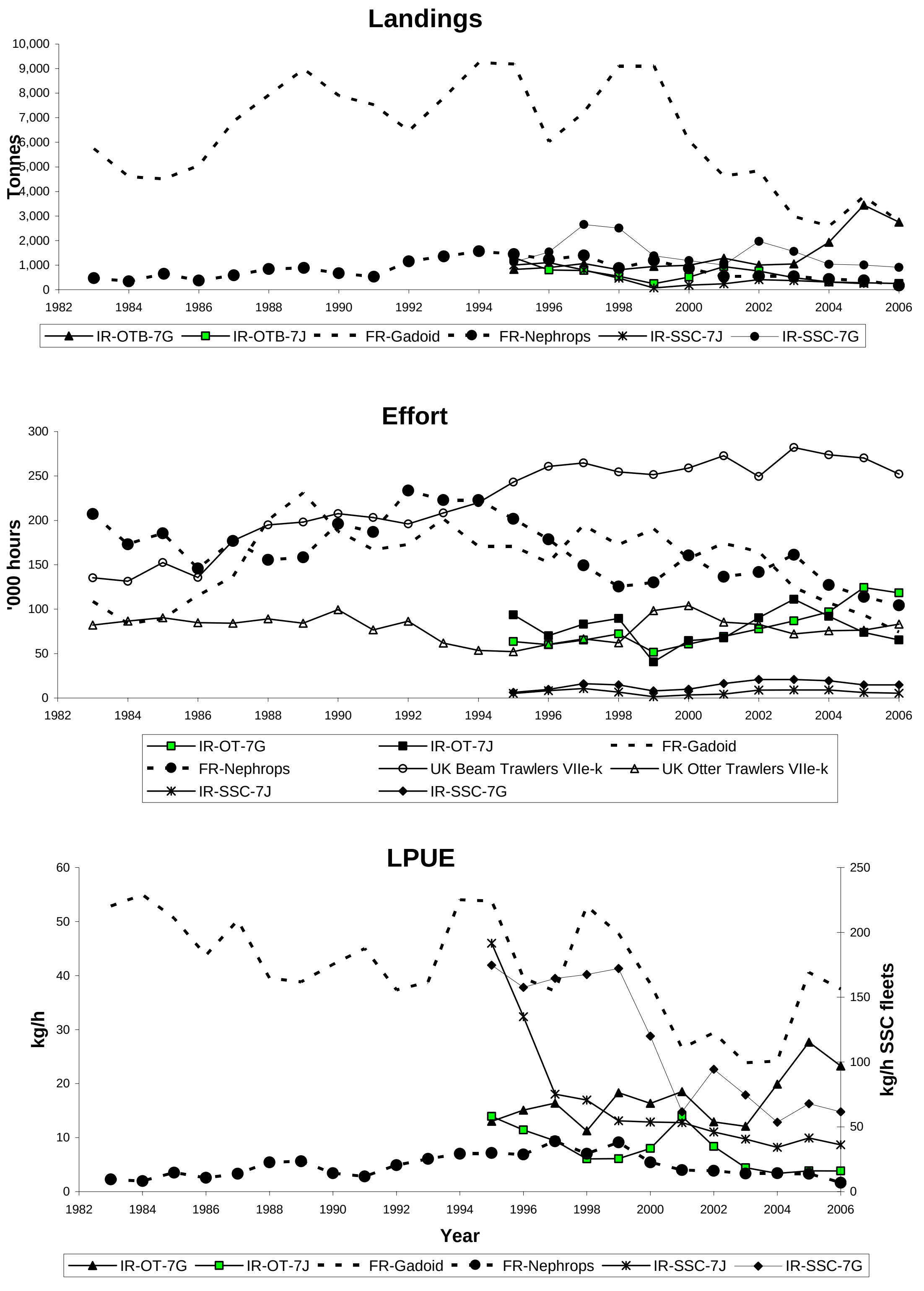
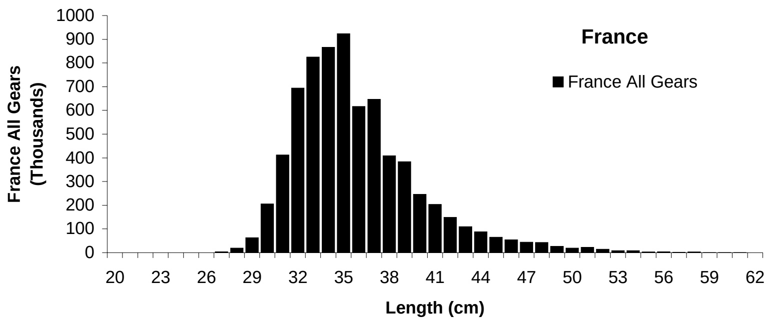
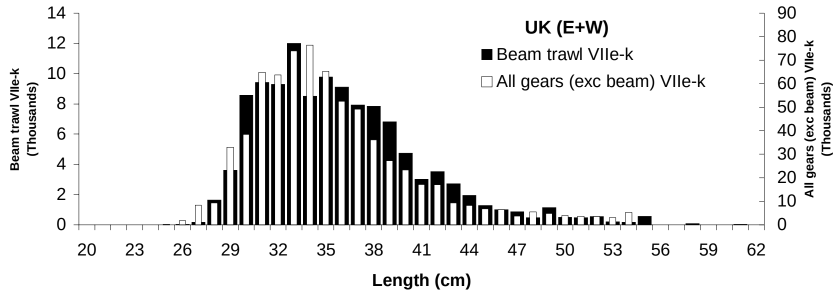
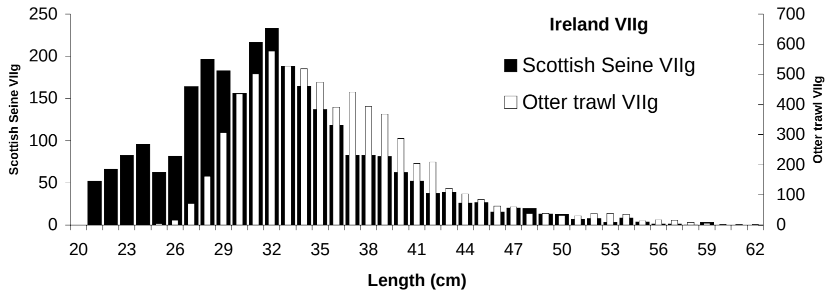


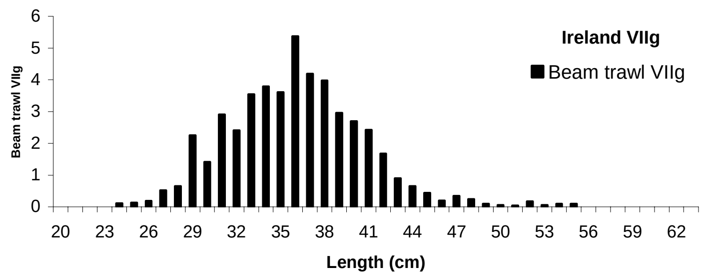
Figure 4.2.4 Whiting in VIIe-k (Celtic Sea).

Landings, Effort and Landings per Unit Effort (LPUE) for some fleets landing whiting. For the French fleets LPUE & Effort are power corrected.









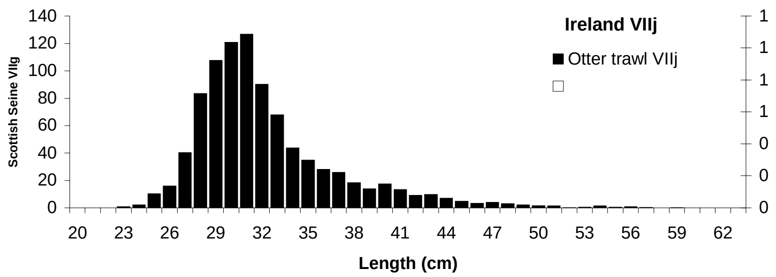
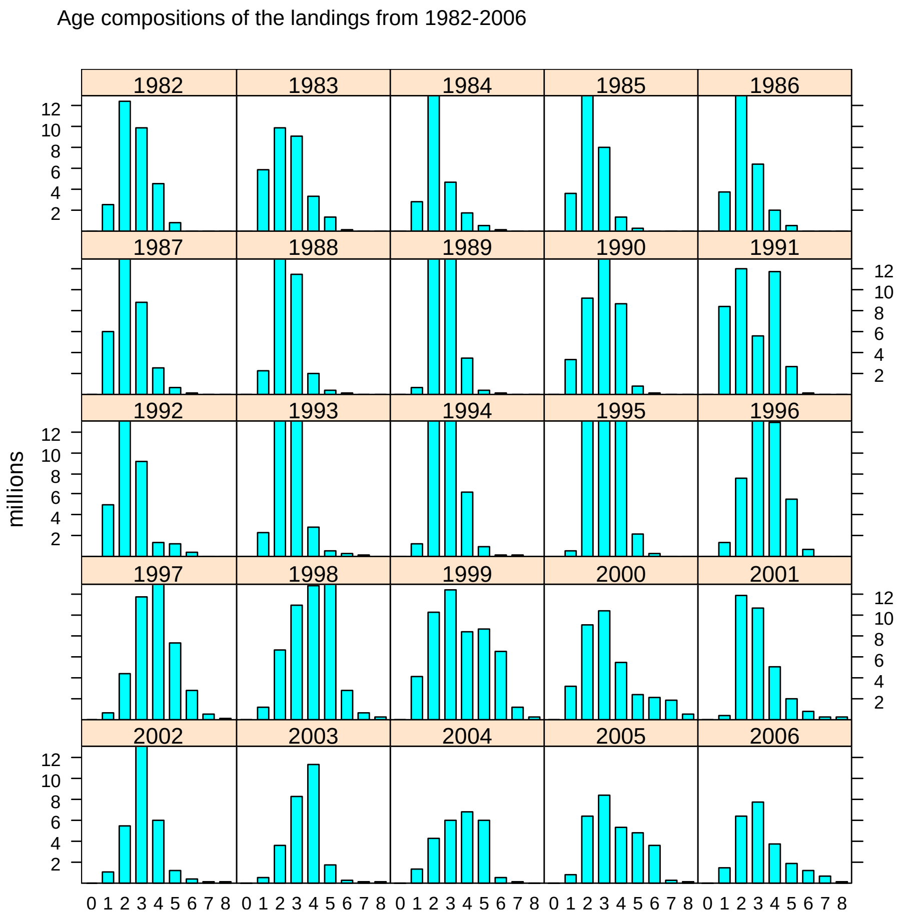


Figure 4.2.5 Whiting in VIIe-k (Celtic Sea).



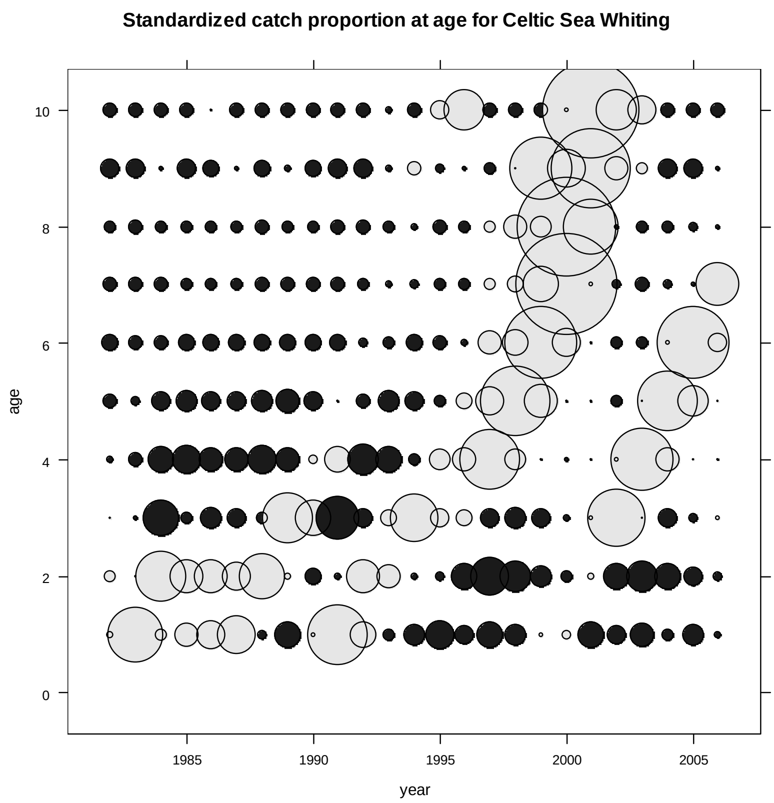


Figure 4.2.6 **Whiting in VIIe-k (Celtic Sea).**

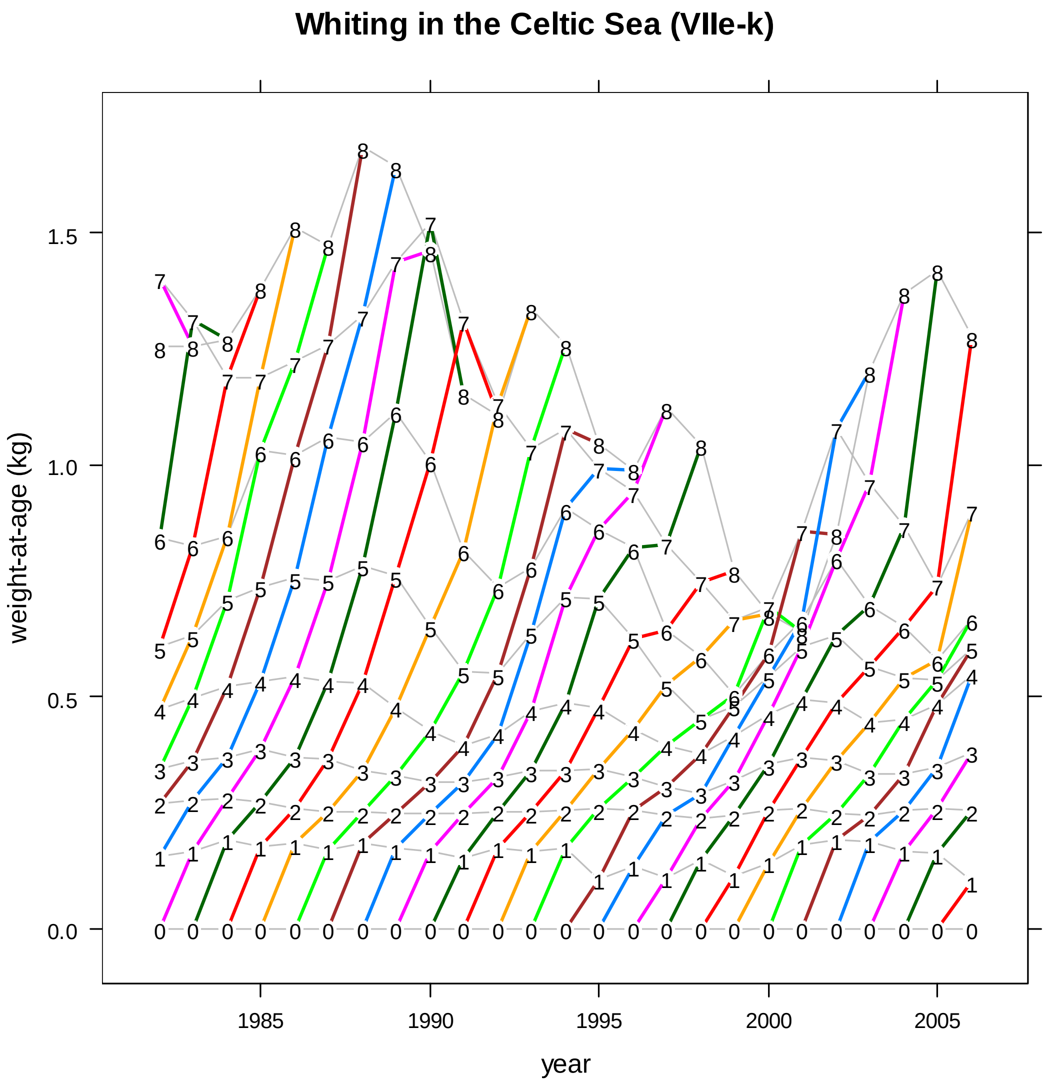


Figure 4.2.7 **Whiting in VIIe-k (Celtic Sea). Sock weights-at-age.**

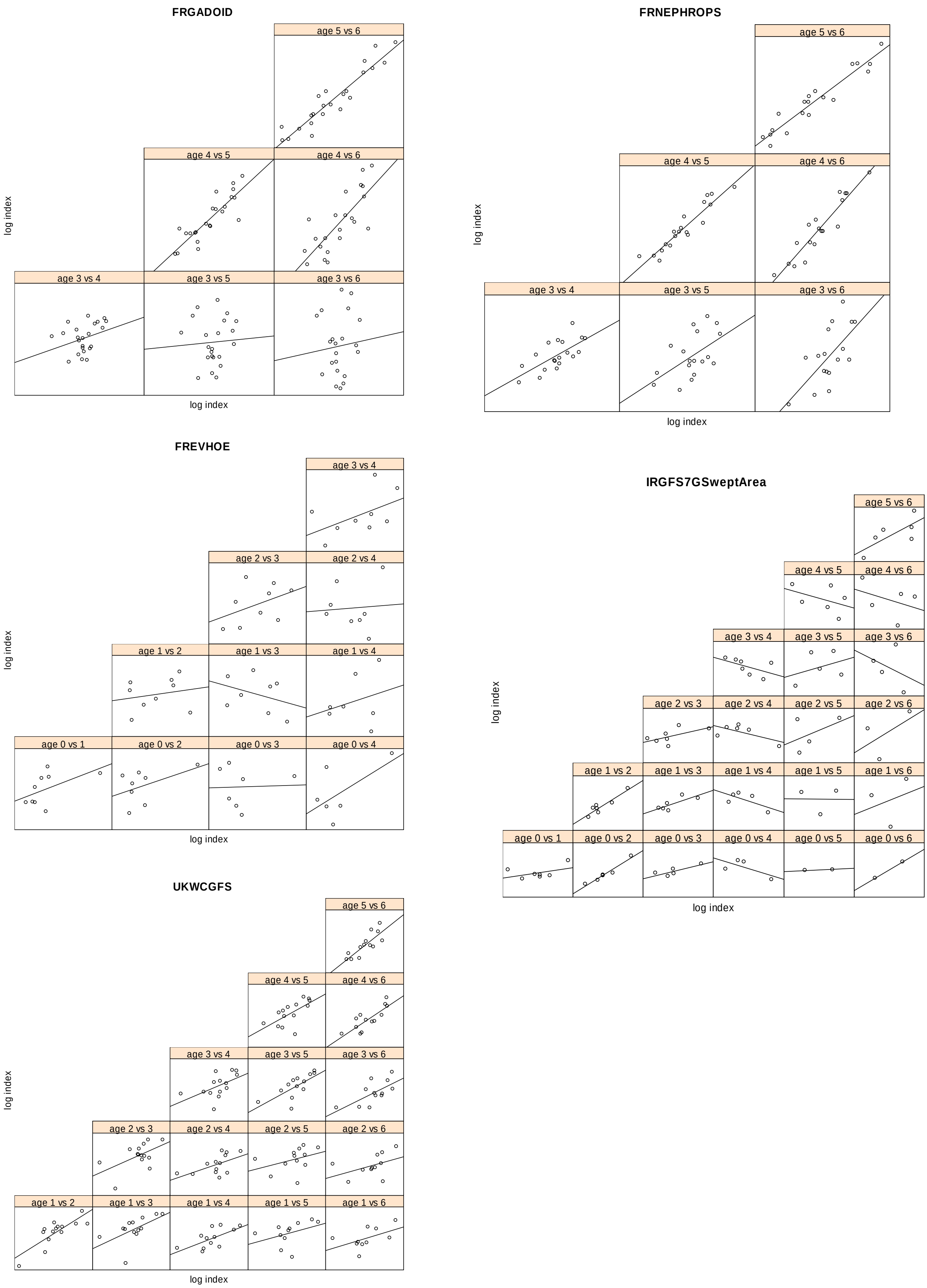


Figure 4.2.8 Whiting in VIIe-k (Celtic Sea)

Pair wise scatter plots for the log numbers at age for the main tuning fleets to examine internal constancy of the indices

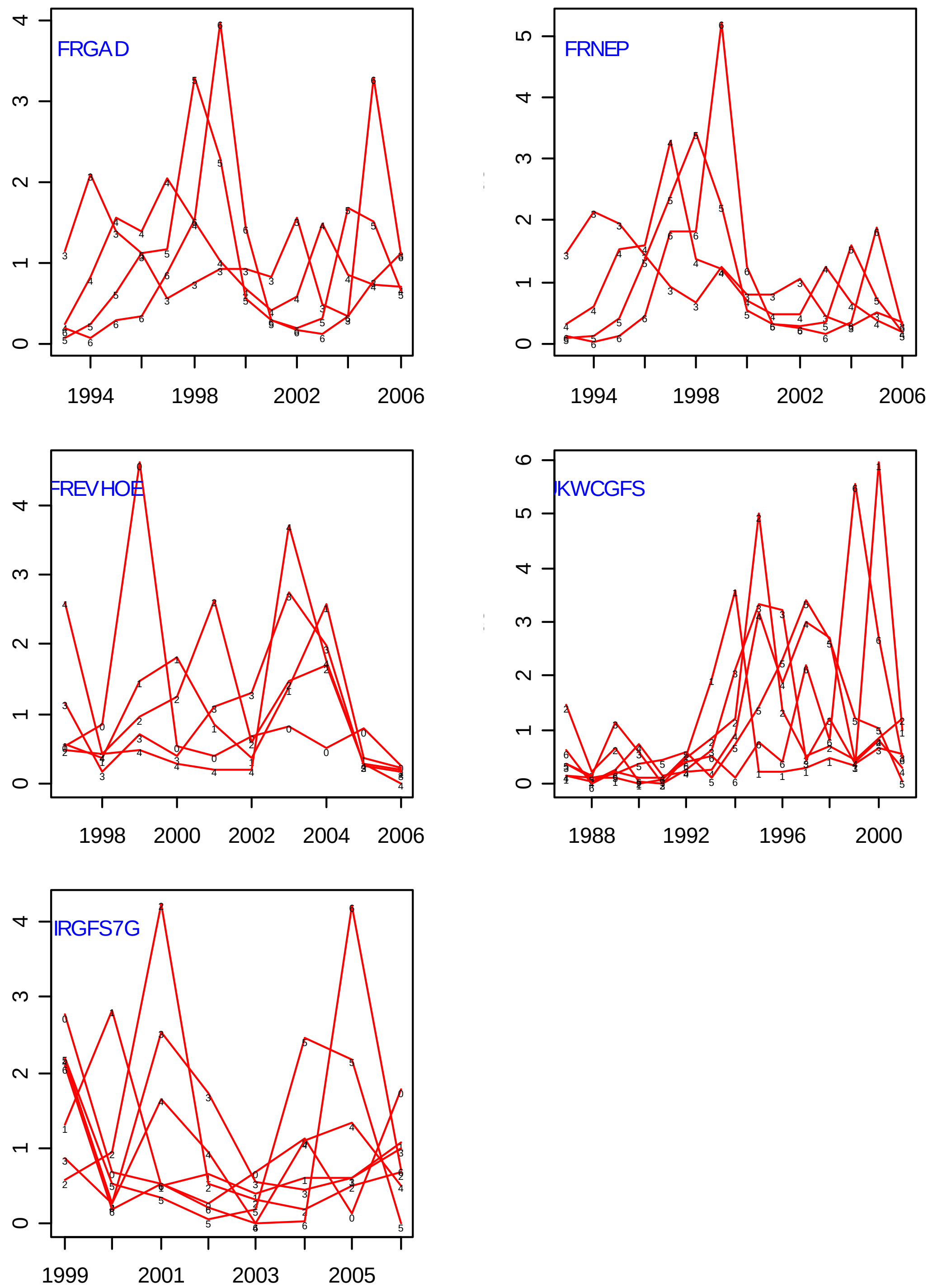


Figure 4.2.9 **Whiting in VIIe-k (Celtic Sea)**

Mean standardised plots of indices by age and year.

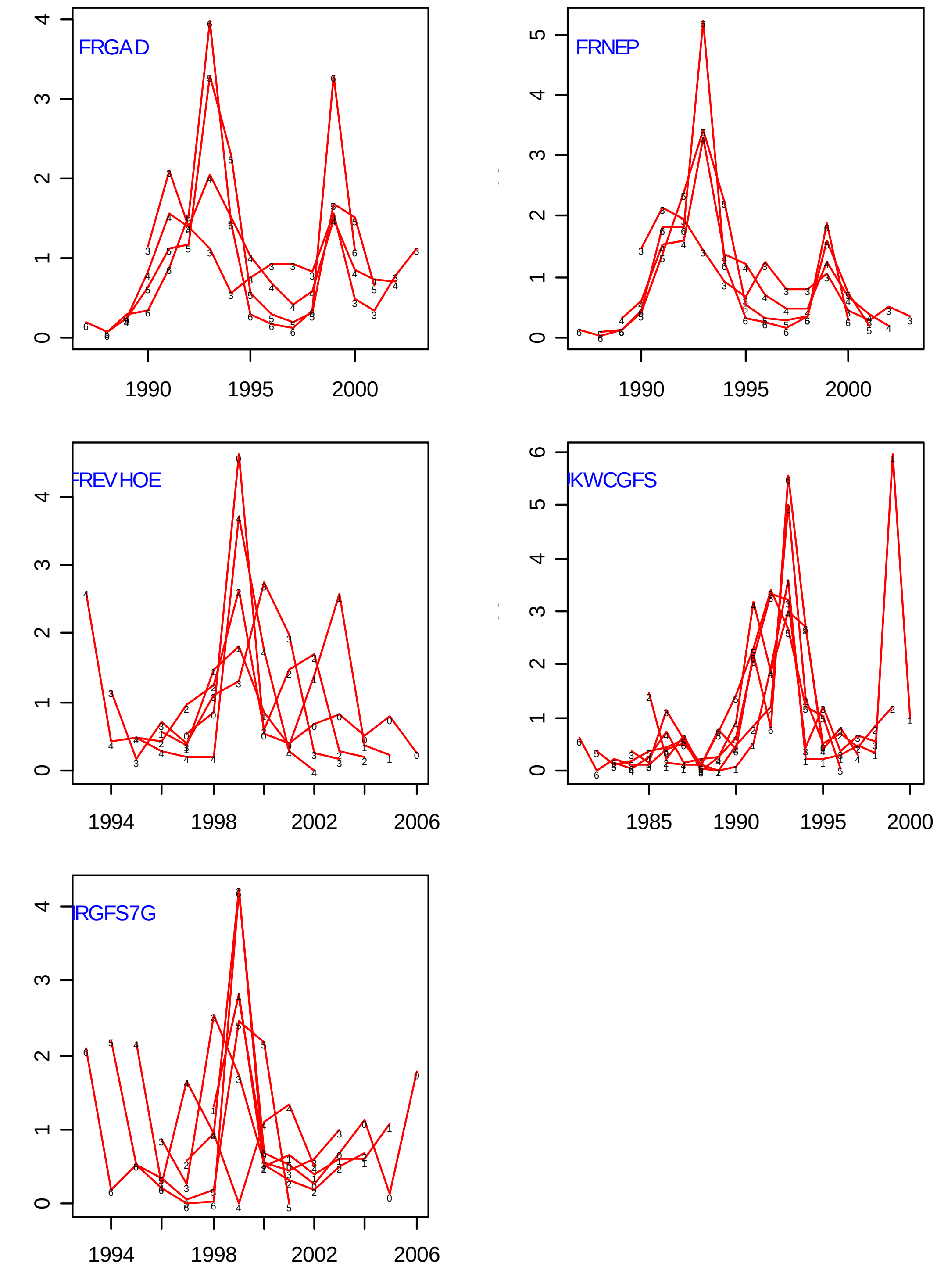


Figure 4.2.10 **Whiting in VIIe-k (Celtic Sea)**

Mean standardised plots of indices by age and cohort

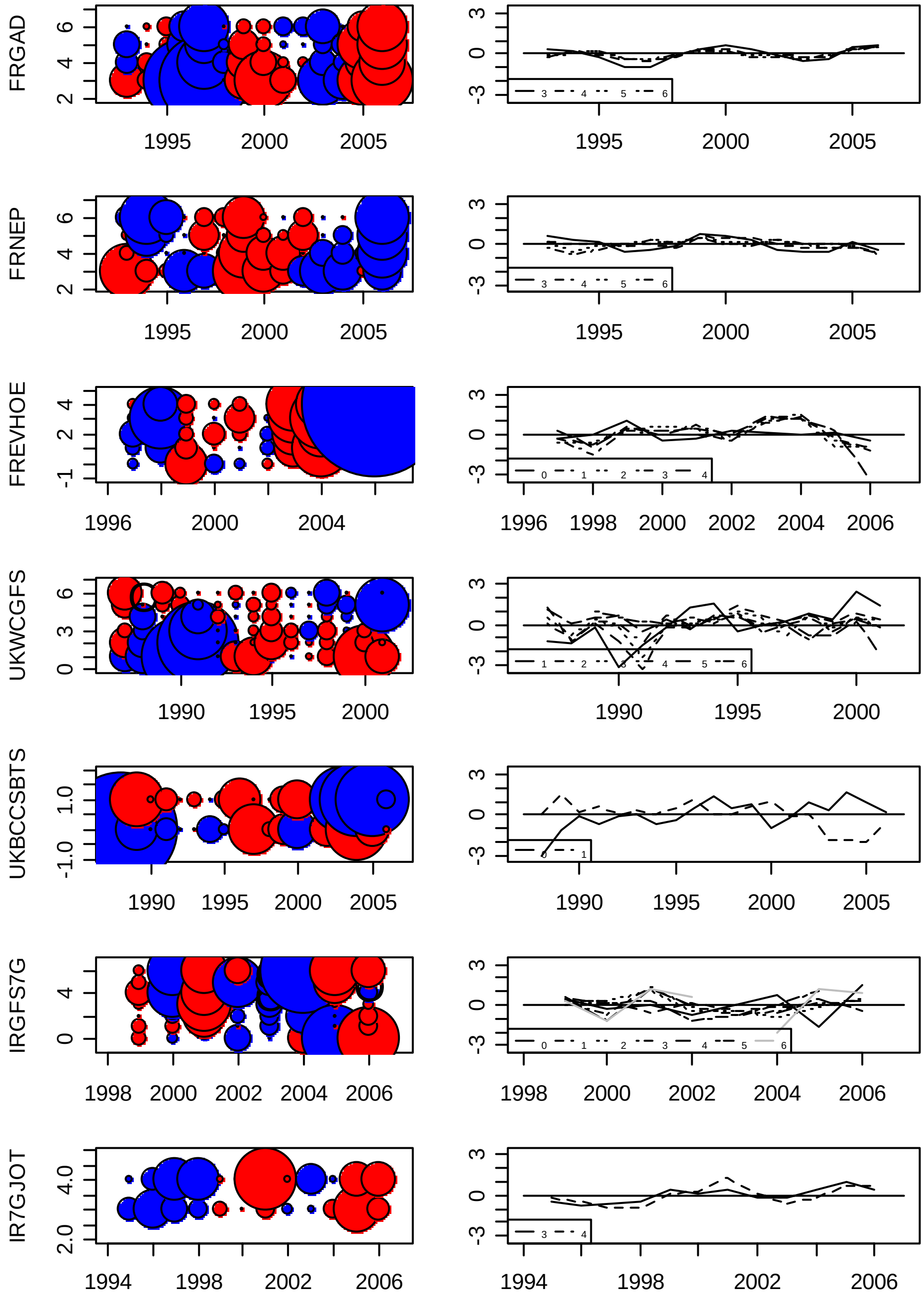


Figure 4.2.11 Whiting in VIIe-k (Celtic Sea)

Catachability residuals for single fleet runs (Shrinkage = 1.5)

Note the open circles indicate ages with no data

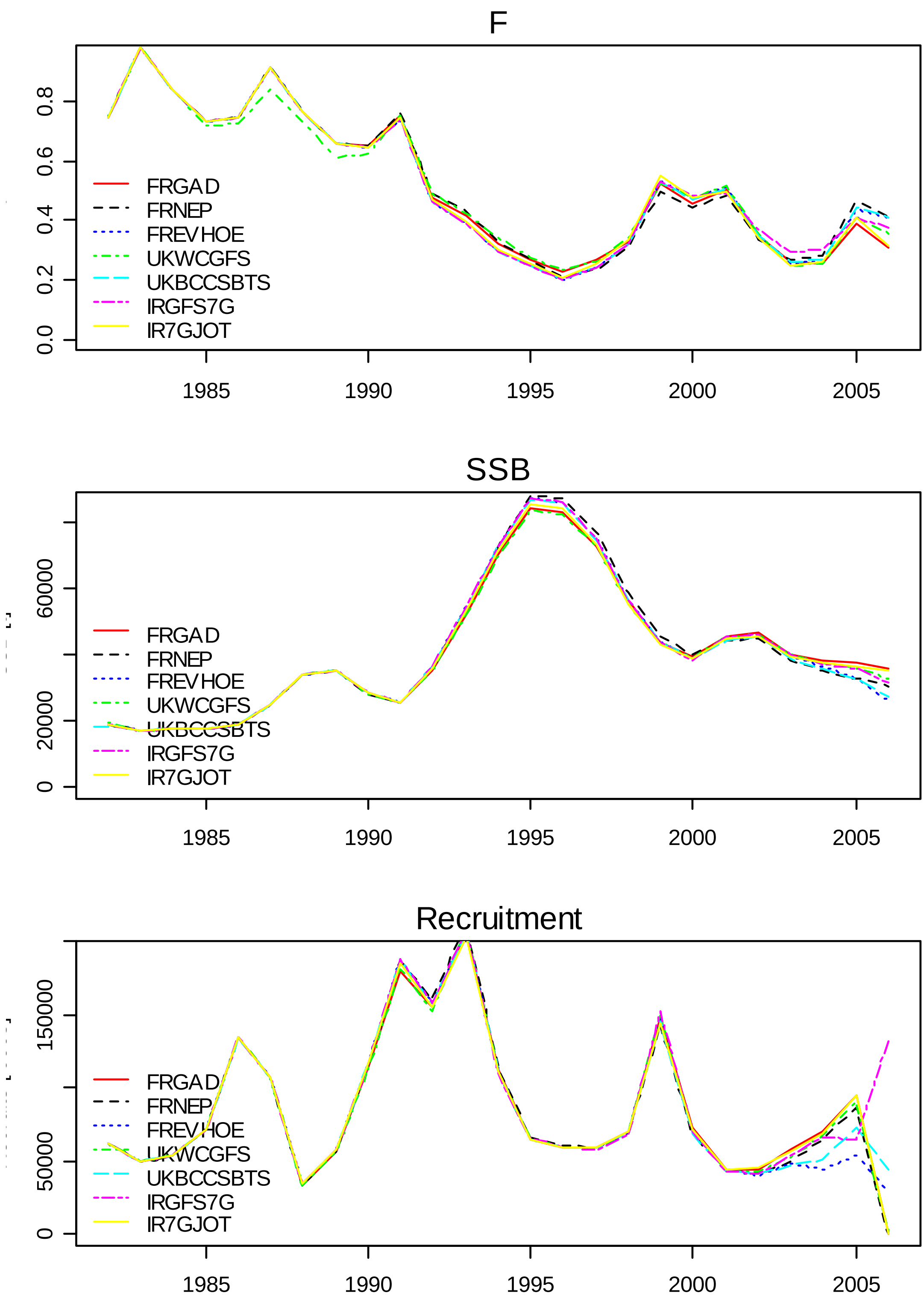


Figure 4.2.12 **Whiting in VIIe-k (Celtic Sea)**

Comparative plot of single fleet runs with shrinkage of 1.5

Note only the surveys provide recruit estimates at age 0

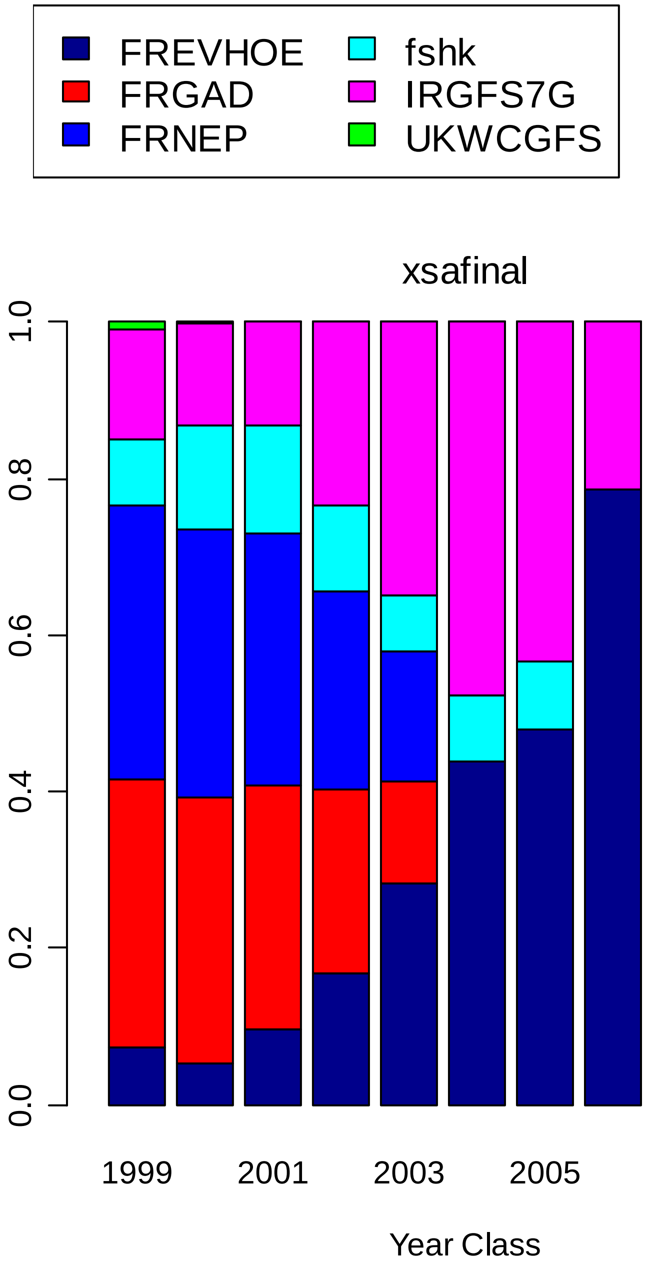


Figure 4.2.13 **Whiting in VIIe-k (Celtic Sea)**

The survivor estimate weightings given by all fleets.

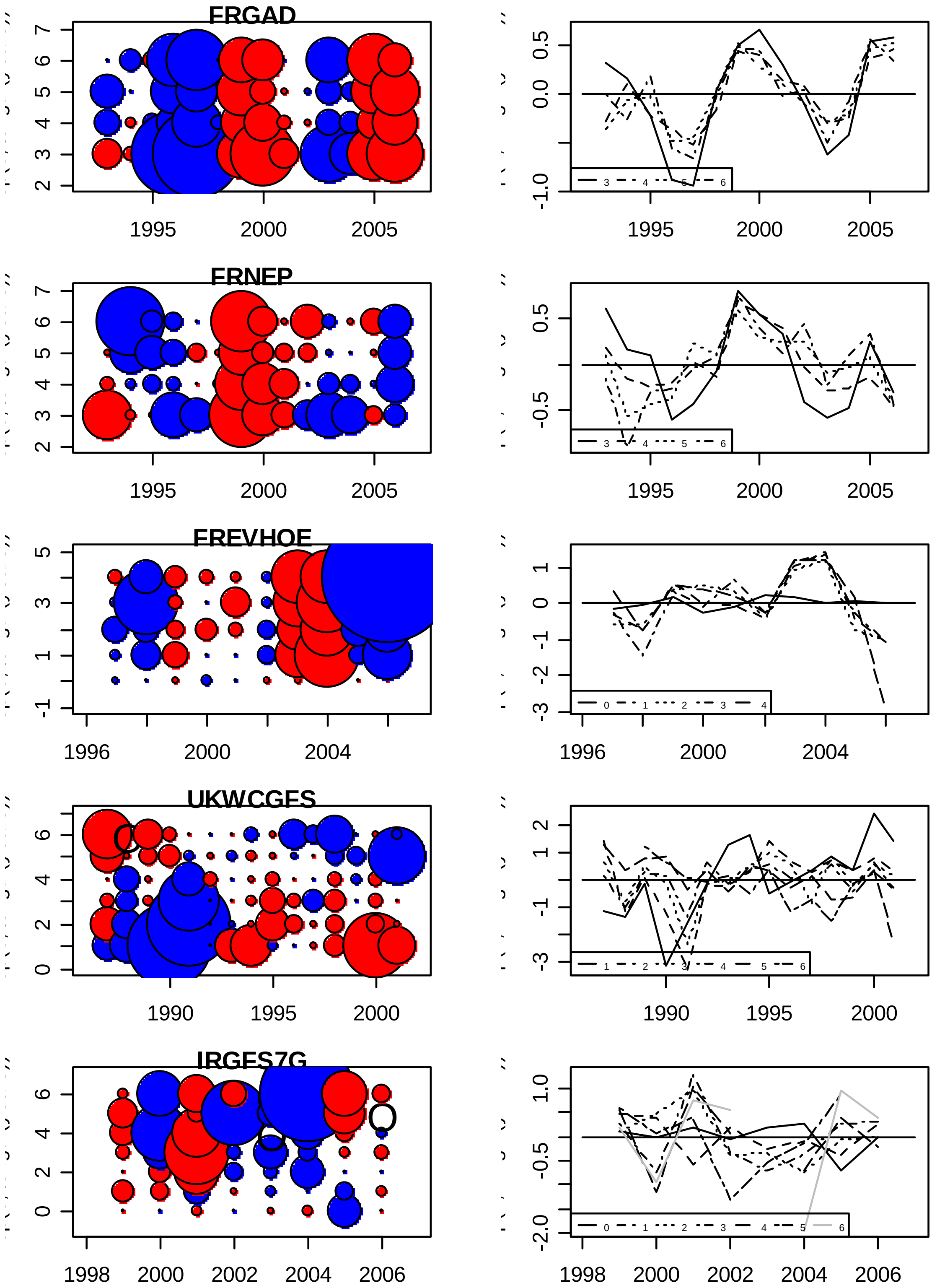


Figure 4.2.14 **Whiting in VIIe-k (Celtic Sea)**

Catachability residuals for single fleet runs (Shrinkage = 1.5)

Note the open circles indicate ages with no data

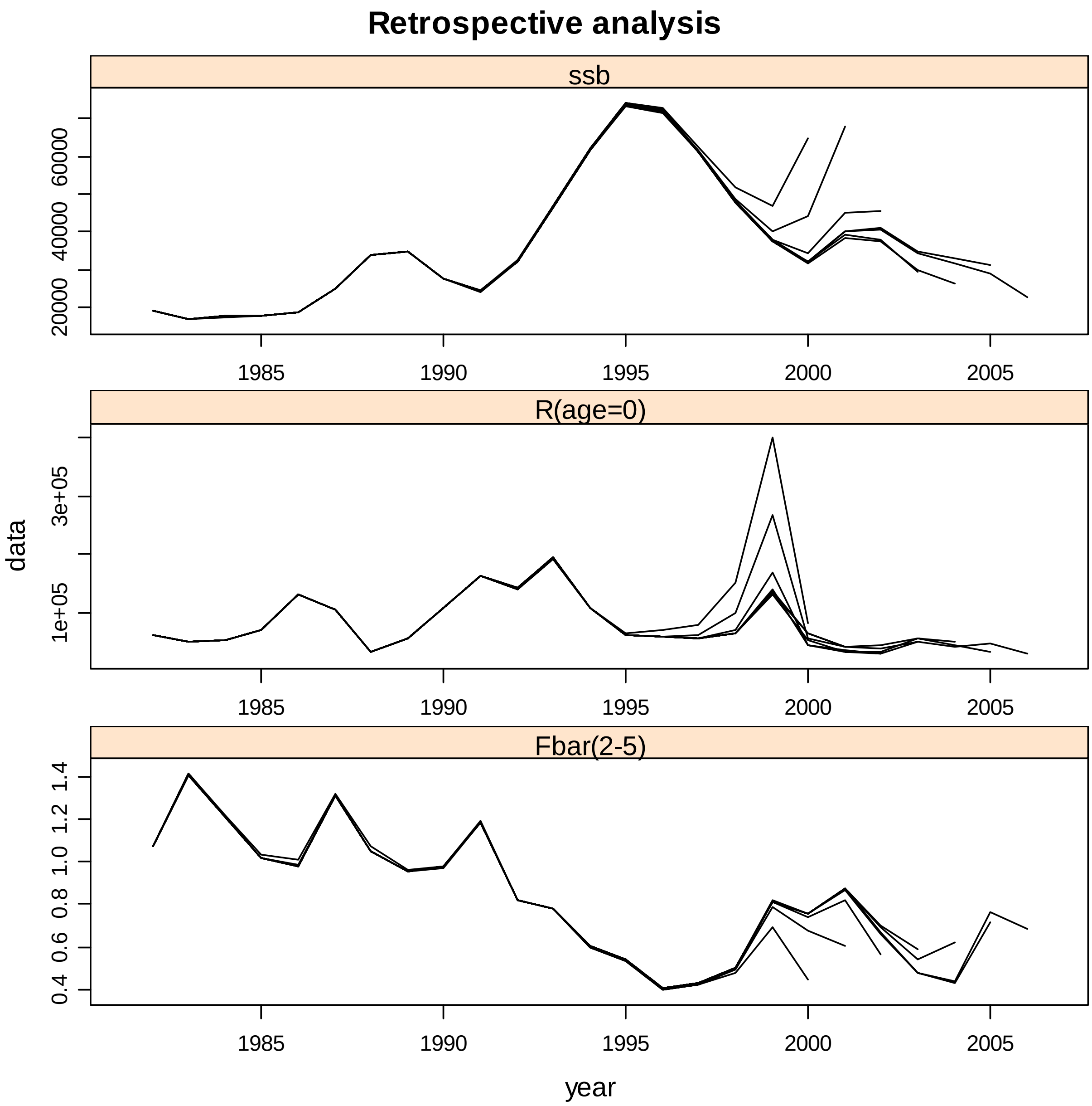
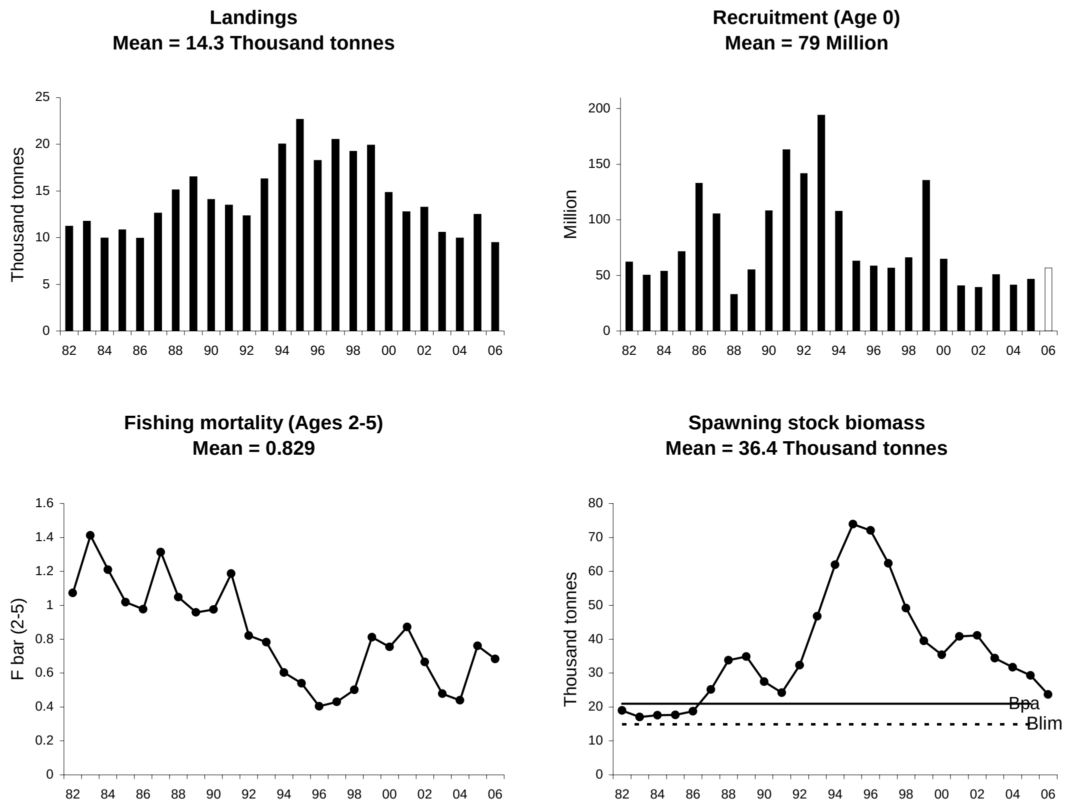


Figure 4.2.15 **Whiting in VIIe-k (Celtic Sea)**

The retrospective analysis for the final assessment with a F shrinkage of 1.0

Stock summary of final XSA run.
B_{PA} and Blim are also indicated on the SSB plot.



Note: The open bar indicates that recruitment 2006 is replaced by $GM_{95\text{-}05}$

Figure 4.2.16 Whiting in VIIe-k (Celtic Sea)

Stock recruitment relationship from final XSA run.
Labels indicate the year.

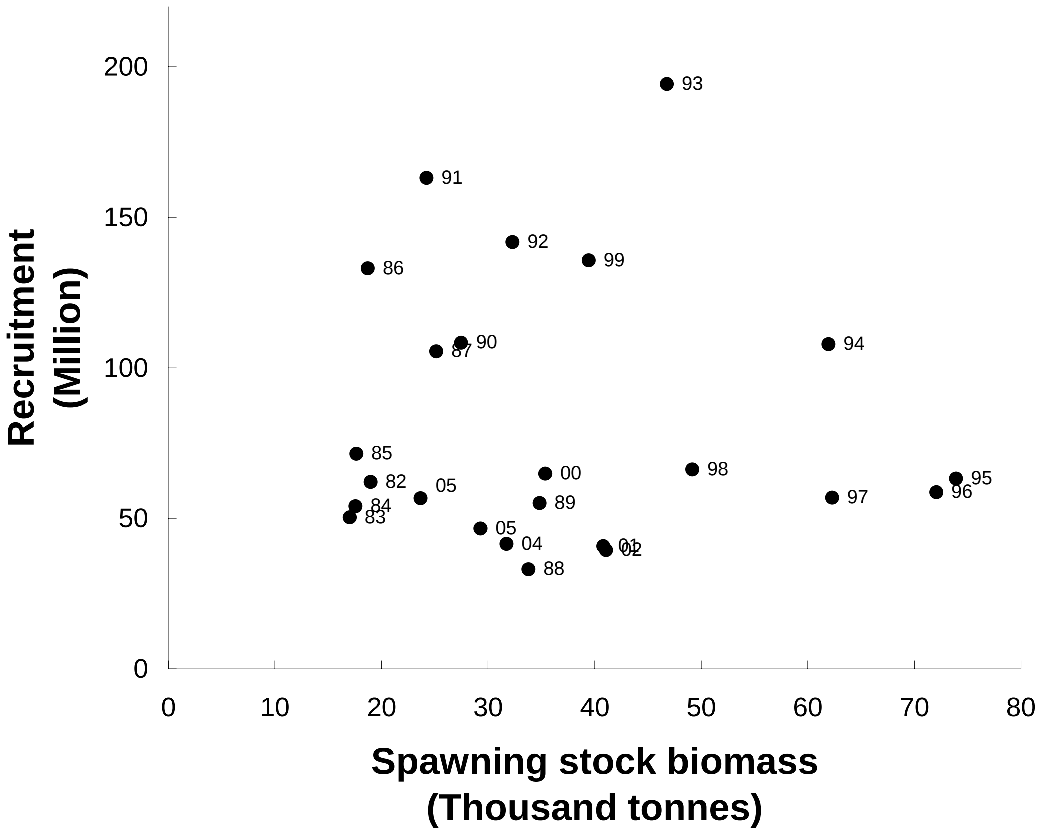
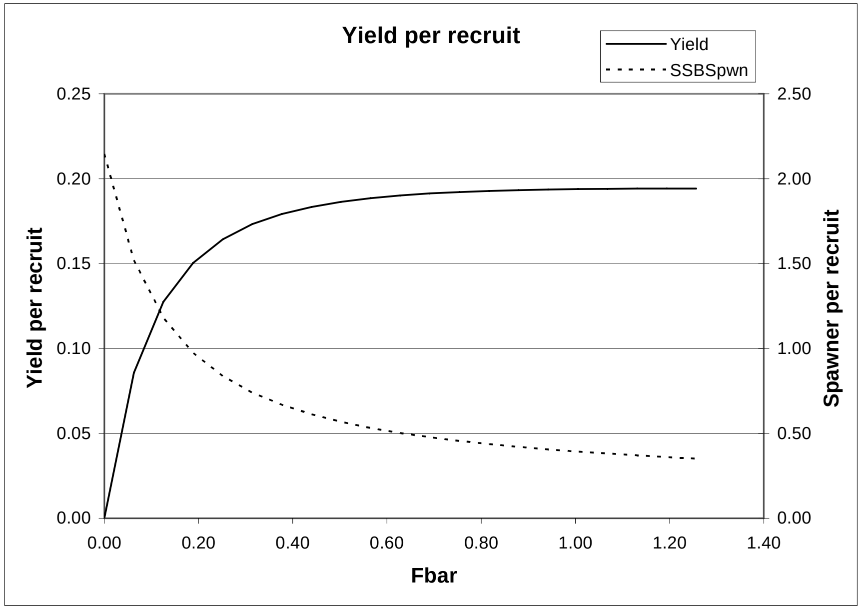
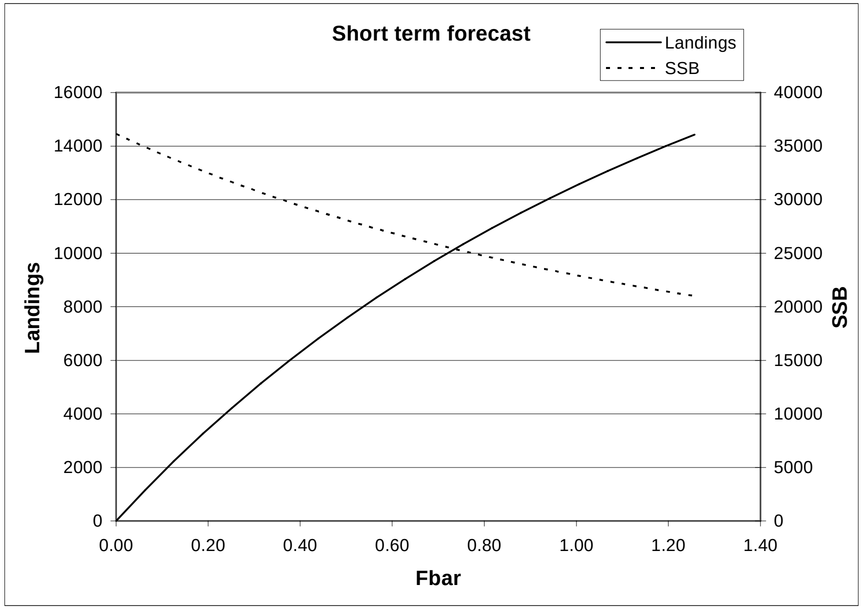


Figure 4.2.17 **Whiting in VIIe-k (Celtic Sea)**





MFYPR version 2a
Run: whg7e-k
Time and date: 19:36 04/07/2007

Reference point	F multiplier	Absolute F
Fbar(2-5)	1.0000	0.6284
FMax	1.9965	1.2546
F0.1	0.3673	0.2308
F35%SPR	0.4861	0.3055

Weights in kilograms

MFDP version 1a
Run: whg7e-k
whg7e-kMFDP Index file 04/07/2007
Time and date: 19:31 04/07/2007
Fbar age range: 2-5

Input units are thousands and kg - output in tonnes

Figure 4.2.18 Whiting in VIIe-k (Celtic Sea) Yield per recruit and short term forecast plots

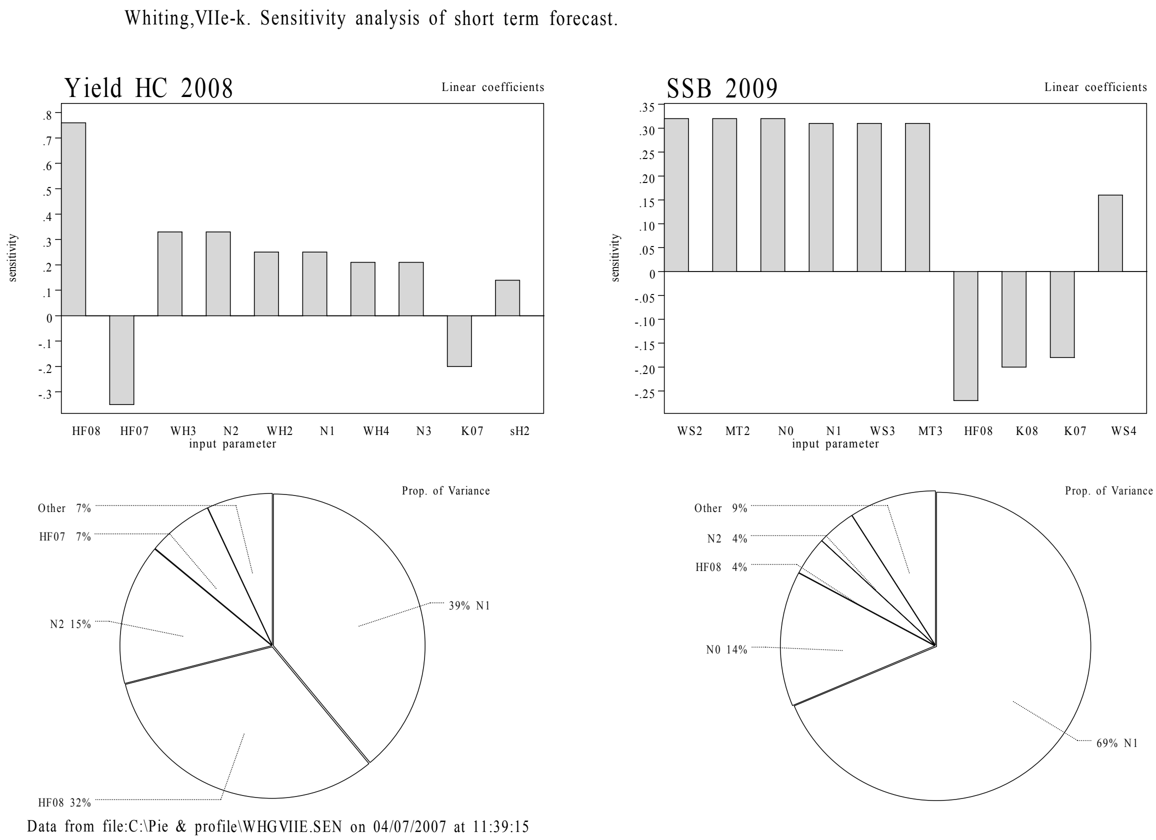


Figure 4.2.19 Whiting in VIIe-k (Celtic Sea) Sensitivity analysis

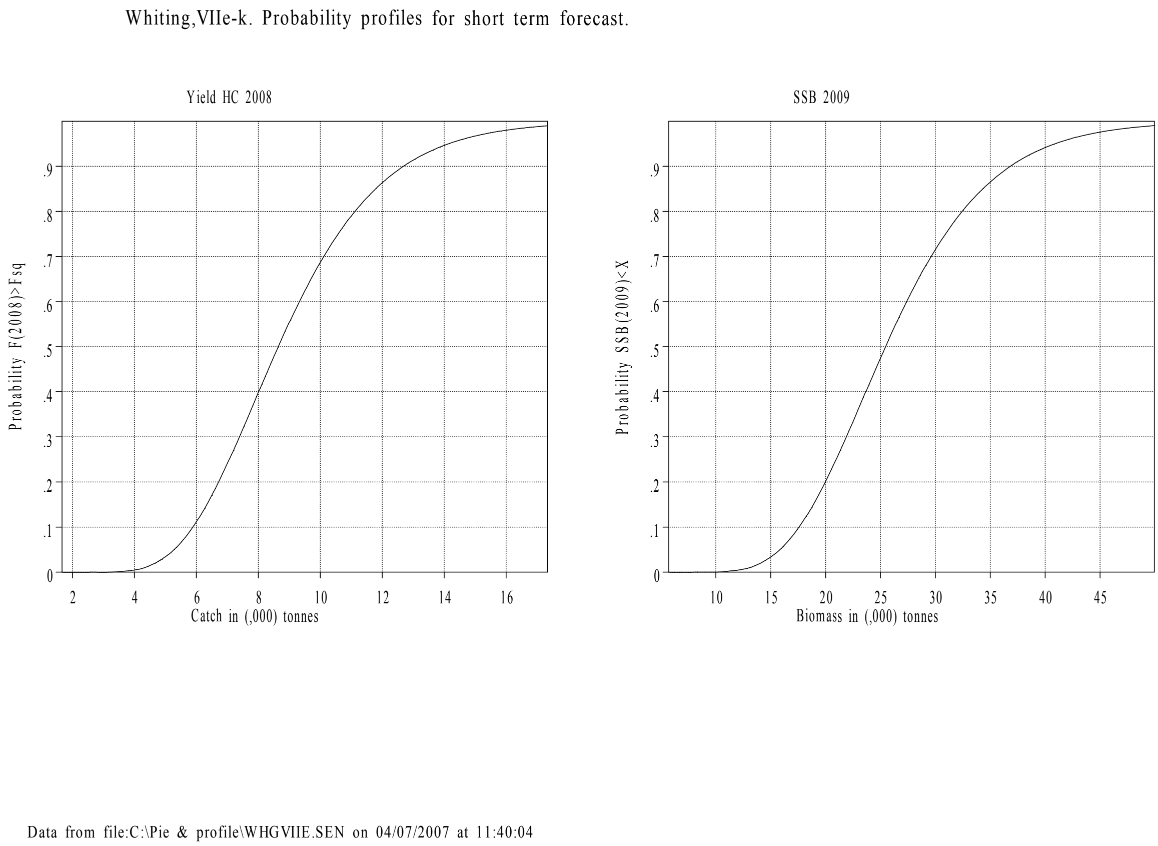


Figure 4.2.20 Whiting in VIIe-k (Celtic Sea) Probability profiles for the short term forecast

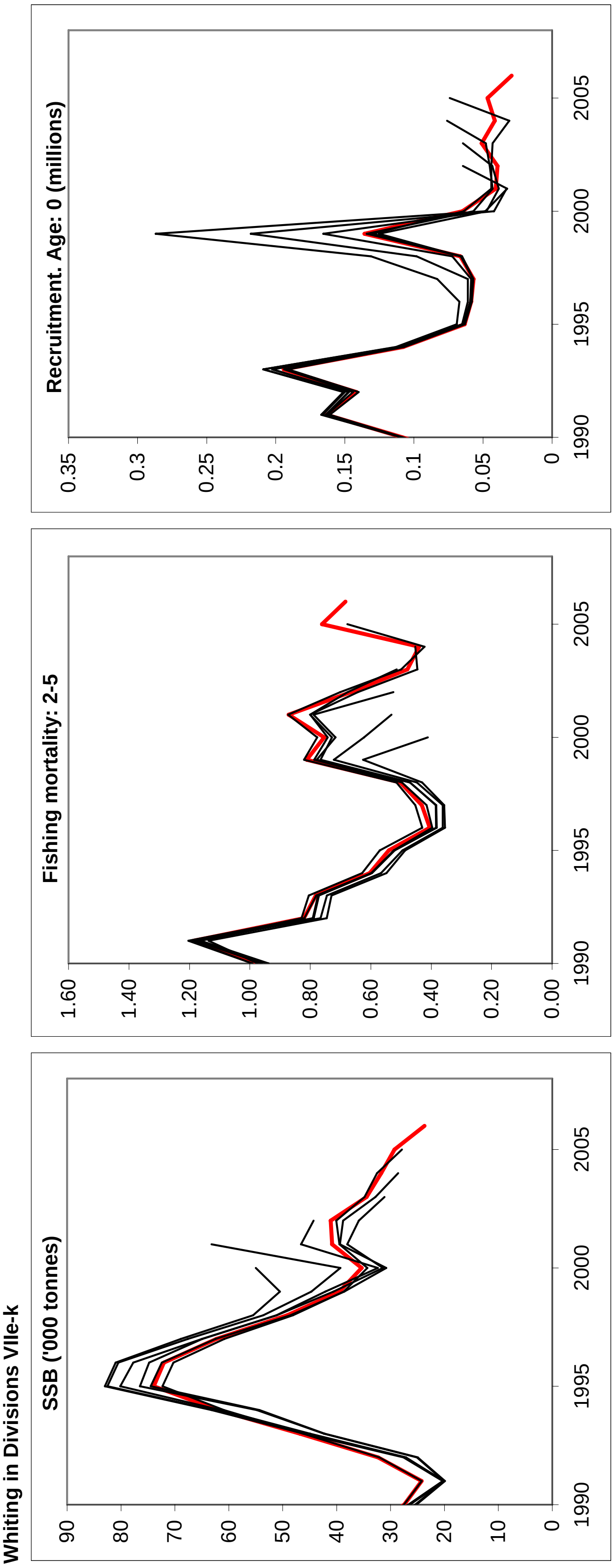


Figure 4.2.21 **Whiting in VIIe-k (Celtic Sea)**

Comparison with historic assessments.

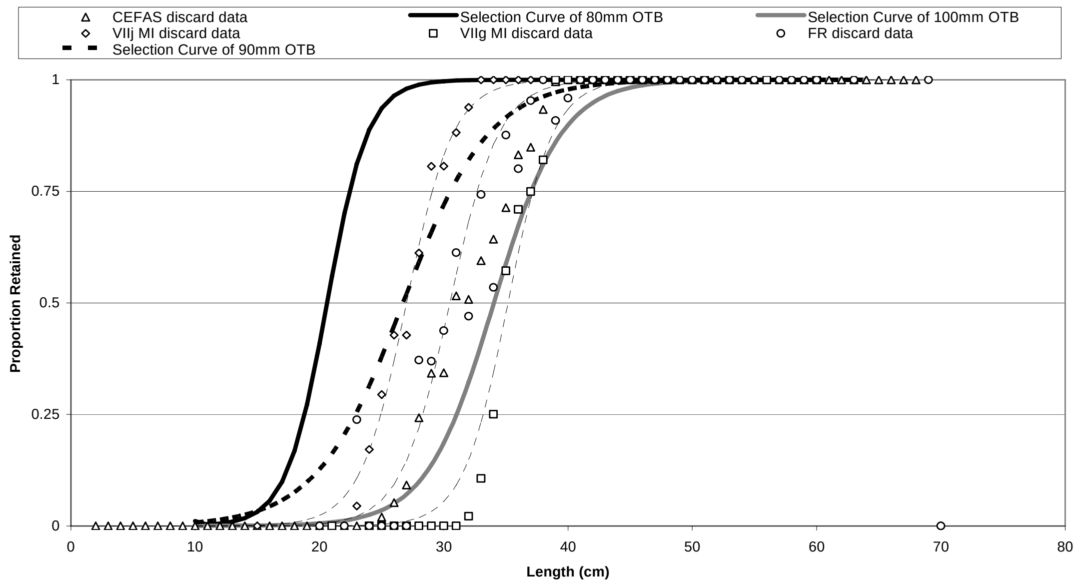


Figure 4.2.22 Whiting in VIIe-k (Celtic Sea)

Comparison of theoretical selection curves with observed onboard selection practices.

4.3 Sole in the Celtic Sea (ICES Divisions VIIfg)

Type of assessment in 2007: Update assessment (section 1.6).

The model settings were not changed compared to last year.

All the relevant biological and methodological information can be found in the Stock Annex. Here, only the basic input and output from the assessment model will be presented.

4.3.1 The fishery

This section is available in the Stock Annex.

ICES advice applicable to 2006 and 2007

Exploitation boundaries in relation to precautionary limits: *A 26% reduction in F is needed to reduce F below Fpa. This corresponds to landings of less than 880 t in 2006.*

Exploitation boundaries in relation to precautionary limits: *A 24% reduction in F is needed to reduce F below Fpa. This corresponds to landings of less than 840 tonnes in 2007.*

Management applicable to 2006 and 2007

Management of sole in VIIf,g is by TAC and technical measures. The agreed TACs in 2006 and 2007 are 950 t and 893 t respectively. Technical measures in force for this stock are minimum mesh sizes and minimum landing size (24cm). National regulations also restricted areas for certain types of vessels.

Council Regulation (EC) No 51/2006, Annex III, part A 4.2 prohibited fishing in ICES rectangles 30E4, 31E4 and 32E3 during February and March 2006 with derogations for vessels using pots, creels or nets with less than 55 mm mesh size. The prohibition does not apply within 6 nautical miles from the base line.

Council Regulation (EC) No 41/2007, Annex III, part A 7.2 prohibited fishing in ICES rectangles 30E4, 31E4 and 32E3 during February and March 2007 with derogations for vessels using pots, creels or nets with less than 55 mm mesh size. The prohibition does not apply within 6 nautical miles from the base line.

Working Document WD2 examines trends in French fishing effort in ICES Division VIIfg / Impact of the Trevose closure. Working Document WD 3 – Effects of 2005-2007 Trevose cod closure on UK demersal fleets. Working Document WD4 examines the impact of the temporal closure of ICES rectangles 30E4, 31E4 and 32E3 (Celtic Sea) on the Belgian fishery behaviour.

Recent trends in the fishery

Total international landings as used by the Working Group were 946 t in 2006, within 1 % of the TAC of 950 t (Table 4.3.1) and 14% below last year's Working Group forecast of 1103 t assuming *status quo* F.

In the beginning of the time series officially reported landings in area VIIf,g were higher than the WG estimates. In recent years official landings have been lower than the WG estimates and the unallocated landings can reach up to 20% of the official landings. In the last two years they account only for about 5%. As in last year's assessment, the catch-at-age matrix has been adjusted for area misreporting in 2006 (see section 4.3.12 on misreporting).

Recent discard estimates are available and suggest discarding of sole is usually minor. This issue is further elaborated on in section 4.3.2 on age and length composition and mean weights at age.

The WGFTFB report (ICES 2007) made the following comments relevant to this stock.

- A £5 million decommissioning scheme will reduce capacity in the UK SW beam trawl fleet in 2007. There was also decommissioning of 9 Belgian vessels between Aug'2005 and Nov' 2006 and these had been responsible for around 18% of the total Belgian kWdays in the Celtic sea in recent years. A Decommissioning Scheme launched in Ireland in October 2005 removed a total of 36 vessels and a further decommissioning programme will be announced in 2007. However, recent modernisation of the Irish Demersal fleet has led to around 23 extra vessels joining the fleet. Belgian beam trawlers are investigating use of two sets of smaller trawls from each beam in order to reduce fuel consumption, referred to as 'outrigging'. Belgian and French vessels are being equipped with 3D mapping sonar that has opened up new areas to fishing. Several countries report that new gear monitoring equipment fitted to trawls and trawl doors have the potential to increase efficiency.
- Voluntary use of technical modifications for beam trawls in Bristol Channel promoted to industry via workshops, demonstration and project meetings. The south-west UK beam trawl fleet is using benthic release panels that release about 75% of benthic invertebrates from the catches. Full square mesh codends are also being tested in order to reduce the capture of benthos further and improve the selection profile on gadoids

Commercial fleet effort and LPUE

Available estimates of effort and LPUE are presented in Tables 4.3.2a,b and Figures 4.3.1a,b. Effort (corrected for horsepower) for the Belgian beam trawl fleet (BEL-BEAM) steadily increased from 1991 to 2000. This series was temporally discontinued in 2003, since these data did not reflect the true change in LPUE and concurrent effort. This is due to a change in the calculation of the effort statistics from the official logbooks and sale slip notes (See also last year's working group report). Therefore the raw effort data from 1991 for the Belgian beam trawlers are also presented in Table 4.3.2a and indicate that effort decreased since 2004..

The effort from the UK (E&W) beam trawl fleet (UK-CSBT) followed more or less the same pattern of the Belgian beam trawl fleet up to 2003. Since then effort has declined sharply to a record low value in the time series for 2006.

Belgian and UK(E&W) beam trawl LPUE has gradually declined since the seventies, and increased slightly in recent years.

Irish effort and LPUE data is represented in the Tables 4.3.2a,b but not plotted in the Figures 4.3.1a,b as landings are minor and not thought to be representative for trends in the main fisheries for sole in VIIfg.

4.3.2 Age and length composition and mean weights at age

Annual length compositions for 2006 are given by fleet in Table 4.3.3. Historical data on length distribution for the Belgian and UK (England and Wales) landings from 1994 onwards are given in Figures 4.3.2a. For most of the years, Belgian landings tend to contain smaller fish than UK (England and Wales) landings, especially if strong or above average year classes are coming through.

Recent discard estimates are available for the UK beam trawler and the French bottom trawl fleet (Figure 4.3.2.b). Data are raised to the sampled trips. Since most demersal working groups were moved to the beginning of the year, Belgium could not process all their data on time. Therefore it was decided to not calculate and deliver any Belgian discard data to the working groups this year. The available information suggests that discards are not a substantial part of the catch for this high valued species and therefore no discards estimates are included in this assessment.

Only very minor revisions from France were made to the 2005 data.

Quarterly data for 2006 were available for catch numbers and weight at age, for the Belgian, and UK fleets. These comprise around 90% of the international landings. Catch weights at age for 2006 were calculated, weighted by national catch numbers at age, and then quadratically smoothed in year (using age = 1.5, 2.5 etc.) and SOP-corrected. The quadratic fit used for 2006 was:

$$W(t) = 0.0023 + (0.0553*(AGE)) - (0.0003*(AGE)^2) \qquad R^2 = 0.95$$

Further details on raising procedures are given in the Stock Annex.

Stock weights at age were the catch weights of the Belgian (BEL-BEAM) and the UK (UK-CSBT) beam trawl fleets in the first quarter and (as in previous years and described in the stock annex) smoothed by fitting a quadratic fit .(in ICES files):

$$W(t) = 0.0381 + (0.0397*(AGE)) + (0.0009*(AGE)^2) \qquad R^2 = 0.97$$

Stock and catch weights show no trends but the weights at the older ages are much noisy. (Plot in ICES files).

Catch numbers at age are given in Table 4.3.4, and weights at age in the catch and the stock are given in Tables 4.3.5 and 4.3.6. The historical age compositions (1995 onwards) are plotted in Figure 4.3.3.

Sampling levels for those countries providing age compositions are given in Table 1.3.1.

4.3.3 Natural mortality and maturity at age

Natural mortality was assumed to be 0.1 for all ages and years, and the maturity ogive based on UK(E&W) beam-trawl survey data (combined sex – see stock annex) was used:

Age	1	2	3	4	5	6+
Maturity	0.00	0.14	0.45	0.88	0.98	1.00

The proportion of M and F before spawning was set to zero.

4.3.4 Surveys and abundance indices

Abundance indices for the UK beam trawl survey (UK-BCCSBTS-S) are shown in Table 4.3.7. Abundance at age 0 is highly variable. Since last year ages 1 up to 9 are included in the assessment since there is evidence of tracking year classes at older ages (Figures 4.3.4ab). The 1998 year class is the highest estimate in the time series and the 2005 year class is estimated to be below average.

4.3.5 Catch-at-age analysis

Data screening

The results of exploratory XSA runs, which are not included in this report, are available in ICES files.

General approaches and methods are described in Section 1.4.1. The age range for the analyses was 1-10+, as in previous assessments. However, there is no commercial catch at age 1 and therefore zero values were included in the catch matrix in order to incorporate the survey results.

A preliminary inspection of the quality of international catch-at-age data was carried out using separable VPA with a reference age of 4, terminal F=0.5 and terminal S=0.8. As last year, the log-catch ratios for the fully recruited ages (3-10) did not show any patterns or large residuals, except for the ages 1/2.

XSA tuning data were available from Belgium beam trawlers (BEL-BEAM); from UK beam trawlers (UK-CSBT), Division VIIf; and from the UK Corystes September beam-trawl survey (UK-BCCSBTS-S). Data from a new Irish groundfish survey (IR-GFS) were too short to include in the assessment yet (Table 4.3.8). Note that the Belgian beam trawl fleet is temporally discontinued in 2003. This is due to a change in the calculation of the effort statistics from the official logbooks and sale slip notes in the most recent years (see also last year's working group report). Before the next benchmark assessment, a new derivation of these data should become available.

The tuning data were examined for trends in catchability by carrying out XSA single fleet tuning runs (lightly shrunk, mean q model for all ages, full time series and un-tapered), using data for each of the fleets individually. There were no long term strong trends for any of the fleets. The Belgian beam trawl fleet (BEL_BEAM) had a somewhat noisier log catchability residuals pattern, especially for age 2. A large residual on age 2 in the Belgian tuning fleet in 2003 was noted. The residuals of the UK beam trawl survey with ages 1 to 9 showed no trends or large values, except for age 9 which had some zero values and gave some high residuals. However the results indicate that the survey estimates of the survivors are very similar to the estimates of the other fleets and therefore inclusion or exclusion of this age is likely to have little effect. Consequently ages 1-9 were used in further investigations.

As the UK Corystes September Beam-trawl Survey (UK-BCCSBTS-S) is the sole provider of the survivors estimate at age 1, its consistency in year class estimation was investigated (detailed XSA diagnostics in ICES files). In addition the mean-standardised indexes were plotted for all ages (Figure 4.3.4a,b). The Working Group concluded that the survey has been able to track year class strength in the past rather well but noted that the estimate of a year class strength at age 1 could differ somewhat from estimates of that year class at older ages. This was especially the case for strong year classes but not for average and below average year classes. Therefore the Working Group decided to retain the survey estimates.

Final XSA-run

The final settings used in this year's assessment are as detailed below:

	2006 assessment			2007 assessment		
Fleets	Years	Ages	α-β	Years	Ages	α-β
BEL-BEAM commercial	71-03	2-9	0-1	71-03	2-9	0-1
UK-CSBT commercial	91-05	2-9	0-1	91-06	2-9	0-1
UK-BCCSBTS-S survey	88-05	1-9	0.75-0.85	88-06	1-9	0.75-0.85
-First data year	1971			1971		
-Last data year	2005			2006		
-First age	1			1		
-Last age	10+			10+		
Time series weights	None			None		
-Model	Mean q model all ages			Mean q model all ages		
-Q plateau set at age	7			7		
-Survivors estimates shrunk towards mean F	5 years / 5 ages			5 years / 5 ages		
-s.e. of the means	1.5			1.5		
-Min s.e. for pop. Estimates	0.3			0.3		
-Prior weighting	None			None		

The catchability residuals from the final XSA-run are shown in Figure 4.3.5 and the XSA tuning diagnostics are given in Table 4.3.9.

In general, estimates between fleets are consistent for ages 3 and above except for the Belgian Beam trawl fleet at age 4. The Belgian beam trawl fleet gave lower survivor estimates for age 5 which were down weighted to less than 2% in the final survivors estimate. F shrinkage gets low weights for all ages (< 3%). By not applying population shrinkage, the survivor estimates at age 1 (year class 2005) are now solely given by the survey. Although incoming recruitment is only depending on the survey's estimate, and age 1 estimates may have been sometimes over estimated in the past, the relative estimate of the same year class at age 2 (entering the fishery) has always been confirmed in subsequent assessments (Figure 4.3.6).

Retrospective patterns for the final run are shown in Figure 4.3.6. SSB is underestimated and fishing mortality overestimated.

The final XSA output is given in Table 4.3.10 (fishing mortalities) and Table 4.3.11 (stock numbers). A summary of the XSA results is given in Table 4.3.12 and trends in yield, fishing mortality, recruitment and spawning stock biomass are shown in Figure 4.3.7.

Last year, fishing mortality and SSB in 2005 were estimated to be 0.45 and 2764 t respectively. In this year's assessment, the estimates of F and SSB in 2005 have been revised downward by 15% and upward by 8% respectively. Fishing mortality in 2006 was estimated to be 0.33 and SSB 2576 t.

4.3.6 Estimating recruiting year class abundance

The 2004 year class was estimated to be around 4.7 million fish at age 1, which is below average and 3% lower than estimated last year. The XSA survivor estimate for this year class was used for further prediction.

The 2005 year class was estimated to be 3.9 million one year olds, which is below average. The survey gets all the weighting (see also section 4.3.5) The XSA survivors estimate for this year class was used for further prediction.

The long term GM recruitment (4.9 million, 1971-2004) was assumed for the 2006 and subsequent year classes.

The 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**
2004	4685	XSA	76%	21%	3%
2005	3888	XSA	100%	0%	0%
2006 and subsequent	4913	GM	-	-	-

4.3.7 Historic trends in biomass, fishing mortality and recruitment

Trends in landings, SSB, F(4-8) and recruitment are presented Table 4.3.12 and Figure 4.3.7.

After a period (1978-1990) of continuous increases in the fishing mortality (from 0.19 to 0.64), F dropped in the two following years to 0.40. In the period 1995-2003, fishing mortality fluctuated around a high level, except for 2000. Since 2003 fishing mortality has dropped from 0.57 to 0.33 in 2006.

Recruitment has fluctuated around 5 million recruits with occasional strong year classes. The 1998 year class is estimated to be the strongest in the time series.

SSB is estimated to have declined continuously from the highest value of 7900 t in 1971 to the lowest observed in the time series in 1998. The exceptional year class of 1998 had increased SSB to above the long term average, but as the influence of this year class on SSB wanes, SSB has declined.

4.3.8 Short-term catch/landing prediction

For the current prediction, population numbers at the start of 2007, estimated for ages 2 and older, were taken from the XSA output. GM recruitment was assumed for the 2006 and subsequent year classes. Fishing mortality was set as the mean over the last three years and scaled to the 2006 estimate. The main reasons for rescaling F were the retrospective analysis showing a systematic over estimation of F in the last seven years, and the decommissioning of several Belgian beam trawlers. Between August 2005 and November 2006, 9 Belgian vessels were decommissioned and over the period 2000-2004 these vessels accounted for approximately 17.6% of the total kW fishing days in VIIfg. The decommissioning will have its full impact from 2007 onwards. In addition, the main fishing grounds for sole are in rectangles 30E4 and 31E4. Both rectangles were closed in January-February 2005, and February-March 2006-07. Typically, catch rates of Celtic Sea sole are high during January-March. Finally effort from the UK beam trawl fleet decreased considerable over the last three years. Weights at age in the catch and in the stock are averages for the years 2004-2006. All the input data are shown in Table 4.3.13, the results in Tables 4.3.14 (management options) and Tables 4.3.15 (detailed output).

Assuming *status quo* F, implies a catch in 2007 of 940 t (the agreed TAC is 893 t) and a catch of 920 t in 2008. Assuming *status quo* F will result in a SSB of 2810 t in 2008 and 2700 t in 2009.

Assuming *status quo* F, the proportional contributions of recent year classes to the landings in 2008 and SSB in 2009 are given in Table 4.3.16. The assumed GM recruitment accounts for 6 % of the landings in 2008 and 15 % of the 2009 SSB.

4.3.9 Yield and biomass per recruit

Yield-per-recruit results, long-term yield and SSB, conditional on the present exploitation pattern and assuming *status quo* F in 2007, are given in Table 4.3.17 and Figure 4.3.8 (program used: MFYPR). F_{max} is estimated to be 0.23 compared to 0.27 last year but also 0.23 the previous year. Long term yield and SSB (using GM recruitment and Fsq) are estimated to be 910 t and 2700 t respectively.

4.3.10 Biological reference points

The Working Group's current approach to reference points is outlined in Section 1.4.4. Current biological reference points are given in the text table below:

Reference points	**ACFM 98-03**
F_{lim}	0.52 (based on F_{loss}, WG98)
F_{pa}	0.37 (F_{lim} x 0.72)
B_{lim}	Not defined
B_{pa}	2200 t (based on B_{loss} (1991), WG98)

Results from the PA software are shown in Figure 4.3.9 and 4.3.10.

Figure 4.3.11 shows the relationship between historical and predicted SSB on F values, plotted into zones according to the precautionary reference points defined. This assessment indicates that SSB is above B_{pa}, and F is below F_{pa} .

The WG notes that the basis on which the reference points were set in the past is not valid anymore since there is no stock-recruitment relation for this stock (Figure 4.3.12). Furthermore, the highest recruitment has been produced by the lowest biomass. Nevertheless, SSB should be maintained (a) within a range where recruitment is not impaired and (b) above the lowest observed biomass (under the condition that SSB has increased afterwards). It should be noted that B_{loss} is now 1600 t and that the SSB value from 1991 (basis for previous B_{loss}) is estimated to be 2100 t.

F_{loss} is poorly defined (last year estimated to be 0.61 and now estimated to be 0.49) and therefore is unsuitable as a basis for setting reference points The new Fpa value calculated from this year's F_{loss} value equals 0.35, which is around current fishing mortality.

4.3.11 Sensitivity and risk analysis

A sensitivity analysis (method in Section 1.4.3) was carried out to examine the contribution of different sources of uncertainty to the partial variance and sensitivity of predicted SSB and yield (Figure 4.3.13). The input values are presented in Table 4.3.18. Population numbers for sensitivity analysis were the estimates for 2007. Table 1.4.1 gives a description of the abbreviated variable names.

Figure 4.3.13 shows the sensitivity to the input parameters of the forecast on the predicted yields in 2008 and the predicted biomass in 2009. The yield in 2008 is most sensitive to the year effect on fishing mortality in 2008 en the population numbers at age 2. SSB in 2009 is predominantly sensitive to the population numbers at age 2 (49%).

Probability profiles of expected yield and SSB are given in Figure 4.3.14. The approximate 90% confidence intervals of the expected status quo yield in 2008 are 700 t and 1200 t. There is a less than 10% probability that at current fishing mortality SSB will fall below a value of 2200 t (B_{pa}.).

4.3.12 Comments on the assessment

Sampling

Sampling for sole in division VIIf,g are considered to be at a reasonable level (Table 1.3.1).

Discarding

Discarding of sole is minor and the Working Group concludes that the lack of discard data would not notably affect the assessment results.

Consistency

The trends and estimates of fishing mortality, SSB and recruitment were rather consistent with last year's assessment (Figure 4.3.6).

The historical performance of this assessment is pretty consistent apart of the period when the strong 1998 year class pasted through the fisheries. The Working Group noted that during that time, a power model was used in the assessment which revised the survey estimate of that year class down substantially. There is a tendency to overestimate fishing mortality and an underestimate SSB (Figure 4.3.15).

Misreporting

Misreporting is considered to be a problem for this stock and the level of misreporting has probably substantially increased, as a result of the exceptionally strong 1998 year class in association with more restrictive quotas. It is known that misreporting occurs to surrounding areas and this has been taken into account where possible. Corrections have been made to the landings for 2003, 2004, 2005 and 2006. It was assumed that misreporting of fishing hours did not occur in adjacent ICES subarea VIIh, especially since CPUE from 2003 onwards in that subarea reached unrealistic high values (more than 100 kg/hour fishing). Therefore the Working Group decided to assume an arbitrary CPUE of 20 kg/hour in subarea VIIh and calculate the more realistic landings for these years. The difference in declared landings with the assumed landings in VIIh were then added to the VIIfg landings which were 162, 139, 54 and 26 tonnes for 2003 to 2006 respectively.

Industry input

In 2006 the UK industry indicated that fishing was poor in area VIIfg at spawning time and a wide reduced number of vessels prosecuted the fishery. Fishing in 2007 showed good numbers and a wide size range of sole, and the number of beam trawlers prosecuting the fishery were more similar to historical levels, despite the cod closure.

At a Pre-WG industry meeting, the Irish industry questioned the stock definitions as used by the WG in for sole and plaice in VIIfg and VIIh-k. The WG did not have any new information on stock discrimination for this area that might suggest the stock data for VIIfg and VIIh-k should be merged in the assessment. Previous studies tagging studies in VIIf has shown little evidence of movement in an out of that area but there is no information from tagging on movement of sole between VIIf and VIIj. In general, once settle it thought that there is little movement of sole other that short inshore offshore migrations with some long-shore drift.

4.3.13 Management considerations

There is no apparent stock/recruitment relationship for this stock and no evidence of reduced recruitment at low levels of SSB (Figure 4.3.12).

In recent years, fishing mortality has been high. SSB has been declining over the whole time series, but has increased since 2001 due to the 1998 year class but as the influence of this year class wanes, SSB declines again. At current levels of fishing mortality, there is a high probability that SSB will remain within the observed range of stock dynamics in the short term.

In 2004 and 2005, the number of beam trawlers operating in the Celtic Sea increased considerable compared to the period before (WD 4). This was mainly due to effort limitations in the Eastern English Channel in 2004 and 2005 (in addition to effort limitations that were already in place in the North Sea and the Irish Sea), Belgian vessels searched for alternative fishing grounds. Given that the Celtic Sea is one of the few flatfish fishing grounds without stringent effort limitations, vessels moved their effort to the Celtic Sea. Since 2006, effort limitations in the Eastern English Channel were lifted for beam trawlers so that vessels that were fishing traditionally on these fishing grounds moved their effort back from the Celtic Sea into the Eastern English Channel.

Nine Belgian beam trawlers were decommissioned between August 2005 and November 2006. Over the period 2000-04, these vessels accounted on average for 17.6% of the total kWdays in the Celtic Sea.

Further details on the effects of the rectangle closures 30E4, 31E4 and 32E3 since 2005 are provided in section 2.1

Management plans

Last year the WG presented results from a series of medium-term scenarios (using the CS5 program), carried out in conjunction with VIIfg plaice, to simulate some possible management plans for the two stocks. Results indicate that an F in the range 0.27 to 0.49 which in the long-term would maintain yield at or above 95% of that given by Fmax, whilst posing a low probability (<5%) of SSB falling below Blim. This will imply reductions in F of 0-18% from current fishing mortality. A similar analysis for VIIf,g plaice, carried out in 2005 (see section 4.3.13) indicated a target F range for plaice between 0.25 and 0.56 which will imply reductions in F of 0-39% from current fishing mortality.

Since the exploitation pattern used in last year’s analysis has not markedly changed, the Working Group considered the long term target F’s for sole still valid.

The WG believes that phased effort over a number of years to reach these target fishing mortalities, and implemented in conjunction with technical conservation measures, should be considered.

Table 4.3.1 Celtic Sea SOLE. Divisions VIIf and VIIg. Official Nominal landings (t), 1986–2006 and data used by the Working Group.

Country	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006[1]
Belgium	1039*	701*	705*	684*	716*	982*	543*	575*	619*	763*	695*	660*	675*	604	694	720	703	715	735	648	578
Denmark	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
France	146	117	110	87	130	80	141	108	90	88	102	99	98	61	74	77	65	124	79	104	48
Ireland	188*	9	72	18	40	32	45	51	37	20	19	28	42	51	29	35	32	26	33	34	36
UK(E. & W,NI.)	611*	437	317	203	353	402	325	285	264	294	265	251	198	231	243	288	318	342	283	217	232
UK(Scotland	-	-	-	-	0	0	6	11	8	-	0	0	-	0	-	-	+	+	-	-	-
Netherlands	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	1,989	1,264	1,204	992	1,239	1,496	1060	1030	1,018	1,165	1081	1038	1013	886	1,040	1,120	1,118	1,207	1,130	1003	894
Unallocated	-389	-42	-58	-	50	-389	-79	-102	-9	-8	-86	-111	-138	65	51	48	227	185	119	41	52
Total used in assessment	1,600	1,222	1,146	992	1,189	1,107	981	928	1,009	1,157	995	927	875	1,012	1,091	1,168	1,345	1,392	1,249	1044	946

[1]Preliminary

*** including VIIg-k**

Table 4.3.2a **Sole in VIIf,g. Indices of effort**

Year	England & Wales Otter trawl	England & Wales Beam trawl[1]	Belgium Beam trawl[2]	Belgium Beam trawl[4]	Irish Otter trawl[3]	Irish Scottish seine[4]	Irish Beam trawl[4]
1971			11.06				
1972	45.72		8.44				
1973	45.28		17.39				
1974	38.94		18.83				
1975	33.53		16.38				
1976	25.61		28.07				
1977	27.16		24.11				
1978	27.08		18.09				
1979	23.84		18.90				
1980	26.43		29.02				
1981	24.10		35.39				
1982	19.20		28.77				
1983	17.61		34.95				
1984	23.16		33.48				
1985	25.24	18.70	40.49				
1986	21.18	20.72	52.46				
1987	24.43	38.76	37.26				
1988	20.09	25.62	42.92				
1989	17.61	20.26	53.58				
1990	22.56	30.77	40.27				
1991	18.57	40.81	18.05				
1992	16.00	35.78	25.47				
1993	13.79	39.64	31.27				
1994	9.48	37.03	38.35				
1995	8.46	37.59	47.81		63.56	6.43	20.78
1996	8.67	39.78	47.63	55.31	60.04	9.73	26.76
1997	8.14	43.00	51.98	64.47	65.10	16.13	28.25
1998	7.13	47.84	52.11	62.08	72.30	14.94	35.25
1999	5.69	50.87	55.03	57.17	51.66	8.01	40.87
2000	4.05	51.19	56.05	52.41	60.60	9.90	37.03
2001	4.42	49.32	52.06	55.80	69.43	16.33	39.71
2002	6.10	37.53	43.24	50.69	77.69	20.86	31.62
2003	9.94	40.71	42.81	63.58	86.79	20.91	49.26
2004	9.42	32.37		82.25	96.99	19.38	54.86
2005	12.09	27.73		70.03	124.39	14.81	49.65
2006	12.97	18.55		59.72	118.36	14.79	60.35

[1]Division VIIf only - Fishing hours (x10^3) corrected for fishing power

[2]Fishing hours (x 10^3) corrected for fishing power using P = 0.000204 BHP^1.23

[3]Division VIIg only - Fishing hours (x10^3)

[4]D Fishing hours (x10^3)

Table 4.3.2b **Sole in VIIf,g. LPUE indices**

	England & Wales		Belgium	Belgium	England & Wales	England & Wales[4]	Irish	Irish	Irish
	Otter trawl[1]	Otter trawl[1]	Beam trawl[2]	Beam trawl[5]	Beam trawl[1]	Beam trawl Survey	Otter trawl[5]	Scottish sein[5]	Beam trawl6
Year	Division VIIf	Division VIIg[3]	Division VIIf+g	Division VIIf+g	Division VIIf	Division VIIf+g	Division VIIg	Division VIIg	Division VIIg
1971			47.92		-	-			
1972	2.42	2.11	37.06		-	-			
1973	2.45	0.98	39.47		-	-			
1974	2.10	1.83	37.81		-	-			
1975	1.82	1.79	31.41		-	-			
1976	2.02	1.30	30.50		-	-			
1977	1.84	1.21	27.90		-	-			
1978	1.82	1.17	23.35		13.99	-			
1979	1.80	1.15	33.19		14.83	-			
1980	1.86	1.55	29.73		18.99	-			
1981	1.45	0.60	24.03		13.58	-			
1982	1.73	0.56	25.93		11.79	-			
1983	2.22	1.14	22.18		13.50	-			
1984	1.53	1.70	20.78		13.59	-			
1985	1.55	1.55	17.94		12.52	-			
1986	1.38	0.99	17.83		10.94	-			
1987	0.94	1.15	17.32		7.31	-			
1988	0.62	0.27	15.29		4.39	71.14			
1989	0.99	0.87	11.33		5.38	135.18			
1990	0.76	0.67	15.64		5.98	90.67			
1991	0.69	0.85	24.24		4.80	122.88			
1992	1.00	1.25	18.57		4.14	115.79			
1993	0.55	0.25	15.21		4.80	75.42			
1994	0.90	0.27	13.94		4.26	107.77			
1995	0.96	0.87	13.62		4.52	72.50	0.40	0.62	0.81
1996	0.66	0.52	11.27	11.02	3.94	70.15	0.73	0.05	0.88
1997	0.86	0.52	9.96	8.61	3.28	81.66	0.42	0.23	1.16
1998	0.60	0.40	10.12	8.97	2.67	135.41	0.48	0.11	1.11
1999	0.91	0.74	11.26	11.70	3.21	168.46	0.17	0.09	0.5
2000	0.49	1.85	11.90	13.49	3.36	236.43	0.19	0.05	0.26
2001	1.14	2.13	13.25	13.39	4.02	154.79	0.27	0.55	0.15
2002	0.78	3.60	18.71	17.42	5.64	118.11	0.43	0.29	0.14
2003	0.57	0.00	19.48	11.25	5.23	123.93	0.12	0.03	0.20
2004	0.60	0.19		8.78	5.75	149.65	0.18	0.02	0.20
2005	0.76	0.26		9.01	4.94	76.26	0.14		0.28
2006	1.16	0.60		9.01	5.96	68.96	0.11	0.05	0.26

[1]Kg/hr corrected for GRT.

[2]Kg/hr corrected for fishing power using P = 0.000204 BHP^1.23

[3]Division VIIg (East).

[4]Kg/100km

[5]Kg/hour

Table 4.3.3 Sole in VIIf,g Annual length distributions by fleet (2006)

	UK (England & Wales)		Belgium	Ireland*
Length (cm)	Beam trawl	All gears (minus beam)	All gears	All gears
20				1
21				4
22	996		20239	30
23	3084	287	164647	48
24	15639	3157	354934	79
25	29919	7897	390484	95
26	49462	10513	381211	170
27	53243	12101	294664	184
28	53158	13853	253604	434
29	52354	13484	167804	444
30	43013	8409	153994	370
31	43744	9237	104326	272
32	40225	5902	89339	222
33	30561	5199	68372	262
34	25846	7206	52564	286
35	22105	7878	45376	348
36	22973	4991	41409	314
37	17311	4696	32082	294
38	14755	5850	29567	243
39	14985	4551	21519	218
40	12016	4478	15780	111
41	8590	3909	10364	123
42	6984	2378	6327	65
43	3508	1641	4715	34
44	2137	313	4463	25
45	2117	378	1681	21
46	2374	313	1562	20
47	791	270	519	11
48	36	95	606	2
49	61	0	216	2
50	123	0	25	
51	212	0	93	
52	61	0	141	
53	34	0		
54		74		
55				
56				
57				
58				
59				
60				
Total	572417	139060	2712627	4732

* Distributions from sample only

Table 4.3.4 Catch numbers at age

Run title : CELTIC SEA SOLE.2007 WG.COMBSEX.PLUSGROUP

At 12/06/2007 15:23

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

YEAR,	1971,	1972,	1973,	1974,	1975,	1976,
AGE						
1,	0,	0,	0,	0,	0,	0,
2,	386,	541,	364,	155,	119,	312,
3,	270,	902,	1882,	438,	287,	834,
4,	1341,	314,	748,	863,	336,	560,
5,	625,	670,	305,	411,	638,	611,
6,	433,	329,	352,	209,	304,	559,
7,	537,	213,	119,	239,	110,	261,
8,	763,	232,	110,	97,	102,	131,
9,	376,	314,	116,	109,	67,	197,
+gp,	1220,	730,	644,	541,	372,	463,
TOTALNUM,	5951,	4245,	4640,	3062,	2335,	3928,
TONSLAND,	1861,	1278,	1391,	1105,	919,	1350,
SOPCOF %,	100,	100,	100,	100,	100,	100,

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

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	314,	318,	328,	657,	602,	342,	647,	672,	196,	494,
3,	438,	741,	560,	972,	675,	831,	1078,	846,	1473,	1296,
4,	349,	339,	747,	876,	792,	309,	729,	606,	766,	1173,
5,	271,	154,	208,	584,	399,	467,	284,	542,	565,	526,
6,	244,	159,	154,	180,	377,	280,	349,	184,	296,	358,
7,	404,	99,	197,	62,	150,	207,	225,	277,	100,	193,
8,	120,	198,	124,	96,	120,	92,	192,	106,	140,	87,
9,	28,	71,	153,	100,	94,	111,	52,	47,	73,	103,
+gp,	365,	174,	169,	352,	380,	326,	320,	274,	240,	328,
TOTALNUM,	2533,	2253,	2640,	3879,	3589,	2965,	3876,	3554,	3849,	4558,
TONSLAND,	961,	780,	954,	1314,	1212,	1128,	1373,	1266,	1328,	1600,
SOPCOF %,	100,	100,	100,	100,	100,	100,	100,	100,	100,	100,

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

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	318,	526,	479,	277,	1458,	433,	354,	295,	129,	177,
3,	957,	464,	1164,	994,	690,	1700,	863,	790,	1156,	1035,
4,	797,	879,	601,	1176,	658,	644,	1104,	739,	1098,	904,
5,	577,	441,	621,	399,	496,	409,	332,	864,	420,	424,
6,	273,	387,	237,	452,	151,	253,	186,	283,	483,	229,
7,	205,	127,	188,	138,	156,	61,	161,	149,	133,	192,
8,	100,	78,	82,	115,	55,	59,	63,	65,	112,	57,
9,	61,	67,	24,	50,	46,	28,	83,	42,	65,	43,
+gp,	179,	268,	102,	129,	162,	89,	99,	146,	109,	106,
TOTALNUM,	3467,	3237,	3498,	3730,	3872,	3676,	3245,	3373,	3705,	3167,
TONSLAND,	1222,	1146,	992,	1189,	1107,	981,	928,	1009,	1157,	995,
SOPCOF %,	100,	100,	100,	100,	100,	100,	100,	100,	100,	100,

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

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	245,	197,	608,	1721,	704,	29,	119,	425,	271,	685,
3,	890,	932,	1718,	1480,	1918,	1465,	697,	1721,	855,	1330,
4,	599,	724,	834,	683,	860,	2202,	1134,	792,	837,	715,
5,	400,	297,	282,	241,	436,	660,	1860,	794,	473,	576,
6,	252,	171,	143,	60,	242,	249,	402,	721,	398,	163,
7,	127,	108,	80,	56,	65,	95,	223,	114,	348,	148,
8,	126,	51,	31,	43,	39,	54,	80,	60,	48,	178,
9,	45,	52,	23,	19,	26,	36,	26,	34,	41,	44,
+gp,	106,	87,	44,	51,	81,	51,	75,	49,	43,	51,
TOTALNUM,	2790,	2619,	3763,	4354,	4371,	4841,	4616,	4710,	3314,	3890,
TONSLAND,	927,	875,	1012,	1091,	1168,	1345,	1392,	1249,	1044,	946,
SOPCOF %,	100,	100,	100,	100,	100,	100,	100,	100,	100,	100,

Table 4.3.5 Sole VIIf,g Catch weights at age

Run title : CELTIC SEA SOLE.2007 WG.COMBSEX.PLUSGROUP

At 12/06/2007 15:23

Table 2 Catch weights at age (kg)

YEAR,	1971,	1972,	1973,	1974,	1975,	1976,
AGE						
1,	.0390,	.1060,	.0810,	.0630,	.0460,	.1140,
2,	.1060,	.1470,	.1430,	.1370,	.1320,	.1670,
3,	.1670,	.1860,	.2020,	.2050,	.2120,	.2180,
4,	.2220,	.2260,	.2580,	.2700,	.2860,	.2680,
5,	.2720,	.2640,	.3110,	.3290,	.3550,	.3160,
6,	.3150,	.3020,	.3610,	.3850,	.4170,	.3630,
7,	.3520,	.3400,	.4080,	.4360,	.4730,	.4090,
8,	.3830,	.3760,	.4520,	.4830,	.5230,	.4530,
9,	.4080,	.4130,	.4930,	.5250,	.5670,	.4960,
+gp,	.4397,	.5384,	.6021,	.6239,	.6715,	.6649,
SOPCOFAC,	.9999,	1.0009,	1.0005,	.9995,	.9999,	.9988,

Table 2 Catch weights at age (kg)

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	.0980,	.0680,	.0230,	.0480,	.0780,	.0610,	.0850,	.0190,	.0890,	.0460,
2,	.1690,	.1540,	.1320,	.1440,	.1540,	.1560,	.1730,	.1310,	.1700,	.1440,
3,	.2350,	.2340,	.2320,	.2340,	.2250,	.2430,	.2550,	.2350,	.2460,	.2360,
4,	.2970,	.3090,	.3210,	.3160,	.2920,	.3240,	.3300,	.3300,	.3170,	.3210,
5,	.3550,	.3780,	.4010,	.3920,	.3550,	.3970,	.3980,	.4160,	.3830,	.4000,
6,	.4090,	.4410,	.4710,	.4610,	.4140,	.4620,	.4590,	.4940,	.4440,	.4710,
7,	.4600,	.4990,	.5310,	.5230,	.4690,	.5210,	.5140,	.5620,	.5000,	.5360,
8,	.5060,	.5510,	.5810,	.5790,	.5190,	.5720,	.5610,	.6220,	.5520,	.5940,
9,	.5480,	.5980,	.6220,	.6270,	.5650,	.6170,	.6020,	.6730,	.5980,	.6450,
+gp,	.6681,	.7196,	.6636,	.7202,	.6654,	.7043,	.6786,	.7716,	.7026,	.7479,
SOPCOFAC,	.9996,	.9979,	1.0011,	.9992,	.9999,	.9994,	1.0004,	.9985,	1.0016,	1.0004,

Table 2 Catch weights at age (kg)

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	.0480,	.0740,	.0130,	.0490,	.0540,	.0730,	.0570,	.0810,	.0680,	.0270,
2,	.1460,	.1570,	.1090,	.1340,	.1500,	.1470,	.1340,	.1510,	.1470,	.1240,
3,	.2360,	.2350,	.1980,	.2140,	.2390,	.2160,	.2070,	.2160,	.2200,	.2140,
4,	.3200,	.3090,	.2800,	.2910,	.3200,	.2810,	.2750,	.2760,	.2880,	.2960,
5,	.3960,	.3780,	.3550,	.3630,	.3930,	.3420,	.3380,	.3310,	.3510,	.3720,
6,	.4660,	.4420,	.4240,	.4300,	.4590,	.3980,	.3960,	.3800,	.4090,	.4390,
7,	.5280,	.5020,	.4870,	.4940,	.5160,	.4510,	.4500,	.4250,	.4620,	.5000,
8,	.5840,	.5570,	.5430,	.5530,	.5660,	.4990,	.5000,	.4650,	.5100,	.5520,
9,	.6320,	.6080,	.5920,	.6090,	.6080,	.5430,	.5450,	.5000,	.5530,	.5980,
+gp,	.7404,	.7385,	.6909,	.7474,	.6740,	.6402,	.6445,	.5626,	.6429,	.6773,
SOPCOFAC,	1.0010,	.9993,	.9993,	.9993,	.9998,	.9995,	.9994,	.9996,	.9982,	1.0008,

Table 2 Catch weights at age (kg)

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
AGE										
1,	.0740,	.0790,	.0150,	.0780,	.0660,	.0540,	.1230,	.0660,	.0680,	.0850,
2,	.1560,	.1630,	.1220,	.1660,	.1480,	.1300,	.1710,	.1300,	.1450,	.1390,
3,	.2340,	.2440,	.2220,	.2480,	.2250,	.2020,	.2180,	.1940,	.2190,	.1920,
4,	.3070,	.3200,	.3150,	.3220,	.2960,	.2710,	.2660,	.2560,	.2880,	.2450,
5,	.3760,	.3930,	.4000,	.3900,	.3630,	.3360,	.3130,	.3170,	.3540,	.2970,
6,	.4400,	.4620,	.4780,	.4510,	.4250,	.3990,	.3610,	.3770,	.4150,	.3490,
7,	.5000,	.5280,	.5490,	.5060,	.4820,	.4570,	.4080,	.4350,	.4730,	.4000,
8,	.5550,	.5890,	.6130,	.5530,	.5330,	.5130,	.4540,	.4930,	.5280,	.4510,
9,	.6050,	.6470,	.6700,	.5940,	.5790,	.5640,	.5010,	.5490,	.5780,	.5010,
+gp,	.7071,	.7809,	.7655,	.6649,	.6773,	.7045,	.6379,	.7217,	.6918,	.6177,
SOPCOFAC,	.9997,	.9994,	1.0005,	1.0000,	.9954,	1.0001,	1.0019,	1.0003,	1.0004,	.9992,

Table 4.3.6 Sole VIIf,g Stock weights at age

Run title : CELTIC SEA SOLE.2007 WG.COMBSEX.PLUSGROUP

At 12/06/2007 15:24

Table 3 Stock weights at age (kg)

YEAR,	1971,	1972,	1973,	1974,	1975,	1976,
AGE						
1,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,
2,	.0760,	.1130,	.1130,	.1130,	.1130,	.1130,
3,	.1360,	.1570,	.1420,	.1590,	.1410,	.1600,
4,	.1900,	.2220,	.2030,	.2210,	.2150,	.2100,
5,	.2390,	.2980,	.2630,	.3050,	.2950,	.2690,
6,	.4060,	.3510,	.3340,	.4500,	.3530,	.3540,
7,	.4720,	.3520,	.3220,	.4480,	.5930,	.4320,
8,	.3890,	.5930,	.4000,	.4640,	.4230,	.4620,
9,	.3460,	.4170,	.5390,	.6240,	.4650,	.4250,
+gp,	.5826,	.6005,	.5822,	.6707,	.7112,	.7280,

Table 3 Stock weights at age (kg)

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,
2,	.1450,	.1130,	.1130,	.1130,	.1130,	.1130,	.1130,	.1180,	.1130,	.1130,
3,	.1740,	.1670,	.1630,	.1570,	.1590,	.1640,	.1750,	.1730,	.1750,	.1800,
4,	.2360,	.2570,	.2550,	.2380,	.2320,	.2550,	.2620,	.2740,	.2680,	.2730,
5,	.3660,	.3600,	.3920,	.3540,	.3060,	.3560,	.3700,	.4290,	.4720,	.3980,
6,	.3920,	.4130,	.4370,	.3940,	.3850,	.4870,	.4880,	.5170,	.4330,	.4620,
7,	.4540,	.5210,	.4850,	.6220,	.4620,	.5430,	.6330,	.6410,	.4620,	.5460,
8,	.5050,	.5080,	.5950,	.5560,	.5510,	.6100,	.6060,	.6130,	.4800,	.6360,
9,	.9070,	.5600,	.6570,	.7040,	.7370,	.7660,	.4640,	.8360,	.9440,	.8900,
+gp,	.7006,	.7826,	.6963,	.7714,	.6627,	.8561,	.8230,	.9784,	.7983,	.8435,

Table 3 Stock weights at age (kg)

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,
2,	.1130,	.1130,	.1130,	.1130,	.1130,	.1130,	.1480,	.1130,	.1130,	.1040,
3,	.1530,	.1580,	.1520,	.1640,	.1790,	.1840,	.1960,	.1350,	.1430,	.1860,
4,	.2420,	.2330,	.2270,	.2470,	.2300,	.2650,	.2670,	.2270,	.2330,	.2840,
5,	.3610,	.3630,	.3080,	.3690,	.3560,	.3880,	.3920,	.3290,	.3350,	.3870,
6,	.4730,	.4660,	.4650,	.4760,	.5360,	.4980,	.4700,	.4300,	.4410,	.4860,
7,	.4680,	.6870,	.5460,	.5230,	.3760,	.7510,	.4920,	.5210,	.5400,	.5730,
8,	.5870,	.6870,	.5260,	.7530,	.8590,	.7540,	.5760,	.5990,	.6290,	.6470,
9,	.8200,	.6760,	.5420,	.8470,	.7350,	.4750,	.6360,	.6610,	.7050,	.7080,
+gp,	.8378,	.8180,	.7522,	.9732,	.6789,	.8963,	.7272,	.7572,	.8447,	.8080,

Table 3 Stock weights at age (kg)

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
AGE										
1,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,	.0900,
2,	.1130,	.1130,	.1100,	.0620,	.1130,	.1130,	.1580,	.1160,	.1490,	.1430,
3,	.1780,	.1950,	.2040,	.1690,	.1870,	.1890,	.2050,	.1760,	.2130,	.1880,
4,	.2760,	.2820,	.3170,	.3060,	.3120,	.2890,	.2580,	.2480,	.2750,	.2350,
5,	.3860,	.3710,	.4330,	.4340,	.4340,	.4030,	.3170,	.3290,	.3370,	.2840,
6,	.4950,	.4540,	.5410,	.5340,	.5380,	.5120,	.3810,	.4150,	.3990,	.3340,
7,	.5980,	.5290,	.6350,	.6030,	.6190,	.6090,	.4490,	.5020,	.4590,	.3860,
8,	.6890,	.5930,	.7120,	.6480,	.6800,	.6910,	.5210,	.5870,	.5200,	.4410,
9,	.7660,	.6440,	.7720,	.6770,	.7250,	.7570,	.5940,	.6670,	.5790,	.4960,
+gp,	.8923,	.7318,	.8525,	.7070,	.7835,	.8730,	.8113,	.8690,	.7401,	.6414,

Table 4.3.7 Sole in VIIf,g. Indices of abundance (No/100km)
(Survey UK-BCCSBTS-S)

	0	1	2	3	4	5	6	7	8	9
1988	30	81	326	49	19	5	0	0	0	0
1989	144	222	331	176	20	15	7	4	2	2
1990	30	385	313	50	16	4	7	3	0	0
1991	32	241	517	67	17	15	4	0	2	2
1992	4	394	260	139	30	18	10	1	2	1
1993	5	161	341	41	23	2	2	2	1	1
1994	1	351	356	110	19	9	7	0	0	2
1995	33	125	226	51	12	7	12	3	2	2
1996	5	152	204	52	23	5	2	3	2	2
1997	31	420	180	19	11	14	4	3	5	0
1998	87	765	416	50	8	12	7	2	1	5
1999	24	2424	238	32	14	5	3	5	2	0
2000	673	824	803	27	25	4	0	2	1	1
2001	22	336	534	245	20	8	6	2	0	2
2002	7	575	211	113	95	12	6	2	4	0
2003	13	361	505	42	27	47	8	3	3	2
2004	58	754	378	87	15	21	39	4	2	0
2005	36	337	226	32	13	6	4	14	1	2
2006	11	268	200	40	12	7	0	2	10	0
geomean	21	350	318	59	19	9				
mean	65	483	346	75	22	11	7	3	2	1

Table 4.3.8 Sole in VIIf,g. Tuning fleets

Series, year and age ranges used in tuning are shown in bold

BEL-BEAM **Belgium Beam Trawl (Effort=Corrected formula - '000 fishing hours)**

1971 2003
1 1 0 1
2 14

11.06	111	77	384	179	124	154	218	108	32	107	76	21	40	1971
8.44	132	220	76	163	80	52	57	76	39	23	14	38	14	1972
17.39	179	926	368	150	173	58	54	57	108	32	23	21	45	1973
18.83	102	287	565	270	136	156	64	79	90	75	38	39	37	1974
16.38	69	167	195	370	176	64	59	39	33	29	37	18	23	1975
28.07	199	533	357	391	357	167	84	125	40	17	21	51	35	1976
24.11	220	307	244	190	170	283	84	20	35	39	36	18	52	1977
18.09	173	403	185	84	86	54	108	38	11	21	61	8	9	1978
18.90	222	379	506	141	104	133	84	103	35	12	16	4	6	1979
29.02	438	647	583	389	119	45	63	66	92	22	25	16	10	1980
35.39	429	481	565	286	268	107	86	67	86	74	33	13	13	1981
28.77	245	594	221	334	200	148	66	80	54	19	41	16	25	1982
34.95	363	605	409	159	196	127	108	29	44	32	15	12	12	1983
33.48	372	467	334	300	102	153	59	26	26	16	24	19	18	1984
40.49	52	909	471	372	208	75	104	46	68	15	29	16	10	1985
52.46	377	900	823	359	230	140	49	58	65	29	50	6	9	1986
37.23	247	664	438	344	191	119	47	29	20	4	14	2	16	1987
42.92	362	293	603	250	197	77	51	36	26	19	19	13	16	1988
53.58	244	680	428	471	179	145	62	13	24	10	19	3	17	1989
40.27	231	742	663	181	240	70	59	17	26	12	2	4	12	1990
18.05	1028	380	225	131	29	26	9	7	13	8	4	1	2	1991
25.47	327	1062	376	210	98	14	14	7	9	5	0	0.3	2	1992
31.27	296	615	629	161	81	75	38	36	19	4	2	1	1	1993
38.35	205	524	523	530	176	71	20	15	16	11	6	5	7	1994
47.81	77	827	838	277	250	78	48	21	17	8	1	5	2	1995
47.63	104	737	579	258	130	88	29	17	9	12	3	3	0	1996
51.98	193	661	377	241	143	74	55	23	16	18	7	3	2	1997
52.11	166	771	608	188	100	84	33	25	21	8	6	10	7	1998
55.03	493	1286	622	189	66	36	11	14	5	3	1	3	0	1999
56.05	1509	1174	435	124	20	16	14	6	2	9	3	1	1	2000
52.06	621	1445	710	307	174	38	16	11	11	6	17	1	1	2001
43.24	0	1292	1704	570	163	56	27	15	1	1	1	4	0.6	2002
42.81	16	538	929	1274	315	159	50	19	12	2	7	1	3	2003

UK-CSBT **UK(E+W) VIIf Beam Trawl (Effort= '000 fishing hours)**

1991 2006
1 1 0 1
2 14

40.81	52	98	189	171	60	67	23	20	16	13	5	4	4	1991
35.78	18	220	103	83	69	22	21	10	13	5	3	1	1	1992
39.64	6	83	198	77	50	41	11	24	9	5	4	3	4	1993
37.03	23	80	59	116	36	31	19	11	15	8	5	4	4	1994
37.59	16	87	73	56	105	24	30	23	8	8	4	5	3	1995
39.78	22	96	128	70	45	52	15	13	12	4	9	5	2	1996
43.00	10	60	86	69	53	27	39	11	11	5	5	3	2	1997
47.48	13	101	73	77	50	17	13	20	7	6	4	2	1	1998
50.87	31	203	107	52	50	28	13	6	10	4	2	1	0	1999
51.19	72	152	150	75	27	28	19	9	4	8	2	2	2	2000
49.32	37	272	99	89	48	19	17	11	9	3	7	1	2	2001
37.53	11	149	375	90	63	28	18	14	9	6	4	3	1	2002
40.71	18	101	176	369	77	45	18	6	7	3	4	1	2	2003
32.37	19	91	65	113	179	34	27	15	7	3	5	1	1	2004
27.73	27	78	126	55	60	115	15	14	4	5	2	2	1	2005
18.55	15.7	86	94	103	32	39	69	13	8	4	2	1	1	2006

UK-BCCSBTS-S **UK(E+W) VIIf Corystes (Effort = Total dist (km) - numbers at age)**

1988 2006
1 1 0.75 0.85
0 9

74.120	22	60	242	36	14	4	0	0	0	0	1988
91.909	132	204	304	162	18	14	6	4	2	2	1989
69.858	21	269	219	35	11	3	5	2	0	0	1990
123.410	40	297	638	83	21	18	5	0	3	2	1991
125.078	5	493	325	174	37	23	12	1	2	1	1992
127.672	6	207	436	52	28	3	2	2	1	1	1993
120.816	1	424	430	133	23	11	9	0	0	3	1994
104.139	34	130	235	53	13	7	13	3	2	2	1995
122.113	6	186	249	63	28	6	3	4	3	3	1996
116.183	36	448	209	22	13	16	5	4	6	0	1997
104.694	91	801	436	52	8	13	7	2	1	5	1998
117.110	28	2839	279	37	16	6	4	6	2	0	1999
105.992	713	873	851	29	26	4	0	2	1	1	2000
118.221	26	397	631	290	24	9	7	2	0	2	2001
113.033	8	647	239	128	107	13	7	2	4	0	2002
111.921	14	404	565	47	30	53	9	3	3	2	2003
101.915	59	768	385	89	15	21	40	4	2	0	2004
119.111	43	401	269	38	16	7	5	17	1	2	2005
120.556	13	323	241	48	15	8	0	3	12	0	2006

IrGFS Irish Groundfish Survey (IBTS 4th Qtr) - number at age (Interim indices for new *Celtic Explorer* series)

2003 2006
1 1 0.79 0.92
1 10

832	1.0	5.2	1.1	3.2	3.0	4.1	4.0	0.0	1.0	0.0	2003
980	1.0	8.0	6.0	5.0	1.0	2.0	1.0	0.0	0.0	1.0	2004
845	0.0	0.0	6.0	2.0	4.0	2.0	2.0	0.0	0.0	0.0	2005
1046	0.0	0.0	4.0	4.0	6.0	4.0	1.0	0.0	0.0	0.0	2006

Table 4.3.9 Sole in VIIf,g diagnostics

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Lowestoft VPA Version 3.1

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 Extended Survivors Analysis

 CELTIC SEA SOLE.2007 WG.COMBSEX.PLUSGROUP

 CPUE data from file SOL7FTUN.dat

 Catch data for  36 years. 1971 to 2006. Ages  1 to  10.

      Fleet,            First, Last, First, Last, Alpha,  Beta
                    ,    year, year,  age ,  age
 BEL-BEAM            ,   1971, 2006,   2,     9,   .000,  1.000
 UK-CSBT             ,   1991, 2006,   2,     9,   .000,  1.000
 UK-BCCSBTS-S        ,   1988, 2006,   1,     9,   .750,   .850


 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   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 had not converged after   30 iterations


 Total absolute residual between iterations
 29 and  30 =     .00073

 Final year F values
 Age          ,      1,      2,      3,      4,      5,      6,      7,      8,      9
 Iteration 29,  .0000,  .1862,  .3704,  .3638,  .4307,  .3669,  .3139,  .1810,  .3201
 Iteration 30,  .0000,  .1862,  .3704,  .3638,  .4306,  .3668,  .3138,  .1809,  .3198
```

Table 4.3.9 continued

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
1,	.000,	.000,	.000,	.000,	.000,	.000,	.000,	.000,	.000,	.000
2,	.073,	.043,	.120,	.146,	.119,	.009,	.023,	.106,	.056,	.186
3,	.458,	.385,	.551,	.419,	.216,	.343,	.279,	.461,	.285,	.370
4,	.582,	.738,	.624,	.390,	.407,	.364,	.431,	.517,	.378,	.364
5,	.650,	.568,	.635,	.324,	.410,	.556,	.528,	.539,	.591,	.431
6,	.785,	.566,	.522,	.234,	.553,	.385,	.694,	.354,	.504,	.367
7,	.707,	.831,	.500,	.352,	.379,	.386,	.626,	.376,	.257,	.314
8,	.610,	.609,	.529,	.487,	.392,	.551,	.578,	.299,	.239,	.181
9,	.668,	.484,	.541,	.640,	.543,	.674,	.496,	.458,	.306,	.320

1

XSA population numbers (Thousands)

	AGE								
YEAR ,	1,	2,	3,	4,	5,	6,	7,	8,	9,
1997 ,	5.44E+03,	3.65E+03,	2.55E+03,	1.43E+03,	8.80E+02,	4.87E+02,	2.63E+02,	2.90E+02,	9.71E+01,
1998 ,	6.26E+03,	4.92E+03,	3.07E+03,	1.46E+03,	7.21E+02,	4.16E+02,	2.01E+02,	1.18E+02,	1.43E+02,
1999 ,	1.47E+04,	5.66E+03,	4.26E+03,	1.89E+03,	6.31E+02,	3.70E+02,	2.14E+02,	7.93E+01,	5.79E+01,
2000 ,	7.30E+03,	1.33E+04,	4.54E+03,	2.22E+03,	9.15E+02,	3.02E+02,	1.98E+02,	1.17E+02,	4.23E+01,
2001 ,	3.71E+03,	6.60E+03,	1.04E+04,	2.70E+03,	1.36E+03,	5.99E+02,	2.16E+02,	1.26E+02,	6.52E+01,
2002 ,	6.12E+03,	3.36E+03,	5.30E+03,	7.58E+03,	1.63E+03,	8.19E+02,	3.12E+02,	1.34E+02,	7.72E+01,
2003 ,	4.92E+03,	5.54E+03,	3.01E+03,	3.41E+03,	4.77E+03,	8.45E+02,	5.04E+02,	1.92E+02,	6.99E+01,
2004 ,	5.83E+03,	4.45E+03,	4.90E+03,	2.06E+03,	2.00E+03,	2.54E+03,	3.82E+02,	2.44E+02,	9.72E+01,
2005 ,	4.68E+03,	5.28E+03,	3.62E+03,	2.79E+03,	1.11E+03,	1.06E+03,	1.62E+03,	2.37E+02,	1.63E+02,
2006 ,	3.89E+03,	4.24E+03,	4.52E+03,	2.46E+03,	1.73E+03,	5.58E+02,	5.78E+02,	1.13E+03,	1.69E+02,

Estimated population abundance at 1st Jan 2007

,	0.00E+00,	3.52E+03,	3.18E+03,	2.82E+03,	1.55E+03,	1.02E+03,	3.50E+02,	3.82E+02,	8.54E+02,

Taper weighted geometric mean of the VPA populations:

,	4.88E+03,	4.46E+03,	3.61E+03,	2.38E+03,	1.42E+03,	8.41E+02,	5.15E+02,	3.25E+02,	2.00E+02,

Standard error of the weighted Log(VPA populations) :

,	.3331,	.3316,	.3386,	.3596,	.4202,	.4923,	.6028,	.7973,	.9595,

Table 4.3.9 continued

Log catchability residuals.

Fleet : BEL-BEAM

Age	1971	1972	1973	1974	1975	1976
1	No data for this fleet at this age					
2	.22	.13	.54	.11	-.16	.54
3	-.49	.17	.37	-.11	-.34	.39
4	.26	-.17	.12	-.06	-.31	-.02
5	.31	.14	.19	.14	.00	.25
6	.13	.30	-.09	.50	.27	-.18
7	.49	-.02	-.30	.12	.37	.15
8	.31	.21	-.42	-.01	-.45	.57
9	.02	-.10	-.18	.15	-.09	.07

Age	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
1	No data for this fleet at this age									
2	.21	.37	.40	1.18	.54	.21	.44	.16	-1.67	-.10
3	.14	.07	.08	.05	.21	.11	-.03	-.20	-.06	.00
4	-.02	.06	.41	.26	-.10	-.16	-.26	-.35	-.13	-.10
5	-.08	-.46	.13	.20	-.14	.05	-.24	.01	.11	-.04
6	.08	-.21	.05	-.05	.20	.20	-.18	-.11	.06	.10
7	.18	-.39	.62	-.88	.16	.40	.13	.21	-.07	.05
8	-.01	-.17	.30	-.16	-.14	.36	.50	-.08	.19	-.27
9	-.27	-.22	.02	-.01	.09	.42	-.21	-.29	-.05	-.07

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1	No data for this fleet at this age									
2	.41	.05	-.31	.08	1.60	.79	.41	-.17	-1.12	-.78
3	-.17	-.55	-.49	.17	.40	.42	.28	-.21	.09	.24
4	.00	-.20	-.15	.12	.07	.30	-.04	.23	.41	.18
5	.00	-.05	-.10	-.04	.00	.24	-.20	.19	.04	.04
6	.38	-.02	.10	.23	-.34	.02	-.34	.34	-.02	.03
7	.68	.02	.19	.21	-.44	-.84	.23	-.08	.07	-.31
8	-.13	.58	.18	.26	-.38	-.94	.47	-.72	-.01	-.30
9	.16	.04	-.28	-.12	-.36	-.41	.35	.05	-.24	-.30

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	No data for this fleet at this age									
2	-.44	-.91	.02	.28	.15	99.99	-3.18	99.99	99.99	99.99
3	.06	-.01	.20	-.04	-.68	.13	-.20	99.99	99.99	99.99
4	-.08	.44	.10	-.55	-.17	-.16	.07	99.99	99.99	99.99
5	.01	-.07	.04	-.91	-.29	.40	.13	99.99	99.99	99.99
6	.20	-.09	-.47	-1.61	.09	-.18	.60	99.99	99.99	99.99
7	.21	.66	-.45	-1.27	-.41	-.20	.49	99.99	99.99	99.99
8	-.23	.16	-.63	-.82	-.73	-.01	.27	99.99	99.99	99.99
9	.02	-.36	-.07	-.58	-.37	.01	.28	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	8	9
Mean Log q	-6.3633	-5.0941	-4.8760	-4.9070	-4.9703	-5.0536	-5.0536	-5.0536
S.E(Log q)	.8520	.2798	.2294	.2415	.3741	.4487	.4171	.2441

Table 4.3.9 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,	.88,	.317,	6.62,	.18,	32,	.76,	-6.36,
3,	1.03,	-.219,	4.99,	.59,	33,	.29,	-5.09,
4,	1.04,	-.347,	4.76,	.71,	33,	.24,	-4.88,
5,	.83,	2.174,	5.30,	.84,	33,	.19,	-4.91,
6,	.76,	2.367,	5.38,	.76,	33,	.27,	-4.97,
7,	.81,	1.754,	5.27,	.74,	33,	.35,	-5.05,
8,	.90,	1.255,	5.19,	.83,	33,	.37,	-5.12,
9,	.93,	1.914,	5.15,	.96,	33,	.20,	-5.14,

1

Fleet : UK-CSBT

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	.45	.20	-1.08	.33	.20	.50
3	99.99	99.99	99.99	99.99	.11	.38	-.08	-.18	-.04	.26
4	99.99	99.99	99.99	99.99	.58	.16	.06	-.42	-.30	.34
5	99.99	99.99	99.99	99.99	.55	.07	-.08	-.20	-.22	.01
6	99.99	99.99	99.99	99.99	.41	.17	-.22	-.38	.19	-.01
7	99.99	99.99	99.99	99.99	.38	-.04	.08	-.19	-.18	.03
8	99.99	99.99	99.99	99.99	.43	-.19	-.32	-.05	.44	-.10
9	99.99	99.99	99.99	99.99	.56	.29	.39	.46	.77	.30

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
1	No data for this fleet at this age									
2	-.56	-.71	-.01	-.02	.04	-.28	-.36	.18	.49	.63
3	-.27	-.07	.30	-.11	-.42	-.01	.05	-.22	.00	.31
4	.12	-.09	-.09	-.02	-.59	-.04	-.04	-.27	.18	.41
5	.05	.22	-.08	-.23	-.38	-.21	.04	-.05	.00	.51
6	.24	.14	.17	-.38	-.31	-.15	.08	-.11	-.10	.25
7	.08	-.16	.06	.06	-.36	-.06	-.04	.07	-.05	.32
8	.31	.01	.30	.26	.07	.41	-.01	.26	-.18	.16
9	.16	.19	-.15	.60	.37	.77	-.14	.66	.16	.46

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,	-9.0139,	-6.9705,	-6.3724,	-6.0027,	-5.8077,	-5.7396,	-5.7396,	-5.7396,
S.E(Log q),	.4840,	.2272,	.3063,	.2535,	.2420,	.1837,	.2689,	.4698,

Table 4.3.9 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,	.95,	.147,	8.99,	.41,	16,	.48,	-9.01,
3,	1.13,	-.697,	6.80,	.68,	16,	.26,	-6.97,
4,	1.06,	-.277,	6.29,	.61,	16,	.33,	-6.37,
5,	.98,	.125,	6.02,	.79,	16,	.26,	-6.00,
6,	1.06,	-.444,	5.77,	.80,	16,	.26,	-5.81,
7,	.92,	.973,	5.75,	.92,	16,	.17,	-5.74,
8,	1.03,	-.286,	5.64,	.85,	16,	.26,	-5.63,
9,	.93,	.397,	5.32,	.72,	16,	.27,	-5.37,

1

Fleet : UK-BCCSBTS-S

Age ,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996
1 ,	99.99,	-1.34,	-.15,	-.43,	-.18,	.25,	-.63,	.40,	-.60,	-.60
2 ,	99.99,	-.07,	.21,	.31,	.07,	.03,	.22,	.25,	.03,	-.03
3 ,	99.99,	.20,	.96,	.01,	.37,	.45,	-.17,	.68,	.03,	.33
4 ,	99.99,	-.26,	.42,	-.20,	.04,	.66,	-.31,	.25,	-.17,	.56
5 ,	99.99,	-.35,	.20,	-.27,	.47,	.80,	-1.25,	-.43,	-.02,	-.26
6 ,	99.99,	99.99,	.25,	-.06,	.04,	.39,	-1.42,	.33,	.36,	-.57
7 ,	99.99,	99.99,	.21,	.29,	99.99,	-.99,	-.64,	99.99,	.20,	-.21
8 ,	99.99,	99.99,	.37,	99.99,	.74,	-.41,	-.42,	99.99,	.25,	.61
9 ,	99.99,	99.99,	1.44,	99.99,	.61,	.17,	-.45,	1.52,	.86,	1.19

Age ,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006
1 ,	.03,	.57,	.87,	.49,	.27,	.31,	.06,	.63,	.04,	.00
2 ,	-.34,	.17,	-.46,	-.08,	.19,	-.15,	.23,	.23,	-.50,	-.30
3 ,	-.68,	.04,	-.61,	-.92,	.28,	.28,	-.20,	.20,	-.65,	-.58
4 ,	.06,	-.22,	.01,	.24,	-.13,	.35,	-.06,	-.09,	-.59,	-.56
5 ,	.92,	.95,	.25,	-.67,	-.30,	.05,	.37,	.41,	-.21,	-.66
6 ,	.22,	.65,	.06,	99.99,	.15,	-.25,	.22,	.44,	-.80,	99.99
7 ,	.70,	.48,	1.14,	.10,	-.07,	-.39,	-.26,	.20,	-.05,	-.72
8 ,	.93,	.15,	1.06,	.04,	99.99,	1.28,	.67,	-.11,	-.98,	-.11
9 ,	99.99,	1.47,	99.99,	1.18,	1.26,	99.99,	1.21,	99.99,	.14,	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,	-7.2002,	-7.1330,	-8.3778,	-8.9655,	-9.0842,	-8.8491,	-9.0002,	-9.0002,	-9.0002,
S.E(Log q),	.5420,	.2505,	.5056,	.3447,	.5804,	.5322,	.5436,	.6839,	1.1176,

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,	.60,	2.064,	7.73,	.61,	19,	.30,	-7.20,
2,	1.07,	-.370,	7.05,	.65,	19,	.27,	-7.13,
3,	.88,	.392,	8.36,	.39,	19,	.46,	-8.38,
4,	1.16,	-.629,	9.15,	.48,	19,	.41,	-8.97,
5,	1.04,	-.124,	9.16,	.37,	19,	.62,	-9.08,
6,	.98,	.077,	8.80,	.46,	16,	.54,	-8.85,
7,	1.43,	-1.172,	10.35,	.34,	16,	.77,	-9.00,
8,	1.60,	-1.401,	10.81,	.29,	15,	.97,	-8.73,
9,	6.01,	-2.211,	25.90,	.02,	12,	3.26,	-8.12,

Table 4.3.9 continued

```
  Terminal year survivor and F summaries :

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

  Year class = 2005

  Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,
 Estimated
      ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
  BEL-BEAM            ,          1.,   .000,       .000,    .00,   0,  .000,     .000
  UK-CSBT             ,          1.,   .000,       .000,    .00,   0,  .000,     .000
  UK-BCCSBTS-S        ,       3518.,   .556,       .000,    .00,   1, 1.000,     .000

    F shrinkage mean  ,          0.,   1.50,,,,                         .000,     .000

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      3518.,       .56,      .00,    1,    .000,   .000


1
 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
 BEL-BEAM            ,          1.,   .000,       .000,    .00,   0,  .000,     .000
 UK-CSBT             ,       6006.,   .499,       .000,    .00,   1,  .213,     .103
 UK-BCCSBTS-S        ,       2553.,   .264,       .142,    .54,   2,  .759,     .227

   F shrinkage mean  ,     10105.,   1.50,,,,                        .028,     .062

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      3184.,       .23,      .24,    4,   1.053,   .186


 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
 BEL-BEAM            ,          1.,   .000,       .000,    .00,   0,  .000,     .000
 UK-CSBT             ,       4045.,   .257,       .078,    .30,   2,  .454,     .272
 UK-BCCSBTS-S        ,       2055.,   .235,       .311,   1.32,   3,  .526,     .480

   F shrinkage mean  ,      3385.,   1.50,,,,                        .020,     .318

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      2822.,       .17,      .21,    6,   1.206,   .370
```

Table 4.3.9 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
BEL-BEAM ,	1.,	.000,	.000,	.00,	0,	.000,	.000
UK-CSBT ,	1924.,	.202,	.136,	.67,	3,	.500,	.303
UK-BCCSBTS-S ,	1248.,	.199,	.225,	1.13,	4,	.485,	.435
F shrinkage mean ,	1300.,	1.50,,,,				.015,	.421

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
1550.,	.14,	.14,	8,	.994,	.364

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
BEL-BEAM ,	42.,	.865,	.000,	.00,	1,	.014,	2.634
UK-CSBT ,	1263.,	.176,	.184,	1.05,	4,	.587,	.360
UK-BCCSBTS-S ,	828.,	.196,	.214,	1.09,	5,	.383,	.508
F shrinkage mean ,	790.,	1.50,,,,				.016,	.527

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
1018.,	.13,	.18,	11,	1.349,	.431

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
BEL-BEAM ,	286.,	.300,	.000,	.00,	1,	.076,	.433
UK-CSBT ,	376.,	.167,	.097,	.58,	5,	.668,	.345
UK-BCCSBTS-S ,	314.,	.194,	.065,	.33,	5,	.238,	.402
F shrinkage mean ,	239.,	1.50,,,,				.018,	.500

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
350.,	.13,	.06,	12,	.486,	.367

Table 4.3.9 continued

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

 Year class = 1999

 Fleet,                  Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                   Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 BEL-BEAM            ,        422.,   .209,       .020,    .10,   3,  .107,     .288
 UK-CSBT             ,        422.,   .158,       .086,    .54,   6,  .625,     .288
 UK-BCCSBTS-S        ,        291.,   .221,       .199,    .90,   7,  .253,     .395

   F shrinkage mean  ,        281.,   1.50,,,,                        .014,     .406

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       382.,       .12,      .08,   17,    .707,   .314


1
 Age  8   Catchability constant w.r.t. time and age (fixed at the value for age)  7

 Year class = 1998

 Fleet,                  Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                   Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 BEL-BEAM            ,        735.,   .175,       .188,   1.07,   4,  .150,     .207
 UK-CSBT             ,        851.,   .141,       .060,    .42,   7,  .624,     .181
 UK-BCCSBTS-S        ,       1000.,   .207,       .102,    .49,   8,  .216,     .156

   F shrinkage mean  ,        331.,   1.50,,,,                        .010,     .413

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       854.,       .10,      .06,   20,    .556,   .181


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

 Year class = 1997

 Fleet,                  Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                   Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 BEL-BEAM            ,        148.,   .175,       .154,    .88,   5,  .145,     .249
 UK-CSBT             ,        111.,   .154,       .096,    .63,   8,  .669,     .320
 UK-BCCSBTS-S        ,         88.,   .247,       .193,    .78,   8,  .171,     .388

   F shrinkage mean  ,        106.,   1.50,,,,                        .016,     .332

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
       111.,       .12,      .08,   22,    .656,   .320
```

Table 4.3.10 Sole in VIIf,g Fishing mortality at age

Run title : CELTIC SEA SOLE.2007 WG.COMBSEX.PLUSGROUP

At 12/06/2007 15:24

Table 8 Fishing mortality (F) at age

YEAR,	1971,	1972,	1973,	1974,	1975,	1976,
AGE						
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0829,	.0680,	.1046,	.0549,	.0417,	.1304,
3,	.1461,	.2525,	.3152,	.1586,	.1226,	.3996,
4,	.3820,	.2259,	.3055,	.2080,	.1575,	.3303,
5,	.3921,	.2968,	.3176,	.2446,	.2094,	.4198,
6,	.3072,	.3276,	.2240,	.3328,	.2569,	.2556,
7,	.4045,	.2175,	.1683,	.2087,	.2610,	.3257,
8,	.3389,	.2719,	.1493,	.1805,	.1159,	.4983,
9,	.2521,	.2027,	.1895,	.1940,	.1637,	.3044,
+gp,	.2521,	.2027,	.1895,	.1940,	.1637,	.3044,
0 FBAR 4- 8,	.3649,	.2679,	.2330,	.2349,	.2001,	.3659,

Table 8 Fishing mortality (F) at age

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0730,	.0833,	.0720,	.2438,	.1468,	.0854,	.1673,	.1224,	.0497,	.1074,
3,	.2436,	.2200,	.1851,	.2805,	.3761,	.2759,	.3719,	.3054,	.3789,	.4663,
4,	.2578,	.2691,	.3203,	.4331,	.3448,	.2626,	.3683,	.3284,	.4423,	.5199,
5,	.2349,	.1548,	.2349,	.3949,	.3186,	.3123,	.3639,	.4555,	.5117,	.5485,
6,	.2617,	.1884,	.2046,	.2920,	.4238,	.3439,	.3607,	.3773,	.4280,	.6309,
7,	.2648,	.1440,	.3339,	.1065,	.3745,	.3861,	.4533,	.4796,	.3220,	.4861,
8,	.2177,	.1794,	.2413,	.2401,	.2748,	.3680,	.6598,	.3546,	.4212,	.4546,
9,	.1656,	.1732,	.1836,	.2787,	.3477,	.3906,	.3256,	.2914,	.3915,	.5549,
+gp,	.1656,	.1732,	.1836,	.2787,	.3477,	.3906,	.3256,	.2914,	.3915,	.5549,
0 FBAR 4- 8,	.2474,	.1871,	.2670,	.2933,	.3473,	.3346,	.4412,	.3991,	.4251,	.5280,

Table 8 Fishing mortality (F) at age

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.1249,	.1129,	.1325,	.0904,	.2197,	.1277,	.0969,	.0807,	.0450,	.0640,
3,	.2781,	.2415,	.3456,	.3931,	.3016,	.3808,	.3568,	.2891,	.4522,	.5249,
4,	.5171,	.3937,	.4961,	.6179,	.4343,	.4512,	.4043,	.5205,	.7233,	.6815,
5,	.4631,	.5347,	.4727,	.6372,	.5084,	.4678,	.3928,	.5639,	.5603,	.6031,
6,	.5431,	.5738,	.5445,	.6657,	.4664,	.4677,	.3564,	.6038,	.6310,	.6026,
7,	.8130,	.4634,	.5380,	.6268,	.4476,	.3083,	.5437,	.4765,	.5632,	.4884,
8,	.4438,	.7500,	.5459,	.6572,	.4844,	.2691,	.5314,	.3891,	.7076,	.4435,
9,	.5906,	.5339,	.4778,	.6720,	.5291,	.4317,	.6541,	.7272,	.7458,	.5738,
+gp,	.5906,	.5339,	.4778,	.6720,	.5291,	.4317,	.6541,	.7272,	.7458,	.5738,
0 FBAR 4- 8,	.5561,	.5431,	.5194,	.6410,	.4682,	.3928,	.4457,	.5108,	.6371,	.5638,

Table 8 Fishing mortality (F) at age

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,	FBAR 04-06
AGE											
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0733,	.0430,	.1198,	.1462,	.1189,	.0091,	.0229,	.1058,	.0555,	.1862,	.1158,
3,	.4579,	.3850,	.5508,	.4193,	.2156,	.3430,	.2786,	.4614,	.2852,	.3704,	.3723,
4,	.5825,	.7383,	.6243,	.3898,	.4072,	.3643,	.4309,	.5166,	.3785,	.3638,	.4196,
5,	.6495,	.5677,	.6352,	.3242,	.4099,	.5557,	.5280,	.5392,	.5913,	.4306,	.5204,
6,	.7846,	.5659,	.5219,	.2341,	.5532,	.3854,	.6936,	.3538,	.5040,	.3668,	.4082,
7,	.7069,	.8310,	.5000,	.3518,	.3794,	.3864,	.6261,	.3764,	.2567,	.3138,	.3157,
8,	.6101,	.6089,	.5293,	.4867,	.3924,	.5511,	.5780,	.2995,	.2392,	.1809,	.2398,
9,	.6676,	.4836,	.5411,	.6399,	.5429,	.6736,	.4962,	.4582,	.3061,	.3198,	.3614,
+gp,	.6676,	.4836,	.5411,	.6399,	.5429,	.6736,	.4962,	.4582,	.3061,	.3198,	
0 FBAR 4- 8,	.6667,	.6624,	.5622,	.3573,	.4284,	.4486,	.5713,	.4171,	.3939,	.3312,	

Table 4.3.11 Sole in VIIf,g Stock numbers at age

Run title : CELTIC SEA SOLE.2007 WG.COMBSEX.PLUSGROUP

At 12/06/2007 15:24

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

YEAR,	1971,	1972,	1973,	1974,	1975,	1976,
AGE						
1,	9566,	4257,	3373,	3389,	2964,	5184,
2,	5102,	8656,	3852,	3052,	3066,	2682,
3,	2088,	4249,	7317,	3139,	2614,	2661,
4,	4441,	1632,	2987,	4831,	2424,	2093,
5,	2026,	2742,	1178,	1991,	3550,	1874,
6,	1721,	1238,	1844,	776,	1411,	2605,
7,	1697,	1145,	807,	1334,	503,	987,
8,	2790,	1025,	834,	617,	979,	351,
9,	1774,	1799,	706,	650,	466,	789,
+gp,	5740,	4173,	3914,	3219,	2585,	1849,
TOTAL,	36944,	30917,	26813,	22998,	20564,	21075,

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

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	4625,	5483,	3529,	5124,	4854,	4879,	6778,	4693,	5636,	3146,
2,	4690,	4185,	4961,	3193,	4637,	4392,	4415,	6133,	4246,	5099,
3,	2130,	3945,	3484,	4177,	2264,	3623,	3649,	3379,	4910,	3656,
4,	1615,	1511,	2865,	2620,	2855,	1406,	2488,	2276,	2253,	3042,
5,	1361,	1129,	1044,	1882,	1537,	1830,	979,	1557,	1483,	1310,
6,	1114,	974,	875,	747,	1147,	1012,	1212,	615,	894,	804,
7,	1826,	776,	730,	645,	505,	679,	649,	764,	382,	527,
8,	645,	1268,	608,	473,	525,	314,	418,	373,	428,	250,
9,	193,	469,	959,	432,	336,	361,	197,	195,	237,	254,
+gp,	2510,	1148,	1057,	1517,	1356,	1056,	1207,	1136,	776,	806,
TOTAL,	20709,	20888,	20112,	20811,	20016,	19552,	21990,	21123,	21244,	18894,

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,	5726,	4483,	3724,	8587,	4195,	4452,	4423,	3404,	3316,	4030,
2,	2847,	5181,	4057,	3370,	7770,	3796,	4028,	4002,	3080,	3001,
3,	4144,	2273,	4188,	3215,	2786,	5644,	3023,	3308,	3341,	2664,
4,	2075,	2839,	1616,	2682,	1964,	1864,	3490,	1914,	2242,	1923,
5,	1636,	1119,	1733,	890,	1308,	1151,	1074,	2107,	1029,	984,
6,	685,	932,	593,	978,	426,	712,	652,	656,	1085,	532,
7,	387,	360,	475,	312,	455,	242,	404,	413,	325,	522,
8,	293,	155,	205,	251,	151,	263,	161,	212,	232,	167,
9,	144,	170,	66,	107,	118,	84,	182,	85,	130,	104,
+gp,	420,	678,	281,	276,	413,	266,	216,	295,	217,	254,
TOTAL,	18357,	18192,	16939,	20668,	19585,	18474,	17652,	16399,	14997,	14182,

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 71-04	AMST 71-04
AGE													
1,	5437,	6255,	14698,	7296,	3714,	6118,	4919,	5832,	4685,	3888,	0,	4913,	5238,
2,	3647,	4920,	5660,	13299,	6602,	3361,	5536,	4451,	5277,	4239,	3518,	4441,	4734,
3,	2547,	3066,	4264,	4543,	10396,	5304,	3013,	4896,	3623,	4517,	3184,	3581,	3821,
4,	1426,	1458,	1888,	2224,	2703,	7583,	3406,	2064,	2793,	2465,	2822,	2365,	2550,
5,	880,	721,	631,	915,	1363,	1628,	4766,	2003,	1114,	1731,	1550,	1424,	1571,
6,	487,	416,	370,	302,	599,	819,	845,	2544,	1057,	558,	1018,	845,	959,
7,	263,	201,	214,	198,	216,	312,	504,	382,	1616,	578,	350,	496,	592,
8,	290,	118,	79,	117,	126,	134,	192,	244,	237,	1131,	382,	316,	450,
9,	97,	143,	58,	42,	65,	77,	70,	97,	163,	169,	854,	202,	343,
+gp,	227,	237,	110,	113,	202,	109,	201,	140,	171,	195,	240,		
TOTAL,	15303,	17535,	27971,	29050,	25987,	25443,	23450,	22650,	20735,	19470,	13918,		

Table 4.3.12 Sole in VIIf,g Summary

Run title : CELTIC SEA SOLE.2007 WG.COMBSEX.PLUSGROUP

At 12/06/2007 15:24

Table 16 Summary (without SOP correction)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 4- 8,
1971,	9566,	9403,	7942,	1861,	.2343,	.3649,
1972,	4257,	7909,	6258,	1278,	.2042,	.2679,
1973,	3373,	6563,	5234,	1391,	.2657,	.2330,
1974,	3389,	6621,	5605,	1105,	.1971,	.2349,
1975,	2964,	5816,	4965,	919,	.1851,	.2001,
1976,	5184,	5332,	4307,	1350,	.3134,	.3659,
1977,	4625,	5871,	4610,	961,	.2084,	.2474,
1978,	5483,	5032,	3715,	780,	.2100,	.1871,
1979,	3529,	5050,	3842,	954,	.2483,	.2670,
1980,	5124,	5201,	3980,	1314,	.3301,	.2933,
1981,	4854,	4564,	3390,	1212,	.3575,	.3473,
1982,	4879,	4773,	3525,	1128,	.3200,	.3346,
1983,	6778,	5101,	3625,	1373,	.3787,	.4412,
1984,	4693,	5334,	3880,	1266,	.3263,	.3991,
1985,	5636,	4762,	3283,	1328,	.4045,	.4251,
1986,	3146,	4593,	3343,	1600,	.4786,	.5280,
1987,	5726,	3711,	2498,	1222,	.4892,	.5561,
1988,	4483,	3874,	2682,	1146,	.4273,	.5431,
1989,	3724,	3221,	2087,	992,	.4753,	.5194,
1990,	8587,	3848,	2372,	1189,	.5013,	.6410,
1991,	4195,	3567,	2096,	1107,	.5281,	.4682,
1992,	4452,	3821,	2412,	981,	.4067,	.3928,
1993,	4423,	3810,	2453,	928,	.3784,	.4457,
1994,	3404,	3238,	2231,	1009,	.4523,	.5108,
1995,	3316,	3066,	2136,	1157,	.5417,	.6371,
1996,	4030,	3042,	2065,	995,	.4818,	.5638,
1997,	5437,	2964,	1817,	927,	.5102,	.6667,
1998,	6255,	3026,	1601,	875,	.5464,	.6624,
1999,	14698,	4218,	1804,	1012,	.5611,	.5622,
2000,	7296,	3792,	1915,	1091,	.5698,	.3573,
2001,	3714,	5207,	3049,	1168,	.3831,	.4284,
2002,	6118,	5635,	3930,	1345,	.3422,	.4486,
2003,	4919,	5177,	3507,	1392,	.3970,	.5713,
2004,	5832,	4650,	3133,	1249,	.3987,	.4171,
2005,	4685,	4631,	3009,	1044,	.3470,	.3939,
2006,	3888,	3993,	2576,	946,	.3673,	.3312,
Arith. Mean ,	5185,	4734,	3358,	1155,	.3824,	.4237,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

Table 4.3.13 Sole in VIIf,g. Prediction input data

MFDP version 1a
Run: Sole7fg_SQ_Scaled
Time and date: 13:16 14-6-2007
Fbar age range: 4-8

Input : F mean 04-06 scaled to 2006 F
Catch and stock weights are mean 04-06
Recruits age 1 in 2007,08 and 09 GM(71-04)

2007

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
1	4913	0.1	0	0	0	0.090	0.000	0.073
2	3518	0.1	0.14	0	0	0.136	0.101	0.138
3	3184	0.1	0.45	0	0	0.192	0.324	0.202
4	2822	0.1	0.88	0	0	0.253	0.365	0.263
5	1550	0.1	0.98	0	0	0.317	0.453	0.323
6	1018	0.1	1	0	0	0.383	0.355	0.380
7	350	0.1	1	0	0	0.449	0.275	0.436
8	382	0.1	1	0	0	0.516	0.209	0.491
9	854	0.1	1	0	0	0.581	0.314	0.543
10	240	0.1	1	0	0	0.750	0.314	0.677

2008

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
1	4913	0.1	0	0	0	0.090	0.000	0.073
2	.	0.1	0.14	0	0	0.136	0.101	0.138
3	.	0.1	0.45	0	0	0.192	0.324	0.202
4	.	0.1	0.88	0	0	0.253	0.365	0.263
5	.	0.1	0.98	0	0	0.317	0.453	0.323
6	.	0.1	1	0	0	0.383	0.355	0.380
7	.	0.1	1	0	0	0.449	0.275	0.436
8	.	0.1	1	0	0	0.516	0.209	0.491
9	.	0.1	1	0	0	0.581	0.314	0.543
10	.	0.1	1	0	0	0.750	0.314	0.677

2009

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
1	4913	0.1	0	0	0	0.090	0.000	0.073
2	.	0.1	0.14	0	0	0.136	0.101	0.138
3	.	0.1	0.45	0	0	0.192	0.324	0.202
4	.	0.1	0.88	0	0	0.253	0.365	0.263
5	.	0.1	0.98	0	0	0.317	0.453	0.323
6	.	0.1	1	0	0	0.383	0.355	0.380
7	.	0.1	1	0	0	0.449	0.275	0.436
8	.	0.1	1	0	0	0.516	0.209	0.491
9	.	0.1	1	0	0	0.581	0.314	0.543
10	.	0.1	1	0	0	0.750	0.314	0.677

Input units are thousands and kg - output in tonnes

Table 4.3.14 Sole in VIIf,g. Management option table

MFDP version 1a
Run: Sole7fg_SQ_Scaled
CELTIC SEA SOLE.2007 WG.COMBSEX.PLUSGROUP - F scaled
Time and date: 13:16 14-6-2007
Fbar age range: 4-8

2007				
Biomass	SSB	FMult	FBar	Landings
4157	2871	1.0000	0.3312	944

2008					2009	
Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
4149	2808	0.0000	0.0000	0	5161	3682
.	2808	0.1000	0.0331	106	5039	3568
.	2808	0.2000	0.0662	208	4921	3457
.	2808	0.3000	0.0994	308	4807	3350
.	2808	0.4000	0.1325	403	4698	3247
.	2808	0.5000	0.1656	496	4591	3147
.	2808	0.6000	0.1987	586	4488	3051
.	2808	0.7000	0.2318	672	4389	2958
.	2808	0.8000	0.2649	756	4293	2869
.	2808	0.9000	0.2981	837	4200	2782
.	2808	1.0000	0.3312	916	4110	2698
.	2808	1.1000	0.3643	992	4023	2617
.	2808	1.2000	0.3974	1065	3939	2539
.	2808	1.3000	0.4305	1136	3858	2463
.	2808	1.4000	0.4637	1205	3779	2390
.	2808	1.5000	0.4968	1271	3703	2320
.	2808	1.6000	0.5299	1336	3630	2252
.	2808	1.7000	0.5630	1398	3558	2186
.	2808	1.8000	0.5961	1459	3490	2122
.	2808	1.9000	0.6292	1517	3423	2061
.	2808	2.0000	0.6624	1574	3358	2001

Input units are thousands and kg - output in tonnes

Fmult corresponding to Fpa = 1.12

.	2808	1.12	0.3709	1006	4006	2601

Bpa = 2 200 t

Table 4.3.15 Sole in VIIf,g. Detailed results

MFDP version 1a
Run: Sole7fg_SQ_Scaled
Time and date: 13:16 14-6-2007
Fbar age range: 4-8

Year:	2007	F multiplier:	1	Fbar:	0.3312				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	0	0	4913	442	0	0	0	0
2	0.1008	321	44	3518	478	493	67	493	67
3	0.3239	841	170	3184	612	1433	276	1433	276
4	0.3650	824	217	2822	713	2483	627	2483	627
5	0.4526	539	174	1550	491	1519	481	1519	481
6	0.3551	290	110	1018	390	1018	390	1018	390
7	0.2745	80	35	350	157	350	157	350	157
8	0.2086	69	34	382	197	382	197	382	197
9	0.3143	220	119	854	496	854	496	854	496
10	0.3143	62	42	240	180	240	180	240	180
Total		3245	944	18831	4157	8772	2871	8772	2871

Year:	2008	F multiplier:	1	Fbar:	0.3312				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	0	0	4913	442	0	0	0	0
2	0.1008	406	56	4445	605	622	85	622	85
3	0.3239	760	153	2878	554	1295	249	1295	249
4	0.3650	608	160	2084	527	1834	463	1834	463
5	0.4526	616	199	1773	561	1737	550	1737	550
6	0.3551	254	97	892	341	892	341	892	341
7	0.2745	148	64	646	290	646	290	646	290
8	0.2086	43	21	241	124	241	124	241	124
9	0.3143	72	39	281	163	281	163	281	163
10	0.3143	186	126	723	542	723	542	723	542
Total		3094	916	18875	4149	8270	2808	8270	2808

Year:	2009	F multiplier:	1	Fbar:	0.3312				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	0	0	4913	442	0	0	0	0
2	0.1008	406	56	4445	605	622	85	622	85
3	0.3239	960	194	3637	699	1637	315	1637	315
4	0.3650	550	145	1884	476	1658	419	1658	419
5	0.4526	455	147	1309	415	1283	406	1283	406
6	0.3551	291	111	1020	390	1020	390	1020	390
7	0.2745	130	56	566	254	566	254	566	254
8	0.2086	80	39	444	229	444	229	444	229
9	0.3143	45	25	177	103	177	103	177	103
10	0.3143	171	116	663	497	663	497	663	497
Total		3087	888	19058	4110	8069	2698	8069	2698

Input units are thousands and kg - output in tonnes

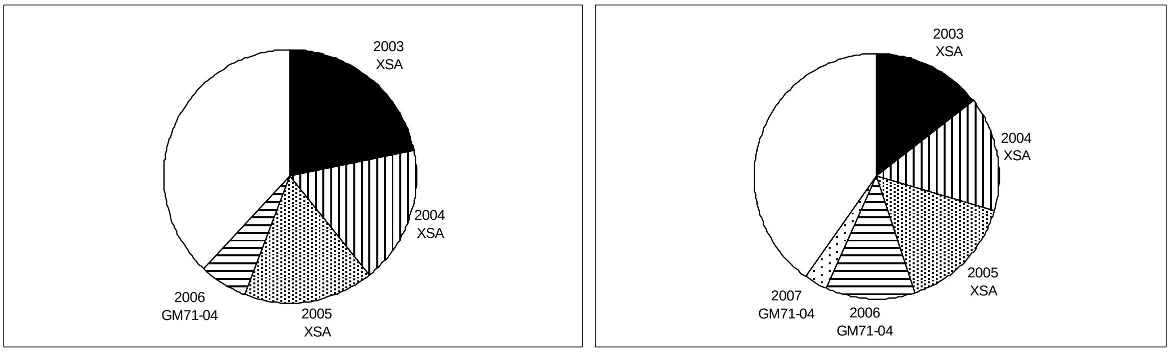
Table 4.3.16 **Sole VIIf,g**
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class			2003	2004	2005	2006	2007
Stock No. (thousands) of		1 year-olds	5832	4685	3888	4913	4913
Source			XSA	XSA	XSA	GM71-04	GM71-04
Status Quo F:							
% in	2007	landings	23.0	18.0	4.7	0.0	-
% in	2008	landings	21.7	17.5	16.7	6.1	0.0
% in	2007	SSB	21.8	9.6	2.3	0.0	-
% in	2008	SSB	19.6	16.5	8.9	3.0	0.0
% in	2009	SSB	14.5	15.0	15.5	11.7	3.2

GM : geometric mean recruitment

Sole VIIf,g : Year-class % contribution to

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



XSA	XSA	XSA	GM71-04	GM71-04
2003	2004	2005	2006	2007

Table 4.3.17 - Sole in VIIf,g Yield per recruit summary table

MFYPR version 2a
Run: Sole7fg_yield_Scaled
Time and date: 13:18 14-6-2007
Yield per results

FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0.0000	0.0000	0.0000	0.0000	10.5083	4.9705	8.1776	4.6614	8.1776	4.6614
0.1000	0.0331	0.2088	0.0946	8.4231	3.5329	6.1015	3.2258	6.1015	3.2258
0.2000	0.0662	0.3367	0.1415	7.1455	2.6859	4.8329	2.3810	4.8329	2.3810
0.3000	0.0994	0.4231	0.1661	6.2844	2.1385	3.9805	1.8355	3.9805	1.8355
0.4000	0.1325	0.4852	0.1790	5.6662	1.7621	3.3707	1.4611	3.3707	1.4611
0.5000	0.1656	0.5318	0.1855	5.2019	1.4916	2.9147	1.1924	2.9147	1.1924
0.6000	0.1987	0.5681	0.1884	4.8413	1.2906	2.5620	0.9931	2.5620	0.9931
0.7000	0.2318	0.5971	0.1892	4.5538	1.1370	2.2822	0.8414	2.2822	0.8414
0.8000	0.2649	0.6207	0.1887	4.3196	1.0172	2.0555	0.7233	2.0555	0.7233
0.9000	0.2981	0.6404	0.1875	4.1254	0.9220	1.8687	0.6297	1.8687	0.6297
1.0000	0.3312	0.6569	0.1858	3.9619	0.8451	1.7124	0.5543	1.7124	0.5543
1.1000	0.3643	0.6711	0.1840	3.8227	0.7821	1.5801	0.4929	1.5801	0.4929
1.2000	0.3974	0.6833	0.1822	3.7026	0.7298	1.4669	0.4421	1.4669	0.4421
1.3000	0.4305	0.6940	0.1803	3.5982	0.6860	1.3690	0.3998	1.3690	0.3998
1.4000	0.4637	0.7033	0.1784	3.5064	0.6489	1.2837	0.3640	1.2837	0.3640
1.5000	0.4968	0.7117	0.1767	3.4252	0.6171	1.2088	0.3336	1.2088	0.3336
1.6000	0.5299	0.7191	0.1750	3.3528	0.5897	1.1425	0.3075	1.1425	0.3075
1.7000	0.5630	0.7258	0.1733	3.2879	0.5658	1.0836	0.2850	1.0836	0.2850
1.8000	0.5961	0.7318	0.1718	3.2293	0.5449	1.0309	0.2654	1.0309	0.2654
1.9000	0.6292	0.7373	0.1703	3.1761	0.5265	0.9834	0.2482	0.9834	0.2482
2.0000	0.6624	0.7423	0.1690	3.1275	0.5101	0.9405	0.2330	0.9405	0.2330

Reference point	F multiplier	Absolute F
Fbar(4-8)	1.0000	0.3312
FMax	0.7013	0.2323
F0.1	0.3409	0.1129
F35%SPR	0.3501	0.116

Weights in kilograms

Table 4.3.18 Sole in VIIfg. Input data for catch forecast and linear sensitivity analysis

Label	Sens Value 2007	CV	Label	Value	CV
Number at age			Weight in the stock		
N1	4913	0.34	WS1	0.090	0.00
N2	3518	0.56	WS2	0.136	0.13
N3	3184	0.24	WS3	0.192	0.10
N4	2822	0.21	WS4	0.253	0.08
N5	1550	0.14	WS5	0.317	0.09
N6	1018	0.18	WS6	0.383	0.11
N7	350	0.13	WS7	0.449	0.13
N8	382	0.12	WS8	0.516	0.14
N9	854	0.10	WS9	0.581	0.15
N10	240	0.12	WS10	0.750	0.15
H.cons selectivity			Weight in the HC catch		
sH1	0.000	0.00	WH1	0.073	0.14
sH2	0.101	0.68	WH2	0.138	0.05
sH3	0.324	0.23	WH3	0.202	0.07
sH4	0.365	0.13	WH4	0.263	0.08
sH5	0.453	0.09	WH5	0.323	0.09
sH6	0.355	0.20	WH6	0.380	0.09
sH7	0.275	0.19	WH7	0.436	0.08
sH8	0.209	0.14	WH8	0.491	0.08
sH9	0.314	0.17	WH9	0.543	0.07
sH10	0.314	0.17	WH10	0.677	0.08
Natural mortality			Proportion mature		
M1	0.10	0.10	MT1	0.00	0.10
M2	0.10	0.10	MT2	0.14	0.10
M3	0.10	0.10	MT3	0.45	0.10
M4	0.10	0.10	MT4	0.88	0.10
M5	0.10	0.10	MT5	0.98	0.10
M6	0.10	0.10	MT6	1.00	0.10
M7	0.10	0.10	MT7	1.00	0.00
M8	0.10	0.10	MT8	1.00	0.00
M9	0.10	0.10	MT9	1.00	0.00
M10	0.10	0.10	MT10	1.00	0.00
Relative effort in HC fishery			Year effect for natural mortality		
HF07	1.00	0.20	K07	1.00	0.10
HF08	1.00	0.20	K08	1.00	0.10
HF09	1.00	0.20	K09	1.00	0.10
Recruitment in 2007 and 2008					
R07	4913	0.34			
R08	4913	0.34			

Proportion of F before spawning = .00
Proportion of M before spawning = .00

Stock numbers in 2007 are VPA survivors.

Table 4.3.18 Sole in VIIfg. Input data for catch forecast and linear sensitivity analysis

Label	Sens Value 2007	CV	Label	Value	CV
Number at age			Weight in the stock		
N1	4913	0.34	WS1	0.090	0.00
N2	3518	0.56	WS2	0.136	0.13
N3	3184	0.24	WS3	0.192	0.10
N4	2822	0.21	WS4	0.253	0.08
N5	1550	0.14	WS5	0.317	0.09
N6	1018	0.18	WS6	0.383	0.11
N7	350	0.13	WS7	0.449	0.13
N8	382	0.12	WS8	0.516	0.14
N9	854	0.10	WS9	0.581	0.15
N10	240	0.12	WS10	0.750	0.15
H.cons selectivity			Weight in the HC catch		
sH1	0.000	0.00	WH1	0.073	0.14
sH2	0.101	0.68	WH2	0.138	0.05
sH3	0.324	0.23	WH3	0.202	0.07
sH4	0.365	0.13	WH4	0.263	0.08
sH5	0.453	0.09	WH5	0.323	0.09
sH6	0.355	0.20	WH6	0.380	0.09
sH7	0.275	0.19	WH7	0.436	0.08
sH8	0.209	0.14	WH8	0.491	0.08
sH9	0.314	0.17	WH9	0.543	0.07
sH10	0.314	0.17	WH10	0.677	0.08
Natural mortality			Proportion mature		
M1	0.10	0.10	MT1	0.00	0.10
M2	0.10	0.10	MT2	0.14	0.10
M3	0.10	0.10	MT3	0.45	0.10
M4	0.10	0.10	MT4	0.88	0.10
M5	0.10	0.10	MT5	0.98	0.10
M6	0.10	0.10	MT6	1.00	0.10
M7	0.10	0.10	MT7	1.00	0.00
M8	0.10	0.10	MT8	1.00	0.00
M9	0.10	0.10	MT9	1.00	0.00
M10	0.10	0.10	MT10	1.00	0.00
Relative effort in HC fishery			Year effect for natural mortality		
HF07	1.00	0.20	K07	1.00	0.10
HF08	1.00	0.20	K08	1.00	0.10
HF09	1.00	0.20	K09	1.00	0.10
Recruitment in 2007 and 2008					
R07	4913	0.34			
R08	4913	0.34			

Proportion of F before spawning = .00
Proportion of M before spawning = .00

Stock numbers in 2007 are VPA survivors.

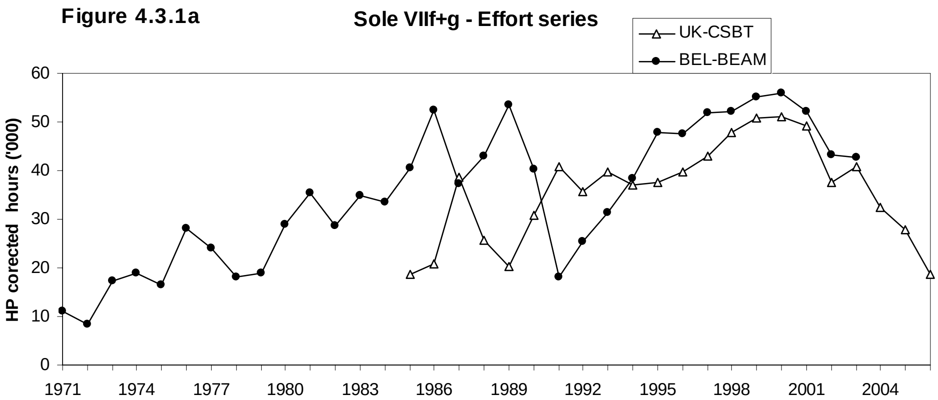


Figure 4.3.1a
Sole VIIf+g - Effort series
UK-CSBT
BEL-BEAM
HP corected hours ('000)
0
10
20
30
40
50
60
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004

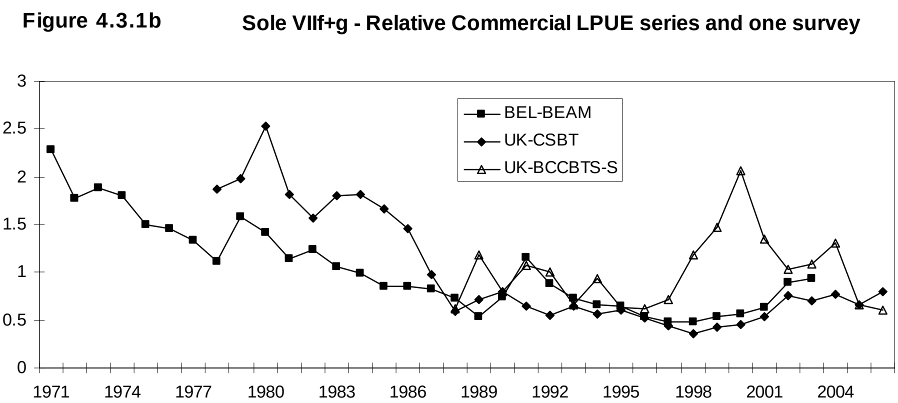


Figure 4.3.1b
Sole VIIf+g - Relative Commercial LPUE series and one survey
BEL-BEAM
UK-CSBT
UK-BCCBTS-S
0
0.5
1
1.5
2
2.5
3
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004

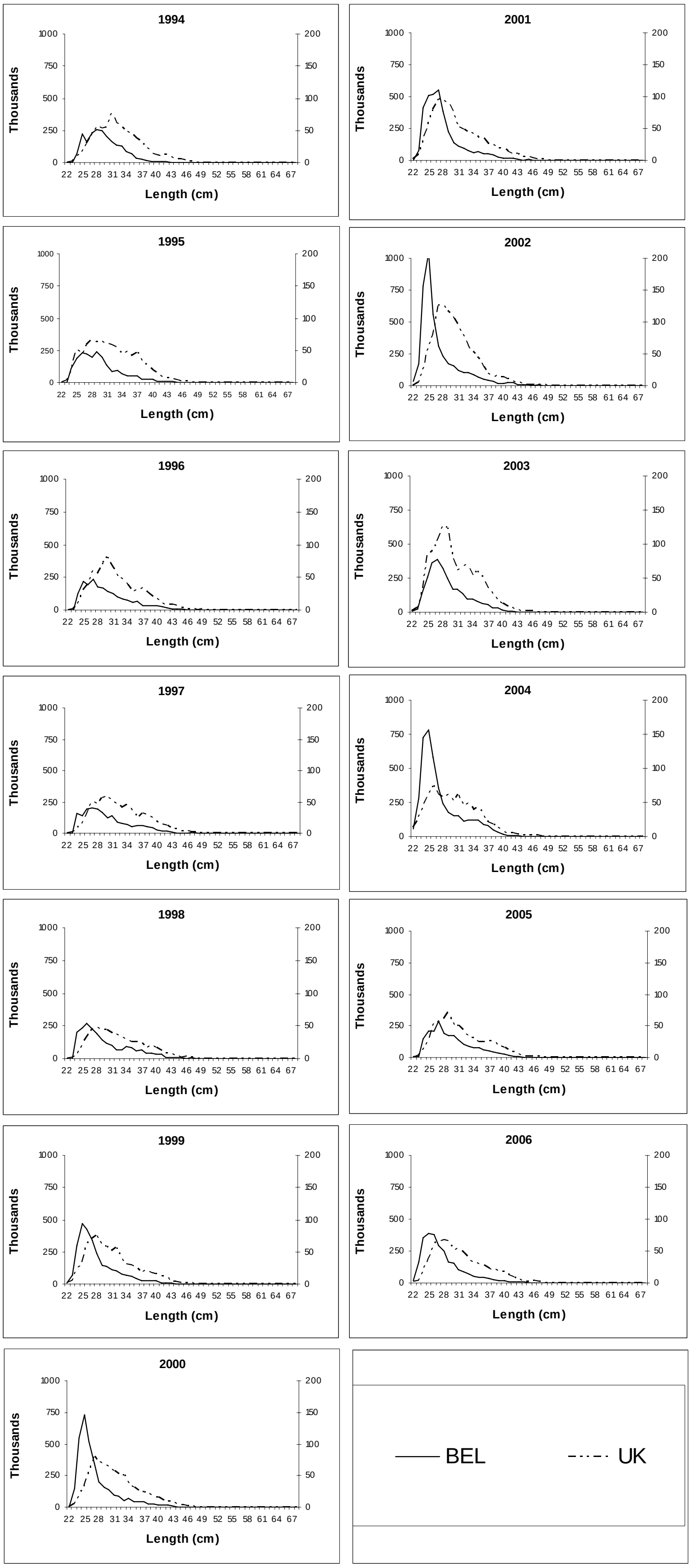
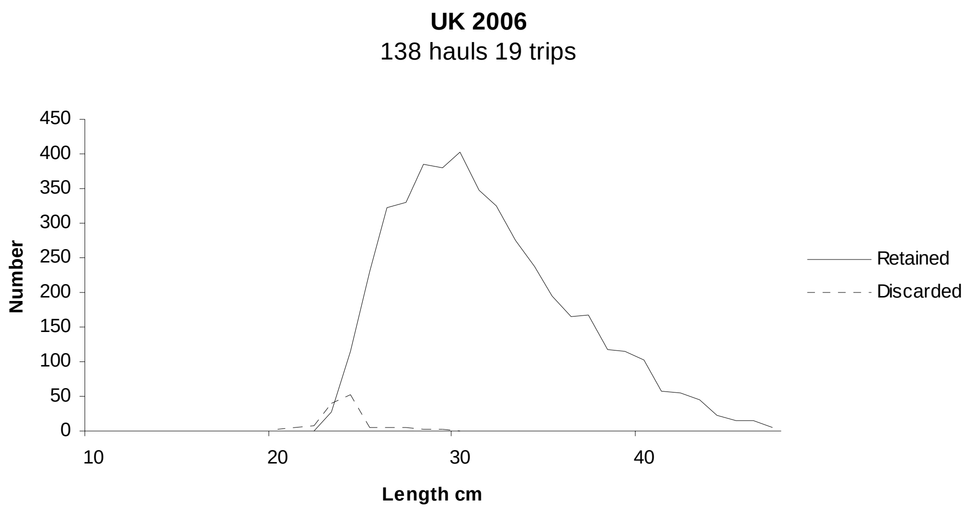
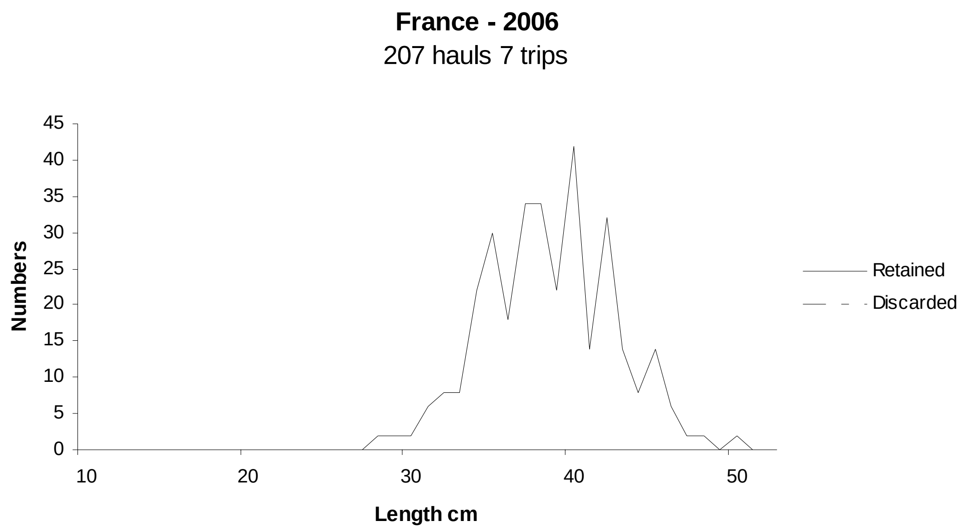


Figure 4.3.2a - Sole in VIIf,g
Length distributions of UK (England & Wales) and Belgian landings from 1994 to 2006





Note: No discards in French sampling trips

Figure 4.3.2b - Sole VIIfg - Length distributions of discarded and retained fish from discard sampling studies

Age Compositions of landings from 1995 to 2006

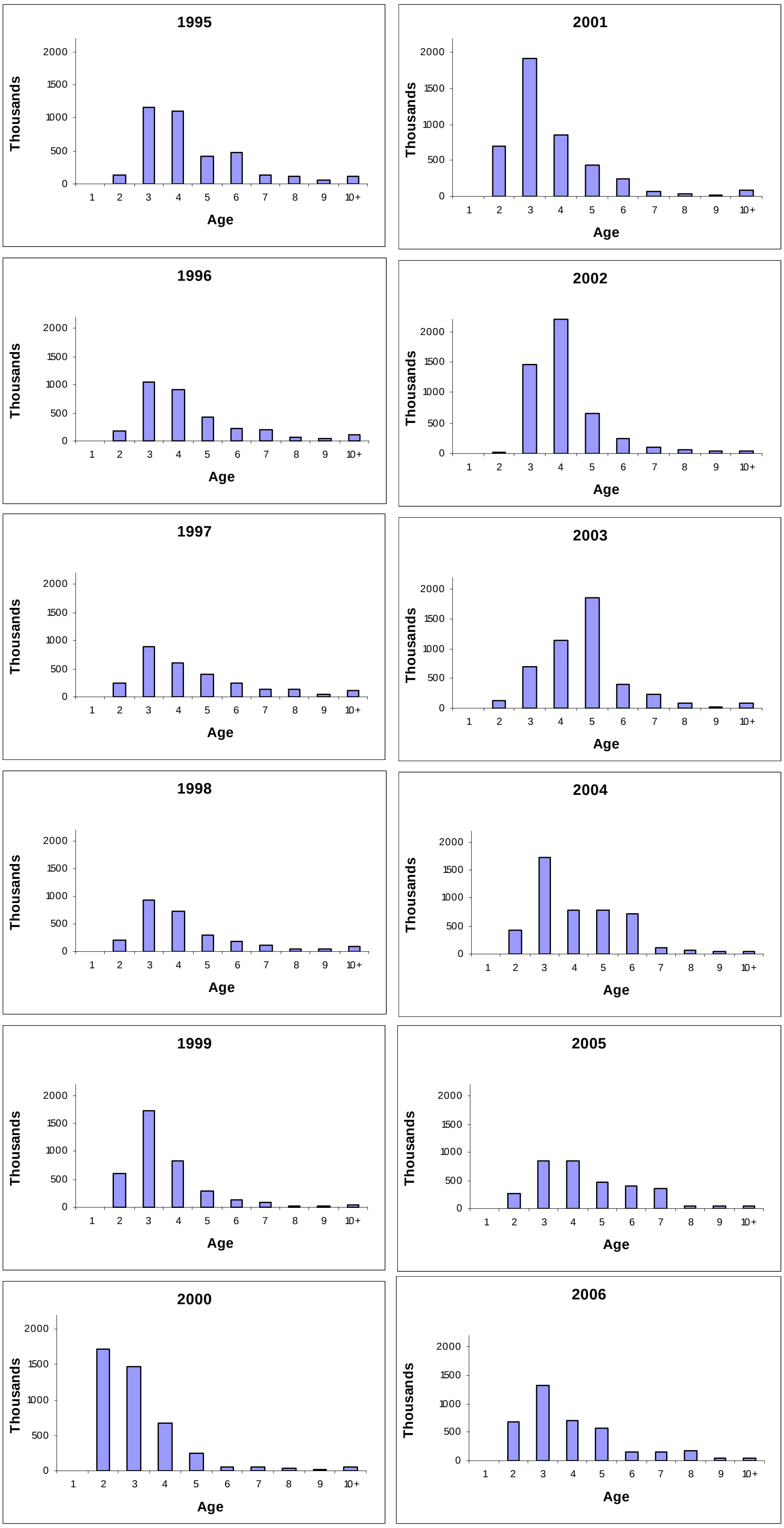


Figure 4.3.3 - Sole in Division VIIf+g

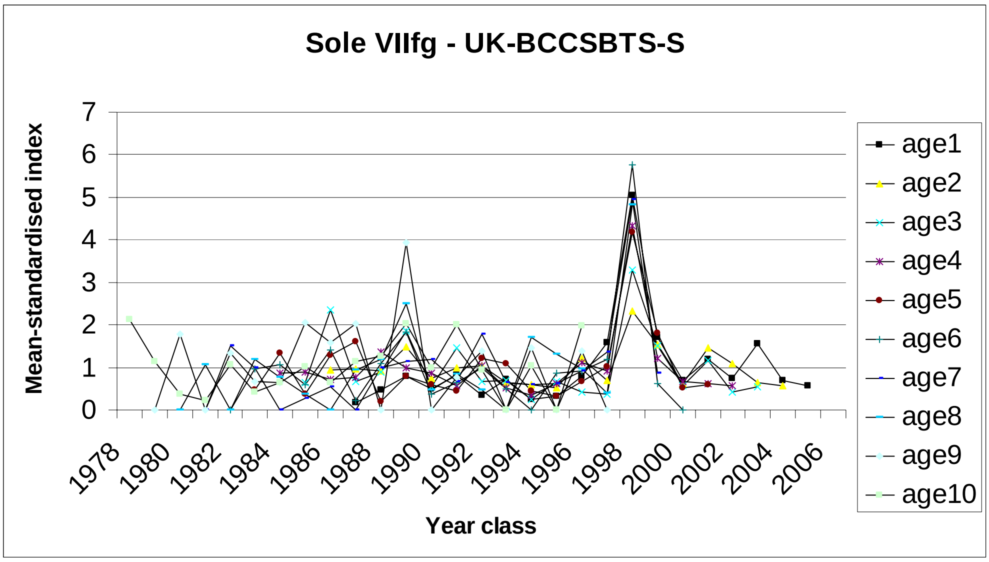


Figure 4.3.4a - Sole VIIfg - Mean-standardised index of UK(E&W) VIIfg Corystes survey (all ages)

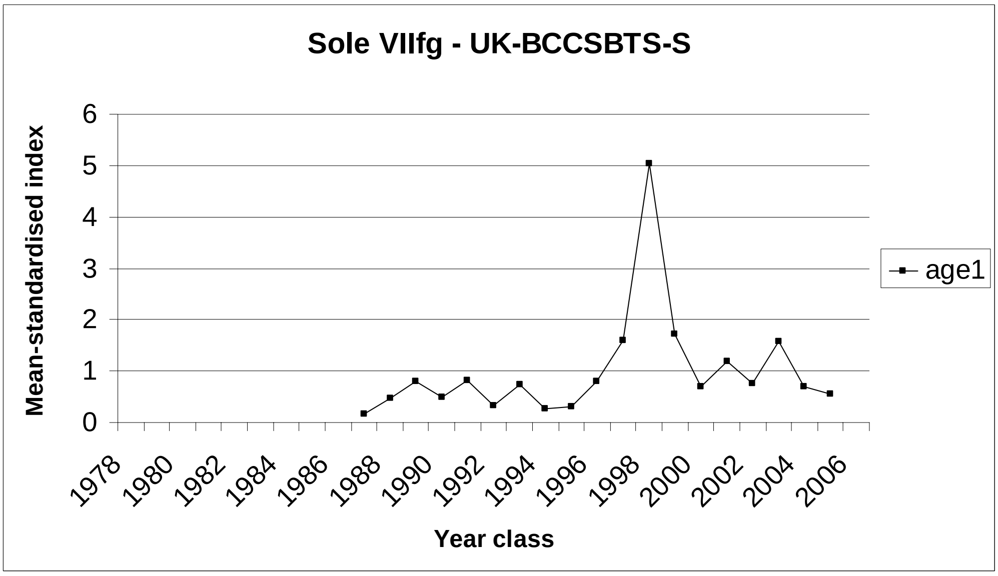


Figure 4.3.4b - Sole VIIfg - Mean-standardised index of UK(E&W) VIIfg Corystes survey (age 1)

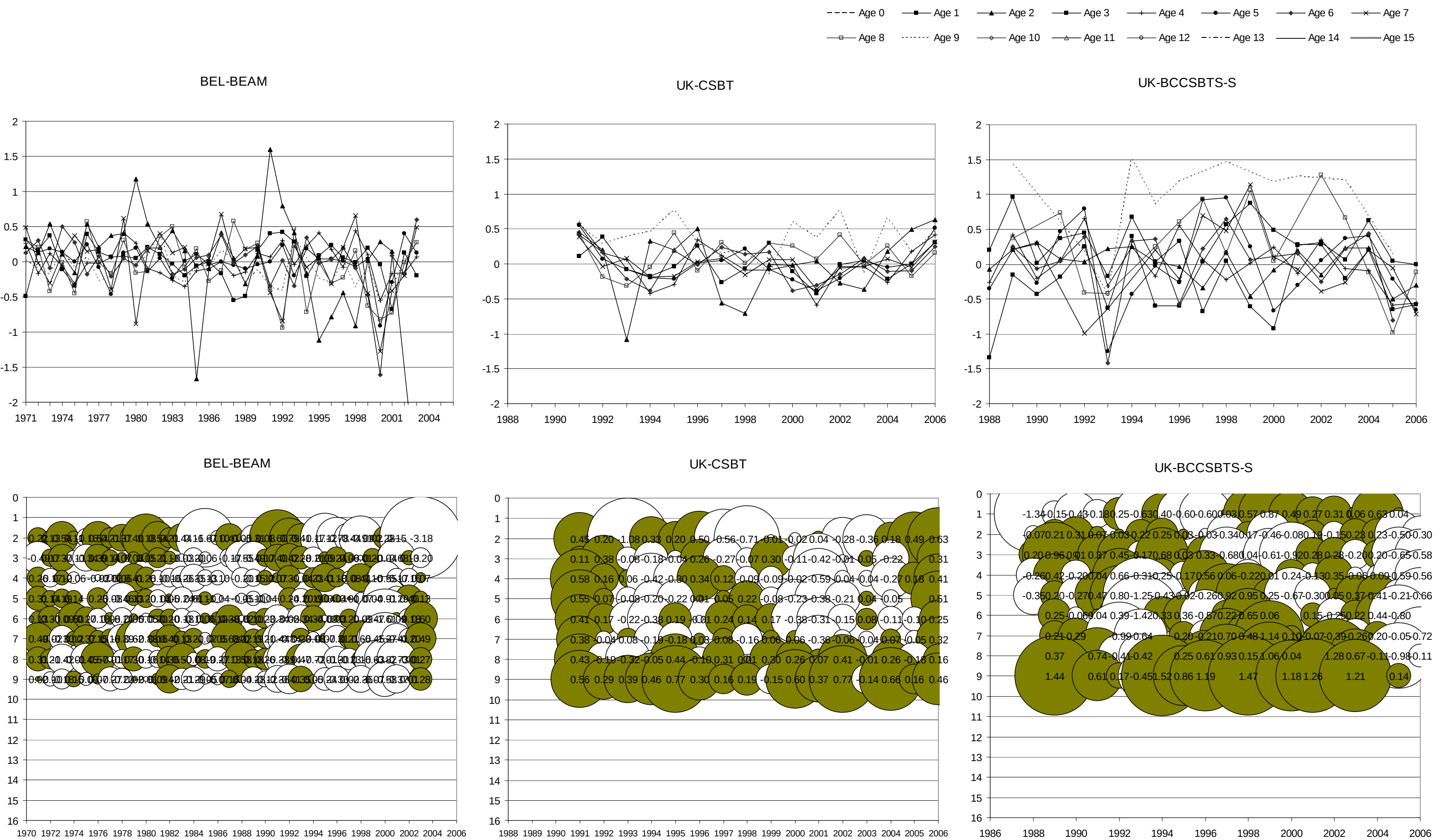


Figure 4.3.5 -VIIf&g SOLE LOG CATCHABILITY RESIDUAL PLOTS - Final XSA

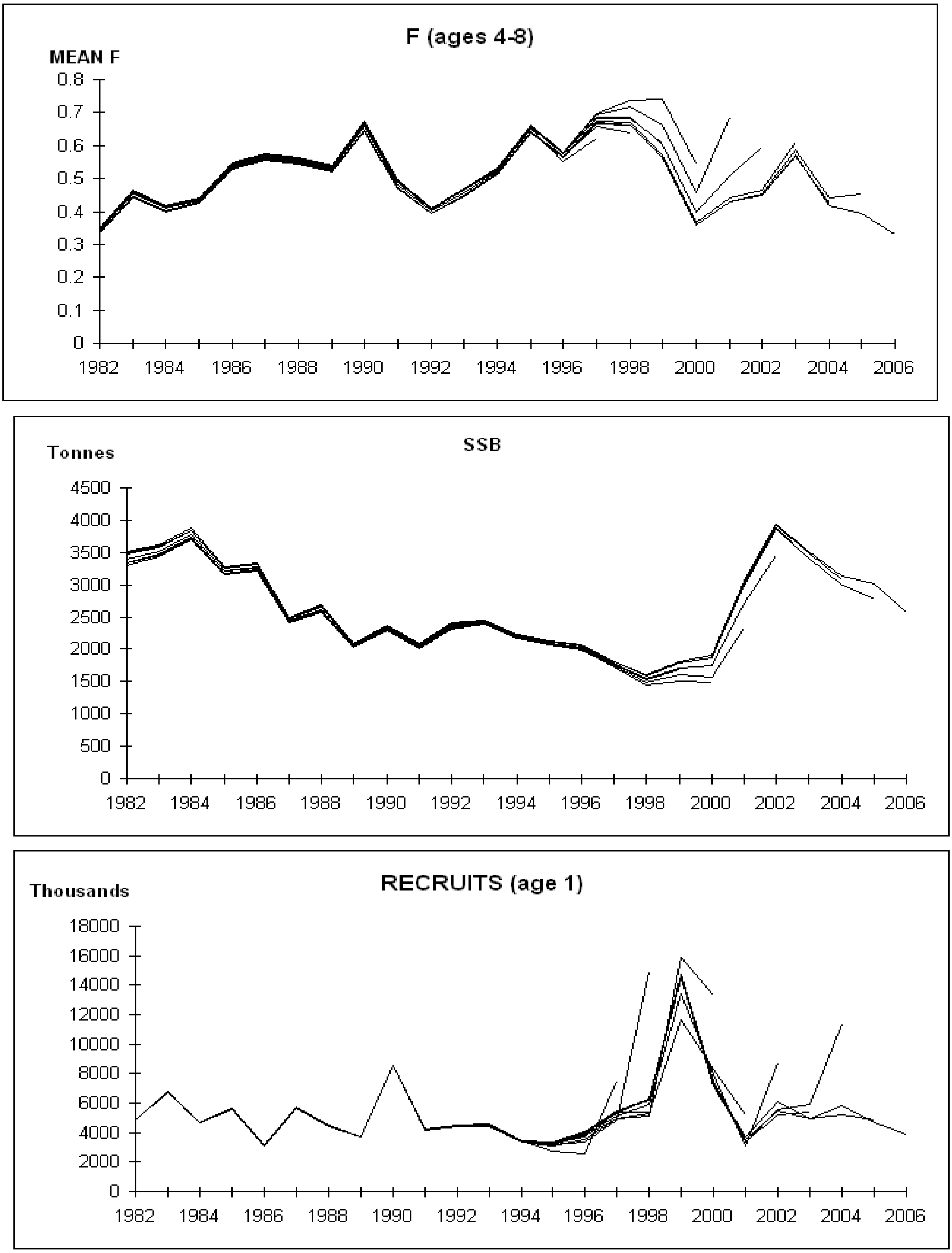


Figure 4.3.6 - Sole VIIf,g retrospective XSA analysys (shinkage SE=1.5)

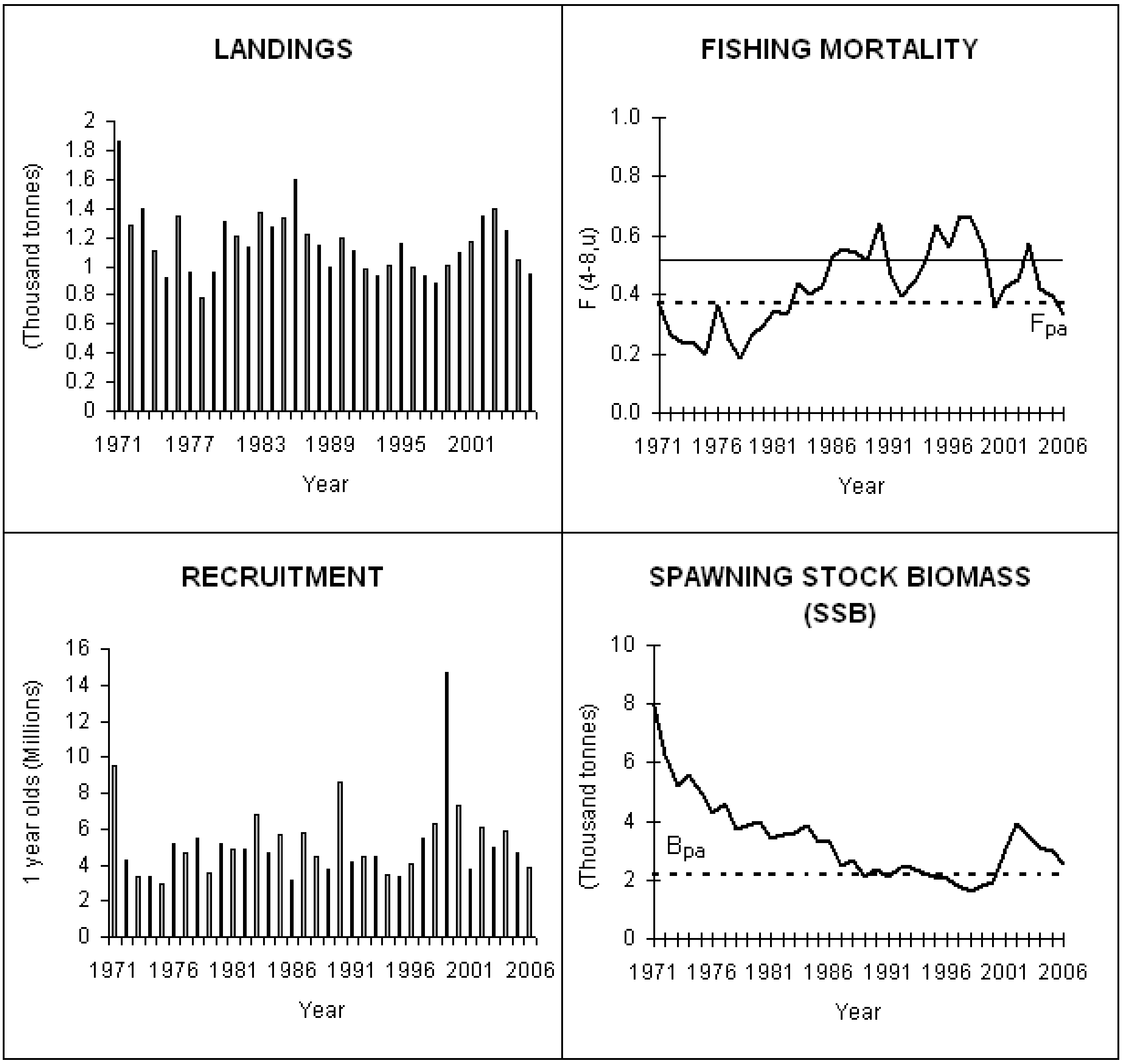
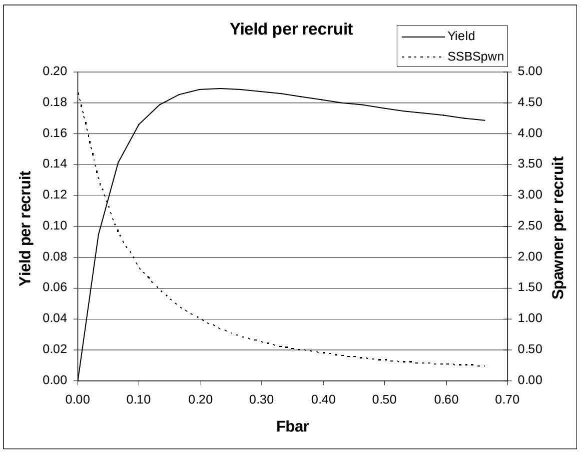
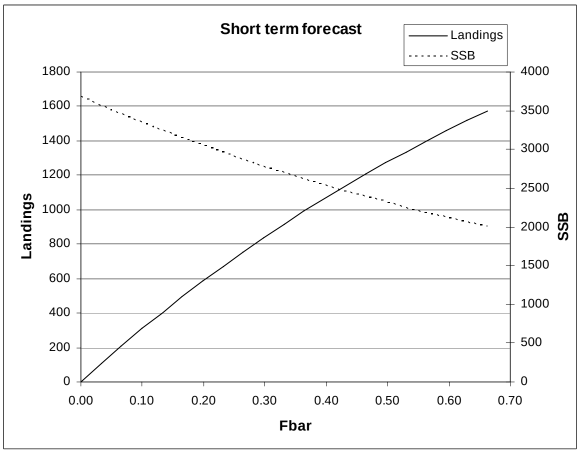


Figure 4.3.7 Sole in Division VIIf,g (Celtic Sea)





MFYPR version 2a
Run: Sole7fg_yield_Scaled
Time and date: 13:18 14-6-2007

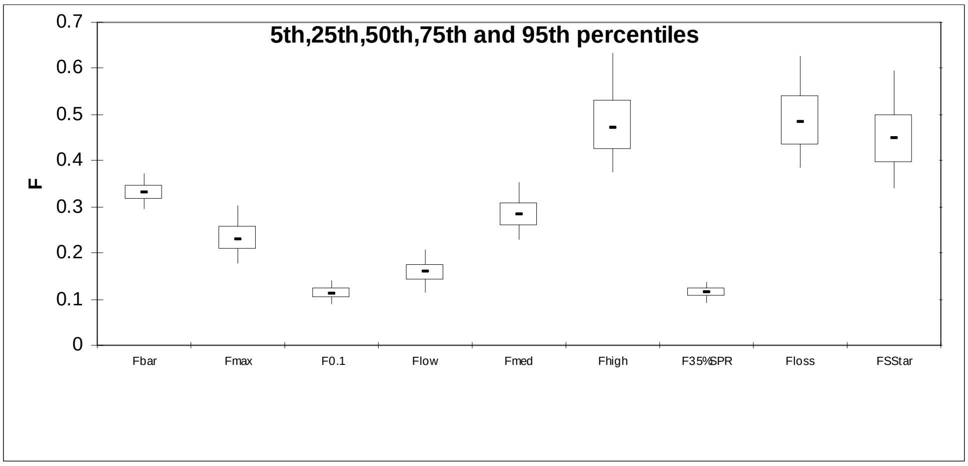
Reference point	F multiplier	Absolute F
Fbar(4-8)	1.0000	0.3312
FMax	0.7013	0.2323
F0.1	0.3409	0.1129
F35%SPR	0.3501	0.1160

Weights in kilograms

MFDP version 1a
Run: Sole7fg_SQ_Scaled
CELTIC SEA SOLE.2007 WG.COMBSEX.PLUSGROUP - F scaled
Time and date: 13:16 14-6-2007
Fbar age range: 4-8

Input units are thousands and kg - output in tonnes

Figure 4.3.8 - Sole in VIIf,g Yield per recruit and short term forecast plots



Reference point	Deterministic	Median	75th percentile	95th percentile	Hist SSB < ref pt %
MedianRecruits	4689	4693	4867	5154	
MBAL	0				0.00
Bloss	1602				
SSB90%R90%Surv	2142	2401	2631	3204	22.22
SPR%ofVirgin	11.89	11.37	12.93	15.07	
VirginSPR	4.66	4.59	5.28	6.26	
SPRloss	0.34	0.33	0.35	0.37	
S*	1602	1804	1970	2314	0.00
	Deterministic	**Median**	**25th percentile**	**5th percentile**	**Hist F > ref pt %**
FBar	0.33	0.33	0.32	0.29	75.00
Fmax	0.23	0.23	0.21	0.18	94.44
F0.1	0.11	0.11	0.10	0.09	100.00
Flow	0.15	0.16	0.14	0.11	100.00
Fmed	0.28	0.28	0.26	0.23	80.56
Fhigh	0.51	0.47	0.42	0.37	33.33
F35%SPR	0.12	0.11	0.10	0.09	100.00
Floss	0.49	0.48	0.43	0.39	33.33
FS*	0.50	0.45	0.40	0.34	33.33

For estimation of Gloss and Floss:
A LOWESS smoother with a span of 1 was used.
Stock recruit data were log-transformed
A point representing the origin was included in the stock recruit data.
For estimation of the stock recruitment relationship used in equilibrium calculations:
A LOWESS smoother with a span of 1 was used.
Stock recruit data were log-transformed
A point representing the origin was included in the stock recruit data.

Celtic Sea Sole

Steady state selection provided as input
FBar averaged from age 4 to 8

Number of iterations = 500
Random number seed = -99
Stock recruitment data Monte Carloed using residuals from the equilibrium LOWESS fit

Data source:
C:\WGSSDS_2007\Sole_VIIfg\Sensetivity\Pa_plot_Mike\SOLVIIF.SEN
C:\WGSSDS_2007\Sole_VIIfg\Sensetivity\Pa_plot_Mike\SOLVIIF.SUM

FishLab DLLs used
FLVB32.DLL built on May 6 1999 at 12:54:28

PASoft2 Feb 2003
29/06/2007 18:30:48

Figure 4.3.9 - Sole in VIIf,g PA reference points

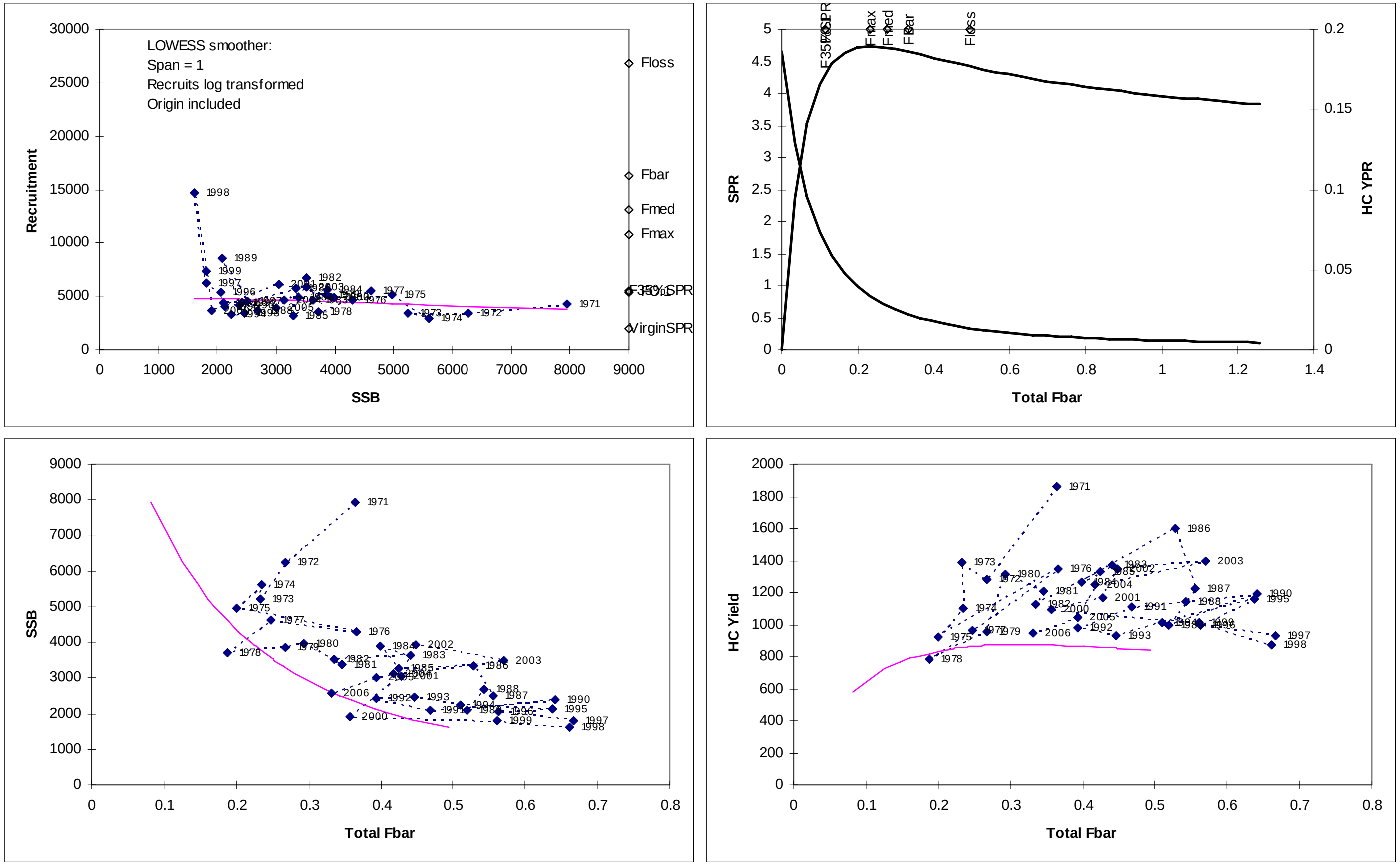
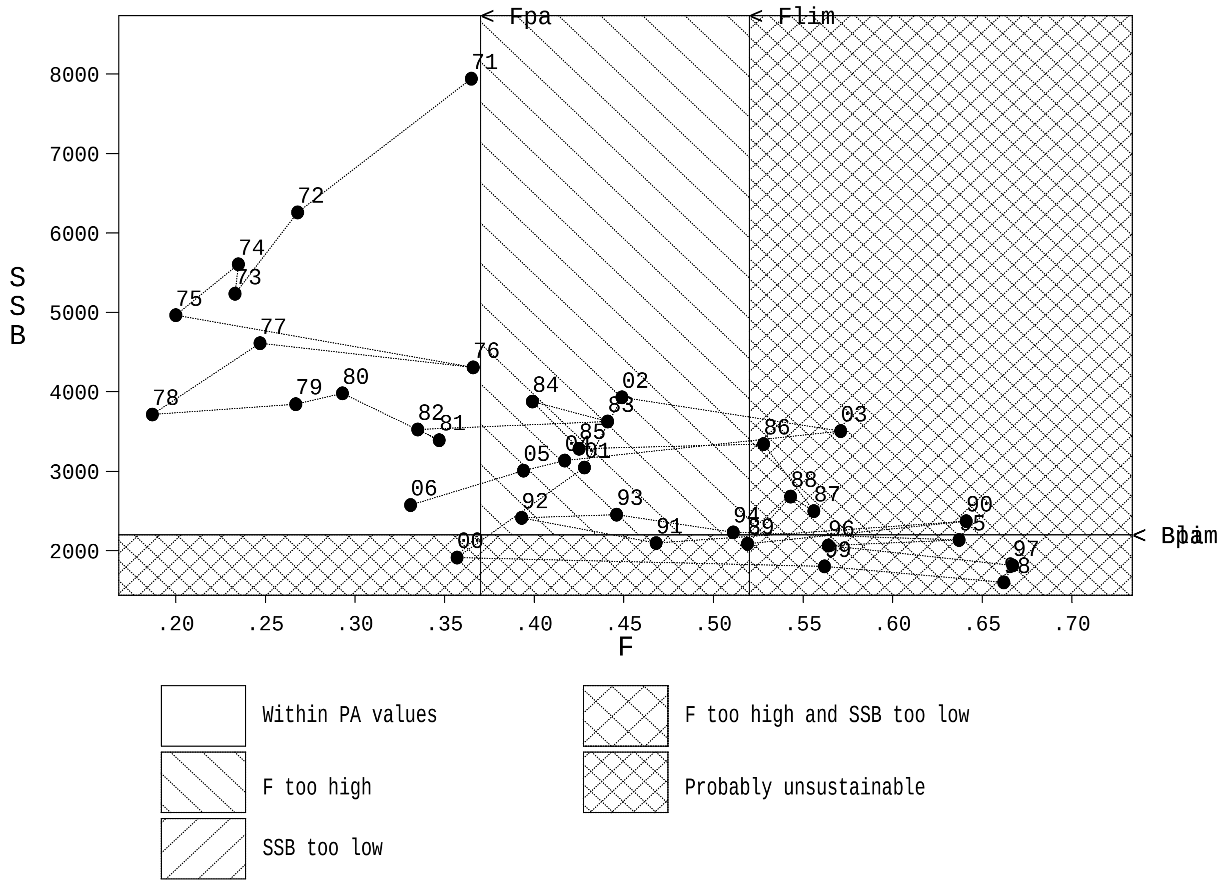


Figure 4.3.10 Sole in VIIf,g PA reference plots

Figure 4.3.11 - Sole in VIIf,g



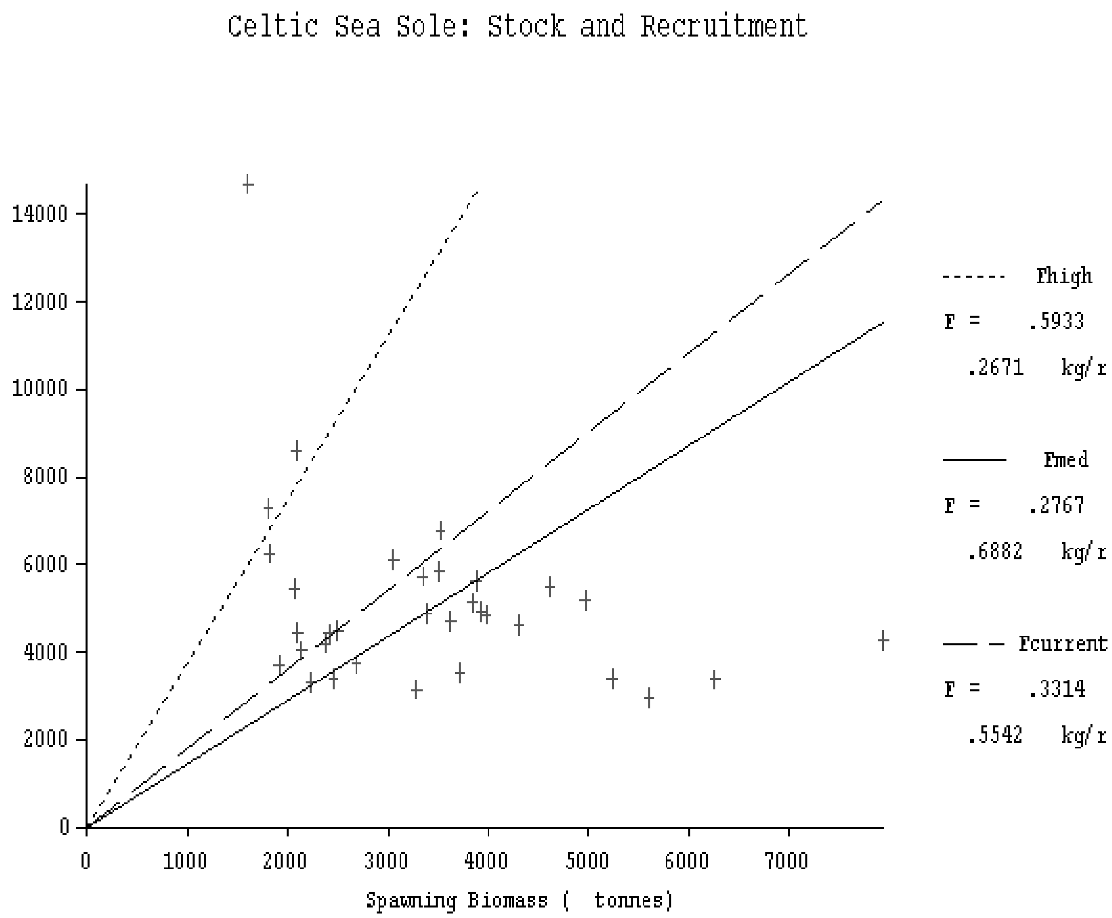
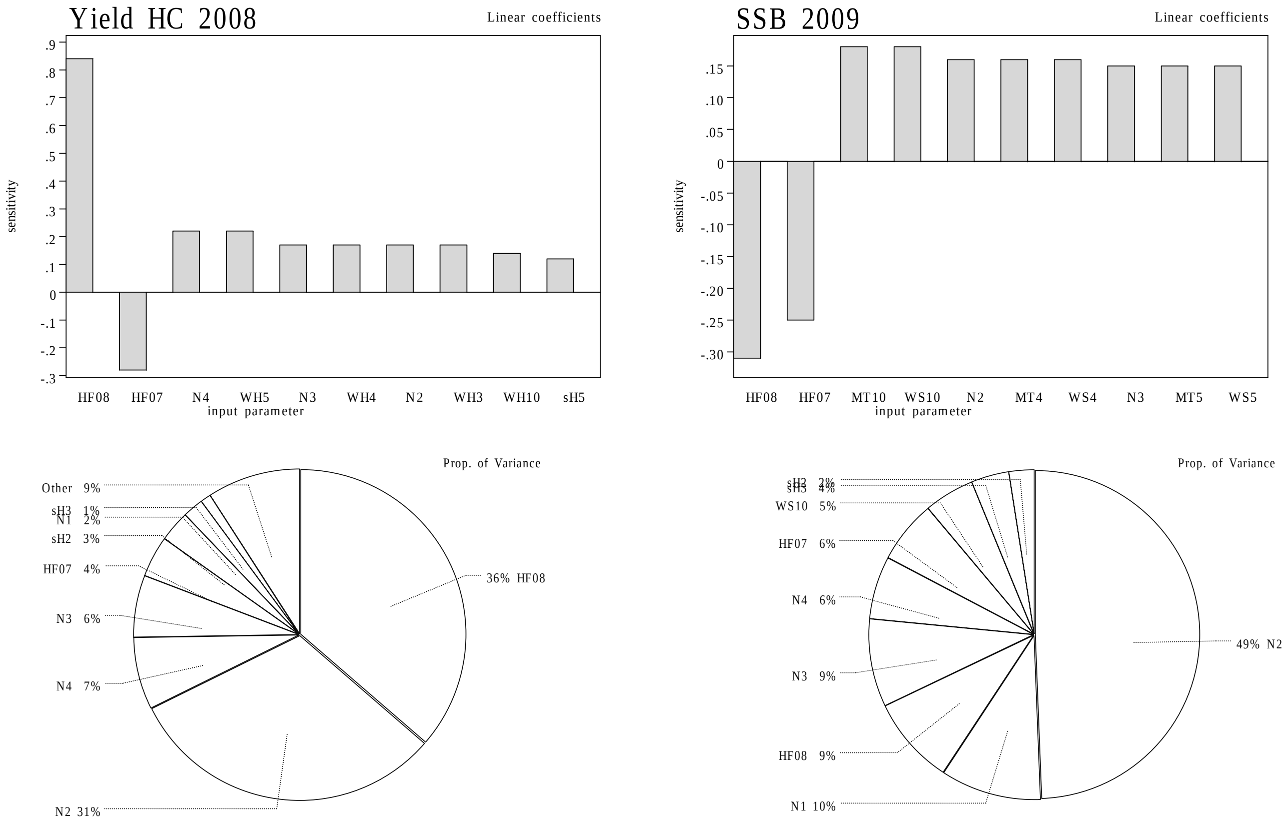


Figure 4.3.12 - Sole VIIfg Stock/recruitment plot

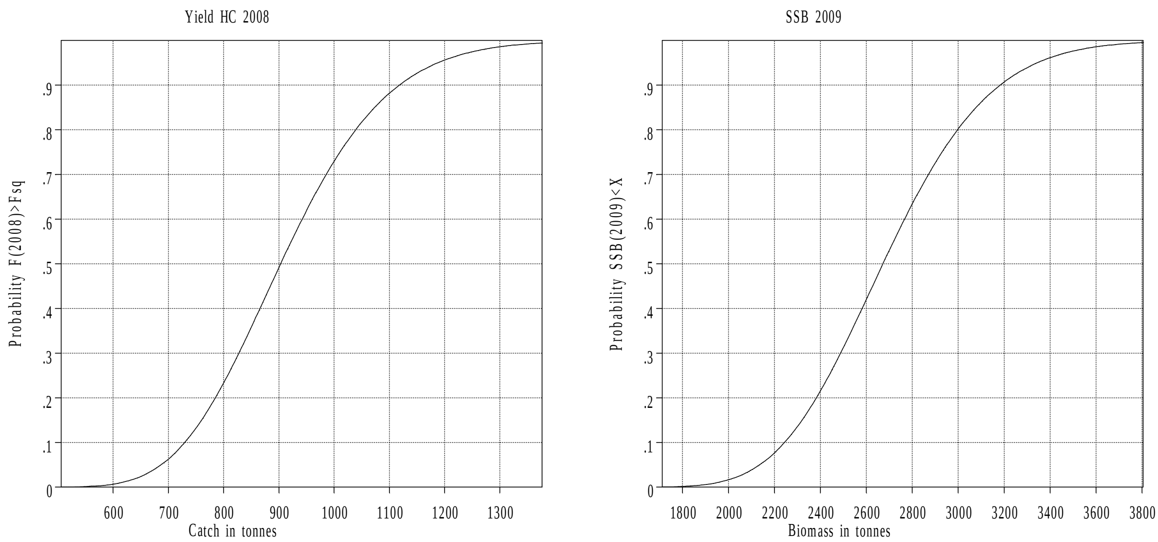
Figure Sole,Celtic Sea. Sensitivity analysis of short term forecast.



Data from file:C:\WGSSDS_2007\Sole_VIIfg\Sensetivity\Pie & profile\SOLVIIF.SEN o

Figure 4.3.13 Sole in VIIf,g Sensitivity analysis

Figure Sole,Celtic Sea. Probability profiles for short term forecast.



Data from file:C:\WGSSDS_2007\Sole_VIIfg\Sensetivity\Pie & profile\SOLVIIF.SEN o

Figure 4.3.14 Sole in VIIf,g Probability profiles for the short term forecast

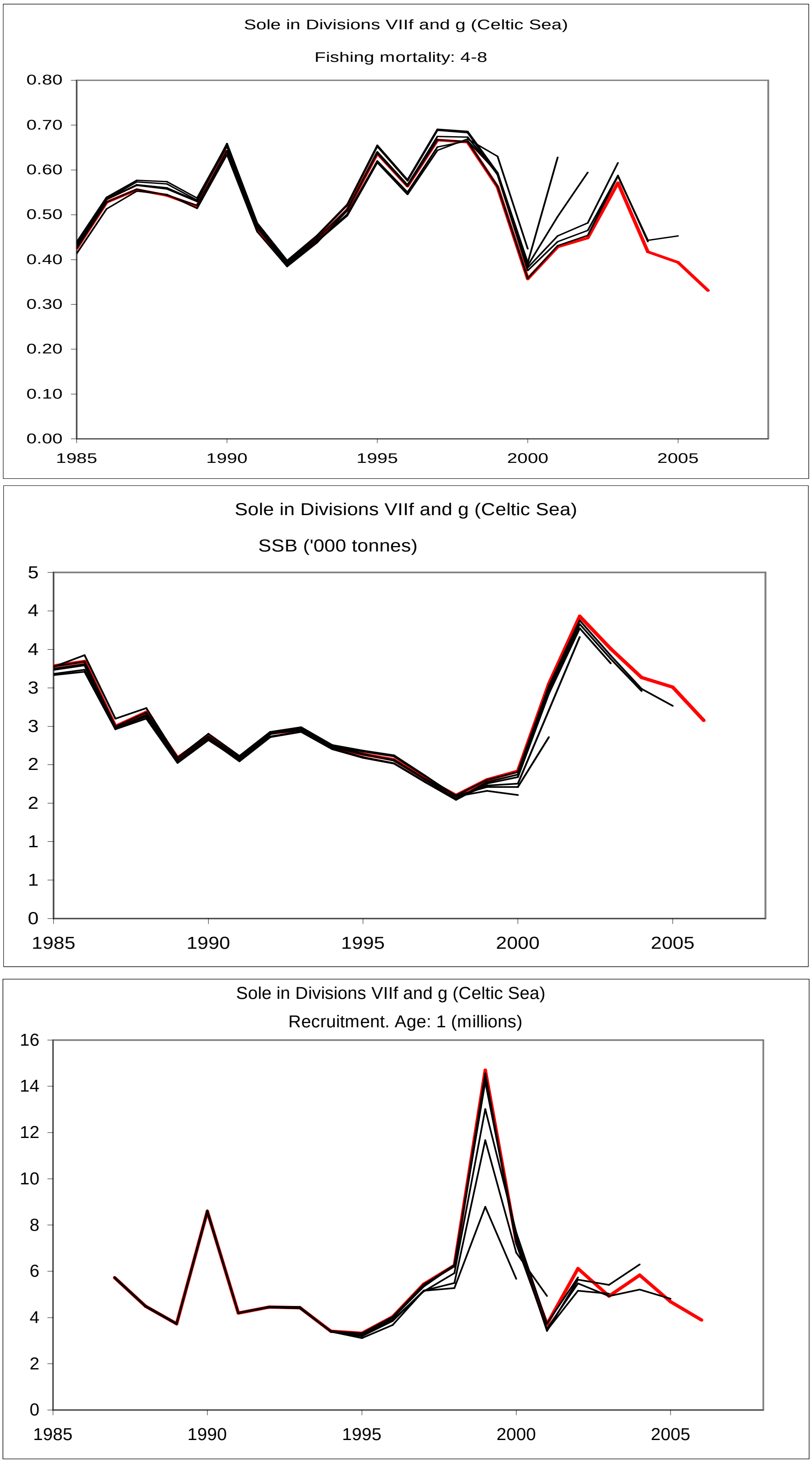


Figure 4.3.15 Sole in VIIfg. Historical Performance of assessment of successive WG assessments

4.4 Plaice in the Celtic Sea (ICES Divisions VIIf,g)

Type of assessment in 2007: Update assessment (see section 1.6)

No changes to the assessment.

Review Group issues:

- Inclusion of discard data in assessment – see section 4.4.12;
- Differences in mortality signals between the survey and catch data - see section 4.4.5

4.4.1 The fishery

Details can be found in section A.2 of the stock annex.

ICES advice applicable to 2007

Exploitation boundaries in relation to precautionary considerations: A 50% reduction in F is needed to increase SSB to around **B**pa in 2008. This corresponds to landings of less than 380 t in 2007.

*If such a large reduction in F is not achievable in the short term, ICES recommends that a recovery plan be developed. This plan should include a sustained reduction of fishing mortality to rebuild the stock above **B**pa in the medium term. Catch and effort reductions are required to promote such a reduction in fishing mortality.*

ICES advice applicable to 2006

Exploitation boundaries in relation to precautionary considerations: A 50% reduction in F is needed to increase SSB to around Bpa in 2007. This corresponds to landings of less than 400 tonnes in 2006.

If such a large reduction in F is not achievable in the short-term, ICES recommends that a recovery plan be developed. This plan should include a sustained reduction of fishing mortality to rebuild the stock above Bpa in the medium term. Catch and effort reductions are required to promote such a reduction in fishing mortality.

Management applicable to 2006 and 2007

Plaice in the Bristol Channel and Celtic Sea (ICES Divisions VIIf and VIIg) are managed by TAC and technical measures. The agreed TAC for VIIf,g plaice in 2006 was 476 t, and in 2007 was 417 t.

Technical measures in force for this stock are minimum mesh sizes, minimum landing size, and restricted areas for certain classes of vessels. Technical regulations regarding allowable mesh sizes for specific target species, and associated minimum landing sizes, came into force on 1 January 2000 (section 2.1). The minimum landing size for plaice in Divisions VIIf,g is currently 27 cm.

The 2007 TAC implied approximately 45% reduction in fishing effort based on the status quo projection conducted at the 2006 working group.

Council Regulation (EC) No 51/2006, Annex III, part A 4.2 prohibited fishing in ICES rectangles 30E4, 31E4 and 32E3 during February and March 2006 with derogations for vessels using pots, creels or nets with less than 55 mm mesh size. The prohibition does not apply within 6 nautical miles from the base line.

Council Regulation (EC) No 41/2007, Annex III, part A 7.2 prohibited fishing in ICES rectangles 30E4, 31E4 and 32E3 during February and March 2007 with derogations for vessels using pots, creels or nets with less than 55 mm mesh size. The prohibition does not apply within 6 nautical miles from the base line.

Beam trawlers account for the vast majority of plaice landed by vessels in Divisions VIIf,g. The proportion of plaice taken from the closed area remained constant in 2005, but declined markedly in February and March 2006. Proportions taken in January and April, immediately before and after the closure, are higher than in previous years. CPUE of plaice in February and March is not dramatically reduced, reflecting the decrease in effort during this period and the fact that plaice can be caught in areas outside of the closed area. This probably had little impact on the fishing mortality on plaice.

Council Regulation (EC) No 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in areas of VIIb, VIIj, VIIg and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998-2002).

Working Document WD2 examines trends in French fishing effort in ICES Division VIIf,g / Impact of the Trevose closure. Working Document WD 3 – Effects of 2005-2007 Trevose cod closure on UK demersal fleets. Working Document WD4 examines the impact of the temporal closure of ICES rectangles 30E4, 31E4 and 32E3 (Celtic Sea) on the Belgian fishery behaviour. The results are summarized in section 4.4.13.

Recent trends in the fishery

National landings data and estimates of total landings used by the WG, are given in Table 4.4.1. The estimated total international landings for 2006 were 403 t, 15% below the TAC (476 t) and 36% below the status quo prediction given by last year's assessment (625 t).

Effort and LPUE data were available for the UK(E+W) beam-trawl, UK(E&W) otter-trawl, Irish otter-trawl, beam-trawl and seine fleets, Belgian beam-trawl and the UK September beam-trawl survey (Tables 4.4.2, 4.4.3 and Figures 4.4.1, 4.4.2).

Commercial LPUE data appear to show a general pattern of steep decline since the high levels in the early 1990s, with a further decline in recent years. However, survey CPUE shows a different pattern: there is still a steep decline but later than the commercial data, followed by an increase to an intermediate level in recent years. This could be explained by a change in discarding practice in the last ten years: further work is necessary to examine this feature.

UK(E&W) beam trawl effort levels have declined in both VIIf and VIIg from the high levels observed in 1999-2001; effort in VIIf in 2006 was at the lowest level since 1984, whilst effort in VIIg (East) has generally increased since 2002. UK(E&W) otter trawl effort levels for VIIf and VIIg have shown a general decline since 1990, with a recent upturn in VIIf. Irish otter trawl effort has steadily increased since 1999, whilst beam trawl and seine fleets show a less-pronounced but general increase for the time series. Other than the rectangle closures, there were no early closures of the fishery for plaice in 2006.

There is relatively little information recently on the level of landings misreporting on this stock.

The WGFTFB report (ICES 2007) made the following comments relevant to this stock.

A £5 million decommissioning scheme will reduce capacity in the UK SW beam trawl fleet in 2007. There was also decommissioning of 9 Belgian vessels between Aug'2005 and Nov' 2006 and these had been responsible for around 18% of the total Belgian kWdays in the Celtic sea in recent years. A Decommissioning Scheme launched in Ireland in October 2005 removed a total of 36 vessels and a further decommissioning programme will be announced in 2007. However, recent modernisation of the Irish Demersal fleet has led to around 23 extra vessels joining the fleet. Belgian beam trawlers are investigating use of two sets of smaller trawls from each beam in order to reduce fuel consumption, referred to as 'outrigging'. Belgian and French vessels are being equipped with 3D mapping sonar that has opened up new areas to fishing. Several countries report that new gear monitoring equipment fitted to trawls and trawl doors have the potential to increase efficiency.

The voluntary use of technical modifications for beam trawls in Bristol Channel were promoted to industry via workshops, demonstration and project meetings. The southwest UK beam trawl fleet is using benthic release panels that release about 75% of benthic invertebrates from the catches. Full square mesh codends are also being tested in order to reduce the capture of benthos further and improve the selection profile on gadoids.

Discards

Routine discard monitoring began in 2002-3 following the introduction of the EU data collection regulations. Discards data for 2002-2005 are available for the UK(E&W) fleets; for 2003-2005 from the Belgium fleets; for 1996-2005 from Irish fleets (although sampling levels prior to 2003 were not high), and for 2005 for French fleets.

Discard data for the Belgium fleets in 2006 could not be prepared in time for this Working Group due to due to changes to the ICES Working Group calendar. In addition, only length frequency and haul summary discard data were available from UK(E+W) and France for 2006. No discard information for 2006 was available from Ireland.

Data for 2006 sampling are summarized in Figures 4.4.3 and 4.4.4. The emerging time series of discard data, and possible further work, are discussed in section 4.4.12.

Indications are that discard rates, although variable, may be substantial in some fleets/periods. The Working Group therefore decided not to include discards in the assessment at this stage but would consider inclusion at future Working Groups as data becomes available.

4.4.2 Age and length compositions and mean weights at age

Annual length compositions for 2006 are given in Table 4.4.4, and length compositions for UK(E+W) landings for the last ten years are presented in Figure 4.4.5.

Revisions to French landings data were reported for 1999-2005 and revised age compositions were supplied for 2004/2005. In addition, Ireland provided a minor revision to their data for 2005. The international age compositions and weights at age have been amended accordingly.

Quarterly age compositions for 2006 were available for Belgium, Ireland and UK(E+W), representing approximately 76% of the total landings. Methods for the derivation of international catch numbers at age and for the calculation of catch and stock weights at age are as standard for this stock, and are fully described in the stock annex, section B.1 and B.2.

Parameter estimates for the in-year smoothing of catch and stock weights in 2006 are as follows:

$Wt = 0.2776+0.0326*(age)+0.0091*(age^2)$ $(R^2 = 0.86)$

The age compositions of landings for the last 10 years are shown in figure 4.4.6. Catch numbers and weights at age in the catch and stock are given in Tables 4.4.5 - 4.4.7. [As in last year's assessment, numbers at age 1 have been replaced by zero values; see section B.1 in the stock annex.]

4.4.3 Natural mortality and maturity at age

A natural mortality estimate of 0.12 was applied to all ages and to all years, as previously.

The maturity ogive detailed below was applied to all years

Age	1	2	3	4	5+
Maturity	0.00	0.26	0.52	0.86	1.00

Further details of the derivation of these can be found in section B.2 of the stock annex. It is expected that new maturity data will become available from sampling carried out under the EU DCR.

4.4.4 Abundance indices from surveys

Indices of abundance given by the UK(E+W) beam trawl survey in VIIf (UK-BCCSBTS-S), the Irish Celtic Sea groundfish survey (IR-ISCSGFS), and the new Irish Celtic Explorer IBTS survey (IRGFS) are presented in Table 4.4.8. The UK(E&W) data indicate a strong 1990 year-class, weak 1989 and 1992 year-classes and an above-average 1999 year-class. The 2004 year-class appears to be of a similar strength to the 1999 year-class as '0' groups, but appears weaker at ages 1 and 2. The 2005 year-class appears to be weak. The Irish groundfish survey covers a shorter year range, so the identification of strong and weak year classes is more difficult from these data. However, the 1999 year-class did show up very strongly at age 1.

The Review Group commented on the utility of examining trends in F and year–class abundance from individual tuning fleets. Figure 4.4.7 shows fleet log LPUE by year-class and illustrates the consistency of year-class estimation by the three tuning fleets. It also shows that strong year classes are well predicted by all fleets but the survey estimate of the strong 1989 year-class has been downgraded by successive surveys. All three fleets also predict poor year-classes consistently. Figure 4.4.8 shows fleet log LPUE by year and illustrates that there is little indication of any serious year effects.

The Review Group had concerns about the relative signals in F between fleets. These have been examined and Figure 4.4.9 shows that indicative values of Z. These show that that Z, and therefore F (as M is considered to be constant) is relatively stable within each fleet and reasonably consistent between the two commercial fleets ($F \approx 0.78$). The survey estimates F to be higher ($F \approx 1.08$) on ages 1-4, but it is likely to suffer from progressive emigration of fish at increasing ages, as the survey is mainly restricted to coastal regions. In the assessment, this is accommodated in the q-at-age parameter so that it is not possible to distinguish emigration from higher values for fishing mortality.

See section 4.4.12 for further analysis and discussion on the beam trawl survey.

4.4.5 Catch at age analysis

See section 1.4.1 for the general approach adopted at the WG. The age range for the analyses was 1-9+, as in previous assessments. As this was an update assessment, full data screening, tuning data and XSA settings were not carried out. However some experimental trial runs were carried out but were not adopted.

Exploratory XSA runs

Three XSA runs were performed this year: The first run used the settings and approach as standard (determined by the benchmark assessment at the 2005 Working Group: see section C in the stock annex). The second run had an additional age in the UK B/Trawl Survey tuning fleet (age6) and the third run turned off the power model for all ages. Examination of the results and diagnostics of these runs showed that there was some justification for reducing the number of ages used in the power model and that this should be explored further at the next benchmark assessment. Also, there seems some justification for including age 6 data from the UK beam trawl survey as it was clear that strong cohorts were still evident at that age.

Given the update only status of this stock this year, these trial exploratory runs were not adopted but should be explored further at the next benchmark assessment.

The tuning data available, and the subset used in the assessment, are given in Table 4.4.9.

Final settings used this year, and last year's configuration are detailed below:

		2006 XSA		2007 XSA	
Fleets	*UK-CSBT*	90-05	4-8	90-06	4-8
UK-CSOT		89-05	4-8	89-06	4-8
UK-BCCSBTS-S		90-05	1-5	90-06	1-5
Taper			No		No
Taper range			-		-
Ages catch dep. Stock size			1-5		1-5
Q plateau			7		7
F shrinkage se			2.5		2.5
	year range		5		5
	age range		4		4
Fleet threshold se			0.5		0.5
Age range			1-9+		1-9+
Age 1 catch numbers			Set to zero		Set to zero
F bar age range			3-6		3-6

Final XSA run

XSA diagnostics from the final run are given in Table 4.4.10 and log catchability residuals plotted in Figure 4.4.10. Survivor estimates for ages 4 and above are reasonably consistent between fleets. The standard error threshold clearly operates on the commercial fleet data, maintaining relatively even weighting up to age 6, after which the survey contribution sharply declines reflecting the lack of data for older ages. The survey contributes around 50% of the weight to estimates of age 1 survivors, with the remainder coming from P-shrinkage. At ages 2 and 3 the survey provides around 70% of the weighting. F-shrinkage is negligible throughout.

The residuals for the UK beam-trawl survey shows inconsistencies between it and both the commercial beam-trawl and otter-trawl tuning datasets and the catch-at-age matrix. The working group considered this to be due to the heavy discarding of the youngest age-classes and resulting in these fish being absent from all commercial data. The survey estimates of these age-classes are probably a true reflection of their strength within the fishery.

The retrospective analysis (Figure 4.4.11) shows a tendency to under-estimate recent terminal F values, and to overestimate SSB. Although there appears to be a pattern of overestimating recruitment, this is due to population shrinkage, which, during periods of low recruitment, will tend to pull recruit estimates back towards an average level for the series.

Fishing mortalities and population numbers from the final XSA run are given in Tables 4.4.11 and 4.4.12 and the summary in Table 4.4.13. Fishing mortality in 2006 is estimated to have been at 0.29, the lowest in the time series. Last year's assessment estimated F in 2005 at 0.35; this year it has been revised upwards to 0.38. Last year's assessment estimated SSB in 2005 to be around 1060 t; this estimate has been revised downwards to around 970 t this year.

SSB in 2006 is estimated at 1,110t. This is a small increase on the previous year but remains at a low level, close to B_{lim} (1,100 t), since 2000.

4.4.6 Estimating recruiting year-class abundance

The XSA estimate of the 2004 year-class (3.2 million 1 year olds) is around 6% below the value estimated last year (3.4 million 1 year olds).

The 2005 year-class is estimated at 2.2 million 1 year olds in 2006. The sources of this estimate are detailed in the table below. The XSA estimate of recruitment at age 1 in 2006 was accepted and recruitment estimates for subsequent years were derived from a short-term geometric mean ($GM_{1989\text{-}05}$).

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**
2004	3241	XSA	68%	-	32%
2005	2242	XSA	52%	-	48%
2006	3022	GM (89-05)			
2007	3022	GM (89-05)			

4.4.7 Historic trends in biomass, fishing mortality and recruitment

A summary of the time series of XSA results is given in Table 4.4.13 and Figure 4.4.12. Fishing mortality has fluctuated without trend since 1977 but has declined sharply since 2002. The apparent decline from 2005 to 2006 should be viewed with caution as the retrospective pattern implies that the 2006 value may be revised upwards in next year’s assessment.

SSB rose to a high level throughout the 1980s, following a series of above-average recruitments, but has declined since 1990. SSB is estimated to have been below B_{pa} (1800t) since 1997, and since 2000 has been close to B_{lim} (1100t).

With the exception of 1994 year-class, all recruitments since 1988 have been below average.

The stock and recruitment scatter plot at Figure 4.4.13 shows that there is no evidence of reduced recruitment at low stock levels.

4.4.8 Short-term catch predictions

The input values for the catch forecast (using the MFDP software) are given in Table 4.4.14. The F at age values used were calculated as the mean of the XSA values from 2004-2006, unscaled. Catch and stock weights at age were also the mean of the period 2004-2006. SSB values are calculated for 1 January. Stock numbers at age in 2007 for ages 2 and older were obtained from the XSA. $GM_{89\text{-}05}$ recruitment (3.0 millions) was assumed for age 1.

Table 4.4.15 gives the management option table from the status quo catch prediction, and short-term results are shown in Figure 4.4.14. Assuming status quo F (Fsq = 0.41) implies landings of 587 t in 2007 and 593 t in 2008. (The TAC for 2007 is 417 t.). SSB is predicted to rise from 1,330 t in 2007 to 1410t in 2008 and 1470 t in 2009. These results are discussed further in section 4.4.13.

The detailed output for the status quo F forecast by age group is given in Table 4.4.16, and the estimated contributions of recent year-classes to the predicted catches and SSBs are given in Table 4.4.17. The assumptions of GM recruitment are predicted to contribute 10% to the landings in 2008 and 29% to SSB in 2009.

4.4.9 Yield and biomass per recruit

Results for yield and SSB per recruit (using program MFYPR), conditional on the recent exploitation pattern, are given in Table 4.4.18 and Figure 4.4.14. F_{max} is given by a reference F of 0.28, around 70% of F_{sq}, and close to last year's estimate (0.31). Long term yield and SSB (at F_{sq} and assuming GM_{89-05} recruitment) are given as 710t and 1,710 t respectively.

4.4.10 Biological reference points

The Working Group's current approach to reference points is outlined in Section 1.4.4. Current reference points are detailed below

Flim	No proposal		
Fpa	No proposal		
Blim	1,100 t	basis :	Bloss (B78, WG98)
Bpa	1,800 t	basis : :	Blim . exp(1.645*0.3)

SSB is currently below Bpa and at Fsq will remain below Bpa in the short term.

Bloss (1010t, 1978) is considered stable. The estimate of SSB in 1978 has not been revised in the last 7 assessments of this stock.

Further details can be found in section G of the stock annex.

4.4.11 Risk and sensitivity analyses

A sensitivity analysis (method in section 1.4.3) was carried out to examine the contribution of different sources of uncertainty to the variance of predicted SSB and yield. Table 1.4.2 gives a description of the abbreviated variable names in Table 4.4.19, which shows the input data, and on Figure 4.4.15, which presents the results of the analysis.

Probability profiles of SSB in 2008 assuming status quo F, and the probability that F in 2008 will exceed status quo F at different catch levels, are given in Figure 4.4.16. The probability that SSB in 2009 will be below Bpa (1,800 t) is around 85%. The 90% confidence limits of yield in 2008 (590t) are approximately 300t and 1,000t.

4.4.12 Comments on the assessment

Consistency

The trends and estimates of fishing mortality, SSB and recruitment in this assessment are consistent with last year's assessment (see Retrospective analysis Fig 4.4.11).

The historic performance of this assessment also shows a good level of consistency as shown in Figure 4.4.17. Estimates of fishing mortality tend to be revised upwards and estimates of SSB tend to be revised downwards each year. This is also noted in the retrospective results (Fig 4.4.11). Overall results show little or no change in the perception of the state of the stock. However it should be noted that this perception is based on landings data only as no estimates of discarding have been included in these assessments.

Sampling

Sampling levels of the landed catch for recent years are considered to be sufficient. The sampling levels for those countries supplying information for 2006 are given in Table 1.3.1.

Discarding and mis-reporting

Estimates of discarding are not included in this assessment. Discard rates are believed to be high for this stock in some seasons/fleets (see figures 4.4.3 and 4.4.4) and their non-inclusion may represent a major deficiency in the assessment. The composition of the fleets and therefore the gear types employed in the fishery show fluctuations over time and it may be that the discard rates observed in the fishery now are not applicable to periods earlier in the time series. From 2003 onwards, discard sampling for Ireland, Belgium and UK(E&W) has been improved under the Data Collection Regulation. Discard data for French fleets in 2005 was also available to the meeting.

RGSSDS2006 asked that the Working Group consider the inclusion of discard data in the assessment. However, for this Working Group, no country was able to provide discard sample data raised to age compositions. The primary reason for this was the changes to the ICES Working Group schedule in 2007. It is hoped that aged based discard information for 2006 will be available for the 2008 Working Group meeting.

The UK, Ireland and France were able to provide summary trip and length based discard data for 2006. At a previous Working Group, Irish discard data was provided raised to age compositions, and these data indicated that 83% of discards (numbers) are aged 1-4

Mis-reporting has been considered a potential problem for this stock in earlier years. Mis-reporting of catches by ICES Division is thought to be minor. Under-reporting may have taken place in the most recent years (industry anecdotal information), but no evidence is available on the magnitude of the problem. The *status quo* forecast indicates landings around 40% in excess of the TAC for 2007. Preliminary estimates of landings for Jan-May 2007 taken by UK(E&W) fleets indicates that they are around 18% lower than those for the same period in 2006. It should be noted that even though total reported landings for this stock in recent years remain below the TAC, fleets may be restricted by their individual quota allocation.

Survey information

The UK September beam trawl survey continues to show good ability to track individual year class strengths as both good and poor year-classes are well predicted in the XSA outputs. As noted in 'Exploratory XSA runs', at the next benchmark assessment, the Working Group should consider the inclusion of age 6 data in the tuning file as it is clear that strong cohorts are still evident at that age.

The Review Group requested that the Working Group examined the *'apparent differences between mortality signals in the survey and the catch data and the strong trend in survey catchability indicating differences between the catch matrix, commercial tuning data and the survey'*. This has been dealt with in section 4.4.4 'Abundance indices from surveys'.

Industry information

A number of DEFRA-funded surveys (Fisheries Science Partnership) were conducted in 2003 - 2006 using chartered UK fishing vessels in order to obtain new information on the catch rates, length distributions and discard rates of target species. Investigations conducted in the Eastern Celtic Sea and Bristol Channel during 2005 (Armstrong et. al., 2005) confirmed that discards of plaice in the Celtic Sea were substantial (e.g. 55% by number from a beam trawl trip in February 2005, and up to 28cm in length). Catch-rates of plaice at the time were highest off the North coast of Cornwall, with the average size of fish caught tending to increase from North to South.

The Pre-WG UK(E&W) industry briefing meeting provided some additional anecdotal information on VIIf,g plaice. The UK Industry believes this stock does not appear to be doing very well. Effort on the whole should have been decreasing with the closure forcing boats to switch to monk and nephrops. Discarding is mainly a MLS problem and not a high grading issue.

According to official statistics, the UK quota was not taken in 2006.

At the Irish Pre-WG industry meeting, the industry questioned the stock definitions used by the WG for sole and plaice in VIIf,g and VIIh-k. The WG had no new information on stock discrimination for these areas that might suggest the stock data for VIIf,g and VIIh-k should be combined into one assessment area. Recent Irish tagging studies do not as yet have sufficient returns to evaluate whether there is any ‘mixing’ between these two stocks. The WG noted that the a declining trend in SSB and low recent recruitments has been observed in both stocks since 1993.

4.4.13 Management considerations

The SSB of this stock is estimated to have been close to Blim (1,100 t) in 2006, just above in 2007 (1,330 t) and is forecast to rise to 1,410 t in 2008 and 1,470 t in 2009 assuming GM89-05 recruitment levels and status quo fishing mortality. The probability that SSB will remain below Bpa in 2009 is around 85% (Figure 4.4.16).

Unfortunately, there is a tendency in this stock to underestimate F in the final year, with a commensurate over estimate in the stock numbers in the final year. Fsq is estimated as the average of the last three years, so that this bias is strongly reduced in the forecast. However, the stock numbers in the final year are used which represent the full level of the bias in the assessment. Combining the optimistic stock numbers with the more conservative Fsq values leads to an overestimate of landings in the subsequent year. This may explain why the TAC is rarely matched by the International landings being reported the following year. Only 88% of the 2005 TAC and only 85% of the 2006 TAC were caught and landed.

Working documents WD2, WD3 and WD4 provide results of an analysis of the effects of the rectangle closures on cod, plaice and sole stocks. The summary for plaice from each WD is reproduced below:

<u>WD2 - French fishing effort in ICES Division VIIf,g / Impact of the Trevose closure.</u>

A strong reduction in the total number of vessels operated (at least once) in ICES Divisions VIIf,g during the first quarter: -45% between 1999 and 2006. Fishing effort also decreased sharply: -65% over 1999-2006 for the gadoids metier

<u>WD3 – Effects of 2005-2007 Trevose cod closure on UK demersal fleets</u>

Sightings of vessels of all nationalities in the first Quarter of 2004 to 2006 showed concentrations of beam trawl effort in rectangle 30E4 when the rectangle was open to fishing. Otter trawl effort in divisions VIIf,g was less concentrated into the closure rectangles during the first 3 months of the year, and the spatial distribution of effort therefore appeared less affected by the closed area. The displacement may in some cases have resulted in vessels targeting different types of fish, however the overall species compositions for specific gear types used in VIIf,g in Quarter 1 changed relatively little over the 2000 – 2007. The most obvious difference during 2005-07 has been an increase in the contribution of flatfish in the otter trawl catches, possibly reflecting displacement onto the more traditional flatfish grounds inshore along the north Cornwall coast. Many vessels (particularly beam trawlers from the UK and Belgium) fished close to the borders of the closed rectangles during the closure, and fished intensively inside the rectangles when they were re-opened.

WD4 – The impact of the temporal closure of ICES rectangles 30E4, 31E4 and 32E3 (Celtic Sea) on the Belgian fishery behaviour.

Due to effort limitations in the Eastern English Channel in 2004 and 2005, the number of Belgian vessels operating in the Celtic Sea increased during these two years. The average number of hours fished per vessel decreased since the introduction of the temporal box closure in 2005. Belgian effort was also displaced mainly to periods just after the closure. Nine Belgian vessels (accounting for approximately 17.6% of the total kWdays in the Celtic Sea) were decommissioned between August 2005 and November 2006.

Conclusions and management plans:

The high level of discarding indicated in this fishery would suggest a mis-match between the mesh size employed in the fishery and the size of the fish being landed on the market. Increases in the mesh size of the gear should result in fewer discards and ultimately, in increased yield from the fishery. The results of studies presented to the 2004 WG (ICES, 2004) would also benefit the sole VIIf,g stock without decreasing sole landings in the long term.

In 2005, the WG presented results from a series of medium-term scenarios (using the CS5 program), carried out in conjunction with VIIf,g sole, to simulate some possible management plans for the two stocks. These were further refined prior to the RGSSDS (2005) meeting, based on a two-stage approach:

1) Identification of a suitable target F level which in the long-term would maintain yield at or above 95% of that given by F_{max}, whilst posing a low probability (<5%) of SSB falling below B_{lim}.

2) Identification of one or more alternative F-reduction strategies in order to attain the chosen target level by a given year. The different scenarios showed the trade-off between loss in short-term yield and increased risk to the stock in the short-term.

Since GM recruitment, exploitation pattern, Fmax and F status quo remain relatively unchanged, The WG decided not to repeat this analysis again this year. The results of 2005 target F analysis, indicated that an F in the range 0.25 to 0.56 would satisfy the requirements in point 1 above. This implies a reduction on F of 0-39% from current fishing mortality.

Since plaice are part of a mixed fishery, with sole as one of the main target species, it is necessary to take into account the results of the same exercise carried out for VIIf,g sole. Since the sole assessment is unchanged this year the WG decided not to repeat the candidate target F analysis. Last years results for sole indicated a target F range of 0.27 to 0.49, implying reductions in F of 0-18% from current fishing mortality.

The WG believes that such an approach to effort reduction that can be phased in over a number of years, and implemented in conjunction with technical conservation measures, should be considered. The area closure may prove to have some beneficial effects for plaice, either in improved recruitment or reduction of overall mortality, but it will be some time before any such effects become apparent. In the meantime effort reductions as described above should benefit both plaice and sole in the Celtic Sea without significant reductions in yield.

Section 2.1 of this report looks at the relative effects on fleet effort and cod landings as a result of the fishery closures over the last 3-years. See also Working Documents WD2, WD3 and WD4 for further analyses of the effects of these closures.

Table 4.4.1 Plaice in divisions VIIf&g
Nominal landings (t) as reported to ICES, and total landings as used by the working group

National landings as estimated by the working group 1977 - 1985; as reported to ICES and total landings as used by the working group 1986 onwards

	1977	*1978*	*1979*	*1980*	*1981*	*1982*	*1983*	*1984*	*1985*	*1986*	*1987*	*1988*	*1989*	*1990*	*1991*
Belgium	214	196	171	372	365	341	314	283	357	665	581	617	843	794	836
UK (Engl. & Wales)	150	152	176	227	251	196	279	366	466	529	496	629	471	497	392
France	365	527	467	706	697	568	532	558	493	878	708	721	1089	767	444
Ireland	28	0	49	61	64	198	48	72	91	302	127	226	180	160	155
N. Ireland												1			
Netherlands										9					
Scotland	0	0	0	7	0	0	0	0	0	1				1	
Total	757	875	863	1373	1377	1303	1173	1279	1407	2384	1912	2194	2583	2219	1827
Unallocated	0	0	0	0	0	0	-27	-69	345	-693	-11	-78	-432	-137	-326
Total as used by WG	757	875	863	1373	1377	1303	1146	1210	1752	1691	1901	2116	2151	2082	1501

	1992	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*
Belgium	371	542	350	346	410	594	540	371	224	241	248	221	212	168	173
UK (Engl. & Wales)	302	290	251	284	239	258	176	170	134	136	105	127	87	55	87
France	504	373	298	254	246	329	298		287	262	186	165	145	132	67
Ireland	180	89	82	70	83	78	135	115	76	45	79	51	45	44	48
N. Ireland															
Netherlands															
Scotland	5	9	1	2											
Total reported	1362	1303	982	956	978	1259	1149	656	721	684	618	564	489	399	375
Unallocated	-174	-189	88	72	-26	-42	-82	312	-3	30	28	30	21	-10	28
Total as used by WG	1188	1114	1070	1028	952	1217	1067	968	718	714	646	594	510	389	403

Table 4.4.2 VIIfg Plaice : LPUE for UK(E&W) fleets

	LANDINGS PER UNIT EFFORT (LPUE)						LANDINGS/EFFORT DATA				ADDITIONAL EFFORT DATA			
	RECT. GROUP VIIf (grp 1)		RECT. GROUP VIIg EAST (grp 2)		RECT. GROUP VIIg WEST (grp 3)		RECT GROUP VIIf (grp1)				VIIg (East)		VIIg (West)	
							otter trawl catch		Beam trawl catch		Otter	Beam	Otter	Beam
YEAR	TRAWL	BEAM TRAWL	TRAWL	BEAM TRAWL	TRAWL	BEAM TRAWL	tonnes	000s hr fished	tonnes	000s hr fished	000s hr fished	000s hr fished	000s hr fished	000s hr fished
1972	7.70		4.97		1.15		361.82	45.72			6.01		0.74	
1973	7.54		2.75		34.92		353.95	45.28			3.59		0.05	
1974	4.99		1.22		0.00		198.12	38.94			2.03		0.00	
1975	4.88		4.07		0.75		173.01	33.53			10.35		0.04	
1976	4.54		2.70		2.13		112.09	25.61			5.21		0.04	
1977	4.06		1.76		0.00		102.81	27.16			5.36		0.04	
1978	4.19	3.06	2.24	0.00	0.00	0.00	117.74	27.08	7.58	2.50	6.73	0.00	0.00	0.00
1979	5.31	3.62	3.34	2.19	0.00	0.00	125.81	23.84	6.30	1.96	4.54	0.13	0.00	0.00
1980	5.91	4.27	4.03	7.15	2.46	0.00	162.29	26.43	17.65	4.31	2.67	0.10	0.60	0.00
1981	5.36	3.50	3.20	3.13	1.05	5.23	126.27	24.10	23.72	6.24	7.78	0.78	4.78	0.10
1982	4.82	5.10	1.14	6.73	0.06	5.57	92.65	19.20	55.42	9.95	7.50	1.86	2.56	0.58
1983	6.05	3.92	2.66	5.24	0.00	4.88	108.76	17.61	47.72	12.35	5.33	6.82	0.00	0.80
1984	6.15	6.41	4.90	7.49	0.00	4.14	160.64	23.16	99.01	13.55	4.35	4.31	0.00	2.06
1985	6.98	6.38	5.09	8.05	2.61	7.10	188.06	25.24	146.73	18.69	5.72	5.14	0.57	1.41
1986	6.62	5.22	4.28	10.62	1.44	11.31	142.84	21.18	90.44	20.72	7.72	4.31	0.82	0.68
1987	6.60	4.32	6.46	10.79	0.86	10.66	199.03	24.43	145.37	38.76	9.87	4.83	0.83	0.92
1988	10.04	8.53	7.32	9.95	1.97	14.42	205.56	20.09	204.58	25.62	9.96	2.18	0.43	0.88
1989	7.40	5.63	6.36	9.67	4.35	16.42	130.67	17.61	96.05	20.26	8.13	3.72	0.25	0.26
1990	4.16	3.93	2.43	6.80	2.70	5.34	97.82	22.56	157.15	30.77	10.55	4.89	0.45	4.32
1991	2.87	3.58	2.22	2.83	1.17	2.94	56.52	18.57	193.27	40.81	6.25	12.39	0.91	2.52
1992	2.78	2.26	2.32	2.54	1.68	2.08	44.82	16.00	91.34	35.78	5.22	16.61	8.42	2.59
1993	2.72	2.84	1.43	2.28	1.77	1.41	38.14	13.79	107.43	39.64	4.43	18.44	0.94	2.73
1994	2.71	2.47	2.18	3.07	0.83	4.14	23.36	9.48	84.97	37.03	3.03	9.48	0.24	1.94
1995	2.93	2.66	2.23	3.34	3.35	2.22	26.38	8.46	96.28	37.59	2.61	11.60	0.46	2.16
1996	2.63	2.05	1.91	1.84	0.38	0.77	23.60	8.67	81.18	39.78	4.60	8.70	1.68	3.91
1997	2.41	1.90	1.89	2.33	1.30	0.48	20.47	8.14	83.68	43.00	5.18	12.67	1.90	2.56
1998	1.59	1.54	1.24	0.93	0.33	0.69	10.94	7.13	85.06	47.84	5.09	10.45	1.55	2.81
1999	2.59	1.63	1.99	0.67	0.35	0.68	11.99	5.69	85.44	50.87	1.97	26.00	3.86	5.47
2000	2.29	1.00	3.10	0.68	0.19	0.60	10.98	4.05	53.46	51.19	2.56	17.53	2.34	3.36
2001	2.25	1.07	2.53	0.87	0.32	0.68	9.78	4.42	53.31	49.32	2.71	19.95	2.68	1.55
2002	1.31	1.14	3.70	1.49	0.54	0.27	6.81	6.10	37.93	37.53	1.54	6.19	2.49	0.93
2003	1.67	1.17	0.82	1.25	0.29	0.09	15.83	9.94	47.73	40.71	0.55	11.87	1.73	2.40
2004	1.28	1.16	0.93	0.51	0.18	0.22	12.44	9.42	40.06	32.37	3.03	14.25	2.03	2.42
2005	0.81	0.75	0.13	0.51	0.01	0.07	9.5	12.09	22.25	27.73	0.30	9.57	2.35	1.67
2006*	1.53	0.88	0.47	0.91	0.05	0.03	19.78	12.97	13.94	18.55	0.31	10.48	3.47	1.16

* Provisional

Table 4.4.3 **VIIfg Plaice : LPUE and effort for Irish and Belgian fleets in VIIf,g**

	IR-OTB-7G			IR-SCC-7G		
Year	**Landings (t)**	**Effort (hr)**	**LPUE (kg/h)**	**Landings (t)**	**Effort (hr)**	**LPUE (kg/h)**
1995	94.23	63.56	1.48	9.55	6.43	1.49
1996	133.66	60.04	2.23	14.20	9.73	1.46
1997	119.84	65.10	1.84	38.79	16.13	2.40
1998	96.72	72.30	1.34	21.38	14.94	1.43
1999	60.05	51.66	1.16	10.40	8.01	1.30
2000	28.78	60.60	0.47	11.40	9.90	1.15
2001	23.82	69.43	0.34	10.93	16.33	0.67
2002	42.30	77.69	0.54	16.42	20.86	0.79
2003	26.35	86.79	0.30	13.80	20.91	0.66
2004	26.62	96.99	0.27	5.04	19.38	0.26
2005	22.78	124.40	0.18	6.46	14.81	0.44
2006	24.58	118.36	0.21	5.10	14.79	0.34

	IR-TBB-7G			IR-GN-7G
Year	**Landings (t)**	**Effort (hr)**	**LPUE (kg/h)**	**Landings (t)**
1995	37.92	20.78	1.83	0.90
1996	53.02	26.76	1.98	1.35
1997	94.59	28.25	3.35	1.17
1998	122.13	35.25	3.46	0.00
1999	25.80	40.87	0.63	0.48
2000	12.62	37.03	0.34	2.54
2001	4.80	39.71	0.12	0.30
2002	7.08	31.62	0.22	0.36
2003	9.37	49.26	0.19	0.20
2004	6.17	54.86	0.11	0.33
2005	9.49	49.65	0.19	0.12
2006	14.40	60.35	0.24	0.09

	BELGIAN Beam Trawl VIIfg		
Year	**Landings (t)**	**Effort (hr)**	**LPUE (kg/h)**
1996	356.89	55.31	6.45
1997	474.71	64.47	7.36
1998	443.38	62.08	7.14
1999	410.22	57.17	7.18
2000	230.63	52.41	4.40
2001	274.84	55.80	4.93
2002	259.80	50.69	5.13
2003	215.95	63.58	3.40
2004	207.27	82.25	2.52
2005	153.73	70.03	2.20
2006	134.44	59.72	2.25

Table 4.4.4 CELTIC SEA PLAICE.
Annual length distribution by fleet 2006

	UK (England & Wales)		Ireland	Belgium
Length (cm)	Beam trawl	All gears (exc beam)	All gears	Beam trawl
21			14	
22			27	
23	254		96	
24	3163	535	410	294
25	3915	3441	779	5504
26	5366	9732	1885	38707
27	8186	17014	4289	104808
28	9038	17425	6597	106429
29	10688	25803	8974	106493
30	9415	19132	8004	73278
31	8145	17954	7526	35711
32	5346	12459	7717	31286
33	5097	12975	6584	24081
34	3815	5990	6174	17603
35	2892	7539	6857	15620
36	2006	3731	6638	11417
37	1692	5457	6037	9824
38	1357	4570	4152	7104
39	1247	4453	3319	4332
40	866	1896	3305	4392
41	642	501	2295	2846
42	516	1715	1625	1918
43	349	971	1666	1123
44	332	250	1243	560
45	284	341	1093	851
46	162	268	983	249
47	142	98	847	263
48	73	60	396	132
49	68	57	847	114
50	75		546	123
51	28	4	219	190
52	22	167	137	72
53	30		164	46
54	56		68	39
55	33	10	82	
56	37		123	19
57			55	
58	9		55	
59				135
60	10			
61			14	
62				
63			14	
64				
65			14	
66				
67				
68			14	
Total	85355	174548	101884	605564

Table 4.4.5 VIIfg Plaice: Catch numbers at age

Run title : CELTIC SEA PLAICE,2007 WG,COMBSEX,PLUSGROUP.
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Table 1 Catch numbers at age Numbers*10**-3

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	989,	851,	877,	1921,	822,	300,	750,	704,	1461,	703,
3,	426,	903,	673,	1207,	2111,	1180,	560,	918,	2503,	2595,
4,	411,	291,	638,	658,	681,	955,	827,	343,	393,	1332,
5,	105,	136,	72,	146,	109,	443,	372,	373,	102,	156,
6,	72,	76,	70,	21,	54,	86,	92,	209,	177,	59,
7,	37,	47,	34,	16,	53,	51,	44,	70,	62,	48,
8,	59,	23,	8,	16,	11,	14,	27,	41,	25,	32,
+gp,	75,	98,	46,	32,	44,	60,	23,	42,	38,	24,
TOTALNUM,	2174,	2425,	2418,	4017,	3885,	3089,	2695,	2700,	4761,	4949,
TONSLAND,	757,	875,	863,	1373,	1377,	1303,	1146,	1210,	1752,	1691,
SOPCOF %,	101,	103,	102,	101,	100,	101,	100,	100,	100,	100,

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	434,	967,	797,	164,	279,	800,	1019,	428,	488,	812,
3,	1883,	2099,	3550,	2078,	1072,	526,	1179,	936,	572,	734,
4,	1812,	1568,	1807,	2427,	1193,	357,	284,	730,	743,	514,
5,	772,	612,	741,	655,	578,	471,	139,	164,	334,	219,
6,	156,	413,	160,	242,	179,	275,	185,	117,	117,	137,
7,	22,	65,	98,	86,	94,	80,	115,	86,	57,	59,
8,	125,	16,	24,	70,	78,	21,	61,	92,	48,	37,
+gp,	76,	73,	23,	46,	79,	96,	59,	64,	131,	96,
TOTALNUM,	5280,	5813,	7200,	5768,	3552,	2626,	3041,	2617,	2490,	2608,
TONSLAND,	1901,	2116,	2151,	2082,	1501,	1188,	1114,	1070,	1028,	952,
SOPCOF %,	100,	100,	100,	100,	101,	100,	100,	101,	101,	100,

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	420,	426,	243,	320,	651,	172,	239,	126,	204,	331,
3,	1318,	921,	982,	606,	371,	665,	571,	579,	329,	458,
4,	929,	849,	802,	482,	323,	545,	465,	428,	268,	139,
5,	272,	287,	372,	203,	199,	184,	150,	261,	135,	133,
6,	121,	96,	116,	145,	108,	114,	85,	46,	74,	75,
7,	60,	82,	45,	53,	62,	65,	34,	27,	25,	50,
8,	20,	39,	27,	22,	23,	24,	26,	15,	14,	12,
+gp,	82,	56,	69,	32,	28,	28,	24,	17,	17,	15,
TOTALNUM,	3222,	2756,	2656,	1862,	1763,	1797,	1593,	1499,	1064,	1214,
TONSLAND,	1217,	1067,	968,	718,	714,	646,	594,	510,	389,	403,
SOPCOF %,	100,	100,	100,	100,	103,	100,	100,	100,	101,	101,

Table 4.4.6 VIIfg Plaice: Catch weights at age

Run title : CELTIC SEA PLAICE,2007 WG,COMBSEX,PLUSGROUP.
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Table 2 Catch weights at age (kg)

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	.0780,	.1940,	.0760,	.1180,	.1850,	.1510,	.1780,	.2760,	.1350,	.0000,
2,	.2050,	.2580,	.2030,	.2380,	.2550,	.2450,	.2740,	.3240,	.2510,	.1600,
3,	.3230,	.3230,	.3250,	.3540,	.3300,	.3390,	.3690,	.3840,	.3630,	.3010,
4,	.4300,	.3890,	.4400,	.4670,	.4120,	.4330,	.4640,	.4550,	.4700,	.4340,
5,	.5280,	.4570,	.5500,	.5760,	.5000,	.5260,	.5590,	.5380,	.5720,	.5590,
6,	.6150,	.5250,	.6520,	.6820,	.5950,	.6200,	.6540,	.6330,	.6700,	.6770,
7,	.6930,	.5950,	.7490,	.7840,	.6950,	.7140,	.7490,	.7390,	.7630,	.7870,
8,	.7600,	.6660,	.8390,	.8820,	.8020,	.8080,	.8440,	.8570,	.8510,	.8890,
+gp,	.8762,	.8435,	1.0653,	1.1812,	1.1824,	1.0948,	1.1579,	1.2661,	1.0036,	1.1033,
SOPCOFAC,	1.0053,	1.0265,	1.0226,	1.0136,	1.0043,	1.0126,	.9997,	1.0003,	1.0048,	.9997,

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	.1290,	.2600,	.1020,	.2400,	.2000,	.1480,	.1720,	.1450,	.2200,	.2220,
2,	.2080,	.2880,	.1760,	.2700,	.2600,	.2570,	.2470,	.2400,	.2640,	.2600,
3,	.2880,	.3250,	.2550,	.3090,	.3270,	.3620,	.3260,	.3310,	.3190,	.3090,
4,	.3680,	.3700,	.3370,	.3580,	.4000,	.4640,	.4070,	.4200,	.3820,	.3680,
5,	.4490,	.4230,	.4230,	.4160,	.4810,	.5630,	.4920,	.5060,	.4560,	.4380,
6,	.5300,	.4840,	.5140,	.4830,	.5670,	.6580,	.5800,	.5890,	.5390,	.5190,
7,	.6120,	.5540,	.6080,	.5600,	.6610,	.7500,	.6710,	.6700,	.6320,	.6090,
8,	.6940,	.6330,	.7060,	.6460,	.7610,	.8390,	.7650,	.7470,	.7350,	.7110,
+gp,	.8632,	.8887,	.9932,	.9097,	1.0465,	1.0399,	1.0061,	.9077,	1.0351,	.9946,
SOPCOFAC,	1.0034,	1.0026,	1.0007,	1.0010,	1.0115,	1.0023,	1.0031,	1.0138,	1.0104,	1.0002,

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
AGE										
1,	.1810,	.1880,	.0960,	.1450,	.2480,	.1320,	.1830,	.1410,	.1750,	.2570,
2,	.2480,	.2480,	.1880,	.2260,	.2990,	.2020,	.2400,	.2040,	.2290,	.2610,
3,	.3180,	.3160,	.2790,	.3090,	.3540,	.2780,	.3050,	.2730,	.2920,	.2840,
4,	.3920,	.3900,	.3690,	.3940,	.4140,	.3580,	.3800,	.3470,	.3660,	.3260,
5,	.4690,	.4710,	.4570,	.4810,	.4780,	.4440,	.4630,	.4260,	.4490,	.3860,
6,	.5500,	.5590,	.5450,	.5700,	.5470,	.5350,	.5560,	.5110,	.5420,	.4650,
7,	.6340,	.6550,	.6310,	.6610,	.6200,	.6320,	.6570,	.6010,	.6450,	.5630,
8,	.7230,	.7570,	.7160,	.7530,	.6970,	.7330,	.7670,	.6970,	.7570,	.6800,
+gp,	.9972,	1.1417,	1.0022,	1.0422,	.9739,	1.0389,	1.0235,	.9394,	1.0416,	.9720,
SOPCOFAC,	1.0010,	1.0030,	1.0021,	1.0050,	1.0277,	1.0011,	1.0037,	1.0008,	1.0100,	1.0090,

Table 4.4.7 VIIfg Plaice: Stock weights at age

Run title : CELTIC SEA PLAICE,2007 WG,COMBSEX,PLUSGROUP.
At 20/06/2007 14:33

Table 3 Stock weights at age (kg)

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	.1120,	.0860,	.1070,	.1090,	.0820,	.0960,	.1030,	.2560,	.0750,	.0000,
2,	.2160,	.1700,	.2120,	.2170,	.1670,	.1920,	.2060,	.2980,	.1930,	.0870,
3,	.3150,	.2520,	.3130,	.3220,	.2570,	.2880,	.3070,	.3520,	.3070,	.2320,
4,	.4060,	.3340,	.4120,	.4260,	.3500,	.3830,	.4080,	.4180,	.4170,	.3690,
5,	.4920,	.4140,	.5070,	.5280,	.4470,	.4790,	.5070,	.4950,	.5210,	.4980,
6,	.5700,	.4930,	.5990,	.6280,	.5480,	.5740,	.6060,	.5840,	.6210,	.6190,
7,	.6420,	.5700,	.6890,	.7270,	.6530,	.6680,	.7040,	.6850,	.7170,	.7330,
8,	.7070,	.6460,	.7750,	.8230,	.7620,	.7630,	.8010,	.7970,	.8080,	.8390,
+gp,	.8389,	.8218,	1.0148,	1.1318,	1.1290,	1.0492,	1.1136,	1.1897,	.9646,	1.0635,

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	.0890,	.2490,	.0660,	.2280,	.1730,	.0920,	.1350,	.0970,	.2010,	.2070,
2,	.1680,	.2730,	.1390,	.2540,	.2290,	.2030,	.2090,	.1930,	.2410,	.2400,
3,	.2480,	.3050,	.2150,	.2880,	.2930,	.3100,	.2860,	.2860,	.2900,	.2840,
4,	.3280,	.3460,	.2950,	.3320,	.3630,	.4140,	.3660,	.3760,	.3490,	.3380,
5,	.4080,	.3950,	.3800,	.3860,	.4400,	.5140,	.4500,	.4630,	.4180,	.4020,
6,	.4890,	.4530,	.4680,	.4480,	.5230,	.6110,	.5360,	.5480,	.4960,	.4770,
7,	.5710,	.5180,	.5600,	.5200,	.6130,	.7050,	.6250,	.6300,	.5850,	.5630,
8,	.6530,	.5930,	.6570,	.6020,	.7100,	.7950,	.7180,	.7090,	.6820,	.6590,
+gp,	.8219,	.8373,	.9380,	.8537,	.9870,	1.0002,	.9544,	.8723,	.9712,	.9302,

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,
AGE										
1,	.1490,	.1610,	.0490,	.1050,	.2240,	.0990,	.1580,	.1110,	.1520,	.2630,
2,	.2140,	.2170,	.1420,	.1850,	.2730,	.1670,	.2100,	.1720,	.2010,	.2570,
3,	.2820,	.2810,	.2340,	.2680,	.3260,	.2390,	.2710,	.2380,	.2590,	.2700,
4,	.3540,	.3520,	.3240,	.3520,	.3840,	.3170,	.3410,	.3090,	.3280,	.3020,
5,	.4300,	.4300,	.4130,	.4380,	.4460,	.4010,	.4200,	.3860,	.4060,	.3530,
6,	.5090,	.5140,	.5010,	.5250,	.5120,	.4890,	.5080,	.4680,	.4940,	.4230,
7,	.5920,	.6060,	.5880,	.6150,	.5830,	.5830,	.6050,	.5560,	.5920,	.5120,
8,	.6780,	.7050,	.6730,	.7070,	.6580,	.6820,	.7110,	.6480,	.7000,	.6190,
+gp,	.9476,	1.0787,	.9622,	.9934,	.9283,	.9806,	.9582,	.8852,	.9730,	.8928,

Table 4.4.8 VIIfg plaice : Survey abundance indices

UK Sept beam trawl survey (No/100km)

Age	*0*	*1*	*2*	*3*	*4*	*5*
1990	17.2	230.5	307.8	91.6	21.5	8.6
1991	1.6	681.5	26.7	52.7	17.0	9.7
1992	2.4	389.4	245.4	10.4	4.0	12.0
1993	3.1	94.0	83.8	34.5	1.6	3.9
1994	119.2	105.1	33.1	16.6	9.1	0.8
1995	1.0	241.0	84.5	16.3	3.8	7.7
1996	8.2	216.2	282.5	32.8	0.8	2.5
1997	6.9	222.1	98.1	33.6	4.3	1.7
1998	4.8	228.3	131.8	48.7	10.5	3.8
1999	168.2	149.4	79.4	29.0	19.6	9.4
2000	84.9	343.4	53.8	24.5	6.6	4.7
2001	30.5	211.5	144.6	15.2	9.3	4.2
2002	0.9	124.0	159.1	71.8	5.1	5.1
2003	52.7	92.9	79.5	59.0	20.6	2.7
2004	162.9	254.1	32.4	26.5	13.7	2.0
2005	2.5	192.3	74.7	21.0	8.4	10.9
2006	77.1	85.4	102.0	34.0	9.9	1.7

Irish Sea Celtic Sea GFS (No/30min towed)

Age	*0*	*1*	*2*	*3*	*4*	*5*	*6*
1997	6.1	37	35	12	3.8	1.4	0.4
1998	5	23	29	10	3.5	1.1	0.4
1999	0.4	92	79	18	3.2	0.5	0.3
2000	56	696	361	8.5	7.1	0.4	0.2
2001	0.2	9.5	30	20.1	6.3	7.3	3.1
2002	4	80	85	48	10.9	4.7	0.2

New Irish Groundfish survey – Celtic Explorer (IBTS Q4) (No/60min towed)

Age	*1*	*2*	*3*	*4*	*5*	*6*	*7*
2003	0	3.25	6.06	2.67	0.58	0.22	0.07
2004	0.12	0.37	1.90	3.12	1.22	0.80	0.06
2005	2.77	4.47	5.89	1.35	0.64	0.21	0.21
2006	0.17	6.02	4.59	1.26	1.03	0.63	0.69

Table 4.4.9 VIIfg plaice : Tuning data available to the working group

(figures used in the assessment shown in bold)

UK (E+W) BEAM TRAWL VIIF.
1990 2006 Thousands of hours, numbers in thousands.
1 1 0 1
1 8

30.8	0.0	1.6	68.2	**159.5**	**46.3**	**26.6**	**11.0**	**9.2**
40.8	9.4	22.6	74.4	**141.5**	**87.1**	**29.0**	**15.1**	**14.1**
35.8	1.6	39.9	27.3	**32.0**	**46.7**	**27.4**	**7.5**	**2.3**
39.6	1.0	40.9	139.5	**25.0**	**15.5**	**24.6**	**15.1**	**7.3**
37.0	12.6	31.7	52.4	**49.1**	**9.2**	**9.1**	**7.6**	**9.8**
37.6	1.0	28.3	30.0	**39.5**	**29.7**	**9.9**	**5.8**	**6.4**
39.8	0.0	74.6	53.8	**13.6**	**13.6**	**12.8**	**3.8**	**4.4**
43.0	0.6	40.7	112.3	**23.7**	**8.4**	**6.7**	**4.5**	**0.7**
47.8	2.7	54.1	73.9	**63.1**	**17.5**	**3.6**	**4.3**	**2.7**
50.8	0.8	22.1	64.2	**52.5**	**25.8**	**7.7**	**2.4**	**1.9**
51.2	0.6	11.9	26.0	**26.9**	**17.8**	**12.7**	**4.9**	**1.8**
49.3	2.8	42.5	27.7	**27.5**	**17.7**	**10.1**	**5.9**	**2.4**
37.5	0.5	19.4	40.3	**16.8**	**7.8**	**7.4**	**3.5**	**1.8**
40.7	1.6	27.7	43.2	**33.8**	**9.9**	**4.9**	**3.4**	**2.4**
32.4	0.9	12.2	34.5	**25.8**	**17.5**	**3.4**	**2.5**	**2.0**
27.7	1.5	12.0	9.1	**12.7**	**7.5**	**5.0**	**1.9**	**1.1**
18.6	0.6	10.2	17.7	**4.5**	**4.4**	**3.0**	**1.6**	**0.4**

UK(E+W) OTTER TRAWL VIIF
1989 2006 Thousands of hours, numbers in thousands.
1 1 0 1
1 8

17.6	0.8	91.2	256.0	**62.0**	**23.1**	**7.4**	**5.1**	**0.4**
22.6	0.1	6.4	97.0	**129.1**	**34.2**	**13.3**	**4.1**	**4.4**
18.6	5.2	13.6	46.9	**78.8**	**36.9**	**16.5**	**4.4**	**5.0**
16.0	3.6	68.2	14.6	**12.5**	**18.5**	**8.5**	**1.4**	**0.4**
13.8	1.3	25.3	42.1	**8.8**	**3.9**	**6.3**	**4.1**	**2.7**
9.5	4.2	11.7	20.5	**15.1**	**2.7**	**3.1**	**1.4**	**1.7**
8.5	5.1	37.8	18.2	**14.5**	**5.5**	**1.6**	**0.8**	**0.7**
8.7	0.0	35.8	20.6	**4.3**	**3.4**	**2.5**	**1.0**	**1.1**
8.1	0.4	16.5	33.7	**5.5**	**1.2**	**0.7**	**0.4**	**0.1**
7.1	0.4	7.8	11.0	**8.6**	**2.0**	**0.5**	**0.7**	**0.2**
5.7	1.0	8.3	12.2	**7.9**	**3.8**	**0.9**	**0.2**	**0.1**
4.1	0.5	9.3	11.4	**6.5**	**2.5**	**1.3**	**0.4**	**0.1**
4.4	1.4	11.1	4.9	**4.0**	**2.4**	**1.3**	**0.6**	**0.2**
6.1	0.0	4.4	8.3	**3.0**	**1.5**	**1.1**	**0.4**	**0.2**
9.9	0.6	11.9	16.2	**9.3**	**2.1**	**1.3**	**0.9**	**0.6**
9.4	0.3	4.3	14.3	**10.4**	**5.8**	**0.9**	**0.5**	**0.3**
12.1	1.5	10.0	5.4	**5.5**	**2.8**	**1.5**	**0.5**	**0.3**
13.0	0.7	12.8	23.3	**6.8**	**6.4**	**4.5**	**2.3**	**0.6**

E+W B/T Survey
1990 2006 (Effort in Km towed, Numbers caught; all stations)
1 1 0.75 0.85 (Revised 24.8.94 - recalculated using BC ALK and Depth Band LDs)
1 6

69.86	**161**	**215**	**64**	**15**	**6**	0
123.41	**841**	**33**	**65**	**21**	**12**	3
125.08	**487**	**307**	**13**	**5**	**15**	2
127.67	**120**	**107**	**44**	**2**	**5**	1
120.82	**127**	**40**	**20**	**11**	**1**	0
104.14	**251**	**88**	**17**	**4**	**8**	1
122.11	**264**	**345**	**40**	**1**	**3**	1
116.18	**258**	**114**	**39**	**5**	**2**	1
104.70	**239**	**138**	**51**	**11**	**4**	2
117.11	**175**	**93**	**34**	**23**	**11**	0
105.99	**364**	**57**	**26**	**7**	**5**	0
118.22	**250**	**171**	**18**	**11**	**5**	5
116.92	**145**	**186**	**84**	**6**	**6**	2
111.92	**104**	**89**	**66**	**23**	**3**	2
101.92	**259**	**33**	**27**	**14**	**2**	1
119.11	**229**	**89**	**25**	**10**	**13**	3
120.63	**103**	**123**	**41**	**12**	**2**	11

Table 4.4.9 (cont.)

```
IR-ISCSGFS : Irish Sea Celtic Sea GFS (VIIg) - Plaice number per 30 min towed
(Prime stations only)
1997 2002
1 1 0.8 0.9
0 6
1   6.1  37   35  12   3.8  1.4  0.4
1   5.0  23   29  10   3.5  1.1  0.4
1   0.4  92   79  18   3.2  0.5  0.3
1  56   696  361   8.5 7.1  0.4  0.2
1   0.2   9.5 30  20.1 6.3  7.3  3.1
1   4.0  80   85  48  10.9  4.7  0.2

IRGFS : Irish Groundfish Survey (IBTS 4th qtr VIIg)
2003 2006
1 1 0.79 0.92
2 7
 832  45  84  37  8  3  1  2003
 980   6  31  51 20 13  1
 845  63  83  19  9  3  3  2005
1046 105  80  22 18 11 12

IR-OTB : Irish VIIg Otter trawl (First provided to 2007WG)
2004 2006
1 1 1 1
2 10
 96991   0.9  7.7  23.3  16.8  9.0  2.7  1.2  0.4  0.4
124395   1.3  7.1  11.5  15.1  9.0  4.0  1.9  1.9  1.4
118364   2.0  8.8   8.2  10.6 11.9  8.3  2.7  1.3  0.9
```

<u>Fleets removed from the historical series:</u>

Belgium beam trawl series - no data since 1999.
UK(E&W) March Groundfish survey (WCGFS) – plaice catches low, new vessel and last survey of the series in 2004.

Table 4.4.10 XSA Tuning Diagnostics

```
Lowestoft VPA Version 3.1

   28/06/2007   8:54

 Extended Survivors Analysis

 CELTIC SEA PLAICE,2007 WG,COMBSEX,PLUSGROUP.

 CPUE data from file c:\temp_assess\p7fg_wg07\vpa data\p7ftun3c.dat

 Catch data for  30 years. 1977 to 2006. Ages  1 to   9.

      Fleet,            First, Last, First, Last, Alpha,  Beta
                      ,    year, year,  age ,  age
 UK (E+W) BEAM TRAWL ,   1990, 2006,   4,     8,   .000,  1.000
 UK(E+W) OTTER TRAWL ,   1989, 2006,   4,     8,   .000,  1.000
 E+W B/T Survey      ,   1990, 2006,   1,     5,   .750,   .850


 Time series weights :

      Tapered time weighting not applied

 Catchability analysis :

      Catchability dependent on stock size for ages <    6

         Regression type = C
         Minimum of   5 points used for regression
         Survivor estimates shrunk to the population mean for ages <  6

      Catchability independent of age for ages >=    7

 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 =   2.500

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

      Prior weighting not applied


 Tuning had not converged after   30 iterations


 Total absolute residual between iterations
 29 and  30 =     .00067

 Final year F values
 Age          ,      1,      2,      3,      4,      5,      6,      7,      8
 Iteration 29,  .0000,  .1305,  .2639,  .2449,  .4007,  .2652,  .4361,  .3636
 Iteration 30,  .0000,  .1305,  .2639,  .2449,  .4006,  .2652,  .4358,  .3633

 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

      1,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000,  .000
      2,  .140,  .165,  .139,  .190,  .271,  .086,  .142,  .101,  .088,  .130
      3,  .537,  .466,  .628,  .542,  .320,  .444,  .412,  .536,  .375,  .264
      4,  .898,  .727,  .875,  .661,  .565,  .981,  .580,  .565,  .462,  .245
      5,  .822,  .707,  .751,  .510,  .571,  .670,  .726,  .690,  .315,  .401
      6,  .608,  .708,  .634,  .677,  .509,  .688,  .688,  .458,  .379,  .265
      7,  .607, 1.020,  .788,  .606,  .621,  .603,  .409,  .431,  .435,  .436
      8, 1.079,  .945, 1.102, 1.051,  .512,  .484,  .466,  .294,  .381,  .363
```

Table 4.4.10 XSA Tuning Diagnostics (continued)

XSA population numbers (Thousands)

YEAR	AGE 1	2	3	4	5	6	7	8
1997	3.35E+03	3.40E+03	3.37E+03	1.66E+03	5.15E+02	2.82E+02	1.40E+02	3.22E+01
1998	2.25E+03	2.97E+03	2.62E+03	1.75E+03	6.01E+02	2.01E+02	1.36E+02	6.77E+01
1999	2.21E+03	1.99E+03	2.24E+03	1.46E+03	7.48E+02	2.63E+02	8.78E+01	4.36E+01
2000	3.28E+03	1.96E+03	1.54E+03	1.06E+03	5.40E+02	3.13E+02	1.24E+02	3.54E+01
2001	2.48E+03	2.91E+03	1.44E+03	7.93E+02	4.85E+02	2.87E+02	1.41E+02	5.99E+01
2002	2.17E+03	2.20E+03	1.97E+03	9.26E+02	4.00E+02	2.43E+02	1.53E+02	6.72E+01
2003	1.57E+03	1.92E+03	1.79E+03	1.12E+03	3.08E+02	1.82E+02	1.08E+02	7.43E+01
2004	2.91E+03	1.39E+03	1.48E+03	1.05E+03	5.57E+02	1.32E+02	8.09E+01	6.38E+01
2005	3.24E+03	2.58E+03	1.12E+03	7.68E+02	5.30E+02	2.48E+02	7.41E+01	4.66E+01
2006	2.24E+03	2.87E+03	2.10E+03	6.81E+02	4.29E+02	3.43E+02	1.51E+02	4.25E+01

Estimated population abundance at 1st Jan 2007

, 0.00E+00, 1.99E+03, 2.24E+03, 1.43E+03, 4.73E+02, 2.55E+02, 2.34E+02, 8.64E+01,

Taper weighted geometric mean of the VPA populations:

, 3.98E+03, 3.60E+03, 2.60E+03, 1.37E+03, 5.96E+02, 2.89E+02, 1.42E+02, 7.24E+01,

Standard error of the weighted Log(VPA populations) :

, .5457, .5348, .5632, .5619, .5580, .5426, .5962, .7714,

Table 4.4.10 XSA Tuning Diagnostics (continued)

```
Log catchability residuals.


Fleet : UK (E+W) BEAM TRAWL

 Age  ,  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,   .00,   .24,   .23,   .23,   .08,   .08,  -.45
    5 , 99.99,   .01,   .03,   .10,  -.04,  -.06,   .24,  -.08
    6 , 99.99,   .89,   .42,   .15,   .39,  -.19,   .41,   .32
    7 , 99.99,  -.06,   .91,  -.30,  -.01,  -.13,  -.12,   .39
    8 , 99.99,   .14,   .31,  -.21,   .04,   .11,   .19,   .03


 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 ,  -.48,  -.02,   .04,  -.12,   .18,   .00,   .09,   .12,   .06,  -.29
    5 ,  -.28,  -.08,  -.09,  -.06,   .09,  -.03,   .34,   .23,  -.25,  -.09
    6 ,  -.35,  -.69,  -.30,   .04,  -.14,   .07,  -.13,  -.05,  -.18,  -.67
    7 ,  -.03,   .02,  -.28,   .00,   .10,  -.24,  -.09,   .13,   .10,  -.38
    8 ,  -.22,   .22,   .31,   .44,   .01,  -.13,  -.04,   .08,  -.01,  -.53


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


   Age ,          6,          7,          8
Mean Log q,   -6.8091,   -6.8235,   -6.8235,
S.E(Log q),     .4089,     .2994,     .2387,



Regression statistics :

Ages with q dependent on year class strength

Age, Slope , t-value , Intercept, RSquare, No Pts, Reg s.e, Mean Log q

 4,     .63,    3.047,      7.02,     .82,     17,     .23,   -6.96,
 5,     .61,    3.856,      6.70,     .87,     17,     .17,   -6.89,

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

 6,     .71,    1.940,      6.49,     .74,     17,     .27,   -6.81,
 7,    1.07,    -.451,      6.94,     .75,     17,     .33,   -6.82,
 8,     .92,    1.117,      6.60,     .93,     17,     .21,   -6.78,
```

Table 4.4.10 XSA Tuning Diagnostics (continued)

Fleet : UK(E+W) OTTER TRAWL

Age	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	-.09	.05	.32	-.05	.02	.07	.26	-.45
5	.00	.06	.05	.05	-.32	-.05	.11	-.04
6	-.26	.57	.70	-.16	.14	.15	.14	.27
7	-.05	-.49	.71	-.92	-.02	-.22	-.37	.82
8	-.05	-.04	.31	-.91	.34	-.03	-.29	.41

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	-.54	-.22	.10	.45	.31	-.16	-.01	.17	-.19	-.04
5	-.56	-.31	.07	.27	.32	.00	.18	.30	-.43	.32
6	-.88	-.70	-.20	.34	.28	.04	.01	-.09	-.50	.15
7	-.54	.35	-.34	.26	.48	-.35	.24	.00	-.16	.59
8	-.26	-.23	-.20	.32	.18	-.27	.24	-.33	-.23	.48

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

Age	6	7	8
Mean Log q	-6.8660	-7.0689	-7.0689
S.E(Log q)	.4074	.4749	.3521

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
4	.72	2.238	6.82	.80	18	.27	-6.68
5	.68	2.244	6.69	.75	18	.26	-6.81

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
6	.79	1.248	6.64	.69	18	.32	-6.87
7	1.37	-1.381	7.78	.47	18	.63	-7.07
8	.94	.518	6.95	.84	18	.34	-7.10

Table 4.4.10 XSA Tuning Diagnostics (continued)

```
Fleet : E+W B/T Survey

 Age  ,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996
    1 , 99.99,   .48,   .79,   .29,  -.72,  -.92,  -.35,  -.15
    2 , 99.99,   .73,  -.51,   .21,  -.39,  -.64,  -.34,   .20
    3 , 99.99,   .32,   .65,  -.72,  -.19,  -.82,  -.59,  -.27
    4 , 99.99,   .11,   .24,  -.55, -1.31,   .03,  -.66, -2.17
    5 , 99.99,  -.10,  -.28,   .29,  -.13, -1.05,   .42,  -.37
    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


 Age  ,  1997,  1998,  1999,  2000,  2001,  2002,  2003,  2004,  2005,  2006
    1 ,   .01,   .44,   .03,   .47,   .26,  -.15,  -.12,   .29,  -.10,  -.56
    2 ,  -.22,   .12,   .17,  -.04,   .26,   .51,   .21,  -.09,  -.15,  -.03
    3 ,  -.33,   .24,   .01,   .14,  -.45,   .89,   .77,   .25,   .17,  -.06
    4 ,  -.64,   .10,  1.05,   .06,   .63,   .20,  1.12,   .75,   .47,   .58
    5 ,  -.41,   .00,   .54,   .15,   .21,   .62,   .40,  -.47,   .72,  -.53
    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


Regression statistics :

Ages with q dependent on year class strength

Age, Slope , t-value , Intercept, RSquare, No Pts, Reg s.e, Mean Log q

 1,    1.02,    -.046,      7.22,     .35,     17,     .47,   -7.23,
 2,     .67,    1.176,      7.79,     .45,     17,     .37,   -7.73,
 3,    1.01,    -.016,      8.36,     .35,     17,     .52,   -8.36,
 4,    1.04,    -.087,      9.20,     .23,     17,     .88,   -9.12,
 5,     .81,     .650,      8.50,     .43,     17,     .50,   -9.00,
```

Table 4.4.10 XSA Tuning Diagnostics (continued)

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 2005

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
UK (E+W) BEAM TRAWL ,	1.,	.000,	.000,	.00,	0,	.000,	.000
UK(E+W) OTTER TRAWL ,	1.,	.000,	.000,	.00,	0,	.000,	.000
E+W B/T Survey ,	1138.,	.518,	.000,	.00,	1,	.516,	.000
P shrinkage mean ,	3603.,	.53,,,,				.484,	.000
F shrinkage mean ,	0.,	2.50,,,,				.000,	.000

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
1989.,	.37,	.80,	2,	2.155,	.000

Age 2 Catchability dependent on age and year class strength

Year class = 2004

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
UK (E+W) BEAM TRAWL ,	1.,	.000,	.000,	.00,	0,	.000,	.000
UK(E+W) OTTER TRAWL ,	1.,	.000,	.000,	.00,	0,	.000,	.000
E+W B/T Survey ,	2093.,	.354,	.035,	.10,	2,	.679,	.139
P shrinkage mean ,	2603.,	.56,,,,				.305,	.113
F shrinkage mean ,	2111.,	2.50,,,,				.015,	.138

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
2238.,	.30,	.07,	4,	.240,	.130

Age 3 Catchability dependent on age and year class strength

Year class = 2003

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
UK (E+W) BEAM TRAWL ,	1.,	.000,	.000,	.00,	0,	.000,	.000
UK(E+W) OTTER TRAWL ,	1.,	.000,	.000,	.00,	0,	.000,	.000
E+W B/T Survey ,	1465.,	.295,	.136,	.46,	3,	.714,	.258
P shrinkage mean ,	1371.,	.56,,,,				.272,	.273
F shrinkage mean ,	828.,	2.50,,,,				.014,	.419

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
1427.,	.26,	.09,	5,	.342,	.264

Table 4.4.10 XSA Tuning Diagnostics (continued)

Age 4 Catchability dependent on age and year class strength

Year class = 2002

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
UK (E+W) BEAM TRAWL ,	355.,	.500,	.000,	.00,	1,	.193,	.315
UK(E+W) OTTER TRAWL ,	454.,	.500,	.000,	.00,	1,	.193,	.254
E+W B/T Survey ,	509.,	.287,	.139,	.48,	4,	.406,	.230
P shrinkage mean ,	596.,	.56,,,,				.198,	.199
F shrinkage mean ,	148.,	2.50,,,,				.010,	.634

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
473.,	.21,	.10,	8,	.463,	.245

Age 5 Catchability dependent on age and year class strength

Year class = 2001

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
UK (E+W) BEAM TRAWL ,	246.,	.363,	.074,	.20,	2,	.247,	.412
UK(E+W) OTTER TRAWL ,	288.,	.363,	.247,	.68,	2,	.247,	.362
E+W B/T Survey ,	223.,	.283,	.190,	.67,	5,	.305,	.446
P shrinkage mean ,	289.,	.54,,,,				.192,	.361
F shrinkage mean ,	154.,	2.50,,,,				.009,	.597

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
255.,	.19,	.09,	11,	.466,	.401

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
UK (E+W) BEAM TRAWL ,	161.,	.304,	.216,	.71,	3,	.366,	.365
UK(E+W) OTTER TRAWL ,	223.,	.304,	.198,	.65,	3,	.366,	.276
E+W B/T Survey ,	433.,	.280,	.090,	.32,	5,	.259,	.152
F shrinkage mean ,	97.,	2.50,,,,				.009,	.547

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
234.,	.17,	.14,	12,	.824,	.265

Table 4.4.10 XSA Tuning Diagnostics (continued)

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

Year class = 1999

Fleet,                  Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
    ,                   Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
UK (E+W) BEAM TRAWL ,        72.,   .287,       .129,     .45,   4,  .431,     .504
UK(E+W) OTTER TRAWL ,       101.,   .287,       .271,     .94,   4,  .431,     .383
E+W B/T Survey      ,        96.,   .294,       .301,    1.02,   5,  .127,     .399

  F shrinkage mean  ,        72.,   2.50,,,,                         .012,     .502

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
       86.,       .18,      .12,   14,    .666,   .436


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

Year class = 1998

Fleet,                  Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
    ,                   Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
UK (E+W) BEAM TRAWL ,        22.,   .274,       .161,     .59,   5,  .461,     .422
UK(E+W) OTTER TRAWL ,        31.,   .274,       .146,     .53,   5,  .461,     .319
E+W B/T Survey      ,        31.,   .311,       .146,     .47,   5,  .068,     .314

  F shrinkage mean  ,        29.,   2.50,,,,                         .011,     .338

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
       26.,       .18,      .09,   16,    .492,   .363
```

Table 4.4.11 VIIfg plaice: Fishing Mortalities

Run title : CELTIC SEA PLAICE,2007 WG,COMBSEX,PLUSGROUP.
At 28/06/2007 18:36

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.3501,	.3347,	.2376,	.3387,	.1952,	.1926,	.2917,	.0954,	.1876,	.1123,
3,	.5445,	.5648,	.4376,	.5381,	.6920,	.4290,	.5924,	.6301,	.5130,	.5330,
4,	.8498,	.8152,	.9281,	.9292,	.6041,	.7112,	.5506,	.8168,	.5511,	.5144,
5,	.4484,	.6925,	.4329,	.5020,	.3372,	.9378,	.6073,	.4674,	.5509,	.3991,
6,	.6853,	.6195,	.8665,	.1962,	.3174,	.4413,	.4525,	.7534,	.3839,	.6525,
7,	.6002,	1.2891,	.5670,	.4389,	.9592,	.5071,	.3856,	.6752,	.4716,	.1544,
8,	.6493,	.8592,	.7024,	.5189,	.5571,	.6527,	.5012,	.6818,	.4915,	.4319,
+gp,	.6493,	.8592,	.7024,	.5189,	.5571,	.6527,	.5012,	.6818,	.4915,	.4319,
FBAR 3- 6,	.6320,	.6730,	.6663,	.5414,	.4877,	.6298,	.5507,	.6669,	.4997,	.5248,

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.0652,	.1008,	.1399,	.0662,	.1657,	.2233,	.3159,	.1944,	.1596,	.2047,
3,	.4449,	.4582,	.5782,	.5823,	.7021,	.4831,	.5373,	.4857,	.3907,	.3473,
4,	.8082,	.7466,	.8305,	.9248,	.7164,	.4816,	.4749,	.6865,	.8202,	.6623,
5,	.5791,	.6419,	.8948,	.7529,	.5251,	.6275,	.3169,	.5039,	.7113,	.5488,
6,	.8051,	.6408,	.3083,	.7610,	.4248,	.4628,	.4887,	.4368,	.7486,	.6529,
7,	.4893,	.8700,	.2748,	.2470,	.6921,	.3102,	.3250,	.4010,	.3579,	1.0033,
8,	.6740,	.7290,	.8613,	.2939,	.3375,	.2895,	.3750,	.4253,	.3717,	.3782,
+gp,	.6740,	.7290,	.8613,	.2939,	.3375,	.2895,	.3750,	.4253,	.3717,	.3782,
FBAR 3- 6,	.6593,	.6219,	.6529,	.7553,	.5921,	.5138,	.4545,	.5282,	.6677,	.5528,

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,	FBAR **-**
AGE											
1,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,	.0000,
2,	.1404,	.1651,	.1387,	.1904,	.2709,	.0863,	.1416,	.1012,	.0876,	.1305,	.1064,
3,	.5372,	.4663,	.6280,	.5417,	.3200,	.4438,	.4125,	.5362,	.3748,	.2639,	.3916,
4,	.8980,	.7268,	.8750,	.6605,	.5649,	.9812,	.5795,	.5655,	.4624,	.2449,	.4243,
5,	.8218,	.7067,	.7511,	.5104,	.5711,	.6697,	.7261,	.6896,	.3151,	.4006,	.4684,
6,	.6080,	.7078,	.6336,	.6773,	.5093,	.6884,	.6883,	.4581,	.3786,	.2652,	.3673,
7,	.6066,	1.0197,	.7881,	.6060,	.6215,	.6028,	.4089,	.4313,	.4349,	.4358,	.4340,
8,	1.0794,	.9451,	1.1019,	1.0514,	.5117,	.4843,	.4664,	.2941,	.3805,	.3633,	.3460,
+gp,	1.0794,	.9451,	1.1019,	1.0514,	.5117,	.4843,	.4664,	.2941,	.3805,	.3633,	
FBAR 3- 6,	.7163,	.6519,	.7219,	.5975,	.4913,	.6958,	.6016,	.5623,	.3827,	.2936,	

Table 4.4.12 VIIfg plaice: Population numbers

Run title : CELTIC SEA PLAICE,2007 WG,COMBSEX,PLUSGROUP.

At 28/06/2007 18:36

Terminal Fs derived using XSA (With F shrinkage)

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

YEAR,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,
AGE										
1,	3582,	4965,	8005,	5550,	2050,	3549,	9262,	10227,	7920,	8228,
2,	3555,	3177,	4404,	7100,	4922,	1818,	3147,	8215,	9070,	7025,
3,	1077,	2222,	2016,	3080,	4488,	3592,	1330,	2085,	6623,	6669,
4,	762,	554,	1120,	1155,	1595,	1992,	2074,	652,	985,	3517,
5,	309,	289,	218,	393,	404,	773,	868,	1061,	256,	503,
6,	154,	175,	128,	125,	211,	256,	268,	419,	590,	131,
7,	87,	69,	83,	48,	91,	136,	146,	151,	175,	356,
8,	131,	42,	17,	42,	27,	31,	73,	88,	68,	97,
+gp,	166,	179,	96,	83,	109,	132,	62,	90,	103,	72,
TOTAL,	9824,	11672,	16088,	17575,	13898,	12279,	17231,	22989,	25791,	26598,

YEAR,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,
AGE										
1,	12071,	7309,	3065,	2187,	4786,	4504,	2900,	3961,	5253,	3839,
2,	7297,	10706,	6483,	2718,	1940,	4245,	3995,	2572,	3513,	4659,
3,	5568,	6063,	8585,	4999,	2257,	1458,	3012,	2583,	1878,	2656,
4,	3471,	3165,	3401,	4271,	2477,	992,	798,	1561,	1410,	1127,
5,	1865,	1372,	1331,	1315,	1502,	1073,	543,	440,	697,	551,
6,	300,	927,	640,	482,	549,	788,	508,	351,	236,	303,
7,	60,	119,	433,	417,	200,	318,	440,	276,	201,	99,
8,	271,	33,	44,	292,	289,	89,	207,	282,	164,	125,
+gp,	163,	149,	42,	191,	292,	404,	199,	195,	446,	322,
TOTAL,	31067,	29843,	24024,	16873,	14292,	13871,	12602,	12221,	13797,	13680,

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,	2007,	GMST 77-**	AMST 77-**
AGE													
1,	3351,	2246,	2210,	3285,	2485,	2169,	1572,	2907,	3241,	2242,	0,	4097,	4766,
2,	3405,	2972,	1992,	1960,	2913,	2204,	1924,	1394,	2578,	2874,	1989,	3676,	4262,
3,	3367,	2624,	2235,	1538,	1437,	1971,	1793,	1481,	1118,	2095,	2238,	2703,	3167,
4,	1665,	1745,	1460,	1058,	793,	926,	1121,	1053,	768,	681,	1427,	1435,	1675,
5,	515,	601,	748,	540,	485,	400,	308,	557,	530,	429,	473,	605,	711,
6,	282,	201,	263,	313,	287,	243,	182,	132,	248,	343,	255,	288,	337,
7,	140,	136,	88,	124,	141,	153,	108,	81,	74,	151,	234,	145,	174,
8,	32,	68,	44,	35,	60,	67,	74,	64,	47,	43,	86,	75,	102,
+gp,	130,	96,	108,	52,	74,	77,	69,	70,	56,	52,	58,		
TOTAL,	12888,	10690,	9148,	8905,	8676,	8209,	7150,	7739,	8660,	8911,	6760,		

Table 4.4.13 VIIfg plaice: Summary

Run title : CELTIC SEA PLAICE,2007 WG,COMBSEX,PLUSGROUP.

At 28/06/2007 18:36

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 3- 6,
1977,	3582,	2345,	1169,	757,	.6473,	.6320,
1978,	4965,	2132,	1010,	875,	.8661,	.6730,
1979,	8005,	3238,	1323,	863,	.6523,	.6663,
1980,	5550,	4079,	1789,	1373,	.7675,	.5414,
1981,	2050,	3201,	1793,	1377,	.7680,	.4877,
1982,	3549,	3258,	2055,	1303,	.6340,	.6298,
1983,	9262,	3689,	1941,	1146,	.5904,	.5507,
1984,	10227,	7123,	2303,	1210,	.5254,	.6669,
1985,	7920,	5568,	2645,	1752,	.6623,	.4997,
1986,	8228,	4207,	2830,	1691,	.5975,	.5248,
1987,	12071,	6072,	3269,	1901,	.5816,	.6593,
1988,	7309,	8854,	3831,	2116,	.5524,	.6219,
1989,	3065,	5069,	3173,	2151,	.6779,	.6529,
1990,	2187,	5326,	3427,	2082,	.6075,	.7553,
1991,	4786,	4396,	2796,	1501,	.5368,	.5921,
1992,	4504,	3871,	2545,	1188,	.4669,	.5138,
1993,	2900,	3511,	2047,	1114,	.5442,	.4545,
1994,	3961,	3147,	1958,	1070,	.5464,	.5282,
1995,	5253,	4010,	1998,	1028,	.5146,	.6677,
1996,	3839,	3852,	1814,	952,	.5247,	.5528,
1997,	3351,	3360,	1783,	1217,	.6824,	.7163,
1998,	2246,	2954,	1676,	1067,	.6368,	.6519,
1999,	2210,	2013,	1378,	968,	.7024,	.7219,
2000,	3285,	2045,	1182,	718,	.6073,	.5975,
2001,	2485,	2679,	1266,	714,	.5638,	.4913,
2002,	2169,	1837,	1082,	646,	.5968,	.6958,
2003,	1572,	1926,	1092,	594,	.5439,	.6016,
2004,	2907,	1665,	950,	510,	.5367,	.5623,
2005,	3241,	2021,	971,	389,	.4007,	.3827,
2006,	2242,	2547,	1110,	403,	.3631,	.2936,
Arith. Mean ,	4631,	3667,	1940,	1156,	.5966,	.5862,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

Table 4.4.14 VIIfg plaice : Catch forecast input data

MFDP version 1a
Run: p7f06
Time and date: 09:51 29/06/2007
Fbar age range: 3-6

Input Fs are mean 2004-2006 unscaled
Catch and stock weights are mean 2004-06
Recruits age 1 in 2007-9 are GM(1989-05)
N at age 2 and above in 2007 are from XSA

2007

Age	*N*	*M*	*Mat*	*PF*	*PM*	*SWt*	*Sel*	*CWt*
1	3022	0.12	0	0	0	0.175	0.000	0.191
2	1989	0.12	0.26	0	0	0.210	0.106	0.231
3	2238	0.12	0.52	0	0	0.256	0.392	0.283
4	1427	0.12	0.86	0	0	0.313	0.424	0.346
5	473	0.12	1	0	0	0.382	0.468	0.420
6	255	0.12	1	0	0	0.462	0.367	0.506
7	234	0.12	1	0	0	0.553	0.434	0.603
8	86	0.12	1	0	0	0.656	0.346	0.711
9	58	0.12	1	0	0	0.917	0.346	0.984

2008

Age	*N*	*M*	*Mat*	*PF*	*PM*	*SWt*	*Sel*	*CWt*
1	3022	0.12	0	0	0	0.175	0.000	0.191
2	.	0.12	0.26	0	0	0.210	0.106	0.231
3	.	0.12	0.52	0	0	0.256	0.392	0.283
4	.	0.12	0.86	0	0	0.313	0.424	0.346
5	.	0.12	1	0	0	0.382	0.468	0.420
6	.	0.12	1	0	0	0.462	0.367	0.506
7	.	0.12	1	0	0	0.553	0.434	0.603
8	.	0.12	1	0	0	0.656	0.346	0.711
9	.	0.12	1	0	0	0.917	0.346	0.984

2009

Age	*N*	*M*	*Mat*	*PF*	*PM*	*SWt*	*Sel*	*CWt*
1	3022	0.12	0	0	0	0.175	0.000	0.191
2	.	0.12	0.26	0	0	0.210	0.106	0.231
3	.	0.12	0.52	0	0	0.256	0.392	0.283
4	.	0.12	0.86	0	0	0.313	0.424	0.346
5	.	0.12	1	0	0	0.382	0.468	0.420
6	.	0.12	1	0	0	0.462	0.367	0.506
7	.	0.12	1	0	0	0.553	0.434	0.603
8	.	0.12	1	0	0	0.656	0.346	0.711
9	.	0.12	1	0	0	0.917	0.346	0.984

Input units are thousands and kg - output in tonnes

Table 4.4.15 VIIfg plaice : management option table - status quo forecast

MFDP version 1a
Run: p7f06
CELTIC SEA PLAICE,2007 WG, Forecast Inputs
Time and date: 09:51 29/06/2007
Fbar age range: 3-6

2007				
Biomass	**SSB**	**FMult**	**FBar**	**Landings**
2504	1328	1.0000	0.4129	587

2008					2009	
Biomass	**SSB**	**FMult**	**FBar**	**Landings**	**Biomass**	**SSB**
2613	1413	0.0000	0.0000	0	3337	2037
.	1413	0.1000	0.0413	70	3264	1970
.	1413	0.2000	0.0826	137	3195	1906
.	1413	0.3000	0.1239	202	3128	1844
.	1413	0.4000	0.1652	264	3063	1784
.	1413	0.5000	0.2065	324	3001	1727
.	1413	0.6000	0.2477	382	2941	1672
.	1413	0.7000	0.2890	438	2884	1620
.	1413	0.8000	0.3303	492	2828	1569
.	1413	0.9000	0.3716	543	2775	1520
.	1413	1.0000	0.4129	593	2724	1473
.	1413	1.1000	0.4542	641	2674	1428
.	1413	1.2000	0.4955	687	2627	1385
.	1413	1.3000	0.5368	732	2581	1344
.	1413	1.4000	0.5781	775	2537	1304
.	1413	1.5000	0.6194	816	2494	1265
.	1413	1.6000	0.6607	856	2453	1228
.	1413	1.7000	0.7019	895	2414	1192
.	1413	1.8000	0.7432	932	2376	1158
.	1413	1.9000	0.7845	968	2339	1125
.	1413	2.0000	0.8258	1003	2304	1094

Input units are thousands and kg - output in tonnes

Table 4.4.16 VIIfg plaice : forecast detailed results - status quo projection

MFDP version 1a
Run: p7f06
Time and date: 09:51 29/06/2007
Fbar age range: 3-6

Year:	2007	F multiplier: 1		Fbar:	0.4129				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	0	0	3022	530	0	0	0	0
2	0.1064	189	44	1989	418	517	109	517	109
3	0.3916	686	194	2238	572	1164	298	1164	298
4	0.4243	467	162	1427	447	1227	384	1227	384
5	0.4684	167	70	473	181	473	181	473	181
6	0.3673	74	38	255	118	255	118	255	118
7	0.434	78	47	234	129	234	129	234	129
8	0.346	24	17	86	56	86	56	86	56
9	0.346	16	16	58	53	58	53	58	53
Total		1702	587	9782	2504	4014	1328	4014	1328

Year:	2008	F multiplier: 1		Fbar:	0.4129				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	0	0	3022	530	0	0	0	0
2	0.1064	255	59	2680	563	697	146	697	146
3	0.3916	486	138	1586	405	825	211	825	211
4	0.4243	439	152	1342	420	1154	361	1154	361
5	0.4684	293	123	828	316	828	316	828	316
6	0.3673	76	39	263	121	263	121	263	121
7	0.434	52	31	157	87	157	87	157	87
8	0.346	37	26	134	88	134	88	134	88
9	0.346	25	25	90	83	90	83	90	83
Total		1664	593	10102	2613	4148	1413	4148	1413

Year:	2009	F multiplier: 1		Fbar:	0.4129				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0	0	0	3022	530	0	0	0	0
2	0.1064	255	59	2680	563	697	146	697	146
3	0.3916	655	185	2137	546	1111	284	1111	284
4	0.4243	311	108	951	298	818	256	818	256
5	0.4684	276	116	779	297	779	297	779	297
6	0.3673	134	68	460	212	460	212	460	212
7	0.434	54	32	161	89	161	89	161	89
8	0.346	25	18	90	59	90	59	90	59
9	0.346	39	38	141	129	141	129	141	129
Total		1749	624	10421	2724	4257	1473	4257	1473

Input units are thousands and kg - output in tonnes

Table 4.4.17 **Plaice in VIIfg**
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			2907	3241	2242	3022	3022
Source			XSA	XSA	XSA	GM89-05	GM89-05
Status Quo F:							
% in	2007	landings	27.6	33.0	7.5	0.0	-
% in	2008		20.7	25.6	23.3	9.9	0.0
% in	2007	SSB	28.9	22.4	8.2	0.0	-
% in	2008	SSB	22.4	25.5	14.9	10.3	0.0
% in	2009	SSB	14.4	20.2	17.4	19.3	9.9

GM : geometric mean recruitment

Plaice in VIIfg : Year-class % contribution to

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

Table 4.4.18 VIIfg plaice : Yield per recruit

MFYPR version 2a
Run: p7fypr07
Time and date: 13:59 30/06/2007
Yield per results

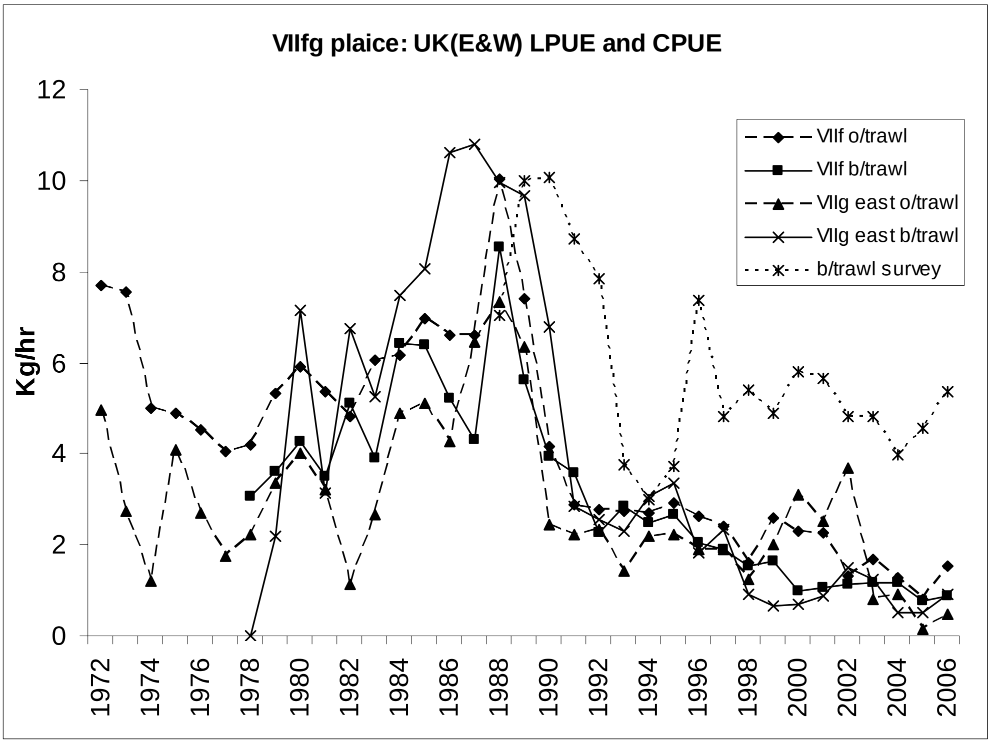
FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0.0000	0.0000	0.0000	0.0000	8.8433	4.9280	6.7118	4.4877	6.7118	4.4877
0.1000	0.0413	0.1975	0.1207	7.1997	3.5592	5.0769	3.1214	5.0769	3.1214
0.2000	0.0826	0.3206	0.1803	6.1766	2.7425	4.0623	2.3072	4.0623	2.3072
0.3000	0.1239	0.4042	0.2109	5.4832	2.2138	3.3770	1.7808	3.3770	1.7808
0.4000	0.1652	0.4643	0.2265	4.9848	1.8516	2.8866	1.4209	2.8866	1.4209
0.5000	0.2065	0.5095	0.2341	4.6108	1.5929	2.5203	1.1644	2.5203	1.1644
0.6000	0.2477	0.5446	0.2373	4.3207	1.4019	2.2377	0.9755	2.2377	0.9755
0.7000	0.2890	0.5726	0.2380	4.0896	1.2571	2.0139	0.8328	2.0139	0.8328
0.8000	0.3303	0.5955	0.2373	3.9015	1.1448	1.8328	0.7225	1.8328	0.7225
0.9000	0.3716	0.6145	0.2358	3.7455	1.0560	1.6837	0.6356	1.6837	0.6356
1.0000	0.4129	0.6306	0.2341	3.6141	0.9846	1.5589	0.5661	1.5589	0.5661
1.1000	0.4542	0.6443	0.2322	3.5019	0.9262	1.4533	0.5095	1.4533	0.5095
1.2000	0.4955	0.6562	0.2304	3.4051	0.8779	1.3627	0.4630	1.3627	0.4630
1.3000	0.5368	0.6666	0.2286	3.3206	0.8374	1.2844	0.4241	1.2844	0.4241
1.4000	0.5781	0.6758	0.2269	3.2462	0.8030	1.2160	0.3914	1.2160	0.3914
1.5000	0.6194	0.6840	0.2254	3.1802	0.7735	1.1558	0.3636	1.1558	0.3636
1.6000	0.6607	0.6913	0.2240	3.1212	0.7480	1.1024	0.3396	1.1024	0.3396
1.7000	0.7019	0.6979	0.2226	3.0681	0.7257	1.0548	0.3189	1.0548	0.3189
1.8000	0.7432	0.7039	0.2214	3.0201	0.7062	1.0121	0.3008	1.0121	0.3008
1.9000	0.7845	0.7094	0.2204	2.9763	0.6888	0.9736	0.2849	0.9736	0.2849
2.0000	0.8258	0.7145	0.2194	2.9363	0.6733	0.9388	0.2708	0.9388	0.2708

Reference point	F multiplier	Absolute F
Fbar(3-6)	1.0000	0.4129
FMax	0.6887	0.2844
F0.1	0.334	0.1379
F35%SPR	0.354	0.1462

Weights in kilograms

Table 4.4.19 VIIfg plaice : Input to sensitivity analysis

```
1      9      2007  3
1      0      0

      value c.v                                value      c.v
 'N1'        3022  0.33          'WS1'      0.175 0.45
 'N2'        1989  0.80          'WS2'      0.210 0.21
 'N3'        2238  0.30          'WS3'      0.256 0.06
 'N4'        1427  0.26          'WS4'      0.313 0.04
 'N5'         473  0.21          'WS5'      0.382 0.07
 'N6'         255  0.19          'WS6'      0.462 0.08
 'N7'         234  0.17          'WS7'      0.553 0.07
 'N8'          86  0.18          'WS8'      0.656 0.06
 'N9'          58  0.18          'WS9'      0.917 0.05

 'sH1'       0.000 0.00          'M1'       0.12  0.1
 'sH2'       0.106 0.49          'M2'       0.12  0.1
 'sH3'       0.392 0.04          'M3'       0.12  0.1
 'sH4'       0.424 0.18          'M4'       0.12  0.1
 'sH5'       0.468 0.25          'M5'       0.12  0.1
 'sH6'       0.367 0.10          'M6'       0.12  0.1
 'sH7'       0.434 0.32          'M7'       0.12  0.1
 'sH8'       0.346 0.40          'M8'       0.12  0.1
 'sH9'       0.346 0.40          'M9'       0.12  0.1

 'WH1'       0.191 0.31          'MT1'      0     0.1
 'WH2'       0.231 0.12          'MT2'      0.26  0.1
 'WH3'       0.283 0.03          'MT3'      0.52  0.1
 'WH4'       0.346 0.06          'MT4'      0.86  0.1
 'WH5'       0.420 0.08          'MT5'      1     0.1
 'WH6'       0.506 0.08          'MT6'      1     0
 'WH7'       0.603 0.07          'MT7'      1     0
 'WH8'       0.711 0.06          'MT8'      1     0
 'WH9'       0.984 0.05          'MT9'      1     0

 'R08'       3022  0.33          'K07'      1     0.1
 'R09'       3022  0.33          'K08'      1     0.1
 'HF07'      1     0.33          'K09'      1     0.1
 'HF08'      1     0.33
 'HF09'      1     0.33

Plaice

Celtic Sea

1
  1  9  1
1
H.cons.
  3  6
 1977      2006
 Stock numbers in 2007 are VPA survivors.
```



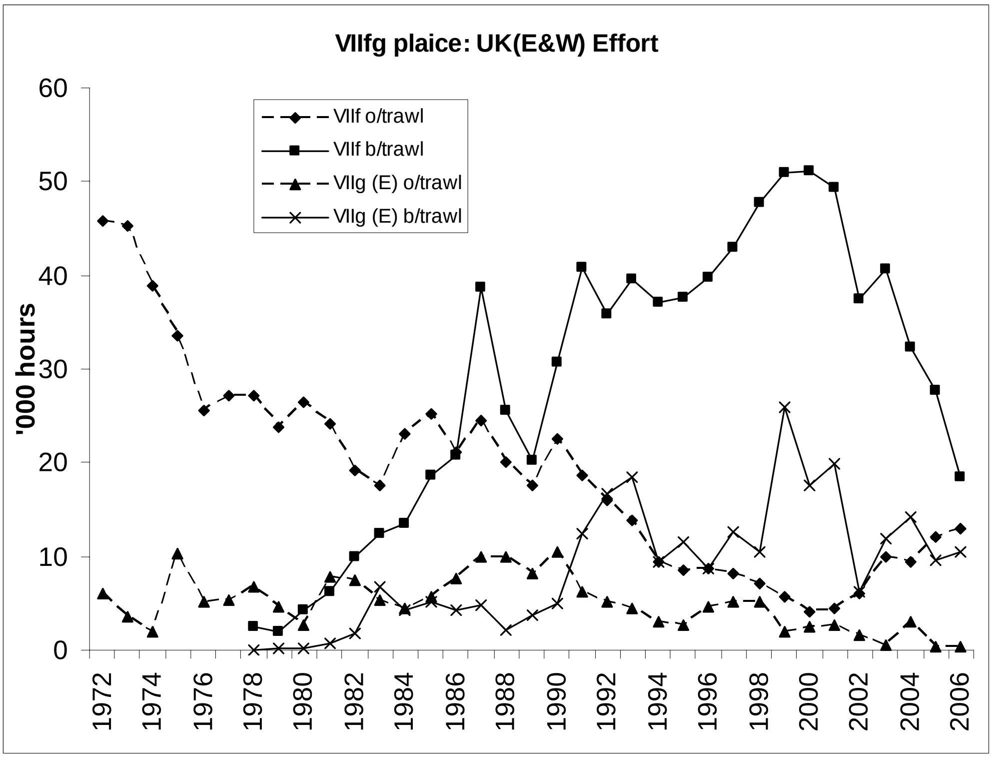


Figure 4.4.1 Celtic Sea Plaice (VIIf&g): UK(E&W) LPUE and effort by fleet

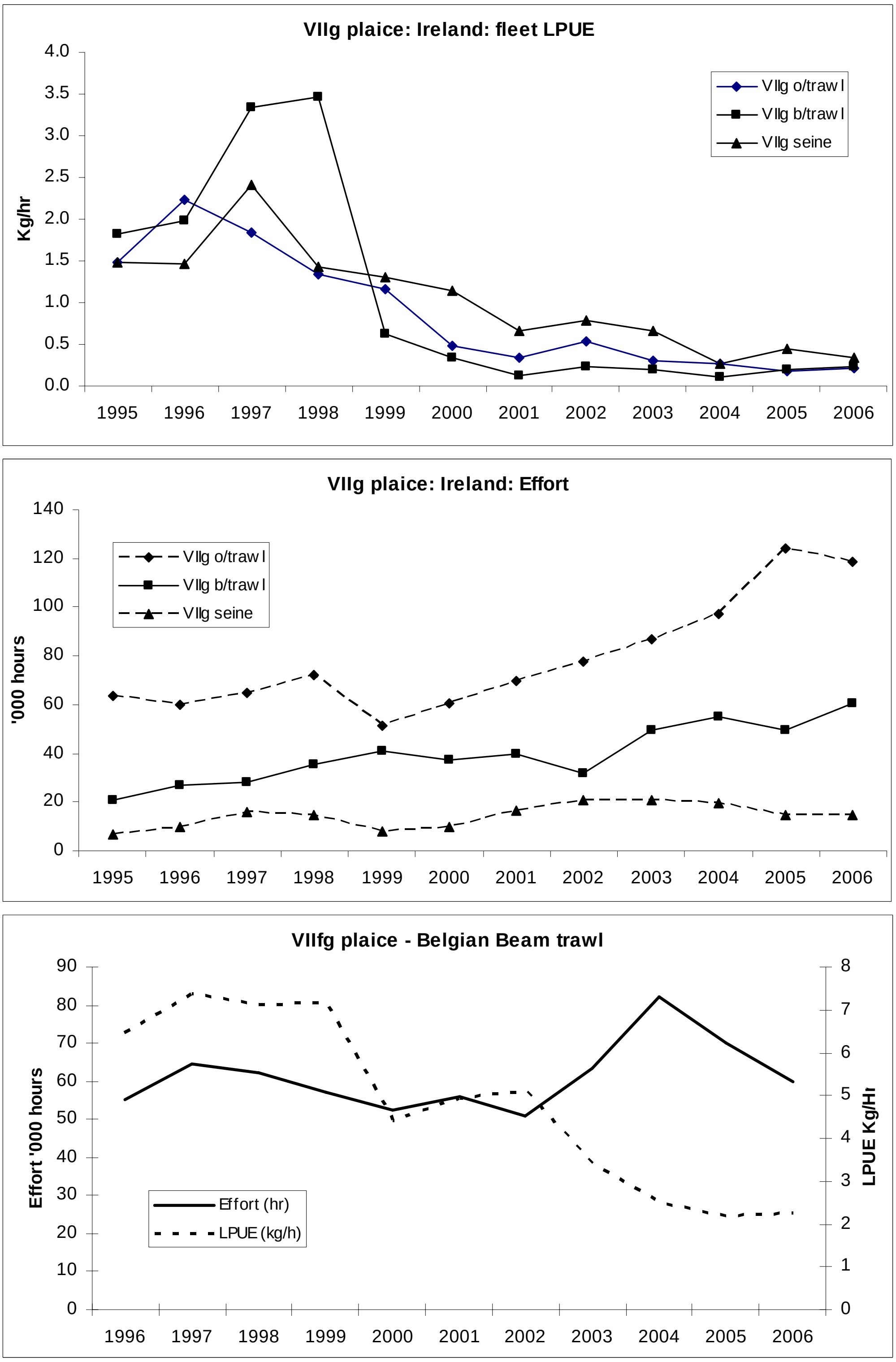


Figure 4.4.2 Celtic Sea Plaice (VIIf&g): Ireland and Belgium: LPUE and effort by fleet

Number and weight of discards and landings collected (sum of number from sampled hauls)
Length structure of discards and landings collected by observations on board (sum of number from sampled hauls)

France
Bottom Trawl

Sampling number and weight

Quarter 1

Trip(s) sampled :	**0**
Haul(s) sampled :	**0**
Total hauls :	**0**
Catch in number :	
discard :	0
landing :	0
Catch in weight (kg) :	
discard :	0.0
landing :	0.0
number of haul(s) with presence of species :	0

Quarter 2

Trip(s) sampled :	**1**
Haul(s) sampled :	**38**
Total hauls :	**59**
Catch in number :	
discard :	14
landing :	2
Catch in weight (kg) :	
discard :	2.2
landing :	1.0
number of haul(s) with presence of species :	5

Quarter 3

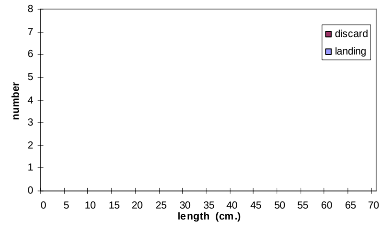
Trip(s) sampled :	**3**
Haul(s) sampled :	**99**
Total hauls :	**155**
Catch in number :	
discard :	588
landing :	246
Catch in weight (kg) :	
discard :	141.2
landing :	170.4
number of haul(s) with presence of species :	46

Quarter 4

Trip(s) sampled :	**3**
Haul(s) sampled :	**70**
Total hauls :	**123**
Catch in number :	
discard :	63
landing :	103
Catch in weight (kg) :	
discard :	13.4
landing :	69.6
number of haul(s) with presence of species :	17

Sampling length

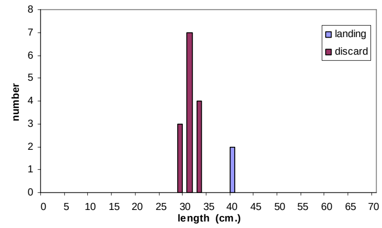
Quarter 1



Catch in number :
discard : 0
landing : 0

number of haul(s) with length sampled for species : 0

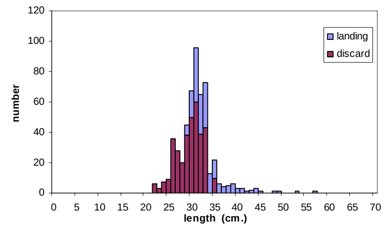
Quarter 2



Catch in number :
discard : 14
landing : 2

number of haul(s) with length sampled for species : 5

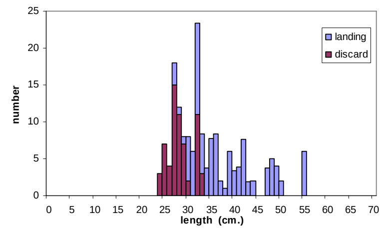
Quarter 3



Catch in number :
discard : 349
landing : 179

number of haul(s) with length sampled for species : 25

Quarter 4



Catch in number :
discard : 63
landing : 103

number of haul(s) with length sampled for species : 17

Figure 4.4.3 Plaice VIIfg 2006

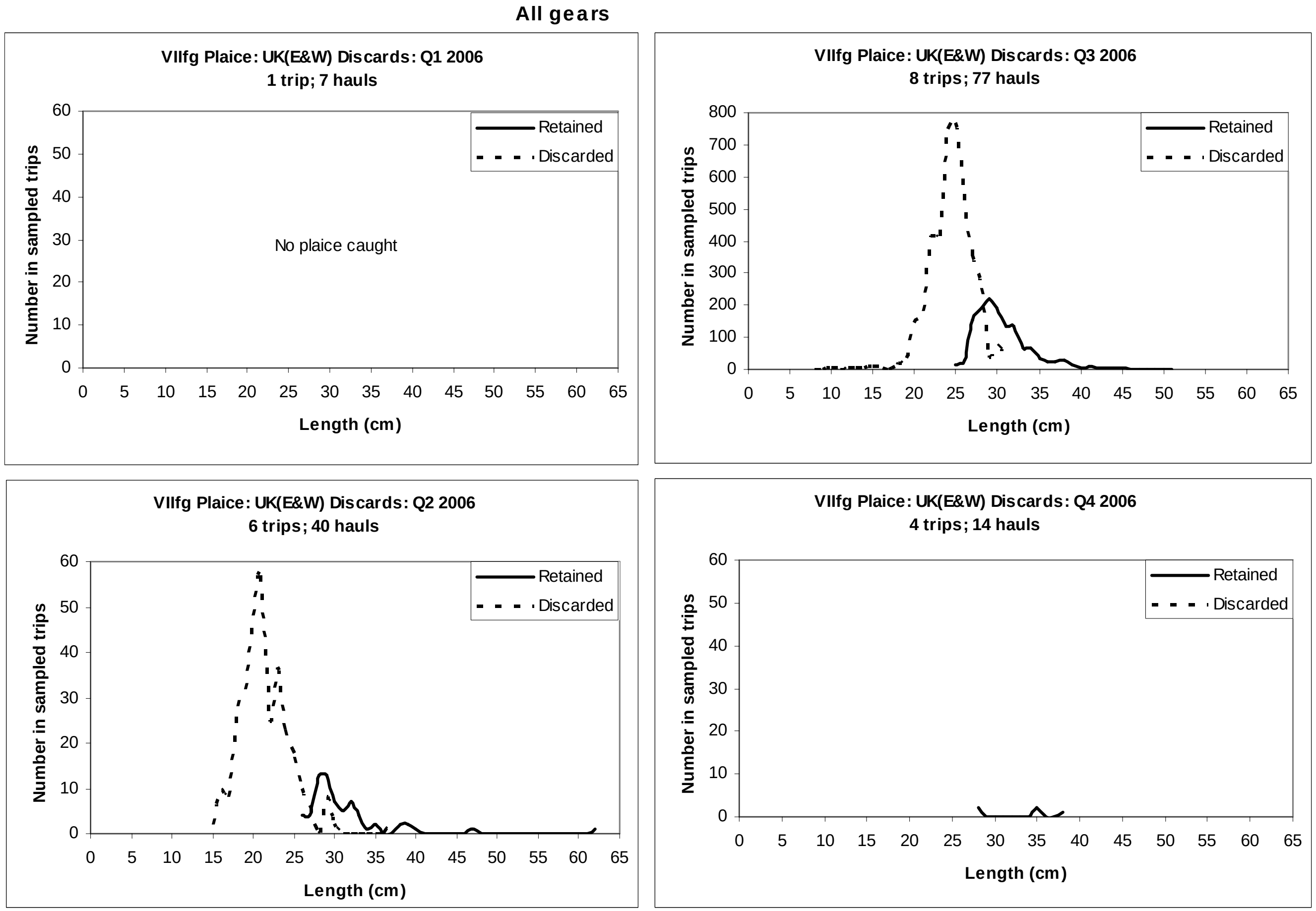


Figure 4.4.4 **Plaice VIIfg** **UK(E&W) Discard sampling results in 2006: raised to sampled trips**

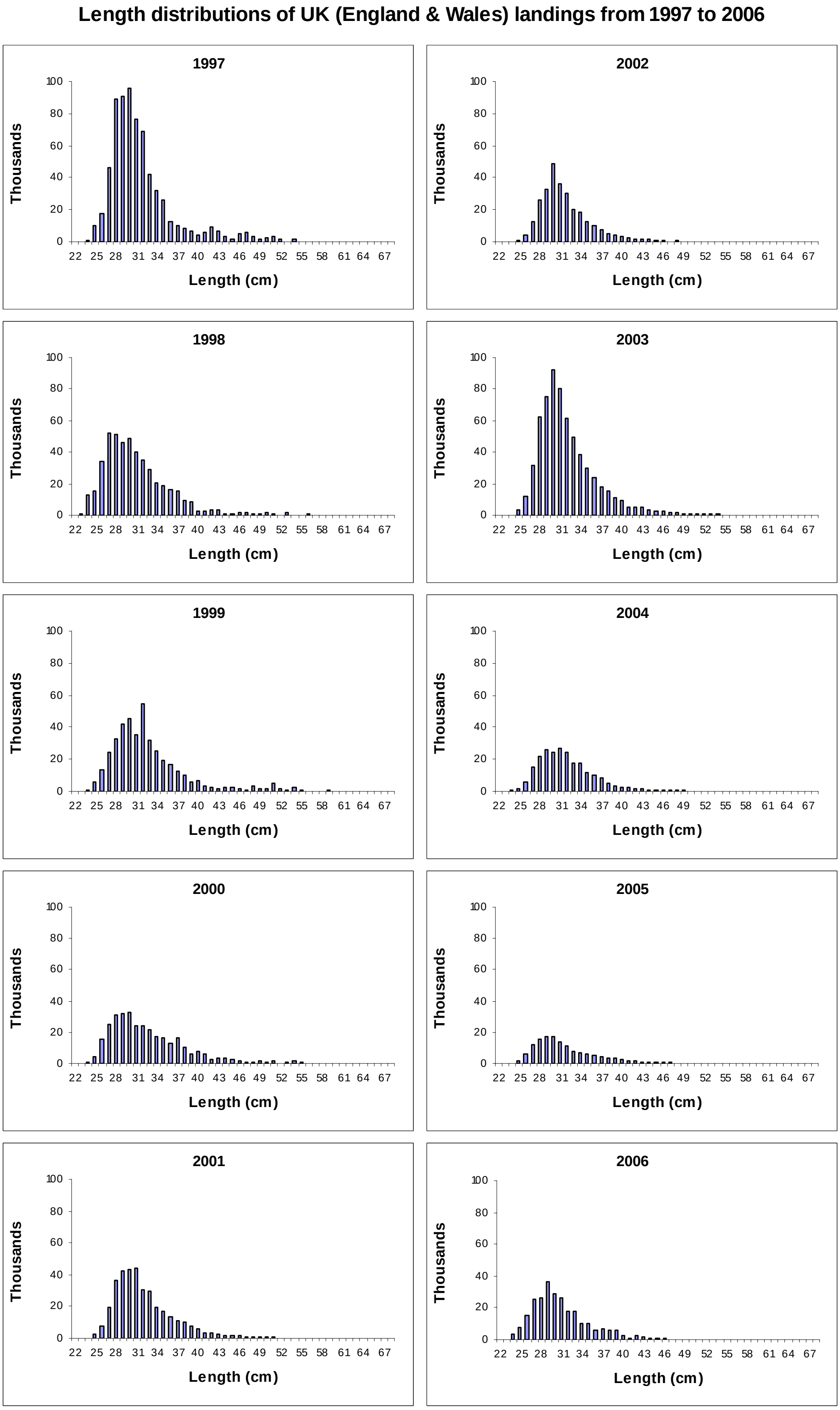


Figure 4.4.5 **Plaice in Division VIIf&g**

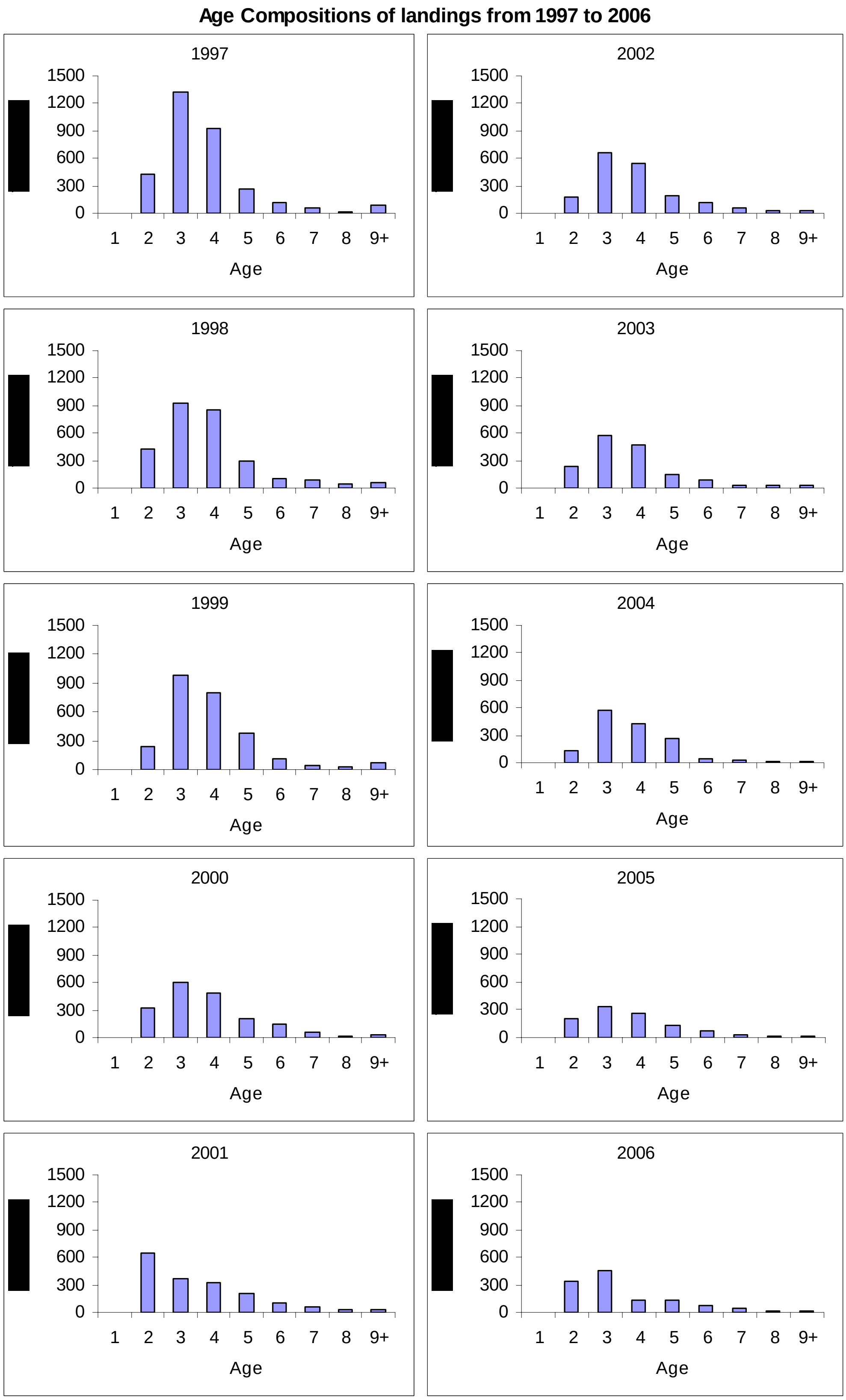


Figure 4.4.6 **Plaice in Division VIIf+g**

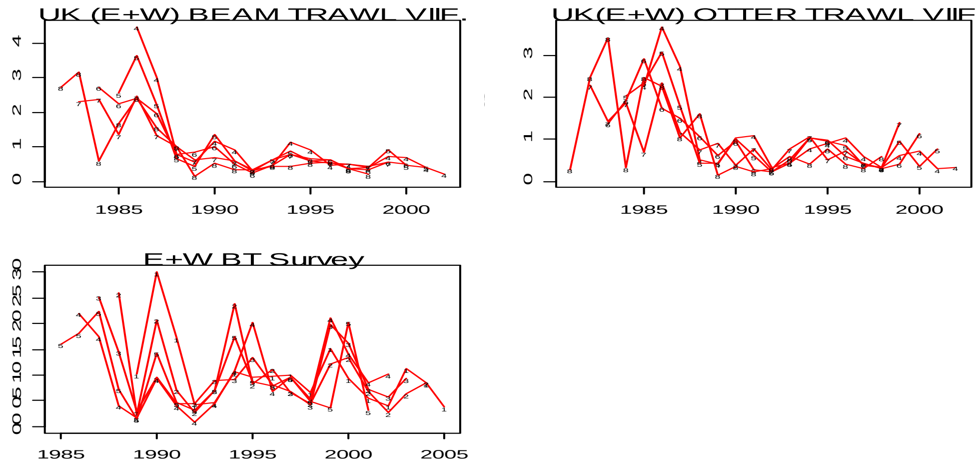


Figure 4.4.7 VIIfg plaice: Fleet log CPUE – by year class

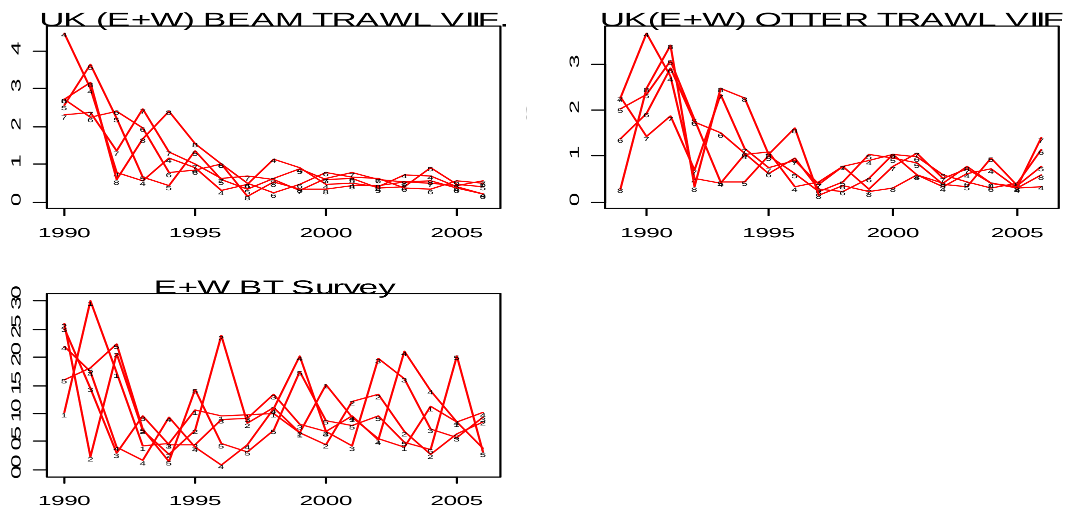


Figure 4.4.8 VIIfg plaice: Fleet log CPUE – by year

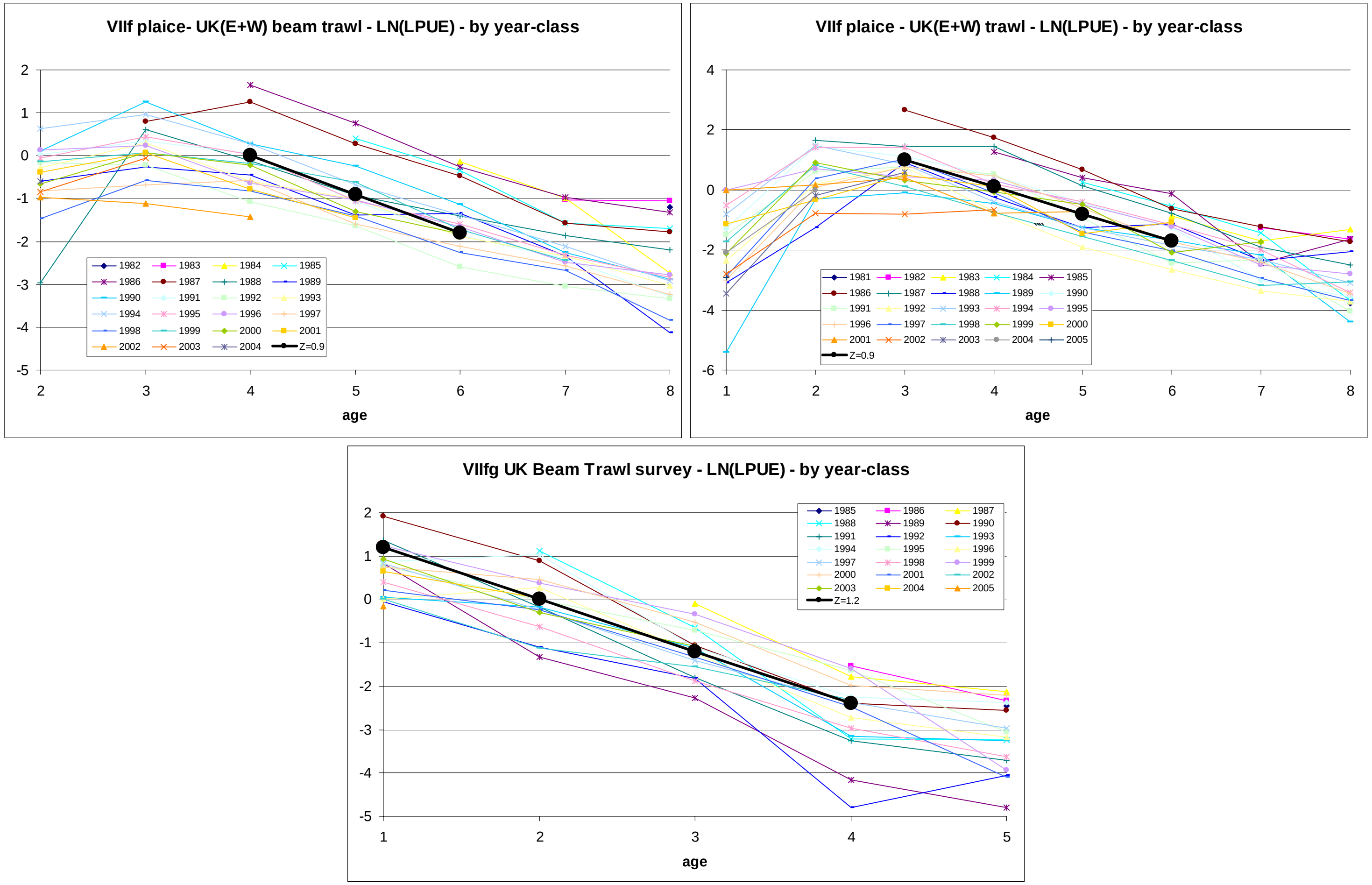


Figure 4.4.9 : Estimation of F using tuning data

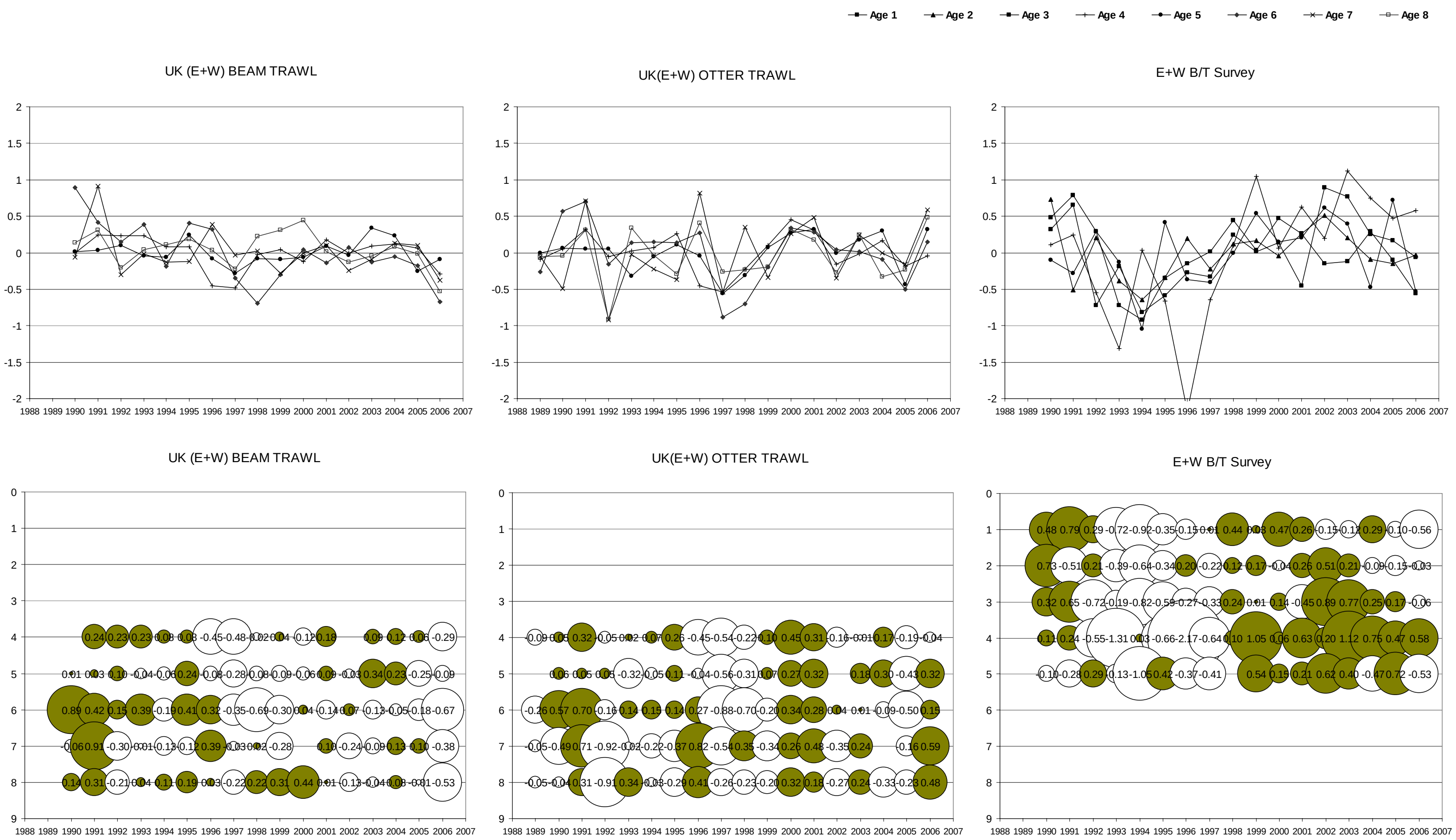


Figure 4.4.10: VIIf&g Plaice fleet log catchability residuals from the final run

(Shrinkage SE=2.5)

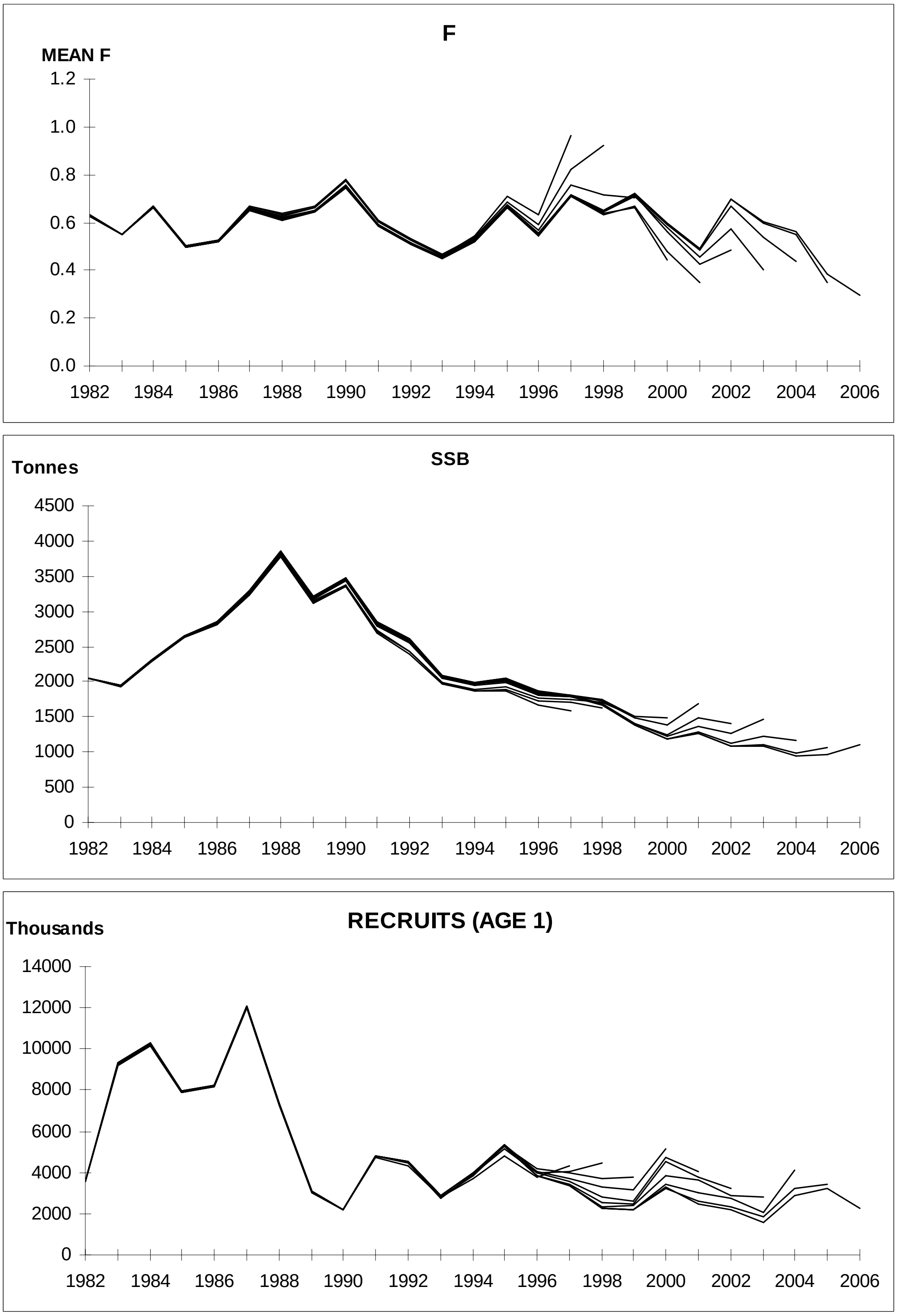


Figure 4.4.11 **VIIf&g PLAICE RETROSPECTIVE XSA**

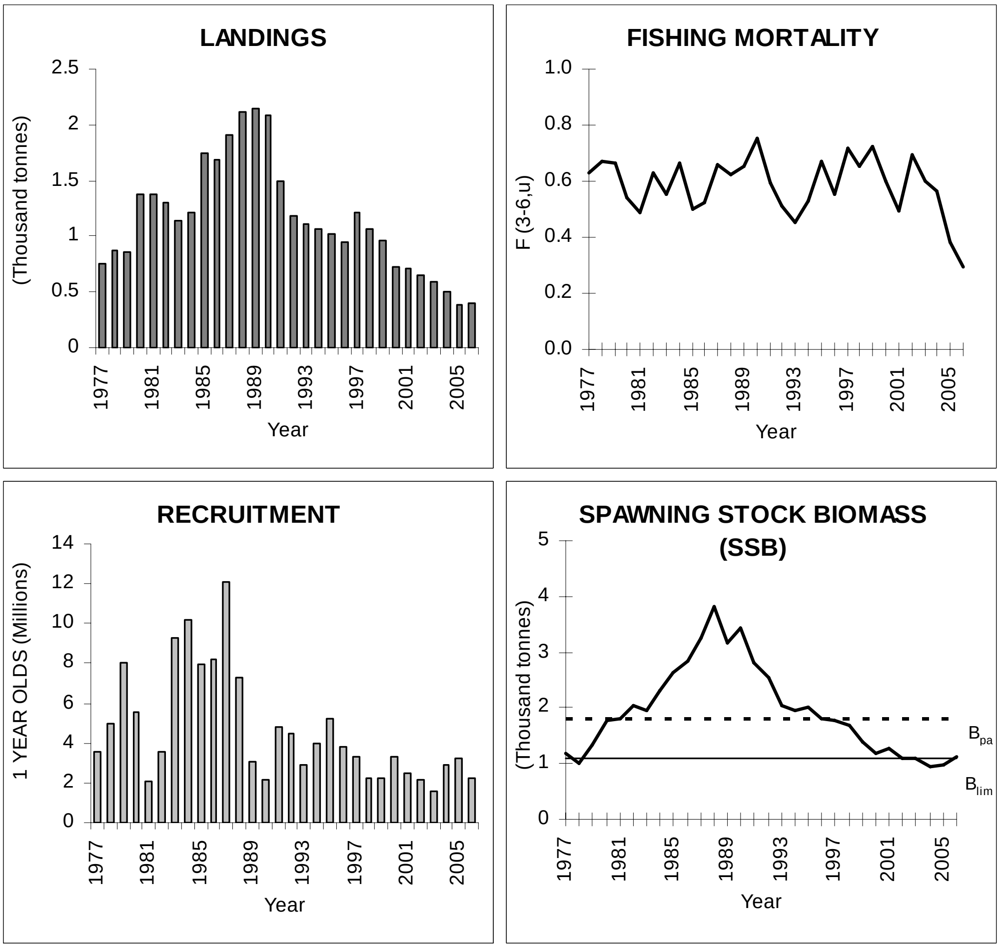


Figure 4.4.12 **Plaice in Division VIIfg**

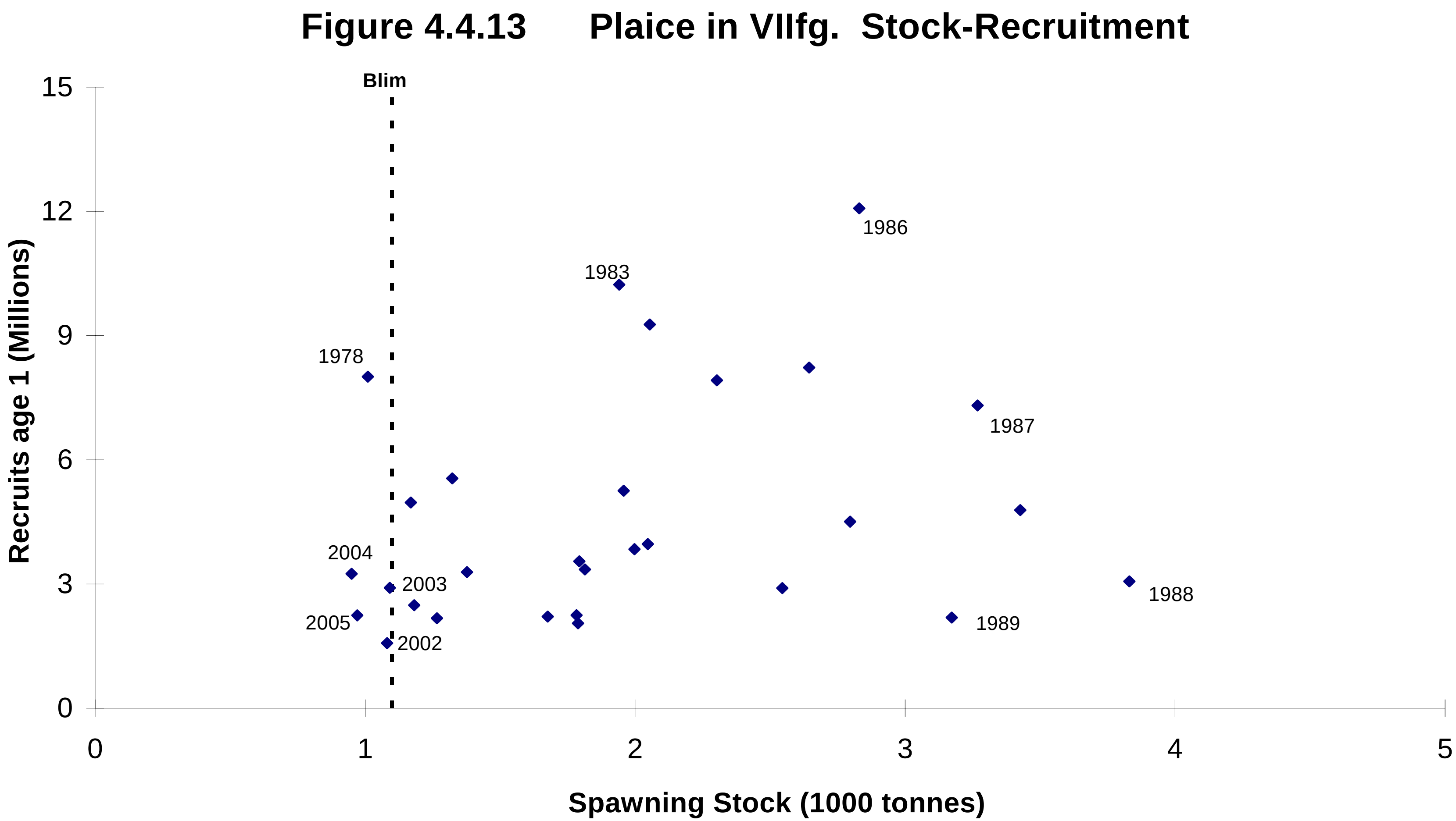
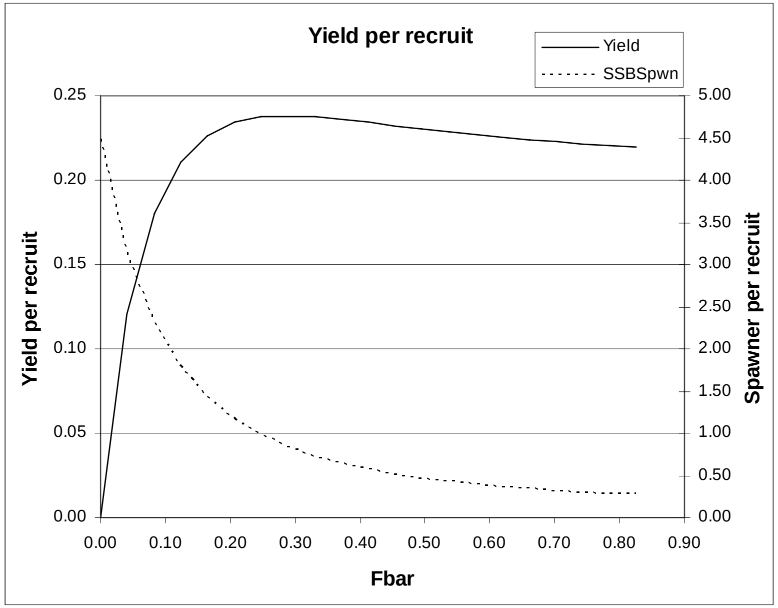
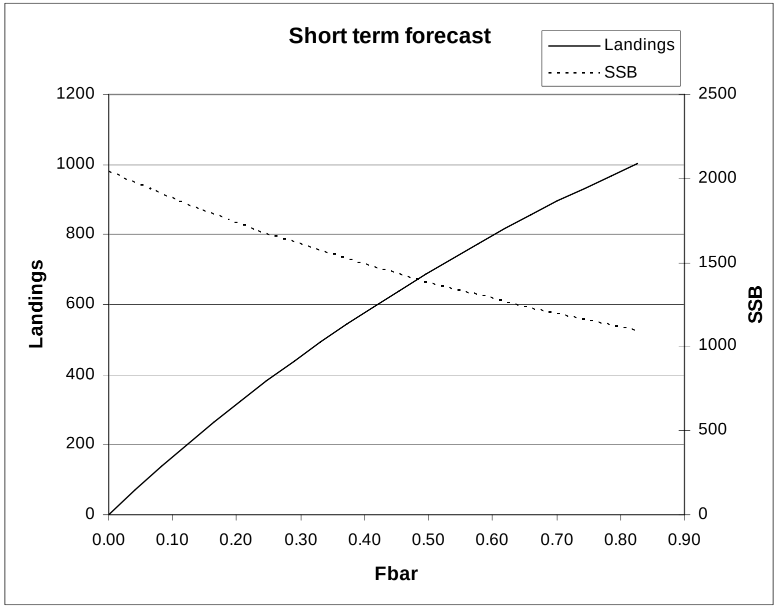


Figure 4.4.13 Plaice in VIIfg. Stock-Recruitment
Blim
Recruits age 1 (Millions)
Spawning Stock (1000 tonnes)
15
12
9
6
3
0
0
1
2
3
4
5
1986
1983
1978
1987
2004
2003
2005
2002
1988
1989





MFYPR version 2a
Run: p7fypr07
Time and date: 13:59 30/06/2007

Reference point	F multiplier	Absolute F
Fbar(3-6)	1.0000	0.4129
FMax	0.6887	0.2844
F0.1	0.3340	0.1379
F35%SPR	0.3540	0.1462

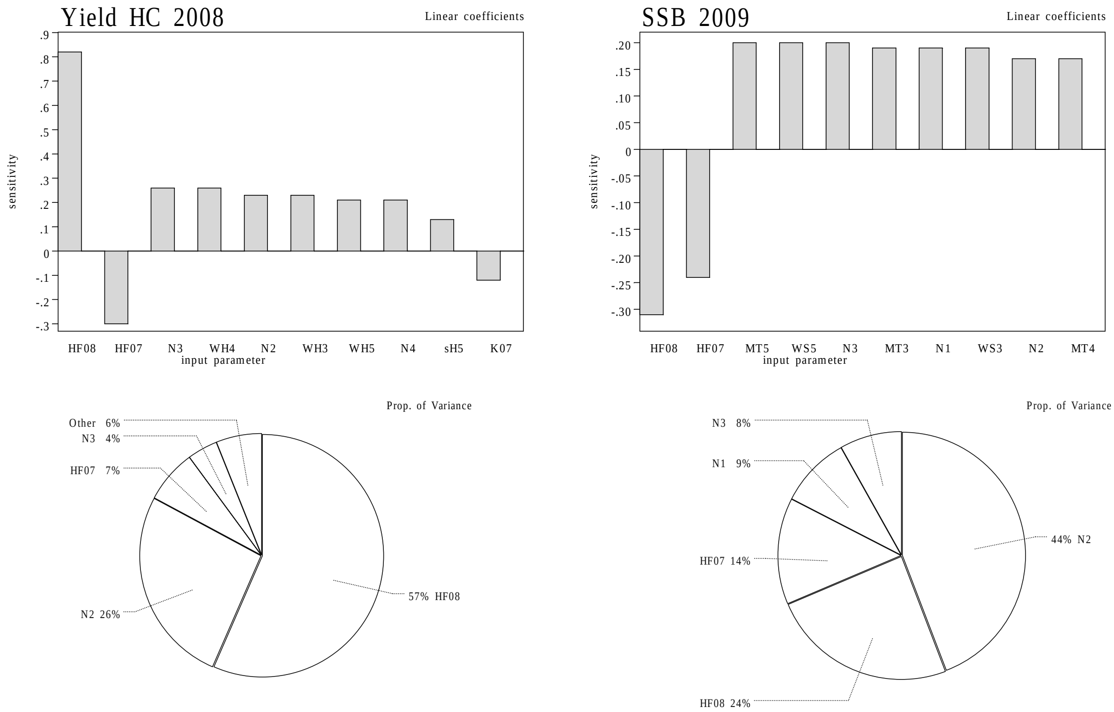
Weights in kilograms

MFDP version 1a
Run: p7f06
CELTIC SEA PLAICE,2007 WG, Forecast Inputs
Time and date: 09:51 29/06/2007
Fbar age range: 3-6

Input units are thousands and kg - output in tonnes

Figure 4.4.14 VIIfg Plaice : Yield per recruit and short term forecast results

Figure Plaice,Celtic Sea. Sensitivity analysis of short term forecast.



Data from file:C:\sens\PLEVIIF.SEN on 30/06/2007 at 18:12:28

Figure 4.4.15 VIIfg plaice: sensitivity analysis of short term forecast

Figure Plaice,Celtic Sea. Probability profiles for short term forecast.

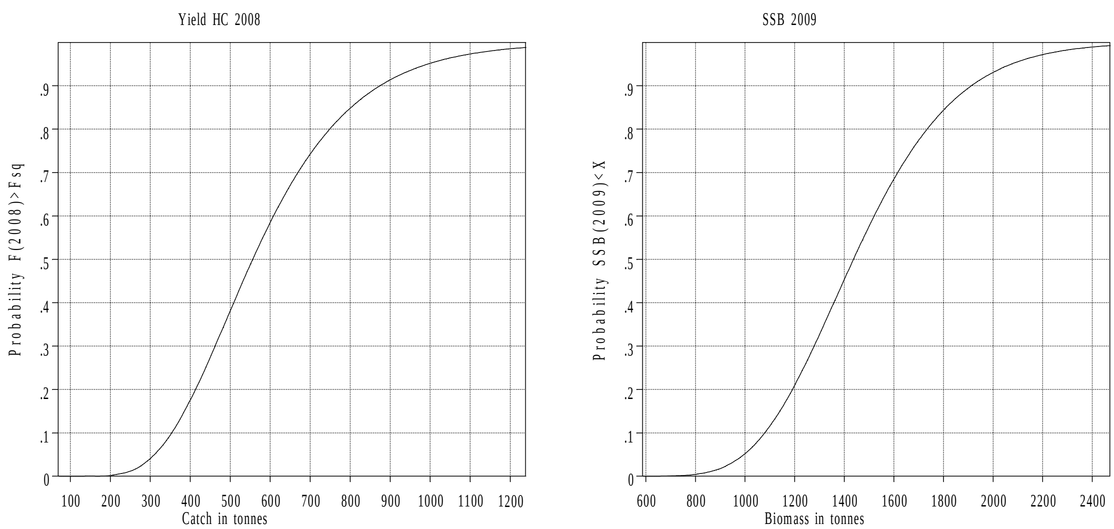


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Figure 4.4.16 VIIfg plaice: Probability profiles for short term forecast

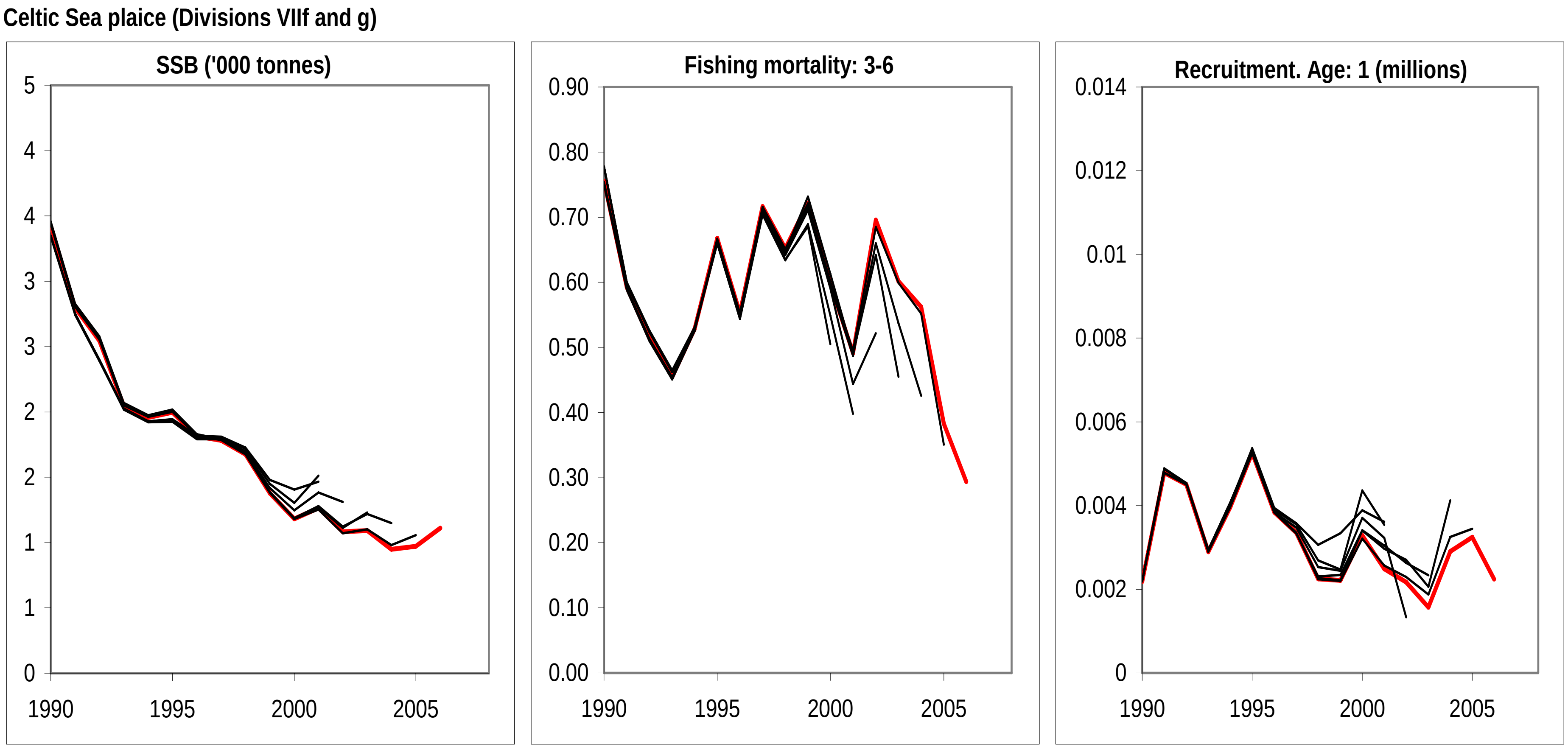

Figure 4.4.17 VIIfg plaice : Comparison of recent assessment time series

4.5 Haddock in the Celtic Sea and West of Ireland (ICES Divisions VIIb-k)

Type of assessment: Exploratory

Changes to the assessment:

- Discards were added to the catch numbers at age using a different raising procedure to last year.
- A different selection of tuning fleets was made
- Stock weights were estimated using a 3-year running average, rather than by modelling growth.

Review group issues:

- Further exploration of survey data, particularly EVHOE, WCGFS and the UK groundfish survey.

The EVHOE survey provides somewhat noidy signals and some of this might be related to the fact that prior to 2001 age-length keys from other surveys were applied to estimate the age distribution in the data. However, exploratory analysis indicates that the EVHOE survey index is in close agreement with other surveys for a number of age classes and is useful as a tuning fleet. The WCGFS has been carried out on a number of different vessels and sampling design has changed during the time series. The WCGFS is discontinued in 2002 and not included in this year's assessment. No recent UK survey data were made available to the WG.

The Stock Annex for Haddock in Division VIIb-k was updated.

4.5.1 The Fishery

This section is available in the stock annex.

ICES advice applicable to 2007

Exploitation boundaries in relation to precautionary considerations: *Because of the strong 2001 and 2002 year classes, SSB has increased, but ICES is unable to provide a reliable estimate of the current stock size. Future catches and SSB will be highly dependent on the strength of incoming year classes and their discard mortality. In this context the stock should be managed by ensuring that the effort is not allowed to increase, rather than by TAC management.*

Management considerations: *Most of the haddock caught are discarded. Discards include both fish under the minimum landing size (MLS) and larger fish. Haddock are caught in mixed demersal fisheries in the Celtic Sea and management should take this into account. An increase in mesh size or other technical measures to reduce discarding would be of huge benefit to this stock and have a substantial impact on medium-term yield. Haddock is a relatively low value species and targeting practices in the fishery are highly dependent on availability and market demand.*

Management applicable to 2006 and 2007

There are no explicit management objectives for this stock. The TAC for haddock is set for all of Subarea VII, VIII, IX and X. The TAC was 11,520 t in 2006 and 2007.

Technical measures applied to this stock include a minimum landing size ($\geq$ 30 cm) and the minimum mesh sizes applicable to the mixed demersal fisheries.

Council Regulation (EC) No 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in areas of VIIb, VIIj, VIIg and VIIh. Effort exerted within the ‘biologically sensitive area’ by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998-2002).

Council Regulation (EC) No 51/2006, Annex III, part A 4.2 prohibited fishing in ICES rectangles 30E4, 31E4 and 32E3 during February-March 2006 for all vessels and gears (except within 6 nautical miles from the baseline).

Council regulation (EC) No 41/2007, Annex III part A 7.2 prohibited fishing in ICES rectangles 30E4, 31E4 and 32E3 from 1 February 2007 until 31 March 2007. This prohibition did not apply within 6 nautical miles from the baseline.

Recent Trends in the fishery

Table 4.5.1 gives nominal landings of haddock from the Celtic Sea and west of Ireland (Divisions VIIb-k) as reported by each country to ICES, together with Working Group estimates. France provided updated landings statistics for 1999-2005. Ireland provided updated landings for 2005. The 2005 landings figure of 6,553t was revised to 6,648t at WGSSDS2007. The 2006 landings were estimated to be 5,378t.

Previously, the working group has stated that “the level of misreporting of this stock is not known but misreporting is considered unlikely to be a significant source of unaccounted mortality of haddock in the assessment because the TAC has been in excess of recent landings.” However at WGSSDS2005 information on misreporting, although not quantified, was provided indicating a widespread problem for this stock.

Commercial fleet effort and LPUE

Effort and LPUE data were available from the Irish otter trawl fleets operating in Divisions VIIb, VIIj and VIIg for 1995-2006, French gadoid trawlers in VIIfgh for 1983-2006 and effort data were available for the UK beam trawl fleet in VIIe-k and all other trawl gears in VIIek for 1983-2006 (Table 4.5.2). Revisions to the French data were provided for 1999-2005. There has been an increase in effort for the Irish otter trawl fleet since 1999, doubling over this period, while effort in VIIb and VIIj has recently decreased. The overall effort of the Irish otter trawl fleet remains fairly constant. In recent years there has been a fleet modernisation and decommissioning scheme in Ireland. A further decommissioning scheme is imminent and aims to remove 40% of the capacity in the whitefish sector nationally. The effort of the French gadoid fleet has been decreasing since 2001 and is less than half of the effort during the 1990s. The UK beam trawl effort has remained fairly steady since the mid-1990s. LPUE in VIIb appears to show a downward trend, while LPUE of the French Gadoid fleet has peaked in 2004 and decreased somewhat since (Figure 4.5.1)

Changes in Fleet Dynamics between 2005 and 2007

Comments from the 2007 Working Group on Fishing Technology and Fish Behaviour (WGFTFB) relevant to VIIbk haddock are reproduced below:

- *There is evidence of French demersal vessels concentrating effort around the edges of the cod box closures (30E4, 31E4, 32E3). Also some French vessels have switched from targeting cod to monkfish (France; Changes in Fleet Dynamics)*
- *A Decommissioning Scheme was launched in Ireland October 2005 and continued in 2006. To date, a total of 36 (includes one in 2005) vessels have been decommissioned in respect of 35 vessels in 2006. 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. (Ireland; Pressure on quotas; removal of 4,901 GTs and 15,392 kW’s from the fleet from the Irish whitefish and scallop fleets).*

- *Several Irish whitefish vessels that have been permanently tied-up have been sold to Gambia in 2006. Another of the larger whitefish vessels (34m/1200hp) has been sold recently to South Africa. This vessel had been active up until mid-2006. (Ireland; Economics; 2 inactive and 1 active 34m demersal vessel).*
- *Despite quota restrictions, high levels of control and enforcement, increased fuel costs and a major review of the Irish industry, during 2006 and the first quarter of 2007 around 23 new or modern second-hand vessels have entered the Irish demersal fleets. This has been driven by the imminent introduction of the new safety regulations for vessels between 15m and 24m, accelerated as a consequence of the tragic sinking of 4 vessels in the south-east. These regulations will prove onerous and are likely to be similar to the Torrmelinos Convention rules for vessels over 24 m. In anticipation of these changes a number of skippers are looking for more modern vessels. The tonnage being taken out to introduce these new vessels is largely inefficient or inactive (< 2 years) tonnage and the Irish whitefish fleet, while reducing in size by numbers has increased in terms of efficiency. This will almost certainly mean that quotas will become even more restrictive, particularly quotas for Nephrops (all areas), Rockall mixed fishery, mackerel and herring dry-hold quotas and mixed whitefish (mainly haddock and cod in Area VIIb-k). (Ireland; Increased effort).*
- *Several French vessels have reverted from Nephrops twin trawling to single rig trawling in the Celtic Sea due to high fuel and difficulties finding crew. (France; Change in fishing method)*
- *Several French vessels working in the English Channel (VIId & e) have converted from trawling to Danish seine to reduce fuel costs). (France; Fuel costs; several vessels).*
- *Several countries report that new gear monitoring equipment fitted to trawls and trawl doors (Scanmar etc) have the potential to increase efficiency. These sensors measure roll, pitch and stability of trawl doors. This type of sensor is being increasingly used to optimise trawl door performance while towing, increasing catch efficiency. (France and England-UK; increased efficiency)*

4.5.2 Age and length composition and mean weights at age

Length composition of landings were available for haddock landed into Ireland, France and the UK in 2006 (Table 4.5.3; Figure 4.5.2). Catches from VIIb included larger numbers of small (<30cm) haddock than catches from other areas. This is consistent with survey observations that indicate a large number of young (age 0 and 1) haddock in this area with relatively few older fish. Length distributions of Irish otter trawl landings in VIIg and VIIj are similar to the French Gadoid fleet landings in VIIghj, these fleets account for the vast majority of the landings.

Discards

Discard data were available for the Irish otter trawl fleets in VIIbgj from 1995 onwards (Table 4.5.4a). French discard data were available for 2005-6 and UK discard data were available for 2003-2006 (Figure 4.5.3). Due to the very short time-series of French and UK discard data, Irish otter trawl discards were used to estimate discard numbers-at-age by raising them to the international level. Otter trawlers account for most of the international effort in VIIb-k, the other main gear types are seine and beam trawl, no attempt was made to estimate discards for these gears. No discard data were available for 1993-4, discarding in these years was estimated from the average of 1995-99, which was a period with relatively low discarding.

Irish otter trawl discard length distributions were raised to the national level using the ratio of total number of trips in each metier in each year to the number of trips sampled for discards, following recommendations by Borges et al. (2005). At WGSSDS06 efforts were made to raise discard data using total reported landings (so that misreporting would be taken into account). However, this resulted in spurious patterns in recent years.

Irish discard data from VIIgj were then raised to international discards by using the ratio of the international effort in VIIe-k to the Irish effort in VIIgj (Table 4.5.4b; effort in hrs fished). This approach assumes that Irish discarding in VIIjg is representative of the international discards and does not take differences in vessel power or differences in target species into account) The official landings statistics indicate that during 1993-2005 most of the non-Irish landings were from VIIfg (52%) and only 13% were from VIIbc. This provides some justification for raising the Irish VIIgj discards to international levels. Also, France, Ireland and the UK accounted for 95% of the landings in VIIek, so using effort data from these countries to raise the data seems reasonable. France accounted for 50-80% of the landings of Haddock in VIIb-k during 1993-1996. French discard data are only available for 2005-6 and the length distributions of the discards and landings appear similar to the Irish length data from the same area (WGSSDS05 and Figure 4.5.3). However, the assumption that discard rates per unit effort of Irish otter trawlers in VIIgj are similar to the discard rates of the French and UK fleets need to be investigated further. As more data become available it will be possible to investigate this assumption and clarify the reliability of this method of raising discard data.

Table 4.5.4a shows that on average around one in 300 Irish trips were sampled for discards. Discards in VIIgj were then further raised by a factor of around 2-3 to international discards. The raising factors involved are, therefore, very large and the discard data are expected to be quite variable.

The age structure of young haddock appears to vary between years and between VIIb and VIIgj It was therefore considered appropriate to apply separate Age-Length Keys (ALKs) to VIIb and VIIg on an annual basis. For years where age data was insufficient or absent, the average ALK of all years was applied for the relevant area. For many years, it was possible to clearly identify the youngest cohorts from the length distributions. Based on this, some spurious age readings were adjusted. The following rules were applied to correct the data:

Area	Year	Lengths	Change ages from	Change ages to	Observations affected
VIIb	all	<14	1	0	14
VIIb	2003	>14	0	1	28
VIIb	96,97,99,00,01,02,04,05	>15	0	1	8
VIIb	2006	>18	0	1	31
VIIb	all	>25	1	2	110
VIIb	all	<20	2	1	10
VIIgj	all	<22	2	1	28
VIIgj	all	<25	3	2	7

The changes affected 236 age observations out of a total of 3021. Figure 4.5.4 gives an overview of the ALK data used and the corrections made. Some of the ageing problems might be attributed to the fact that many discard otoliths were not read by dedicated age readers. Figure 4.5.5 shows the Irish discard-numbers-at age and the numbers raised to international levels.

Landings

Data for the areas VIIbc, VIIe, VIIfgh and VIIj,k were aggregated and updated using the same procedures as in previous years (described in the Stock Annex). Age compositions were available for age classes 0 to 10. Total international catch numbers-at-age are given in Table 4.5.5a, landings numbers-at-age are given in Table 4.5.5b and discard numbers-at-age in Table 4.5.5c. It is possible to track strong year classes in both the landings and the discards-at-age matrices. Figure 4.5.6 shows the age compositions of the catches: discards account for the majority of the catch numbers in ages classes up to age 3.

Mean catch weights (including discards) at age are given in Table 4.5.6, stock weights (including discards) are given in Table 4.5.7 and Figure 4.5.7. In 2004, mean weight at age in the stock was modelled using a quadratic function fitted through year classes to the quarter 1 catch weights at age. In 2005 a different approach was used, the stock weights were modelled using a Von Bertalanfy growth in weight equation, which is considered to be a biologically more realistic model. The same procedure was followed in 2006. As the growth model did not fit the data very well (due to strong year-effects), it was decided to revert back to applying a 3-year running average to smooth the data. Weights at ages 7+ were constrained not to allow negative growth in weight. Stock and catch weights included discards.

4.5.3 Natural mortality and maturity at age

In the absence of a direct estimate of natural mortality, a constant value of 0.2 was assumed for all age classes and years. The proportions of F and M before spawning were both set to zero to reflect the SSB calculation date of 1st January. Maturity was knife-edged at age 2 following Bellail's investigation (WD2, WGSSDS2003). Irish Q1 survey data from 2004-5 in VIIbgj suggested similar knife-edged maturity ogive at age 2 for females but also indicated that some males mature before the age of two.

4.5.4 Abundance indices

Abundance indices for surveys are given in Table 4.5.8. Survey data tuning series were made available by Ireland, the UK, and France. A new commercial tuning fleet of French gadoid trawlers for 2002-2006 (FR7fghGAD) was supplied. Interim tuning fleets of the Irish Groundfish Survey (IGFS) were provided by Ireland but the time series is too short to be used (2003-present). The raising procedure for the Irish Swept Area Survey (IR7gSAGFS) was adjusted and updated indices were provided. The Irish Sea-Celtic Sea Groundfish Survey (IR7gISCSGFS) is no longer relevant as it has been incorporated in IR7gSAGFS.

The standardised indices are given in Figure 4.5.8 by year and by cohort in Figure 4.5.9. Figure 4.5.10 shows the catch curves and Figure 4.5.11 shows the scatterplots of the correlations of the indices of age classes within cohorts. The Irish West Coast Groundfish Survey (IR7bjWCGFS; discontinued 2002) has very noisy signals, which is probably due to changes in sampling design and vessels. This index was omitted from the analysis. The Irish Swept Area Survey (IR7gSAGFS) continues to track year classes well, this index was included. The UK West Coast Survey (UK7efghjWCS) has strong year effects and was omitted. The new commercial French gadoid fleet (FR7fghGAD) appeared to perform reasonably well for ages 2 to 7 and was included. The EVHOE survey is noisy but on further analysis does show patterns that are consistent with other surveys, particularly for ages 0, 2, 3 and 4, this index was therefore included. The Irish VIIbj Otter trawl fleet (IR7bjOTB) tracks strong year classes and shows good consistency except for the youngest and oldest age classes.

4.5.5 Catch-at-age analysis

The general approach to data screening and analysis followed that outlined in Section 1.4.1. Very few haddock at age 9 or 10 were present in the catch at age matrix and a plus group of 8+ was used. Age group 0 was included in the assessment data to allow inclusion of 0-group indices in the XSA runs. However, in most years no landings at this age were recorded and discard data for this age group was very variable, both over time and between areas. Therefore, catch numbers at age 0 were set to zero to avoid spurious F-shrinkage effects at this age.

Data screening: catch at age

The general methodology is outlined in section 1.4.1. Preliminary investigations were carried out using FLR under R version 2.4.1; The packages FLCore 1.4.3 and FLEDA 1.4.2 were used. Single fleet runs were carried out with discards included. The single fleet runs were performed with F-shrinkage SE of 2.5. Trends in Fbar2-5 were very similar for both survey fleets, the commercial fleets showed the same trend but a consistently lower F. This is probably the result of reduced catchability of older fish for the surveys. It is therefore important to include both survey and commercial tuning fleet data. Residuals were high for the youngest ages in the IR7bjOTB fleet and for older ages in the surveys.

A separable VPA was carried out (using the Lowestoft VPA software) with a terminal F of 1.0 on age 2 and Terminal S of 1.25. High residuals were apparent for age 0. Residuals were also high for ages 8 and higher, so the plus group was retained at 8+.

Exploratory XSA runs

All XSA runs were carried out in FLR; the final run was replicated with the Lowestoft VPA version 3.1 software. A SPALY run was performed, using the settings of run 1 in 2006. The effect of the revised French landings data was examined and found to be trivial. The revised stock weights resulted in a lower SSB in some years (up to 15%). The different selection of tuning fleets had a very small influence on the XSA results. A series of runs were carried out with discards included, which increased the estimated SSB by more than 100% in some years (as well as discards, 2-year-old fish were now also included in SSB estimates). Patterns in F and recruitment (at age 3) were similar to runs without discard data, although Fbar2-5 was higher in recent years when discards were included. The effect of changing F shrinkage was examined and found to be minor unless heavy shrinkage was used (0.5) which reduced the retrospective pattern in the number of recruits at age 0 of the 2002 year class. F shrinkage was retained at 1.5 for the final run. The setting for q-plateau was examined by setting the q-plateau at the oldest age and plotting the catchability-at-age (Figure 4.5.12). For the survey fleets, catchabilty decreased with age up to around age 4. For the Irish commercial fleet, catchability slowly increased over the age range and for the French commercial fleet catchability appeared constant with age. The q plateau was retained at age 4 as a compromise between the different patterns between the fleets.

Final XSA run

The final settings used for this year's assessment are given below.

		2006 XSA (Run 1)		2007 Final XSA	
		Year range	Age range	Year range	Age range
Catch data		93-05	3-8+	93-**06**	**1-8+****
Survey tuning fleets	IR7bjWCGFS	93-02	3-3	**Not used**	
	UK7efghjWCS	98-03	3-5	**Not used**	
	FR7fghjEVHOE	97-05	3-3	97-**06**	**0-5**
	IR7gSAGFS	Not used		99-06	**0-5**
Commercial tuning fleets	IR7bjOTB	95-05	3-7	95-**06**	**2**-7
	FR7fghGAD	Not used		**02-06**	**2-6**
Discards included		No		**Yes**	
Taper		No		No	
Ages catch dep stock size		None		None	
Q plateau		4		4	
F shrinkage SE		1.5		1.5	
F shrinkage year range		5		5	
F shrinkage age range		3		3	
Fleet SE threshold		0.3		0.3	
Fbar range		3-5		**2**-5	

* No final assessment was presented at WGSSDS06, instead three proposed runs were presented, one of which included discards. The settings presented here for WGSSDS06 are of the first (SPALY run).

** Catch numbers in the 0-group were set to zero, this ageclass was included in the XSA to estimate recruitment

The XSA diagnostics are given in Table 4.5.9. The fishing mortality shows a year-effect for 2002, (F>1.1 for ages 2, 3 and 4); see also Figure 4.5.13. The catch numbers at age show a drastic drop for those ages between 2002 and 2003 (Table 4.5.5), this appears to be mainly the result of relatively high estimates of discards in 2002, followed by low estimates for those cohorts in 2003 (Figure 4.5.5 and 4.5.6). The catcability residuals are given in Figure 4.5.14, the residuals are relatively large and the EVHOE survey shows some year effects. The Irish 7gjOTB fleet shows positive residuals for older ages and negative residuals for younger ages in recent years, this could to be a result of increased discarding in recent years, or related to the choice of q-plateau.

The weighting applied to the terminal survivor estimates is shown in Figure 4.5.15. The Irish 7gjOTB fleet dominates weighting for the older ages. The French Gadoid fleet takes a lot of the weighting at ages 2 and 3 and the youngest ages are dominated by the survey fleets. F-shrinkage does not account for much of the weighting in any of the ages. Agreement on the terminal survivor estimates appears to be good. The detailed survivor estimates are shown in Figure 4.5.16. The commercial fleets appear provide consistent survivor estimates as more data become available for each cohort. The survey fleets show quite noisy survivor estimates.

The retrospective analysis is shown in Figure 4.5.17. There is a tendency for F to be adjusted upwards, so the apparent reduction in F might not be reliable. However, the stock levels appear to be decreasing since peaking in 2002, which might result in a decrease in F. The number of recruits in the 2002 year class was revised considerably downwards as more data became available on that cohort.

Estimating recruiting year class abundance

The stock summary is given in Table 4.5.10 and Figure 4.5.18. Estimated recruitment of the 2006 year class is very low, only around 20% of the level of 2002. SSB has decreased as the last strong year class (2002) is fished out. The two survey tuning fleets (EVHOE and SAGFS) show good agreement on the trends in the 0-group (Figure 4.5.19). The new Irish Groundfish Survey (not used in the analysis) indicates slightly higher recruitment in 2006 compared to 2005 for VIIb and VIIj; it is believed that a significant amount of recruitment takes place in VIIb and the north of VIIj, this area is not covered by the EVHOE or SAGFS indices. Nevertheless, these 0-group indices of these surveys correlate well with the estimated population numbers at later ages in the same cohort (Figure 4.5.19)

4.5.6 Historical trends of biomass, recruitment and fishing mortality

Following good recruitment in 1999, 2001 and 2002 the SSB and catch increased, however, due to high discarding, the landings did not increase in line with the increased stock levels (Table 4.5.10 and Figure 4.5.18).

4.5.7 Short-term catch predictions

Short-term projections were not attempted

4.5.8 Yield and biomass per recruit

No yield-per recruit analysis was attempted.

4.5.9 Biological reference points

It is not possible to derive precautionary reference points for this stock from the short time-series of information available.

4.5.10 Sensitivity and Risk Analysis

It is not possible to carry out meaningful medium-term predictions for this stock given the short time series of stock and recruitment estimates.

4.5.11 Comments on the assessment

Sampling

The sampling levels for countries supplying data for 2006 are given in Table 1.3.1. Sampling levels of the landed catch for recent years are considered to be sufficient to support current assessment approaches, although the accuracy depends on levels of misreporting. Sampling levels for discarding are quite low, resulting in a high level of variability.

Discarding

Discards appear to account for more than half of the catch weight in recent years and it is therefore very important that they are taken into account. France has been collecting discard data for the last two years and this will hopefully improve the assessment in the future.

The method of raising discards sample data used here has a few undesirable features. Firstly, the data is only from the Irish OTB fleet and this fleet is not the largest component of the overall fishery, although otter trawls in general do account for most of the haddock VIIbk fishery. Secondly, a small number of discard trips was raised to account for a very large component of the catch data. The level of variability is unknown but likely to be high. Additionally, raising data by number of trips to the total Irish discards, does not take mis-reporting into account and Finally, raising data up to international levels using effort, assumes that discard rates per hour trawled are similar for the Irish OTB fleet and all other fleets.

Nevertheless, the discard-at-age matrix did allow tracking of cohorts and there does seem to be merit in including them in the assessment, despite the reservations outlined above.

Surveys

The EVHOE survey data are quite noisy but indices for some age classes agree with other fleets, The SAGFS appears to perform quite well but the time series is still quite short. The Irish Groundfish Survey (IGFS) has been running for four years now and might be used next year.

Consistency

No comparisons are made this year since the assessments are tentative.

Mis-reporting

Levels of misreporting are unknown for this fishery. Misreporting was previously not considered to be a problem because the TAC has always been in excess of landings. There is information of underreporting (where haddock were reported as whiting) for some of the fleets although it remains difficulty to quantify. Recent reductions in the TAC have brought the TAC to a level closer to recent landings. Problems associated with mis-reporting may be exacerbated as quotas become increasingly restrictive. Despite the fact that the total reported landings for this stock remain below the TAC, fleets may be restricted by their individual quota allocation.

Industry Input

Meetings with representatives of the fishing industry were held in France, Ireland and the UK prior to WGSSDS2007. No specific issues were raised by the industry on VIIb-k haddock.

4.5.12 Management considerations

Recruitment is highly variable and the SSB tends to peak 2 years after high recruitment and then decrease rapidly if no other high level of recruitment occurs. Recent estimates of F remain quite high, while the recent estimates for recruitment are quite low. Due to high levels of discarding, the fleets have not benefited from the recent peak in stock levels; although the catches increased substantially, landings remained roughly the same since the start of the time series.

An increase in mesh size to reduce discarding is likely to be beneficial to this stock and could increase the yield considerably. Reduced selectivity on younger ages would avoid much discarding and would promote stock increase when strong year classes are confirmed. Figure 4.5.20 shows that current cod-end selection characteristics of all fleets (based on experimental observations for the North Sea) are inconsistent with the fishermen’s retention profiles. In Celtic Sea fisheries, some fleets are using 80 mm mesh to target *Nephrops*, 90 mm mesh in mixed fisheries and 100 mm to target gadoids and other species. In order to minimise discards, it would be preferable to match the selection characteristics of gears used with onboard selection. Clearly, there is a need to increase the selectivity characteristics of the gears through technical measures such as an increase in mesh size or manipulation to the position and mesh size of the mandatory square mesh panel. These technical measures would need to be evaluated in the context of other species caught in the mixed fisheries.

There have been major changes in the fleet dynamics over the period of the assessment. Effort in the French gadoid fleet has been declining since 1999. Irish Otter trawl effort has shifted its focus from VIIj to VIIg, but has overall remained fairly constant. In recent years there has been a fleet modernisation and decommissioning scheme in Ireland. A further decommissioning scheme is imminent and aims to remove 40% of the capacity in the whitefish sector nationally.

The closure of three rectangles in the Celtic Sea was in place during the first quarter of 2005, 2006 and 2007 to protect the cod stock. The impact of this on haddock remains unclear but the Irish landings data suggest that landings from these rectangles are minor.

There is some information of mis-reporting in years when haddock quotas were restrictive. It is not possible for the WG to evaluate the scale of this problem and the assessment is largely based on landings reported in logbooks. The recent introduction of buyers and sellers legislation may improve future landings statistics.

Stocks of haddock in Divisions VIa, VIIa and VIIb-k have shown different growth rates and patterns of recruitment variation during the 1990s. This may reflect latitudinal variations in environmental conditions. Catches of haddock along the Atlantic seaboard of the British Isles are recorded more or less continuously between the west coast of Scotland and the Celtic Sea. Significant genetic differences have been found between samples collected at much smaller spatial scales than the entire west coast of the British Isles (ICES: WGNSDS 1999). The implications of this result for evaluating the present stock management units remain unclear. Further investigation is needed to better define the biological stock units.

4.5.13 References

Borges, L., Zuur, A.F., Rogan, E. and Officer, R., 2005. Choosing the best sampling unit and auxiliary variable for discards estimations. Fish Res, 75(1-3): 29-39.

Gerritsen, H.D., McGrath, D. and Lordan, C., 2006. A simple method for comparing age-length keys reveals significant regional differences within a single stock of haddock (Melanogrammus aeglefinus). ICES J. Mar. Sci., 63(3): 1096-1100.

Table 4.5.1. Nominal landings (t) of haddock in VIIb-k, officially reported to ICES and total landings used by the Working group.

	Offical landings						Un-	Used by WG		
Year	Belgium	France	Ireland	UK	Others	Total	allocated	Landings	Discards	Catch
1984	0	3328	646	403	549	4926				
1985	4	2438	794	175	565	3976				
1986	6	2279	317	245	86	2933				
1987	12	2380	314	273	0	2979				
1988	64	3275	275	409	0	4023				
1989	117	3412	323	295	27	4174				
1990	22	2110	461	318	31	2942				
1991	18	1508	1020	250	97	2893				
1992	21	1461	1073	306	26	2887				
1993	51	1839	1262	256	0	3408	-60	3348	1496**	4844
1994	123	2788	908	240	17	4076	55	4131	1496**	5627
1995	189	2964	966	266	83	4468	2	4470	1612	6082
1996	133	4527	1468	439	86	6653	103	6756	2554	9310
1997	246	6581	2789	569	85	10270	557	10827	2930	13757
1998	142	3674	2788	444	312	7360	308	7668	632	8300
1999	51	2725	2034	278	159	5247	-220	5027	561	5588
2000	90	3088	3066	289	123	6656	969	7625	5199	12824
2001	165	4842	3608	422	665	9702	-956	8746	3307	12053
2002	132	4348	2188	315	106	7089	-276	6813	10771	17584
2003	118	5781	1867	393	82	8241	130	8371	9050	17421
2004	136	6130	1715	313	159	8453	128	8581	11692	20273
2005	167	4174	2037	292	197	6867	-219	6648	8224	14872
2006*	100	2786	1838	273	24	5021	357	5378	4021	9399

* preliminary

** No discard data available, the average effort for 1995-1999 was used to estimate discards

Table 4.5.2. LPUE and effort of haddock in VIIb-k for Irish otter trawl and French gadoid fleets and effort only for UK fleets (beam trawl and all other trawls).

	IR-OT-7B VIIb		IR-OT-7J VIIj		IR-OT-7G VIIg		FR-Gadoid VIIf,g,h		UK-Beam VIIe-k	UK-Trawl VIIe-k
Year	**LPUE**	**Effort**	**LPUE**	**Effort**	**LPUE**	**Effort**	**LPUE**	**Effort**	**Effort**	**Effort**
1983							2.18	115379	135344	82054
1984							2.02	85790	131465	86722
1985							2.83	92012	152487	90298
1986							1.64	119664	135738	84748
1987							3.20	144186	177118	84267
1988							7.27	221164	194882	89148
1989							5.28	247929	198156	84140
1990							2.23	201349	207576	99492
1991							1.94	179381	203196	76712
1992							3.74	190784	196065	86397
1993							4.23	213508	208421	61903
1994							7.95	181031	220023	53743
1995	6.49	65273	2.36	93642	1.48	63442	9.12	184067	243136	52270
1996	4.51	41480	3.36	70225	5.36	60032	15.36	170141	260817	60509
1997	5.52	49540	9.12	83171	5.82	65105	19.58	226015	264814	66707
1998	7.01	63520	6.49	89610	4.09	72298	11.62	189457	254590	62114
1999	6.51	62047	4.53	40609	2.34	51586	5.05	206601	251431	98350
2000	4.78	62758	4.72	64626	10.43	60594	8.86	170292	258962	104088
2001	4.92	60725	8.32	67659	8.34	69374	16.39	190482	272662	85338
2002	3.42	46793	6.49	90446	3.28	77689	13.61	176678	249480	83023
2003	2.56	63959	4.34	111267	3.28	86791	22.01	144180	282097	72303
2004	3.13	60446	3.94	91957	3.45	96991	31.41	119444	273871	75681
2005	3.32	47399	4.59	73920	4.42	124395	22.23	101148	270347	76361
2006	3.58	39650	5.10	65350	4.16	118360	17.73	78870	252066	83160

LPUE calculated as landings in kg/h fishing.
Effort in hours fishing.

Table 4.5.3. Length distributions of the landings of haddock in VIIb-k in 2006 (numbers x 1000).

Length (cm)	**IR-OTB VIIb** landings 149 t	**IR-OTB VIIj** landings 410 t	**IR-OTB VIIg** landings 534 t	**IR-SSC VIIj** landings 151 t	**IR-SSC VIIg** landings 342 t	**FR-Gadoid VIIgfh** landings 2201 t	**UK-Beam VIIe-k** landings 63 t	**UK- All other gears VIIe-k** landings 174 t
20								
21	10.1				0.4			
22	12.7				1.3			
23	10.1	0.2	0.3		0.3			
24	15.2	0.2			5.3			
25	25.4				11.5			
26	25.4	2.3	2.3		27.6			
27	25.4	5.1	4.5		53.5	2.4		
28	25.4	11.1	4.4		90.9	4.7		
29	25.4	16.4	11.9		135.4	23.2	0.1	
30	20.3	20.9	25.6		77.3	66.9	0.5	3.5
31	17.8	30.6	47.8	1.0	65.6	93.3	1.5	8.6
32	20.3	35.6	59.4	1.0	48.2	87.7	2.7	21.8
33	20.3	40.5	60.4	2.3	49.1	134.2	3.4	27.1
34	22.8	37.3	53.5	4.6	36.8	185.8	4.0	19.6
35	2.5	34.2	51.8	6.6	25.7	191.0	2.7	12.8
36	10.1	40.1	42.2	7.3	25.7	241.1	2.7	7.8
37	5.1	36.7	46.9	7.3	21.1	244.4	6.1	9.6
38	7.6	43.1	43.4	5.3	27.2	225.7	3.8	7.9
39	7.6	45.0	42.0	8.0	19.5	160.6	4.1	8.5
40	5.1	41.2	30.2	4.0	20.6	151.8	5.2	2.4
41		35.9	33.6	6.3	14.1	132.9	4.5	4.9
42	2.5	31.4	28.9	6.6	13.0	124.9	3.3	4.7
43	2.5	27.0	26.0	6.3	14.6	93.6	2.9	3.5
44		23.5	19.9	9.6	8.6	75.1	3.5	2.0
45	2.5	18.4	23.0	8.6	4.5	84.8	1.7	2.7
46		14.0	26.7	10.0	9.3	85.6	1.7	3.5
47	2.5	10.6	18.4	5.3	0.8	76.0	1.5	3.7
48		9.9	9.8	7.3	1.6	84.6	1.3	2.4
49		9.2	8.3	4.6	1.2	77.6	1.0	4.2
50	2.5	6.6	5.1	5.3	2.5	61.5	1.0	3.3
51	5.1	6.4	9.5	2.0	0.5	66.2	0.8	3.5
52		3.8	6.1	5.3	2.1	40.4	0.8	4.1
53		4.0	5.7	1.7	2.6	25.8	0.7	5.1
54	2.5	1.4	8.5	6.6	2.6	27.4	0.6	5.3
55		2.3	5.7	3.3	1.7	14.4	0.8	4.7
56		1.9	4.2	2.3	1.2	17.7	0.7	4.0
57		1.8	5.4	4.3	3.4	7.6	0.6	2.8
58		1.3	3.2	3.7	0.5	12.6	0.6	2.4
59		1.1	3.5	1.7	1.4	8.6	1.0	3.1
60	2.5	0.5	1.5	0.3	0.6	2.7	0.6	2.0
61	2.5	1.0	1.5	0.7	0.3	4.1	1.1	1.5
62	2.5	0.1	0.8	0.7		1.2	0.9	1.2
63	2.5	0.1	0.9	0.3	0.5	3.8	0.6	1.0
64		0.2	1.3		0.3	5.2	0.3	0.5
65	2.5	0.5	0.6	0.3		2.6	0.4	0.7
66		0.1	1.1	0.3	1.1	5.1	0.1	1.0
67			0.6		0.3	1.4	0.2	0.3
68			1.3			0.6	0.2	0.2
69		0.7	0.3			2.3	0.2	0.2
70			0.6			1.1	0.2	0.1
71							0.1	0.1
72			0.3			0.1	0.1	
73				0.3		0.2	0.0	0.2
74			0.3				0.1	
75			0.3			0.7		0.1
76							0.0	
77							0.0	
78						0.3		
79						0.7	0.0	
80								

Table 4.5.4a. Number of Irish discard trips by year and Metier

Metier	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total
OTB VIIb Nephrops directed	1	1		5	2	2	1	1	3	2	5	6	4	1	34
OTB VIIbc Demersal		3			1						1				5
OTB VIIbcjk Meg & Monk	1	3		5	9	3	3	4	4	2	3	14	9	1	61
OTB VIIck Nephrops directed	1				1	1	2								5
OTB VIIg Demersal	3	3		1	6	4	1		1		4	11	8	1	43
OTB VIIgfh Nephrops directed	4	6		2	1	1	1	1	2		2	2	3		25
OTB VIIj Demersal	1	1	2	4	1	2	2		1		7	3	6	1	31
OTB VIIjh Nephrops directed										2	2	2	2		8
SSC VIIgj Demersal	1			1	3	4					3	5	3		20
Total number of discard trips	12	17	2	18	24	17	10	6	11	6	27	43	35	4	232
Total number of trips in VIIbgj			4211	5799	6062	7008	5434	5091	4676	4625	6532	4510	4781	4497	63226

Table 4.5.4b. Effort (per 1000h) and the raising factor used to raise the Irish 7gj discard data to international discards

Fleet	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total
IR OTB 7b	56*	56*	65	41	50	64	62	63	61	47	64	60	47	40	664
IR OTB 7jg	138*	138*	157	130	148	162	92	125	137	168	198	189	198	184	1889
International 7e-k**	411	371	393	361	441	413	397	400	413	428	415	384	376	346	4766
Raising factor: (Int. 7ek / IR 7gj)	3.00	2.70	2.50	2.77	2.97	2.55	4.31	3.19	3.01	2.54	2.09	2.03	1.90	1.88	

* average of 1995-99

** includes IR OTB 7jg, FR GAD 7fgh and UK trawl (excl beam) 7e-k

Table 4.5.5. (a) Catch numbers-at-age of haddock in VIIb-k. (b) Landings numbers-at-age. (c) Discard numbers-at-age. Strong yearclasses are highlighted.

HADDOCK VIIb-k, SSWG 2007, COMBSEX, PLUSGROUP, CATCH NOS (Discards included)
Note: Catch numbers of the naught group were set to zero

1	2										
1992	2006										
0	10										
1											
2792	3947	4921	1155	865	275	130	130	42	3	0	#1993
2783	4944	4544	1071	511	315	66	25	63	0	0	#1994
10847	4470	1237	1090	462	581	338	161	44	0	0	#1995
450	9134	12687	1505	879	336	275	126	71	10	10	#1996
919	7172	16267	3714	713	593	239	130	33	42	22	#1997
1314	1264	4303	6300	846	302	252	179	73	56	6	#1998
413	2707	3063	1569	1646	245	80	44	14	3	0	#1999
1549	32811	6504	776	545	589	134	23	14	2	0	#2000
2175	13419	12164	1553	326	295	298	51	29	7	0	#2001
14333	22175	16491	6817	927	77	88	73	19	5	2	#2002
17725	20395	22378	2694	1626	112	42	48	41	10	0	#2003
5243	8323	25911	7685	1150	715	50	12	16	3	0	#2004
6093	11894	9361	9831	2216	443	115	4	14	3	0	#2005
14412	7299	4961	2907	2609	371	57	7	0	0	0	#2006

HADDOCK VIIb-k, SSWG 2007, COMBSEX, PLUSGROUP, LANDINGS NOS (No discards)
Note: Landings numbers of the naught group were set to zero

1	2										
1992	2006										
0	10										
1											
9	494	3311	954	815	257	130	130	42	3	0	#1993
0	1491	2934	870	461	297	66	25	63	0	0	#1994
25	2237	1185	1090	462	581	338	161	44	0	0	#1995
0	2399	10373	1206	648	260	275	126	71	10	10	#1996
0	1581	12102	3119	694	580	239	130	33	42	22	#1997
3	640	3264	6199	846	302	252	179	73	56	6	#1998
0	622	2585	1560	1646	245	80	44	14	3	0	#1999
28	4676	2344	587	535	589	134	23	14	2	0	#2000
11	3998	8036	1053	282	295	298	51	29	7	0	#2001
1	872	4216	3354	760	39	88	73	19	5	2	#2002
16	665	8293	1998	1149	112	42	48	41	10	0	#2003
4	117	5870	4540	881	573	50	12	16	3	0	#2004
0	783	836	4223	1909	443	115	4	14	3	0	#2005
0	814	3382	1350	2148	371	57	7	0	0	0	#2006

HADDOCK VIIb-k, SSWG 2007, COMBSEX, PLUSGROUP, DISCARD NOS
Note: Discard numbers of the naught group were set to zero

1	2										
1992	2006										
0	10										
1											
2783	3453	1610	201	50	18	0	0	0	0	0	#1993
2783	3453	1610	201	50	18	0	0	0	0	0	#1994
10822	2233	52	0	0	0	0	0	0	0	0	#1995
450	6735	2314	299	231	76	0	0	0	0	0	#1996
919	5591	4165	595	19	13	0	0	0	0	0	#1997
1311	624	1039	101	0	0	0	0	0	0	0	#1998
413	2085	478	9	0	0	0	0	0	0	0	#1999
1521	28135	4160	189	10	0	0	0	0	0	0	#2000
2164	9421	4128	500	44	0	0	0	0	0	0	#2001
14332	21303	12275	3463	167	38	0	0	0	0	0	#2002
17709	19730	14085	696	477	0	0	0	0	0	0	#2003
5239	8206	20041	3145	269	142	0	0	0	0	0	#2004
6093	11111	8525	5608	307	0	0	0	0	0	0	#2005
14412	6485	1579	1557	461	0	0	0	0	0	0	#2006

Table 4.5.6. Mean catch weights-at-age (including discards) of haddock in VIIb-k.

HADDOCK VIIb-k, SSWG 2007, COMBSEX, PLUSGROUP, CATCH WTS (discards included)

1	3										
1993	2006										
0	10										
1											
0.000	0.185	0.332	0.533	0.815	1.329	1.693	2.130	2.593	2.325	2.325	1993
0.000	0.226	0.473	0.786	1.073	1.363	1.990	2.399	2.673	2.593	2.325	1994
0.000	0.275	0.711	0.932	0.964	1.052	1.284	2.040	2.495	2.673	2.593	1995
0.000	0.171	0.365	0.651	0.989	1.264	1.450	1.850	2.105	1.835	1.415	1996
0.000	0.173	0.432	0.844	1.212	1.397	1.453	0.965	1.451	0.706	1.570	1997
0.000	0.242	0.349	0.658	1.024	1.325	1.558	1.915	2.106	1.544	2.044	1998
0.000	0.218	0.431	0.661	1.094	1.406	2.267	2.594	2.559	1.575	1.544	1999
0.000	0.172	0.549	1.106	1.681	1.826	2.308	2.486	2.213	2.449	1.575	2000
0.000	0.211	0.475	0.895	1.698	1.783	1.705	2.297	1.669	1.386	2.449	2001
0.000	0.186	0.395	0.607	0.939	1.507	1.671	1.504	1.532	1.589	1.840	2002
0.000	0.192	0.395	0.730	1.162	1.429	1.800	1.705	1.589	2.143	3.045	2003
0.000	0.194	0.403	0.707	1.146	1.212	1.855	1.806	1.876	3.092	1.950	2004
0.000	0.199	0.345	0.595	0.994	1.260	1.959	2.681	1.882	2.185	2.708	2005
0.000	0.262	0.495	0.455	0.824	1.484	2.117	2.619	4.022	4.019	2.185	2006

Table 4.5.7. Mean stock weights-at-age (including discards) of haddock in VIIb-k a 3-year running average was applied to smooth the data.

HADDOCK VIIb-k, SSWG 2007, COMBSEX, PLUSGROUP, STOCK WTS (Q1 wts 3yr running average, discards included)

1	4										
1993	2006										
0	10										
1											
0.066	0.190	0.353	0.627	0.821	1.507	2.010	2.114	3.779	3.779	3.779	**#1993**
0.075	0.245	0.439	0.745	0.925	1.486	1.864	2.142	3.403	3.779	3.779	**#1994**
0.070	0.235	0.442	0.791	1.063	1.320	1.720	1.998	2.833	3.403	3.779	**#1995**
0.073	0.225	0.463	0.911	1.198	1.427	1.712	1.961	2.484	2.833	3.403	**#1996**
0.064	0.159	0.353	0.778	1.166	1.365	1.676	2.044	2.542	2.484	2.833	**#1997**
0.061	0.169	0.373	0.665	1.067	1.305	1.782	2.198	2.231	2.542	2.484	**#1998**
0.064	0.177	0.380	0.675	1.090	1.456	2.050	2.363	2.324	2.231	2.542	**#1999**
0.069	0.183	0.436	0.782	1.304	1.693	2.224	2.373	2.363	2.324	2.324	**#2000**
0.080	0.182	0.415	0.825	1.312	1.713	1.893	2.224	2.373	2.363	2.324	**#2001**
0.056	0.183	0.390	0.740	1.284	1.674	1.895	1.893	2.224	2.647	2.651	**#2002**
0.055	0.187	0.365	0.670	1.132	1.526	1.944	1.895	1.893	3.145	2.647	**#2003**
0.050	0.191	0.350	0.657	1.184	1.596	2.320	1.975	1.936	3.147	3.145	**#2004**
0.066	0.211	0.379	0.565	1.040	1.526	2.176	2.428	2.685	3.151	3.147	**#2005**
0.060	0.221	0.383	0.499	0.949	1.528	2.198	2.912	3.187	3.017	3.151	**#2006**

Table 4.5.8. Tuning data available for haddock in VIIb-k, the tuning data used in the final assessment is highlighted in bold font.

HADDOCK VIIb-k, WGSSDS 2006, TUNING DATA

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IR-7b-OT : Irish Otter Trawl in 7B - effort, nos at age per 1000h

1995	2006											
1	1	0	1									
0	10											
65.3	0.0	0.0	20.5	104.3	76.1	105.3	62.0	29.6	8.1	0.0	0.0	#1995
41.5	0.0	19.4	93.2	30.2	30.0	17.9	21.5	9.4	5.1	0.8	0.8	#1996
49.5	0.0	8.3	195.2	116.9	29.6	31.9	19.1	13.5	4.1	5.3	8.4	#1997
63.5	0.0	9.8	147.4	290.7	68.1	37.7	34.6	25.0	9.5	8.4	0.9	#1998
62.0	0.0	0.4	193.6	225.9	190.9	49.6	12.4	6.0	2.3	0.7	0.0	#1999
57.7	0.0	41.3	57.2	22.2	56.8	98.5	31.2	7.5	6.9	0.7	0.0	#2000
60.4	0.0	20.2	289.1	72.8	13.9	42.5	60.4	7.4	8.2	2.0	0.0	#2001
46.8	0.3	3.9	38.9	95.2	28.6	4.3	17.3	17.6	4.8	1.3	0.6	#2002
64.0	0.0	2.2	21.7	42.2	66.8	15.1	9.0	10.6	10.4	2.5	0.1	#2003
60.4	0.0	0.6	43.7	68.3	59.8	79.6	11.0	3.2	4.8	0.3	0.2	#2004
47.4	0.0	9.7	60.8	64.4	57.4	32.7	2.0	1.6	1.0	0.3	0.0	#2005
39.7	0.0	15.4	146.1	80.4	66.0	5.3	6.8	0.0	0.0	0.0	0.0	#2006

IR-7j-OT : Irish Otter Trawl in 7J - effort, nos at age per 1000h

1995	2006											
1	1	0	1									
0	10											
93.6	3.6	323.2	92.2	37.7	1.4	0.5	0.0	0.0	0.0	0.0	0.0	#1995
70.2	0.0	146.9	464.1	24.0	9.9	3.2	1.6	0.0	0.0	0.0	0.0	#1996
83.2	0.0	136.4	929.0	190.9	38.6	26.4	6.7	1.5	0.0	0.0	0.0	#1997
89.6	0.3	69.0	287.7	515.6	48.0	7.3	4.3	3.0	1.6	0.0	0.0	#1998
40.6	0.0	8.5	119.2	52.1	61.2	3.2	1.6	1.8	0.6	0.0	0.0	#1999
64.1	0.0	100.1	80.4	30.6	26.2	37.0	4.9	0.0	0.0	0.0	0.0	#2000
67.7	0.4	347.9	523.0	62.7	21.7	10.4	6.3	1.4	0.1	0.1	0.0	#2001
90.4	0.2	38.9	495.4	322.3	36.0	3.9	7.3	3.2	0.6	0.6	0.0	#2002
111.3	0.7	26.6	318.3	125.7	150.1	23.0	3.6	4.1	2.6	0.0	0.0	#2003
92.0	0.0	7.8	204.5	207.1	84.4	34.4	2.4	0.8	0.6	0.3	0.0	#2004
73.9	0.1	2.3	32.2	207.1	152.6	61.2	9.6	0.0	0.0	0.0	0.0	#2005
65.3	0.0	32.4	117.4	111.6	222.7	44.3	5.4	0.9	0.0	0.0	0.0	#2006

IR-7bj-OT : Irish Otter Trawl in 7B&J - effort, nos at age per 1000h

1995	2006											
1	1	0	1									
0	10											
158.9	3.6	323.2	**112.7**	**142.0**	**77.6**	**105.8**	**62.0**	**29.6**	8.1	0.0	0.0	#1995
111.7	0.0	166.3	**557.4**	**54.1**	**39.9**	**21.1**	**23.1**	**9.4**	5.1	0.8	0.8	#1996
132.7	0.0	144.7	**1124.2**	**307.8**	**68.1**	**58.2**	**25.8**	**15.0**	4.1	5.3	8.4	#1997
153.1	0.3	78.8	**435.1**	**806.3**	**116.1**	**45.1**	**39.0**	**28.0**	11.2	8.4	0.9	#1998
102.7	0.0	8.9	**312.8**	**277.9**	**252.1**	**52.8**	**13.9**	**7.8**	3.0	0.7	0.0	#1999
121.7	0.0	141.3	**137.6**	**52.8**	**83.0**	**135.5**	**36.1**	**7.5**	6.9	0.7	0.0	#2000
128.4	0.4	368.1	**812.0**	**135.6**	**35.0**	**52.9**	**66.7**	**8.8**	8.3	2.0	0.0	#2001
137.2	0.5	42.9	**534.2**	**417.5**	**64.6**	**8.3**	**24.6**	**20.8**	5.4	1.3	0.6	#2002
175.2	0.7	28.8	**340.0**	**167.9**	**216.9**	**38.1**	**12.6**	**14.7**	13.0	2.5	0.1	#2003
152.4	0.0	8.4	**248.2**	**275.3**	**144.2**	**114.0**	**13.4**	**4.0**	5.4	0.6	0.2	#2004
121.3	0.1	12.1	**92.9**	**271.6**	**210.1**	**93.9**	**11.7**	**1.6**	1.0	0.3	0.0	#2005
105.0	0.0	47.8	**263.5**	**192.0**	**288.7**	**49.6**	**12.2**	**0.9**	0.0	0.0	0.0	#2006

Table 4.5.8 (Cont'd)

IR-7g-ISCSGFS : Irish Sea Celtic Sea GFS (VIIg; Prime stations only) – nos per 30min

1997	2002				
1	1	0.8	0.9		
0	4				
1	18.9	11.7	15.2	2.4	2.4
1	241.6	23.6	5.6	0.8	0.2
1	2465.2	6.6	0.4	0.4	0.1
1	1191.4	710.6	0.9	0.0	0.0
1	1200.9	34.5	13.7	0.0	0.0
1	560.9	119.9	8.5	2.8	0.2

IR-7bj-WCGFS : Irish Autumn WCGFS - effort, nos at age per min

1993	2002							
1	1	0.75	0.79					
0	6							
1901	6647	1307	86	52	7	6	0.0	#1993
2386	47261	727	111	68	5	7	0.0	#1994
2210	239176	6136	17	6	2	3	0.0	#1995
2248	37211	9305	333	141	28	22	0.0	#1996
2396	661	8679	526	249	88	120	0.0	#1997
2486	12340	601	685	451	50	31	0.0	#1998
2304	53123	808	22	66	7	18	0.0	#1999
2400	57484	14036	28	22	6	22	0.0	#2000
1107	45261	10419	6230	209	173	364	302.0	#2001
1301	141437	17366	2026	849	7	5	27.0	#2002

UK-7efghj-WCGFS-1gp : Standardised no <= 26 cm as proxy for 1-gp

1992	2001		
1	1	0.15	0.25
1	1		
1	1.7	#1992	
1	19.8	#1993	
1	33.4	#1994	
1	20.8	#1995	
1	145.9	#1996	
1	26.7	#1997	
1	7.1	#1998	
1	9.3	#1999	
1	19.6	#2000	
1	15.6	#2001	

UK-7efghj-WCGFS : Aged component - effort, nos at age per min

1998	2004							
1	1	0.15	0.25					
1	6							
3744.0	380.3	245.8	170.3	51.0	9.5	10.9	#1998	Cirolana
3823.0	580.2	18.5	8.0	37.9	14.5	1.0	#1999	Cirolana
4092.0	1639.0	33.0	1.5	1.5	11.2	1.0	#2000	Cirolana
3700.0	949.9	335.5	33.1	0.0	1.5	4.5	#2001	Cirolana
3387.0	3995.1	317.5	100.8	13.8	2.1	0.0	#2002	Cirolana
2326.0	13655.1	947.1	75.3	45.7	4.6	0.0	#2003	Cirolana
1689.0	3334.1	7174.4	410.7	56.4	18.7	4.0	#2004	Cefas Endeavour

Table 4.5.8 (Cont'd)

FR-7fghj-EVHOE: THALASSA - effort, nos at age per 30min

1997	2006						
1	1	0.75	1				
0	5						
1	**6.38**	**10.49**	**1.53**	**0.10**	**0.07**	**0.00**	#1997
1	**10.72**	**8.85**	**1.38**	**1.82**	**0.44**	**0.13**	#1998
1	**102.68**	**57.65**	**1.70**	**0.58**	**0.32**	**0.16**	#1999
1	**26.03**	**15.50**	**0.17**	**0.03**	**0.04**	**0.02**	#2000
1	**188.39**	**16.98**	**3.12**	**0.29**	**0.01**	**0.00**	#2001
1	**281.02**	**12.38**	**7.49**	**5.53**	**0.31**	**0.00**	#2002
1	**46.57**	**228.87**	**11.61**	**0.77**	**0.10**	**0.01**	#2003
1	**83.49**	**3.25**	**9.52**	**1.24**	**0.11**	**0.03**	#2004
1	**111.84**	**26.13**	**1.26**	**2.36**	**0.49**	**0.10**	#2005
1	**14.74**	**8.67**	**1.04**	**0.20**	**0.34**	**0.17**	#2006

FR-7fgh-GAD : French Gadoid Trawlers in VIIfgh FU05 - effort, nos at age per 1000h

2002	2006									
1	1	0	1							
1	9									
178.7	267.5	**1518.8**	**1435.8**	**17.3**	**5.1**	**3.9**	1.2	0.0	0.0	#2002
144.2	124.8	**3434.6**	**787.5**	**313.0**	**9.3**	**2.3**	0.8	0.1	0.3	#2003
119.4	0.0	**2901.3**	**1909.1**	**219.5**	**102.0**	**4.5**	0.1	0.1	1.0	#2004
101.1	284.7	**258.6**	**1399.6**	**480.4**	**114.5**	**25.9**	1.0	5.5	0.0	#2005
78.9	210.3	**801.7**	**211.6**	**532.7**	**79.2**	**4.9**	0.1	0.0	0.0	#2006

IR-7g-SAGFS : VIIg, Irish Sea Celtic Sea GFS +Irish Groundfish Survey (IBTS 4th Qtr) nos at age per 10km2

1999	2006									
1	1	0.8	0.9							
0	8									
1	**4894**	**129**	**17**	**17**	**5**	1	0	0	0	#1999 ISCSGFS
1	**1549**	**3038**	**25**	**0**	**0**	0	0	0	0	#2000 ISCSGFS
1	**26150**	**1676**	**122**	**12**	**0**	0	0	0	0	#2001 ISCSGFS
1	**14484**	**2402**	**272**	**37**	**3**	0	0	3	3	#2002 ISCSGFS
1	**2819**	**6393**	**453**	**11**	**6**	0	0	0	0	#2003 IBTS Q4
1	**11248**	**1853**	**1302**	**78**	**6**	3	0	0	0	#2004 IBTS Q4
1	**13073**	**2311**	**147**	**112**	**17**	1	0	0	0	#2005 IBTS Q4
1	**3458**	**2145**	**245**	**22**	**6**	2	1	0	0	#2006 IBTS Q4

IR-GFS-7G : Irish Groundfish Survey in VIIg (IBTS 4th Qtr) - Haddock no. @ age (Interim indices: New Celtic Explorer series) – NOT USED

2003	2005								
1	1	0.79	0.92						
0	7								
832	3042	6975	489	11	6	0	0	0	2003
980	14567	2400	1687	101	7	4	0	0	2004
845	15997	2594	173	125	20	1	0	0	2005
1046	5098	3163	361	32	9	3	1	0	2006

IR-GFS-7J : Irish Groundfish Survey in VIIj (IBTS 4th Qtr) - Haddock no. @ age (Interim indices: New Celtic Explorer series) – NOT USED

2003	2005								
1	1	0.79	0.92						
0	7								
780	4592	16281	640	74	20	1	0	0	2003
720	5175	1620	1395	44	7	4	1	0	2004
881	1474	1273	240	286	36	6	2	0	2005
901	2636	262	124	53	50	7	0	0	2006

Table 4.5.8 (Cont'd)

IR-GFS-7g&J : Irish Groundfish Survey in VIIg & j (IBTS 4th Qtr) - Haddock no. @ age (Interim indices: New Celtic Explorer series) – NOT USED

2003	2005								
1	1	0.79	0.92						
0	7								
1612	7708	23095	1212	88	27	1	1	0	2003
1740	19162	4533	3109	183	15	10	1	0	2004
1726	16119	5196	433	413	56	6	2	0	2005
1947	7776	3433	416	87	75	10	1	0	2006

IR-GFS-7b : Irish Groundfish Survey in VIIb (IBTS 4th Qtr) - Haddock no. @ age (Interim indices: New Celtic Explorer series) – NOT USED

2003	2005									
1	1	0.79	0.92							
0	8									
757	11834	34773	2793	874	313	6	1	2	7	2003
728	31311	2960	6688	925	372	196	46	2	1	2004
724	3737	7082	964	2299	188	37	5	0	0	2005
700	8823	2303	2471	614	421	39	16	7	0	2006

Table 4.5.9. XSA diagnostics of the final run for haddock in VIIb-k

Lowestoft VPA Version 3.1

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Extended Survivors Analysis

HADDOCK VIIb-k SSWG 2007 COMBSEX PLUSGROUP

CPUE data from file HAD7TU.txt

Catch data for 14 years. 1993 to 2006. Ages 0 to 8.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
IR-7bj-OT : Irish Ot	1995	2006	2	7	0	1
FR-7fghj-EVHOE: THAL	1997	2006	0	5	0.75	1
FR-7fgh-GAD : French	2002	2006	2	6	0	1
IR-7g-SAGFS : VIIg	1999	2006	0	5	0.8	0.9

Time series weights :

Tapered time weighting not applied

Catchability analysis :

Catchability independent of stock size for all ages

Catchability independent of age for ages >= 4

Terminal population estimation :

Survivor estimates shrunk towards the mean F
of the final 5 years or the 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 converged after 28 iterations

Regression weights

1	1	1	1	1	1	1	1	11

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	0.539	0.193	0.197	0.74	0.394	0.396	0.314	0.39	0.434	0.164
2	0.825	0.742	0.998	1.021	0.685	1.287	0.914	0.849	1.064	0.324
3	1.053	0.931	0.674	0.755	0.73	1.12	0.74	0.985	0.968	1.273
4	0.704	0.732	0.675	0.524	0.861	1.533	0.92	0.85	0.893	0.753
5	0.756	0.753	0.481	0.546	0.608	0.494	0.767	1.655	0.992	0.35
6	0.457	0.886	0.452	0.531	0.596	0.364	0.564	0.992	1.786	0.31
7	0.697	0.756	0.362	0.224	0.394	0.28	0.346	0.307	0.181	0.461

XSA population numbers (Thousands)

	AGE							
YEAR	0	1	2	3	4	5	6	7
1997	9700	19000	32000	6310	1560	1230	720	286
1998	20400	7940	9080	11500	1800	631	474	373
1999	84700	16700	5360	3540	3710	710	243	160
2000	55700	69400	11200	1620	1480	1550	359	127
2001	91500	45600	27100	3310	622	716	733	173
2002	102000	74900	25200	11200	1310	216	319	331
2003	34800	83700	41300	5690	2990	231	108	181
2004	45600	28500	50000	13600	2220	976	88	50
2005	65300	37300	15800	17500	4150	778	153	27
2006	16900	53400	19800	4460	5450	1390	236	21

Table 4.5.9 (Cont'd)

Estimated population abundance at 1st Jan 2007

0	13800	37200	11700	1020	2100	802	142

Taper weighted geometric mean of the VPA populations:

37900	31400	16300	5460	2170	828	331	151

Standard error of the weighted Log(VPA populations) :

0.7377	0.7228	0.7031	0.6633	0.5409	0.6243	0.7112	0.9708

Log catchability residuals.

Fleet : IR-7bj-OT : Irish Ot

Age	1995	1996
0	No data for this fleet at this age	
1	No data for this fleet at this age	
2	-0.35	0.6
3	-0.43	-0.75
4	-0.66	-1.08
5	0.13	-1.1
6	0.43	-0.24
7	0.01	-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	0.65	0.79	1.49	-0.23	0.47	0.3	-1.04	-1.43	-0.95	-0.3
3	0.43	0.6	1	-0.01	0.15	0.15	-0.48	-0.62	-0.66	0.62
4	-0.16	0.09	0.52	0.1	0.19	0.25	0.16	0.16	0.15	0.28
5	-0.06	0.21	0.53	0.55	0.35	-0.41	0.91	1.05	1.06	-0.29
6	-0.47	0.4	0.25	0.68	0.56	0.22	0.48	1.07	0.9	0.06
7	0.02	0.26	0.05	0.01	-0.11	-0.02	0.02	0.13	0.01	-0.05

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	-8.4218	-7.7732	-7.4374	-7.4374	-7.4374	-7.4374
S.E(Log q)	0.8644	0.5858	0.4447	0.6941	0.5805	0.1012

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	2.27	-1.696	6.7	0.15	12	1.81	-8.42
3	1.21	-0.666	7.59	0.51	12	0.73	-7.77
4	0.94	0.254	7.45	0.66	12	0.44	-7.44
5	1.19	-0.517	7.29	0.44	12	0.79	-7.19
6	1.54	-2.357	7.78	0.66	12	0.57	-7.07
7	0.99	0.361	7.39	0.99	12	0.1	-7.42
1							

Table 4.5.9 (Cont'd)

Fleet : FR-7fghj-EVHOE: THAL

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	-0.56	-0.78	0.05	-0.9	0.58	0.87	0.15	0.46	0.4	-0.27
1	0.24	0.64	1.77	-0.49	-0.28	-1.1	1.64	-1.47	0.38	-1.32
2	-0.88	0.21	1.17	-1.86	-0.12	1.35	0.97	0.53	-0.15	-1.22
3	-1.59	0.61	0.42	-1.69	-0.15	1.91	0.28	0.11	0.47	-0.36
4	-0.52	1.19	0.1	-1.18	-1.08	1.87	-0.59	-0.26	0.62	-0.15
5	99.99	1.04	0.9	-1.9	99.99	99.99	-0.73	0.02	0.76	0.17
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	-6.5926	-7.0921	-8.1776	-8.3701	-8.6993	-8.6993
S.E(Log q)	0.6066	1.1474	1.0642	1.0561	0.978	1.0533

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	0.67	2.43	7.93	0.87	10	0.33	-6.59
1	1.88	-0.925	4.12	0.12	10	2.18	-7.09
2	0.91	0.197	8.34	0.35	10	1.02	-8.18
3	0.54	2.125	8.54	0.73	10	0.48	-8.37
4	0.8	0.464	8.5	0.41	10	0.82	-8.7
5	1.35	-0.354	9.37	0.17	7	1.54	-8.66

1

Fleet : FR-7fgh-GAD : French

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	99.99	0.05	0.43	0.24	-0.78	0.06
3	99.99	99.99	99.99	99.99	99.99	-0.1	0.04	0.34	-0.06	-0.22
4	99.99	99.99	99.99	99.99	99.99	-1.84	0.21	0.31	0.65	0.67
5	99.99	99.99	99.99	99.99	99.99	-1.68	-0.81	0.67	0.93	-0.04
6	99.99	99.99	99.99	99.99	99.99	-2.39	-1.53	-0.29	1.37	-1.07
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	-7.3861	-6.5519	-6.9266	-6.9266	-6.9266
S.E(Log q)	0.4614	0.2125	1.0486	1.0946	1.6729

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	0.57	2.355	8.62	0.91	5	0.18	-7.39
3	0.86	0.824	6.9	0.93	5	0.19	-6.55
4	0.38	3.197	7.57	0.9	5	0.22	-6.93
5	0.5	2.317	6.71	0.88	5	0.37	-7.11
6	-6.44	-0.834	-11.85	0	5	9.55	-7.71

1

Table 4.5.9 (Cont'd)

Fleet : IR-7g-SAGFS : VIIg

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
0	99.99	99.99	-0.76	-1.49	0.84	0.14	-0.42	0.69	0.49	0.51
1	99.99	99.99	-1.76	0.43	-0.04	-0.17	0.63	0.53	0.52	-0.14
2	99.99	99.99	-0.79	-1.12	-0.7	0.68	0.38	1.19	0.35	0
3	99.99	99.99	-0.06	99.99	-0.3	-0.06	-0.92	0.38	0.47	0.47
4	99.99	99.99	-0.65	99.99	99.99	0.62	-0.04	0.2	0.65	-0.78
5	99.99	99.99	-0.77	99.99	99.99	99.99	99.99	1.01	-0.42	-0.86
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	-1.9232	-2.7632	-3.9496	-4.5343	-5.2206	-5.2206
S.E(Log q)	0.8166	0.7833	0.8039	0.5044	0.612	0.9167

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	1.13	-0.207	0.76	0.3	8	0.99	-1.92
1	0.53	1.964	6.53	0.74	8	0.35	-2.76
2	0.55	2.535	6.6	0.84	8	0.33	-3.95
3	0.75	1.09	5.59	0.8	7	0.37	-4.53
4	3.97	-1.582	-3.06	0.07	6	2.13	-5.22
5	1.05	-0.023	5.41	0.1	4	1.11	-5.48
1							

Terminal year survivor and F summaries :

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

Year class = 2006

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
IR-7bj-OT : Irish Ot	1	0	0	0	0	0	0
FR-7fghj-EVHOE: THAL	10489	0.636	0	0	1	0.65	0
FR-7fgh-GAD : French	1	0	0	0	0	0	0
IR-7g-SAGFS : VIIg	22962	0.866	0	0	1	0.35	0
F shrinkage mean	0	1.5				0	0

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
13803	0.51	0.37	2	0.729	0

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

Year class = 2005

Table 4.5.9 (Cont'd)

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
IR-7bj-OT : Irish Ot	1	0	0	0	0	0	0
FR-7fghj-EVHOE: THAL	38040	0.562	0.709	1.26	2	0.489	0.16
FR-7fgh-GAD : French	1	0	0	0	0	0	0
IR-7g-SAGFS : VIIg	43503	0.6	0.314	0.52	2	0.43	0.141
F shrinkage mean	13930	1.5				0.081	0.388

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
37153	0.4	0.31	5	0.782	0.164

1

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

Year class = 2004

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
IR-7bj-OT : Irish Ot	8677	0.9	0	0	1	0.105	0.417
FR-7fghj-EVHOE: THAL	11465	0.512	0.53	1.04	3	0.242	0.33
FR-7fgh-GAD : French	12472	0.505	0	0	1	0.332	0.307
IR-7g-SAGFS : VIIg	16525	0.502	0.215	0.43	3	0.269	0.24
F shrinkage mean	2738	1.5				0.052	0.971

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
11727	0.28	0.2	9	0.722	0.324

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

Year class = 2003

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
IR-7bj-OT : Irish Ot	1537	0.541	0.538	1	2	0.132	0.998
FR-7fghj-EVHOE: THAL	785	0.569	0.251	0.44	4	0.078	1.471
FR-7fgh-GAD : French	775	0.273	0.174	0.64	2	0.529	1.48
IR-7g-SAGFS : VIIg	1531	0.425	0.131	0.31	4	0.194	1
F shrinkage mean	1747	1.5				0.067	0.918

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
1024	0.21	0.13	13	0.608	1.273

1

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

Table 4.5.9 (Cont'd)

Year class = 2002

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
IR-7bj-OT : Irish Ot	2234	0.383	0.322	0.84	3	0.321	0.721
FR-7fghj-EVHOE: THAL	2730	0.603	0.252	0.42	5	0.096	0.623
FR-7fgh-GAD : French	2253	0.28	0.181	0.65	3	0.306	0.717
IR-7g-SAGFS : VIIg	1745	0.408	0.342	0.84	5	0.226	0.856
F shrinkage mean	1326	1.5				0.051	1.023

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
2102	0.2	0.12	17	0.617	0.753

Age 5 Catchability constant w.r.t. time and age (fixed at the value for age) 4

Year class = 2001

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
IR-7bj-OT : Irish Ot	700	0.386	0.167	0.43	4	0.36	0.392
FR-7fghj-EVHOE: THAL	1096	0.666	0.139	0.21	6	0.124	0.267
FR-7fgh-GAD : French	1074	0.356	0.12	0.34	4	0.246	0.272
IR-7g-SAGFS : VIIg	823	0.457	0.306	0.67	6	0.218	0.342
F shrinkage mean	225	1.5				0.053	0.913

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
802	0.22	0.12	21	0.534	0.35

1

Age 6 Catchability constant w.r.t. time and age (fixed at the value for age) 4

Year class = 2000

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
IR-7bj-OT : Irish Ot	176	0.401	0.195	0.49	5	0.537	0.257
FR-7fghj-EVHOE: THAL	198	0.656	0.253	0.39	6	0.069	0.232
FR-7fgh-GAD : French	141	0.433	0.301	0.7	5	0.194	0.312
IR-7g-SAGFS : VIIg	104	0.438	0.219	0.5	6	0.127	0.403
F shrinkage mean	37	1.5				0.074	0.87

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
142	0.27	0.13	23	0.503	0.31

Age 7 Catchability constant w.r.t. time and age (fixed at the value for age) 4

Table 4.5.9 (Cont'd)

Year class = 1999

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
IR-7bj-OT : Irish Ot	11	0.286	0.09	0.32	6	0.924	0.464
FR-7fghj-EVHOE: THAL	11	0.687	0.271	0.39	6	0.004	0.466
FR-7fgh-GAD : French	20	0.756	0.374	0.49	4	0.01	0.271
IR-7g-SAGFS : VIIg	15	0.472	0.25	0.53	6	0.006	0.351
F shrinkage mean	10	1.5				0.056	0.475

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
11	0.28	0.05	23	0.172	0.461

1
1

Table 4.5.10. Stock summary for Haddock in VIIb-k

Year	Recruits age 0	TotBIO	TotSSB	Landings	Yield/SSB	Fbar 2-5
1993	15212	14639	11446	3348	0.293	0.504
1994	38440	16615	13565	4131	0.305	0.424
1995	60088	19789	12371	4470	0.361	0.372
1996	23221	31231	20155	6756	0.335	0.629
1997	9702	25086	22061	10827	0.491	0.834
1998	20411	17447	16104	7668	0.476	0.790
1999	84724	13468	10512	4882	0.464	0.707
2000	55671	24742	12030	7411	0.616	0.712
2001	91533	26380	18084	8632	0.477	0.721
2002	102180	35363	21644	6403	0.296	1.108
2003	34802	39251	23598	8146	0.345	0.835
2004	45603	36585	31133	8581	0.276	1.085
2005	65278	30024	22133	6648	0.300	0.979
2006	16859	29575	17734	5378	0.303	0.675

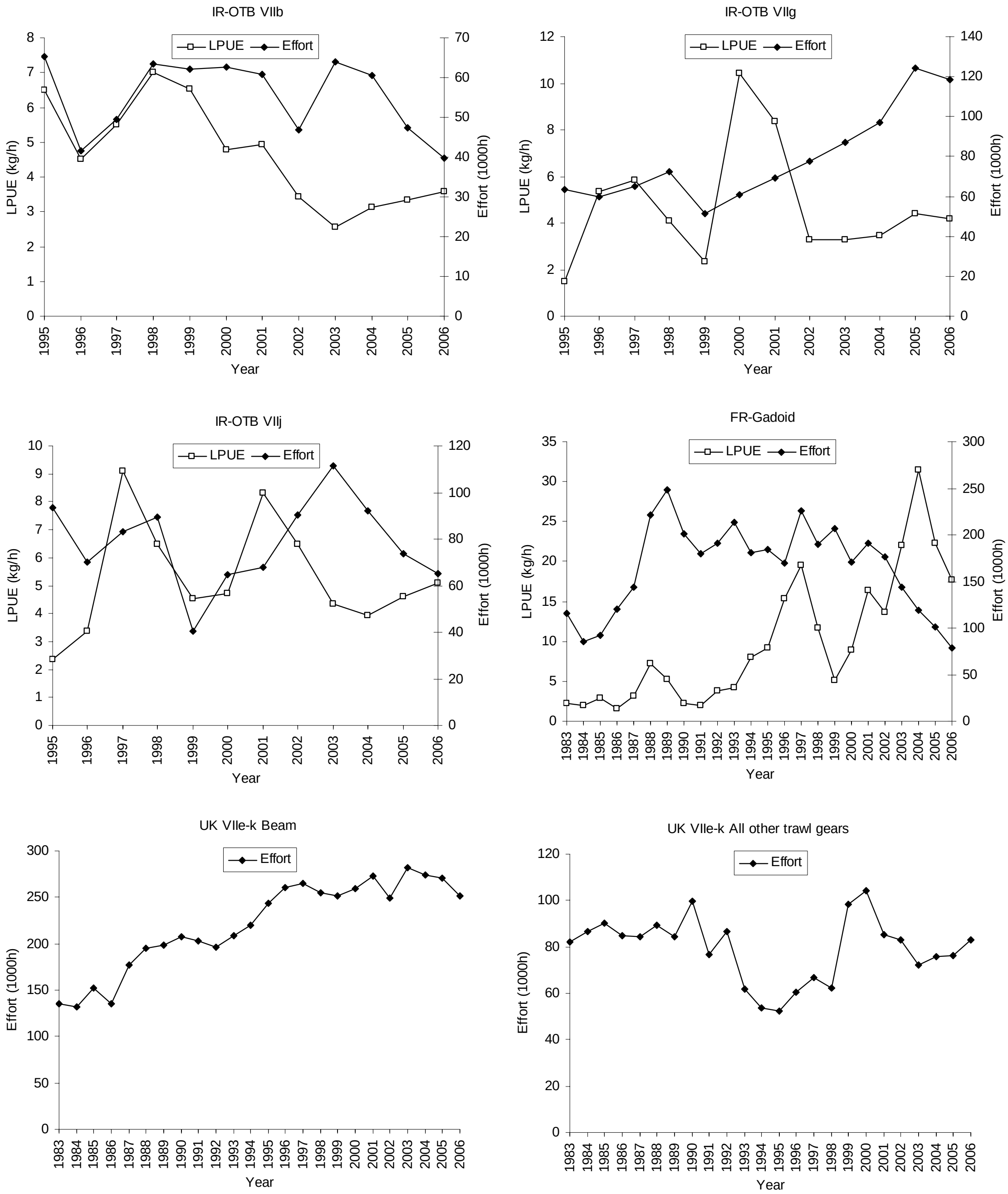

Figure 4.5.1. LPUE and effort of haddock in VIIb-k for Irish otter trawl and French gadoid fleets and effort only for UK fleets (beam trawl and all other trawls).

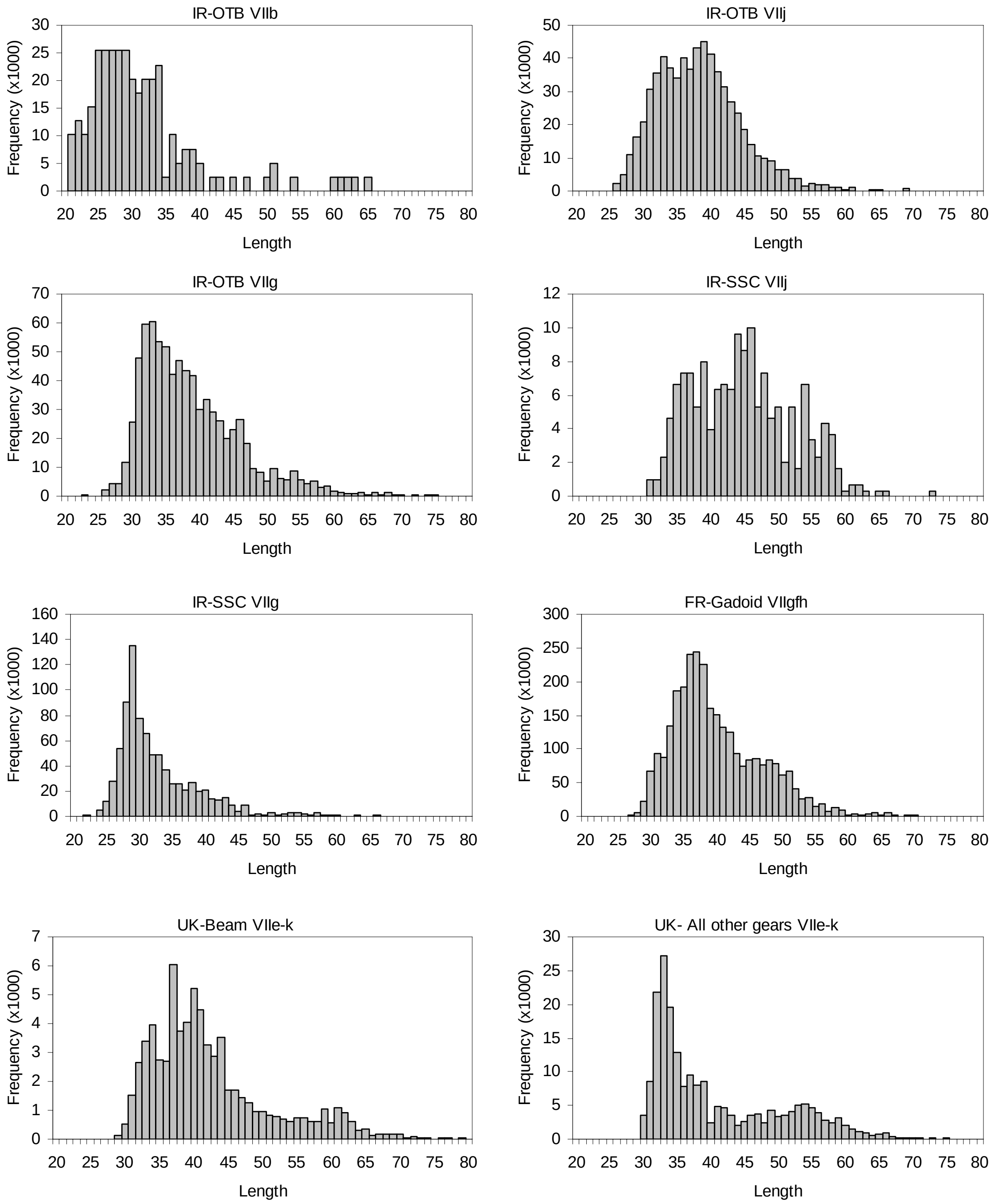

Figure 4.5.2. Length distributions of the landings of haddock in VIIb-k in 2006 (numbers x 1000).

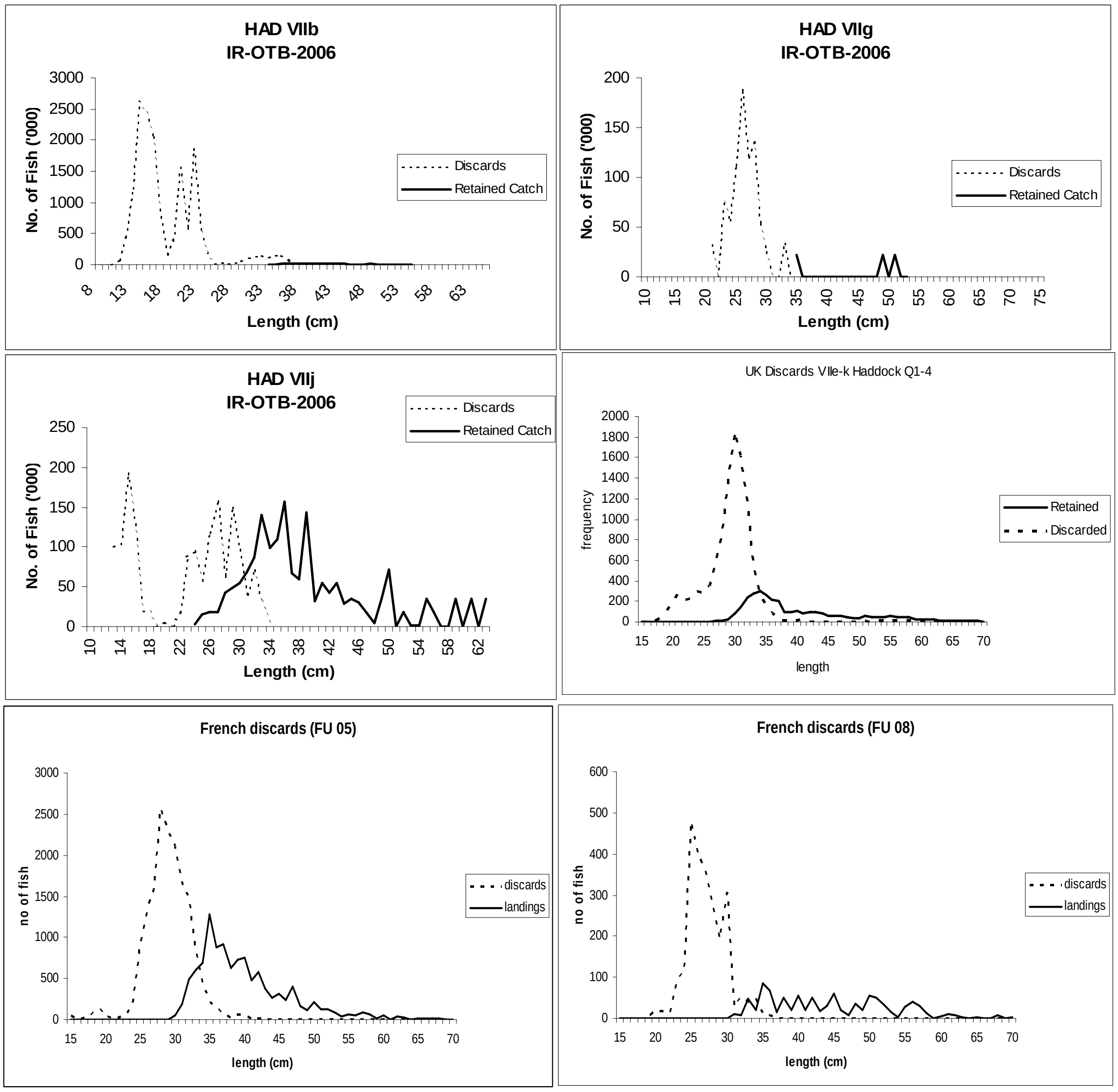

Figure 4.5.3. Length distributions of discards of haddock in VIIb-k for Irish, UK and French fleets (FU5 is the French gadoid fleet and FU8 is the French nephrops fleet)

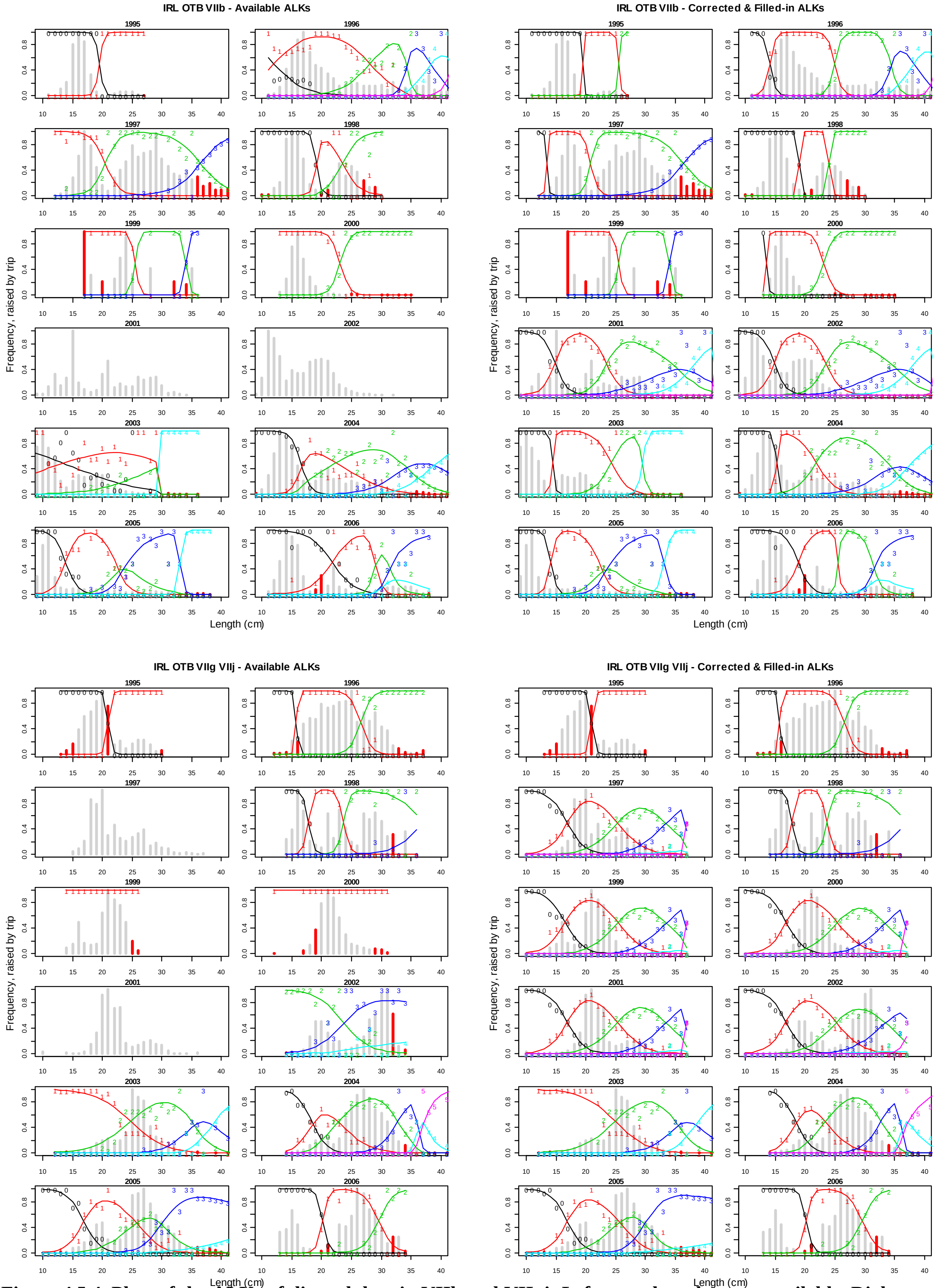

Figure 4.5.4. Plots of the ALKs of discard data in VIIb and VIIgj; Left: raw data that was available. Right: corrected data. The numbers represent the observed proportions-at-age in each length class. The curves are multinomial models that help visualisation and are used to predict missing data (Gerritsen et al., 2006). The grey bars are scaled length distributions, red (dark) bars are age observations with missing length data. Some corrections were applied to the raw age-length data using rules outlined in paragraph 4.5.2, average ALKs were applied for years with insufficient data.

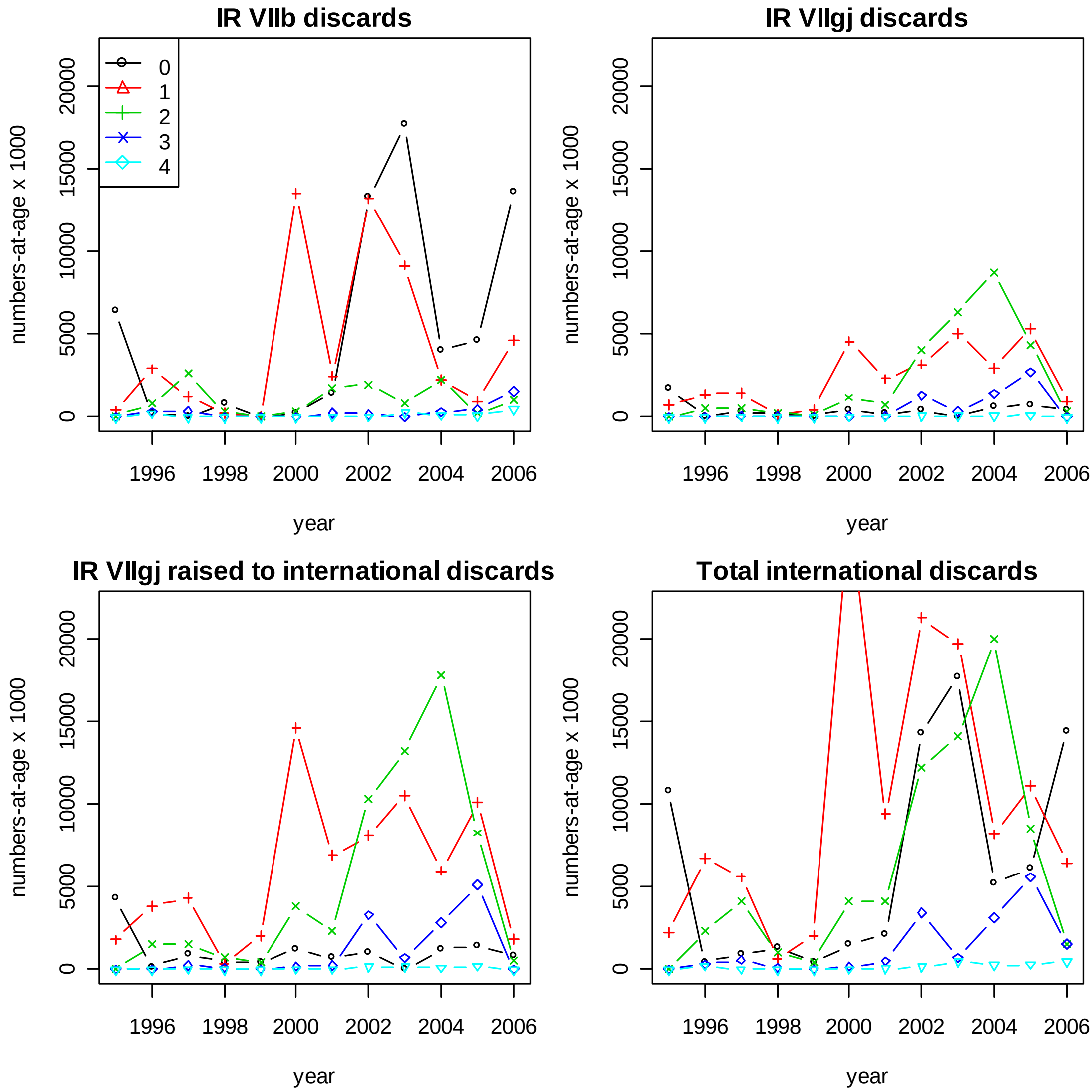

Figure 4.5.5. Numbers-at-age of Irish discards of haddock in VIIb and VIIgj, also the Irish VIIgj discards raised to international levels and the total international discards (IR VIIb + Raised IR VIIgj).

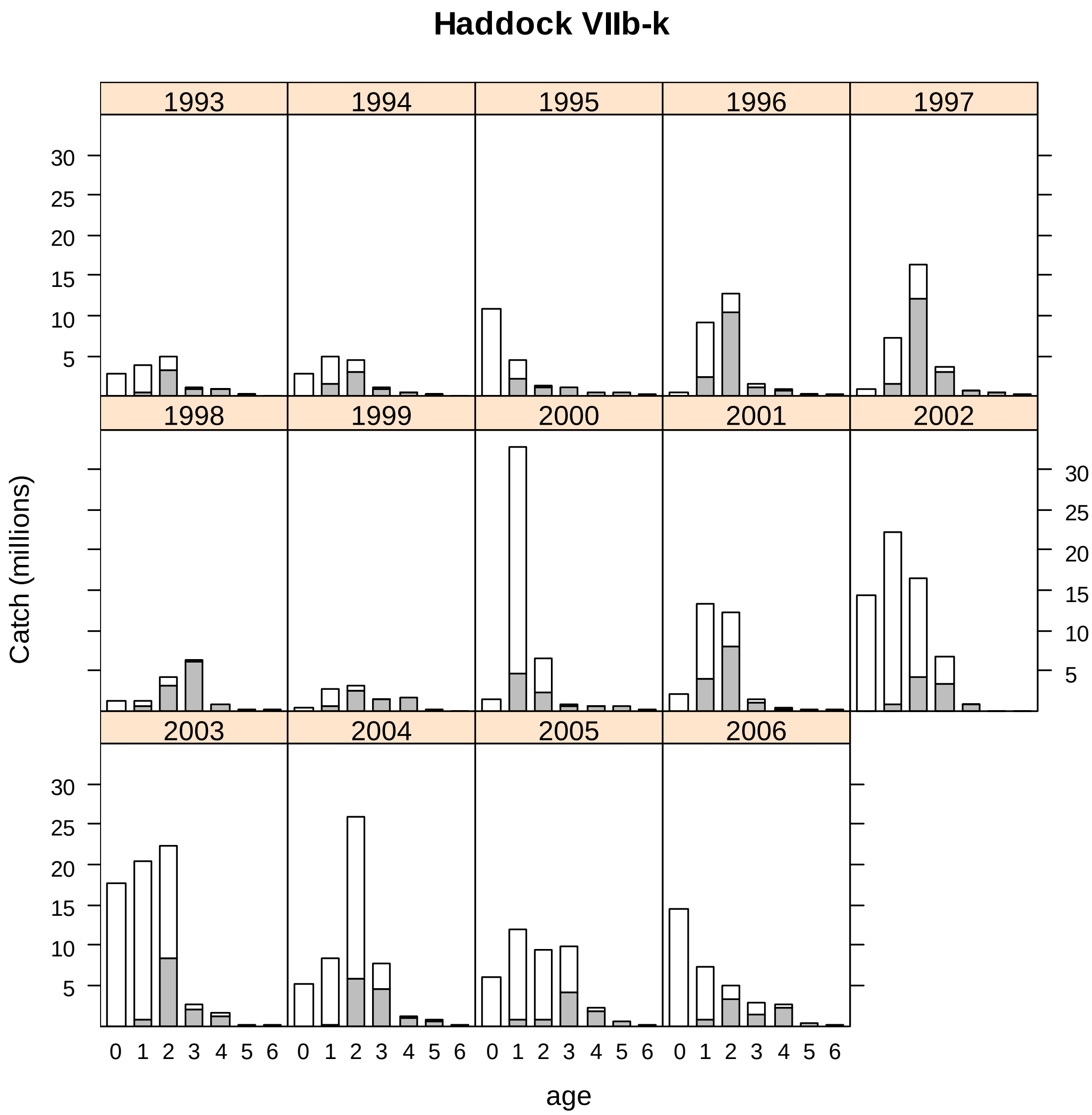

Figure 4.5.6. Age compositions of landings (grey) and discards (white) of haddock in VIIB-k.

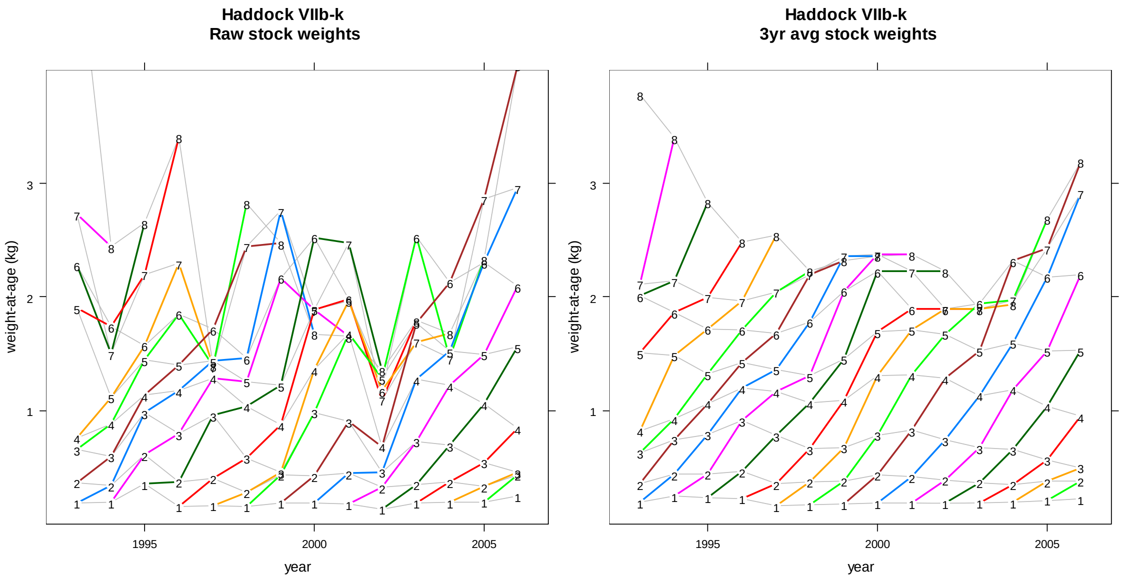

Figure 4.5.7. Raw stock weights (left) and smoothened stock weights using a 3-year running average (right) for haddock VIIb-k.

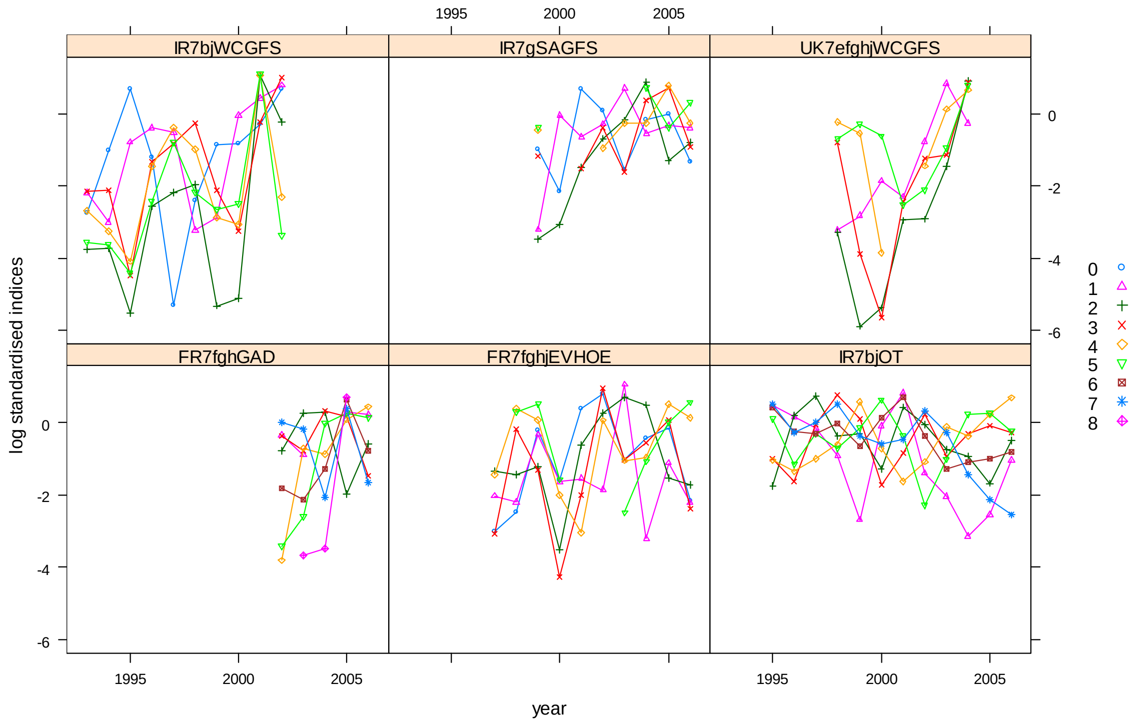

Figure 4.5.8. Log standardised indices of tuning fleets by year for haddock in VIIb-k. The IR7bjWCGFS and UK7e-jWCGFS were not used in the assessment.

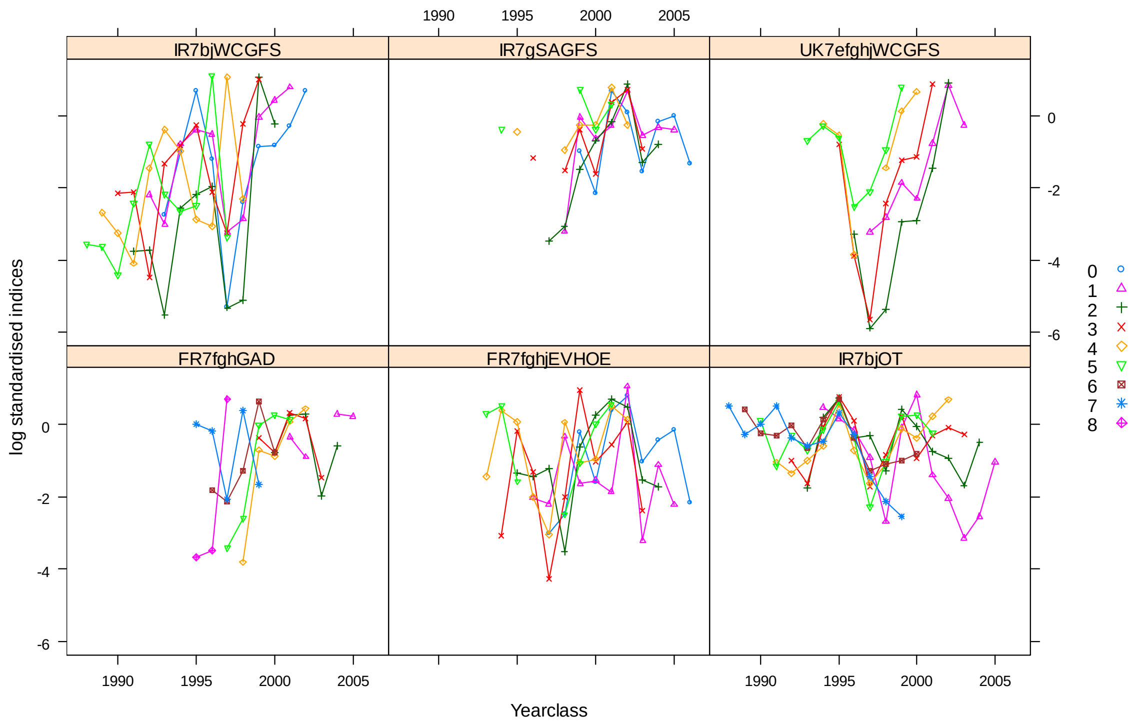

Figure 4.5.9. Log standardised indices of tuning fleets by cohort for haddock in VIIb-k. The IR7bjWCGFS and UK7e-jWCGFS were not used in the assessment.

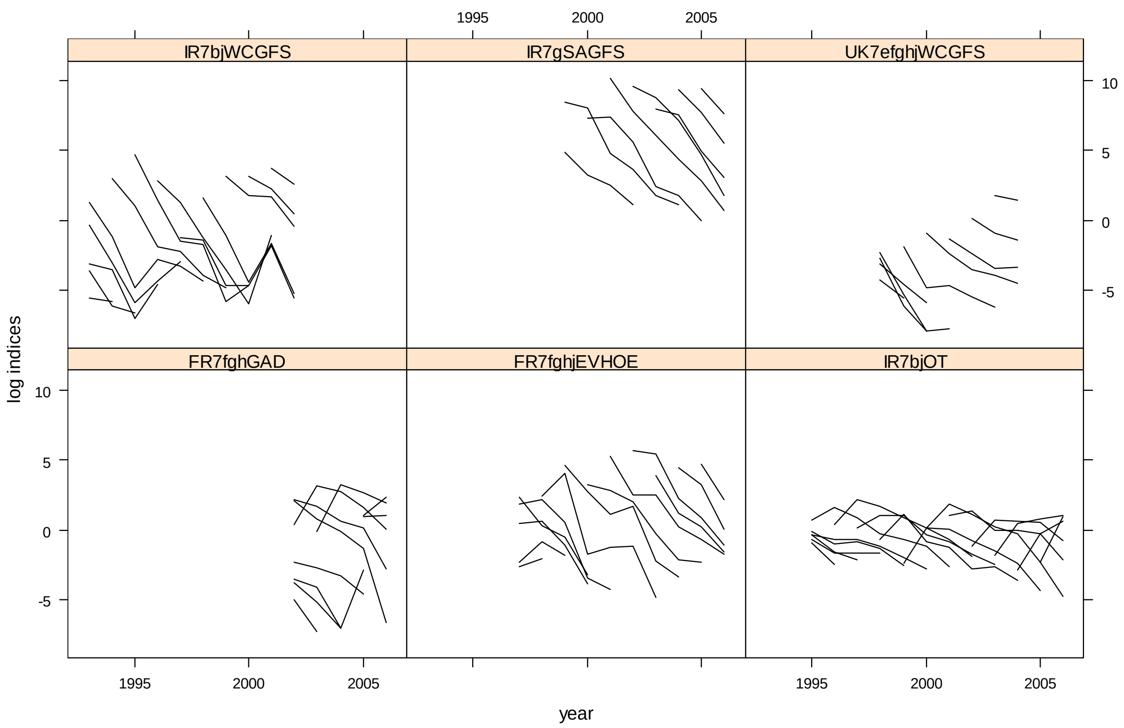

Figure 4.5.10. Catch curves of of tuning fleets by cohort for haddock inVIIb-k. The IR7bjWCGFS and UK7e-jWCGFS were not used in the assessment.

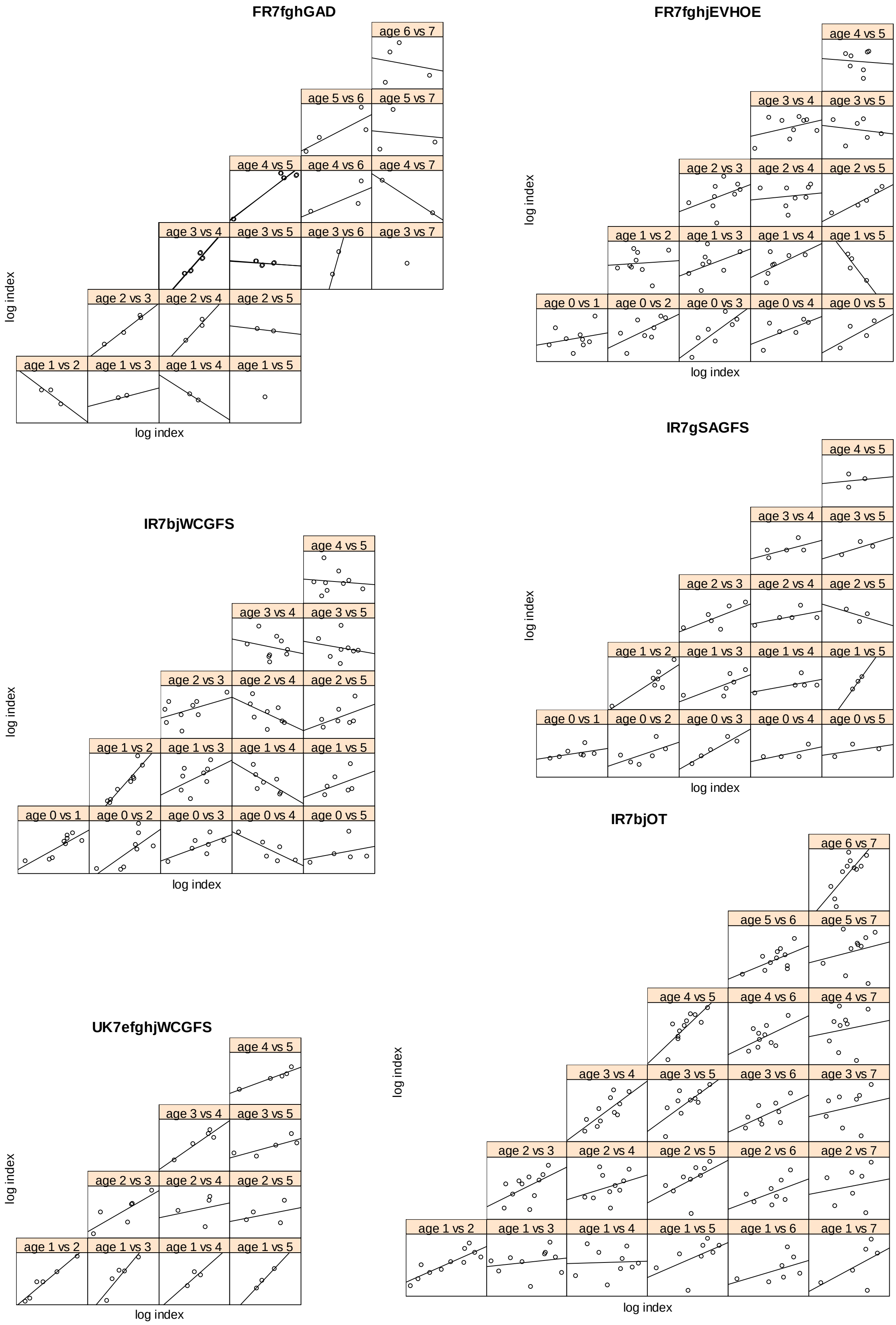

Figure 4.5.11. Scatterplots of tuning fleets for haddock in VIIb-k

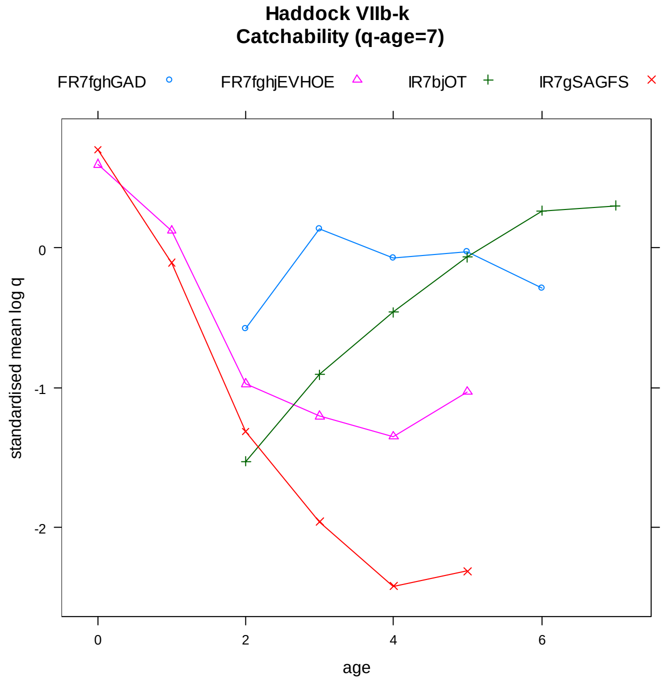

Figure 4.5.12. Catchability of tuning fleets with the q-plateau set at the oldest age for haddock VIIb-k

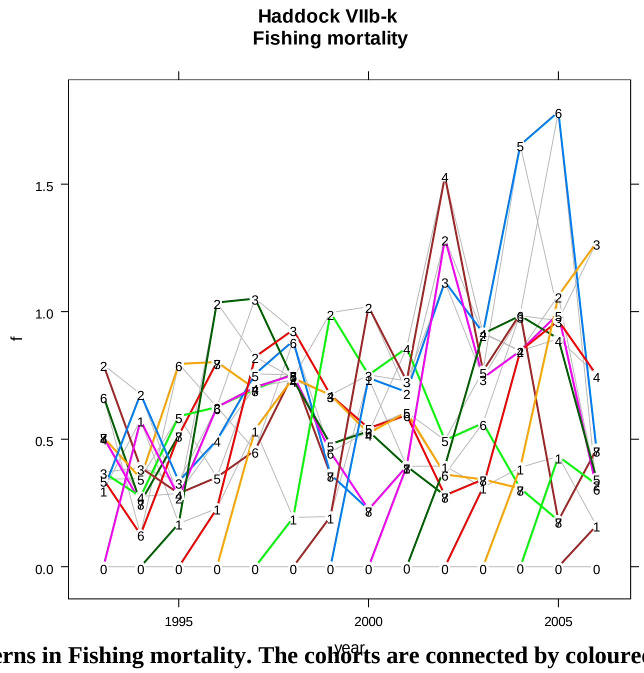

Figure 4.5.13. Patterns in Fishing mortality. The cohorts are connected by coloured lines.

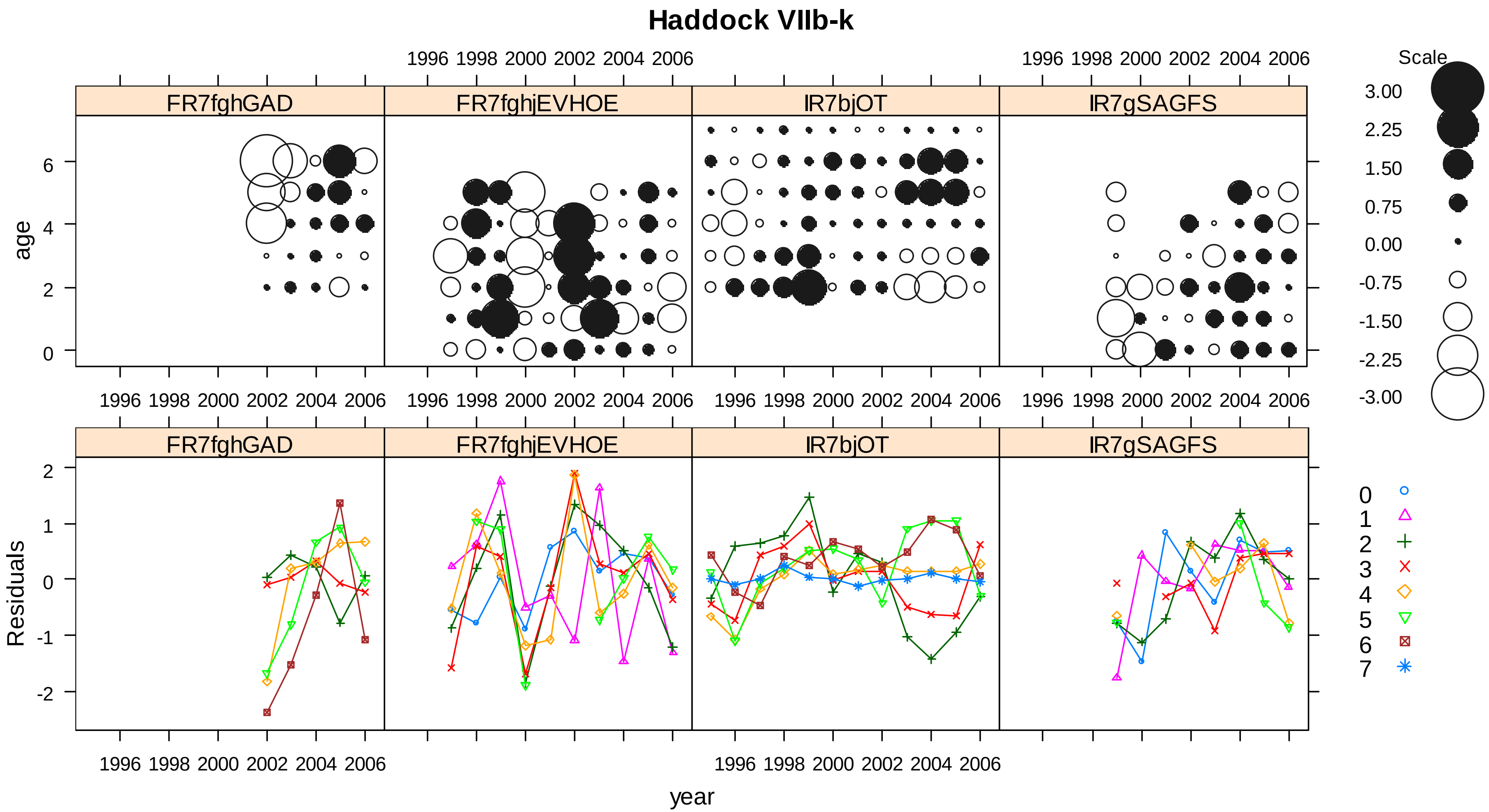

Figure 4.5.14. Log-catchability residual plots for haddock in VIIb-k

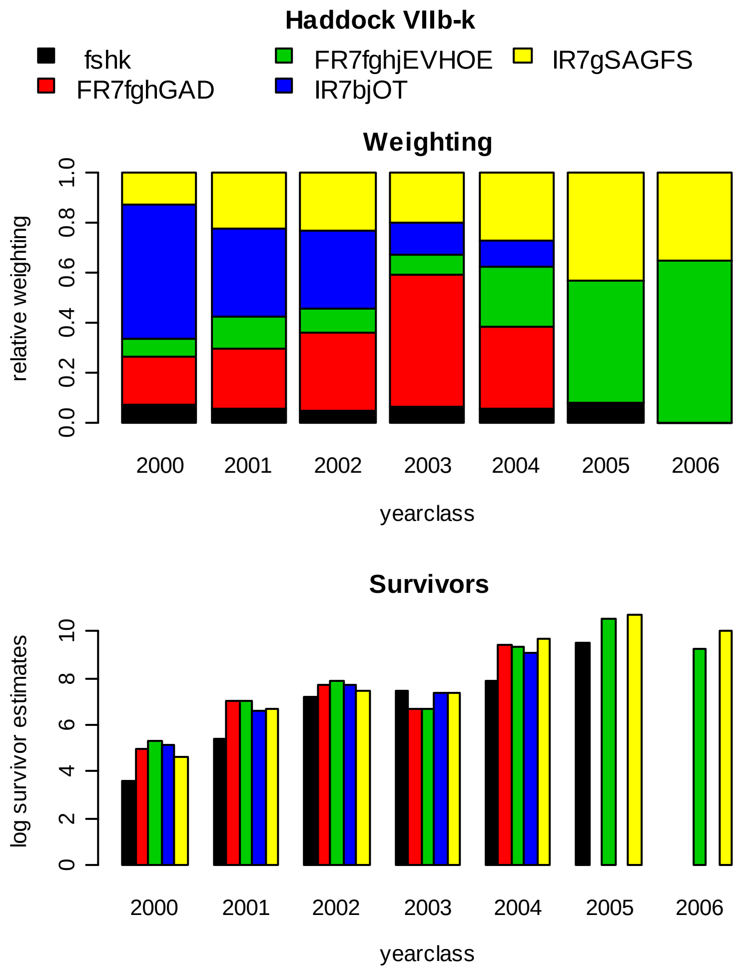

Figure 4.5.15. Scaled weights and survivor estimates for haddock in VIIb-k.

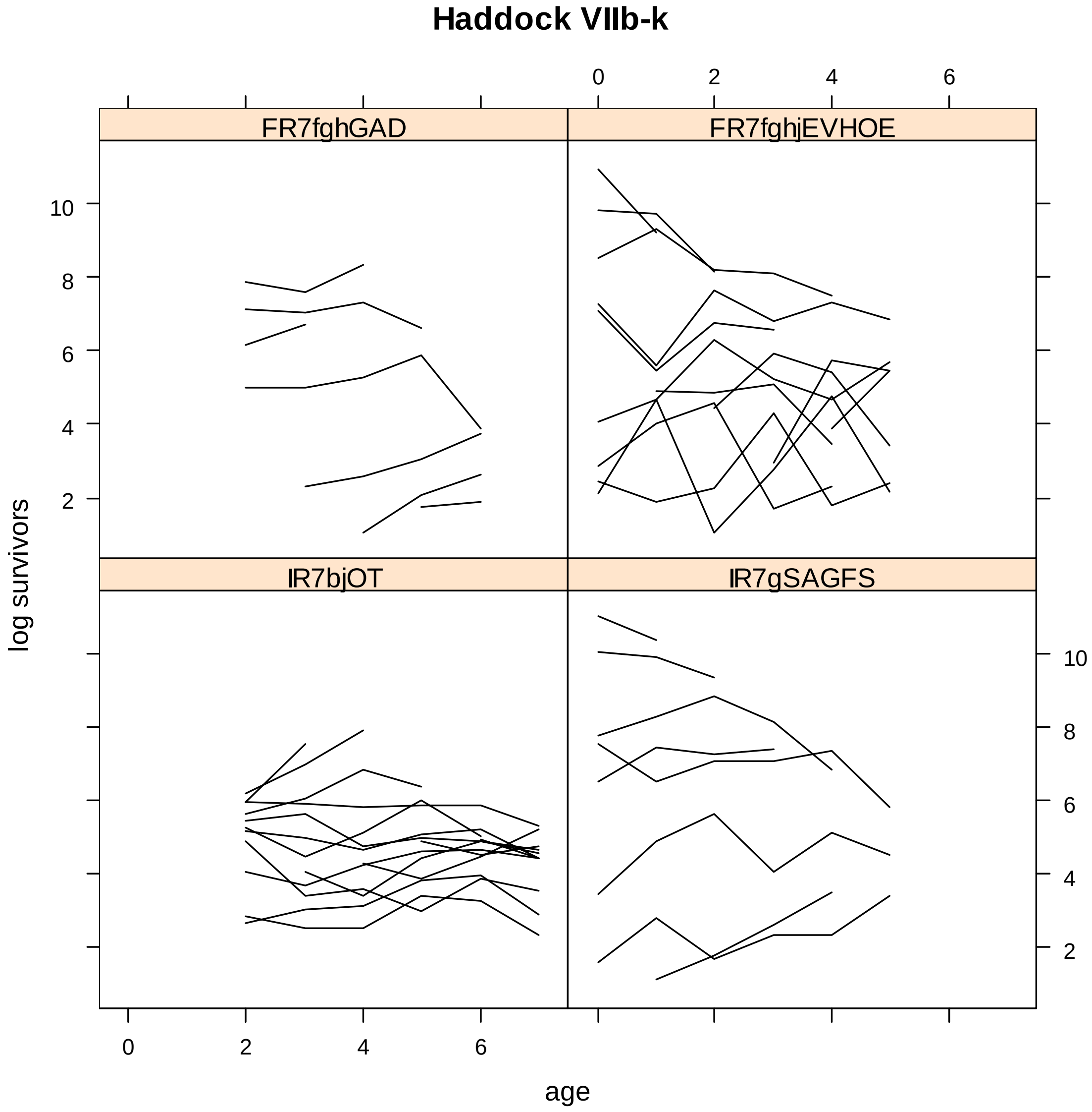

Figure 4.5.16. For each fleet and each age in the cohort's history, the estimates of the terminal population at the end of the final assessment year is given for each the tuning fleet. The lines join each cohort.

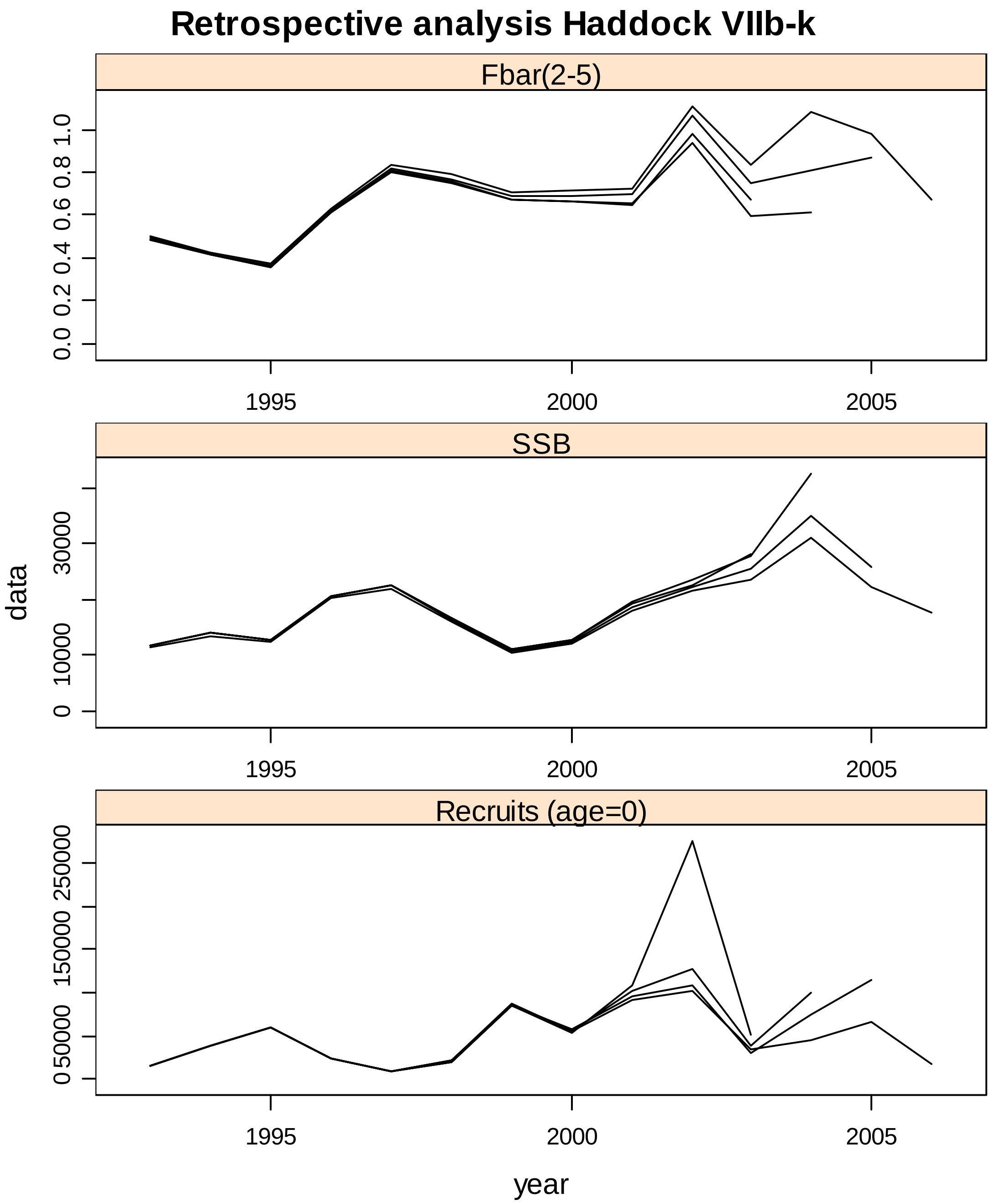

Figure 4.5.17 Retrospective XSA analysis for haddock in VIIb-k

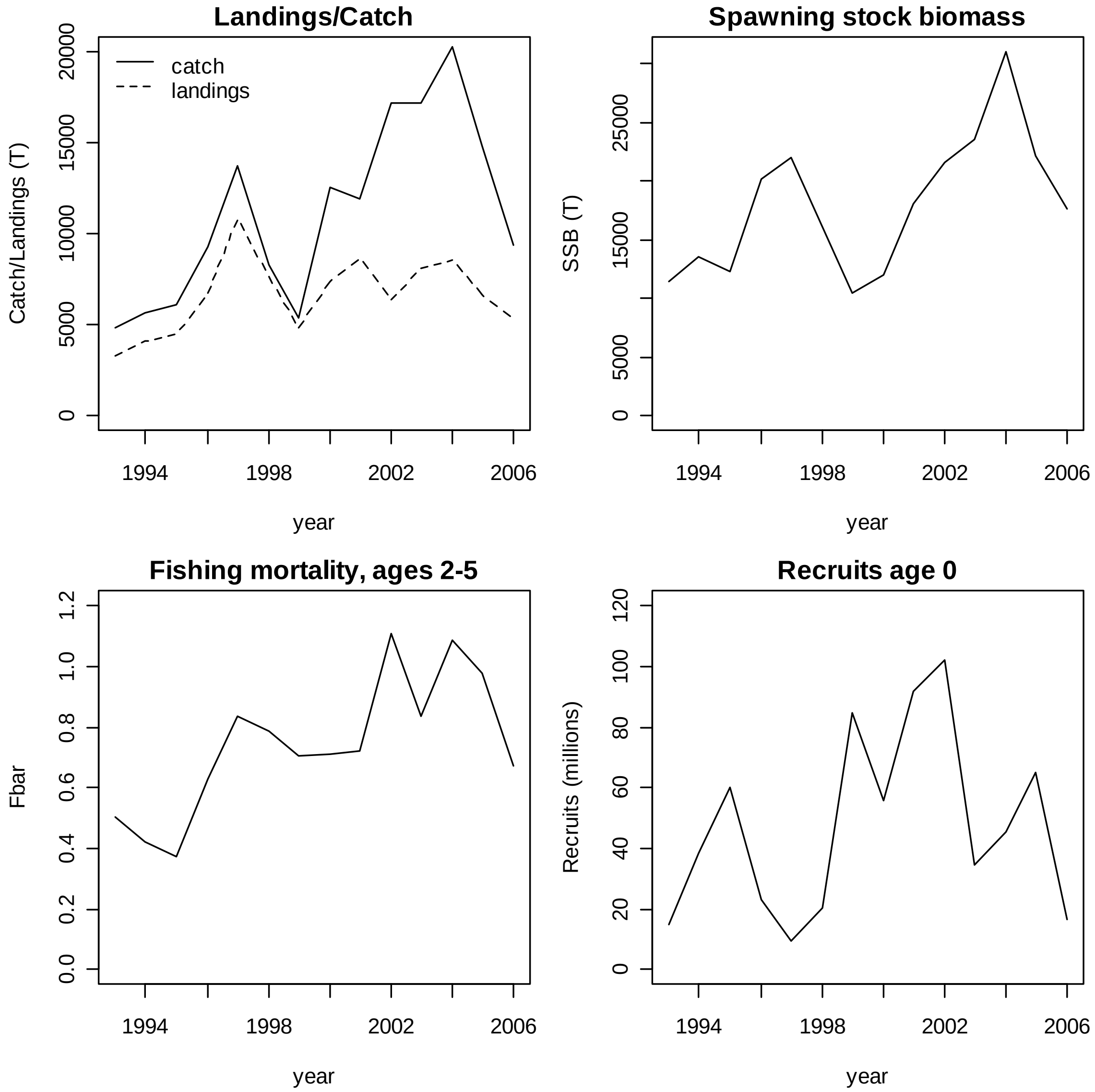

Figure 4.5.18 Stock summary plot final run for haddock in VIIb-k

Figure 4.5.19. Top: Indices of recruitment at age 0. The EVHOE and SAGFS indices were used as tuning fleets. The IGFS (Irish GroundFish Survey) was not used due to the short time series. Bottom: Correlation between the indices of recruitment and the XSA population numbers of the same cohort.

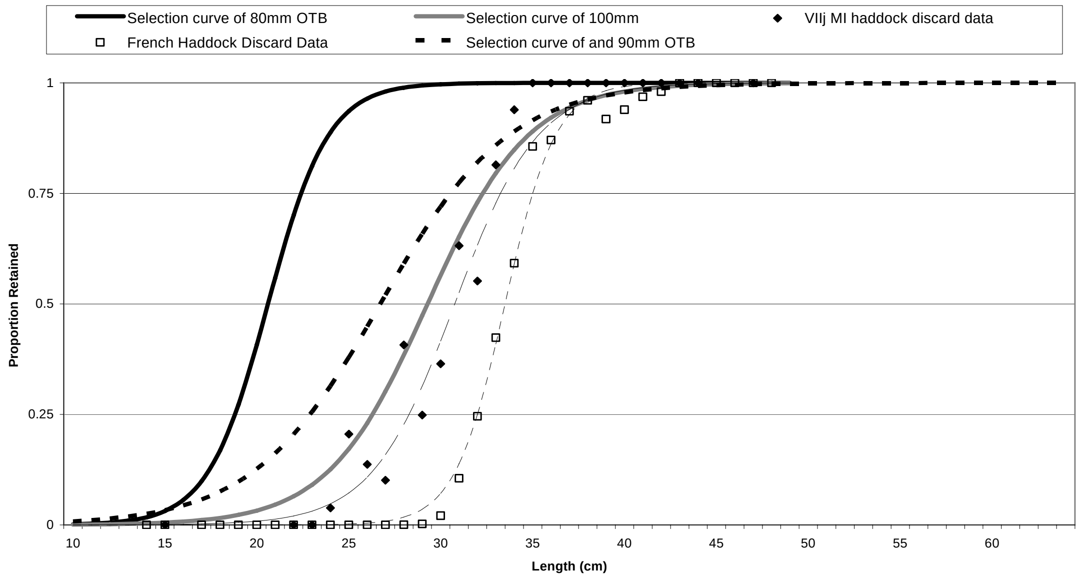

Figure 4.5.20. Haddock VIIb-k Comparison of theoretical selection curves with observed onboard selection practices.

4.6 Sole in the Southwest of Ireland (ICES Divisions VIIh-k)

Type of assessment at 2007 WG: None: Catch Table update

No major changes were made to the data at the 2007 WG.

A tentative assessment was carried out by the 2003 Working Group for VIIh–k Sole. U.K. beam trawl catch at age data was provided to the Working Group for the first time in 2003. The 2007 WG updated the catch tables and did not collate input data for an assessment.

4.6.1 The Fishery

Ireland, UK , France and Belgium are the major participants in this fishery. Sole were predominantly caught by Irish otter trawl vessels in VIIj, within a mixed species fishery. Irish otter trawl vessels operate from the ports of Castletownbere, Dingle, Union Hall, Baltimore and Schull. These vessels target mainly hake, anglerfish and megrim. Ireland, France and the UK are the main participants in this fishery.

ICES advice applicable to 2007.

Exploitation boundaries in relation to precautionary considerations

"Catches in 2007 should be no more than the recent average (2003–2005) of around 287 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment."

Management applicable to 2006 and 2007

The agreed TAC for sole in 2006 and in 2007 was 650 t.

Sole is managed through TAC and technical conservation measures

Council Regulation (EC) No 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in areas of VIIb, VIIj, VIIg and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998-2002).

Recent trends in the fishery

National landings data as well as estimates of total landings used by the WG are given in Table 4.6.1. Working group estimates of landings show a declining trend since 1996, with the 2006 landings of 272 t, the second lowest observed in the time series.

Commercial fleet effort and LPUE

Landings, effort and LPUE data for the Irish Otterboard trawl fleet in VIIj is presented in Table 4.6.2 and Figure 4.6.1. Despite a peak in 1997, LPUE indicates a declining trend over the time series observed. .

4.6.2 Age and length compositions and mean weights at age

No update is available for 2006. Age and length compositions and mean weights at age have previously been described in the WGSSDS 2004 report.

4.6.3 Survey and abundance indices

Survey Indices are available from the IRGFS and are presented in Table 4.6.3. Catches for this survey are low. It is unlikely that it will provide a good indication of the abundance of this stock as it uses a GOV trawl primarily aimed at targeting gadoids.

4.6.4 Comments

It is known that misallocating occurs in Division VIIh-k from surrounding areas. This has been taken into account where possible and can be seen from the decreased unallocated landings (Table 4.6.1).

In response to the recent Irish industry request to examine combining the VIIf,g and VIIh-k sole quotas there is no evidence that there is any mixing between these two stocks. In the stock interaction matrix the technical interaction is classified as zero meaning the stocks are “never if only rarely caught together and they are thus not linked in the fisheries”. Furthermore the results of recent tagging experiments suggest that there is only limited movement of sole between the Bristol Channel and adjacent areas.

4.6.5 Management considerations

Sole are taken as part of a mixed demersal fishery by otter trawlers and by an international beam trawl fleet. Therefore, management options proposed for sole should also take into consideration those on other species in VIIh-k.

Table 4.6.1 Sole in Divisions VII h-k (Southwest Ireland).
Nominal landings (t), 1973-2006,as officially reported to ICES.

Country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Belgium	406	369	210	638	519	290	384	522	576	471	411	474
Denmark	-	-	-	-	-	-		-	-	-	-	-
France	390	143	207	19	103	23	29	27	107	104	176	120
Ireland	108	116	97	152	126	73	109	162	195	172	176	156
Netherlands	4	15	2	33	140	60	-	-			51	194
Spain	190	153	152	131	26	1	8	2			38	
UK - Eng+Wales+	.	.	.	.	.	.	.	.	.	.	.	.
UK - England & W	6	5	24	11	12	11	18	42	83	108	129	151
UK - Scotland	-	-	-	-	-	-	-	-	-	-	-	-
Total	1104	801	692	984	926	458	548	755	961	855	981	1095

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Belgium	318	442	271	254	252	353	358	312	317	338	433
Denmark	-	-	-	-	-	-	-	-	-	-	-
France	25	38	44	53	84	66	55	43	44	42	47
Ireland	201	188	168	182	206	266	306	255	237	184	243
Netherlands	280	3		-	-	-	-	-	-	-	-
Spain				-	-	-	-	-	-	-	-
UK - Eng+Wales+	.	.	.	.	177	144	234	215	209	172	192
UK - England & W	200	261	193	166	.	.	.	.	.	.	.
UK - Scotland	-	-	-	-	-	-	-	2	5	2	-
Total	1024	932	676	655	719	829	953	827	812	738	915

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Belgium	375	368	346	101	8	13	154	170	157	90	36.2
Denmark	-	-	-	-	-	-	-	-	-	.	
France	50	58	74	.	79	103	108	138	108	99	62.2
Ireland	183	203	221	207	111	125	130	105	111	98	67.3
Netherlands	70	-	7	1	10	-	-	-	-	.	1
Spain	-	-	-	-	-	-	1	-	-	2	
UK - Eng+Wales+	148	113	111	97	95	111	124	78	79	112	
UK - England & W	.	.	.	.	.	.	.	.	.	.	
UK - Scotland	-	-	-	-	-	-	-	-	-	.	
UK											86.3
Total	826	742	759	406	303	352	517	491	455	401	253
Unallocated	383	178	336	25	-26	27	87	246	165	75	-19
Total figures used by Working Group	443	564	423	381	329	325	430	245	290	326	272

Table 4.6.2 Landings, Effort and LPUE for Sole VIIh-k

IR-OTB-7G			
Year	**Landings (t)**	**Effort (hr)**	**LPUE (kg/h)**
1995	165.78	93.69	1.77
1996	131.93	70.24	1.88
1997	291.69	83.19	3.51
1998	127.55	89.61	1.42
1999	82.01	40.61	2.02
2000	87.14	64.63	1.35
2001	110.65	67.66	1.64
2002	126.36	90.45	1.40
2003	106.00	111.27	0.95
2004	76.11	91.96	0.83
2005	74.86	73.92	1.01
2006	49.71	65.35	0.76

Table 4.6.3 **Sole in Divisions VIIh-k**

Available Survey tuning data

IrGFS : Irish Groundfish Survey (IBTS 4th Qtr) - Sole number at age (Interim indices for new Celtic Explorer series)

2003	2005									
1	1	0.79	0.92							
2	11									
780	0.0	3.1	3.1	0.2	2.2	2.2	0.1	0.1	1.0	0.0
720	1.9	2.0	8.4	6.4	1.0	0.0	0.0	2.0	0.0	0.0
881	2.7	1.1	1.4	2.2	1.2	0.2	0.0	3.0	0.7	0.3
901	7.0	1.0	4.5	3.5	1.0	0.0	1.0	1.0	2.0	1.0

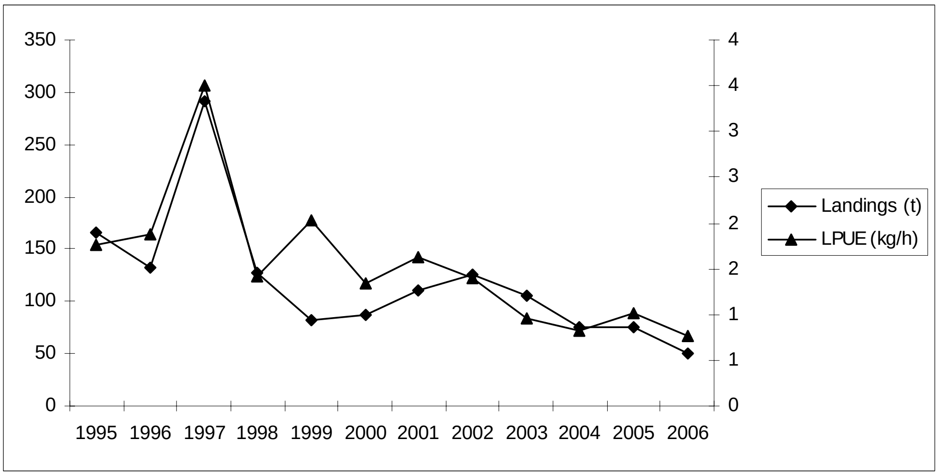

Figure 4.6.1 Landings, Effort and LPUE for Sole VIIh-k

4.7 Plaice in the Southwest of Ireland (ICES Divisions VIIh-k)

Type of assessment: Exploratory:

An exploratory assessment was last conducted for this stock at the 2002 Working Group. In 2007, the Working Group collated international data for the first time since 2003. A new commercial tuning fleet was presented for this stock and updated survey time series supplied.

4.7.1 The Fishery

Ireland, UK and France are the major participants in this fishery. Plaice are predominantly caught within mixed species otter trawl fisheries in Division VIIj. Irish vessels operate from the ports of Castletownbere, Dingle, Union Hall, Baltimore and Schull. These vessels target mainly hake, anglerfish and megrim. Otter trawlers accounted for 92% of the catch in 2006 with beam trawlers and seiners taking lesser catches of plaice.

ICES advice applicable to 2006

Exploitation boundaries in relation to precautionary considerations

Catches in 2005 should be no more than the recent average (2002-2004) of around 245 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.

ICES advice applicable to 2007

Exploitation boundaries in relation to precautionary considerations

The single stock exploitation boundary recommended by ICES was that "Catches in 2005 should be no more than the recent average (2002–2005) of around 196 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment."

Management applicable to 2006 and 2007

Plaice is managed through a precautionary TAC and technical conservation measures. In 2006, the TAC was set at 396 t and in 2007 it was set at 337 t. The MLS for plaice is 27cm.

Council Regulation (EC) No 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in areas of VIIb, VIIj, VIIg and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998-2002).

Recent trends in the fishery

National landings data as well as estimates of total landings used by the WG are given in Table 4.7.1. Generally, landings show a declining trend since 1993 with a slight increase in 1997 and 2002. The total international landings in 2006, as used by the Working Group, were 147 t, which is 37% below the agreed TAC and is the lowest observed value in the time series. No estimates of mis reporting are available for this stock but given the high TAC underreporting is not thought to be a problem.

A Decommissioning Scheme was launched in Ireland October 2005 and continued in 2006. To date, a total of 36 (includes one in 2005) vessels have been decommissioned in respect of 35 vessels in 2006. 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.

Commercial fleet effort and LPUE

Historically, trends in LPUE for the combined OTB fleet (all metiers using OTB gears) operating in VIIj were reported to WGSSDS as a potential tuning fleet. However, this level of aggregation failed to consider fleet specific behaviour in terms of targeted species, spatial operational differences and technological creep through modernisation of the fleet. In 2007, a more detailed breakdown and analysis of OTB activity and reporting landings of plaice from VIIj was conducted with the aim of offering a more refined candidate tuning fleet for VIIj plaice. Reported landings of *Nephrops* from OTB vessels from 1995 to 2006 were used to define two metiers, IR DEMERSAL DIRECTED OTB and OTB *Nephrops* where the reported landings of *Nephrops* accounted for at least 35% of the total catch (by weight). In 2000, the Irish State introduced a fleet modernisation programme, which provided state aid to introduce more modern vessels into the ageing Irish fleet. This is likely to have had some level of impact on the operational efficiency of the fleet and therefore could have resulted in increases in LPUE through technological advancement thus biasing the time series in recent years. In order to compensate for this, all new vessels introduced in the Irish fleet post 2000 have been removed from the commercial LPUE tuning data.

Table 4.7.2 and Figure 4.7.1 shows the LPUE and Effort trends for the IR-DEMERSAL DIRECTED OTB fleet. LPUE data shows a noisy but declining trend over the time series with a peak evident in 1997. Effort for this fleet has increase over the period 1999-2003 but has been declining since.

Table 4.7.2 shows the LPUE and Effort trends of other Irish tuning fleets. These fleets have contributed to less than 10% to the total Irish landings of Plaice in VIIj in recent years. They mostly show a stable trend in recent years, with a slight increase in LPUE for the SSC fleet since 2004.

4.7.2 Age and length compositions and mean weights at age

Table 4.7.3 and Figure 4.7.2 present the length composition of Irish sampling in VIIj, 2000-2006.

Quarterly age compositions are available for Ireland, representing approximately half of the 2006 landings. The Irish age compositions for VIIj are raised to include the quarterly landings from the UK, France and Belgium. Minor revisions were made to landings values for 1999-2003. In addition, the 2002 age length key was considered unreliable and was replaced with a combined 2001-2003 ALK which was the applied to the 2002 length frequency distributions. The time series of age composition for the stock shows a general reliance on 2-4 year old fish in the landings (Table 4.7.4 and Figure 4.7.3).

Stock weights at age were calculated using the first quarter catch weights at age smoothed using a 3-year average. Catch, and stock weights at age are given in Tables 4.7.5 and 4.7.6 respectively.

4.7.3 Natural mortality and maturity at age

In the absence of a direct estimate of natural mortality for plaice off southwest Ireland, a constant value of 0.12 was assumed for all ages and years, as for other plaice stocks assessed by the Working Group. The combined maturity ogive used was that for plaice in VIIfg and is given below.

Age	1	2	3	4	5 and older
Prop. Mature	0.00	0.26	0.52	0.86	1.00

Proportions of F and M before spawning were set to zero.

4.7.4 Abundance indices from surveys

There is very limited fishery independent survey information available for this stock. However, abundance indices were available for the Irish West Coast Groundfish Survey (IR-WCGFS) and also from the new Irish Groundfish Survey (IR-GFS) and their details are given in Table 4.7.7. The full series is shown in Table 4.7.8. It is difficult to see any consistently strong or weak year classes in the IR-WCGFS survey. The IR-WCGFS was carried out on commercial vessels and targeted juvenile gadoids both in terms of gear used and survey stratification. The IR-GFS shows very low catches of plaice at some ages despite this the survey also shows increased plaice CPUE in 1997 in common with commercial fleets. The new IR-GFS on RV Celtic Explorer shows very low catches of plaice in recent years at all ages.

4.7.5 Catch at age analysis

4.7.6 Data screening and exploratory runs

All relevant tuning runs and VPA outputs not included in this report are available in ICES stock files. A separable VPA was run using a terminal F of 0.8 and S of 0.5, with a reference age of 3. Residuals were quite high due to low catch numbers, particularly for the youngest and oldest age classes. Notwithstanding that, no major trends in the catch at age data were apparent. Ages 0 and 1 fish were poorly represented in the catches and were removed from the assessment data. The age range for further analyses was 2-8+ (Table 4.7.9 & Figure 4.7.4).

4.7.6.1 Commercial catch data

Commercial tuning data were available for the IR-DEMERSAL DIRECTED OTB fleet (1995-2006). Scatter plots (available in the ICES files) by age for this fleet shows a negative correlation for ages 1 but improves for older ages. There is a positive correlation for ages 2 to 6 but mainly driven by one data point. There are mostly negative correlations for ages older than 6. Standardized Indices by year and year class indicate weak internal consistency for this fleet.

4.7.6.2 Survey data

Two surveys were available for exploratory analysis, the IRWCGFS and the IRGFS. For the IR-WCGFS pair wise scatter plots indicate positive correlations between age classes out to age 5, mainly driven by a few data points. Standardized Indices by year and year class indicate poor internal consistency for this fleet. Due to the short time series of the IRGFS and low numbers of fish caught, it is difficult to interpret log-standardized indices, but may indicate some tracking of the 2001 year class.

Exploratory XSA runs

Single-fleet XSA runs were carried out with weak F-shrinkage to screen the tuning data and check for catchability trends using the mean q model for all ages over the full time series. Results are plotted in Figure 4.7.5. In the IR-DEMERSAL DIRECTED OTB fleet the residuals were generally low, with the exception of age 2. For the IR-WCGFS there were relatively high residuals for all ages. This survey caught very few numbers of plaice at ages 6 and 7 and these ages were therefore excluded from subsequent runs. There is some evidence of a year effect in 1993 and 1994. Residuals were quite low for the IRGFS with the exception of age 4.

Despite the relatively high residuals of the IR-WCGFS and short time series of the IRGFS, it was decided to retain these tuning fleets due to the fact that the IR- DEMERSAL DIRECTED OTB tuning data is derived from the same age composition data as that used for calculation of the overall catch at age matrix.

The choice of q-plateau was examined by releasing it to older ages but there was no justification for setting it older the 4.

The reason for using stronger shrinkage was mainly due to noisy data.

Final XSA run

A tentative XSA runs was considered using the following settings

		Year	2002 XSA	Year	2007 XSA
Range of catch data		93-01	2-9+	93-**06**	2-8+
Fleets	IR-OTB	95-01	2-8		
Fleets	IR-WCGFS	93-01	2-5	93-**02**	2-5
Fleets	**IRGFS**			**03-06**	**2-4**
Fleets	**IR-DEMERSAL DIRECTED**			**95-06**	**2-8**
Taper			No		No
Taper range			-		-
Ages catch dep. Stock size			-		-
F bar range			4-6		**3**-6
q plateau			7		**4**
F shrinkage se			1.5		**0.5**
year range			5		5
age range			5		5
Fleet s.e. threshold			0.3		0.3

Table 4.7.10 presents the full diagnostics for the XSA run, and catchability residuals are plotted in Figure 4.7.6. Log catchability residuals are generally low in the commercial fleet, except for ages 2 and 7. Residuals given by the IR-WCGFS are noisier, across all ages. The IR-WCGFS caught few 4 or 5 year olds, particularly in earlier years.

A retrospective analysis excluding the short IRGFS time series is presented in Figure 4.7.8. There is no strong retrospective bias in F, SSB and recruitment although it is highly variable particularly in the earlier years.

Fishing mortalities and population numbers from the final XSA run are given in Tables 4.7.11 and 4.7.12

4.7.7 Estimating recruiting year-class abundance

Recruitment at age 2 in the XSA is dominated by F shrinkage which receives 74% of the weighting. Given the lack of survey data it is not possible to independently estimate recruitment for this stock.

4.7.8 Historic trends in biomass, fishing mortality and recruitment

Table 4.7.13 and Figure 4.7.7 summarises the estimates of recruitment, spawning stock biomass, landings and F3-6 for the period 1993 to 2006 for the stock. Landings have declined since the beginning of the observed time series and are now at their lowest level. Recruitment, although not well estimated has also shown a decline in recent years. Overall there is a declining trend in F despite a temporary rise in 2002. SSB also shows a declining trend over the time series.

4.7.9 Short-term catch predictions

Given the exploratory nature of the assessment it was not possible to carry out short-term projections for this stock.

4.7.10 Yield and biomass per recruit

It was not possible to carry out medium term projections for this stock.

4.7.11 Biological reference points

It is not possible to derive precautionary reference points for this stock from the short time-series of information available.

4.7.12 Risk and sensitivity analyses and medium-term projections

It is not possible to carry out medium-term predictions for this stock as the short time series of stock and recruitment estimates precluded any meaningful prediction of the medium-term dynamics of the stock.

4.7.13 Comments on the assessment

Consistency

Given the high standard errors for the survey, the paucity of data and the fact that the survivors estimates are heavily reliant on the commercial IR-DEMERSAL DIRECTED OTB fleet (which is also the main contributor to the catch at age data) the WG felt the assessment was indicative of trends only.

However it is clear from trends in recruitment and SSB that the stock is in a state of decline.

Inherent imprecision in recruitment estimates and fishing mortality make it difficult to predict the future status of the stock with acceptable confidence.

It is also problematic to assess stocks like this where there is limited dynamic range in cohort strength because tracking of year classes becomes difficult.

Sampling

The sampling levels for those countries supplying data for 2006 are given in Table 1.3.1. The majority of the sampling for this stock is provided by Ireland. The majority of the sampling is generated from the Irish otter board trawl fleet. Revisions to raw data (1993-1998) will be made inter-sessionally to correct for SOP errors.

Discarding and mis-reporting

Underreporting and misreporting of catches from ICES Divisions VIIg and VIIj may have taken place in the mort recent years but no information is available on the scale of the problem. However, given the TAC for this stock is higher than the landings in recent years it is unlikely that it is a quota limiting species for the fishery in this area.

The level of discarding is not well quantified for this stock but indications from Irish sampling are that levels of plaice discarding for the Otter board demersal directed fleet can be quite variable from year to year.

Survey information

Survey information for this stock is poor. The IR_WCGFS may have high residuals due to the fact that the survey was carried out on commercial vessels and targeted gadoids both in terms of gear used and survey stratification. The IGFS survey is currently the only survey evaluating the abundance and distribution of the stock independent of commercial data. However, it is unlikely that it will provide a good indication of the abundance of this stock as it uses a GOV trawl primarily aimed at targeting gadoids.

Industry information

Representatives of the Irish fishing industry have questioned the stock definitions used by the WG for Celtic Sea plaice (VIIf,g) and South west of Ireland Plaice (VIIh-k) and have suggested that these stocks should be merged into one assessment. Recent tagging studies carried out in Ireland however have not had sufficient returns to evaluate whether there is indeed mixing between these two stocks. The WG noted that the declining trend in SSB and low recent recruitment has been observed in both stocks since 1993.

4.7.14 Management considerations

Landings are substantially below the TAC and have been declining. The 2006 landings are the lowest observed in the time-series. The advice based on recent average landings may not be precautionary enough if this stock is in decline.

Plaice are taken as part of a mixed demersal fishery. Management options proposed for plaice should therefore consider interactions with other demersal trawl fisheries in VIIh-k.

Table 4.7.1 Plaice in Divisions VII h-k (Southwest Ireland).
Nominal landings (t), 1987-2006, as officially reported to ICES.

Country	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
Belgium*	**250**	**245**	**403**	**301**	**252**	**246**	**344**	**197**	**235**	**304**	**442**
Denmark	0.5	0.5	0.5	-	-	-	-	-	-	-	-
France	85	135	229	77	173	90	64	48	60	48	69
Ireland	300	369	454	338	478	477	383	271	321	305	344
Netherlands	-	-	-	-	-	-	-	-	-	52	-
Spain	-	-	-	-	-	-	-	-	-	-	-
UK - Eng+Wales	.	.	73	88	287	264	218	258	282	154	138
UK - England & \	246	433	.	.	.	.	.	.	.	.	.
UK - Scotland	-	1	-	1	0.5	6	7	1	4	1	0.5
Un. Sov. Soc. Re	-	-	-	-	-	.	.	.	.	.	.
Total	881.5	1183.5	1159.5	805	1190.5	1083	1016	775	902	864	993.5
Unallocated	882	1184	1160	805	1191	1083	361	198	360	411	349
Total figures used by Working Group							655	577	542	453	645

Country	1998	1999	2000	2001	2002	2003	2004	2005	2006
Belgium	**335**	45	4	27	69	20	67	32	22
Denmark	-	-	-	-	-	-	-		
France	49	.	54	50	45	33	34	22	25.3
Ireland	286	299	200	160	155	127	91	90	65.8
Netherlands	13	1	2	-	-	-	-	.	
Spain	-	0.5	5	3	2	6	6	.	
UK - Eng+Wales	106	82	75	73	59	56	36	28	18.5
UK - England & \	.	.	.	.	.	.	.	.	
UK - Scotland	0.5	0.5	1	-	-	-	-	.	
Un. Sov. Soc. Re	.	.	.	.	.	.	.	.	
Total	789.5	428	341	313	330	242	234	172	132
Unallocated	346	22	42	52	17	25	13	8	-15
Total figures used by Working Group	444	406	299	261	313	217	221	164	147

* Belgian Landings highlighted include VIIg

Table 4.7.2 **Plaice in Divisions VIIh-k (Southwest Ireland)**

Trends in LPUE and Effort for IR Commercial Tuning Fleets

IR-DEM DIRECTED-OTB-7j				IR-SSC-7j			
Year	Landings (t)	Effort (Days)	LPUE (Tonnes/Day)	Year	Landings (t)	Effort (hr)	LPUE (kg/h)
1995	84.6	2049	0.041	1995	11.697	5.26	2.22
1996	137.8	3418	0.040	1996	14.846	8.15	1.82
1997	325.5	4026	0.081	1997	26.801	10.73	2.50
1998	126.1	4542	0.028	1998	13.358	6.61	2.02
1999	93.5	1881	0.050	1999	1.366	1.41	0.97
2000	93.2	2807	0.033	2000	4.217	3.49	1.21
2001	117.9	3219	0.037	2001	7.671	4.42	1.73
2002	126.1	3478	0.036	2002	14.247	8.87	1.61
2003	99.5	3612	0.028	2003	8.2625	9.15	0.90
2004	68.9	2484	0.028	2004	3.56	9.18	0.39
2005	74.30	2420	0.031	2005	2.47	6.09	0.41
2006	42.60	1899	0.022	2006	2.80	5.33	0.53

IR-TBB-7j				IR-GN-7j			
Year	Landings (t)	Effort (hr)	LPUE (kg/h)	Year	Landings (t)	Effort (hr)	LPUE (kg/h)
1995	4.733	0.22	21.51	1995	1.325	21.32	0.06
1996	3.627	1.47	2.46	1996	0.525	5.23	0.10
1997	2.636	1.77	1.49	1997	5.165	8.28	0.62
1998	25.416	5.23	4.86	1998	3.09	16.03	0.19
1999	52.743	7.43	7.10	1999		8.37	0.00
2000	10.113	6.94	1.46	2000	0.72	7.17	0.10
2001	1.938	2.99	0.65	2001	0.26	6.56	0.04
2002	3.134	3.12	1.01	2002	0.67	8.11	0.08
2003	6.375	9.02	0.71	2003	0.03	11.11	0.00
2004	1.705	2.16	0.79	2004	0.08	6.06	0.01
2005	0.74	2.42	0.31	2005	0.01	6.27	0.00
2006	1.01	1.53	0.66	2006	0.23	6.97	0.03

Table 4.7.3 Plaice in Divisions VII h-k (Southwest Ireland).
Length distribution of Irish sampling (2000), and
Irish landings (2001-2006) in VIIj.

Year	2000	2001	2002	2003	2004	2005	2006
Length (cm)	% Frequency	Number (000's)	Number (000's)	Number (000's)	Number (000's)	Number (000's)	Number (000's)
20					0.142	0.0	0.0
21	0.2	0.6	0.0	0.2	1.0	0.0	0.2
22	0.5	0.4	0.9	0.1	1.6	0.3	0.6
23	2.8	0.7	3.1	1.8	3.9	2.0	1.1
24	3.4	4.3	8.0	3.0	4.3	2.0	2.0
25	6.3	12.2	15.8	6.6	8.0	3.1	2.4
26	7.9	29.8	24.9	8.4	9.4	5.6	4.3
27	9.3	36.4	29.4	15.9	13.3	11.5	4.7
28	10.3	43.7	29.5	20.1	21.3	22.3	8.5
29	9.0	59.7	43.1	28.0	29.0	33.9	15.2
30	6.8	70.3	49.0	35.0	29.7	36.5	18.7
31	5.4	78.2	49.3	37.3	31.1	33.9	19.6
32	5.0	71.1	47.4	31.1	20.2	24.3	15.2
33	6.2	54.3	44.7	25.8	15.0	15.6	11.7
34	3.8	47.0	29.9	18.6	11.1	12.1	9.4
35	4.4	34.0	23.2	17.3	10.0	8.3	7.0
36	2.7	30.1	18.8	9.5	6.8	6.2	5.0
37	3.2	24.8	12.6	8.5	4.2	4.1	4.2
38	2.7	23.8	13.7	5.6	3.8	2.8	3.7
39	2.2	18.1	8.1	6.5	3.9	2.0	3.6
40	1.5	11.0	4.5	2.4	2.1	3.3	3.1
41	1.5	10.7	3.7	3.3	2.3	2.8	2.7
42	1.3	5.1	4.5	1.8	1.6	3.1	2.1
43	0.8	3.8	3.2	1.8	1.7	2.7	1.6
44	0.5	6.5	2.1	3.3	1.6	0.7	1.4
45	0.5	3.8	2.0	1.8	0.5	0.6	1.3
46	0.5	3.3	1.2	1.1	0.4	0.5	0.7
47	0.3	2.7	0.2	1.4	0.4	0.5	0.6
48	0.5	2.7	0.6	1.1	0.6	0.6	0.3
49	0.3	0.6	0.3	1.3	0.4	0.2	0.4
50	0.1	1.1	0.7	0.7	0.1	0.2	0.1
51	0.0	0.8	0.3	0.2	0.2	0.2	0.3
52	0.0	0.4	0.4	0.4	0.1	0.1	0.4
53	0.0	0.5	0.2	0.2	0.0	0.0	0.1
54	0.0	0.6	0.4	0.2	0.0	0.1	0.2
55	0.0	0.5	0.7	0.2	0.1	0.0	0.1
56	0.0	0.2	0.1	0.2	0.0	0.2	0.5
57	0.0	0.5	0.0	0.1	0.1	0.0	0.0
58	0.0	0.2	0.0	0.0		0.1	0.2
59	0.0	0.2	0.0	0.0		0.0	0.0
60	0.0	0.1	0.0	0.0		0.0	0.0
61	0.0	0.1	0.0	0.0		0.0	0.0
62	0.0	0.8	0.0	0.0		0.0	0.0
63	0.0	0.1	0.0	0.0		0.0	0.0
64	0.0	0.2	0.0	0.0		0.0	0.0
65							0.02
66							
Total	100%	696.0	476.5	300.9	240.1	242.8	153.6

Table 4.7.4 Plaice in Divisions VII h-k (Southwest Ireland)
Catch numbers at age.

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

YEAR	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGE														
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	19	0	2	11	4	19	2	1
2	197	149	165	49	496	73	218	118	127	101	65	66	49	38
3	822	660	854	485	513	466	363	227	277	296	186	245	154	89
4	536	428	572	314	411	312	191	226	156	166	85	184	126	111
5	164	115	170	206	200	137	64	74	58	78	34	61	71	79
6	87	76	41	76	61	46	36	50	13	33	15	21	40	30
7	45	30	10	38	19	25	28	11	16	42	25	8	13	11
8	24	16	15	11	2	15	20	5	4	24	15	8	5	4
9	14	14	2	14	1	6	10	2	4	7	6	5	1	2
10	0	0	0	0	0	0	1	2	1	4	3	0	1	2
11	0	0	0	0	0	0	1	0	0	2	2	1	1	2
12	0	0	0	0	0	0	1	1	0	2	1	0	0	1
13	0	0	0	0	0	0	0	0	0	1	0	0	0	0
14	0	0	0	0	0	0	0	0	0	1	0	0	0	0
15	0	0	0	0	0	0	0	0	0	4	4	0	0	0
0 TOTALNUM	1889	1488	1829	1193	1703	1080	953	716	659	774	446	620	464	369
TONSLAND	655	577	542	453	645	444	406	299	261	313	217	221	164	147
SOPCOF %	101	100	100	105	101	101	100	100	100	100	100	100	100	100

Table 4.7.5 Plaice in Divisions VII h-k (Southwest Ireland)
Catch weights at age.

Table 2 Catch weights at age (kg)

YEAR	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGE														
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0.24	0.153	0.223	0.127	0.141	0.133	0.218	0.14
2	0.22	0.257	0.229	0.339	0.276	0.246	0.312	0.281	0.262	0.24	0.286	0.256	0.261	0.297
3	0.274	0.336	0.265	0.308	0.351	0.314	0.375	0.341	0.347	0.319	0.368	0.319	0.291	0.314
4	0.342	0.388	0.321	0.363	0.442	0.413	0.428	0.425	0.408	0.381	0.453	0.346	0.324	0.357
5	0.442	0.484	0.324	0.406	0.407	0.547	0.556	0.512	0.529	0.476	0.558	0.493	0.378	0.415
6	0.607	0.535	0.432	0.48	0.661	0.75	0.662	0.641	0.788	0.617	0.766	0.53	0.518	0.495
7	0.77	0.724	0.748	0.485	0.768	0.797	0.764	0.932	0.91	0.603	0.871	0.691	0.682	0.725
8	0.946	1.014	0.716	0.474	1.062	0.774	0.93	1.357	0.995	0.77	0.921	0.792	0.933	0.895
9	1.189	1.123	1.389	0.459	1.821	1.114	1.135	1.393	1.179	0.998	1.401	0.966	1.155	0.964
10	0	0	0	0	0	0	1.804	1.233	2.373	1.207	1.378	1.335	1.326	1.097
11	0	0	0	0	0	0	2.281	0	2.964	1.367	1.39	1.241	1.537	1.531
12	0	0	0	0	0	0	1.243	1.388	3.239	1.733	1.503	2.022	1.653	1.64
13	0	0	0	0	0	0	0	1.815	0	1.308	1.097	0	1.508	2.329
14	0	0	0	0	0	0	0	0	0	1.214	1.387	0	1.508	2.433
15	0	0	0	0	0	0	0	0	0	1.503	1.914	0	0	0
0 SOPCOFAC	1.006	1.002	1.001	1.053	1.01	1.007	0.998	0.997	1	1.001	1	0.9999	1.0003	1.0006

Table 4.7.6 Plaice in Divisions VII h-k (Southwest Ireland)
Stock weights at age.

Table 3 Stock weights at age (kg)

YEAR	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
AGE														
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0.211	0.206	0.178	0.162	0.137	0.157	0.159	0.166
2	0.187	0.195	0.187	0.19	0.203	0.224	0.196	0.212	0.188	0.214	0.201	0.204	0.179	0.285
3	0.247	0.251	0.268	0.292	0.317	0.308	0.312	0.352	0.346	0.329	0.296	0.293	0.29	0.307
4	0.307	0.314	0.357	0.365	0.386	0.354	0.366	0.404	0.403	0.401	0.352	0.339	0.345	0.346
5	0.412	0.377	0.377	0.396	0.436	0.455	0.481	0.502	0.466	0.48	0.439	0.428	0.421	0.403
6	0.515	0.561	0.56	0.663	0.626	0.595	0.553	0.705	0.723	0.612	0.515	0.508	0.599	0.503
7	0.724	0.715	0.618	0.701	0.751	0.849	0.89	1.001	0.96	0.701	0.64	0.625	0.758	0.71
8	0.9	0.913	0.773	0.863	0.839	0.96	0.986	1.15	1.153	0.85	0.841	0.895	1.033	0.908
9	1.11	1.141	0.867	1.148	1.227	1.583	1.541	1.669	1.626	1.337	1.386	1.41	1.236	1.028
10	1.005	0.998	1.002	1.051	1.009	1.011	1.82	1.78	1.401	1.666	1.414	1.728	1.338	1.173
11	1.005	0.998	1.002	1.051	1.009	1.011	1.395	1.686	1.43	2.122	1.707	1.857	1.83	1.533
12	1.005	0.998	1.002	1.051	1.009	1.011	1.292	1.957	2.153	2.13	1.767	1.776	1.974	1.644
13	1.005	0.998	1.002	1.051	1.009	1.011	0.605	0.605	0.943	0.703	0.703	0.868	1.279	2.055
14	0	0	0	0	0	0	0	0	0.384	0.687	0.687	0.303	0.811	1.622
15	0	0	0	0	0	0	0	0	0.395	0.954	0.954	0	0	0

Table 4.7.7 Plaice in Divisions VII h-k (Southwest Ireland) Survey abundance at age indices

	Irish West Coast Groundfish Survey (no. at age/h)			Irish Groundfish Survey (VIIj) (IBTS 4th Qtr-No.at age/h)					
Year	Age 1	Age 2	Age 3	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6
1993	0.1	6.7	2.2						
1994	2.4	4.8	4.8						
1995	0.0	1.7	3.6						
1996	0.7	0.7	2.0						
1997	0.6	2.7	4.4						
1998	0.0	0.5	1.0						
1999	0.0	0.9	0.5						
2000	0.0	0.0	1.2						
2001	0.0	0.6	0.9						
2002	0.0	0.1	0.4						
2003	Survey discontinued			0.000	0.692	1.385	0.077	0.2	0.1
2004				0.000	0.498	0.583	1.222	0.3	0.0
2005				0.000	0.000	0.405	0.404	0.2	0.0
2006				0.477	1.481	0.559	0.213	0.1	0.0

Table 4.7.8 Plaice in Divisions VII h-k (Southwest Ireland)

Available tuning data

SOUTHWEST IRELAND PLE, SSWG 2007, TUNING DATA (effort, nos at age)

IR-Demersal Directed OLD OTB : Irish Otter trawl - Effort Tonnes per Day - VIIj Plaice numbers at age

1995	2006													
1	1	0	1											
1	14													
2049	0	25.8	133.3	89.3	26.5	6.4	1.6	2.3	0.3	0	0	0	0	0
3418	0	14.9	147.5	95.5	62.6	23.1	11.6	3.3	4.3	0	0	0	0	0
4026	0	250.3	258.9	207.4	100.9	30.8	9.6	1	0.5	0	0	0	0	0
4542	0	21.8	139	93	40.9	13.7	7.5	4.5	1.8	0	0	0	0	0
1881	0.5	18.6	35.2	63.9	73.4	26.7	21.7	6.7	5.8	4.5	0.4	1.9	0.1	0
2807	0	49.2	88.4	62.8	37.9	12.9	7.2	6.1	8	6.7	1.8	2.1	0	0
3219	0	78.7	121.7	59.4	45.6	30.8	20.8	18.8	10.6	6.4	2.4	1.5	1.4	0.9
3478	6.4	42.5	99.5	108.6	38	37.6	19.9	5.5	0.9	0.5	0	0.1	0	0
3612	2.7	41.5	114.2	47.1	16.8	4.6	9.3	6.4	0.9	0.4	1	0	0	0
2484	6.5	18.5	75.4	57.2	19.1	6.4	2.8	2.8	1.4	0.2	0.2	0	0	0
2420	0.9	17.6	58.7	63	36.3	21.4	6.5	2.7	0.6	0.3	0.3	0.1	0.1	0
1899	0.2	8.1	22.9	32.3	24.5	8.4	3.3	1.3	0.8	0.8	0.5	0.2	0	0

IR-WCGFS : Irish West Coast Groundfish Survey (Effort in minutes towed, numbers at age)

1993	2002							
1	1	0.75	0.79					
1	7							
323	11.6	19.4	46.5	24.5	37.5	0	0	1993
673	0	1	12.3	2.1	1.2	0	0	1994
651	0	9	35.8	38.2	21.6	0	0	1995
671	0	0	5.9	27.4	10.2	5	10.5	1996
1232	0	19.3	19.5	7.3	6	4.3	0	1997
1310	0	4.2	18.3	14.8	2	11	0	1998
1281	1.9	3.8	27.5	35	16.4	9.3	0	1999
1190	0	1.6	23.5	15.6	0	0	0	2000
595	0.8	5.8	6.2	2.9	1.5	0.5	0.3	2001
606	0	1	4	4	0	0	0	2002

IrGFS : Irish Groundfish Survey (IBTS 4th Qtr) - number at age (Interim indices for new *Celtic Explorer* series)

2003	2006							
1	1	0.79	0.92					
0	6							
780	0.00	0.00	9.00	18.00	1.00	3.00	1.00	2003
720	0.00	0.00	5.97	7.00	14.67	3.33	0.00	2004
881	0.00	0.00	0.00	5.95	5.93	2.94	0.00	2005
901	0.00	7.17	22.23	8.40	3.20	2.00	0.00	2006

Table 4.7.9 Plaice in Divisions VII h-k (Southwest Ireland).

Diagnostics from final Seperable VPA 1

```
Title : SOUTHWEST IRELAND PLE, SSWG 2007, COMBSEX, PLUSGROUP

At  3/07/2007  11:59

Separable analysis
from 1993 to 2006 on ages  2 to  7
with Terminal F of  .800 on age  3 and Terminal S of  .500

Initial sum of squared residuals was    75.550 and
  final sum of squared residuals is     18.597 after  39 iterations

Matrix of Residuals

 Years,    1993/94,1994/95,1995/96,
  Ages

  2/ 3,     -.637,  -.920,  -.377,
  3/ 4,     -.207,  -.422,   .296,
  4/ 5,      .417,   .101,   .056,
  5/ 6,     -.337,   .214,  -.153,
  6/ 7,      .476,  1.713,  -.375,

  TOT ,      .007,   .005,   .004,
  WTS ,      .001,   .001,   .001,

 Years,    1996/97,1997/98,1998/99,1999/**,2000/**,2001/**,2002/**,2003/**,2004/**,2005/**,        TOT,         WTS,

  2/ 3,    -1.294,   .618, -1.100,   .729,  -.365,   .193,  -.356,  -.126,  -.018,   .311,        .000,        .300,
  3/ 4,     -.175,  -.447,  -.079,  -.174,  -.563,   .176,   .061,  -.123,   .080,  -.191,        .001,        .756,
  4/ 5,     -.124,  -.090,   .359,   .052,   .157,   .105,   .124,  -.059,   .117,  -.286,        .003,       1.000,
  5/ 6,      .673,   .346,   .147,  -.633,   .549,  -.011,   .175,   .077,  -.407,   .169,        .003,        .506,
  6/ 7,     1.345,   .311,  -.174,   .817,   .459, -1.260,  -.658,   .667,   .150,  1.097,        .001,        .228,

  TOT ,      .003,   .003,   .005,   .005,   .005,   .004,   .002,   .001,   .000,  -.001,       1.196,
  WTS ,      .001,   .001,   .001,   .001,   .001,  1.000,  1.000,  1.000,  1.000,  1.000,
```

Table 4.7.9 (Cont'd)

```
   Fishing Mortalities (F)

         ,    1993,   1994,   1995,   1996,
 F-values,   .6219,  .5184,  .5575,  .5252,

         ,    1997,   1998,   1999,   2000,   2001,   2002,   2003,   2004,   2005,   2006,
 F-values,   .7844,  .7215,  .5882,  .6247,  .4696,  .6422,  .3642,  .5514,  .6062,  .8000,

  Selection-at-age (S)
         ,       2,      3,      4,      5,      6,      7,
 S-values,   .2974, 1.0000, 1.0248,  .7665,  .4998,  .5000,

Run title : SOUTHWEST IRELAND PLE, SSWG 2007, COMBSEX, PLUSGROUP

At  3/07/2007  11:59
               Traditional vpa  Terminal populations from weighted Separable populations

   Fishing mortality residuals
   YEAR,       1993,    1994,    1995,    1996,

   AGE
     2,       -.0957,  -.0795,  -.0582,  -.1186,
     3,       -.0378,  -.0851,   .1312,  -.0550,
     4,        .1888,   .0952,   .1801,  -.0080,
     5,        .0529,  -.0232,   .0679,   .2052,
     6,        .0703,   .1952,  -.0769,   .1281,
     7,       -.0004,  -.0599,  -.1892,   .0033,

    Fishing mortality residuals
   YEAR,       1997,    1998,    1999,    2000,    2001,    2002,    2003,    2004,    2005,    2006,

   AGE
     2,        .1433,  -.1447,   .0947,  -.0334,   .0288,  -.0566,  -.0138,  -.0153,   .0467,  -.0002,
     3,       -.1877,  -.0617,  -.0709,  -.1726,   .1011,   .0084,  -.0106,  -.0120,  -.0671,  -.0647,
     4,        .0435,   .0780,  -.0357,   .0056,   .0999,   .0742,  -.0189,   .0719,  -.0840,   .0470,
     5,        .0947,   .1440,  -.1036,  -.0734,  -.0568,   .0985,   .0081,  -.0017,   .0260,   .0856,
     6,       -.0635,  -.0571,   .0629,   .1452,  -.1312,  -.0635,   .0128,  -.0134,   .1914,  -.0454,
     7,       -.2471,  -.1624,  -.0099,  -.1509,   .0006,   .1863,   .1041,  -.1326,  -.0639,  -.1772,1
```

Table 4.7.10 Plaice in Divisions VII h-k (Southwest Ireland). XSA tuning diagnostics from final run.

```
Lowestoft VPA Version 3.1

    3/07/2007  10:13

 Extended Survivors Analysis

 SOUTHWEST IRELAND PLE, SSWG 2007, COMBSEX, PLUSGROUP

 CPUE data from file ple7hjktu_1.txt

 Catch data for  14 years. 1993 to 2006. Ages  2 to   8.

      Fleet,            First, Last, First, Last, Alpha,  Beta
                    ,    year, year,  age ,  age
 IR-Demersal Directed,   1995, 2006,   2,     7,   .000,  1.000
 IR-WCGFS : Irish Wes,   1993, 2006,   2,     5,   .750,   .790
 IrGFS : Irish Ground,   2003, 2006,   3,     5,   .790,   .920


 Time series weights :

      Tapered time weighting not applied


 Catchability analysis :

      Catchability independent of stock size for all ages

      Catchability independent of age for ages >=    4


 Terminal population estimation :

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

      S.E. of the mean to which the estimates  are shrunk =    .500

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

      Prior weighting not applied


 Tuning converged after   21 iterations

1


 Regression weights
       , 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000, 1.000



 Fishing mortalities
    Age,  1997,  1998,  1999,  2000,  2001,  2002,  2003,  2004,  2005,  2006

      2,  .383,  .075,  .298,  .161,  .179,  .136,  .089,  .128,  .154,  .136
      3,  .602,  .683,  .575,  .525,  .623,  .723,  .361,  .503,  .440,  .419
      4,  .976,  .835,  .605,  .790,  .762,  .877,  .422,  .661,  .478,  .598
      5,  .748,  .971,  .359,  .450,  .424, 1.042,  .390,  .553,  .523,  .570
      6,  .801,  .341,  .667,  .482,  .118,  .413,  .514,  .402,  .800,  .390
      7,  .697,  .837,  .333,  .399,  .252,  .615,  .569,  .539,  .432,  .481
```

Table 4.7.10 Plaice in Divisions VII h-k (Southwest Ireland). Contd-

XSA tuning diagnostics from final run.

XSA population numbers (Thousands)

YEAR	AGE 2	3	4	5	6	7
1997	1.65E+03	1.20E+03	7.00E+02	4.03E+02	1.18E+02	4.02E+01
1998	1.07E+03	9.99E+02	5.85E+02	2.34E+02	1.69E+02	4.68E+01
1999	8.97E+02	8.81E+02	4.48E+02	2.25E+02	7.87E+01	1.07E+02
2000	8.41E+02	5.91E+02	4.40E+02	2.17E+02	1.39E+02	3.58E+01
2001	8.24E+02	6.35E+02	3.10E+02	1.77E+02	1.23E+02	7.64E+01
2002	8.45E+02	6.11E+02	3.02E+02	1.28E+02	1.03E+02	9.67E+01
2003	8.12E+02	6.54E+02	2.63E+02	1.11E+02	4.01E+01	6.02E+01
2004	5.87E+02	6.59E+02	4.04E+02	1.53E+02	6.69E+01	2.13E+01
2005	3.65E+02	4.58E+02	3.53E+02	1.85E+02	7.80E+01	3.97E+01
2006	3.16E+02	2.77E+02	2.62E+02	1.94E+02	9.74E+01	3.11E+01

Estimated population abundance at 1st Jan 2007

0.00E+00	2.45E+02	1.62E+02	1.28E+02	9.75E+01	5.84E+01

Taper weighted geometric mean of the VPA populations:

9.63E+02	8.50E+02	4.87E+02	2.18E+02	1.03E+02	5.05E+01

Standard error of the weighted Log(VPA populations) :

.5992	.5642	.4704	.3747	.3832	.5462

1

Log catchability residuals.

Fleet : IR-Demersal Directed

Age	1993	1994	1995	1996
2	99.99	99.99	-.53	-1.48
3	99.99	99.99	-.09	-.27
4	99.99	99.99	-.18	-.55
5	99.99	99.99	-.31	.02
6	99.99	99.99	-.97	.07
7	99.99	99.99	-.32	-.18

Age	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
2	1.19	-1.09	-.08	.49	.85	.11	.07	-.02	.44	.04
3	.26	-.26	-.68	.22	.37	.18	.05	.07	.18	-.03
4	.36	-.44	.24	-.08	.06	.66	-.27	-.03	.15	.08
5	.10	-.29	.95	-.03	.21	.54	-.46	-.20	.26	.09
6	.17	-1.33	1.13	-.65	.04	.48	-.68	-.53	.72	-.37
7	.03	-.43	.47	.09	.18	-.01	-.35	-.15	.04	-.12

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	-11.1325	-9.7554	-9.3817	-9.3817	-9.3817	-9.3817
S.E(Log q)	.7534	.2911	.3392	.3994	.7431	.2598

Table 4.7.10 Plaice in Divisions VII h-k (Southwest Ireland). Contd-

XSA tuning diagnostics from final run.

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,	1.50,	-.759,	13.35,	.18,	12,	1.16,	-11.13,
3,	1.22,	-1.053,	10.45,	.69,	12,	.35,	-9.76,
4,	1.41,	-1.290,	10.71,	.50,	12,	.46,	-9.38,
5,	1.01,	-.023,	9.34,	.50,	12,	.41,	-9.31,
6,	1.73,	-.739,	13.15,	.09,	12,	1.28,	-9.54,
7,	.83,	1.674,	8.47,	.90,	12,	.19,	-9.44,

1

Fleet : IR-WCGFS : Irish Wes

Age	1993	1994	1995	1996
2 ,	1.75,	-1.92,	.62,	99.99
3 ,	1.52,	-.71,	.58,	-1.08
4 ,	1.43,	-1.90,	.93,	.51
5 ,	2.84,	-1.47,	1.41,	.66
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
2 ,	.95,	-.44,	-.17,	-1.00,	1.02,	-.82,	99.99,	99.99,	99.99,	99.99
3 ,	-.34,	-.22,	.26,	.53,	-.10,	-.44,	99.99,	99.99,	99.99,	99.99
4 ,	-.97,	-.25,	.72,	.14,	-.52,	-.10,	99.99,	99.99,	99.99,	99.99
5 ,	-.79,	-1.24,	.46,	99.99,	-.88,	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									

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
Mean Log q,	-12.1303,	-10.3438,	-9.8647,	-9.8647,
S.E(Log q),	1.1713,	.7485,	.9772,	1.5021,

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,	.63,	.568,	10.30,	.26,	9,	.77,	-12.13,
3,	.82,	.373,	9.75,	.36,	10,	.65,	-10.34,
4,	.75,	.427,	8.98,	.26,	10,	.77,	-9.86,
5,	.39,	.714,	7.22,	.19,	8,	.60,	-9.74,

1

Table 4.7.10 Plaice in Divisions VII h-k (Southwest Ireland). Contd-

XSA tuning diagnostics from final run.

```
 Fleet : IrGFS : Irish Ground

  Age  ,  1997,  1998,  1999,  2000,  2001,  2002,  2003,  2004,  2005,  2006
     2 , No data for this fleet at this age
     3 , 99.99, 99.99, 99.99, 99.99, 99.99, 99.99,   .39,  -.36,  -.42,   .39
     4 , 99.99, 99.99, 99.99, 99.99, 99.99, 99.99, -1.28,  1.26,   .13,  -.11
     5 , 99.99, 99.99, 99.99, 99.99, 99.99, 99.99,   .65,   .66,   .11,  -.30
     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 ,          3,          4,          5
 Mean Log q,  -10.2294,  -10.4866,  -10.4866,
 S.E(Log q),     .4498,    1.0411,     .5644,


 Regression statistics :


 Ages with q independent of year class strength and constant w.r.t. time.

 Age, Slope , t-value , Intercept, RSquare, No Pts, Reg s.e,  Mean Q

  3,    1.61,    -.517,     12.69,     .26,      4,     .83,  -10.23,
  4,     .20,    2.301,      6.69,     .80,      4,     .13,  -10.49,
  5,   -1.95,   -2.038,     -5.00,     .19,      4,     .63,  -10.21,
1

 Fleet disaggregated estimates of survivors :


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

 Year class = 2004

 IR-Demersal Directed
        Age,         2,
  Survivors,      256.,
 Raw Weights,     1.420,


 IR-WCGFS : Irish Wes
        Age,         2,
  Survivors,        0.,
 Raw Weights,      .000,


 IrGFS : Irish Ground
        Age,         2,
  Survivors,        0.,
 Raw Weights,      .000,
```

Table 4.7.10 Plaice in Divisions VII h-k (Southwest Ireland). Contd-

XSA tuning diagnostics from final run.

```
 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 IR-Demersal Directed,       256.,   .784,       .000,    .00,   1,  .262,     .130
 IR-WCGFS : Irish Wes,         1.,   .000,       .000,    .00,   0,  .000,     .000
 IrGFS : Irish Ground,         1.,   .000,       .000,    .00,   0,  .000,     .000

   F shrinkage mean  ,       241.,    .50,,,,                        .738,     .138

 Weighted prediction :

 Survivors,         Int,       Ext,     N,    Var,      F
 at end of year,   s.e,       s.e,      ,   Ratio,
       245.,        .42,       .05,     2,    .122,   .136


1
 Age  3   Catchability constant w.r.t. time and dependent on age

 Year class = 2003

 IR-Demersal Directed
         Age,         3,          2,
   Survivors,      157.,       252.,
 Raw Weights,     7.166,       .917,


 IR-WCGFS : Irish Wes
         Age,         3,          2,
   Survivors,        0.,         0.,
 Raw Weights,      .000,       .000,


 IrGFS : Irish Ground
         Age,         3,          2,
   Survivors,      239.,         0.,
 Raw Weights,     2.602,       .000,


 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 IR-Demersal Directed,       166.,   .283,       .150,    .53,   2,  .550,     .411
 IR-WCGFS : Irish Wes,         1.,   .000,       .000,    .00,   0,  .000,     .000
 IrGFS : Irish Ground,       239.,   .503,       .000,    .00,   1,  .177,     .302

   F shrinkage mean  ,       120.,    .50,,,,                        .272,     .532

 Weighted prediction :

 Survivors,         Int,       Ext,     N,    Var,      F
 at end of year,   s.e,       s.e,      ,   Ratio,
       162.,        .23,       .16,     4,    .712,   .419


1
 Age  4   Catchability constant w.r.t. time and dependent on age

 Year class = 2002

 IR-Demersal Directed
         Age,         4,          3,          2,
   Survivors,      138.,       152.,       125.,
 Raw Weights,     4.410,      3.857,       .507,
```

Table 4.7.10 Plaice in Divisions VII h-k (Southwest Ireland). Contd-

```
XSA tuning diagnostics from final run.

 IR-WCGFS : Irish Wes
         Age,          4,           3,           2,
   Survivors,         0.,          0.,          0.,
 Raw Weights,       .000,        .000,        .000,



 IrGFS : Irish Ground
         Age,          4,           3,           2,
   Survivors,       115.,         84.,          0.,
 Raw Weights,       .406,       1.400,        .000,



 Fleet,                  Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                   Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
 IR-Demersal Directed,       143.,   .226,       .041,    .18,   3,  .602,     .548
 IR-WCGFS : Irish Wes,         1.,   .000,       .000,    .00,   0,  .000,     .000
 IrGFS : Irish Ground,        90.,   .469,       .129,    .28,   2,  .124,     .769

   F shrinkage mean  ,       116.,    .50,,,,                         .274,     .644

 Weighted prediction :

 Survivors,         Int,       Ext,    N,    Var,      F
 at end of year,   s.e,       s.e,     ,    Ratio,
       128.,       .20,       .08,    6,    .391,   .598


1
 Age   5    Catchability constant w.r.t. time and age (fixed at the value for
              age)  4

 Year class = 2001

 IR-Demersal Directed
         Age,          5,           4,           3,           2,
   Survivors,       106.,        113.,        104.,        104.,
 Raw Weights,      3.275,       2.813,       2.310,        .315,



 IR-WCGFS : Irish Wes
         Age,          5,           4,           3,           2,
   Survivors,         0.,          0.,          0.,          0.,
 Raw Weights,       .000,        .000,        .000,        .000,



 IrGFS : Irish Ground
         Age,          5,           4,           3,           2,
   Survivors,        72.,        111.,         68.,          0.,
 Raw Weights,      1.421,        .259,        .839,        .000,
```

Table 4.7.10 Plaice in Divisions VII h-k (Southwest Ireland). Contd-

XSA tuning diagnostics from final run.

Fleet,	Estimated,	Int,	Ext,	Var,	N,	Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	,	Weights,	F
IR-Demersal Directed,	108.,	.211,	.020,	.10,	4,	.572,	.527
IR-WCGFS : Irish Wes,	1.,	.000,	.000,	.00,	0,	.000,	.000
IrGFS : Irish Ground,	74.,	.411,	.099,	.24,	3,	.165,	.700
F shrinkage mean ,	93.,	.50,,,,				.263,	.589

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
97.,	.19,	.06,	8,	.303,	.570

Age 6 Catchability constant w.r.t. time and age (fixed at the value for age) 4

Year class = 2000

IR-Demersal Directed

Age,	6,	5,	4,	3,	2,
Survivors,	40.,	76.,	57.,	61.,	65.,
Raw Weights,	1.131,	2.322,	1.661,	1.573,	.205,

IR-WCGFS : Irish Wes

Age,	6,	5,	4,	3,	2,
Survivors,	0.,	0.,	0.,	0.,	26.,
Raw Weights,	.000,	.000,	.000,	.000,	.083,

IrGFS : Irish Ground

Age,	6,	5,	4,	3,	2,
Survivors,	0.,	65.,	206.,	86.,	0.,
Raw Weights,	.000,	1.007,	.153,	.571,	.000,

Fleet,	Estimated,	Int,	Ext,	Var,	N,	Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	,	Weights,	F
IR-Demersal Directed,	61.,	.220,	.108,	.49,	5,	.542,	.379
IR-WCGFS : Irish Wes,	26.,	1.235,	.000,	.00,	1,	.007,	.734
IrGFS : Irish Ground,	79.,	.416,	.228,	.55,	3,	.136,	.302
F shrinkage mean ,	49.,	.50,,,,				.315,	.451

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
58.,	.21,	.09,	10,	.440,	.390

1
Age 7 Catchability constant w.r.t. time and age (fixed at the value for age) 4

Year class = 1999

IR-Demersal Directed

Age,	7,	6,	5,	4,	3,	2,
Survivors,	15.,	35.,	14.,	13.,	20.,	40.,
Raw Weights,	6.872,	.465,	.925,	.841,	.554,	.069,

Table 4.7.10 Plaice in Divisions VII h-k (Southwest Ireland). Contd-

XSA tuning diagnostics from final run.

IR-WCGFS : Irish Wes

Age,	7,	6,	5,	4,	3,	2,
Survivors,	0.,	0.,	0.,	0.,	11.,	47.,
Raw Weights,	.000,	.000,	.000,	.000,	.083,	.028,

IrGFS : Irish Ground

Age,	7,	6,	5,	4,	3,	2,
Survivors,	0.,	0.,	33.,	5.,	0.,	0.,
Raw Weights,	.000,	.000,	.402,	.077,	.000,	.000,

Fleet,	Estimated,	Int,	Ext,	Var,	N,	Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	,	Weights,	F
IR-Demersal Directed,	16.,	.222,	.097,	.44,	6,	.679,	.512
IR-WCGFS : Irish Wes,	16.,	.665,	.634,	.95,	2,	.008,	.509
IrGFS : Irish Ground,	24.,	.561,	.713,	1.27,	2,	.033,	.363
F shrinkage mean ,	20.,	.50,,,,				.279,	.424

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
17.,	.21,	.08,	11,	.407,	.481

1

1

Table 4.7.11 Plaice in Divisions VII h-k (Southwest Ireland).

Fishing mortality at age.

Run title : SOUTHWEST IRELAND PLE, SSWG 2007, COMBSEX, PLUSGROUP

At 3/07/2007 10:14

Table 8 Fishing mortality (F) at age

YEAR,	1993,	1994,	1995,	1996,
AGE				
2,	.0965,	.0753,	.1125,	.0376,
3,	.6659,	.4821,	.7034,	.5020,
4,	1.0673,	.8107,	.9296,	.5501,
5,	.9187,	.6188,	.8200,	.9747,
6,	.8364,	1.5458,	.4222,	1.0227,
7,	.7209,	.7104,	.7934,	.7961,
+gp,	.7209,	.7104,	.7934,	.7961,
0 FBAR 3- 6,	.8720,	.8643,	.7188,	.7624,

Table 8 Fishing mortality (F) at age

YEAR,	1997,	1998,	1999,	2000,	2001,	2002,	2003,	2004,	2005,	2006,	FBAR **-**
AGE											
2,	.3835,	.0752,	.2979,	.1611,	.1795,	.1362,	.0895,	.1279,	.1541,	.1357,	.1392,
3,	.6021,	.6833,	.5748,	.5253,	.6229,	.7232,	.3606,	.5032,	.4402,	.4189,	.4541,
4,	.9756,	.8355,	.6046,	.7902,	.7625,	.8773,	.4222,	.6610,	.4782,	.5982,	.5791,
5,	.7480,	.9706,	.3588,	.4497,	.4242,	1.0422,	.3905,	.5529,	.5229,	.5696,	.5485,
6,	.8007,	.3405,	.6670,	.4815,	.1181,	.4133,	.5139,	.4019,	.7998,	.3905,	.5307,
7,	.6970,	.8371,	.3326,	.3989,	.2525,	.6146,	.5691,	.5385,	.4322,	.4805,	.4838,
+gp,	.6970,	.8371,	.3326,	.3989,	.2525,	.6146,	.5691,	.5385,	.4322,	.4805,	
0 FBAR 3- 6,	.7816,	.7075,	.5513,	.5617,	.4819,	.7640,	.4218,	.5298,	.5603,	.4943,	

Table 4.7.12 Plaice in Divisions VII h-k (Southwest Ireland).

```
    Stock numbers at age

 Run title : SOUTHWEST IRELAND PLE, SSWG 2007, COMBSEX, PLUSGROUP

 At  3/07/2007  10:14


   Table 10    Stock number at age (start of year)               Numbers*10**-3
   YEAR,       1993,    1994,    1995,    1996,

   AGE
     2,         2275,    2182,    1646,    1410,
     3,         1795,    1832,    1795,    1305,
     4,          868,     818,    1003,     788,
     5,          290,     265,     323,     351,
     6,          163,     103,     126,     126,
     7,           93,      63,      19,      74,
   +gp,           78,      62,      33,      48,
0   TOTAL,      5562,    5325,    4946,    4101,


   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 93-**    AMST 93-**

   AGE
     2,         1654,    1071,     897,     841,     824,     845,     812,     587,     365,     316,       0,        1146,         1254,
     3,         1204,     999,     881,     591,     635,     611,     654,     659,     458,     277,     245,         982,         1080,
     4,          700,     585,     448,     440,     310,     302,     263,     404,     353,     262,     162,         526,          577,
     5,          403,     234,     225,     217,     177,     128,     111,     153,     185,     194,     128,         223,          240,
     6,          118,     169,      79,     139,     123,     103,      40,      67,      78,      97,      97,         106,          113,
     7,           40,      47,     107,      36,      76,      97,      60,      21,      40,      31,      58,          54,           61,
   +gp,            6,      39,     126,      30,      47,     107,      75,      36,      24,      29,      33,
0   TOTAL,      4126,    3144,    2762,    2294,    2192,    2192,    2016,    1927,    1503,    1207,     723,
```

Table 4.7.13 Plaice in Divisions VII h-k (Southwest Ireland).

Stock Summary of Final XSA run.

Run title : SOUTHWEST IRELAND PLE, SSWG 2007, COMBSEX, PLUSGROUP ,

At 3/07/2007 10:14

Table 16 Summary (without SOP correction)

,	RECRUITS, Age 2	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 3- 6,
1993,	2275,	1482,	917,	655,	.7142,	.8720,
1994,	2182,	1408,	836,	577,	.6900,	.8643,
1995,	1646,	1377,	868,	542,	.6242,	.7188,
1996,	1410,	1260,	838,	453,	.5403,	.7624,
1997,	1654,	1273,	804,	645,	.8022,	.7816,
1998,	1071,	1046,	692,	444,	.6417,	.7075,
1999,	897,	1013,	728,	406,	.5580,	.5513,
2000,	841,	850,	593,	299,	.5038,	.5617,
2001,	824,	809,	572,	261,	.4571,	.4819,
2002,	845,	814,	566,	313,	.5531,	.7640,
2003,	812,	640,	413,	217,	.5240,	.4218,
2004,	587,	604,	404,	221,	.5484,	.5298,
2005,	365,	503,	374,	164,	.4394,	.5603,
2006,	316,	449,	328,	147,	.4463,	.4943,
Arith. Mean ,	1123,	966,	638,	382,	.5745,	.6480,
0 Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),1		

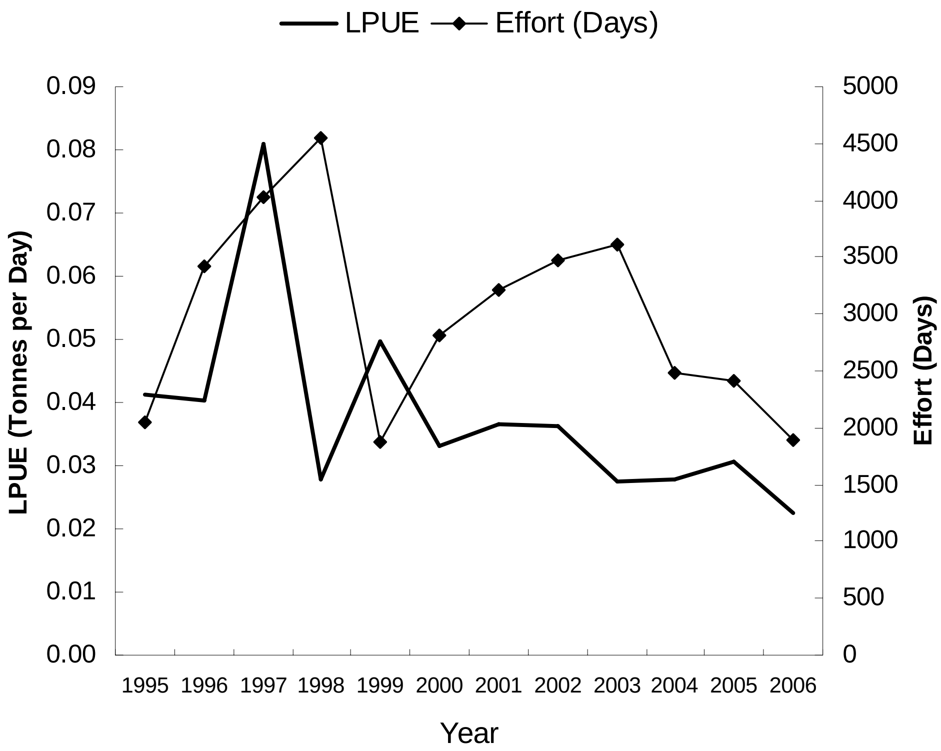

Figure 4.7.1 **Plaice in Divisions VIIh-k (Southwest Ireland)**
Irish Demersal Directed Otter Trawl LPUE and Effort.

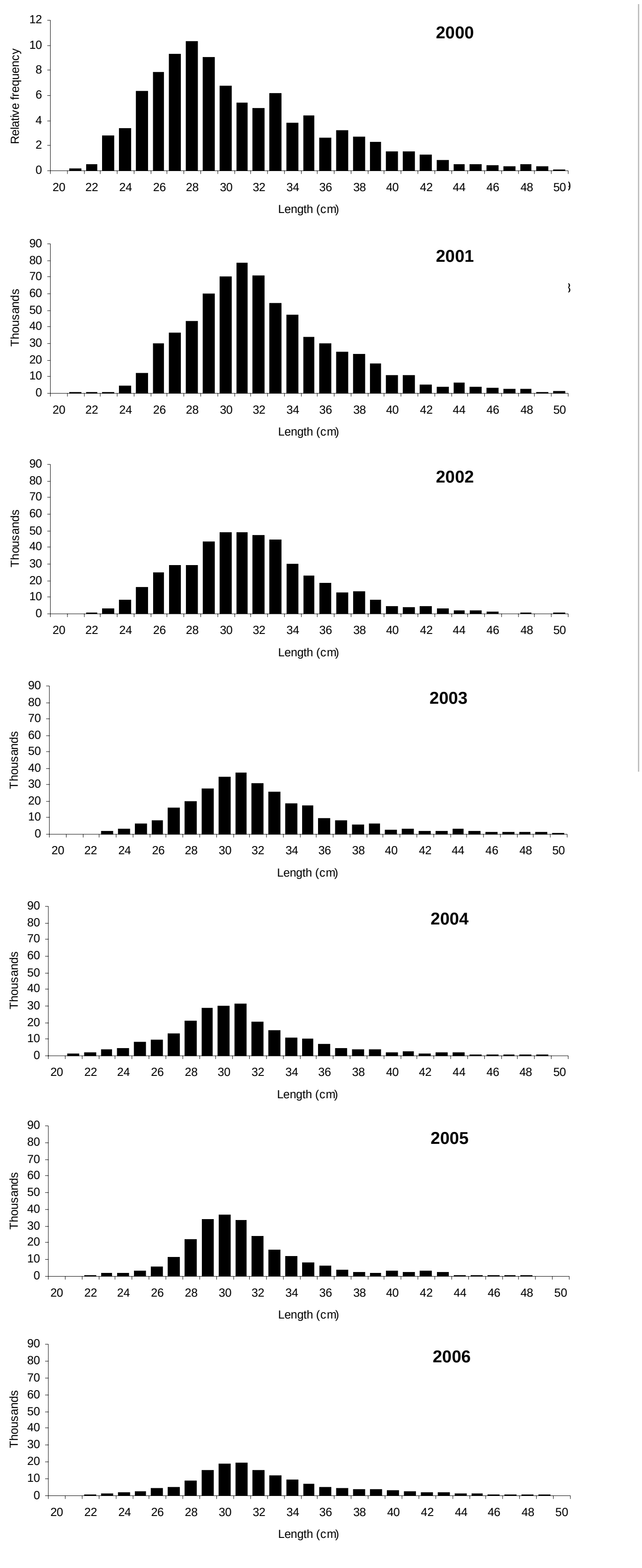

Figure 4.7.2 Plaice in Divisions VII h-k (Southwest Ireland)
Length distribution of Irish sampling (2000), and Irish landings (2001-2006) in VIIj.

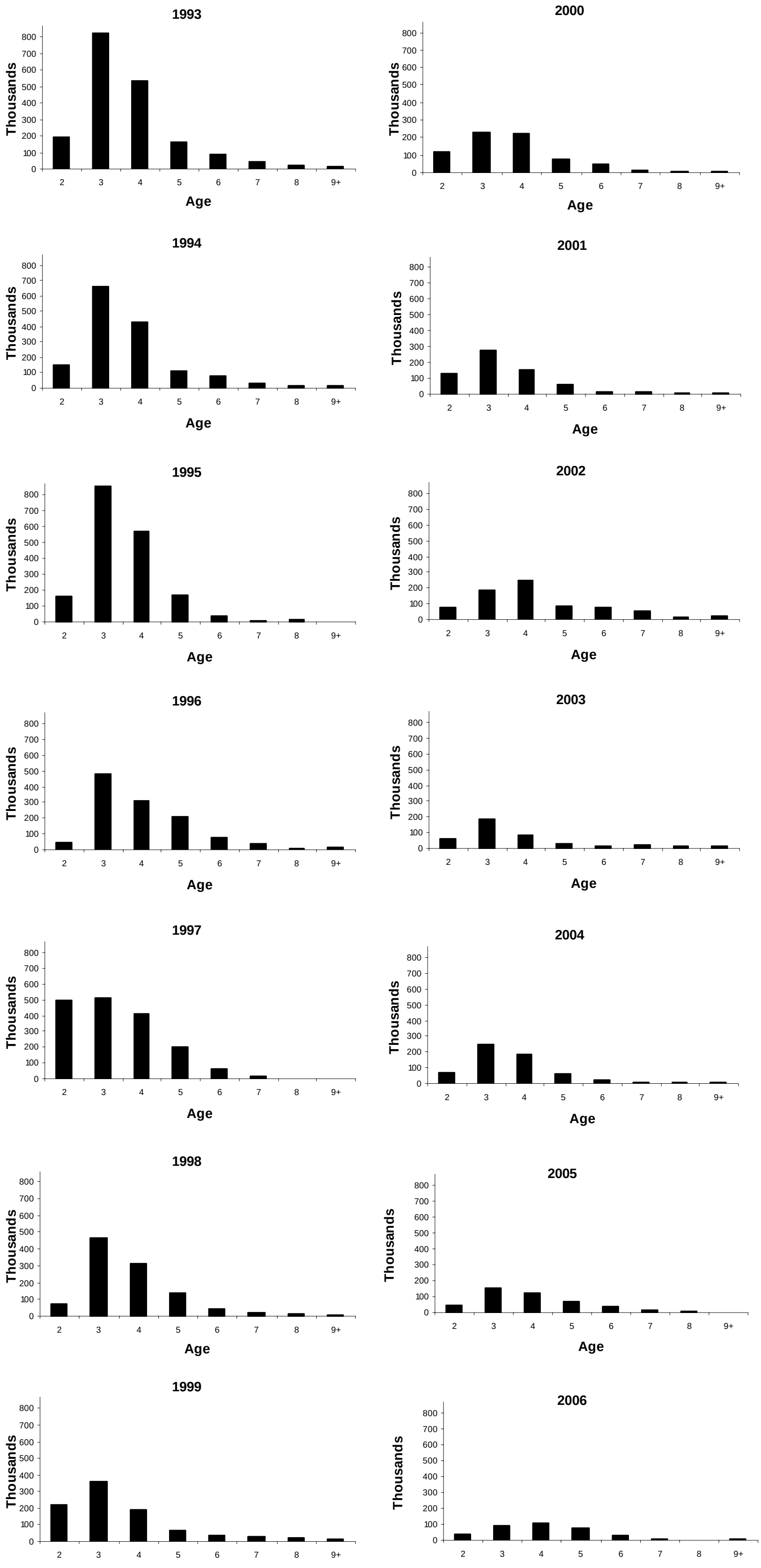

Figure 4.7.3 Plaice in Divisions VIIh-k (Southwest Ireland)
Age Compositions of landings from 1993 to 2006

Plaice VIIh-k Log catchability residual plots from Separable VPA runs.

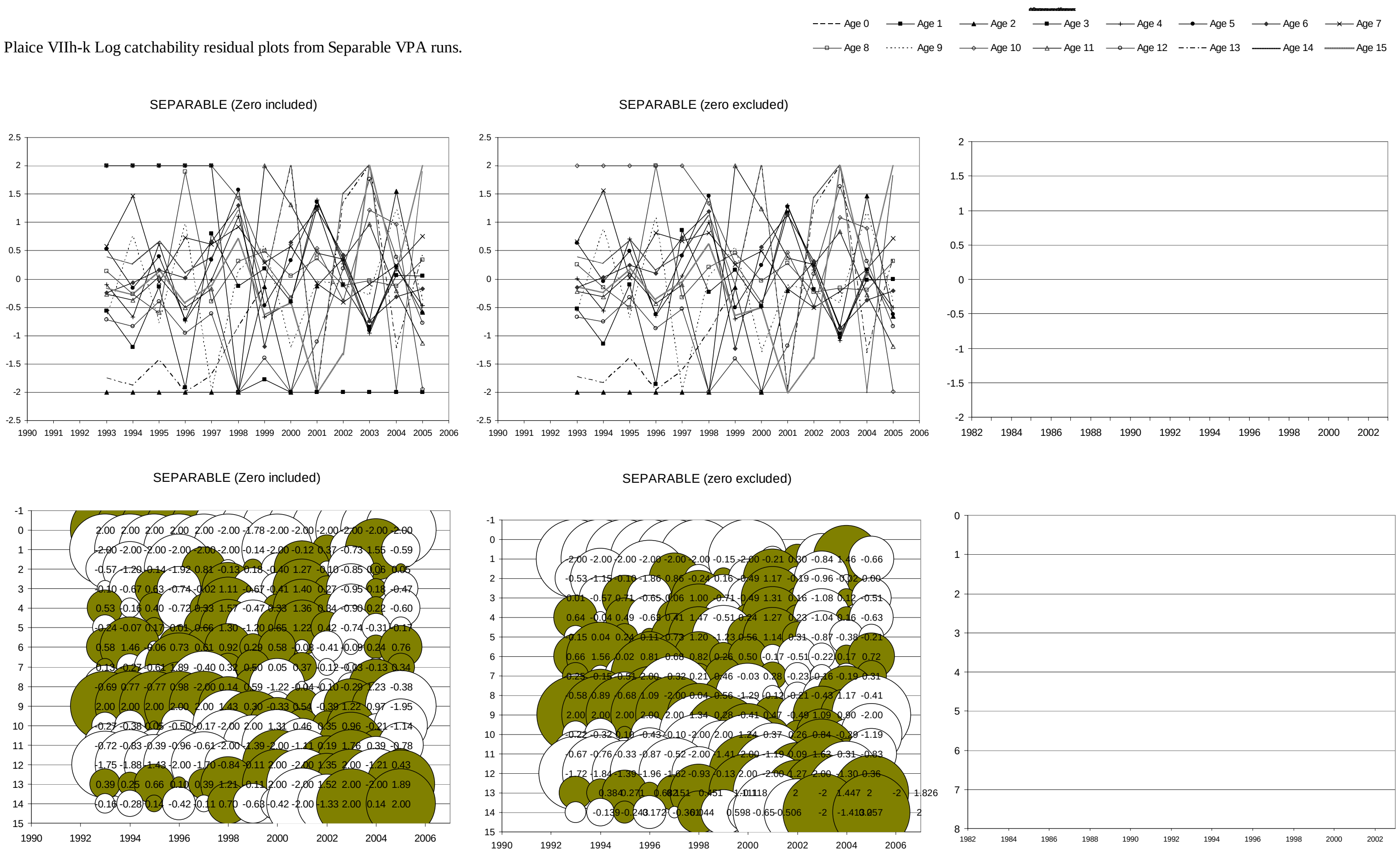

Figure 4.7.4

Plaice VIIh-k Log catchability residual plots from single fleet XSA runs.

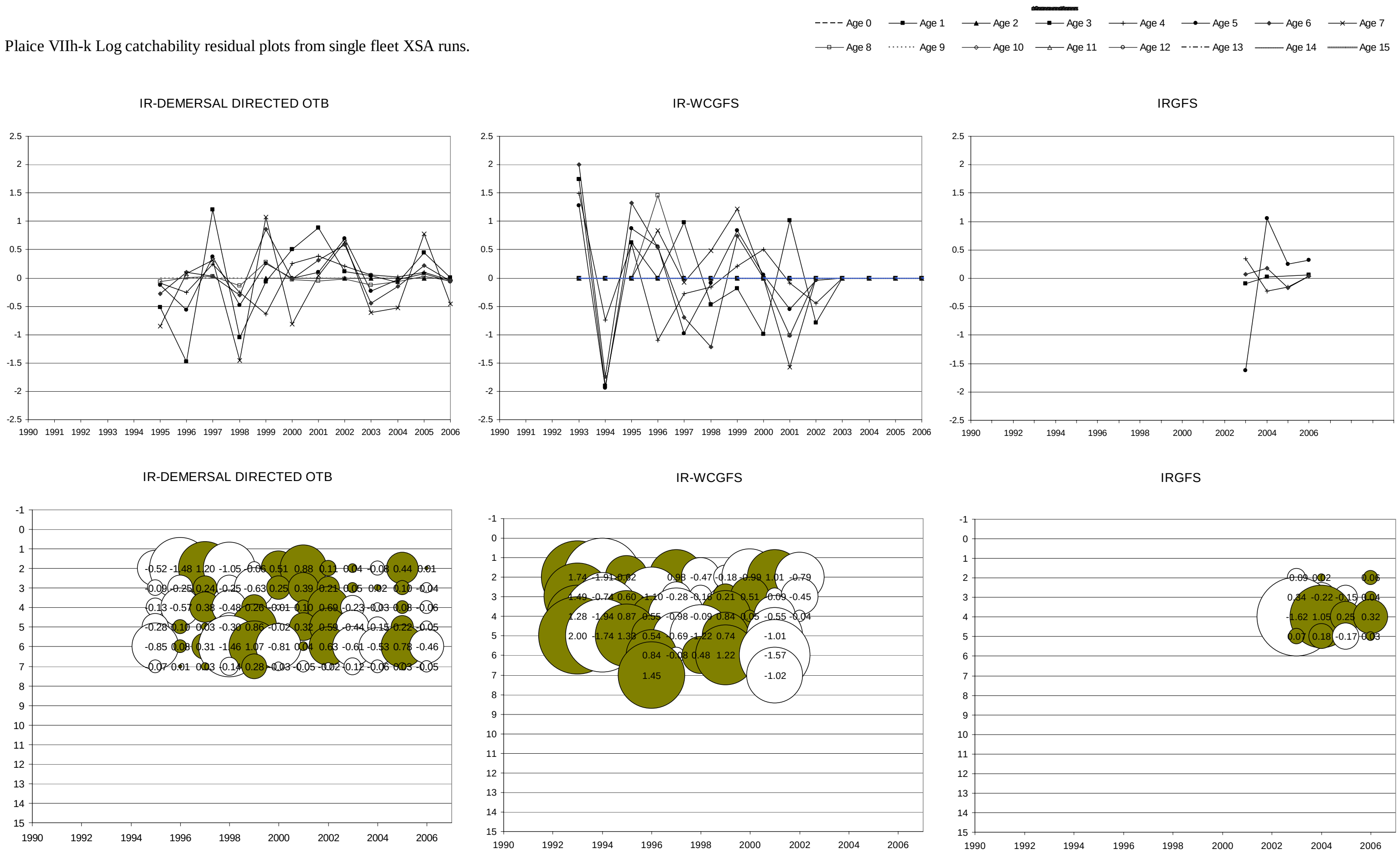

Figure 4.7.5

Plaice VIIh-k Log catchability residual plots from final XSA run.

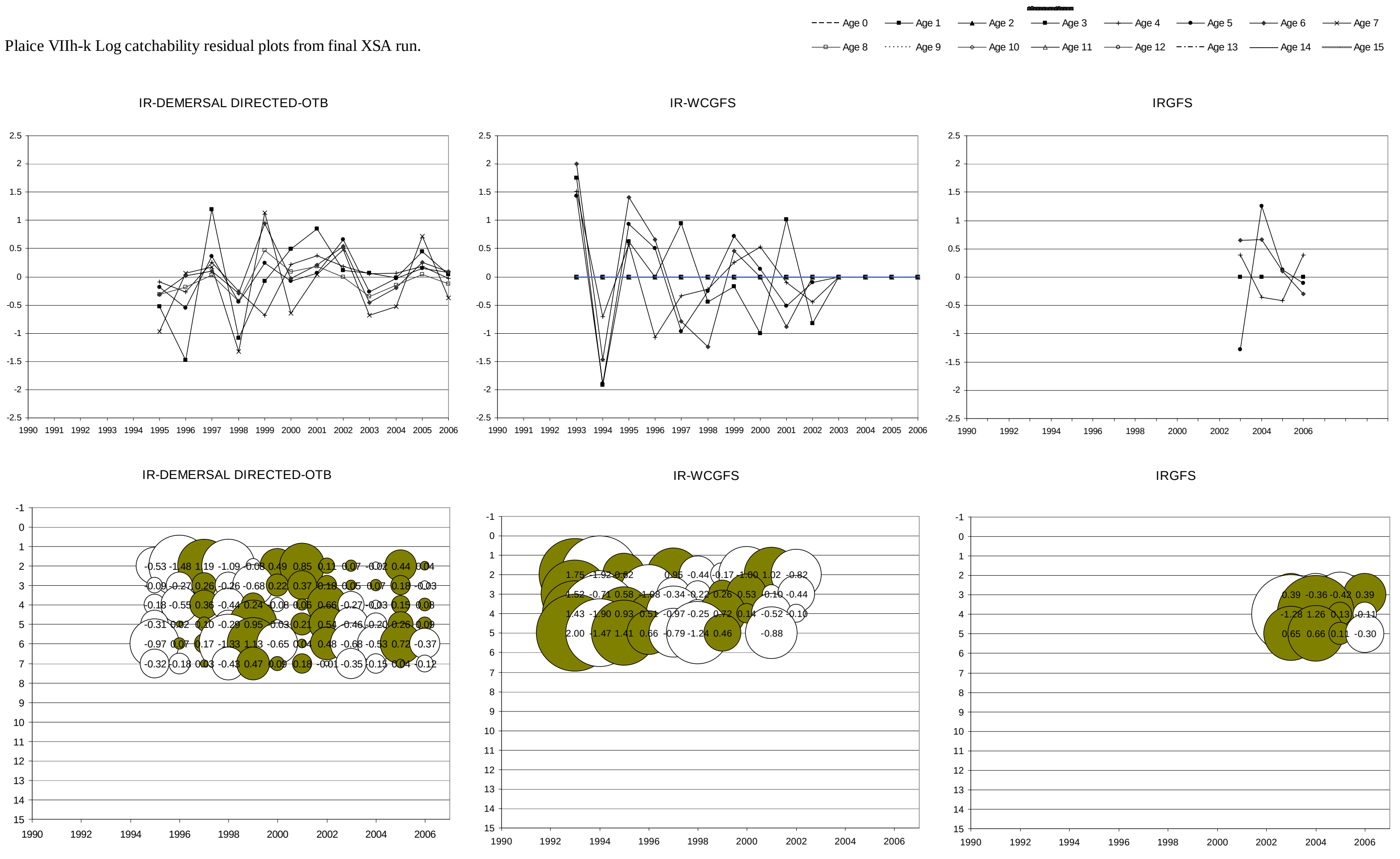

Figure 4.7.6

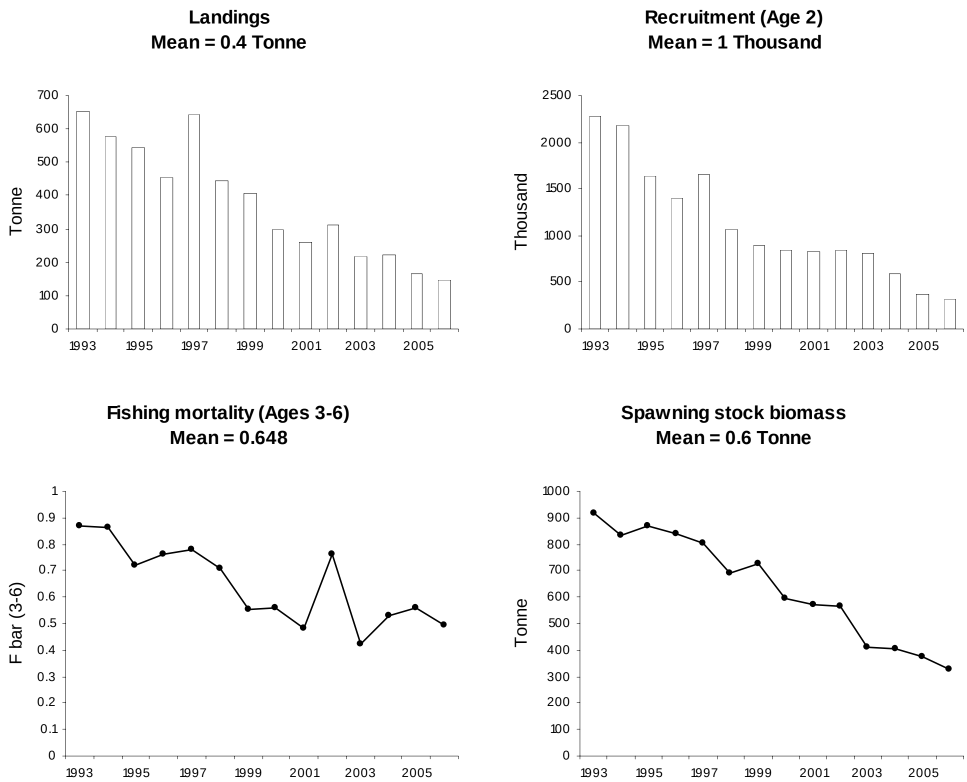

Figure 4.7.7 Plaice in Divisions VIIh-k
Stock summary of final XSA run.

Retrospective Analysis (F Shrinkage SE=0.5)

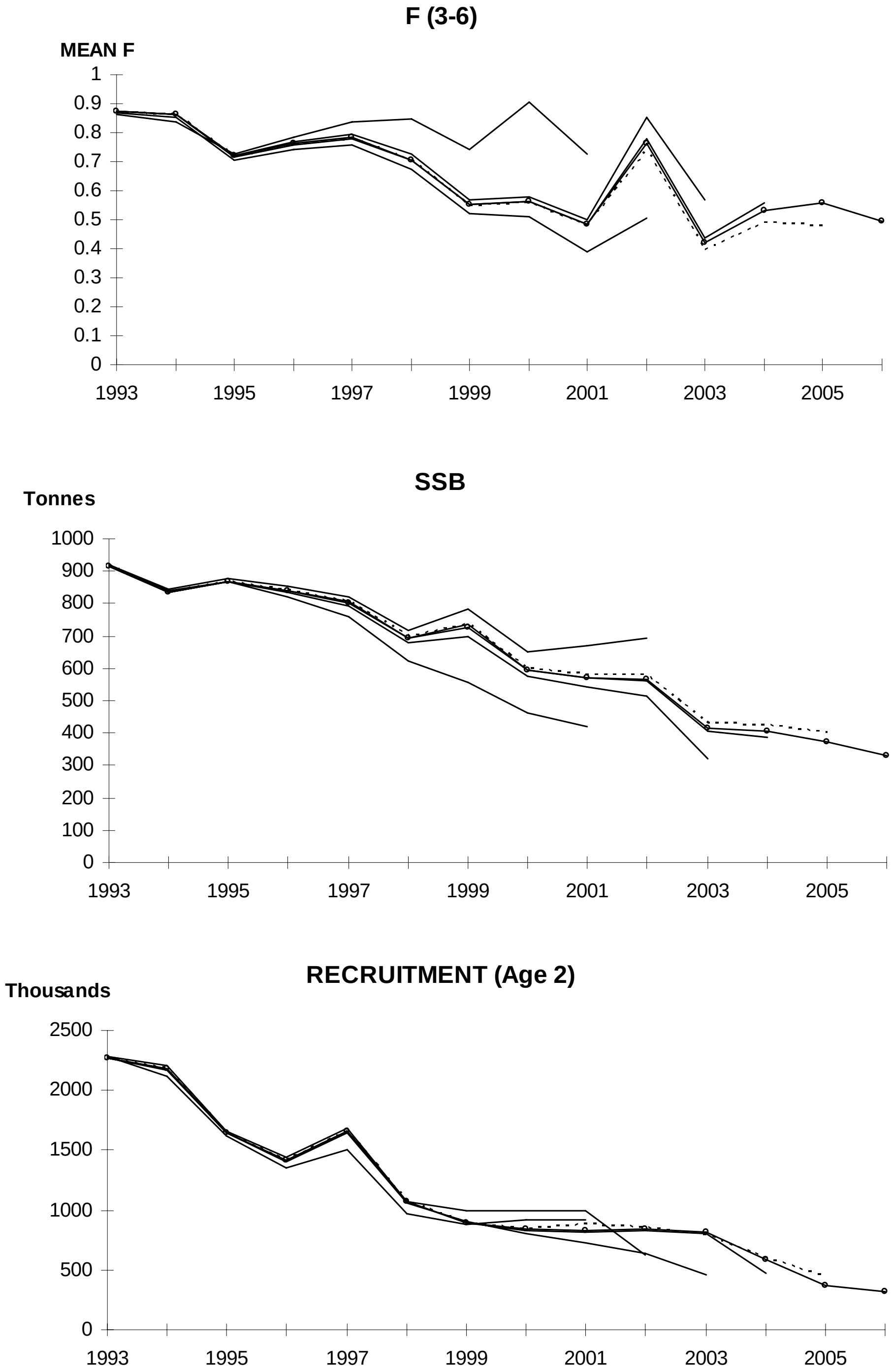

Figure 4.7.8 Plaice in VIIh-k

4.8 *Nephrops* in the Celtic Sea (FU 20-22)

ICES description VIIg,h

Functional Units Celtic Sea, VIIg,h (FU 20-22)

Main changes in the assessment methodology compared to last year:

- Validation of the method of derivation of discards developed since 2006: see § 4.8.2, WD 1

Since 2005, the FU 20-22 *Nephrops* stock has been allocated to the WGSSDS (because of the predominance of cod and whiting in the by-catches).

Type of assessment in 2007: update assessment.

4.8.1 The fishery

This section is detailed in the Stock Annex.

ICES advice applicable to 2007

Exploitation boundaries in relation to precautionary considerations

Landings have been relatively stable at around 4600 t in recent years and there are no other specific concerns about recent stock development. Therefore, ICES advises that *Nephrops* fisheries in this area should be constrained at recent levels of effort.

Management applicable to 2006 and 2007

Management for *Nephrops* stocks should be conducted at an appropriate geographic scale (e.g. Functional Unit). Currently the TAC is set for Subarea VII (25153 t for 2007), and this may allow unrestricted catches for stocks under excessive fishing pressure where catches should be limited.

The MLS implemented by EU is set at 25 mm CL *i.e.* 8.5 cm total length and this regulation is applied by the Irish and UK fleets whereas a more restrictive regulation adopted by the French Producers' Organisations (35 mm CL *i.e.* 11.5 cm total length) is applied by the French trawlers.

In application of the Council Regulation (EC) N° 1459/1999, June 24th 1999, modifying the regulation (EC) N° 850/98 of the Council for the conservation of fishery resources through technical measures for the protection of juveniles, the French minimum mesh size of codend was set at 100 mm in January 2000 whereas the Irish mesh size was maintained at 80 mm.

Recent trends in the fishery

As described in the Stock Annex, landings are reported mainly by France and the Republic of Ireland (Figure 4.8.1; Table 4.8.1). The contribution of French landings has gradually decreased from 80-90% at the end of 80's to 50-60% at the beginning of 2000's. The overall fishing profile remains typically seasonal (Table 4.8.2) with the majority of landings coming from the 2nd and 3rd quarters.

Between 2005 and 2006, French landings decreased slightly (2398 t against 2490 t: -4%) whilst Irish landings declined more steeply (1858 t against 2389 t: -22%).

Between 2005 and 2006, as reported by Figure 4.8.2 and Table 4.8.3, the French fishing effort declined by -9% and the LPUE remained almost stable (+2%) although the evolution of the same indicators for the Irish fleet was different (-14% of fishing effort and -11% of LPUE). This underlines the divergence of features of the targeting vessels for each country and indicates the great heterogeneity of the area.

4.8.2 Length composition of catches

Landings

Global information is given in the Stock Annex. All data are presented in Figure 4.8.3 and Tables 4.8.4 to 4.8.8, 4.8.10a and 4.8.11a. The Table 4.8.12 provides information on mean size of landings by year and country.

Landings reveal significant differences between the two countries. The two ogives of selectivity through meshes are different. The evolution of the French landings had shown a substantial increase of mean sizes since the beginning of 2000's (this coincides with mesh regulations cited in the Stock Annex), but a significant decrease of the mean size occurred in 2006 (41.0 mm CL for both sexes combined against 42.8 mm CL in 2005). The same trend was observed for Irish landings (29.2 mm CL against 31.1 mm CL in 2005).

The WGSSDS 2007 pointed out a significantly increasing proportion of tailed individuals in French landings whereas this proportion was already high for Irish trawlers (25-30% after conversion of tailed weight to total one). In 2006, 15% of total French landings involved in tailed *Nephrops* (11% in 2005; negligible proportion in previous years). Industry explained this recent change by the economic difficulties of the vessels because of the quickly increasing fuel prices. Tailed individuals are intended to compensate this loss. Hence, as this category of *Nephrops* cannot be sampled at auction and the sampling onboard remains difficult to apply routinely, the corresponding size composition may be overestimated when raised to the composition of entire individuals. The problem was partially tackled by apportioning tailed individuals to the smallest category of landings at auction.

Discards

Sampling

The available dataset is detailed in the Stock Annex. Additional French dataset was also acquired in 2005, but it involves in only two quarters (Q3 and Q4; WD 1). As for landings, the Irish biological sampling onboard began in 2002. Thus, there is no common dataset on discards between French and Irish fleets (lack of information of the Irish sampling program for 2005-Q3 and 2005-Q4). Available information on complete yearly sets is given by Table 4.8.9.

The notable contrast between the retained proportions onboard and the spatial heterogeneity of the exploited area prevents direct comparisons of the main fleets. It is not yet possible to estimate if the inter-fleet variability of the discard rate is larger than the inter-annual one.

Changes in discard rate is a consequence of the strength of recruitments, increase in the MLS (which tends to increase the discards) and the gear selectivity. The relative contribution of each of these three factors remains unknown.

Back-calculation

Reliable estimates of discards can only be obtained by sampling onboard. However, as for the main *Nephrops* stocks, the lack of estimation of discards hampers quantitative analysis of recruitment indices, possibilities of back-calculation for discards were investigated. The proportional derivation of discards (processed by WGNEPH) was considered as unreliable because it induces lack of contrast in inter-annual variations of recruitment (see report of WGSSDS 2005). An alternative statistical approach developed since 2006 on other *Nephrops* stocks (VIIIa,b; Bay of Biscay; FU 23-24) was also applied to the FU 20-22. The method is detailed by WD 1. Files created from calculations are available in ICES files. Main concepts of the back-calculation are summarized below:

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 mesh size and MLS remain constant within period).

2) The second step consists in removing undersized individuals unusual in landings which can generate 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 (*e.g.* 1 or 5% of cumulative landings) were eliminated.

3) The third step allows the generation of missing size classes by applying a probability density function which can be symmetrical or not. The whole calculation is based on multiple maximum likelihood function according to the number of missing years. Relationship as between mean sizes of landings and of discards tested on the FU 23-24 *Nephrops* can also be included in the final fitting.

All results are given in Figures 4.8.4 to 4.8.6. Tables 4.8.10b,c,d and 4.8.11b,c,d provide discard estimates, total catches and removals (using mortality rate of discards equal to 75%: Charuau *et al*, 1982).

The final results for French vessels emphasize that the simulated discard rate is notably more variable than that calculated by proportionality of landings (moreover, the previous method was developed on only one annual dataset whereas in the FU 23-24 *Nephrops* stock there were many years of available data on a total time series of the same duration as for FU 20-22). It is worth noting that the discard rate seems to have decreased during the time series since the end of 90's with some peaks over the series which can be associated to strong recruitment level (*e.g.* for years 2001 and 2003 as other information sources such as EVHOE survey indicates: see Stock Annex). Moreover, during the overall time series, some high (years 1988, 2001) or low (year 1990) values of simulated discard rates coincide with increase or decrease of LPUE for 1-2 years later (increase in 1989-1990 and 2002-2003, decrease in 1991-1992). It should be noted that no constraint was set for back-calculations on the relationship between discard rate (year i) and LPUE (years i+1/i+2).

The Irish results indicate the better statistical adequacy of the back-calculation compared to the French results (see WD 1). For 2002, the discard rate generated by the method is equal to 5.5% whilst the calculated by sampling value was 7.2% (as explained during last year's WG, the estimate provided by sampling was not used by WG because it was referred to the whole Management Area M: see WGSSDS 2006). Moreover, for the 11 quarters sampled by the Irish program since 2002 (WD 1) the descending part of the simulated curve for discards seems to be close to that estimated by sampling. However, some inconsistencies remain for the ascending part of simulated curves, thus, this method has to be further investigated.

4.8.3 Natural mortality and maturity at age

These parameters are provided by the Stock Annex.

4.8.4 Abundance indices from surveys

At present abundance indices are not available for this stock. Direct *Nephrops* assessment by trawling are inappropriate because of notable diurnal variations of availability which is higher during dawn and dusk. The current situation will be improved in the future once a data time series has been collected by the Irish specifically designed survey program launched in 2006. However, the Irish and French exploited areas are different. On FU 20-22 the French groundfish survey EVHOE while not focusing on *Nephrops* does provide an indication of the length distributions and the strength of recruitment (Stock Annex). An Irish groundfish survey has been carried out since 2003 giving length compositions of *Nephrops* catches. Moreover, a UK bottom trawl survey occurred on the same area between 1984 and 2004 (see last year's WG), but only two sampling stations were within FU 20-22 area.

4.8.5 Catch-at-age analysis

Age based assessments were conducted on the Celtic Sea stock in the past. In 2003, the WGNEPH assessed only the male component of the FU 20-22 stock exploited by the French fleet. The short time series of Irish data and the very low retained proportion of females retained by the French trawlers suggested that this was the most appropriate way. In 2005, the WGSSDS developed three experimental runs (proportional discard derivation, no discard in catches, logistic derivation which was not yet investigated as currently). The WG concluded that it seemed inappropriate to continue the assessment by the XSA method with data from only one fleet.

The investigations on discard derivation since last year have improved some knowledge on the actual inter-annual variability of the stock. Nevertheless, the French and Irish time series remain different and were provided by applying different exploitation pattern on different areas. It does not yet seem suitable to proceed with an XSA analysis while no valid method of extrapolation from French landings to Irish exists for the period before 2002.

4.8.6 Recruiting year class abundance

As no analytical XSA run was performed, abundance of recent recruiting year classes can be examined only by comparison of independent indicators such as discarded individuals estimated by the logistic derivation method and some surveys indices. As detailed in the Stock Annex, independent sources of information (EVHOE survey's indices, logistically derived discards for no sampled years) agree that some recent recruiting classes (mainly 2001 and probably 2002 and 2003) should be of a good level whereas it is still impossible to indicate the actual state of the more recent year classes.

4.8.7 Comments on the assessment

Consistency

Only the level of consistency can be commented in accordance with the information obtained by the logistic derivation of discards with data provided by surveys in the area even not focusing the species and with analysis of LPUE and mean size of landings. As pointed out by last year's WG, a comparative analysis conducted between LPUE and CPUE of French and Irish vessels with EVHOE indices shows a good agreement between commercial French CPUE and EVHOE series for the period 1997-2005 (R^2=0.65) whilst the relationship is more sparse (R^2=0.36) when the commercial French LPUE are used (see also Stock Annex). Some coincidences between calculated by probabilistic way discard rates and LPUE 1-2 years later have to be emphasized. These results encourage to continue explorations for calculations of discards and show good consistency with other sources. Trenkel and Rochet (2003) examining indicators in the French EVHOE Celtic Sea survey suggest that *Nephrops* population is increasing during recent years. Thus, the event of a high recruitment mainly in 2001 and also in 2002 and 2003 (the second one also coincides with increase of discard rate of the Irish fleet) should have occurred in the stock. Little or no change in the perception of the state of the stock has to be taken into consideration for the moment while the discard rate in 2006 seems to remain stable for both fleets (French trawlers: 29% identical to the 2005's rate; Irish trawlers: 28% against 31% in 2005).

Sampling

The problem of high variability of landing samples between trips still remains (higher coefficients of variation at auction because of higher heterogeneity of the fished area and of long duration of trips *i.e.* 12-15 days and, therefore, less availability of samples at auction). Hence, high CV of numbers at sizes (20-30%) are usual. In any case, commercial samples can be extended by including the commercial part sampled onboard during the DCR plan. Moreover, the problem of no sampled tailed individuals in landings should be resolved onboard before transformation. Failing access to VMS information, the complementary dataset should provide some information on the spatial structure of the stock mainly for the French trawlers providing longer time series with reliable report of information in logbooks.

Discarding

While the selectivity parameters are not significantly improved for *Nephrops* trawlers, it appears appropriate to continue the Irish onboard sampling plan and to conduct a French one on yearly basis. It should be interesting to examine the part of decrease of the French discard rate during recent years due to the selectivity improvement from that related to some weak recruiting classes. Moreover, if the individual growth of this species is faster during the latter period of the compiled time-series, there would be decline of the discarded amounts with no possibility to investigate the actual recruitment level.

Misreporting

Currently, misreporting does not seem to be a problem for either fleet, but the degree of misreporting of Irish fleet before the beginning of 2000's remains unknown.

Industry input

Meetings with representatives of the fishing industry were held in France and Ireland prior to the WG. French partnership underlined that the increase of LPUE series since the end of 90's may be caused by the change of the global fishing efficiency of the fleet because some old units were replaced by more recent ones. Fishing power analysis including spatial distribution should be undertaken on a common set of vessels with the aim of examining these effects. Furthermore, the problem of the unknown actual size composition of tailed individuals in landings was also debated with Producers' Organisations.

4.8.8 Management considerations

Nephrops in these functional units are known to occur in several areas of muddy sediment and the stock structure is uncertain. The *Nephrops* fisheries target different areas, and *Nephrops* catches and landings show very different size structures. These fisheries also have differences in non-*Nephrops* by-catch composition. Cod, whiting, and to a lesser extent haddock are the main by-catch species.

Discarding of small *Nephrops* is substantial. Because of the heterogeneity of FU 20–22 and of divergence in the exploitation pattern of the main fleets, the discard rate seems to have notably fluctuated between fleets or years. This shows that trawls currently used to target *Nephrops* are not technically adapted to select marketable *Nephrops*. Discarding of other fish species is also a problem in *Nephrops* fishery.

Even if the 2007 WG catch-at-age analysis was not conclusive regarding absolute levels of abundance of *Nephrops* in FU 20-22, it provides significant information on the relative stock state.

The French trawlers LPUE and CPUE series both indicate a rise in stock abundance over the recent period suggesting that the stock is currently not recruitment over-fished. However, it should be important to investigate whether the recent downwards trend of Irish LPUE corresponds to an actual signal for the stock. The French trawlers do not show such a decline in 2006. Until 2005, the mean size of landings had also increased except for 2001 when the smaller size composition suggests a stronger recruitment entry in the fishery. Nevertheless, in 2006, mean sizes in landings for both fleets decreased. This point combined to the former UK survey on this area (suggesting a slight trend of decrease of mean sizes for some sampling reference stations: see WGSSDS 2006) could be induced either by stronger recruitment abundance than previously or by over-fishing. As the Irish vessels are more recruitment directed and are concentrated on areas with high densities of small *Nephrops*, it could be suggested that the evolution of mean sizes of landings and discards on annual basis should reveal the actual state of the stock. Anyway, there is no evidence that the whole exploited area belongs to the same stock or that there are several patches linked in meta-population sense.

The average landings since 2000 have been stable and there is little evidence to suggest significant changes in the status of this stock when formulating management advice.

References

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Table 4.8.1. *Nephrops* FU 20-22 (Celtic Sea). Total and by country nominal landings (t) in Division VIIgh as used by WG.

Year	France	Rep. of Ireland	UK	Other Countries[1]	Total reported	Unallocated	Total
1983	3667						
1984	3653						
1985	3599						
1986	2638						
1987	3080	329					
1988	2926	239					
1989	3221	784					
1990	3762	528					
1991	2651	644					
1992	3415	750					
1993	3815	770	63	0	4648	-274	4374
1994	3658	1415	68	2	5143	-274	4869
1995	3803	1575	125	2	5505	-282	5223
1996	3363	1377	86	2	4828	-217	4611
1997	2589	1552	95	4	4240	-213	4027
1998	2241	1619	64	1	3925	-90	3835
1999	2745	824	41	0	3610	-78	3532
2000	2782	1793	47	1	4623	-44	4579
2001	2532	2123	21	1	4677	-33	4644
2002	3134	1496	15	8	4653	-50	4603
2003	3511	1385	19	N/A	4915	0	4915
2004	2511	1626	36	N/A	4173	0	4173
2005	2490	2389	53	N/A	4932	0	4932
2006	2398	1858	N/A	N/A	4256	0	4256

[1]Other countries include Belgium

Table 4.8.2. *Nephrops* FU 20-22 (Celtic Sea). Nominal landings (t) by quarter in Division VIIgh as used by WG.

year	French trawlers					Irish trawlers				
	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4	Total
1987	759	941	972	409	3080					329
1988	547	1065	683	631	2926					239
1989	411	1493	838	480	3221					784
1990	482	1765	1229	287	3762					528
1991	500	1245	518	388	2652					644
1992	681	992	1064	678	3415					750
1993	972	1598	742	504	3815					770
1994	541	1303	1052	762	3658					1415
1995	693	1631	876	604	3803	193	1137	109	136	1575
1996	674	1437	728	523	3363	268	714	330	66	1377
1997	460	1028	683	417	2589	249	971	196	136	1552
1998	642	881	456	262	2241	351	952	264	52	1619
1999	537	719	842	648	2745	214	184	105	321	824
2000	582	1205	727	267	2782	420	1154	149	71	1793
2001	410	853	621	648	2532	456	843	317	508	2123
2002	475	1175	815	671	3134	167	557	408	363	1496
2003	538	1323	1148	502	3510	202	519	478	187	1385
2004	476	943	669	423	2511	234	684	341	367	1626
2005	619	887	548	436	2490	490	1391	233	274	2389
2006	483	1016	568	330	2397	354	976	233	295	1858

Table 4.8.3. Division VIIgh. *Nephrops* effort and LPUE data by country.

The French data are calculated for otter trawlers getting at least 10% of their landing values by targeting this species. The Irish data are linked to otter trawl vessels where >30% of monthly landings in live weight were *Nephrops*.

Year	Effort (Effective hours fishing)		LPUE (kg/h)			
	France	Rep. of Ireland	France			Rep. of Ireland
	Otter	Otter	Total otter	Single Otter[1]	Twin otter[1]	Otter
1983	231440		14.2	14.2		
1984	204600		15.8	15.8		
1985	202830		16.0	16.0		
1986	162510		14.9	14.9		
1987	189580		15.2	15.2		
1988	170840		16.4	16.4		
1989	179060		16.8	16.8		
1990	229470		15.6	15.6		
1991	224710		11.3	11.3		
1992	276450		11.7	11.7		
1993	268410		13.2	13.2		
1994	258490		13.5	13.5		
1995	239240	27147	14.6	14.6		46.1
1996	220120	20997	14.2	14.2	14.2	49.0
1997	187180	24047	12.6	12.5	14.4	47.6
1998	155340	25407	13.0	12.9	14.9	53.0
1999	150770[2]	15705	10.9	10.2	10.0	41.0
2000	194170	28418	13.8	11.5	11.4	47.6
2001	170320	36298	14.6	11.1	12.9	54.4
2002	165670	30195	18.7	13.9	15.8	44.0
2003	191600	29409	18.2	[3]	[3]	33.5
2004	152700	34931	15.8	[3]	[3]	32.8
2005	146880	52582	16.0	13.8	13.9	41.0
2006	134140	45173	16.3			36.4

[1]The single and twin otter French LPUE can be compared with the total otter indices until 1999 when the definition of the fishing effort of trawlers was changed (see note 2).

[2]Since 1999, the French statistics differentiate fishing effort calculated on the basis of the "number of fishing hours" from that deduced from the "number of use of a fishing gear".

[3]Unavalaible data.

Table 4.8.4. *Nephrops* in VIIgh. Length distribution of landings by country in 2002. Quarterly and total values (10^3). The reported size is the carapace length (CL). Conversion of CL to TS (total size) is done by multiplication by 3.3. The Irish data reported from the whole MA M were calculated as explained in WD 13.

CL	Q1		Q2		Q3		Q4		TOTAL	
(mm)	F	IRL	F	IRL	F	IRL	F	IRL	F	IRL
17										
18										
19		4		5				24		33
20		13		6				126		145
21		37		4				172		213
22		72		17				564		653
23		124		85		6		1124		1340
24		236		136		67	84	1804	84	2243
25		421		216		75		1533		2245
26		538		245		182		1495		2459
27		778		326		202		1110		2417
28		760	81	577		607		1516	81	3459
29	21	639		776		470		1220	21	3104
30	41	510		741		1125	253	1107	294	3483
31	47	589		1075		1685	253	1284	300	4632
32	131	565		1199		1558	253	1002	385	4325
33	139	453	81	1624	36	1551	422	995	678	4624
34	234	419	119	1654	163	1455	423	753	938	4281
35	363	326	524	1654	397	1152	709	782	1993	3913
36	498	256	965	1376	1113	599	628	512	3205	2742
37	643	221	1495	1361	699	711	861	412	3697	2705
38	790	198	1556	1156	1587	580	1199	526	5131	2460
39	839	198	2164	820	1448	341	862	270	5313	1628
40	1069	116	2814	907	1451	313	1692	270	7026	1606
41	809	47	2675	380	1017	249	1439	171	5941	847
42	1104	140	2295	322	1174	207	700	156	5272	825
43	504	12	2009	249	773	129	874	85	4160	474
44	599	47	973	234	1065	129	806	28	3443	438
45	349	23	1123	132	599	74	640	71	2711	300
46	143		453	132	884	37	320	14	1801	183
47	178		334	15	465	97	259	14	1235	126
48	77	23	458	102	417	55	183	14	1136	195
49	87	12	129	59	199	37	58	14	473	121
50	72		235	15	156		91	14	555	29
51	48		161		125	18	100		433	18
52	31		70		119	18	98		319	18
53	30		74		44		25		173	
54	31		55		64	18	24		174	18
55	23		51		98	18	18		190	18
56	18		39		18		9		84	
57	11		41		9	18	15		77	18
58	11		22		8	18			41	18
59	10		11		2		1		25	
60	12		13		7	18	1		33	18
61	3		17		7		1		28	
62	4		20		1		1		25	
63	2				1		8		11	
64	2						1		2	
65	2				1				3	
66										
67										
68	1				1				2	
69										
70										
71										
72										
73										
74										
75										
TOTAL	**8974**	**7774**	**21058**	**17600**	**14148**	**13821**	**13312**	**19184**	**57492**	**58378**

Table 4.8.5. *Nephrops* in VIIgh. Length distribution of landings by country in 2003. Quarterly and total values (10^3). The reported size is the carapace length (CL). Conversion of CL to TS (total size) is done by multiplication by 3.3.

CL	Q1		Q2		Q3		Q4		TOTAL	
(mm)	F	IRL	F	IRL	F	IRL	F	IRL	F	IRL
17										
18				2						2
19				11						11
20		5		26		77		12		121
21		24		73		299		33		430
22		33		171		405		43		651
23		169		326		583		61		1139
24		87		862		567		103		1619
25		206		1134		733		144		2217
26		346		1879		1164		259		3648
27		441		1927		1812		306		4485
28		857		2000		2326		407		5589
29		618		1933		2590		581		5723
30		511		1771		2737		468		5486
31	25	1142		1705		2028	26	825	51	5700
32		1377	44	1825	204	1893	105	916	353	6011
33		753	44	2075		1395	105	536	149	4759
34		588	310	1568	714	1348	131	488	1155	3991
35	78	326	487	1305	1633	867	525	348	2722	2847
36	75	261	531	854	1837	527	577	368	3021	2010
37	302	261	1151	629	1429	356	630	338	3511	1585
38	327	392	1240	479	2560	341	735	299	4861	1510
39	503	131	1284	347	2653	356	735	199	5174	1033
40	837		2100	150	1446	170	656	229	5038	550
41	1035	65	2359	244	2143	170	997	100	6534	579
42	1055	131	2251	188	1361	186	738	50	5406	554
43	1108	65	2339	216	1183	93	780	40	5410	414
44	769		1637	75	1422	93	530	40	4358	208
45	759		1446	66	1188	15	486	30	3879	111
46	467	65	1597	47	1153	15	330	20	3548	148
47	301		952	19	378	93	258	40	1889	152
48	311		636	9	302	46	216		1465	56
49	246		370	28	174	31	150	10	941	69
50	100		295	19	104	15	165		665	34
51	80		200	19	78	31	82		441	50
52	43		113	9	87		60	20	302	29
53	25		88		52		28		193	
54	13		81		17		9		121	
55	25		38		9		22		93	
56	10		31		35		3		79	
57	10		25	9	35		3		73	9
58	5		19						24	
59	3		13		9				24	
60										
61			6						6	
62	5								5	
63										
64										
65										
66										
67										
68										
69										
70										
71										
72										
73										
74										
75										
TOTAL	**8516**	**8853**	**21688**	**24000**	**22209**	**23364**	**9082**	**7311**	**61495**	**63529**

Table 4.8.6. *Nephrops* in VIIgh. Length distribution of landings by country in 2004. Quarterly and total values (10^3). The reported size is the carapace length (CL). Conversion of CL to TS (total size) is done by multiplication by 3.3. The missing Irish data of the 1st and 4th quarters were calculated by likelihood function as explained in WD 13.

CL	Q1		Q2		Q3		Q4		TOTAL	
(mm)	F	IRL	F	IRL	F	IRL	F	IRL	F	IRL
17								1		1
18		3						2		6
19		16						4		20
20		30		1		1		8		41
21		46		11		1		19		77
22		69		9				57		135
23		108		25		3		107		244
24		160		100		11		207		479
25		213		179		31		367		790
26		298		438		102		564		1402
27		390		601		271		799		2061
28		443		739		664		1090		2937
29		537		1139		1068		1360		4104
30		680		1584		1565		1520		5350
31		737		2087	72	1677		1562	72	6063
32	77	783	61	2684	251	1551		1541	389	6559
33	309	800	61	2955	358	1346		1385	728	6487
34	337	745		3195	323	1302	150	1143	810	6386
35	700	633	183	2456	681	949	172	908	1736	4946
36	594	553	305	1924	1147	707	644	737	2690	3922
37	733	443	1038	1632	860	466	944	543	3575	3085
38	794	373	1038	1271	1147	374	558	397	3537	2415
39	516	298	1587	704	788	235	644	296	3536	1533
40	668	216	794	429	968	150	537	223	2966	1018
41	467	150	1465	361	1147	153	537	162	3616	825
42	589	105	1720	206	753	95	644	118	3705	524
43	496	68	804	120	717	71	538	79	2555	339
44	443	41	1170	52	628	71	367	59	2608	223
45	452	31	1050	34	520	37	451	46	2472	149
46	124	21	795		141	27	404	29	1463	78
47	296	16	439	34	403	27	84	17	1223	95
48	171	11	635	17	275	14	170	14	1251	56
49	171	9	339	17	278	14	115	6	903	46
50	121	5	380		147	7	65	4	712	16
51	143	4	186		143	3	50	3	522	11
52	112	2	206		125	3	54	3	497	8
53	77	2	196		113	10	75	2	462	14
54	57	2	124		37	3	57	2	275	7
55	57		62		37	3	45	3	201	7
56	35		52		37		34	3	157	3
57	25		52		37	20	16	3	129	23
58	17		10		26		11	3	64	3
59	2		31		4	7	9	3	46	9
60	2				15		5	1	23	1
61					15		2	1	16	1
62					11				11	
63					4				4	
64										
65							2		2	
66						3				4
67								1		1
68							2	1	2	1
69						3				4
70								1		1
71								1		1
72						3				4
73										
74										
75										
TOTAL	**8589**	**9042**	**14783**	**25007**	**12203**	**13053**	**7385**	**15407**	**42960**	**62508**

Table 4.8.7. *Nephrops* in VIIgh. Length distribution of landings by country in 2005. Quarterly and total values (10^3). The reported size is the carapace length (CL). Conversion of CL to TS (total size) is done by multiplication by 3.3.

CL	Q1		Q2		Q3		Q4		TOTAL	
(mm)	F	IRL	F	IRL	F	IRL	F	IRL	F	IRL
17										
18				3						3
19		7		6						13
20		19		34		17		55		126
21		20		75		72		187		354
22		56		86		83		196		421
23		154		211		189	1	407	1	960
24		515		475		368		807		2165
25		669		1116		643		1097		3524
26		1309		1365		1000	8	1876	8	5550
27	9	2133		2267		1768	1	2042	10	8209
28		2055		2985		1890	2	1483	2	8412
29		2439		4383		1904	1	1455	1	10180
30	9	2479		5268		1650	4	1306	13	10703
31		2696		6734		1211	21	1224	21	11865
32	69	2035		7153	8	891	71	874	149	10954
33	43	1498	10	6395	18	680	165	621	236	9194
34	129	1424		4838	59	304	479	741	668	7307
35	285	1102	67	4539	201	198	784	342	1336	6181
36	457	699	217	3413	304	238	1097	323	2075	4672
37	518	511	418	1889	526	79	1210	171	2672	2649
38	570	457	471	1922	570	106	1130	266	2741	2750
39	803	349	583	1259	777	53	952	247	3114	1908
40	649	296	600	563	711	53	745	95	2704	1007
41	725	134	602	464	557	26	601	57	2484	682
42	770	81	725	331	503	40	423	38	2421	490
43	562	134	574	99	421	40	459	19	2016	292
44	605	81	583	33	282	13	294		1763	127
45	540		728	33	253		277	19	1797	52
46	513	54	683	66	164		185		1545	120
47	395		733	33	203		137		1468	33
48	255		739		161	26	76		1231	26
49	268		660		181		50		1158	
50	238		681	33	309		34		1262	33
51	260		464		277		41		1042	
52	177		341		219		22		758	
53	151		324		202		24		701	
54	99		235		185		20		540	
55	87		188		209		16		501	
56	49		129		86		9		274	
57	57		136		75		9		277	
58	32		63		69		5		168	
59	31		47		49		5		133	
60	15		7		13		4		39	
61	15		9		18		1		43	
62	3		4		4				11	
63	3		3		10		1		17	
64					1				1	
65			1		1				2	
66			1		1				2	
67					1				1	
68					1				1	
69										
70					1				1	
71										
72					1				1	
73										
74										
75					1				1	
TOTAL	**9388**	**23403**	**11027**	**58069**	**7634**	**13541**	**9365**	**15948**	**37413**	**110962**

Table 4.8.8. *Nephrops* in VIIgh. Length distribution of landings by country in 2006. Quarterly and total values (10^3). The reported size is the carapace length (CL). Conversion of CL to TS (total size) is done by multiplication by 3.3.

CL	Q1		Q2		Q3		Q4		TOTAL	
(mm)	F	IRL	F	IRL	F	IRL	F	IRL	F	IRL
17										
18						4				4
19				7		8				15
20		80		21		11		123		235
21		93		57		12		335		498
22		266		196		70		578		1110
23		559		493		125		1136		2313
24		1542		861		432		1695		4530
25		1999		1517		697		2194		6407
26		2945		3098		1341		2687		10071
27		3261		4651		1733		2849		12494
28		3244		5763	10	2062	6	2339	16	13408
29		2825		6529		1699		1431		12485
30		1950	13	6513	10	1446	13	1111	35	11020
31		1739		4683	20	1018		727	20	8166
32	17	989	26	4626	69	710	38	574	150	6899
33	52	673	13	3339	79	651	95	428	239	5092
34	151	398	206	2466	207	578	349	343	913	3785
35	284	412	310	1698	256	272	482	330	1332	2712
36	395	178	839	1203	492	275	825	264	2550	1920
37	638	123	1419	836	720	147	863	247	3640	1353
38	644	96	1948	524	1152	111	844	171	4589	902
39	784	82	1756	358	1142	92	660	139	4341	671
40	731	14	2000	278	926	19	634	95	4291	406
41	633	14	1742	264	1034	51	603	66	4012	395
42	719		1485	128	798	11	356	52	3358	190
43	671	14	1247	100	822	7	352	32	3092	152
44	484		958	85	523	11	235	38	2200	133
45	427		891	56	338	7	133	17	1789	80
46	344		690	14	472	4	133	14	1640	32
47	295	27	525	28	289		96	14	1205	69
48	261		461	7	139		54	12	915	19
49	167		246	14	139		74	3	625	17
50	86		214		118		25	6	444	6
51	71		99		116		31		316	
52	68		155	14	71		21		314	14
53	61		113		46		11		232	
54	42		72		43		10		167	
55	34		62		28		11		135	
56	33		39		23		9		105	
57	29		37		13		5		85	
58	17		37		12		5		72	
59	11	14	26		9		4		49	14
60	7		15		12		2		36	
61	4		10		6		1		21	
62	3		3		4		1		10	
63	1				1		1		3	
64	2		2		2				7	
65			1		1				2	
66										
67										
68										
69										
70										
71										
72										
73										
74										
75										
TOTAL	**8166**	**23538**	**17661**	**50428**	**10142**	**13601**	**6983**	**20050**	**42951**	**107617**

Table 4.8.9. *Nephrops* in VIIgh. French (year 1997) and Irish (year 2003) programs of discard sampling onboard. Length distribution of landings (L) and discards (D) by sex (10^3). The reported size is the carapace length (CL, in mm). Conversion of CL to TS (total size) is done by multiplication by 3.3.

CL	French sampling (year 1997)						Irish sampling (year 2003)					
	males		females		Total		males		females		Total	
	L	D	L	D	L	D	L	D	L	D	L	D
14										19		19
15								10		74		84
16				1		1		10		58		68
17								30		141		171
18				1		1	1	134	1	127	2	261
19		1				1	3	242	7	372	11	614
20		1		12		13	37	452	84	1038	121	1489
21				10		10	121	902	309	2216	430	3118
22		187		294		481	274	1963	377	2693	651	4657
23		630		1150		1780	554	2503	584	2655	1139	5158
24		874		1172		2046	843	2392	776	2091	1619	4482
25		1428		2490		3918	1063	2056	1154	2109	2217	4164
26		1439		1889		3328	1483	1631	2165	2396	3648	4026
27	15	4695		7332	15	12027	1979	1304	2506	1622	4485	2926
28	28	4399		6888	28	11287	2484	1030	3104	1196	5589	2227
29	45	3521		5089	45	8610	2538	723	3185	833	5723	1556
30	218	6863	19	9305	236	16167	2561	433	2926	457	5486	890
31	521	3140	21	4821	542	7960	3339	300	2361	211	5700	511
32	1155	4842	65	6535	1220	11377	3642	166	2369	109	6011	275
33	1984	3885	160	5140	2144	9025	2648	57	2111	9	4759	67
34	2035	1360	152	1384	2186	2744	2532		1459		3991	
35	3251	1385	357	1254	3608	2639	1672		1175		2847	
36	3409	570	418	950	3827	1520	1300		710		2010	
37	3799	410	464	333	4262	743	1214		371		1585	
38	4138	205	666	189	4804	394	1295		215		1510	
39	3395	72	224	85	3619	157	912		122		1033	
40	4713	120	205	64	4918	184	463		87		550	
41	2861	33	202	41	3062	74	561		19		579	
42	3367	43	47	34	3414	77	504		50		554	
43	2678	25	47		2725	25	389		25		414	
44	1787	8	63		1849	8	161		46		208	
45	2236	7	52	2	2288	9	111				111	
46	1428	1			1428	1	148				148	
47	1021				1021		152				152	
48	954	2	16		970	2	56				56	
49	603				603		69				69	
50	733	1			733	1	34				34	
51	353				353		50				50	
52	372				372		29				29	
53	286	3			286	3						
54	198				198							
55	110				110							
56	54				54							
57	81				81		9				9	
58	36				36							
59	8				8							
60	23				23							
61	8				8							
62	3				3							
	47904	**40149**	**3176**	**56463**	**51080**	**96612**	**35232**	**16335**	**28297**	**20427**	**63529**	**36762**
%D		***46***		***95***		***65***		***32***		***42***		***37***

Table 4.8.10.a Nephrops in FUs 20-22 Celtic Sea (VIIg,h) landings length distributions in 1987-2006.French trawlers.

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	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	57	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	38	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	53	0	36	0	0	0	0	43	0	0	0	0	0	0	0	0	0	1	0
24	0	106	0	57	0	30	0	0	43	0	0	0	0	0	0	84	0	0	0	0
25	24	289	0	0	14	0	85	0	86	0	0	0	0	0	0	0	0	0	0	0
26	88	309	0	29	53	60	19	12	109	15	0	0	0	44	0	0	0	0	8	0
27	149	490	0	143	34	111	84	23	644	20	15	0	38	22	25	0	0	0	10	0
28	684	1177	110	465	448	669	111	78	601	60	28	59	29	44	0	81	0	0	2	16
29	1104	3180	710	728	922	966	213	309	610	62	45	93	21	88	0	21	0	0	1	0
30	2030	4373	958	1241	1719	2139	393	631	1113	246	236	294	343	148	251	294	0	0	13	35
31	2317	7579	1804	2146	3047	3212	935	1113	1074	696	542	475	600	152	596	300	51	72	21	20
32	3640	8076	3103	2521	4057	4393	2253	2650	2486	1803	1220	1043	1532	329	1957	385	353	389	149	150
33	4449	8059	4294	4456	6036	6608	2468	3177	3203	2699	2144	1396	2382	737	3013	678	149	728	236	239
34	4312	8452	5210	5034	5804	6509	3757	4532	3129	4239	2186	2308	3234	1106	3666	938	1155	810	668	913
35	6179	6948	6479	6677	5721	7896	5213	6666	4870	6136	3608	3354	4008	2090	5957	1993	2722	1736	1336	1332
36	5691	5137	5914	5800	4591	8225	5941	5440	4339	5583	3827	3587	4127	2541	5294	3205	3021	2690	2075	2550
37	5479	5084	5281	5077	3959	8066	6026	6653	7127	6995	4262	4465	4552	3326	5399	3697	3511	3575	2672	3640
38	4940	3623	5931	6143	3797	7579	6784	6950	7141	7410	4804	4525	4603	3307	3184	5131	4861	3537	2741	4589
39	3870	2383	4832	5402	3091	5528	5667	4853	5497	5691	3619	3127	3466	4367	3369	5313	5174	3536	3114	4341
40	4622	2590	4843	4796	2772	3386	7263	5497	6493	5277	4918	4453	5071	4214	4161	7026	5038	2966	2704	4291
41	2482	2302	3636	3702	2216	2745	5349	4396	4044	4225	3062	2875	3089	4013	3268	5941	6534	3616	2484	4012
42	2695	2462	3675	4147	2218	2919	5485	4473	4433	4096	3414	2996	3828	3798	2094	5272	5406	3705	2421	3358
43	1994	1645	2371	3271	2110	2429	3652	3222	3257	3205	2725	2267	2412	3146	2618	4160	5410	2555	2016	3092
44	1275	1274	2165	3235	1793	1680	2415	2580	3403	2115	1849	2109	2577	2937	2148	3443	4358	2608	1763	2200
45	1590	1231	1999	2366	1550	1636	2732	2183	2142	2086	2288	1474	1982	2625	1299	2711	3879	2472	1797	1789
46	1265	988	1415	2066	1229	1222	1653	1348	1747	1183	1428	1014	1403	2219	1039	1801	3548	1463	1545	1640
47	1184	806	1151	1446	865	939	1604	1323	1635	1247	1021	1012	1205	1317	902	1235	1889	1223	1468	1205
48	1182	778	858	1787	1057	966	1134	1204	1338	877	970	789	1114	1083	628	1136	1465	1251	1231	915
49	767	525	708	1277	766	738	950	898	816	747	603	433	687	827	451	473	941	903	1158	625
50	834	437	565	809	527	576	981	969	972	702	733	420	604	778	424	555	665	712	1262	444
51	571	307	511	692	437	406	489	639	743	504	353	274	427	629	324	433	441	522	1042	316
52	668	353	447	786	403	278	612	571	770	510	372	253	346	444	333	319	302	497	758	314
53	526	260	315	477	303	303	365	395	635	389	286	157	285	424	241	173	193	462	701	232
54	268	205	253	387	236	191	344	462	448	294	198	110	256	270	187	174	121	275	540	167
55	391	111	148	204	128	171	276	364	262	197	110	109	183	236	132	190	93	201	501	135
56	150	107	156	95	121	96	162	191	152	141	54	76	102	150	176	84	79	157	274	105
57	129	85	118	90	48	74	93	110	176	116	81	41	72	80	98	77	73	129	277	85
58	55	49	96	91	73	68	83	154	124	56	36	28	30	102	107	41	24	64	168	72
59	92	33	74	31	12	48	93	68	49	22	8	7	20	62	90	25	24	46	133	49
60	52	4	26	26	17	24	47	71	69	17	23	13	19	54	67	33	0	23	39	36
61	7	4	22	8	0	11	19	22	22	5	8	0	15	55	38	28	6	16	43	21
62	11	10	7	21	7	9	25	9	29	20	3	0	6	11	26	25	5	11	11	10
63	6	0	12	0	1	0	5	12	13	2	0	2	0	15	0	11	0	4	17	3
64	0	0	5	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	1	7
65	16	4	5	0	0	0	6	2	3	0	0	0	0	9	0	3	0	2	2	2
66	0	0	0	0	0	2	0	2	0	0	0	0	0	5	0	0	0	0	2	0
67	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
68	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	1	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	1	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	2	0	0	0	0	0	0	0	0	0	0	1	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	1	0
Total	**67794**	**81948**	**70215**	**77770**	**62182**	**82908**	**75824**	**74255**	**75892**	**69686**	**51080**	**45637**	**54669**	**47802**	**53566**	**57492**	**61495**	**42960**	**37413**	**42951**
Weights	**3080**	**2926**	**3221**	**3762**	**2652**	**3415**	**3815**	**3658**	**3803**	**3363**	**2589**	**2241**	**2745**	**2782**	**2532**	**3134**	**3510**	**2511**	**2490**	**2397**

Table 4.8.10.b Nephrops in FUs 20-22 Celtic Sea (VIIg,h) discards length distributions in 1987-2006.French trawlers.

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	266	4004	447	235	1423	1830	165	229	202	312	0	153	94	71	642	131	112	63	25	82
11	332	4555	523	283	1711	2153	206	276	251	366	0	175	113	82	726	151	134	75	30	93
12	414	5175	612	341	2054	2529	258	334	313	428	0	200	135	95	820	174	160	89	35	105
13	517	5871	716	411	2463	2968	323	403	389	500	0	229	162	110	925	200	191	105	42	118
14	644	6648	836	493	2950	3478	403	485	483	584	0	262	194	127	1042	230	229	125	50	133
15	801	7515	974	592	3526	4070	503	584	599	682	0	299	233	147	1172	264	273	148	60	150
16	996	8476	1133	710	4206	4755	627	702	743	794	1	341	278	169	1317	302	325	176	71	168
17	1235	9537	1316	849	5005	5543	781	842	920	923	0	387	332	195	1477	346	388	208	84	189
18	1528	10703	1525	1013	5940	6447	970	1008	1137	1072	0	440	395	224	1653	396	461	245	100	212
19	1886	11978	1763	1205	7026	7479	1202	1204	1402	1242	0	498	469	257	1847	452	548	289	119	238
20	2319	13364	2031	1429	8278	8650	1485	1434	1725	1435	13	562	556	294	2058	514	650	340	140	266
21	2840	14859	2334	1688	9712	9969	1829	1702	2115	1653	10	633	657	336	2288	584	770	400	166	298
22	3461	16462	2671	1986	11337	11447	2244	2013	2583	1899	481	711	773	383	2537	662	909	468	195	332
23	4193	18167	3045	2325	13160	13087	2739	2369	3141	2174	1780	795	906	435	2805	748	1070	546	229	370
24	5044	19968	3457	2706	15180	14891	3323	2775	3800	2480	2046	887	1057	492	3091	843	1255	634	268	410
25	6020	21852	3904	3130	17390	16857	4004	3232	4568	2816	3918	985	1227	556	3395	946	1468	735	313	455
26	7120	23807	4386	3595	19773	18976	4786	3739	5451	3182	3328	1089	1416	625	3716	1058	1709	847	364	503
27	8336	25818	4900	4098	22303	21233	5669	4296	6451	3578	12027	1199	1622	700	4053	1179	1980	971	420	555
28	9652	27865	5442	4634	24944	23607	6647	4897	7564	4001	11287	1314	1846	781	4402	1307	2282	1107	484	610
29	11045	42700	6006	5194	27656	26074	7706	5536	8779	4447	8610	1432	2084	867	4763	1443	2614	1254	554	668
30	12483	35105	6585	5772	57932	28601	8829	6204	10077	4914	16167	1554	2334	957	5133	1586	2974	1412	629	730
31	13502	35522	7173	9559	52685	61039	9989	6889	11432	5395	7960	1678	2592	1052	5508	1734	3361	1578	711	795
32	12374	22938	10988	6357	30272	35147	20679	14384	25096	5885	11377	1642	2752	1149	2519	1885	3770	1750	797	863
33	6560	14262	8488	6744	23041	23628	12682	12079	16531	12121	9025	3453	5618	1248	11594	2039	4196	1927	887	932
34	4350	8576	6427	5028	11216	10924	8222	7255	5899	9287	2744	3345	3932	1734	7296	2003	4631	1932	980	1004
35	3316	5040	5029	4598	4536	6264	5866	4577	4861	5211	2639	2780	2418	2655	10134	3327	9659	4050	1827	1077
36	1854	2330	2909	2522	2042	2974	3225	1988	2062	2463	1520	1489	1420	2242	6307	4223	5813	3654	2098	1151
37	1065	1219	1522	1427	937	1497	1466	1302	1702	1580	743	1024	665	1746	3185	1879	2810	1908	1163	1874
38	688	578	1070	1130	475	633	729	579	763	826	394	463	366	992	1244	1749	2461	1232	742	1467
39	367	188	567	615	190	230	308	177	254	325	157	150	103	715	566	931	1367	559	530	740
40	291	124	358	354	95	52	210	90	144	124	184	102	84	371	381	543	484	291	269	351
41	98	66	158	175	31	21	73	46	49	59	74	35	27	178	174	224	360	198	68	192
42	73	55	119	136	15	11	34	20	23	21	77	18	14	105	56	120	133	81	135	80
43	36	18	43	67	8	4	9	10	9	10	25	7	5	49	35	47	64	35	40	42
44	13	8	27	44	3	2	3	4	4	3	8	3	3	23	13	27	36	18	79	15
45	13	6	15	19	1	1	1	1	2	1	9	1	1	13	4	10	17	8	22	5
46	6	3	7	11	1	0	1	0	1	0	1	0	0	6	1	6	9	2	58	4
47	3	2	4	5	0	0	0	0	0	0	0	0	0	1	1	2	2	2	11	1
48	2	1	2	4	0	0	0	0	0	0	2	0	0	1	0	1	1	1	7	0
49	1	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0
50	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48	0
53	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	2	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	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	7	0	66	0
61	0	0	0	0	61	0	0	0	0	0	0	29	0	0	0	0	0	0	2	0
62	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	19	0
63	0	8	0	10	0	2	0	0	0	0	0	0	4	0	0	0	3	0	3	0
64	1	6	0	8	32	2	5	8	4	4	0	18	3	13	0	0	2	9	5	0
65	0	0	0	6	25	1	0	0	0	3	0	15	2	0	0	0	2	0	6	0
66	1	4	6	5	20	0	3	0	2	2	0	13	2	0	17	0	1	6	7	2
67	0	3	5	4	16	1	2	4	2	2	0	11	1	8	14	0	1	5	2	2
68	0	2	0	3	13	1	2	3	1	1	0	10	1	7	11	0	1	0	12	1
69	0	2	3	3	11	0	1	2	1	1	0	8	1	6	9	4	1	3	2	1
70	0	1	3	2	9	0	1	2	1	1	0	7	1	5	8	4	0	3	6	1
71	0	1	2	2	7	0	1	1	1	1	0	6	1	4	6	3	0	2	1	1
72	0	1	2	1	6	0	1	0	0	0	0	5	0	3	5	3	0	2	1	0
73	0	1	1	1	4	0	0	1	0	0	0	4	0	3	4	2	0	1	1	0
74	0	0	1	1	4	0	0	1	0	0	0	4	0	2	4	2	0	1	1	0
75	0	0	1	1	3	0	0	1	0	0	0	3	0	2	3	1	0	1	1	0
Total	**125752**	**425396**	**99536**	**81530**	**389726**	**377075**	**118210**	**93687**	**131541**	**82811**	**96612**	**30494**	**36900**	**22234**	**98962**	**34283**	**59692**	**29493**	**15097**	**17286**
Weights	**1995**	**5251**	**1727**	**1484**	**5819**	**5573**	**2211**	**1717**	**2389**	**1544**	**1737**	**628**	**711**	**549**	**1873**	**792**	**1410**	**710**	**443**	**418**

Table 4.8.10.c Nephrops in FUs 20-22 Celtic Sea (VIIg,h) catches length distributions in 1987-2006.French trawlers.

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	266	4004	447	235	1423	1830	165	229	202	312	0	153	94	71	642	131	112	63	25	82
11	332	4555	523	283	1711	2153	206	276	251	366	0	175	113	82	726	151	134	75	30	93
12	414	5175	612	341	2054	2529	258	334	313	428	0	200	135	95	820	174	160	89	35	105
13	517	5871	716	411	2463	2968	323	403	389	500	0	229	162	110	925	200	191	105	42	118
14	644	6648	836	493	2950	3478	403	485	483	584	0	262	194	127	1042	230	229	125	50	133
15	801	7515	974	592	3526	4070	503	584	599	682	0	299	233	147	1172	264	273	148	60	150
16	996	8476	1133	710	4206	4755	627	702	743	794	1	341	278	169	1317	302	325	176	71	168
17	1235	9537	1316	849	5005	5543	781	842	920	923	0	387	332	195	1477	346	388	208	84	189
18	1528	10703	1525	1013	5940	6447	970	1008	1137	1072	0	440	395	224	1653	396	461	245	100	212
19	1886	11978	1763	1205	7026	7479	1202	1204	1402	1242	0	498	469	257	1847	452	548	289	119	238
20	2319	13364	2031	1429	8278	8650	1485	1434	1725	1435	13	562	556	294	2058	514	650	340	141	266
21	2840	14915	2334	1696	9712	9969	1829	1702	2115	1653	10	633	657	336	2288	584	770	400	166	298
22	3461	16462	2671	1986	11337	11447	2282	2013	2583	1899	481	711	773	383	2537	662	909	468	195	332
23	4193	18221	3045	2360	13160	13087	2739	2369	3184	2174	1780	795	906	435	2805	748	1070	546	230	370
24	5044	20074	3457	2763	15180	14921	3323	2775	3843	2480	2046	887	1057	492	3091	927	1255	634	268	410
25	6044	22141	3904	3130	17404	16857	4089	3232	4654	2816	3918	985	1227	556	3395	946	1468	735	313	455
26	7208	24116	4386	3623	19826	19036	4805	3751	5560	3197	3328	1089	1416	669	3716	1058	1709	847	372	503
27	8485	26308	4900	4241	22336	21343	5753	4319	7096	3598	12042	1199	1660	722	4077	1179	1980	971	430	555
28	10337	29042	5552	5099	25392	24276	6758	4975	8166	4061	11315	1373	1875	825	4402	1388	2282	1107	486	626
29	12149	45879	6716	5922	28579	27040	7919	5844	9389	4509	8655	1525	2105	955	4763	1464	2614	1254	555	668
30	14513	39478	7543	7012	59651	30739	9222	6835	11190	5160	16403	1848	2677	1105	5384	1880	2974	1412	642	766
31	15819	43100	8977	11705	55732	64251	10924	8002	12507	6091	8503	2153	3192	1204	6104	2033	3413	1649	732	815
32	16014	31014	14092	8878	34328	39540	22932	17034	27582	7688	12597	2685	4284	1478	4475	2270	4123	2140	946	1013
33	11009	22321	12781	11200	29077	30235	15150	15256	19734	14820	11169	4849	8000	1985	14607	2718	4345	2656	1123	1172
34	8662	17028	11636	10062	17020	17434	11980	11787	9029	13525	4930	5653	7165	2840	10962	2941	5787	2742	1648	1917
35	9495	11987	11509	11275	10258	14161	11079	11244	9732	11347	6247	6134	6425	4745	16091	5320	12382	5785	3163	2409
36	7544	7468	8823	8321	6633	11198	9165	7428	6402	8046	5347	5076	5547	4783	11601	7428	8833	6344	4173	3701
37	6544	6303	6804	6504	4895	9562	7492	7954	8829	8574	5005	5488	5217	5073	8584	5576	6321	5483	3835	5514
38	5628	4201	7001	7273	4272	8212	7513	7529	7904	8236	5198	4988	4969	4299	4427	6880	7322	4769	3482	6055
39	4237	2571	5399	6018	3281	5758	5976	5030	5751	6016	3776	3276	3569	5082	3935	6244	6541	4095	3645	5081
40	4913	2714	5201	5150	2866	3438	7472	5588	6637	5402	5102	4555	5155	4586	4542	7569	5523	3257	2973	4643
41	2580	2368	3794	3877	2247	2767	5422	4442	4093	4283	3136	2910	3117	4191	3442	6164	6894	3814	2552	4203
42	2768	2517	3794	4283	2233	2930	5519	4493	4456	4117	3491	3014	3842	3903	2150	5392	5539	3786	2555	3437
43	2030	1663	2414	3338	2118	2433	3660	3232	3266	3215	2750	2274	2417	3195	2653	4207	5475	2590	2056	3133
44	1288	1282	2192	3279	1796	1681	2418	2584	3408	2118	1857	2112	2580	2960	2162	3470	4395	2626	1843	2215
45	1603	1238	2014	2385	1551	1637	2733	2185	2144	2087	2297	1474	1983	2637	1303	2720	3896	2481	1819	1794
46	1271	991	1422	2077	1230	1222	1654	1348	1748	1183	1429	1014	1403	2225	1041	1807	3556	1465	1603	1643
47	1188	808	1155	1450	865	939	1604	1323	1635	1247	1021	1012	1205	1319	903	1237	1890	1225	1480	1206
48	1185	780	860	1791	1057	966	1135	1205	1338	877	972	789	1114	1084	628	1137	1466	1252	1238	915
49	768	525	709	1279	766	738	950	898	816	747	603	433	687	827	451	473	941	903	1166	626
50	835	437	565	810	527	576	981	969	972	702	734	420	604	778	424	555	665	712	1280	444
51	572	307	512	693	437	406	489	639	743	504	353	274	427	629	324	433	441	522	1048	316
52	668	353	447	786	403	278	612	571	770	510	372	253	346	444	333	319	302	497	806	314
53	526	260	315	477	303	303	365	395	635	389	289	157	285	424	241	173	193	462	703	232
54	268	205	254	387	236	191	344	462	448	294	198	110	256	270	187	174	121	275	552	167
55	391	111	148	204	128	171	276	364	262	197	110	109	183	236	132	190	93	201	513	135
56	150	107	156	95	121	96	162	191	152	141	54	76	102	150	176	84	79	157	278	105
57	129	85	118	90	48	74	93	110	176	116	81	41	72	80	98	77	73	129	312	85
58	55	49	96	91	73	68	83	154	124	56	36	28	30	102	107	41	24	64	184	72
59	92	33	74	31	12	48	93	68	49	22	8	7	20	62	90	25	24	46	133	49
60	52	4	26	26	17	24	47	71	69	17	23	13	19	54	67	33	7	23	105	36
61	7	4	22	8	61	11	19	22	22	5	8	29	15	55	38	28	6	16	45	21
62	11	10	7	21	7	9	25	9	29	20	3	25	6	11	26	25	5	11	30	10
63	6	8	12	10	1	2	5	12	13	2	0	2	4	15	0	11	3	4	20	3
64	1	6	5	8	32	2	5	8	4	4	0	18	3	13	2	2	2	9	6	7
65	16	4	5	6	25	1	6	2	3	3	0	15	2	9	0	3	2	2	8	2
66	1	4	6	5	20	2	3	2	2	2	0	13	2	5	17	0	1	6	9	2
67	6	3	5	4	16	1	2	4	2	2	0	11	1	8	14	0	1	5	3	2
68	0	2	5	3	13	1	2	3	1	1	0	10	1	7	11	2	1	2	13	1
69	0	2	3	3	11	0	1	2	1	1	0	8	1	6	9	4	1	3	2	1
70	0	1	3	2	9	0	1	2	1	1	0	7	1	5	8	4	0	3	7	1
71	0	1	2	2	7	0	1	1	1	1	0	6	1	4	6	3	0	2	1	1
72	0	1	2	1	6	0	1	2	0	0	0	5	0	3	5	3	0	2	2	0
73	0	1	1	1	4	0	0	1	0	0	0	4	0	3	4	2	0	1	1	0
74	0	0	1	1	4	0	0	1	0	0	0	4	0	2	4	2	0	1	1	0
75	0	0	1	1	3	0	0	1	0	0	0	3	0	2	3	1	0	1	2	0
Total	**193546**	**507344**	**169752**	**159300**	**451908**	**459983**	**194034**	**167942**	**207432**	**152496**	**147692**	**76131**	**91570**	**70036**	**152528**	**91774**	**121187**	**72454**	**52510**	**60238**
Weights	**5075**	**8177**	**4949**	**5246**	**8470**	**8988**	**6027**	**5376**	**6191**	**4907**	**4326**	**2870**	**3456**	**3331**	**4405**	**3926**	**4921**	**3220**	**2933**	**2815**

Table 4.8.10.d Nephrops in FUs 20-22 Celtic Sea (VIIg,h) removals length distributions in 1987-2006.French trawlers.

Removals=Landings+dead catches (discard survival rate : 25%)

CL mm/Year	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
10	199	3003	335	176	1068	1373	124	172	151	234	0	114	70	53	482	98	84	47	19	62
11	249	3416	393	212	1283	1614	155	207	189	274	0	131	84	62	545	113	100	56	22	70
12	311	3881	459	256	1541	1897	194	250	235	321	0	150	101	71	615	130	120	67	27	79
13	387	4403	537	308	1847	2226	242	302	292	375	0	172	122	82	694	150	143	79	32	89
14	483	4986	627	370	2212	2609	302	364	362	438	0	197	146	95	782	172	171	94	38	100
15	601	5636	730	444	2644	3053	377	438	450	511	0	224	174	110	879	198	205	111	45	112
16	747	6357	850	532	3155	3566	470	526	557	595	1	255	208	127	988	227	244	132	53	126
17	926	7153	987	637	3754	4157	585	631	690	693	0	291	249	146	1108	260	291	156	63	142
18	1146	8028	1144	760	4455	4835	727	756	853	804	0	330	296	168	1240	297	346	184	75	159
19	1415	8984	1322	904	5269	5609	901	903	1051	931	0	373	352	192	1385	339	411	217	89	179
20	1740	10023	1524	1072	6209	6487	1114	1075	1293	1076	10	422	417	220	1544	386	488	255	106	200
21	2130	11201	1750	1273	7284	7477	1372	1277	1586	1240	7	475	493	252	1716	438	577	300	125	223
22	2596	12346	2003	1490	8503	8585	1721	1510	1937	1425	361	533	580	287	1903	497	681	351	146	249
23	3145	13679	2284	1779	9870	9815	2054	1777	2399	1631	1335	597	680	326	2103	561	802	409	172	277
24	3783	15082	2592	2087	11385	11199	2492	2081	2893	1860	1535	665	793	369	2318	717	942	476	201	308
25	4539	16678	2928	2347	13057	12643	3088	2424	3512	2112	2938	739	920	417	2546	710	1101	551	235	341
26	5428	18165	3290	2725	14883	14292	3608	2816	4197	2402	2496	817	1062	513	2787	794	1282	635	281	377
27	6401	19853	3675	3216	16761	16035	4336	3245	5483	2704	9035	899	1254	547	3064	884	1485	728	325	416
28	7924	22076	4192	3940	19156	18375	5096	3750	6275	3061	8493	1044	1413	630	3302	1061	1711	830	365	473
29	9388	35204	5215	4624	21665	20521	5992	4460	7194	3397	6502	1167	1584	738	3573	1104	1960	941	416	501
30	11393	30702	5897	5570	45168	23589	7015	5284	8671	3931	12362	1459	2094	866	4100	1483	2231	1059	485	583
31	12444	34220	7183	9315	42561	48991	8427	6280	9649	4742	6512	1733	2544	941	4727	1600	2572	1255	554	616
32	12920	25279	11345	7289	26760	30754	17762	13438	21308	6216	9753	2275	3596	1191	3846	1798	3181	1702	747	797
33	9369	18756	10659	9514	23316	24328	11979	12236	15601	11790	8913	3986	6596	1673	11708	2208	3296	2174	901	938
34	7574	14884	10030	8805	14216	14703	9924	9973	7554	11204	4244	4817	6182	2406	9138	2440	4629	2259	1403	1666
35	8666	10728	10251	10126	9124	12595	9613	10099	8516	10044	5587	5439	5821	4081	13558	4488	9967	4773	2707	2140
36	7081	6885	8096	7691	6122	10455	8359	6931	5886	7431	4967	4704	5192	4223	10024	6372	7380	5431	3649	3414
37	6278	5998	6423	6147	4661	9188	7126	7629	8404	8179	4819	5232	5051	4636	7787	5106	5619	5006	3544	5045
38	5456	4057	6734	6990	4153	8053	7330	7384	7713	8029	5100	4872	4878	4051	4116	6442	6707	4461	3297	5689
39	4145	2524	5257	5864	3233	5700	5898	4986	5687	5935	3737	3239	3543	4903	3793	6011	6200	3956	3512	4896
40	4840	2683	5112	5061	2843	3425	7420	5565	6601	5370	5056	4529	5134	4493	4447	7433	5402	3184	2906	4555
41	2555	2351	3755	3833	2239	2761	5404	4431	4080	4269	3118	2901	3110	4146	3398	6109	6804	3765	2535	4155
42	2750	2504	3764	4249	2229	2927	5511	4488	4451	4112	3472	3009	3839	3876	2136	5362	5506	3766	2522	3417
43	2021	1659	2404	3321	2116	2432	3658	3229	3263	3212	2744	2273	2415	3182	2644	4195	5459	2581	2046	3123
44	1285	1280	2185	3268	1795	1681	2417	2583	3407	2117	1855	2111	2580	2954	2158	3463	4385	2621	1823	2211
45	1600	1236	2011	2380	1551	1637	2733	2184	2143	2087	2294	1474	1983	2634	1302	2718	3892	2479	1813	1793
46	1270	990	1420	2074	1229	1222	1654	1348	1748	1183	1428	1014	1403	2223	1040	1805	3554	1465	1589	1642
47	1187	808	1154	1449	865	939	1604	1323	1635	1247	1021	1012	1205	1318	903	1237	1890	1225	1477	1206
48	1184	779	860	1790	1057	966	1135	1204	1338	877	971	789	1114	1084	628	1137	1466	1252	1236	915
49	768	525	708	1278	766	738	950	898	816	747	603	433	687	827	451	473	941	903	1164	626
50	835	437	565	809	527	576	981	969	972	702	733	420	604	778	424	555	665	712	1276	444
51	571	307	512	693	437	406	489	639	743	504	353	274	427	629	324	433	441	522	1047	316
52	668	353	447	786	403	278	612	571	770	510	372	253	346	444	333	319	302	497	794	314
53	526	260	315	477	303	303	365	395	635	389	288	157	285	424	241	173	193	462	702	232
54	268	205	254	387	236	191	344	462	448	294	198	110	256	270	187	174	121	275	549	167
55	391	111	148	204	128	171	276	364	262	197	110	109	183	236	132	190	93	201	510	135
56	150	107	156	95	121	96	162	191	152	141	54	76	102	150	176	84	79	157	277	105
57	129	85	118	90	48	74	93	110	176	116	81	41	72	80	98	77	73	129	303	85
58	55	49	96	91	73	68	83	154	124	56	36	28	30	102	107	41	24	64	180	72
59	92	33	74	31	12	48	93	68	49	22	8	7	20	62	90	25	24	46	133	49
60	52	4	26	26	17	24	47	71	69	17	23	13	19	54	67	33	5	23	88	36
61	7	4	22	8	45	11	19	22	22	5	8	22	15	55	38	28	6	16	44	21
62	11	10	7	21	7	9	25	9	29	20	3	19	6	11	26	25	5	11	26	10
63	6	6	12	7	1	2	5	12	13	2	0	2	3	15	0	11	2	4	20	3
64	1	5	5	6	24	1	3	6	3	3	0	14	2	10	2	2	2	7	5	7
65	16	4	5	5	19	1	6	2	3	2	0	12	2	9	0	3	1	2	7	2
66	1	3	5	4	15	2	2	2	2	2	0	10	1	5	13	0	1	4	7	2
67	6	2	4	3	12	1	2	3	1	1	0	8	1	6	10	0	1	4	2	1
68	0	2	5	2	10	0	1	2	1	1	0	7	1	5	9	2	1	2	10	1
69	0	1	2	2	8	0	1	2	1	1	0	6	1	4	7	3	0	2	1	1
70	0	1	2	2	6	0	1	1	1	1	0	5	1	4	6	3	0	2	6	1
71	0	1	2	1	5	0	1	1	0	0	0	4	0	3	5	2	0	2	1	0
72	0	1	1	1	4	0	0	2	0	0	0	4	0	2	4	2	0	1	1	0
73	0	0	1	1	3	0	0	1	0	0	0	3	0	2	3	2	0	1	1	0
74	0	0	1	1	3	0	0	1	0	0	0	3	0	2	3	1	0	1	1	0
75	0	0	1	1	2	0	0	0	0	0	0	2	0	1	2	1	0	1	2	0
Total	**162108**	**400995**	**144867**	**138918**	**354477**	**365714**	**164481**	**144520**	**174547**	**131794**	**123539**	**68507**	**82344**	**64477**	**127788**	**83204**	**106264**	**65080**	**48736**	**55916**
Weights	**4576**	**6864**	**4517**	**4875**	**7016**	**7594**	**5474**	**4946**	**5594**	**4521**	**3892**	**2712**	**3278**	**3194**	**3937**	**3728**	**4568**	**3043**	**2822**	**2710**

Table 4.8.11.a Nephrops in FUs 20-22 Celtic Sea (VIIg,h)
landings length distributions in 2002-2006.Irish trawlers.

Landings					
CL mm/Year	**2002**	**2003**	**2004**	**2005**	**2006**
10	0	0	0	0	0
11	0	0	0	0	0
12	0	0	0	0	0
13	0	0	0	0	0
14	0	0	0	0	0
15	0	0	0	0	0
16	0	0	0	0	0
17	0	0	1	0	0
18	0	2	6	3	4
19	33	11	20	13	15
20	145	121	41	126	235
21	213	430	77	354	498
22	653	651	135	421	1110
23	1340	1139	244	960	2313
24	2243	1619	479	2165	4530
25	2245	2217	790	3524	6407
26	2459	3648	1402	5550	10071
27	2417	4485	2061	8209	12494
28	3459	5589	2937	8412	13408
29	3104	5723	4104	10180	12485
30	3483	5486	5350	10703	11020
31	4632	5700	6063	11865	8166
32	4325	6011	6559	10954	6899
33	4624	4759	6487	9194	5092
34	4281	3991	6386	7307	3785
35	3913	2847	4946	6181	2712
36	2742	2010	3922	4672	1920
37	2705	1585	3085	2649	1353
38	2460	1510	2415	2750	902
39	1628	1033	1533	1908	671
40	1606	550	1018	1007	406
41	847	579	825	682	395
42	825	554	524	490	190
43	474	414	339	292	152
44	438	208	223	127	133
45	300	111	149	52	80
46	183	148	78	120	32
47	126	152	95	33	69
48	195	56	56	26	19
49	121	69	46	0	17
50	29	34	16	33	6
51	18	50	11	0	0
52	18	29	8	0	14
53	0	0	14	0	0
54	18	0	7	0	0
55	18	0	7	0	0
56	0	0	3	0	0
57	18	9	23	0	0
58	18	0	3	0	0
59	0	0	9	0	14
60	18	0	1	0	0
61	0	0	1	0	0
62	0	0	0	0	0
63	0	0	0	0	0
64	0	0	0	0	0
65	0	0	0	0	0
66	0	0	4	0	0
67	0	0	1	0	0
68	0	0	1	0	0
69	0	0	4	0	0
70	0	0	1	0	0
71	0	0	1	0	0
72	0	0	4	0	0
73	0	0	0	0	0
74	0	0	0	0	0
75	0	0	0	0	0
Total	**58378**	**63529**	**62508**	**110962**	**107617**
Weights	**1496**	**1385**	**1626**	**2389**	**1858**

Table 4.8.11.b Nephrops in FUs 20-22 Celtic Sea (VIIg,h)
discards length distributions in 2002-2006.Irish trawlers.

Total Discards

CL mm/Year	2002	2003	2004	2005	2006
10	0	0	0	138	0
11	0	0	1	175	0
12	0	0	1	222	0
13	0	19	1	281	19
14	0	84	9	353	38
15	0	68	3	476	203
16	0	171	5	582	137
17	0	261	11	838	238
18	0	614	70	1086	361
19	0	1489	51	1776	558
20	0	3118	118	2296	871
21	1	4657	110	2886	1662
22	5	5158	198	3779	2952
23	19	4482	419	4699	3356
24	77	4164	614	5080	4758
25	289	4026	793	4738	5362
26	1123	2926	853	5064	5559
27	549	2227	765	4427	6385
28	458	1556	787	3530	5155
29	211	890	634	2672	2579
30	123	511	487	1569	1046
31	137	275	391	1027	589
32	163	67	295	383	335
33	99	0	57	252	161
34	54	0	29	198	60
35	29	0	15	156	0
36	15	0	9	122	0
37	7	0	5	96	0
38	4	0	3	75	0
39	2	0	2	58	0
40	1	0	1	46	0
41	0	0	1	36	0
42	0	0	0	28	0
43	0	0	0	22	0
44	0	0	0	17	0
45	0	0	0	13	0
46	0	0	0	10	0
47	0	0	0	8	0
48	0	0	0	6	0
49	0	0	0	5	0
50	0	0	0	4	0
51	0	0	0	3	0
52	0	0	0	2	0
53	0	0	0	2	0
54	0	0	0	1	0
55	0	0	0	1	0
56	0	0	0	1	0
57	0	0	0	1	0
58	0	0	0	1	0
59	0	0	0	0	0
60	0	0	0	0	0
61	0	0	0	0	0
62	0	0	0	0	0
63	0	0	0	0	0
64	0	0	0	0	0
65	0	0	0	0	0
66	0	0	0	0	0
67	0	0	0	0	0
68	0	0	0	0	0
69	0	0	0	0	0
70	0	0	0	0	0
71	0	0	0	0	0
72	0	0	0	0	0
73	0	0	0	0	0
74	0	0	0	0	0
75	0	0	0	0	0
Total	**3368**	**36762**	**6739**	**49240**	**42384**
Weights	**46**	**289**	**84**	**480**	**439**

Table 4.8.11.c Nephrops in FUs 20-22 Celtic Sea (VIIg,h)
catches length distributions in 2002-2006.Irish trawlers.

Total catches

CL mm/Year	2002	2003	2004	2005	2006
10	0	0	0	138	0
11	0	0	1	175	0
12	0	0	1	222	0
13	0	19	1	281	19
14	0	84	9	353	38
15	0	68	3	476	203
16	0	171	5	582	137
17	0	261	12	838	238
18	0	615	76	1089	365
19	33	1500	71	1789	573
20	146	3238	158	2421	1106
21	214	5087	187	3240	2160
22	658	5809	332	4200	4062
23	1359	5621	664	5659	5669
24	2320	5783	1092	7245	9288
25	2534	6243	1583	8262	11769
26	3583	6575	2255	10613	15630
27	2966	6712	2826	12636	18879
28	3918	7144	3724	11942	18563
29	3315	6613	4737	12852	15064
30	3607	5997	5836	12272	12066
31	4769	5974	6454	12892	8755
32	4488	6077	6854	11337	7234
33	4723	4759	6544	9446	5253
34	4336	3991	6414	7505	3845
35	3942	2847	4961	6337	2712
36	2756	2010	3930	4794	1920
37	2712	1585	3090	2745	1353
38	2464	1510	2418	2825	902
39	1630	1033	1535	1967	671
40	1607	550	1019	1052	406
41	847	579	826	717	395
42	825	554	525	517	190
43	475	414	340	314	152
44	438	208	223	144	133
45	300	111	149	65	80
46	183	148	78	130	32
47	126	152	95	41	69
48	195	56	56	33	19
49	121	69	46	5	17
50	29	34	16	37	6
51	18	50	11	3	0
52	18	29	8	2	14
53	0	0	14	2	0
54	18	0	7	1	0
55	18	0	7	1	0
56	0	0	3	1	0
57	18	9	23	1	0
58	18	0	3	1	0
59	0	0	9	0	14
60	18	0	1	0	0
61	0	0	1	0	0
62	0	0	0	0	0
63	0	0	0	0	0
64	0	0	0	0	0
65	0	0	0	0	0
66	0	0	4	0	0
67	0	0	1	0	0
68	0	0	1	0	0
69	0	0	4	0	0
70	0	0	1	0	0
71	0	0	1	0	0
72	0	0	4	0	0
73	0	0	0	0	0
74	0	0	0	0	0
75	0	0	0	0	0
Total	**61747**	**100290**	**69247**	**160202**	**150002**
Weights	**1542**	**1674**	**1710**	**2869**	**2298**

Table 4.8.11.d Nephrops in FUs 20-22 Celtic Sea (VIIg,h)
removals length distributions in 2002-2006.Irish trawlers.
Removals=Landings+dead catches (discard survival rate : 25%)

CL mm/Year	2002	2003	2004	2005	2006
10	0	0	0	103	0
11	0	0	0	131	0
12	0	0	1	167	0
13	0	14	1	211	14
14	0	63	7	265	29
15	0	51	2	357	152
16	0	128	4	437	103
17	0	196	9	628	179
18	0	462	59	817	275
19	33	1128	58	1345	433
20	145	2459	129	1847	888
21	214	3922	160	2519	1744
22	656	4519	283	3256	3324
23	1354	4500	559	4484	4830
24	2301	4742	939	5975	8099
25	2462	5237	1385	7077	10429
26	3302	5843	2042	9347	14240
27	2829	6155	2634	11529	17283
28	3803	6755	3527	11059	17274
29	3262	6391	4579	12184	14419
30	3576	5870	5715	11880	11805
31	4735	5906	6356	12635	8608
32	4448	6061	6780	11241	7150
33	4698	4759	6530	9383	5213
34	4322	3991	6407	7455	3830
35	3935	2847	4958	6298	2712
36	2753	2010	3928	4764	1920
37	2711	1585	3088	2721	1353
38	2463	1510	2417	2806	902
39	1630	1033	1534	1952	671
40	1607	550	1019	1041	406
41	847	579	825	708	395
42	825	554	524	510	190
43	474	414	339	309	152
44	438	208	223	140	133
45	300	111	149	62	80
46	183	148	78	128	32
47	126	152	95	39	69
48	195	56	56	31	19
49	121	69	46	4	17
50	29	34	16	36	6
51	18	50	11	2	0
52	18	29	8	2	14
53	0	0	14	1	0
54	18	0	7	1	0
55	18	0	7	1	0
56	0	0	3	1	0
57	18	9	23	0	0
58	18	0	3	0	0
59	0	0	9	0	14
60	18	0	1	0	0
61	0	0	1	0	0
62	0	0	0	0	0
63	0	0	0	0	0
64	0	0	0	0	0
65	0	0	0	0	0
66	0	0	4	0	0
67	0	0	1	0	0
68	0	0	1	0	0
69	0	0	4	0	0
70	0	0	1	0	0
71	0	0	1	0	0
72	0	0	4	0	0
73	0	0	0	0	0
74	0	0	0	0	0
75	0	0	0	0	0
Total	**60904**	**91100**	**67562**	**147892**	**139406**
Weights	**1531**	**1602**	**1689**	**2749**	**2188**

Table 4.8.12. *Nephrops* in VIIgh. Mean sizes (carapace length, CL in mm) of French and Irish landings.

Year	French sampling			Irish sampling		
	Males	Females	Total	Males	Females	Total
1987	38.8	35.1	38.1			
1988	35.7	34.7	35.6			
1989	38.9	36.0	38.5			
1990	39.7	35.4	39.0			
1991	38.2	34.1	37.5			
1992	37.6	34.9	37.3			
1993	40.0	36.6	39.6			
1994	39.7	37.1	39.3			
1995	39.9	36.1	39.4			
1996	39.5	36.8	39.2			
1997	39.9	37.4	39.8			
1998	39.9	36.4	39.5			
1999	40.1	36.9	39.6			
2000	42.0	39.2	41.4			
2001	38.8	39.1	38.9			
2002	40.9	39.7	40.8	33.0	31.1	32.2
2003	41.5	39.7	41.4	32.0	29.7	31.0
2004	41.6	39.8	41.4	33.5	32.2	32.8
2005	43.1	40.2	42.8	31.2	31.0	31.1
2006	41.5	39.5	41.0	29.7	28.6	29.2

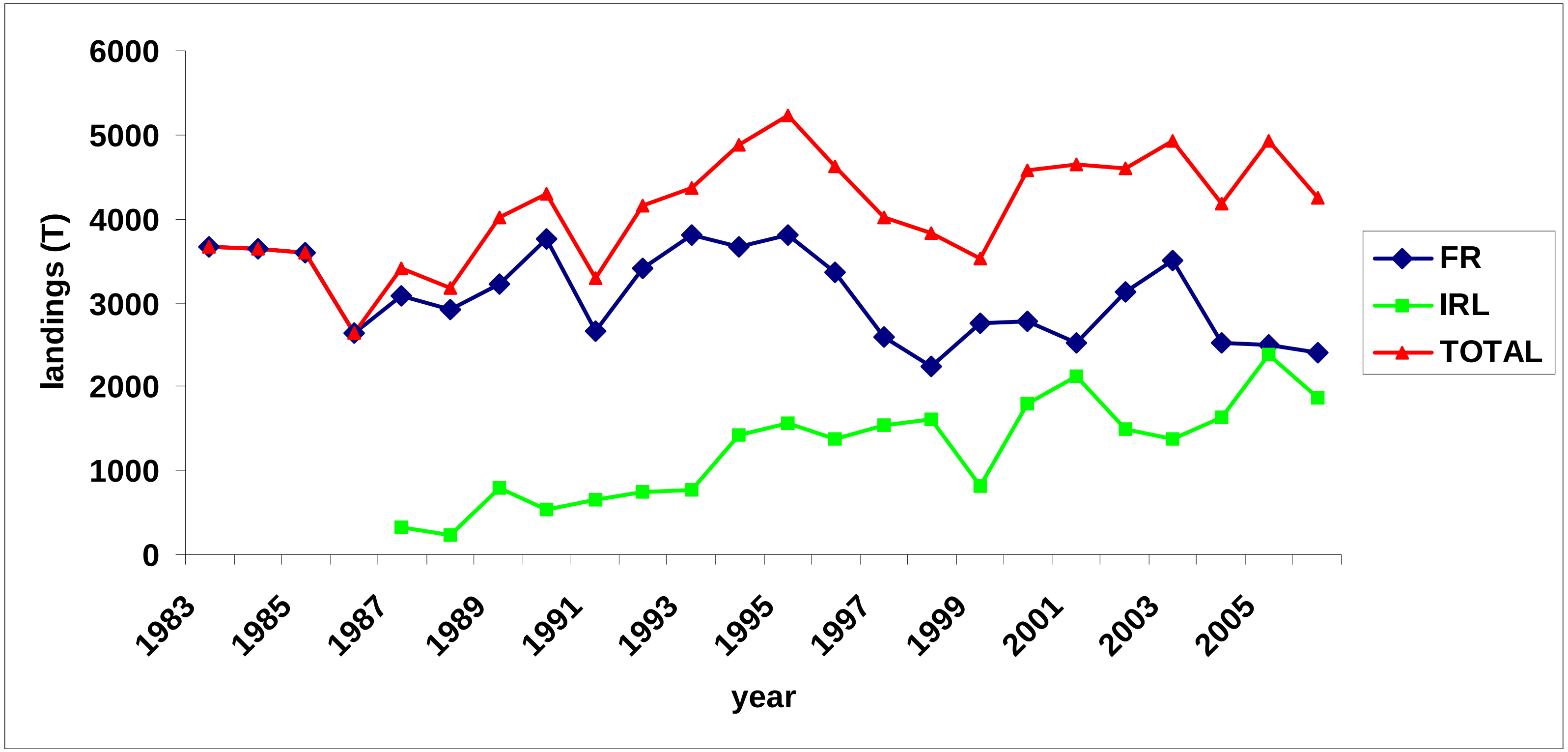
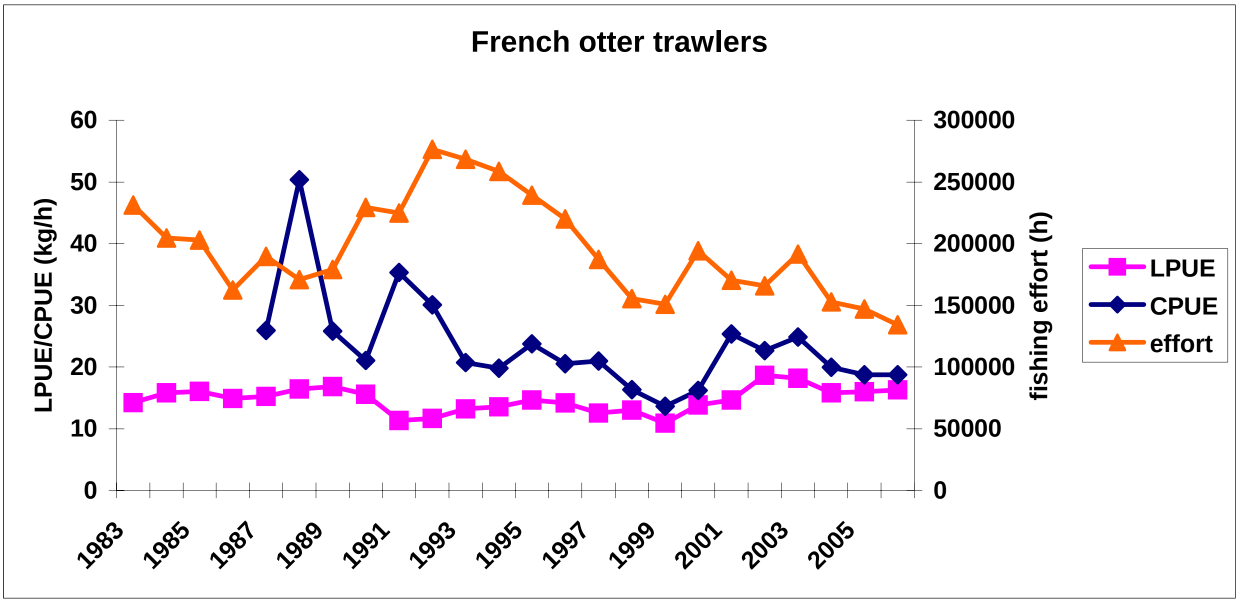


Figure 4.8.1. *Nephrops* in VIIgh. Evolution of nominal landings (t).



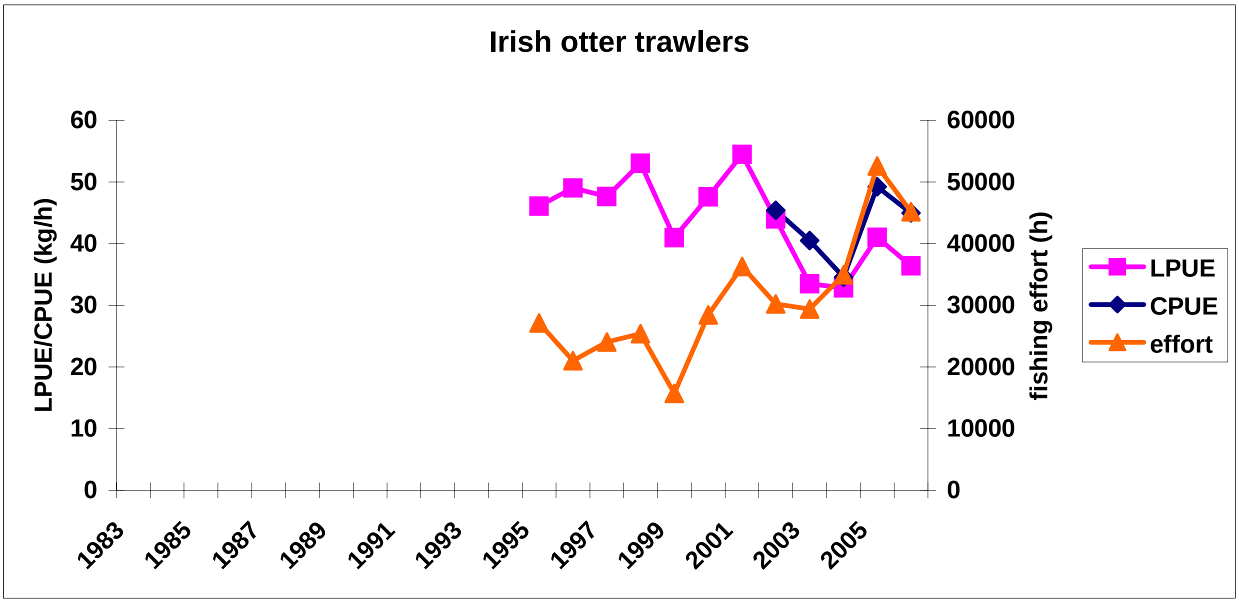
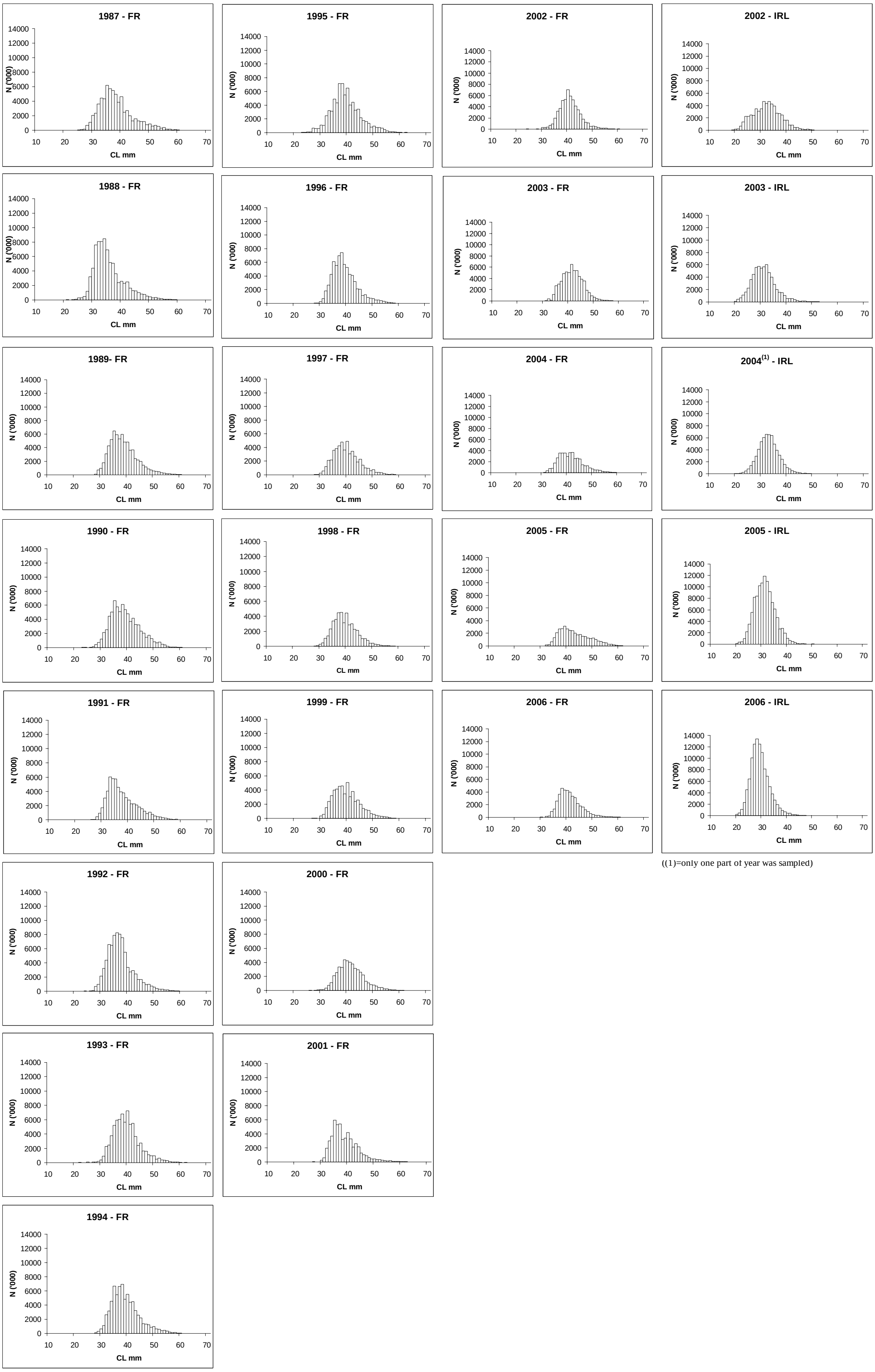


Figure 4.8.2. *Nephrops* in VIIgh. LPUE and fishing effort series for French (above) and Irish fleet (below). The CPUE indices are calculated by including discard sampling onboard and, failing that, by the derivation method as explained in Report, Annex 1 and WD 13.



((1)=only one part of year was sampled)

Figure 4.8.3. Nephrops in FU 20-22 Celtic Sea (VIIg,h) landings of French trawlers (1987-2006) and of Irish trawlers (2002-2006)

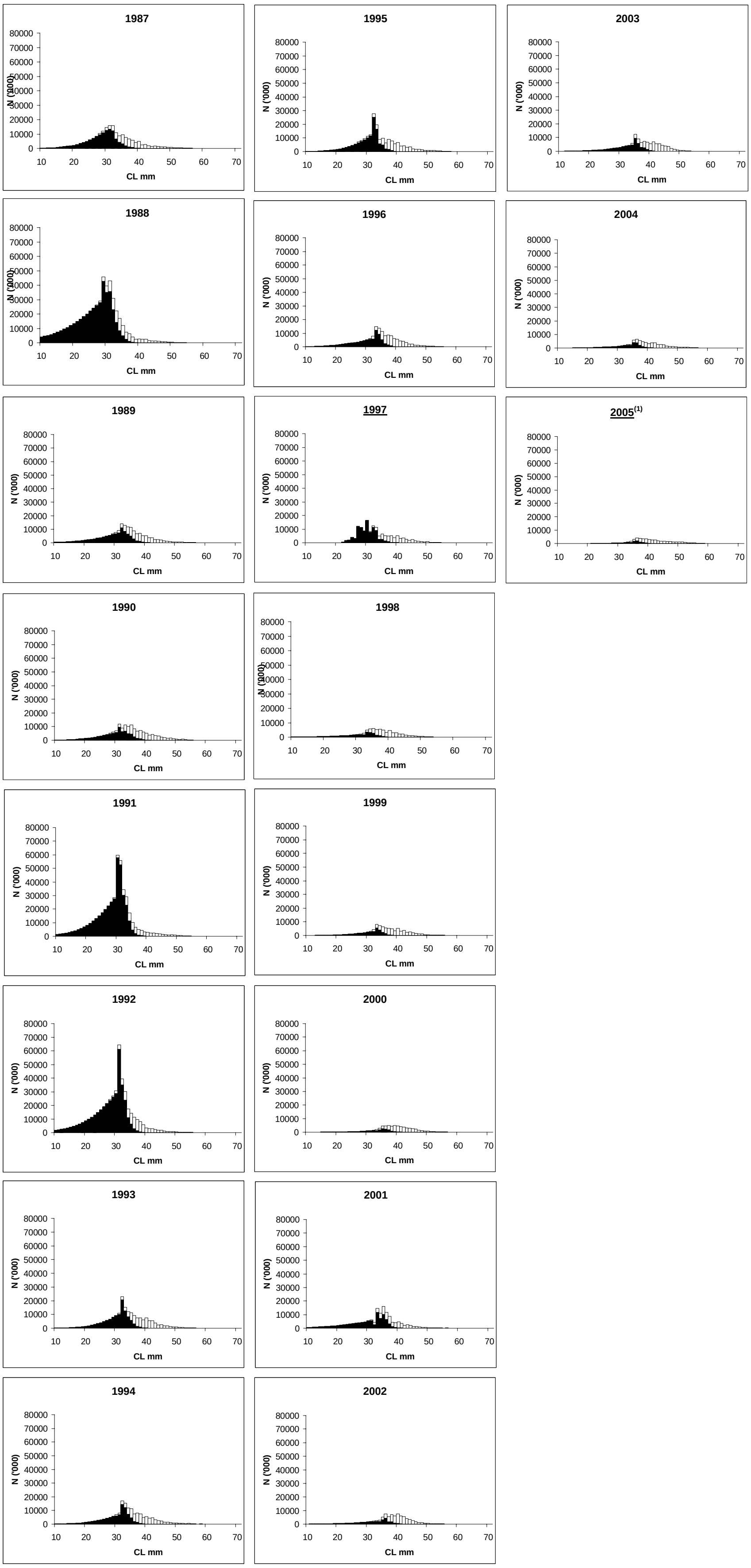


Figure 4.8.4. Nephrops in FU 20-22 Celtic Sea (VIIg,h). Catches (landings in white and discards in black) of the French fleet. Length distributions in 1987-2006. Sampled years for discards are underlined ((1)=only a part of year was sampled for discards)

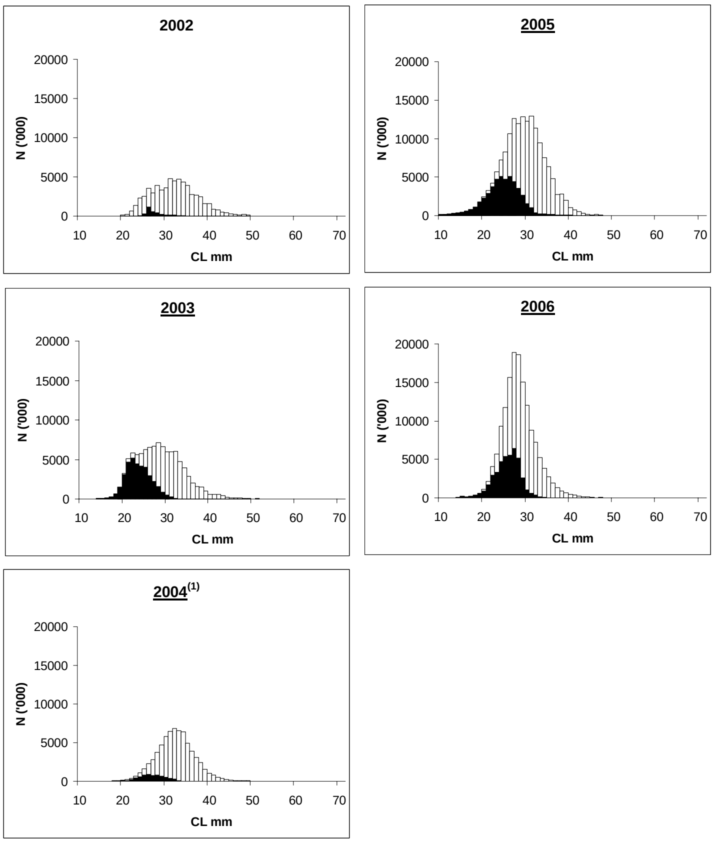


Figure 4.8.5. Nephrops in FU 20-22 Celtic Sea (VIIg,h). Catches (landings in white and discards in black) of the Irish fleet. Length distributions in 2002-2006. Sampled years for discards are underlined ((1)=only a part of year was sampled for landings)

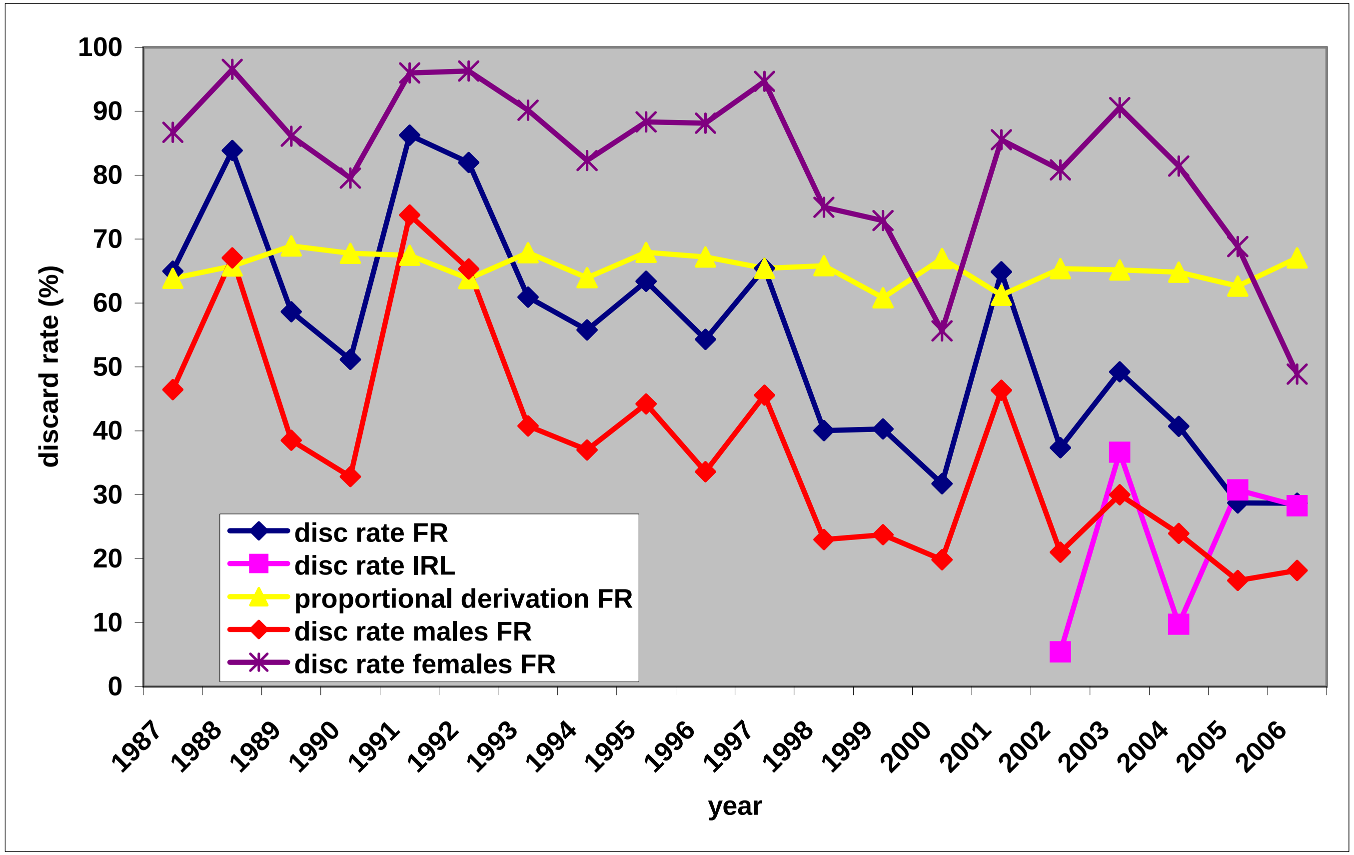


Figure 4.8.6. Comparison of different discards rates according to back-calculation method (proportional or logistic derivation presented in WG).

5 West of Ireland Stocks

5.1 Cod in Divisions VIIb,c

5.1.1 The fishery

Cod in Division VIIb,c are caught mainly in mixed species otter trawl fisheries. The TAC area covers Subareas VIIb-k, VIII, IX and X. The TAC in 2007 was set at 4,743 t. Ireland is the major participant in this fishery.

No assessment was carried out on this stock in 2007. The Working Group considered the inclusion of Cod VIIb,c data in future assessments. Cod in Divisions VIIb,c are included in the management area VIIb-k. However it is unclear whether the dynamics of this stock mean that it would be more appropriate to include Cod VIIb,c in the Cod VIa assessment rather than the Cod VIIe-k assessment. Until the dynamics of these cod stocks become clear the Working Group resolved to continue the collation of data on VIIb,c cod.

Table 5.1.1 Nominal Landings (t) of Cod in Division VIIb,c for 1995-2006

COUNTRY	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
France	91	115	71	44	…[1]	46	38	54	33	13	16	8
Germany	-	-	3	-	-	-	-	-				
Ireland	282	353	177	234	154	141	107	59	59	60	32	14.3
Netherlands	-	-	-	-	-	-	+	-	1			
Norway	3	1	6		11	+*	1	5				1
Spain	6	3		6	2	3	1	1				
UK(E/W/NI)	25	35	37	25	4	4	2	1	8			
UK(Scotland)	66	12	7	9	1	-		1	1	10		
UK												1
TOTAL	**473**	**519**	**301**	**318**	**172**	**194**	**150**	**122**	**102**	**83**	**48**	**24.3**

[1]See VIIg-k.

5.1.2 Age Composition

Data for this stock has been provided by Ireland. The bulk of the sampling is carried out in Division VIIb.

Table 5.1.2. Age and weight composition of Cod in Division VIIb,c in 2006.

Summary	Age0	Age1	Age2	Age3	Age4	Age5	Age6
No landed ('000)	0	0.094	3.186	0.576	0.157	0.172	0.059
Mean Weight (kg)	0	0.676	1.317	2.889	4.54	6.358	10.361
% Distribution	0	2.21	74.96	13.56	3.69	4.05	1.38
Mean L (cm)	0	38.5	48.52	63.73	75.4	84.91	98.6
Mean L (+0.5 cm)	0	39	49.02	64.23	75.9	85.41	99.1

5.2 Whiting in Divisions VIIb,c

5.2.1 The fishery

Whiting in Division VIIb,c are caught mainly in mixed species otter trawl fisheries. The TAC area covers Sub-areas VIIb-k. The TAC in 2007 was set at 19,940 t. Ireland is the major participant in this fishery.

No assessment was carried out on this stock in 2007. The Working Group considered the inclusion of whiting VIIb,c data in future assessments. Whiting in Divisions VIIb,c are included in the management area VIIb-k. However it is unclear whether the dynamics of this stock mean that it would be more appropriate to include whiting VIIb,c in the whiting VIa assessment rather than the whiting VIIe-k assessment. Until the dynamics of these whiting stocks become clear the Working Group resolved to continue the collation of data on VIIb,c whiting.

Table 5.2.1 Nominal Landings (t) of Whiting in Division VIIb,c for 1995-2006

COUNTRY	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
France	57	76	65	37*	…1*	109	114	113	92	63	129	54.4
Ireland	1,894	1,233	403	323	206	563	357	386	423	135	65	47.6
Netherlands	-	-	-	-	-	-	2	-	3		2	
Spain	+	+	-	27	1	4	-	6		31	18	
UK(E/W/NI)	24	96	75	49	10	6	5	4	5	1	11	4.6
UK(Scotland)	71	17	4	27	-	19	1	+	-		10.8	
TOTAL	**2,046**	**1,422**	**547**	**463**	**217**	**701**	**479**	**509**	**523**	**230**	**235.8**	**106.6**

[1]See VIIg-k.

5.2.2 Age Composition

Data for this stock has been provided by UK (E & W), Belgium and Ireland. The bulk of the sampling is carried out in Division VIIb.

No landed ('000)	0	104.3	30.76	13.99	30.59	15.66	1.3968	7.47
Mean Weight (kg)	0	0.236	0.307	0.421	0.943	1.676	1.42	1.94

5.3 Sole in West of Ireland (Division VIIb,c)

Type of assessment at 2007 WG: None: Catch Table update

An assessment was attempted by the 2002 Working Group for Sole VII b,c. However due to the short time series of available data, and the lack of independence between the catch at age data and the available tuning data, it was not possible to carry out an acceptable assessment for this stock. This situation has remained unchanged. The 2007 WG updated the catch tables and did not collate input data for an assessment.

5.3.1 The Fishery

Ireland is the major participant in this fishery. Sole are normally caught in mixed species otter trawl fisheries in Division VIIb. The vessels operate from the ports of Rossaveal and the Aran Islands. These vessels target mainly nephrops, hake, anglerfish and megrim. Ireland had an average of 84% of total international landings between 1996-2005.

ICES advice applicable to 2007

Exploitation boundaries in relation to precautionary considerations: *Recent catches have been close to the TAC of 65 t. Catches should not be allowed to increase unless it can be shown that an expansion of the fishery is sustainable.*

Management applicable to 2006 and 2007

Sole is managed by a precautionary TAC and technical measures. The agreed TAC for 2006was 64t. In 2007, the TAC was set at 65 t.

Council Regulation (EC) No 1954/2003 established measures for the management of fishing effort in a 'biologically sensitive area' in areas of VIIb, VIIj, VIIg and VIIh. Effort exerted within the 'biologically sensitive area' by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998-2002).

Recent trends in the Fishery

National landings data and estimates of total landings used by the Working Group are given in Table 5.4.1. The estimated total international landings for 2006 were 44 t, well below the TAC of 64 t. Ireland has been the major participant in this fishery. Working group estimates of landings have shown a decline since 2004.

Commercial fleet effort and LPUE

No update is available for 2006. Recent trends have described in the WGSSDS 2004 report.

Survey and abundance indices

Survey Indices are available from the IRGFS and are presented in Table 5.3.2. Catches for this survey are low, especially at older ages.

5.3.2 Age and length compositions and mean weights at age

No update is available for 2006. Age and length compositions and mean weights at age have previously been described in the WGSSDS 2004 report.

5.3.3 Management considerations

Sole are taken as part of a mixed demersal fishery by otter trawlers. Management options proposed for sole should also take into consideration other demersal fish species and *Nephrops* taken in the VIIbc fishery.

5.4 Plaice in West of Ireland (Division VII b,c)

Type of assessment at 2007 WG: None: Catch Table update

An assessment was attempted by the 2002 Working Group for PlaiceVII b,c. However due to the short time series of available data, and the lack of independence between the catch at age data and the available tuning data, it was not possible to carry out an acceptable assessment for this stock. This situation has remained unchanged. The 2007 WG updated the catch tables and did not collate input data for an assessment.

5.4.1 The Fishery

The Irish fleet is the major participant in this fishery. Plaice are normally caught in mixed species otter trawl fisheries in Division VIIb. The majority of the Irish landings are taken by otter trawls (95%) and Scottish seines (4%). The vessels operate from the ports of Rossaveal and the Aran Islands. These vessels target mainly other demersal fish species and nephrops. On average, Ireland took around 85% of the international landings between 1996-2005.

ICES advice applicable to 2007

Exploitation boundaries in relation to precautionary considerations: *Catches in 2005 should be no more than the recent average (2003-2005) of around 55 t, in order to avoid an expansion of the fishery until there is more information to facilitate an adequate assessment.*

Management applicable to 2006 and 2007

Plaice is managed by a precautionary TAC and technical measures. The agreed TAC for 2006 was 144 t. In 2007, the TAC was set at 122 t.

Council Regulation (EC) No 1954/2003 established measures for the management of fishing effort in a ‘biologically sensitive area’ in areas of VIIb, VIIj, VIIg and VIIh. Effort exerted within the ‘biologically sensitive area’ by the vessels of each EU Member State may not exceed their average annual effort (calculated over the period 1998-2002).

Recent trends in the Fishery

National landings data and estimates of total landings used by the Working Group are given in Table 5.4.1. The estimated total international landings for 2006 was 30 t, well below the TAC of 122t. Ireland has been the major participant in this fishery. Working group estimates of landings for this stock show a steady decline since 1996 and landings in 2006 are the lowest in the observed time series.

Commercial fleet effort and LPUE

No update is available for 2006. Recent trends have described in the WGSSDS 2004 report.

Survey and abundance indices

Survey Indices are available from the IRGFS and are presented in Table 5.4.2. Catches for this survey are low at younger and older ages. Ages 2-5 dominate the catches in the survey.

5.4.2 Age and length compositions and mean weights at age

No update is available for 2006. Recent trends have described in the WGSSDS 2004 report.

5.4.3 Management considerations

Plaice are taken as part of a mixed demersal fishery primarily by otter trawlers. Therefore, management options proposed for plaice, should also take into consideration other demersal fish species in the VIIb,c fishery.

Table 5.3.1 **Sole in Divisions VII b, c (Southwest Ireland).**
Nominal landings (t), 1973-2006,as officially reported to ICES.

Country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
France	-	25	7	6	3	3	6	9	6	5	9	3
Ireland	12	12	19	44	14	16	13	24	47	55	40	17
Spain	19	16	30	25	1	-	11	1	-	-	-	-
UK - Eng+Wales+N.Irl.	.	.	.	.	.	.	.	.	.	.	.	.
UK - England & Wales	-	-	-	-	-	-	-	-	-	1	-	-
Total	31	53	56	75	18	19	30	34	53	61	49	20

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
France	6	8	2	2	-	-	5	2	1	1	2
Ireland	44	29	39	34	38	41	46	43	59	60	59
Spain	-	-	-	-	-	-	-	-	-	-	-
UK - Eng+Wales+N.Irl.	.	.	.	.	-	-	-	-	-	-	-
UK - England & Wales	-	-	-	1	.	.	.	.	.	.	.
Total	50	37	41	37	38	41	51	45	60	61	61
Unallocated									0	9	-2
Total as estimated by the Working Group									60	70	59

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
France	2	3	-	.	13	11	14	24	24	13	11
Ireland	52	51	49	68	65	53	50	50	49	38	31.2
Spain	-	-	-	-	-	-	-	-	-	.	.
UK - Eng+Wales+N.Irl.	-	1	-	-	-	-	-	-	-	.	.
UK - England & Wales	.	.	.	.	.	.	.	.	.	.	.
Total	54	55	49	68	78	64	64	74	73	51	
Unallocated	3	0	17	4	-10	-4	-3	-10	-4	-7	
Total as estimated by the Working Group	57	55	66	72	68	60	61	64	69	44	43

Table 5.3.2 **Sole in Divisions VII b,c**

Available Survey tuning data

IrGFS : Irish Groundfish Survey (IBTS 4th Qtr) - Sole number at age (Interim indices for new Celtic Explorer series)

2003	2005										
1	1	0.79	0.92								
0 10+											
757	0.0	0.0	0.0	7.0	1.9	5.0	6.5	2.0	0.0	0.0	1.0
728	0.0	1.0	6.0	1.9	21.2	12.2	9.6	3.1	3.1	5.7	4.0
724	0.0	5.0	5.0	7.3	7.0	9.8	5.0	4.3	2.0	3.3	9.4
700	0.0	0.0	10.0	7.0	5.0	7.0	3.0	1.0	3.0	2.0	6.0

Table 5.4.1 Plaice in Divisions VII b, c (Southwest Ireland). Nominal landings (t) 1973-2006 as officially reported to ICES.

Country	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Denmark	-	-	-	-	-	-	2	-	-	-	-	-
France	60	45	10	9	4	16	6	12	9	8.00	37	2
Ireland	124	106	153	133	135	122	117	142	135	122	108	110
Spain	-	-	-	-	-	-	-	65	58	22	7	-
UK - Eng+Wales+N.Irl.	.	.	.	.	.	.	.	.	.	.	.	.
UK - England & Wales	1	1	-	-	-	-	-	-	4	4	-	3
UK - Scotland	-	-	-	-	-	-	-	-	-	-	-	3
Total	185	152	163	142	139	138	125	219	206	156	152	118

Country	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Denmark	-	-	-	-	-	-	-	-	-	-	-
France	10	11	13	9	1	11	9	3	2	1	5
Ireland	150	114	153	157	159	130	179	180	191	200	239
Spain	-	-	-	-	-	-	-	-	-	-	-
UK - Eng+Wales+N.Irl.	.	.	.	.	1	2	-	6	1	2	1
UK - England & Wales	7	5	1	2	.	.	.	.	.	.	.
UK - Scotland	-	-	-	-	13	90	3	3	2	3	1
Total	167	130	167	168	174	233	191	192	196	206	246

Country	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Denmark	-	-	-	-	-	-	-	-	-	.	
France	1	3	-	.	31	8	17	8	16	14	10
Ireland	248	206	160	157	99	70	51	56	39	25	19.6
Spain	-	-	-	-	-	-	-	2	1	.	
UK - Eng+Wales+N.Irl.	2	-	1	-	-	-	2	-	-	.	
UK - England & Wales	.	.	.	.	.	.	.	.	.	.	
UK - Scotland	-	-	-	2	-	-	-	-	-	.	
UK											0.3
Total	251	209	161	159	130	78	70	66	56	39	29.5
Unallocated	-11	4	22	13	-22	9	1	6	-1	-1	1
Total as used by the Working Group	240	213	183	172	108	87	71	72	55	38	30.5

Table 5.4.2 **Plaice in Divisions VII b,c**

Available Survey tuning data

IrGFS : Irish Groundfish Survey (IBTS 4th Qtr) - Sole number at age (Interim indices for new Celtic Explorer series)

2003	2005									
1	1	0.79	0.92							
0	9									
757	0.0	6.0	122.0	84.0	67.0	20.0	5.0	3.0	1.0	3.0
728	0.0	59.3	355.0	405.2	164.0	115.5	39.1	3.1	0.0	0.0
724	2.0	3.6	20.0	65.6	75.8	22.1	8.6	4.9	1.0	0.0
700	0.0	93.0	254.5	222.9	127.1	21.4	24.5	4.5	3.8	0.0

Stock Annex 1 -WGSSDS-Haddock (Celtic Sea and West of Ireland)

Stock specific documentation of standard assessment procedures used by ICES.

Stock:	Haddock (*Melanogrammus aeglefinus*) : Division VIIb-k
Working Group:	Assessment of Southern Shelf Demersal Stocks
Date created:	7th July 2003
Last updated:	5rd July 2007

A.General

A.1 Stock definition

To be described intersessionally.

A.2 Fishery

Haddock in Divisions VIIb-k are taken as a component of catches in mixed trawl fisheries. France usually takes about 50-80% of the landings. French landings are made mainly by gadoid trawlers, which prior to 1980 were mainly fishing for hake in the Celtic Sea. Ireland has usually taken about 25-40% of the landings. Irish demersal trawlers from Dunmore East and Castletownbere and other ports in south-west Ireland have traditionally targeted haddock in a mixed trawl fishery. In Divisions VIIb and VIIc, the Irish fleet operates mainly from the ports of Rossaveal and the Aran Islands. Fleets from Belgium, Norway, the Netherlands, Spain, and the UK take the remainder of the landings. Landings reported between 1984 and 1995 varied between 2,600t and 4,900t, then increased sharply to 6,700 t in 1996 and to 10,300 t in 1997 before declining in 1998. Landings in 2001 were again high at 9,700 and have shown a moderate downward trend since.

A detailed description of the Irish Fishery is given in the annual WD to WGSSDS: ‘A summary of the Irish Fishery and Sampling of Haddock in VIIb-k’.

A.3 Ecosystem aspects

To be described intersessionally.

B. Data

B.1 Commercial Catch

Sampling and Data Raising: Data on landings at age and mean weight at age were available for fleets landing into Ireland in 1993-2005 and from France and the UK in 2002-3005. Due to the inclusion of the French and UK data, the numbers landed at age were raised differently to the 2002 Working Group. UK VIIe-k data was used to scale catch numbers according to the landings for each area. French VIIf,g,h data was used with Irish VIIg data to VIIf,g,h catch numbers. The table below shows the data available and the procedures used to derive quarterly length compositions, age compositions and mean weights at age.

		Data source:				
Division	**Data**	**UK**	**France**	**Ireland**	**Belgium**	**Derivation of international landings**
VII b,c	Length composition			VII b		
	ALK			VII b		
	Age Composition			VII b		IRL raised
	Mean weight at age			VII b		IRL VIIb
	Landings		VIIb,c	VIIb,c		
VII e	Length composition	VIIe-k				Derived from UK VIIe-k
	ALK	VIIe-k				Raised to international Landings
	Age Composition	VIIe-k				
	Mean weight at age	VIIe-k				
	Landings	VIIe	VIIe		VIIe	
VII f,g,h	Length composition		VII f,g,h	VII g		
	ALK		VII f,g,h	VII g		
	Age Composition		VII f,g,h	VII g		IRL & FRA raised
	Mean weight at age		VII f,g,h	VII g		IRL & FRA raised
	Landings	VIIf,g	VIIf,g,h		VIIf,g,h,j,k	
VIIe-h	Length composition					VIIf,g,h & VIIe
	ALK					
	Age Composition					
	Mean weight at age					
	Landings					
VII j-k	Length composition			VII j		IRL raised
	ALK			VII j		
	Age Composition			VII j		IRL raised
	Mean weight at age			VII j		IRL VIIj
	Landings	VIIj,k	VIIj,k	VIIk		
VII b,c,e,f,g,h,j,k	Length composition					
	ALK					
	Age Composition					VIIb,c + VIIe + VIIfgh + VIIjk
	Mean weight at age					Weighted mean by numbers caught
	Landings					

Weights at Age: Previous to the WGSSDS 2004 the stock weights at age were smoothed using a three year rolling average across ages. In 2004, the working group estimation of stock weights was done using a quadratic function fitted through cohorts to the Quarter 1 catch weight data (Figure 1) Stock weights at age 0 were set to zero. The model fit was further constrained such that weights at older ages were always greater than at the preceding age. Where there were insufficient data points to fit the model, the average of the modelled weights at each age was used. In 2005 the stock weights were modelled using a Von Bertalanfy growth in weight equation. The raw stock weight data show significant year-effects and although these might be due to changes in sampling or ageing errors, it is also possible that weights-at-age are subject to inter-annual variation in condition. As the modelled stock weight did not fit the data very well and because it is not clear whether stock weights at age are more influenced by cohort- or year-effects, it was decided in 2007 to revert to using a three year rolling average to smooth the data, and constraining the weights of older ages to at least that at the preceding age in the cohort.

B.2 Biological

Natural Mortality and Maturity Ogives: In the absence of a direct estimate of natural mortality, a constant value of 0.2 was assumed for all age classes and years. Maturity was assumed to be knife-edged at age 2. Recent Irish Survey data is in agreement with this maturity ogive, although some males mature at age one.

B.3 Tuning data

Survey tuning data: There are four main surveys that contribute to the assesment of Haddock VIIb-k.

The UK has conducted a first quarter annual groundfish survey since 1986 on the R.V. *Cirolana*. The survey covers ICES areas VIIf,g,h j and the north western part of VIIe. In 2004, the same survey was carried out on the RV.CEFAS *Endeavour*. This survey is now discontinued as resources from this survey have been redirected to the collection of maturity and growth data under the auspices of the Data Collection Regulation (DCR). Furthermore the number of survey days has been reduced from 32 to 14 and the survey coverage is different spatially.

France has conducted an annual groundfish in the fourth quarter since 1997. The survey is carried out on the R.V. *Thalassa* covering VIIf, g, h, and j. Age data is available from 2001 onwards. It was decided at WGSSDS $_{2004}$ to work up catch at age data for 1997-2000 for this survey. This was carried out by applying age-length keys from the Irish groundfish survey (IR-ISCSGFS) for the relevant years to the FR-EVHOE length distributions (age-length distributions from the UK-WCGFS were also used where age data were not available from the IR-ISCSGFS).

Since 1999, Ireland has conducted an annual fourth quarter groundfish survey in ICES areas VIIb and VIIj. The Irish West Coast groundfish surveys were conducted on chartered commercial vessels. As the same vessel was used in Divisions VIIb and j, the IR-WCGFS-7B and IR-WCGFS-7J tuning datasets were combined to create the IR-WCGFS-7B&J tuning dataset.

Since 1997, Ireland has conducted a groundfish survey in the Irish Sea and Celtic Sea covering ICES areas VIIg and VIIa aboard the R.V. *Celtic Voyager* and the West Coast Groundfish Sruvey in VIa, VIIb and VIIg on various commercial vessels, Both these surveys were discontinued in 2002.

Ireland commenced a new research vessel survey in 2003 and data from this survey (IR-GFS) were presented for the first time to the 2004 WG. The survey is conducted aboard the RV *Celtic Explorer*.

A combination of the *Celtic Voyager* and *Celtic Explorer* surveys in the area of overlap (VIIg) was presented for the first time in 2006. The two surveys were standardised by using a swept area estimate of the catches. (IR7gSAGFS),

All the above surveys are co-ordinated by IBTS (International Bottom Trawl Survey).

Commercial tuning Data: There are two commercial tuning fleet available for this assessment.

Irish Otter trawl VIIbj (IR7bjOTB). This fleet consists mainly of vessels from 15-35m in length, operating from the west and southwest coast of Ireland. (Vessels of the Irish OTB fleet in VIIg regularly switch between targeting nephrops to targeting whitefish. Significant numbers of new boats have also been added to this fleet, making it unsuitable as a tuning fleet.)

At WGSSDS06 a new French Gadoid tuning fleet (FR7ghjGAD) was presented for the first time. The index started in 2002

C. Historical stock development

The assessment indicates clear trends in SSB, F and recruitment, which are not in conflict with the results from previous WG assessments. Recruitment is highly variable. F is relatively high and SSB follows recruitment.

Table 1 describes the assessment methods and settings.

D. Short term projections

E. Medium term projections

F. Yield and biomass per recruit / long term projections

G. Biological reference points

There are no biological reference points for this stock.

H. Other Issues

I.References

Table 1. History of assessments.

		2002 XSA		2003 XSA		2004 XSA		2005 XSA		2006 XSA*		2007 XSA	
		Year range	Age range	Year range	Age range	Year range	Age range	Year range	Age range	Year range	Age range	Year range	Age range
Catch data		93-01	1-8+	93-02	1-8+	93-03	0-8+	93-04	3-8+	93-05	3-8+	93-06	1-8+
Survey tuning fleets	IR7bjWCGFS	93-01	1-1	93-02	1-1	93-02	0-3	93-02	3-3	93-02	3-5	Not used	
	UK7efghjWCS	98-01	1-3	98-02	1-3	98-03	1-5	Not used		98-03	3-5	Not used	
	FR7fghjEVHOE	Not used		Not used		97-03	0-3	97-04	3-3	97-05	3-5	97-06	0-5
	IR7gSAGFS	Not used		Not used		Not used		Not used		Not used		99-06	0-5
	IR7gISCSGFS	Not used		Not used		97-03	0-3	97-04	3-3	Not used		Not used	
Commercial tuning fleets	IR7bjOTB	95-01	1-7	95-02	1-7	95-03	1-7	95-04	3-7	95-05	3-7	95-06	2-7
	FR7fghGAD	Not used		Not used		Not used		Not used		Not used		2-7	2-7
Discards included		No		No		No		No		No*		Yes	
Taper		No		No		No		No		No		No	
Ages catch dep stock size		None		None		None		None		None		None	
Q plateau		4		4		4		4		4		4	
F shrinkage SE		1.5		1.5		1.5		1.5		1.5		1.5	
F shrinkage year range		5		5		5		5		5		5	
F shrinkage age range		3		3		3		3		3		3	
Fleet SE threshold		0.3		0.3		0.3		0.3		0.3		0.3	
Fbar range								3-5		3-5		2-5	

* No final assessment was presented at WGSSDS06, instead three proposed runs were presented, one of which included discards. The settings presented here for WGSSDS06 are of the first (SPALY run).

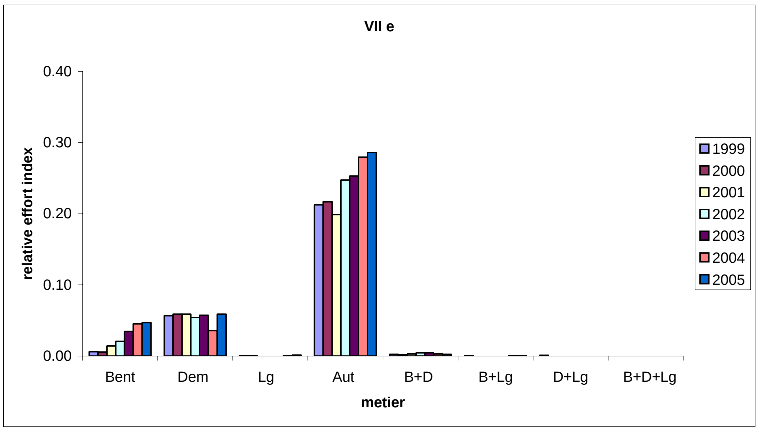
Stock Annex 2 - Cod in VII e-k

The fishery

Cod in Divisions VIIe-k are taken as components of catches in mixed demersal trawl fisheries. Landings are made mainly by French fleets ~70%, mainly by French gadoid trawlers, which prior to 1980 were also fishing for hake in the Celtic Sea. Since 1988, this fleet represents ~21% of international landings in VIIe-k but more in the area of the bulk of landings (VII f,g and at a smaller level VIIh). French Nephrops fleets represents since 1988 ~12% of international landings in VII e-k. In the same period, UK (England and Wales) accounts for about 9% and Ireland for 14% but 28% in 2005, while Belgian vessels take about 4% in average. In Ireland in recent years, cod has increasingly been targeted using gillnet, rather than trawl.

Landings are made throughout the year, but mainly in the winter months during November to April. They fluctuate around 4,000t in the 1970s, increase up to a peak of around 20,000t in 1989 and then fluctuated around 10,000t up to 2002. They have declined to 6,000 t in 2003 an dropped to 3,500 t in 2004 and 3,000 t in 2005 with Cod limitation and high grading by French fleets and lower level of the stock. In 2005 and 2006, there has been a box closure in 1st quarter in area when and where LPUE were the highest at least for French fleets.

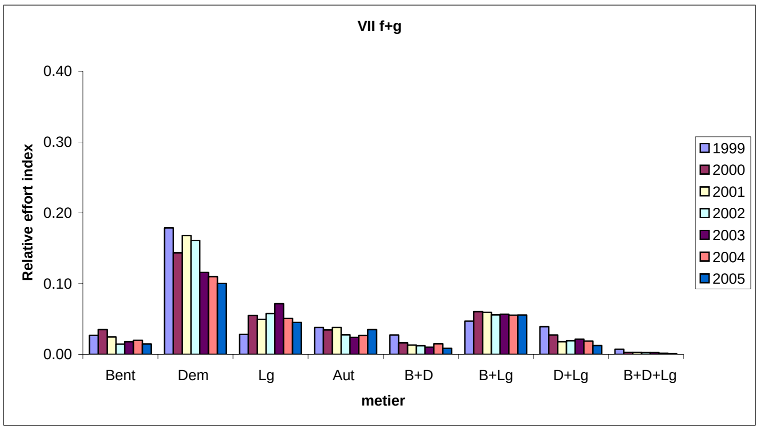
Tables below show by Division or Area the trend of relative effort index from 1999 to 2005, displayed by metier and Division VIIe or area VIIfg, VIIh, VII j,k and also VIIb,c, from analysis of **all** fishing sequences. A fishing sequence within a trip is a combination of time fished, ICES rectangle, gear used and harvest by group of species. This presentation is in line with the successive extended area of the stock assessed: VII f,g, VII f,g,h, VIIe-h and at the end VII e-k. One note that the scale is 0.0-0.4 in VIIe, VIIfg and VIIh figures and only 0.0-0.2 in VIIjk and VIIbc.



Landings of main species in descending order of **Aut**:

Monkfish
Whiting
Pollack
Sole
Ling
Cod

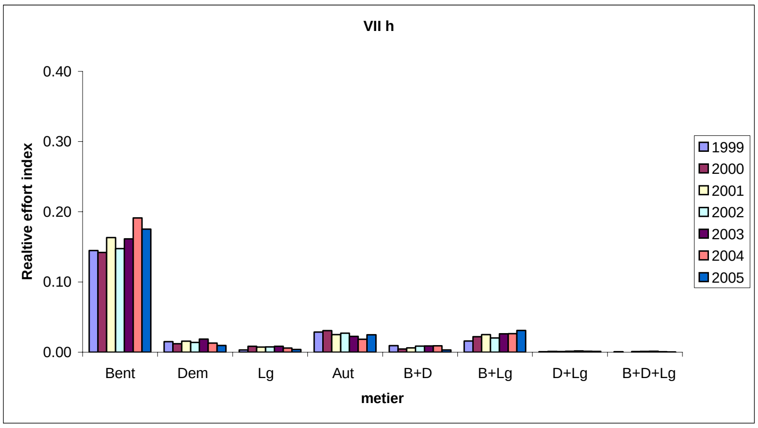
In VIIe, effort of pelagic trawlers targeting Bass and Sea Bream in winter is included in **Aut**



Landings of main species in descending order of **Dem**:

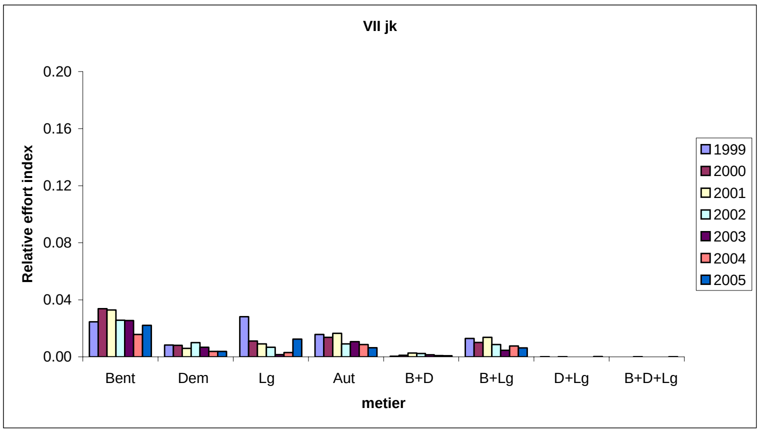
Whiting
Haddock
Cod
Monkfish
Pollack
Ling
Hake

Decreasing trend of fishing effort of all fleets



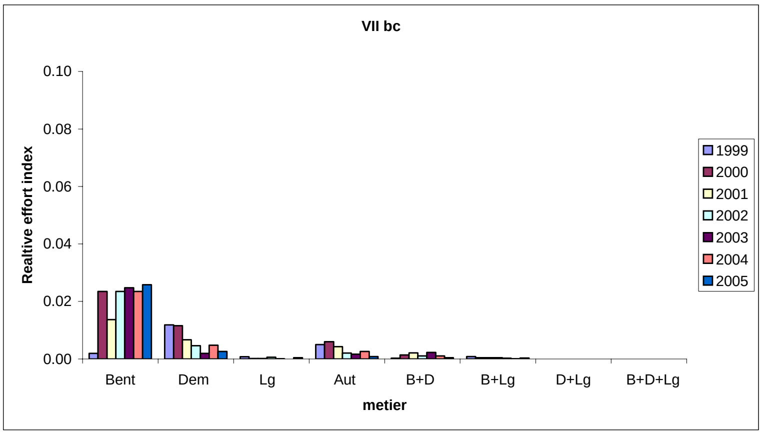
Landings of main species in descending order of **Bent**:

Monkfish
Cuckoo ray
Megrim
Haddock
Cod
Hake



Landings of main species in descending order of **Bent**:

Monkfish
Megrim
Hake
Whiting
Haddock



Landings of main species in descending order of **Bent**:

Monkfish
Megrim
Whiting
Haddock
Hake

Table below shows a series 1999-2006 of the effort of French trawlers in VII b-c, VIIe, VII fg, VIIh, VII j-k. This corresponds to the step by step extending of the area assessed: VII fg up to 1994 WG, VII fgh up to 1996 WG and then VII ef,g,h and finally VII e-k. This table use the definition of metiers of Annex II. Since 2003, total effort in VII ek has gradually decreased by –8% in 2004, again –7% in 2005 and then –3% in 2006 for a total decreasing of –18% since 2003. One can note that there are high values of effort in VIIe for the category “Others”. This correspond to otter trawlers which cannot be integrated in the define “metiers”by the thresholds. They fish mainly bib, gurnards, squids, cuttlefish and in recent years red mullet among a variety of species.

France **Effort in hours fishing by metier**

Trawlers classified using the treshold method on landings by fishing sequencies

Benthic threshold > 20% Anglefish+Megrim+ Cuckoo ray

Gadoid threshold >40% All gadoids

Nephrops threshold > 10% Nephrops

Note that some errors occured (Nephrops in VIIe) from erroneous logbooks or mistakes at input of fisheries statistics in database

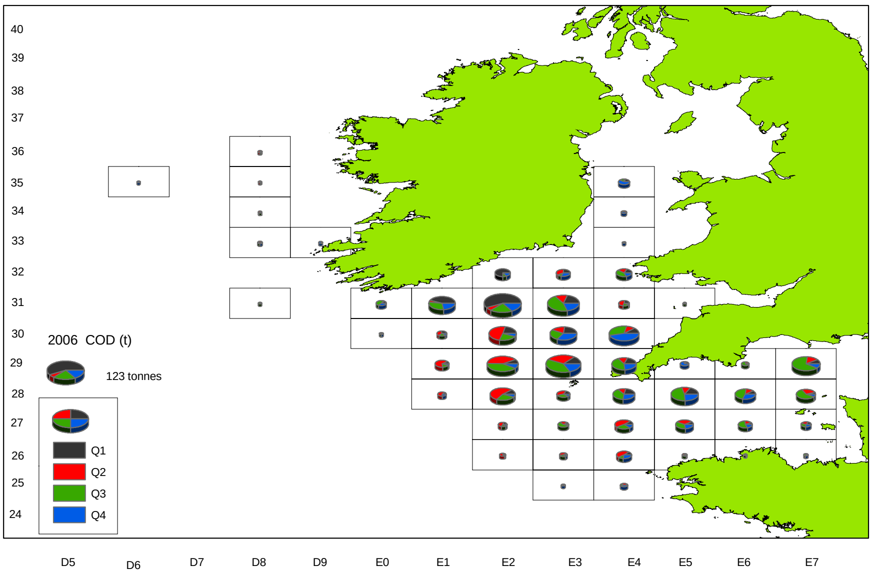
1999	**VII bc**	**VIIe**	**VIIfg**	**VIIh**	**VIIjk**	**VIIe-k**
Benthic trawlers	2040	6490	28973	154882	26255	216600
Gadoid trawlers	12613	60777	190704	15897	8896	276274
Nephrops trawlers	762	251	30265	3350	30116	63982
Others	5300	227133	40495	30661	16808	315097
Mixed Benth+Gadoid	243	2585	29299	9941	542	42367
Mixed Benthic+Neph	875	178	50328	16895	13782	81183
Mixed Gadoid+Neph	0	1033	41998	540	178	43749
Mixed benthic+Gadoid+Neph	0	0	7667	426	0	8093
	21833	298447	419729	232592	96577	1047345
2000	**VII bc**	**VIIe**	**VIIfg**	**VIIh**	**VIIjk**	**VIIe-k**
Benthic trawlers	25766	7541	39726	158328	37216	242811
Gadoid trawlers	12197	64778	157316	12976	8904	243974
Nephrops trawlers	148	545	61731	9410	13359	85045
Others	6392	237699	36205	32207	14971	321082
Mixed Benth+Gadoid	1760	1896	17451	4723	1321	25391
Mixed Benthic+Neph	458	72	66551	23479	10112	100214
Mixed Gadoid+Neph	20	0	29287	1056	0	30343
Mixed benthic+Gadoid+Neph	0	0	3013	34	16	3063
	46741	312531	411280	242213	85899	1051923
2001	**VII bc**	**VIIe**	**VIIfg**	**VIIh**	**VIIjk**	**VIIe-k**
Benthic trawlers	14242	14841	25749	172324	34925	247839
Gadoid trawlers	6916	60242	174136	16346	6245	256969
Nephrops trawlers	129	18	52174	8461	10261	70914
Others	4241	203021	39103	24876	17368	284368
Mixed Benth+Gadoid	2108	3098	12868	6610	2541	25117
Mixed Benthic+Neph	446	105	62447	25110	13756	101418
Mixed Gadoid+Neph	0	0	19272	740	72	20084
Mixed benthic+Gadoid+Neph	0	0	2799	811	83	3693
	28082	281325	388548	255278	85251	1010402
2002	**VII bc**	**VIIe**	**VIIfg**	**VIIh**	**VIIjk**	**VIIe-k**
Benthic trawlers	23832	20632	14142	150762	26317	211853
Gadoid trawlers	4785	53930	164718	13960	10634	243242
Nephrops trawlers	598	1	62053	8282	7395	77731
Others	1970	237859	28596	25733	9350	301538
Mixed Benth+Gadoid	862	4878	12285	9408	2061	28632
Mixed Benthic+Neph	438	30	56312	20527	9082	85951
Mixed Gadoid+Neph	0	0	20666	1496	22	22184
Mixed benthic+Gadoid+Neph	0	35	2677	957	0	3669
	32485	317365	361449	231125	64861	974800
2003	**VII bc**	**VIIe**	**VIIfg**	**VIIh**	**VIIjk**	**VIIe-k**
Benthic trawlers	26864	37630	18592	172843	27663	256728
Gadoid trawlers	1775	60610	124563	19617	7155	211945
Nephrops trawlers	40	93	77363	8962	1804	88222
Others	1999	262963	27057	21937	11026	322983
Mixed Benth+Gadoid	2366	4752	10542	9629	1453	26376
Mixed Benthic+Neph	322	91	58390	27424	4856	90761
Mixed Gadoid+Neph	0	21	22964	1764	0	24749
Mixed benthic+Gadoid+Neph	0	0	2535	1430	19	3984
	33366	366160	342006	263606	53976	1025748
2004	**VII bc**	**VIIe**	**VIIfg**	**VIIh**	**VIIjk**	**VIIe-k**
Benthic trawlers	24785	43931	18782	189099	16570	268382
Gadoid trawlers	4574	34319	107097	12347	3708	157471
Nephrops trawlers	37	464	51458	5804	3125	60851
Others	2559	271882	28000	17560	8302	325744
Mixed Benth+Gadoid	960	2752	14406	8787	1018	26963
Mixed Benthic+Neph	74	232	55860	26648	8413	91153
Mixed Gadoid+Neph	0	8	18412	1118	0	19538
Mixed benthic+Gadoid+Neph	0	0	1537	440	20	1997
	32989	353588	295552	261803	41156	952099
2005	**VII bc**	**VIIe**	**VIIfg**	**VIIh**	**VIIjk**	**VIIe-k**
Benthic trawlers	26180	37274	14716	163187	20960	236137
Gadoid trawlers	2398	47027	93247	7901	3657	151832
Nephrops trawlers	418	1180	45054	4073	12221	62528
Others	704	245404	31645	17533	6161	300743
Mixed Benth+Gadoid	414	2082	8537	3114	783	14516
Mixed Benthic+Neph	275	178	55296	30586	6488	92548
Mixed Gadoid+Neph	0	0	12431	1060	237	13728

Figures below show for France and Republic of Ireland the 2006 quarterly landings of cod and the annual UK landings by ICES Rectangle. One can note that French data for VIIa, b and c are shown but are not considered in the assessment. French landings of OTB are more widely distributed in the assessed area than those of French OTT which target more Nephrops, monkfish, megrim, cuckoo ray than cod in Celtic Sea. Also, fishing grounds in VIIe are not appropriated for the twin gear used in Celtic Sea by these vessels.

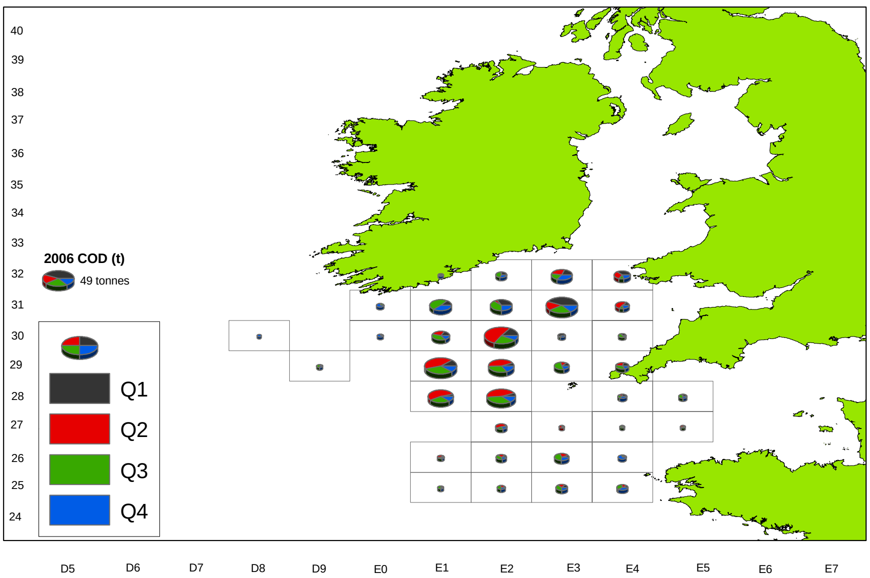
Landings of Irish fleets are mainly harvested in area north of N 50°30. GNS, OTB and TBB landings are mainly harvested in ICES rectangles 31E2,E3, 32E2 in the 1st quarter and at a lower level in the 2nd quarter. This does not show quite different areas and time periods as those of French fleets. May be the smaller mean length of Irish landings in recent years come from a smaller mesh size used for trawlers which target Nephrops (80 mm)?

Annual landings from UK fleets are harvested mainly offshore the Cornwall in ICES rectangles 29 and 30E3 and 29E5.

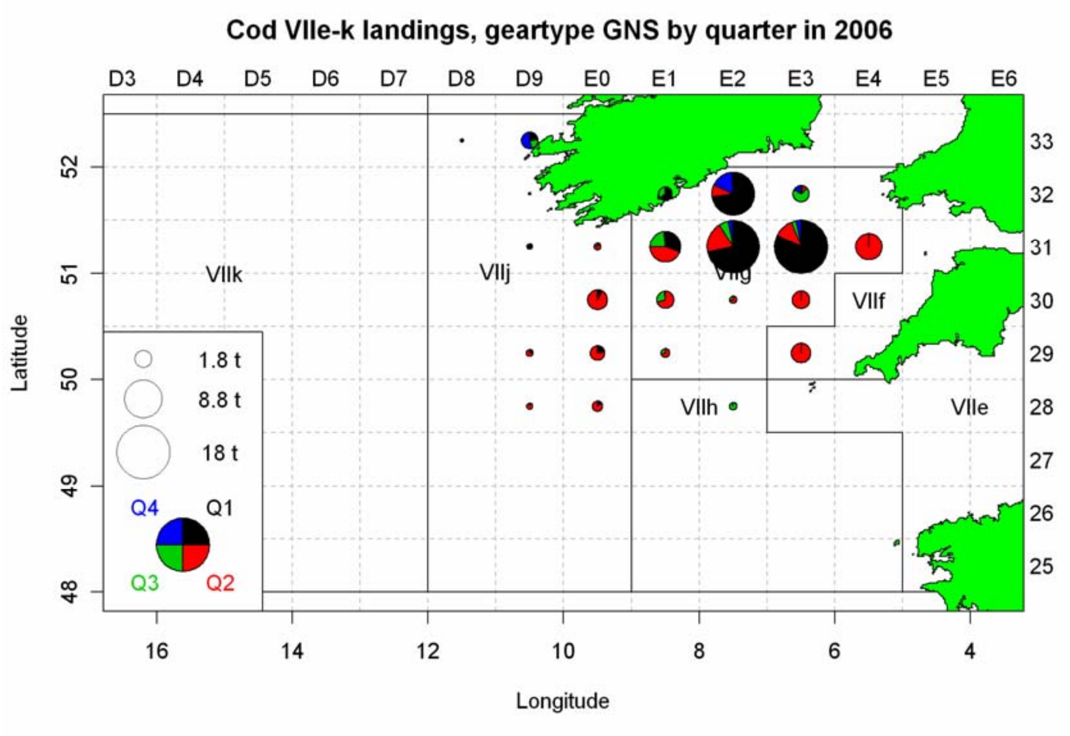
COD FR OTB 2006

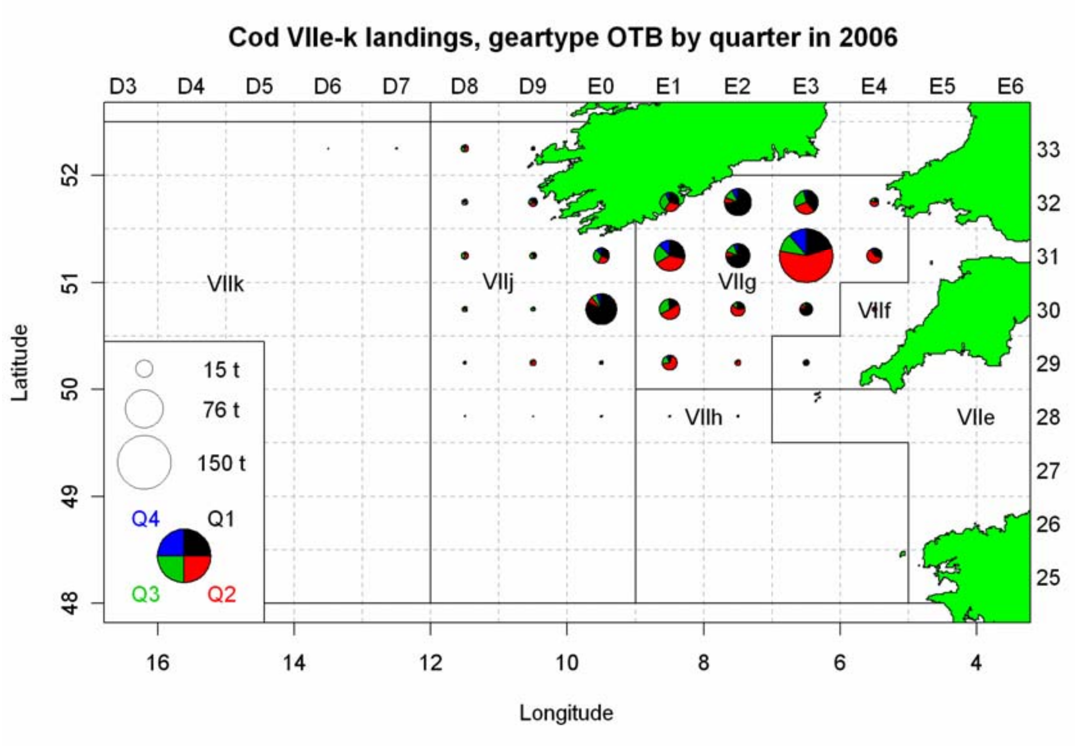


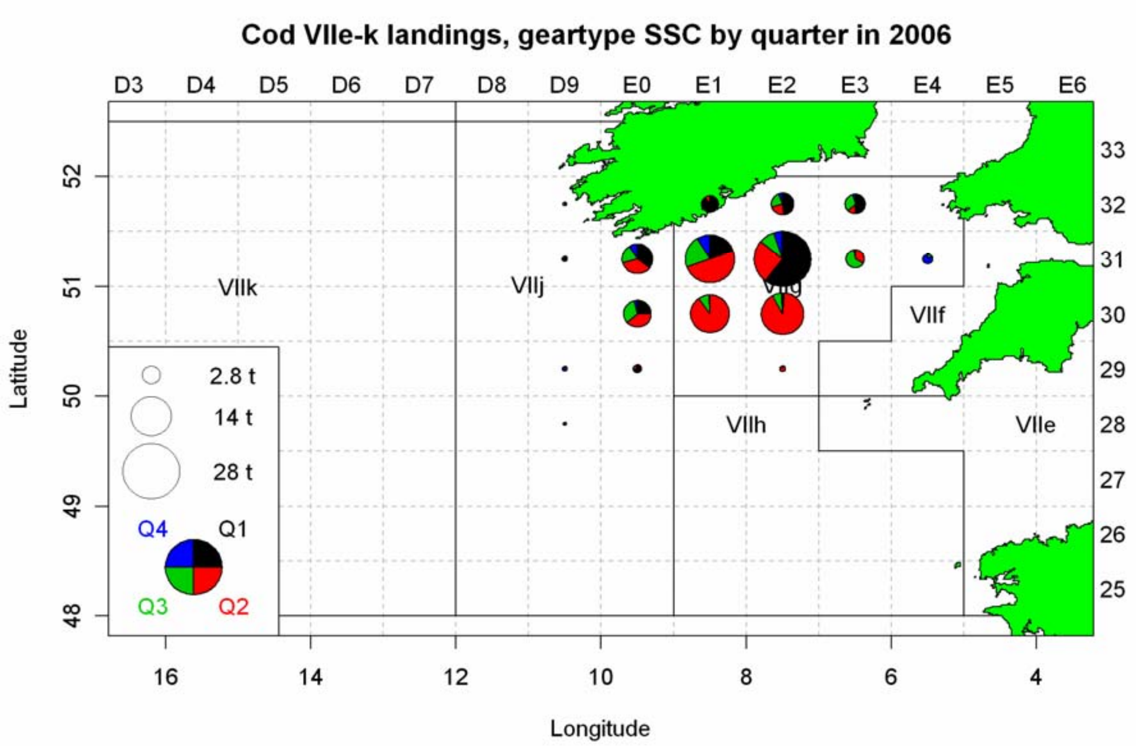
COD FR OTT 2006

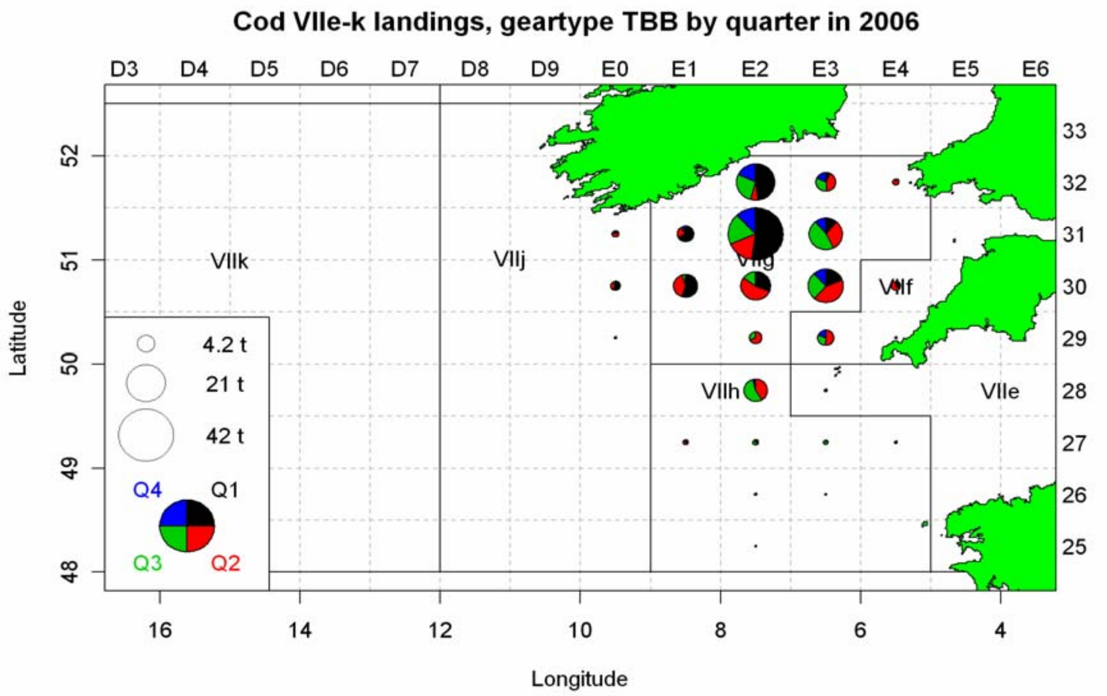


IRISH landings





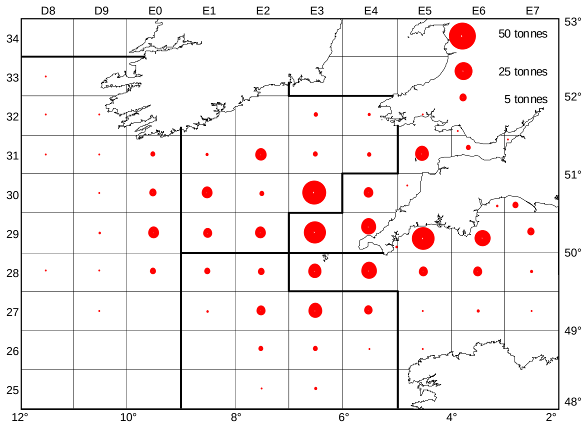

Cod VIIe-k landings, geartype SSC by quarter in 2006
D3 D4 D5 D6 D7 D8 D9 E0 E1 E2 E3 E4 E5 E6
33 32 31 30 29 28 27 26 25
52 51 50 49 48
16 14 12 10 8 6 4
VIIk
VIIj
VIIg
VIIf
VIIh
VIIe
2.8 t
14 t
28 t
Q4 Q1 Q3 Q2
Latitude
Longitude

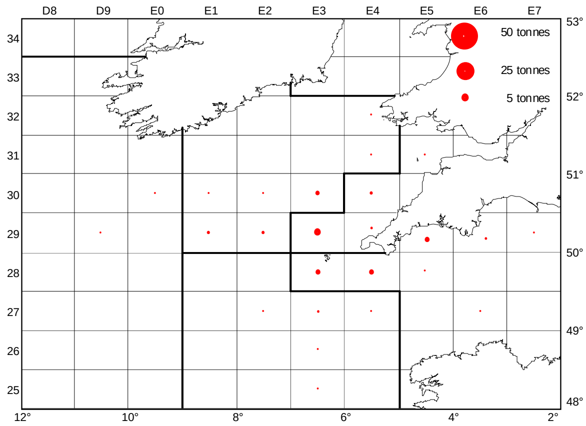

Cod VIIe-k landings, geartype TBB by quarter in 2006
D3 D4 D5 D6 D7 D8 D9 E0 E1 E2 E3 E4 E5 E6
33 32 31 30 29 28 27 26 25
52 51 50 49 48
16 14 12 10 8 6 4
VIIk
VIIj
VIIg
VIIf
VIIh
VIIe
4.2 t
21 t
42 t
Q4 Q1 Q3 Q2
Latitude
Longitude

2007 WORKING GROUP PREPARATION **LANDINGS BY ICES RECTANGLE**

STOCK : VIIe-k Cod **YEAR :** 2006

COUNTRY : (UK England and Wales)





Total UK (E+W) Landings 353.71 tonnes **Total UK Landings by Sampled Vessels 20.80 tonnes**

UK Vessels landing into England and Wales

Table below shows the contribution of the main gears to quarterly French landings in 2006. Clearly the main gears are otter trawl and twin trawl. Some small landings from bottom line in VIIe and gillnet in VIIj occurs.

Cod in ICES Divisions VII e-k						
Fishing year 2006						
Total French landings, tonnes(live weight) by gear						
		VIIe				
Description	Fishery	Q1	Q2	Q3	Q4	Year 2006
Otter trawl	OTB	40.36	69.269	167.564	67.367	344.56
Twin trawl	OTT	2.467	3.173	3.07	3.455	12.165
Bottom line	LLS	3.658	1.141	7.74	4.107	16.646
Gill net	GNS	0.682	1.237	0.547	0.368	2.834
Tramel	GTR	0.47	1.278	0.73	0.736	3.214
Otter trawl (2 boats)	PTB		1.358			1.358
Purse seine	PS1	0.957	0.746		0.545	2.248
Other gears	Other gears	0.384	0.963	0.239	0.502	2.088
	Grand Total	48.978	79.165	179.89	77.08	385.113
		VIIf				
Description	Fishery	Q1	Q2	Q3	Q4	Year 2006
Otter trawl	OTB	30.946	54.582	91.915	67.726	245.169
Twin trawl	OTT	3.922	4.378	10.829	3.779	22.908
Beam trawl	TBB	0.343		0.788	1.294	2.425
Other gears	Other gears	0	0.216	0.219	0.01	0.445
	Grand Total	35.211	59.176	103.751	72.809	270.947
		VIIg				
Description	Fishery	Q1	Q2	Q3	Q4	Year 2006
Otter trawl	OTB	181.001	139.781	179.157	96.522	596.461
Twin trawl	OTT	64.678	94.321	94.395	54.312	307.706
Gill net	GNS		0.58			0.58
Tramel	GTR				0.769	0.769
Other gears	Other gears	0.41	0.461	0.353	0.343	1.567
	Grand Total	246.089	235.143	273.905	151.946	907.083
		VIIh				
Description	Fishery	Q1	Q2	Q3	Q4	Year 2006
Otter trawl	OTB	15.778	74.915	39.65	18.203	148.546
Twin trawl	OTT	7.832	50.924	43.305	21.348	123.409
Bottom line	LLS		0.902			0.902
Gill net	GNS		0.653	0.291	0.085	1.029
Tramel	GTR	0.469	0.636	1.198	2.375	4.678
Other gears	Other gears	0.244	0.171	0.25	0.26	0.925
	Grand Total	24.323	128.201	84.694	42.271	279.489
		VIIj				
Description	Fishery	Q1	Q2	Q3	Q4	Year 2006
Otter trawl	OTB	1.774	2.741	7.934	6.12	18.569
Twin trawl	OTT	0.114	0.3	2.222	5.275	7.911
Gill net	GNS		10.401	8.733		19.134
Other gears	Other gears	0	0.068	0.036	0	0.104
	Grand Total	1.888	13.51	18.925	11.395	45.718
		VIIk				
Description	Fishery	Q1	Q2	Q3	Q4	Year 2006
Otter trawl	OTB	0.007	0.005			0.012
Twin trawl	OTT	0.003				0.003
Gill net	GNS			0.36		0.36
Other gears	Other gears	0	0	0	0	0
	Grand Total	0.01	0.005	0.36	0	0.375

Annex II : Definition of the French métiers in the Western Approaches.

Area : Celtic Sea (Sub-Area VII – VIIa,d)

Gear : Otter Trawl

No	Species	Thresholds
1	Anglerfish + Megrim + Cuckoo Ray	20%
2	All Gadoids	40%
3	Nephrops	10%

Métier	> Threshold	Label	Fishery-Unit
FU04	1	'pure' Benthic Species	FU04
FU05a	2	'pure' Gadoids	FU05
FU08a	3	'pure' Nephrops	FU08
FU05b	none	Others	FU05
FU05c	1+2	'mixed' Benthic + Gadoids	FU05
FU08b	3 + 1	'mixed' Nephrops + Benthic	FU08
FU08c	3 + 2	'mixed' Nephrops + Gadoids	FU08
FU08d	3 + 1 + 2	'mixed' Nephrops + Benthic + Gadoids	FU08

Gear : Gill Nets

No	Species	Thresholds
1	Anglerfish	30%
2	Hake	30%
3	Sole	30%
4	Albacore	20%

Métier	> Threshold	Label	Fishery-Unit
FU03a	1	'pure' Anglerfish	FU03
FU03b	2	'pure' Hake	FU03
FU03c	3	'pure' Sole	FU03
FU03d	none	Others	FU03
FU03e	1+2+3	Mixed demersal	FU03
FU03f	4	'pure' Albacore	FU03

Gear : Pelagic Trawls

No	Species	Thresholds
1	Anchovy + Sardine	50%
2	Albacore	20%
3	Mackerel	50%

Métier	> Threshold	Label	Fishery-Unit
FUPM01	1	Small Pelagics	
FUPM02	2	Albacore	
FUPM03	3	Mackerel	
FUPM04	none	Others	

The FR-NEPHROPS fleet used in assessments of cod, whiting is the FU08, the FR-GADOID is FU05a.

Table below shows the French landings updated since 1999 and provisional data for 2006 by ICES Division.

06 april 2007 RB from cumulmareeHarmonie

Cod	**France**	**1999 updated data**			
Landings					
Tonnes live w	**Q1**	**Q2**	**Q3**	**Q4**	**1999**
VIIb	30.5	1.6	3.5	12.8	48.4
VIIc	1.8	0.5	1.8	1.6	5.7
VIIe	80.6	151.7	291.2	134.7	658.2
VIIf	753.7	134.3	65.1	49.6	1002.8
VIIg	1279.4	735.4	679.6	393.8	3088.2
VIIh	88.1	256.2	205.1	104.6	654.0
VIIj	12.6	19.1	34.1	18.5	84.2
VIIk	0.0	0.1	0.4	0.1	0.5

Cod	**France**	**2003 updated data**			
Landings					
Tonnes live w	**Q1**	**Q2**	**Q3**	**Q4**	**2003**
VIIb	10.3	14.8	9.3	1.9	36.3
VIIc	0.1	0.6	0.6	0.2	1.6
VIIe	108.4	180.5	263.5	85.4	637.7
VIIf	540.1	99.0	64.2	23.8	727.2
VIIg	1311.4	776.8	674.2	272.0	3034.4
VIIh	72.1	435.4	200.2	40.1	747.8
VIIj	7.8	27.5	19.6	19.6	74.6
VIIk	0.0	0.1	0.1	0.0	0.1

Cod	**France**	**2000 updated data**			
Landings					
Tonnes live w	**Q1**	**Q2**	**Q3**	**Q4**	**2000**
VIIb	4.4	6.5	12.2	7.7	30.8
VIIc	0.2	2.8	2.2	5.7	10.8
VIIe	59.9	151.7	195.0	142.6	549.3
VIIf	517.6	59.6	72.3	72.9	722.5
VIIg	835.6	465.8	629.3	422.4	2353.2
VIIh	43.3	278.7	195.1	61.8	579.0
VIIj	8.6	16.8	34.1	17.5	77.0
VIIk	0.0	0.1	0.2	0.1	0.4

Cod	**France**	**2004 updated data**			
Landings					
Tonnes live w	**Q1**	**Q2**	**Q3**	**Q4**	**2004**
VIIb	3.4	5.0	0.4	2.7	11.5
VIIc	1.4	0.3	2.9	1.6	6.2
VIIe	47.1	51.2	55.3	55.3	208.8
VIIf	220.6	55.4	33.2	28.9	338.1
VIIg	634.7	308.6	324.6	172.9	1440.8
VIIh	42.7	203.3	111.9	55.6	413.6
VIIj	2.5	9.5	4.7	6.1	22.8
VIIk	0.0	0.2	0.1	0.0	0.3

Cod	**France**	**2001 updated data**			
Landings					
Tonnes live w	**Q1**	**Q2**	**Q3**	**Q4**	**2001**
VIIb	3.3	10.5	6.5	5.1	25.4
VIIc	2.7	3.6	1.7	3.3	11.3
VIIe	97.9	143.1	190.9	160.7	592.6
VIIf	464.6	146.9	214.2	165.3	991.1
VIIg	972.1	817.6	772.4	775.4	3337.5
VIIh	58.8	447.6	312.2	115.1	933.6
VIIj	19.2	63.8	62.8	30.7	176.4
VIIk	0.0	0.3	0.9	0.0	1.2

Cod	**France**	**2005 updated data**			
Landings					
Tonnes live w	**Q1**	**Q2**	**Q3**	**Q4**	**2005**
VIIb	0.3	1.9	1.6	2.1	6.0
VIIc	0.0	1.6	0.7	0.2	2.6
VIIe	57.7	60.2	93.5	64.2	275.7
VIIf	39.6	86.2	83.0	48.4	257.2
VIIg	212.8	223.1	236.4	175.0	847.3
VIIh	37.7	107.9	76.5	52.5	274.6
VIIj	2.8	9.9	12.4	5.9	31.0
VIIk	0.0	0.1	0.1	0.0	0.2

Cod	**France**	**2002 updated data**			
Landings					
Tonnes live w	**Q1**	**Q2**	**Q3**	**Q4**	**2002**
VIIb	13.8	17.2	9.2	4.0	44.2
VIIc	3.3	1.4	0.4	1.7	6.7
VIIe	99.7	192.9	290.0	84.0	666.7
VIIf	1481.9	386.4	113.4	56.6	2038.3
VIIg	818.4	1497.3	1051.7	337.2	3704.6
VIIh	51.1	485.9	298.5	48.5	884.0
VIIj	16.9	76.6	86.1	14.1	193.6
VIIk	0.0	1.3	0.2	0.0	1.5

Cod	**France**	**2006 provisional data**			
Landings					
Tonnes live w	**Q1**	**Q2**	**Q3**	**Q4**	**2006**
VIIb	0.3	3.5	1.4	1.1	6.4
VIIc	0.0	1.0	0.5	1.4	2.9
VIIe	49.0	79.2	179.9	77.1	385.1
VIIf	35.2	59.2	103.8	72.8	270.9
VIIg	246.1	235.1	273.9	151.9	907.1
VIIh	24.3	128.2	84.7	42.3	279.5
VIIj	1.9	13.5	18.9	11.4	45.7
VIIk	0.0	0.0	0.4	0.0	0.4

Table below shows the Irish landings 2005 updated and 2006 by fishery and ICES Division. Misreporting have been input in VIIg. Quarterly landings are shown on maps.

The Marine Institute, Fisheries Science Services, Galway, Ireland

Working Group Southern Shelf Demersal Stocks 2007
COD in ICES Divisions VIIe-k
REVISED Irish Landings (live weight, tonnes)

Fishing Year 2005
(All gears, Irish vessels landing into Irish and Foreign Ports)

FSS_SpeciesName	**Cod**
Landing Year	**2005**
Landing Quarter	**(All)**

Sum of Est Tonnes Live	Division						
GearType	VIIe	VIIf	VIIg	VIIh	VIIj	VIIk	Grand Tc
FPO - Pots			0.0301		0.1416		0.17169
GND - Gillnets (Drift)					0.1062		0.1062
GNS - Gillnets (Set)		1.0349	90.987	0.1959	3.7017		95.9198
LHP - Hooks and lines Hand lines and pole lines (hand operated)					0.3009		0.3009
OTB - Bottom Otter Trawls		5.4929	333.66	1.2673	49.466	0.4449	390.331
OTM - Mid-water Otter Trawls			0.2773				0.2773
PTB - Bottom Pair Trawls			1.3865				1.3865
PTM - Mid-water Pair Trawls					0.328	0.0295	0.35754
SSC - Scottish Seines (Fly-dragging)			74.265		20.482		94.7468
TBB - Beam Trawls	0.1245	3.625	138.42	19.543	5.5578		167.268
U10-Under 10s			18.585				18.585
SPR - Pair seines		0.3634	16.485				16.848
PS - Purse Seines			0.5263				0.52628
Grand Total	0.1245	10.516	674.62	21.006	80.083	0.4744	786.825

		Q1	Q2	Q3	Q4	Total
Possibly misreported into VIIa	GNS - G	46.191	4.8203		0.0207	51.032

The Marine Institute, Fisheries Science Services, Galway, Ireland

Working Group Southern Shelf Demersal Stocks 2007
COD in ICES Divisions VIIe-k
Irish Landings (live weight, tonnes)

Fishing Year 2006
(All gears, Irish vessels landing into Irish and Foreign Ports)

1.01828

FSS_SpeciesName	**Cod**
Landing Year	**2006**
Landing Quarter	**(All)**

Sum of Est Tonnes Live	Division						
GearType	VIIe	VIIf	VIIg	VIIh	VIIj	VIIk	Grand Tc
DRB - Dredges			0.1416				0.1416
GNS - Gillnets (Set)		2.77536	68.5628	0.41536	7.8618		79.6153
GTR - Trammel Nets					0.0325		0.03245
OTB - Bottom Otter Trawls		2.906532	422.619	0.56168	48.678	0.1947	474.959
OTM - Mid-water Otter Trawls			2.11596				2.11596
PTB - Bottom Pair Trawls			0.85807		0.1446		1.00262
PTM - Mid-water Pair Trawls			0.98294		0.0472		1.03014
SSC - Scottish Seines (Fly-dragging)			102.232		19.668		121.9
TBB - Beam Trawls	0.109976	5.921099	147.236	8.349058	3.0207		164.636
U10-Under 10s			9.44				9.44
Grand Total	0.109976	11.602991	754.187	9.326098	79.453	0.1947	854.874

Possuble Misreported into VIIa					
GNS - Gillnets (Set)	95.7157	4.88756	1.89036	0.52274	103.02

Table below shows the UK landings by fishery in VII e-k in 2006

2007 WORKING GROUP PREPARATION : **GENERAL INFORMATION ON FISHING**

STOCK : **VIIe-k Cod** **YEAR :** **2006**

COUNTRY : **UK (ENGLAND & WALES)**

LANDINGS BY UK VESSELS - BY COUNTRY OF LANDING (tonnes)

VESSEL NATIONALITY	COUNTRY OF LANDING	Q1	Q2	Q3	Q4	ANNUAL
UK	England & Wales	82.742	87.553	106.928	76.482	353.705
England & Wales	Spain	0.369	3.461	4.684	0.437	8.951
England & Wales	France	1.375	0.932	0.326	0.066	2.699
England & Wales	Ireland	1.633	0.000	0.000	0.000	1.633
England & Wales	Netherlands	0.000	0.000	0.006	0.000	0.006
	TOTAL	86.119	91.946	111.944	76.985	366.994

TAC for 2006 5580 **tonnes**
(VII b-k,VIII, IX, X Cod)

TAC for 2007 4185 **tonnes**
(VII b-k,VIII, IX, X Cod)

UK (E&W) quota 689 **tonnes**
(VII b-k,VIII, IX, X Cod)

UK (E&W) quota 533 **tonnes**
(VII b-k,VIII, IX, X Cod)

UK (E+W) quotas are current 'post swap' levels.

LANDINGS BY UK VESSELS INTO ENGLAND & WALES - BY GEAR GROUP (tonnes)

GEAR GROUP	Q1	Q2	Q3	Q4	ANNUAL
Beam Trawl	18.726	22.449	29.494	21.513	92.182
All bar beam Trawl	64.016	65.104	77.434	54.969	261.523
All gears	82.742	87.553	106.928	76.482	353.705

Table below shows the Belgian landings by Division in VII e-k in 2006

Belgium	**2006**	**Kg live weight**				
div	espece	Q1	Q2	Q3	Q4	Year
	Gadus morhua					
VIIe	Gadus morhua	940	2343	723	517	4523
VIIf	Gadus morhua	16298	31520	936	3632	52386
VIIg	Gadus morhua	13424	11250	8916	11358	44948
VIIh	Gadus morhua	38	1055	328		1421
VIIj	Gadus morhua					0
VIIk	Gadus morhua					0
VIIIa	Gadus morhua			57		57
VIIIb	Gadus morhua		26			26
						0
VIIfgh	Gadus morhua	29760	43824	10180	14990	98755
VII jk	Gadus morhua	0	0	0	0	0
VII e-k	Gadus morhua	30701	46193	10960	15507	**103361**

Age and length composition and mean weight at age

A full revision of French data back to 1983 has been carried out in 2003-2004 but using the new French database in 2007, a full revision has been also carried out since 1999 which entailed a revision of VIIe-k catch numbers at aage and mean weights at age since then.

WG SSDS 2005:

Data available:

UK:

Quarterly landings by ICES Division

Quarterly and annual length composition (1 cm class) by gear group (otter and beam trawlers) in VII e-k.

Quarterly ALKs in VII e-k (5cm class)

Quarterly age compositions and mean weights at age by gear group and total in VII e-k

Ireland:

Quarterly landings by ICES Division

Quarterly ALKs in VII g, j (1 cm class)

Quarterly length and age compositions and mean weights at age for Otter (single + twin-rig) trawlers in VIIg

Semester 1 and quarter 3,4 length and age compositions and mean weights at age for Beam trawlers in VIIg

Quarter 2 length and age compositions and mean weights at age for Scottish seiners in VIIg

Semester 1, 2 length and age compositions and mean weights at age for Otter(single + twin-rig) trawlers in VIIj

Semester 1 length and age composition and mean weights at age for Scottish seiners in VIIj

France:

Quarterly landings by ICES Division

Quarterly ALKs in VII f,g (1cm class)

Quarterly length and age compositions and mean weights at age for Gadoid trawlers in VII f-h

Quarterly length and age compositions and mean weights at age for Nephrops trawlers in VII f-h

Quarterly length and age compositions and mean weights at age for French landings from VII f-h

Belgium:

Quarterly landings by ICES Division

Aggregation of data to estimate length and age compositions and mean weights at ages for year 2004

The series of FR-GADOID and FR-NEPHROPS reflect the high grading since 2003.

French sampling for length and age is lower in 2004 as a consequence of high grading (boxes of smaller category scarce)

[In 2004, French quarterly age and length compositions and mean weights at age of the landings from French gadoid and *Nephrops* fisheries were available for Divisions VIIf,g,h. Ireland provided data per quarter for Division VIIg, and per semester for Division VIIj (due to poor sampling by quarter). The UK provided quarterly age and length compositions, and mean weights at age for the landings in area VIIe-k. Quarterly landing data have been provided by Belgium.

The raising procedure was as follows. First, quarterly French data for VIIf,g,h were combined with quarterly Irish data for Division VIIg. These were raised to the total VIIf,g,h landings of France, Ireland and Belgium. Secondly, Irish data from VIIj were raised per semester to the total Irish landings from VIIj,k (VIIg landings were 65% of VIIj,k landings). The VIIj,k Irish data were raised per semester to the total VIIj,k landings from France, Ireland and Belgium in VIIj,k. Thirdly the quarterly data from VIIf,g,h, the data per semester from VIIj,k and quarterly UK data from VIIe-k were been combined. VIIj,k data from the 1st semester were added to the 1st quarter data, and VIIj,k data from the 2nd semester were added to the 3rd quarter data. Results have been quarterly raised to the International landings from VIIe-k.

At each step, quarterly mean weights at ages have been weighted by numbers caught]

<u>Irish data 2004</u>: because of poor sampling in some quarters, data have been provided by quarter or semester depending on fleets sampled (OT= single and twin-rig otter trawlers, BT= beam trawlers, SSC= Scottish seiners). See ICES files for the raising to Irish landings in VIIg and VIIj and VII jk summarized in table below.

Area	Data available	Derivation
VIIg	Q1 OT+ Q1-2 BT	raised to Q1 landings in VIIg
	Q2 OT+ Q2SSC	raised to Q2 landings in VIIg
	Q3 OT + Q3 BT	raised to Q3 landings in VIIg
	Q4 OT+ Q4 BT	raised to Q4 landing in VIIg
VIIj	Q1&2 OT + Q1&2 SSC	raised to Q1 + Q2 landings in VII j and in VIIj,k
to VIIjk	Q3&4 OT	Raised to Q3+ Q4 landings in VII j and in VIIj,k

Aggregation of data:

Data source

Division	Data	UK	France	Ireland	Derivation of international landings
VII f,g,h	Length composition		VII f,g,h	VII g	(FR+IRL) raised to international landings except UK
	ALK		VII f,g,h	VII g	
	Age composition		VII f,g,h	VII g	(FR+IRL) raised to international landings except UK
	Mean weight at age		VII f,g,h	VII g	Weighted mean by numbers caught
VII j,k	Length composition			VII j	IRL raised to international landings except UK
	ALK			VII j	
	Age composition			VII j	IRL raised to international landings except UK
	Mean weight at age			VII j	IRL VIIj
VII e-k	Length composition	VIIe-k			(VIIfgh+VIIjk+ UK) raised to international landings
	ALK	VIIe-k			
	Age composition	VIIe-k			(VIIfgh+VIIjk+ UK) raised to international landings
	Mean weight at age	VIIe-k			Weighted mean by numbers caught

[Stock weights were calculated from the 1st quarter catch weights. For some older ages, catch weight at age in 1st quarter are sometimes higher than 2nd quarter weights (before and after spawning). When this was the case, the value from the 2nd quarter was set as the stock weight for that at age.]

WG SSGS 2004:

In 2004, the use of the French Fisheries Databases, which provide landings and/or effort data by Divisions, has shown that there are small discrepancies between French landings data used previously and new estimates for some years in the past. Some landings data have been revised upwards, some others have been revised downwards. As the old database was not usable any more, and no information was available to explain why there are some revisions downwards, it has been decided to use the information from recent databases for years as far back as possible. A revision of French and international data in terms of catch numbers at age and mean weights at age has been carried out back to 1988.

The table below shows the data source and the procedures used this year to derive 2003 quarterly length compositions, age compositions and mean weights at age.

Data source

Division	Data	UK	France	Ireland	Derivation of international landings
VII f,g,h	Length composition		VII f,g,h	VII g	(FR+IRL) raised to international landings except UK
	ALK		VII f,g,h	VII g	
	Age composition		VII f,g,h	VII g	(FR+IRL) raised to international landings except UK
	Mean weight at age		VII f,g,h	VII g	Weighted mean by numbers caught
VII j,k	Length composition			VII j	IRL raised to international landings except UK
	ALK			VII j	

	Age composition		VII j	IRL raised to international landings except UK
	Mean weight at age		VII j	IRL VIIj
VII e-k	Length composition	VIIe-k		(VIIfgh+VIIjk+ UK) raised to international landings
	ALK	VIIe-k		
	Age composition	VIIe-k		(VIIfgh+VIIjk+ UK) raised to international landings
	Mean weight at age	VIIe-k		Weighted mean by numbers caught

Derivation of mean weights at age

The mean weights at age in the catch were derived by combining VIIfgh and VIIjk and UK (VIIe-k) data weighted by numbers caught at age (Table 4.1.5). Mean weights at age in the stock were derived by combining VIIfgh, VIIjk and UK data of 1st quarter and also 2nd quarter for some older ages generally included in the +group (Table 4.1.6). The series of catch numbers, catch weights and stock weights at age for each area or combination are available in the ICES file.

2005 and 2006 Derivation of catch numbers at age and mean weights at age WG SSDS 2007

Quarterly data available

France VII e-k

UK VII e-k

Ireland VII-k

Below is the table for 2005 updated. For the series 1999-2006, Excel tables are in ICES file of WG SSDS 2007.

UK + Jers+Guern+Scotl =		308.950				2005	COD		Revise le 31 mai 2007 RB	
VII e-k	Q1	Q2	Q3	Q4	total					
Tonnes	86.713	62.739	84.188	75.310	308.950		updated 01/06/07 in Q3			
live weight	Q1		Q2		Q3		Q4		ANNUAL	2005
AGE	Number	Weight	Number	Weight	Number	Weight	Number	Weight	NOS	WT
0	0	0.000	0	0.000	0	0.000	0	0.000	0	
1	0	0.000	1479	0.777	5404	0.835	8938	1.042	15822	0.947
2	19137	1.895	19383	2.116	19826	2.669	14565	3.456	72910	2.476
3	3847	5.178	925	5.004	1585	5.428	270	5.660	6627	5.233
4	826	7.511	989	7.583	1110	7.767	1047	8.173	3972	7.775
5	1500	9.975	323	9.293	484	10.475	376	9.780	2683	9.956
6	717	11.917	287	11.166	268	10.461	52	12.063	1324	11.465
7	54	15.133	216	10.433	150	11.001	120	10.613	541	11.102
8	0	0.000	0	0.000	0	0.000	0	0.000	0	
9	0	0.000	0	0.000	0	0.000	0	0.000	0	
10	0	0.000	0	0.000	0	0.000	0	0.000	0	
Total	26082		23601		28828		25368		103879	
SOP		86.712		62.740		84.189		75.310		308.951
Landings	86.713		62.739		84.188		75.31		308.95	

France VII e-k						tonnes	COD	2005	Revise le 15 juin 2007 RB	
Landings	Q1	Q2	Q3	Q4	total	live weight				
France	350.6	487.5	501.8	346	1685.9	updated 15/06/2007				
Total	350.6	487.5	501.8	346	1685.9					
	Q1		Q2		Q3		Q4		Year 2005	
Age	Number	Weight	Number	Weight	Number	Weight	Number	Weight	NOS	WT
0									0	
1	0	0.000	8565	0.613	16394	0.851	9949	1.373	34908	0.941
2	69905	1.640	114968	2.069	107080	2.657	64286	3.316	356239	2.387
3	17856	4.453	14457	5.120	6514	5.711	5064	6.687	43891	5.117
4	5769	6.336	3835	7.476	6807	8.263	3417	9.303	19827	7.729
5	9451	9.611	12031	9.666	6809	9.818	3617	10.902	31908	9.822
6	2484	11.690	2039	12.478	2724	12.044	875	12.055	8122	12.046
7	0	0.000	0	0.000	613	11.012	0	0.000	613	11.012
8	0	0.000	0	0.000	0	0.000	156	13.798	156	13.798
9	0	0.000	0	0.000	224	15.550	127	10.841	351	13.851
10										
Tot	105465		155895		147164		87490		496014	
SOP		350.6		487.5		501.800		346		1685.9
Landings	350.6		487.5		501.8		346		1685.9	1

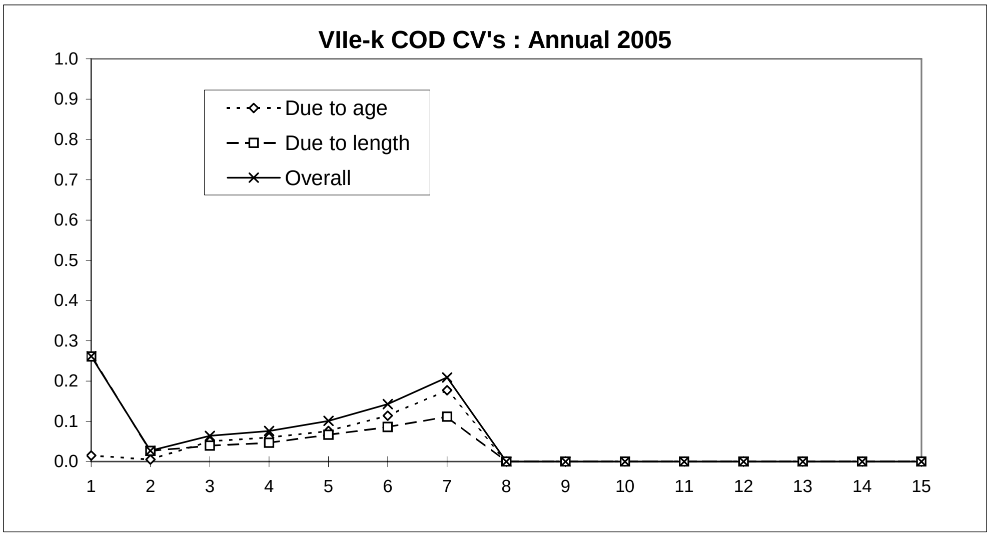
IRL VII e-k						tonnes	COD	2005	Revise le 15 juin 2007 RB	
Landings	Q1	Q2	Q3	Q4	Total	live weight				
IRL	236.48	295.69	169.19	168.81	870.1766249	updated 15/06/07				
Total	236.483	295.692	169.188	168.814	870.177	misreported in VIIa input				
	Quarter 1		Quarter 2		Quarter 3		Quarter 4		Year 2005	
Age	Numbers	Weight (kg)	Numbers	Weight (kg)	Numbers	Weight (kg)	Numbers	Weight (kg)	Numbers	Weight (kg)
0									0	
1	6051	0.588	19325	0.591	69095	0.713	101331	0.759	195802	0.721
2	34969	1.661	83275	1.533	29558	1.770	26883	2.024	174685	1.674
3	28864	3.715	36300	2.461	8330	3.532	4882	4.160	78377	3.143
4	7283	5.482	11984	3.495	4108	6.271	1807	6.704	25181	4.753
5	3174	6.956	3342	5.510	1097	8.132	452	8.768	8065	6.618
6	454	8.631	323	8.160	371	8.971	113	8.933	1261	8.638
7	154	10.208	519	7.852	17	8.044	15	7.887	706	8.373
8	10	9.105	33	9.107	3	9.097	1	9.097	48	9.106
9	0	0.000							0	0.000
10	0	0.000							0	0.000
Tot	80961		155100		112580		135483		484125	
SOP		236.4829201		295.6915219		169.1880916		168.8140912		870.1766249
Landings	236.4829201		295.6915219		169.19		168.814		870.1766249	1

FR highgrading included at the end														
International VIIe-k		2005				tonnes	COD		UK VII ek + IRL VIIe-k+		Calcul Hg VII e-k			
Landings	Q1	Q2	Q3	Q4	Total	live weight			FR VIIe-k raised to		voir fichier			
UK	86.713	62.739	84.188	75.310	308.95		updated 01/06/07		Internat VII e-k		fr VII fgh 05 rev 22 mai 2007 high grading input.xls			
Irlande	236.48	295.69	169.19	168.81	870.177		updated 15/06/07							
France	350.6	487.5	501.8	346	1685.9		updated 01/06/07							
Belgium	108.941	48.332	10.995	17.631	185.899		updated 06/06/06, no revision in 2007							
Total	782.737	894.263	766.171	607.755	3050.926								VII ek international	
Total (pb jk)											Highgrading Fr VII e-k		Fr high grading added	
	Quarter 1		Quarter 2		Quarter 3		Quarter 4		Year 2005		Year 2005		Year 2005	
Age	Numbers	Weight (kg)	Numbers	Weight (kg)	Numbers	Weight (kg)	Numbers	Weight (kg)	Numbers	Weight (kg)	Numbers	Weight (kg)	Numbers	Weight (kg)
0									0					
1	7030	0.588	31047	0.607	92217	0.745	123809	0.831	254102	0.766	43511	0.833	297613	0.775
2	144061	1.685	230059	1.868	158742	2.491	108893	3.007	641755	2.174	39080	1.049	680835	2.110
3	58743	4.087	54635	3.250	16668	4.579	10521	5.452	140568	3.922			140568	3.922
4	16122	5.958	17767	4.644	12200	7.537	6458	8.365	52547	6.176			52547	6.176
5	16410	9.053	16593	8.773	8512	9.635	4578	10.590	46092	9.213			46092	9.213
6	4247	11.354	2800	11.810	3412	11.578	1071	11.716	11530	11.565			11530	11.565
7	242	11.487	777	8.611	792	10.944	139	10.308	1951	10.036			1951	10.036
8	12	9.105	35	9.107	3	9.097	162	13.772	212	12.659			212	12.659
9	0		0		227	15.550	130	10.841	358	13.835			358	13.835
10	0		0		0		0		0				0	
Tot	246867		353713		292774		255761		1149115		82591		1231706	
SOP		782.7353092		894.2631432		766.1723536		607.7554279		3050.926234		77.229		3128.155
Landings	782.7369201		894.2625219		766.1710916		607.7550912		3050.925625	1.000000	77.229		3128.154625	

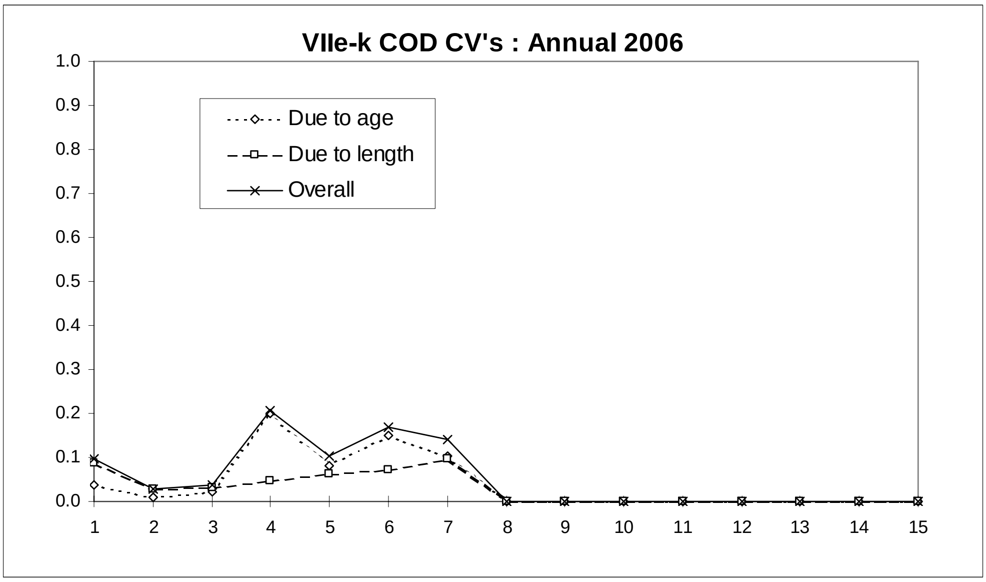
UK + Jers+Guern+Scotl =		**366.994**		**(MANQUE Jersey-Guernse**		**2006**	**COD**		**provisional 5**	**juin 2007**
VII e-k	**Q1**	**Q2**	**Q3**	**Q4**	**total**					
Tonnes	**86.119**	**91.946**	**111.944**	**76.985**	**366.994**					
live weight	**Q1**		**Q2**		**Q3**		**Q4**		**ANNUAL**	**2006**
AGE	**Number**	**Weight**	**Number**	**Weight**	**Number**	**Weight**	**Number**	**Weight**	**NOS**	**WT**
0	0	0.000	0	0.000	0	0.000	0	0.000	0	
1	0	0.000	1347	0.895	6678	1.049	9019	1.385	17044	1.215
2	12542	1.501	27078	1.836	25129	2.485	15631	3.104	80380	2.233
3	11999	4.337	6724	4.844	6468	5.202	1765	6.377	26956	4.805
4	1132	5.357	76	7.643	152	8.444	15	10.370	1374	5.879
5	361	8.875	384	9.595	438	8.946	469	9.404	1653	9.212
6	273	10.559	247	10.899	17	9.819	15	10.370	551	10.684
7	254	12.251	133	11.270	252	13.860	0	0.000	640	12.681
8	0	0.000	0	0.000	0	0.000	0	0.000	0	
9	0	0.000	0	0.000	0	0.000	0	0.000	0	
10	0	0.000	0	0.000	0	0.000	0	0.000	0	
Total	26561		35989		39134		26914		128598	
SOP		86.126		91.955		111.956		76.990		367.027
Landings	86.119		91.946		111.944		76.985		366.994	1.000089536
France VIIe-k						**tonnes**	**COD**	**2006**	**provisional 5**	**juin 2007**
Landings	**Q1**	**Q2**	**Q3**	**Q4**	**total**	**live weight**				
France	356.5	515.2	661.5	355.5	1888.7					
Total	**356.5**	**515.2**	**661.5**	**355.5**	**1888.7**					
	Q1		**Q2**		**Q3**		**Q4**		**Year 2006**	
Age	**Number**	**Weight**	**Number**	**Weight**	**Number**	**Weight**	**Number**	**Weight**	**NOS**	**WT**
0										
1	0	0.000	316	0.943	5462	1.128	50585	0.942	56363	0.960
2	25878	1.775	113693	1.952	172969	2.249	71361	2.764	383902	2.225
3	41788	4.469	36555	4.881	34782	5.344	10227	6.426	123351	5.000
4	4181	7.940	5522	7.726	3878	8.012	1786	8.922	15367	7.995
5	1725	9.422	3347	9.135	1845	9.769	896	11.557	7813	9.625
6	4591	11.492	2563	12.128	986	11.914	1503	12.360	9643	11.839
7	1320	11.292	817	12.580	1519	12.955	0	0.000	3656	12.271
8	524	12.822	0	0.000	0	0.000	0	0.000	524	12.822
9									0	
10									0	
Tot	**80008**		**162814**		**221440**		**136357**		**600620**	
SOP		**356.5**		**515.2**		**661.500**		**355.5**		**1888.7**
Landings	**356.5**		**515.2**		**661.5**		**355.5**		**1888.7**	1.00000000
IRL VII e-k						**tonnes**	**COD**	**2006**	**provisional 5**	**juin 2007**
Landings	**Q1**	**Q2**	**Q3**	**Q4**	**Total**	**live weight**				
IRL	400.9	328.101	155.512	73.378	957.891	mis reported in	put			
Total	**400.9**	**328.101**	**155.512**	**73.378**	**957.891**					
	Q1		**Q2**		**Q3**		**Q4**		**Year 2006**	
	Numbers	**Weight**	**Numbers**	**Weight**	**Numbers**	**Weight**	**Numbers**	**Weight**	**Numbers**	**Weight**
Age		**(kg)**		**(kg)**		**(kg)**		**(kg)**		**(kg)**
0	0	0.000	0	0.000	0	0.000	0	0.000	0	
1	3478	0.701	9517	0.521	52081	0.599	13885	0.825	78960	0.634
2	132432	1.206	92854	1.589	46310	1.812	12814	2.714	284411	1.497
3	45036	3.985	31768	4.454	6801	4.554	3760	5.347	87365	4.258
4	3959	5.988	1342	6.580	1033	6.829	569	7.151	6902	6.325
5	1841	8.270	1947	8.421	254	7.272	218	8.590	4259	8.296
6	1718	11.571	638	10.360	67	7.795	116	9.314	2539	11.064
7	25	8.406	12	14.295	0	0.000	0	0.000	37	10.276
8	25	9.714	164	12.685	0	0.000	0	0.000	189	12.297
9	0	0.000	0	0.000	0	0.000	0	0.000	0	
10	0	0.000	0	0.000	0	0.000	0	0.000	0	
Tot	**188513**		**138242**		**106546**		**31362**		**464662**	
SOP		**400.8699532**		**328.0258264**		**155.4959772**		**73.367**		**957.758**
Landings	**400.9**		**328.101**		**155.512**		**73.4**		**957.891**	**0.999861493**
No FR highgrading in 2006									**provisional 5**	**juin 2007**
International VIIe-k		**2006**				**tonnes**	**COD**			
Landings	**Q1**	**Q2**	**Q3**	**Q4**	**Total**	**live weight**				
UK	86.119	91.946	111.944	76.985	366.994					
Irlande	400.9	328.101	155.512	73.378	957.891					

Precision of the national catch at age

UK results


VIIe-k COD CV's : Annual 2005
Due to age
Due to length
Overall
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

UK results


VIIe-k COD CV's : Annual 2006
Due to age
Due to length
Overall
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

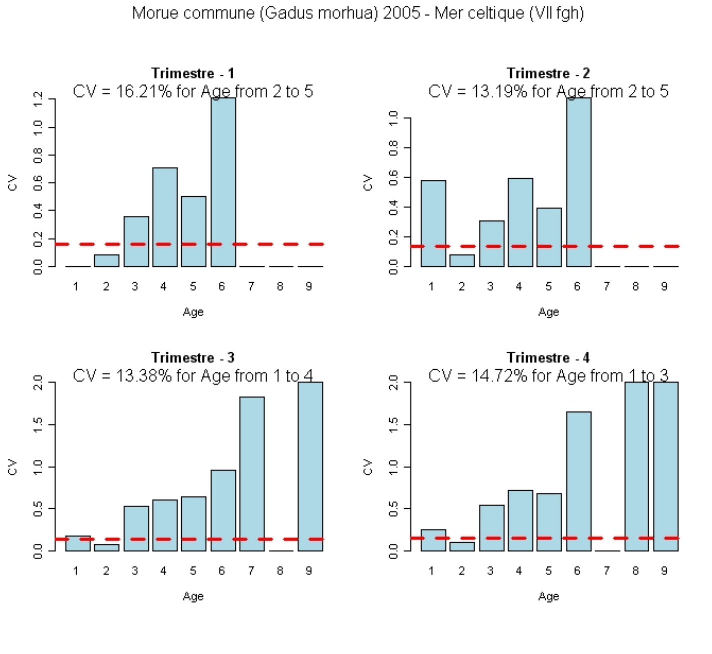


Figure 7 - Morue commune (Gadus morhua), 2005, Mer celtique (VII fgh) - Precision relative aux strucutres en âge

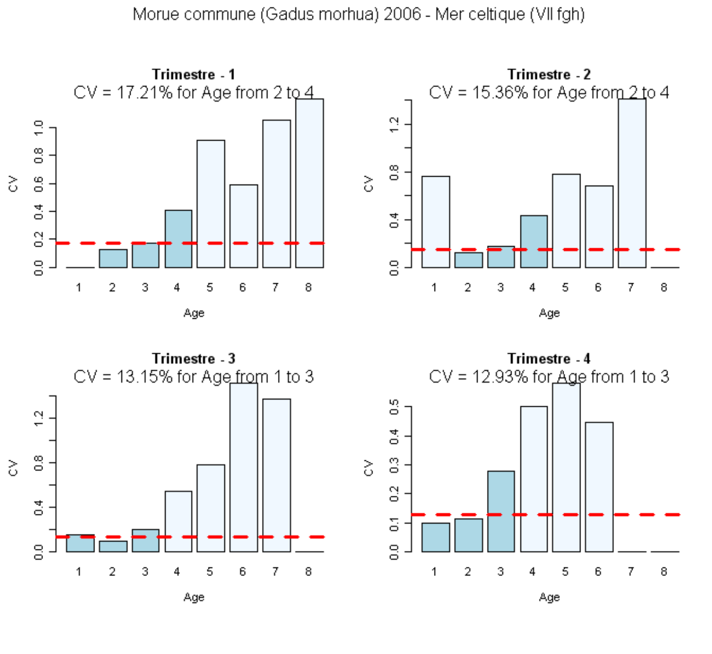


Figure 7 - Morue commune (Gadus morhua), 2006, Mer celtique (VII fgh) - Precision relative aux strucutres en âge

Figure 7 : CVs of French age compositions covering 99% of the catch numbers from VII fgh.

Maturity ogive

The combined sex maturity ogive used is based on data collected during the UK Westerly Groundfish Surveys in spring from 1996 up to 1999, as used since the 1999 SSDS Working Group (WD). It is applied to the full range of years and has replaced the previous assumed knife-edged ogive used in the past by the Irish Sea and celtic Sea Working Group.

Celtic Sea Cod Tagging Project.

In March 2007 the Marine Institute working in conjunction with the Irish South and East Fish Producer's Organisation started a project to tag and release cod working with boats from Dunmore East, Co. Waterford. The tagging concentrated on catching cod within an area known as the Celtic Sea Cod Box. This box is located south of Waterford, represented by ICES Rectangle 32E3, and is closed in the spring (1^{st} Feb – 31^{st} March) along with two other Rectangles (30E4, 31E4) North of Newlyn as part of the scheme to protect spawning cod in the Celtic Sea. No fishing is permitted within these boxes except for shellfish species and for pelagic species such as herring, mackerel etc during the closed period.

To date over 500 cod have been tagged and released in the area of the box. The cod tagged and released in the vicinity of the box ranged in size from 24 cm to 100 cm, with the majority being of the larger sizes (>50cm). To augment this work a further three days work was carried out in the estuary in Waterford where local fishermen reported an abundance of small cod. An extra 254 cod were captured, tagged and released in this inshore area. These cod were of a smaller size range with lengths ranging from 16cm to 47 cm with a mean length of 26cm.

To date we have received information from fishermen/processors for 17 recaptures (2.25%). Irish & French fishermen and processors as well as processors in Grimsby and Fleetwood have returned information on recaptured fish. All of the returns to date have come from the initial offshore survey. The majority of the recaptures have occurred close to the release site with the furthest south recaptured in ICES Rectangle 29E1. One recapture has been recorded in ICES Area VIIf (29E3) with the remaining recaptured in VIIg.

Local fishermen have reported a good run of cod in this area in the spring and as late as yesterday were still reporting a good sign of cod of all sizes in the Celtic Sea. Some fishermen have complained that, having exhausted their cod quota, they have had to move off some of their *Nephrops* grounds to avoid further incidental capture of cod.

Macdara Ó Cuaig 7^{th} July '07

Surveys indices

As previously, abundance indices have been calculated using geographical and depth stratifications, but the EVHOE indices for all species (cod, whiting, haddock) were slightly revised in 2005 according to minor modifications proposed by the 2005 IBTS Working Group. These modifications were the change of some geographical boundaries and the definition of a new geographical stratum. The proposed changes by the IBTS WG are applicable to the whole series.

Historical development of the area assessed:

In late 70's and upwards, this stock was assessed in the Irish Sea and Celtic Sea WG. The area assessed was VIIfg. ALKs and other biological parameters were from VIIa cod. Age reading for that stock in France began in 1980.

Up to 1992, assessment was carried out using Separable VPA and then Laurec-Shepherd software. The package with XSA was first used in 1993 and since then.

In 1994, the stock was extended to VIIh in order to account with catches mostly harvested in the north eastern par t of this Division.

In 1995, as a 1988-1995 series was available for Division VIIe, 2 separated assessments, one in VIIe and the other in VII fgh had shown that the trends of F, SSB and R were similar. Then the SSDS WG decided to incorporate VIIe in the area assessed as it was suggested by ACFM but because the series were different (VIIfgh from 1971 and VIIe from 1988), estimates of SSB and R from VIIfgh assessment were scaled to VIIe-h..

In 1996, the stock was extended to VIIe-k to take into account for the small catches from Divisions VIIje-k. Again, the SSB and R from the long series from VIIfgh were scaled to VIIe-k.

At SSDS WG 1999, in order to obtain a relatively consistent series of landings for the longest series as possible, it was decided to scale the available landings in VIIfgh to VIIe-k for the historical series 1971-1987. this avoid the tedious process of scaling SSB and R repeated year after year.

The extending of the area assessed has been supported by few biological data about the identity of the stock. In that period, there was some data from tagging which suggested that only a small component of cod landings from the Celtic Sea were fish which spawned in the Irish Sea and no cod tagged in the Celtic Sea were recaptured in the Irish Sea. There was no evidence of cod movement out of the Division VIIe. In 2007, tagging programs carried out by CEFAS and also the Marine Institute (see above) might provide some information on the current movements of cod in or out the area assessed.

Stock Annex 3-WGSSDS-Western Channel Plaice

Stock specific documentation of standard assessment procedures used by ICES.

Stock: Plaice (*Pleuronectes platessa*) : Division VIIe

Working Group: Assessment of Southern Shelf Demersal Stocks

Date created: 6th July 2003 (SF)

Last updated: 3rd July 2006 (BFMH)

A. General

A.1 Stock definition

The management area for this stock is strictly that for ICES area VIIe called the Western English Channel, although the TAC area includes the larger component of VIId (Eastern English Channel).

Between 1965 and 1976, more than 5 500 plaice were tagged and released around Start Point. Analysis of the recaptures from plaice tagged whilst spawning in the Channel during January and February showed that 20% spent the summer in the western Channel, 24% in the eastern Channel, and approximately 56% migrated to the North Sea after spawning. Few of the plaice tagged in the western Channel during April and May were recaptured outside the Channel however, suggesting that there is a resident stock that does not migrate to the North Sea after spawning in the Channel.

The main spawning areas are south of Start Point and south of Portland Bill. Spawning takes place between December and March with a peak in January and February.

FIGURE A shows the spawning areas for VIIe plaice.

A.2 Fishery

In the western English Channel plaice are taken mainly as a by-catch in beam trawls directed at sole and anglerfish. The main plaice fishery is concentrated to the south and west of Start Point. Although plaice are taken throughout the year, landings are heaviest during February /March and October /November. The fisheries taking plaice in the western English Channel mainly involve vessels from the bordering countries: UK vessels report about 82%, France 17% and Belgium 1% of the total plaice landings from ICES Division VIIe. Landings reached a peak of more than 2 500 tonnes in 1990, then declined rapidly, before stabilising in the last few years.

Main metiers

There are ten main metiers which exploit important fish and shellfish stocks in the Channel. Otter trawling accounts for a wide range of target species in season - cuttlefish, anglerfish, gurnard, rays, cod, whiting, plaice, sole, squid and lemon sole - and involves boats from France (600), England (470), Belgium (15) and the Channel Islands (11). Beam trawling is also important for boats from the 3 former nations (26, 83 & 65 respectively), targeting sole, anglerfish and plaice, with up to 25 of the Belgian boats extending this fishery into the Bay of Biscay. Many boats from France (626) and England (80) join two Channel Islands vessels dredging for scallops and taking a valuable by-catch of sole and anglerfish. The other main towed gear is mid-water trawls, used either for the small pelagic species - mackerel, sprat, pilchard and herring - or for bass and black bream with a by-catch of gadoids by French (40) and English (25) boats. Purse seines are used by 8 UK vessels to take mainly mackerel and pilchard in the western Channel.

The fixed netting metier in the Channel is really composed of several metiers using specific net gears and mesh sizes depending on target species, the most important being with gill nets and trammel nets (580 French and 380 English boats) for sole, cod, ling, pollack, hake, plaice, bass and spider crab. Rays, anglerfish, turbot, crabs, lobster and crawfish are also taken in tangle nets (305 Fr., 300 Eng. & 7 CI).

Similarly, potting (960 Fr., 275 Eng & 560 CI) uses several distinct gears to catch brown (edible) crabs, spider crabs, cuttlefish, lobsters and whelk, both inshore and offshore, and there are zones in the western Channel partitioning potting and towed gears for alternating periods. Longlining has been replaced by fixed net in many cases, but conger eel, sharks, rays and bass are still taken (260 Fr., 60 Eng & 13 CI). Handlines are used for mackerel, bass, pollack and ling by small boats working along both the English (390) and French (120 Fr & 90 CI) coasts of the Channel.

A.3 Ecosystem aspects

B. Data

B.1 Commercial Catch

Sampling and Data Raising

Quarterly age compositions were available only from UK(England and Wales) landings for the years 1995-2005 (and 1989), which accounted for approximately 81% of total international landings. The total international age composition was obtained by raising the combined gears quarterly UK(England and Wales) age compositions to include the landings of the Channel Isles, France and Belgium, and summing to give an annual total.

For the earlier years of 1990 - 1994, French age compositions were also available. For these years, the UK(England and Wales) age compositions were raised to UK(Total) by including landings from the Channel Islands. Finally, UK(Total) and French age compositions were combined and raised to include Belgian landings. For the years 1981 – 1988 Prior to this, the stock data was aggregated for area of VIId+VIIe. For these years, Belgium also provided age compositions data and this was combined with UK(Total) and French age compositions. French age compositions were based on age data provided by the UK.

Age data representing French landings were available for 2002 and 2003 , but were not used in the assessment.

Table A shows the national data availability for VIIe plaice stock for the time period 1981-2005

Table B shows CV of numbers at age for sampling (all fleets combined).

Weights at Age

Total international catch and stock weights at age were calculated as the weighted mean of the annual weight at age data supplied (weighted by landed numbers), and smoothed using a quadratic fit:

[e.g. : $Wt = (0.1109*Age) - (0.0004*(Age^2)) - 0.008$; $R^2 = 0.98$]

where catch weights at age are mid-year values (age = 1.5, 2.5 etc.), and stock weights at age are 1st January values (age = 1.0, 2.0 etc.). Catch weights at age have been scaled to give a SOP of 100%, and the same scaling has been applied to stock weights at age.

This technique has been used for at least the time that the stock has been assessed by the Southern Shelf Demersal WG. In early years in the time series, weights at age were averaged over a period of years, and derived from separate-sex mean weights at age.

B.2 Biological

The main spawning areas for plaice in the western Channel are south of Start Point and Portland Bill. Spawning takes place from December to March, with a peak in January and February.

On average, about a quarter of plaice in the western Channel are mature at age 2, half are mature at age 3 and all are mature at age 5. The majority of plaice landed in the western Channel in 2001, for example, were at ages 2 - 5, and therefore 73% of those landed were mature.

Natural Mortality and Maturity Ogives

Initial estimates of natural mortality (0.12 ^{yr} all years and all ages) and maturity were based on values estimated for Irish Sea plaice (Siddeek, 1981). A new maturity ogive based on UK(E&W) VIIfg survey data for March 1993 and March 1994 (Pawson and Harley 1997) was produced in 1997 and is applied to all years in the assessment.

Age	*1*	*2*	*3*	*4*	*5+*
Old Maturity	0	0.15	0.53	0.96	1.00
New Maturity	0	0.26	0.52	0.86	1.00

The proportion of mortality before spawning was originally set at 0.2 since approximately 20% of the total catch was taken prior to late February – early March, considered to be the time of peak spawning activity. The proportion of F and M before spawning was changed to zero prior to the 1994 Southern Shelf Demersal Working Group as it was considered that these settings were more robust to seasonal changes in fishing patterns, especially with respect to the medium term projections.

B.3 Surveys and survey tuning data

An annual 4m beam trawl survey has taken place in the Lyme Bay area of the Western English Channel since 1984, initially aboard chartered fishing Vessels (MV BOGEY 1 and latterly MV CARHELMAR) and more recently aboard the CEFAS research vessel CORYSTES, coming back to MV CARHELMAR in 2005.

Appendix 1 provides a history of the survey and details the survey methodology and objectives.

The Western English Channel beam trawl survey data is used to calculate assessment tuning data for both VIIe plaice and sole. Indices of abundance at age for years 1986 to the present, and for ages 1-5 have been used in the most recent assessments. Appendix 1 also describes how these indices of abundance at age are derived.

B.4 Commercial LPUE

E+W commercial fleet LPUE declined rapidly from a peak in the late 1980s and have been at a fairly stable at a low level since 1995. The survey series shows CPUE at a peak in 1988, followed by a rapid decline during the period 1989-1995. Recent years have seen a recovery to a recent high in 2000 where levels have generally remained since.

UK beam trawl effort has increased rapidly over the time series, reaching record high levels in 2003 whilst the UK trawl effort has slowly decreased over the time series, reaching a record low level in 2005.

FIGURES B & C show plots of UK effort for 1998-2005 by ICES rectangle for beam and trawl gears, respectively.

Commercial tuning Data

Commercial tuning information for this stock comprises of the UK(E&W) otter trawl fleet and the UK(E+W) beam trawl fleet. These fleets have been used by Working Groups for a number of years, and initially contained data for years back to 1976 (otter) and 1978 (beam). However in the most recent assessments carried out for this stock, otter trawl fleet data is currently used only for years 1988 to the present and for ages 3-9. Beam trawl fleet data is currently used for years 1989 to the present, and ages 3-9.

B.5 Other relevant data

C. Historical stock development

The stock of plaice in the western English Channel has been assessed by the ICES Southern Shelf Demersal WG since 1992 and has been managed by TAC since 1984. The TAC is applicable to VIId (Eastern Channel) and VIIe combined, although in 1997 there was a separate limit for landings from VIIe. This was unpopular with the industry, due to the national split being based on VIId+VIIe combined reported landings for the reference period, and has not been repeated since.

Technical measures in force

Technical measures currently in force in the Western English Channel are a minimum mesh size of 80mm for otter and beam trawlers and 70mm for *Nephrops* trawlers. Panels of 75mm square mesh are compulsory in all *Nephrops* fisheries in ICES sub-area VII

There is also a minimum landing size (MLS) on 27cm in force.

Assessment Methods and Settings

In 1991 the stock was assessed using a Laurec-Shepherd tuned VPA. Concerns about deteriorating data quality prompted the use in 1992 of XSA.

Trial runs have, over the years, explored most of the options with regards XSA settings.

The effect of the power model on the younger ages was explored in 1994; 1995; 1996; 1998 & 2004.

The use of P shrinkage was investigated in 2001.

Different levels of F shrinkage were explored in 1994; 1995; 2000; 2002 & 2004

The level of the + group was examined in 1995 & 2004

The effect of different time tapers was investigated in 1996.

The S.E. threshold on fleets was examined in 1996 and 2001

The level of the catchability plateau was investigated in 1994; 1995; 2002 & 2004.

TABLE C shows the history of VIIe plaice assessments and details the parameters used.

D. Short term projection

Standard ICES software is used for the short-term projections – MFDP.

The status quo F forecast predicts landings in 2006 and 2007 to be 805 t and 800 t respectively and result in SSB of 1177 t in 2007 and 1264 t in 2008. The 2004 year-class is estimated to contribute around 32% of the landings in 2007. Around 49% of the predicted 2008 SSB rely upon year-classes for which GM recruitment was assumed.

E. Medium term projections

F. Yield and biomass per recruit / long term projections

Standard ICES software is used for the long-term projections – MFYPR.

As with most plaice stocks, there is no clear stock/recruitment relationship evident.

G. Biological reference points

Biological reference points were proposed for this stock by the 1998 working group as below

F_{lim}	Not defined	
F_{pa}	0.45	(low probability that $SSB_{MT} < B_{pa}$)
B_{lim}	1,300 t	(equal to B_{loss})
B_{pa}	2,500 t	(equal to MBAL)

The current Working Group view of these reference points is that they are considered unreliable.

H. Other Issues

I. References

FIGURE A – Map of spawning areas for VIIe plaice

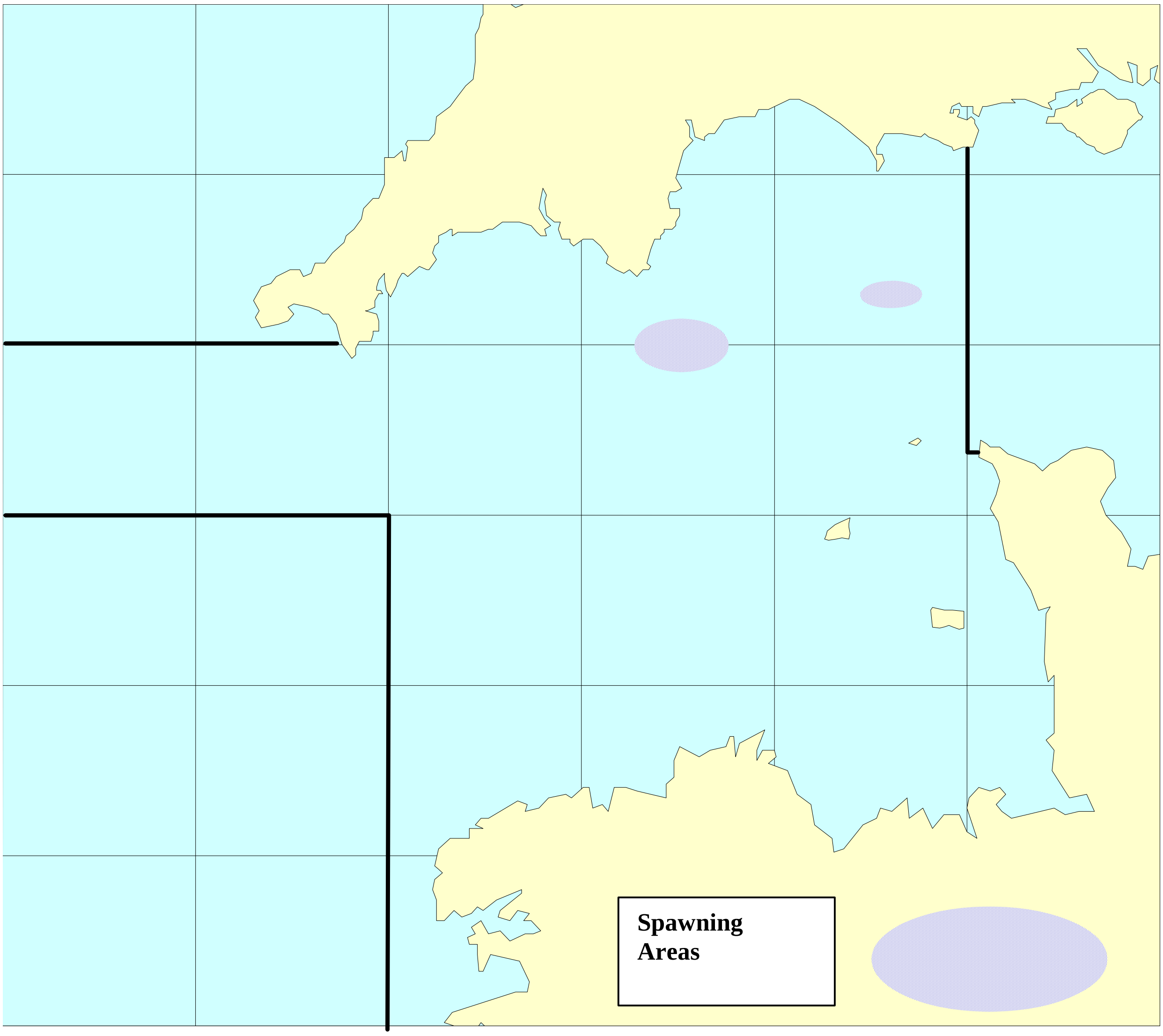
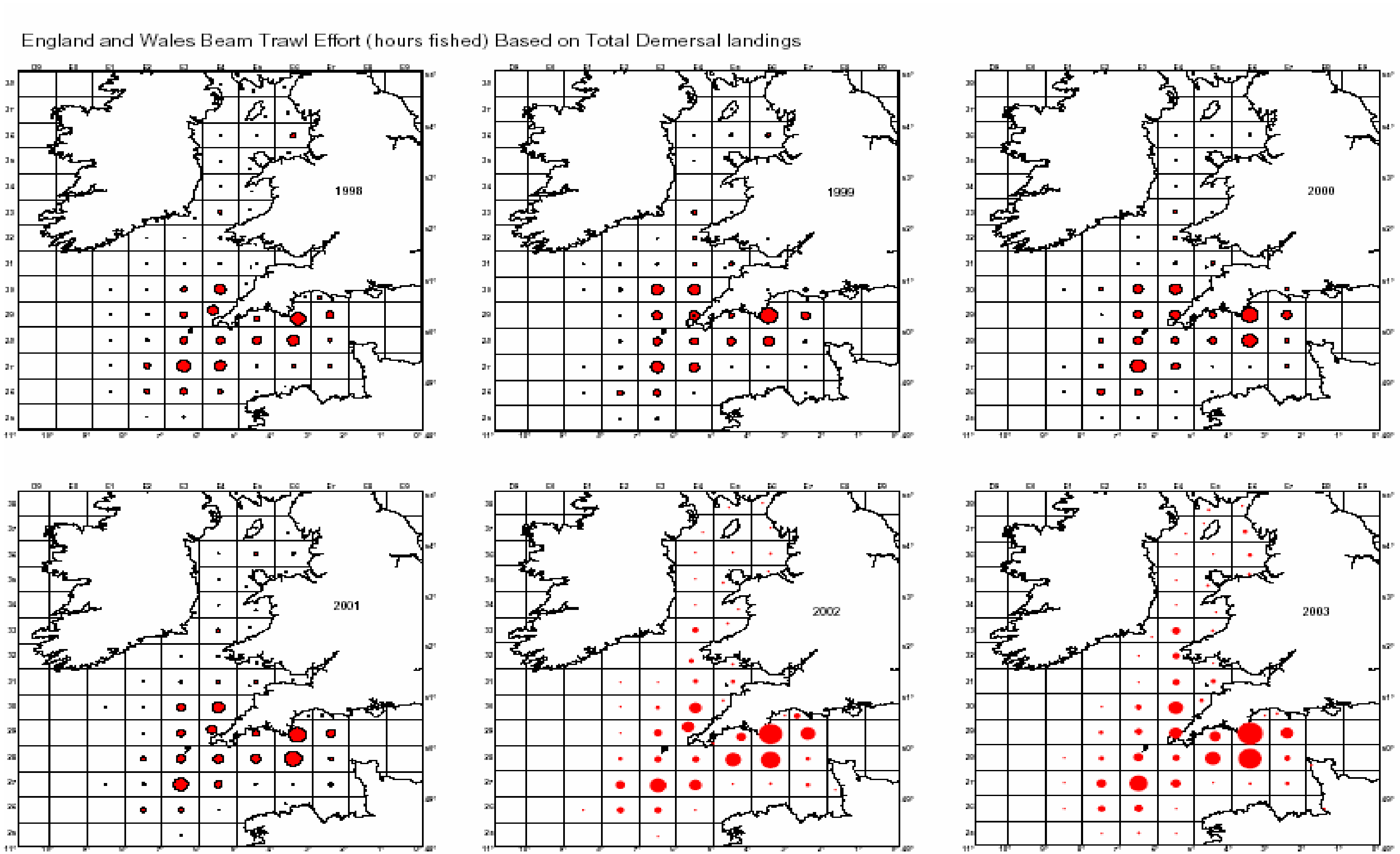


TABLE A - VIIe plaice - Catch Derivation table for assessment years 1981-2006

		source				
Year of WG	Data	UK	Belgium	France	derivation of international landings	% sampled
1981*	length composition	quarterly	quarterly	quarterly	UK ALK used with French LDs	100
	ALK	quarterly	quarterly	-	UK+Belgium+France combined to total international	
	Age composition	quarterly	quarterly	-	No analytical assessment carried out	
1982*		As for 1981	As for 1981	As for 1981	As for 1981	100
1983*		As for 1981	As for 1981	As for 1981	As for 1981	100
1984*		As for 1981	As for 1981	As for 1981	As for 1981	100
1985*		As for 1981	As for 1981	As for 1981	As for 1981	100
1986*		As for 1981	As for 1981	As for 1981	As for 1981	100
1987*		As for 1981	As for 1981	As for 1981	As for 1981	100
1988*		As for 1981	As for 1981	As for 1981	As for 1981	100
1989*	length composition	quarterly	-	-	UK raised to total international	70
	ALK	quarterly	-	-		
	Age composition	quarterly	-	-		
1990	length composition	quarterly	-	quarterly	UK+France raised to total international	96
	ALK	quarterly	-	quarterly		
	Age composition	quarterly	-	quarterly		
1991		As for 1990	-	As for 1990	As for 1990	97
1992		As for 1990	-	As for 1990	As for 1990	97
1993		As for 1990	-	As for 1990	As for 1990	98
1994	length composition	quarterly	-	quarterly	UK ALKs applied to French LDs	96
	ALK	quarterly	-	-	UK+France raised to total international	
	Age composition	quarterly	-	-		
1995		As for 1989	-	-	As for 1989	86
1996		As for 1989	-	-	As for 1989	84
1997		As for 1989	-	-	As for 1989	82
1998		As for 1989	-	-	As for 1989	76
1999		As for 1989	-	-	As for 1989	79
2000		As for 1989	-	-	As for 1989	79
2001		As for 1989	-	-	As for 1989	83
2002		As for 1989	-	-	As for 1989	80
2003		As for 1989	-	-	As for 1989	80
2004		As for 1989	-	-	As for 1989	81
2005		As for 1989	-	-	As for 1989	79
2006		As for 1989	-	-	As for 1989	74
* stock assessed as VIId,e plaice						

FIGURE B


England and Wales Beam Trawl Effort (hours fished) Based on Total Demersal landings
1998
1999
2000
2001
2002
2003

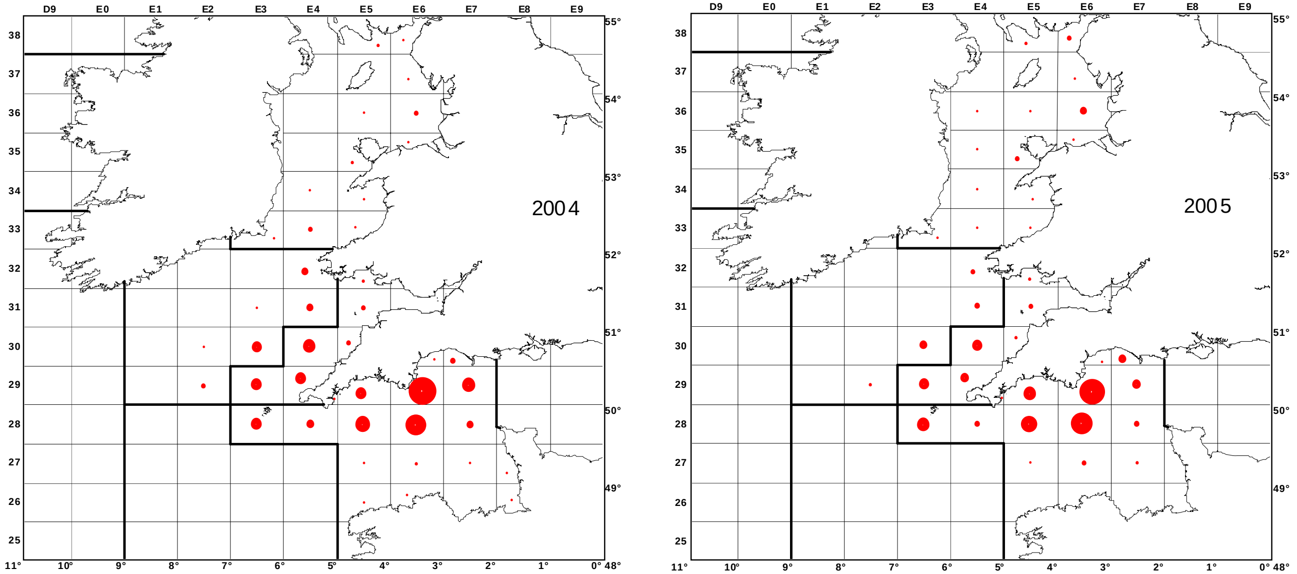
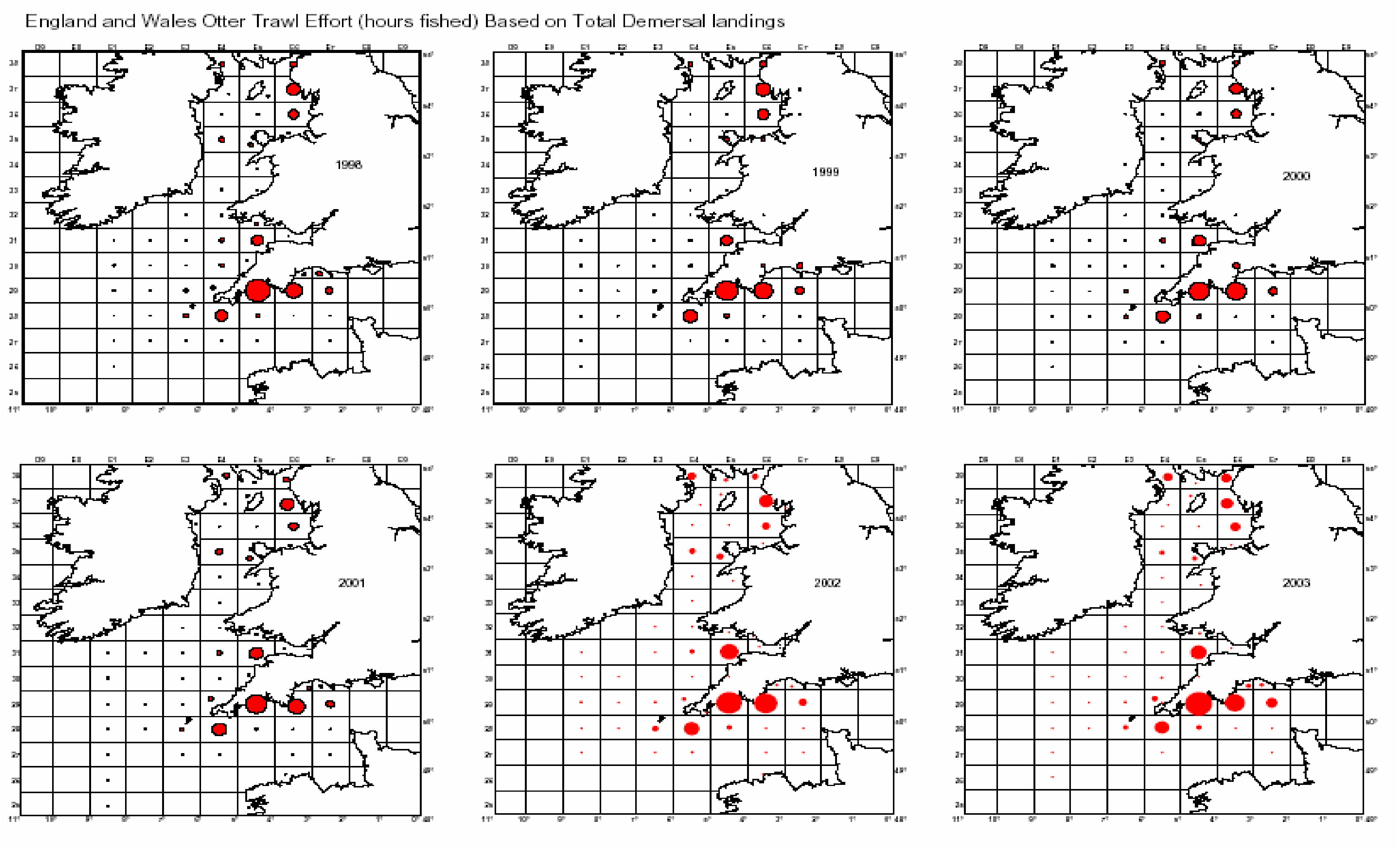
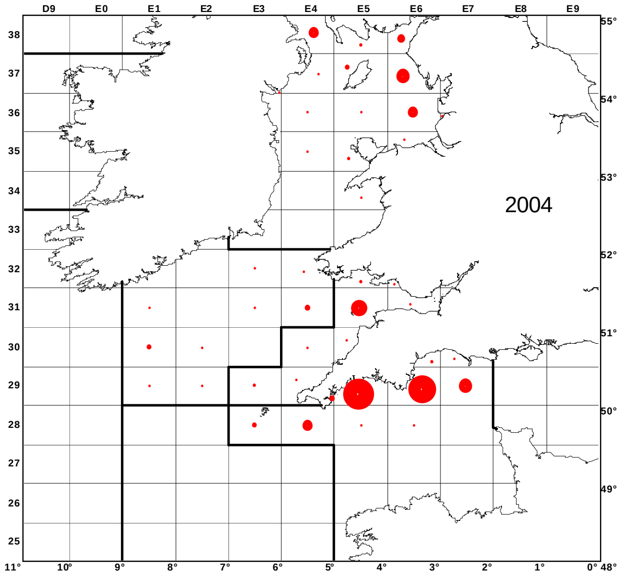

2004
2005

FIGURE C


England and Wales Otter Trawl Effort (hours fished) Based on Total Demersal landings
1998
1999
2000
2001
2002
2003


2004

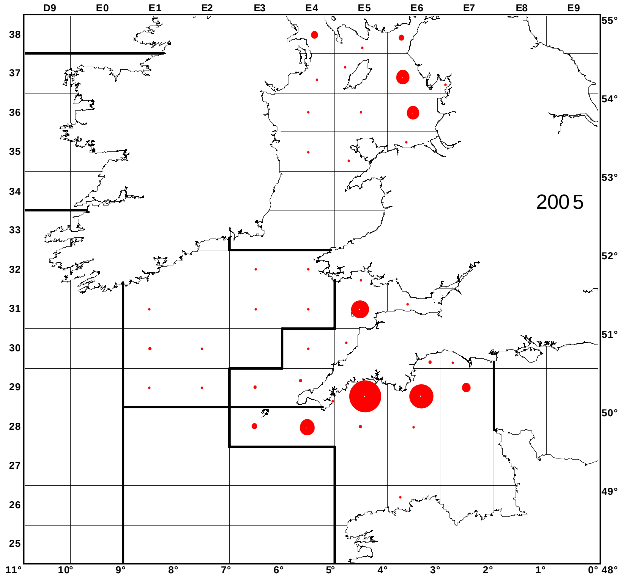

2005

TABLE B - CV of numbers at age for commercial sampling

		CV BY AGE								
YEAR	COUNTRY	1	2	3	4	5	6	7	8	9
2005	UK(E+W)	18%	3%	3%	3%	6%	7%	11%	10%	9%

TABLE C - History of VIIe plaice assessments

Assessment parameters used (1991-2004)																
	1991*	1992*	1993*	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Assessment Age Range	1-10+	1-10+	1-10+	1-10+	1-10+	1-10+	1-10+	1-10+	1-10+	1-10+	1-10+	1-10+	1-10+	1-10+	1-10+	1-10+
Fbar Age Range	3-8	3-7	3-7	3-7	3-7	3-7	3-7	3-7	3-7	3-7	3-7	3-7	3-7	3-7	3-7	3-7
Assessment Method	LS/Trad VPA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA
Tuning Fleets																
UK trawl yrs	76-90	76-91	76-92	84-93	84-94	86-95	87-96	88-97	88-98	88-99	88-00	88-01	88-02	88-03	88-04	88-05
Ages	1-9	1-9	1-9	2-9	2-9	2-9	2-9	2-9	2-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9
UK trawl (historic) yrs														76-87	76-87	76-87
Ages														2-9	2-9	2-9
UK beam yrs	78-90	78-91	78-92	84-93	84-94	86-95	87-96	89-97	89-98	89-99	89-00	89-01	89-02	89-03	89-04	89-05
Ages	1-9	1-9	1-9	2-9	2-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9	3-9
UK b/trawl survey yrs		86-91	86-92	86-93	86-94	86-95	87-96	88-97	86-98	86-99	86-00	86-01	86-02	86-03	86-04	86-05
Ages		1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5	1-5
Time taper		20yr tri	20yr tri	20yr tri	20yr tri	None	None	None	None	None	None	None	None	None	None	None
Power model ages		1	1	1	1-3	1-3	1-3	0	1	1-5	1-5	1-5	1-5	0	0	0
P shrinkage		TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Q plateau age		8	7	7	7	7	7	7	7	7	7	7	7	7	7	7
F shrinkage S.E		0.3	0.3	0.3	0.8	1.5	1.5	1.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Num yrs		5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Num ages		5	5	5	4	4	4	4	4	4	4	4	4	4	4	4
Fleet S.E.		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
* Early version of XSA/VPA and tuning fleet age/year ranges used not specified. Assumed all years used but age range used uncertain.																

APPENDIX A – Beam trawl surveys of the western English Channel (ICES Division VIIe)

1. HISTORY OF THE SURVEY

Complaints from the fishing industry in the south- west about the lack of scientific investigation and knowledge of the local sole stock provided the catalyst for the survey in VIIe. Following enquiries of the local fishery officers and normal tendering procedures, a skipper-owned 300-hp beam trawler – the Bogey 1 - was selected. The first year (1984) the survey consisted of a collection of tows on the main sole grounds. In 1989 the Bogey 1 was replaced with the Carhelmar and the survey continued unchanged until 2002 when R.V. Corystes took over the survey as an extension to its 'near-west groundfish survey'.

Due to the changes occurring through the time series, the surveys completed on R.V. Corystes (2002 onwards) will be described separately to the 'previous' surveys (pre 2002).

2.a. SURVEY OBJECTIVES (1984 to 2001, and 2005 onwards)

To provide independent (of commercial) indices of abundance of all age groups of sole and plaice on the west channel grounds, and an index of recruitment of young (1-3 year old) sole prior to full recruitment to the fishery.

2.b. SURVEY OBJECTIVES (2002 to 2004)

The primary objectives of the Irish Sea beam trawl survey are to (a) carry out a 4m beam-trawl survey of groundfish to i) obtain fisheries independent data on the distribution and abundance of commercial flatfish species, and ii) derive age compositions of sole and plaice for use in the assessment of stock size; and (b) to collect biological data, including maturity and weight at age, for sole, plaice, lemon sole and other commercially important species. The epibenthic by-catch from these catches has been quantified, and these surveys are also used to collect biological samples in support of other CEFAS projects and training courses.

3.a. SURVEY METHODS (1984 to 2001, and 2005 onwards)

For the years 1984-1988 the vessel was unchanged and was equipped with two 6m chain mat beam trawls with 75mm cod-ends. For the survey hauls one of the cod-ends was fitted with a 60mm liner. In 1989 the Bogey 1 was replaced by the latest design 24m 300hp(220kw) beam trawler Carhelmar. In 1988 two commercial chain mat 4m-beam trawls (measured inside the shoe plates) were purchased by MAFF as dedicated survey gear. Both beams were fitted with the standard flip-up ropes and 75mm cod-end. For years 1989 and 1990 only 1 cod-end was fished with a 40mm liner but from 1991 with the introduction of 80mm cod-ends both were fitted with 40mm liners. The vessel and gear has remained unchanged since 1991.

Between 1989 and 2001 the survey remained relatively unchanged apart from small adjustments to the position of individual hauls to provide an improved spacing. In 1995 two inshore tows in shallow water (8-15m) were introduced. The survey now consists of 58 tows of 30 minutes duration, with a towing speed of 4 knots in an area within 35 miles radius of Start Point. The survey design is stratified by 'distance from the coast' bands, in contrast to the VIIa,f+g survey that is stratified by depth bands. The reason for this is that the coastal shelf with a depth of water less than 40m is relatively narrow and in addition is often fished with fixed gear. The survey bands (in miles) are 0-3, 3-6, 6-12, 12+ inshore, and 12+offshore.

3.b. SURVEY METHODS (2002 to 2004)

The standard gear used is a single 4m beam-trawl with chain mat, flip up rope, and a 40mm codend liner to retain small fish. The gear is towed at 4 knots (over the ground) for 30 minutes, averaging 2 nautical miles per tow. Fishing is only carried out in daylight, shooting after sunrise and hauling no later than sunset, as the distribution of some species is known to vary diurnally.

Once onboard the catch is sorted to species level, with the exception of small gobies and sandeels, which are identified to genus. Plaice, sole, dab, and elasmobranchs are sorted by sex, all fish categories weighed, and total lengths are measured to the full centimetre below, or half centimetre if the species is pelagic. Area stratified samples of selected species are sampled for weight, length, sex, maturity, and otoliths or scales removed for ageing.

The standard grid of 58 stations was fished in 2002 and 2003 (see map), and although other stations have been fished in this period, they were for exploratory purposes and were not included in the assessment.

4. ABUNDANCE INDEX CALCULATION

Plaice and sole abundance indices are calculated by allocating the appropriate ages to the fish that are caught. This gives the age composition (AC) of the catch, and this is used in the appropriate working group analysis.

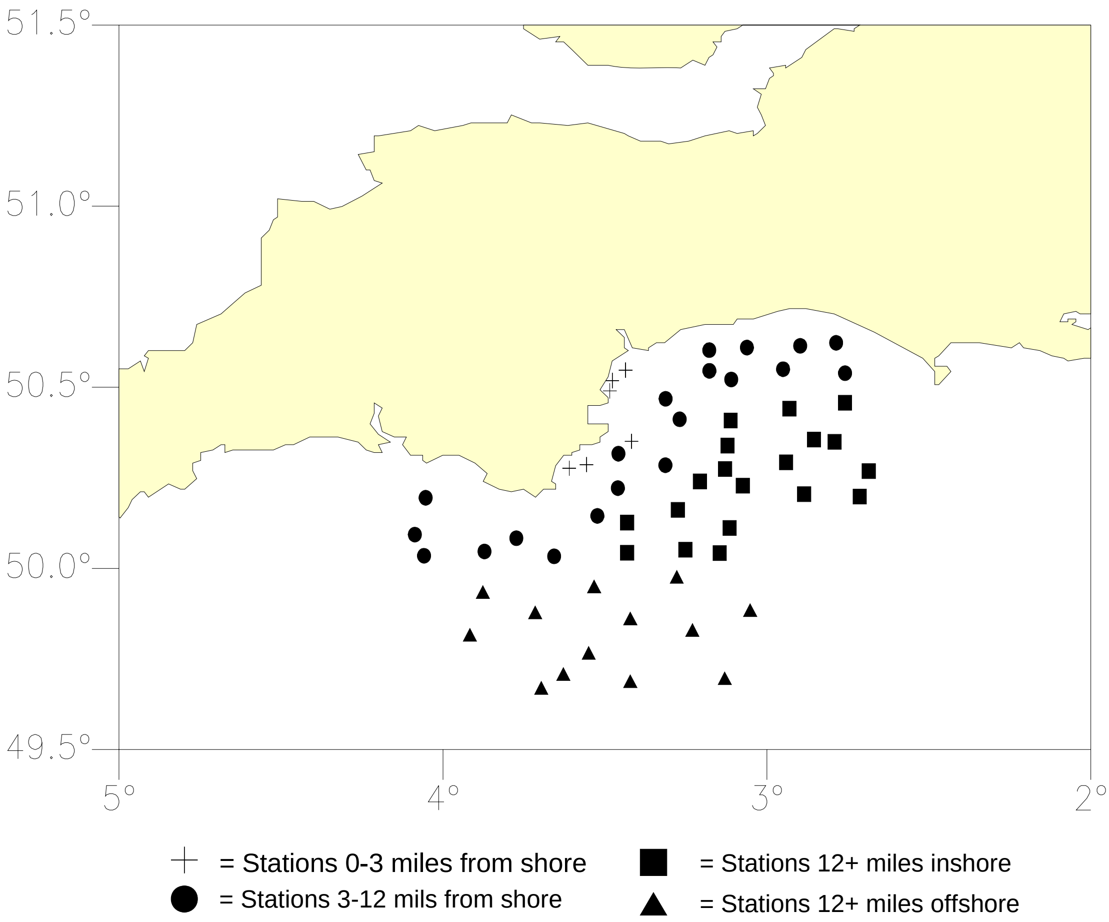
The AC's are calculated by proportioning a length distribution (LD) to an appropriate age length key (ALK). To account for possible population differences within ICES Division VIIe, biological samples are taken from sectors stratified by distance from shore (see map). The survey bands (in miles) are 0-3, 3-12, 12+ inshore, and 12+ offshore. Where appropriate the ALK's are separated by sex, and this allows a particular 'sector, depth-band and sex' ALK to be raised to the corresponding LD to give an accurate AC for that particular habitat. The AC's can then be combined as required to give results in the form of 'numbers at age, per distance or time'.

Between 1984 and 1990 a total survey age-length key was applied to the 'grid' length distribution, but from 1990 onwards stratum stratified age-length keys were used.

The table below show the stratifications currently used to calculate the 'near-west ground fish survey' abundance indices

5. MAP OF SURVEY GRID

Additional stations have been fished throughout the time period, but as these stations are not consistently fished, they are excluded from this map.



6. SUMMARY

AREA COVERED	-	ICES DIVISION VIIE
Target species	-	Flatfish, particularly pre-recruit plaice and sole
Time period	-	September-October. 1988 to present.
Gear used	-	1984-1988 – 2 * 6m beam trawls
	-	1989-2001 – 2 * 4m beam trawls
	-	– 1* 4m beam trawl
	-	2005- – 2 * 4m beam trawls
Mean towing speed	-	4 knots over the ground
Tow duration	-	30 minutes
Vessel used	-	1984-1988 - F.V. Bogey 1
	-	1989-2001 - F.V. Carhelmar
	-	2002-2004 - R.V. Corystes
	-	2005- - F.V. Carhelmar

Stock Annex 4 –WGSSDS-Celtic Sea Plaice

Stock specific documentation of standard assessment procedures used by ICES.

Stock:	Plaice (division VIIfg)
Working Group:	Assessment of Southern Shelf Demersal Stocks
Date:	12th July 2003
Last updated:	3rd July 2006 (SF)

A. General

A.1 Stock definition

The degree of separation between the stocks of plaice in the Irish Sea and the Celtic Sea is currently unclear. Numerous tagging studies indicate a southerly movement of mature fish from the south east Irish Sea into the Bristol Channel during the spawning season. Whilst some of these fish remain in this area the majority return to summer feeding grounds in the Irish Sea (Dunn and Pawson ,2002). Mixing is also considered to occur between the Celtic Sea and Eastern Channel stocks and time series of recruitment estimates for all three stocks show very similar patterns.

Principal spawning grounds have been identified off Trevose Head in division VIIf and off the coast of south east Ireland in division VIIg. Nursery grounds are located in the coastal waters of south Wales and south east Ireland.

FIGURE A shows the spawning areas for VIIfg plaice

A.2 Fishery

Plaice are taken mainly as a by-catch in beam trawl fisheries directed at sole and anglerfish, and as part of a mixed demersal fishery (rays, gadoids, flatfish and squid) by otter trawlers. The main fleets are from Belgium, France and the UK(England & Wales). Otter trawling predominated until the mid-1970s, when beam trawl effort increased rapidly. Landings rose to a maximum in the late 1980s, declined during the early 1990s, and then fluctuated around 1,000 t. Landings in recent years however, have declined from this level.

The main fishery occurs in the spawning area off the north Cornish coast, at depths greater than 40m, about 20 to 25 miles offshore. Although plaice are taken throughout the year, landings are heaviest in the first and third quarters.

A.3 Ecosystem aspects

B. Data

B.1 Commercial Catch

International catch at age data based on quarterly market sampling and annual landings figures are available from 1977. For the period 1991 to 2005 quarterly age compositions have typically represented around 70% of the total international landings, though in 2002 this fell to around 25% when age compositions were not available for the Belgian fleet. Belgian age sampling in 1993 was at a reduced level and was augmented with UK data. There was no UK sampling in the 4th quarter of 1994 and landings of 1 year olds by the UK otter trawl fleet may be underestimated in this year. Sampling levels during the earlier years in the time series are considered to be low for all fleets and the quality of the catch data, particularly for older ages, up until around 1992 is believed to be poor. In 1995 UK age compositions for the period 1984-88 were revised using new ALKs which used data from adjacent time periods where necessary. In the 2005 benchmark assessment, it was noted that numbers at age 1 in the landings data were very sparse and variable, reflecting the selection on this age (and especially considering the probable substantial discarding), so the values were replaced by zero to avoid fitting to noise. Keeping age 1 in the assessment allows the survey data at age 1 to contribute.

TABLE A1 shows the history of the derivation of catch numbers at age.

TABLE A2 shows the history of precision levels for catch at age data.

B.2 Biological

Weights at Age

As a consequence of low sampling levels weights at age were considered to be poorly estimated. Up until 1990 constant weights at age had been used in the assessment, based on observations made over the period 1984 – 87. In 1991 catch weights and stock weights were estimated using quadratic fits for each year. This procedure was repeated in 1992, and subsequent years, except that a calculated intercept was used rather than forcing the curve through the origin.

Total international catch and stock weights at age are calculated as the weighted mean of the national weights at age, smoothed using a quadratic fit. Catch weights at age are taken as mid-year values (age = 1.5, 2.5 etc.), and stock weights at age are January 1 values (age = 1.0, 2.0 etc.). Catch weights at age are scaled to give a SOP of 100%, and the same scaling has been applied to the stock weights at age.

Weights at age for this stock are smoothed because sampling levels have in the past been relatively poor, and the resulting data sets have been noisy. Thus fitting a curve through the data avoids problems of missing data or poorly-represented weight at age. Sampling levels show some improvement but data for the older ages are still variable.

Natural Mortality and Maturity Ogives

Initial estimates of natural mortality (0.12^{yr} all years and all ages) and maturity were based on values estimated for Irish Sea plaice. A new maturity ogive based on UK(E&W) VIIfg survey data for March 1993 and March 1994 (Pawson and Harley 1997) was produced in 1997 and is applied to all years in the assessment.

Age	1	2	3	4	5+
Old Maturity	0	0.15	0.53	0.96	1.00
New Maturity	0	0.26	0.52	0.86	1.00

The proportion of mortality before spawning was originally set at 0.2 since approximately 20% of the total catch was taken prior to late February – early March, considered to be the time of peak spawning activity. The proportion of F and M before spawning was changed to zero at the request of ACFM in 1996 as it was considered that these settings were more robust to seasonal changes in fishing patterns, especially with respect to the medium term projections.

B.3 Surveys

To date data have been available for only one survey in VIIf&g: the UK 4m beam trawl survey.

Appendix 1 provides a history of the survey and details the survey methodology and objectives

B.4 Commercial CPUE

LPUE has declined since the late 1980s for E+W commercial fleets: rapidly during 1989-1991 and more slowly since then. The Belgian beam trawl series shows LPUE falling after 1991, recovering to an intermediate level in 1997 then declining. Irish LPUE data show a decline for all towed gears since 1997-98.

The survey series shows CPUE at a peak in 1989-1990, followed by a rapid decline during 1992-1994. A recovery to a recent high in 1996 has been followed by a return to below-average levels in 2002-2005.

UK beam trawl effort has generally increased over the time series, reaching new high levels in VIIf and VIIg (East) in 1999. Effort in VIIf has remained high in 2000, but has declined in VIIg(East). Belgian beam trawl fleet data show a sharp decline in effort in 1990-1991 followed by a return to the level seen in the early 1980s. UK otter trawl effort in VIIf has slowly declined over the time series.

FIGURES B & C show plots of UK effort for 1998-2005 by ICES rectangle for beam and otter trawl gears.

B.5 Other relevant data

C. Historical stock development

The stock of plaice in the Celtic Sea has been assessed by ICES since 1978 and has been managed by TAC since 1987.

<u>Tuning Data</u>

Until 1992 tuning information for this stock comprised the Belgian beam trawl fleet (from 1977) and the UK(E&W) otter trawl fleet (from 1981). Effort was re-calculated for the Belgian beam trawl fleet in 1993 and again (subject to the discovery of errors) in 1994. The UK(E&W) tuning series was revised in 1995 and separate otter trawl and beam trawl tuning series were produced using length samples from each gear type and an all gears ALK. Since the data could only be separated for 1988 onwards the two new tuning series were slightly reduced in length. In 1996 UK(E&W) commercial effort data were re-scaled to thousands of hours so as to avoid numerical problems associated with low CPUE values.

In 1993 the UK(E&W) beam trawl survey series which began in 1988 was considered to be of sufficient length for inclusion in the assessment. Since 1991 tow duration has been 30 minutes but prior to this it was 15 minutes. In 1997 values for 1988 to 1990 were raised to 30 minute tows, however, data for 1988 and 1989 were of poor quality and gave spurious results. The series was therefore truncated to 1990.

Two new first quarter survey series were made available to the working group in 1998. The UK(E&W) (*Cirolana*) March survey using a Portugese high headline trawl (PHHT) and the UK(E&W) (*Corystes*) March beam trawl survey. Both of which started in 1993 The March *Corystes* beam trawl survey covered a reduced area in 1995 and a different vessel was used in 1996, consequently it has not been considered appropriate for inclusion in the assessment. Whilst the *Cirolana* PHHT survey was included in the assessment in 1999 it has subsequently been excluded as catches of plaice are generally very low

The effects of vessel characteristics on LPUE for UK(E&W) commercial tuning series was investigated in 2001 to investigate the requirement for fishing power corrections due to

MAGP IV re-measurement requirements. It was found that vessel characteristics had less effect on LPUE than geographic factors and unexplained noise and concluded that corrections were not necessary. However, vessels of certain size tended to fish in certain rectangles. This confounding may have resulted in the under-estimation of vessel effects.

Assessment Methods and Settings

In 1991 the stock was assessed using a Laurec-Shepherd tuned VPA. Concerns about deteriorating data quality prompted the use in 1992 of XSA. Since then XSA has been the model used.

Trial runs have, over the years, explored most of the options with regards to XSA settings.

The applicability of the power model on the younger ages was explored in 1994; 1995; 1996 and 1998.

The use of P shrinkage was investigated in 2001.

Different levels of F shrinkage were explored in 1994; 1995; 2000 and 2002

The level of the + group was examined in 1995.

The effect of different time tapers was investigated in 1996.

The S.E. threshold on fleets was examined in 1996 and 2001

The level of the catchability plateau was investigated in 1994; 1995 and 2002.

Effects of removing data for younger ages in commercial tuning fleets, changing the standard error thresholds, and of including historic tuning fleet data, were investigated in 2005.

TABLE B shows the history of VIIfg plaice assessments and details the parameters used

D. Short term projection

Software: Multi Fleet Deterministic Projection (MFDP)

Age based short term projections are conducted for a 3-year period using initial stock numbers derived from XSA analyses. Numbers at age 1 are considered poorly estimated, and in the 2005 assessment catch numbers at age 1 were replaced by zero values. Population numbers at age 1 use a geometric mean of past recruitment values. Recent recruitments have been estimated to be at a lower level and to be less variable than those earlier in the time series. Consequently a short-term geometric mean (from 1989 - present) is used.

The exploitation pattern is typically an un-scaled 3 year arithmetic mean, though alternative options may be used depending on recent F trajectories and the working groups perception of the fishery.

Catch and stock weights at age are generally taken as the mean of the last 3 years. Maturity ogive and natural mortality estimates are those used in the assessment method.

E. Medium term projections

Software: MLA miscellany

Input values to the medium term forecast are the same as those used in the short term forecast. Any stock recruit relationship is poorly defined and whilst a Beverton Holt SRR has been assumed in earlier years, a simple geometric mean is now considered more appropriate, though it remains unclear whether the full time series or a reduced time series from 1989 should be used.

F. Yield and biomass per recruit / long term projections

Software: Multi Fleet Yield per Recruit (MFYPR)

Yield per recruit calculations are conducted using the same input values as those used for the short term forecasts.

G. Biological reference points

Biological reference points were proposed for this stock by the 1998 working group as below

F_{lim}	No proposal	
F_{pa}	No proposal	
B_{lim}	1,100 t	(equal to B_{loss})
B_{pa}	1,800 t	(equal to B_{lim} * exp(1.645*0.3))

An F_{pa} value of 0.6 was proposed by ACFM in 1998 basis (~c. F_{med}, >95% probability of SSB > B_{pa} in medium term).

H. Other Issues

None

I. References

Dunn, M.R. and Pawson, M.G., 2002. The stock structure and migrations of plaice populations on the west coast of England and Wales. In *Journal of fish biology* (2002), Vol. 61, pp 360-393.

Pawson, M.G and Harley, B.F.M., (unpubl.: Cefas internal report)

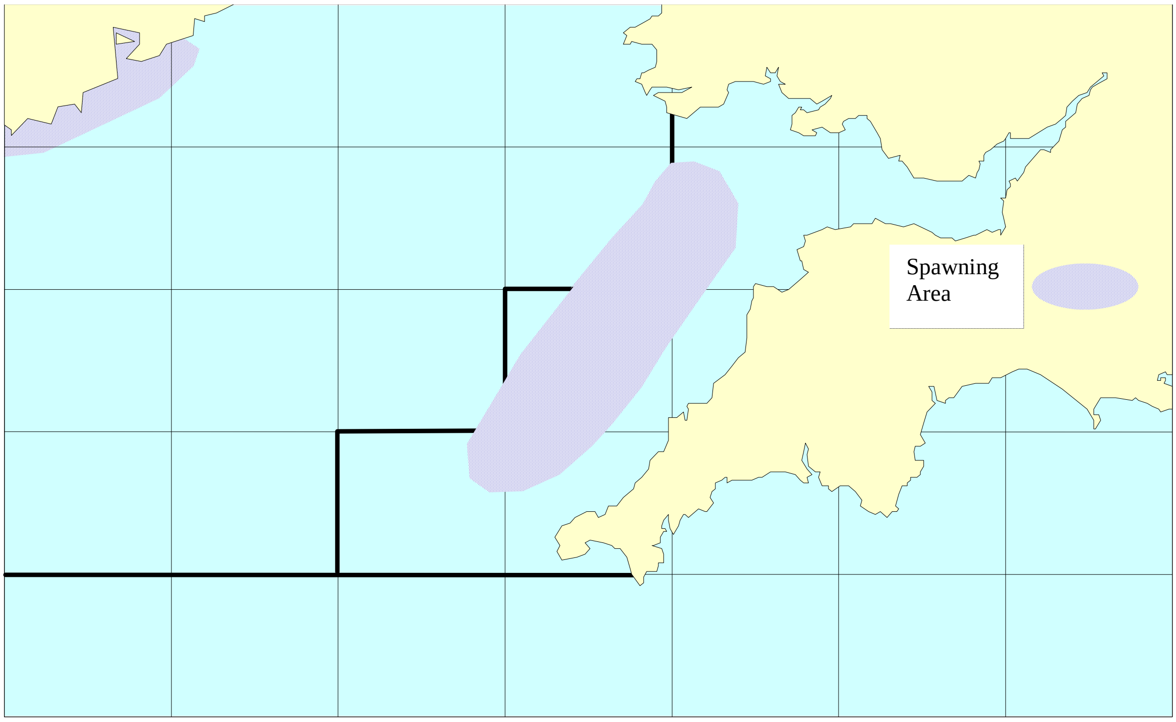


FIGURE A – Spawning areas for VIIfg plaice

TABLE A - VIIFG PLAICE - CATCH DERIVATION TABLE FOR ASSESSMENT YEARS 1982-2001						
		source				
Year of WG	Data	*UK*	*Belgium*	*Ireland*	*derivation of international landings*	*% sampled*
1982	*length composition*	-	quarterly	-	Belgium raised to total international	26
	ALK	-	quarterly	-		
	Age composition	-	quarterly	-		
1983	*length composition*	quarterly	quarterly	-	No assessment carried out	27
	ALK	-	quarterly	-		
	Age composition	-	quarterly	-		
1984		-	As for 1983	-	As for 1983	27
1985	*length composition*	quarterly	quarterly	-	UK+Belgium combined and then raised to total international	49
	ALK	quarterly	quarterly	-		
	Age composition	quarterly	quarterly	-		
1986		As for 1985	As for 1985	-	As for 1985	58
1987		As for 1985	As for 1985	-	As for 1985	56
1988	*length composition*	quarterly	quarterly	-	UK raised to inc France & Ireland	81
	ALK	quarterly	quarterly	-	UK+Belgium combined to total international	
	Age composition	quarterly	quarterly	-		
1989		As for 1988	As for 1988	-	As for 1988	62
1990		As for 1988	As for 1988	-	As for 1988	61
1991		As for 1988	As for 1988	-	As for 1988	61
1992	*length composition*	quarterly	quarterly	quarterly	UK raised to inc France	64
	ALK	quarterly	quarterly	quarterly	UK+Ireland+Belgium combined to total international	
	Age composition	quarterly	quarterly	quarterly		
1993		As for 1992	As for 1992	-	As for 1992	53
1994	*length composition*	quarterly	quarterly	quarterly	UK raised to inc France	70
	ALK	quarterly	quarterly	quarterly	Belgium ALKs supplemented with UK(E+W) data	
	Age composition	quarterly	quarterly	quarterly	UK+Ireland+Belgium combined to total international	
1995		As for 1992	As for 1992	As for 1992	As for 1992	56
1996		As for 1992	As for 1992	As for 1992	As for 1992	76
1997		As for 1992	As for 1992	As for 1992	As for 1992	75
1998		As for 1992	As for 1992	As for 1992	As for 1992	73
1999		As for 1992	As for 1992	As for 1992	As for 1992	72
2000		As for 1992	As for 1992	As for 1992	As for 1992	74
2001		As for 1992	As for 1992	As for 1992	As for 1992	60

TABLE A (CONT.) - VIIFG PLAICE - CATCH DERIVATION TABLE FOR ASSESSMENT YEARS 2002-2005						
		source				
Year of WG	Data	*UK*	*Belgium*	*Ireland*	*derivation of international landings*	*% sampled*
2002	*length composition*	quarterly	-	quarterly	UK raised to inc France;	25
	ALK	quarterly	-	quarterly	UK+Ireland raised to include Belgium	
	Age composition	quarterly	-	quarterly		
2003	*length composition*	quarterly	1st qtr	quarterly	Belgium raised using 1st qtr values	70
	ALK	quarterly	1st qtr	quarterly	UK raised to inc France	
	Age composition	quarterly	1st qtr	quarterly	UK + Bel + IR combined to total int.	
2004	*length composition*	quarterly	Q1 & Q2 only	quarterly	Belgium raised using 1st & 2nd qtr values	70
	ALK	quarterly	Q1 & Q2 only	quarterly	UK raised to inc France	
	Age composition	quarterly	Q1 & Q2 only	quarterly	UK + Bel + IR combined to total int.	
2005	*length composition*	quarterly	-	quarterly	Ireland by gear raised to total Irish.	70
	ALK	quarterly	-	quarterly	UK raised to include French landings	
	Age composition	quarterly	annual	annual	UK + Bel + IR combined to total int.	

England and Wales Beam Trawl Effort (hours fished) Based on Total Demersal landings

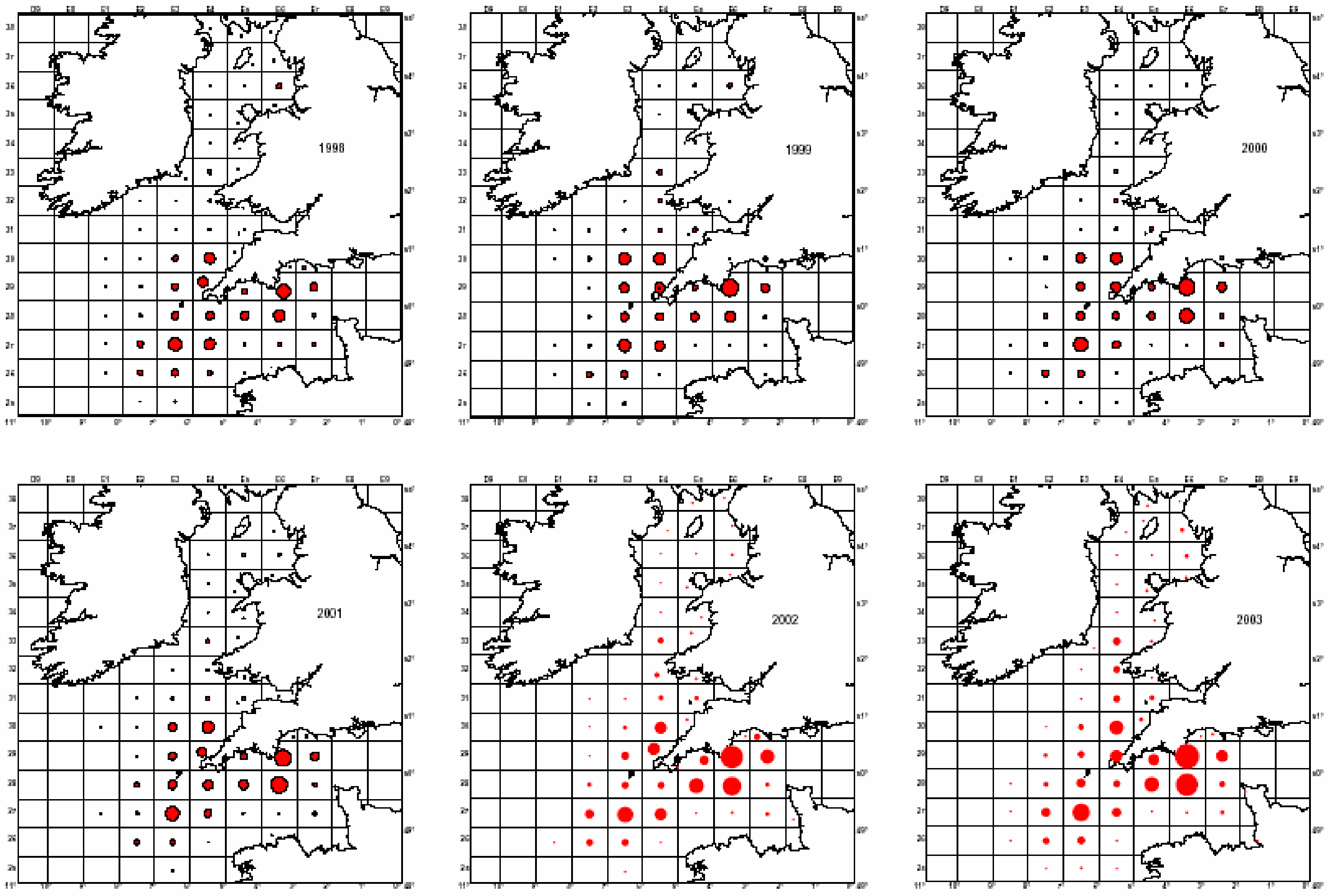
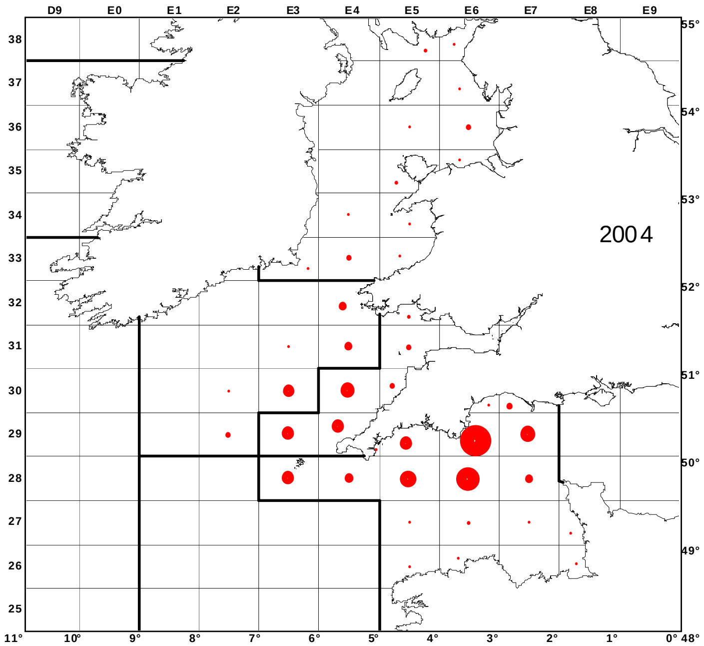
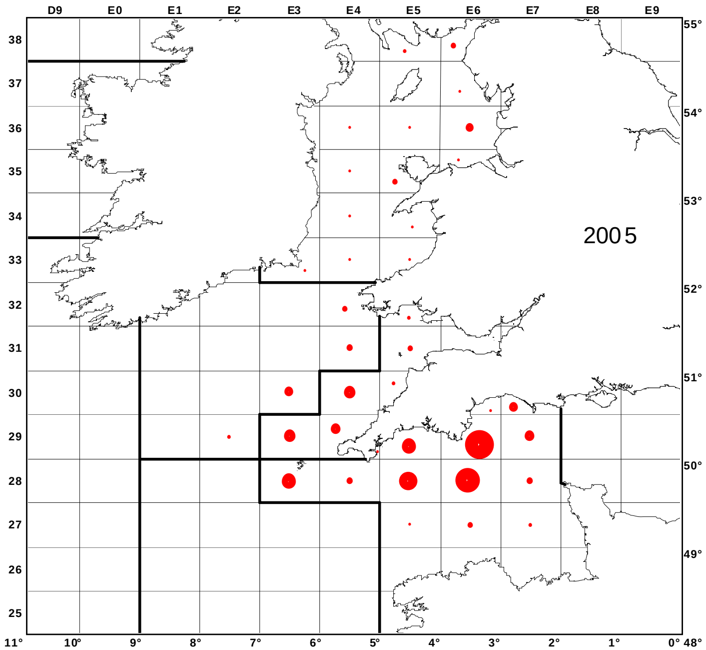


FIGURE B

FIGURE B (continued)





England and Wales Otter Trawl Effort (hours fished) Based on Total Demersal landings

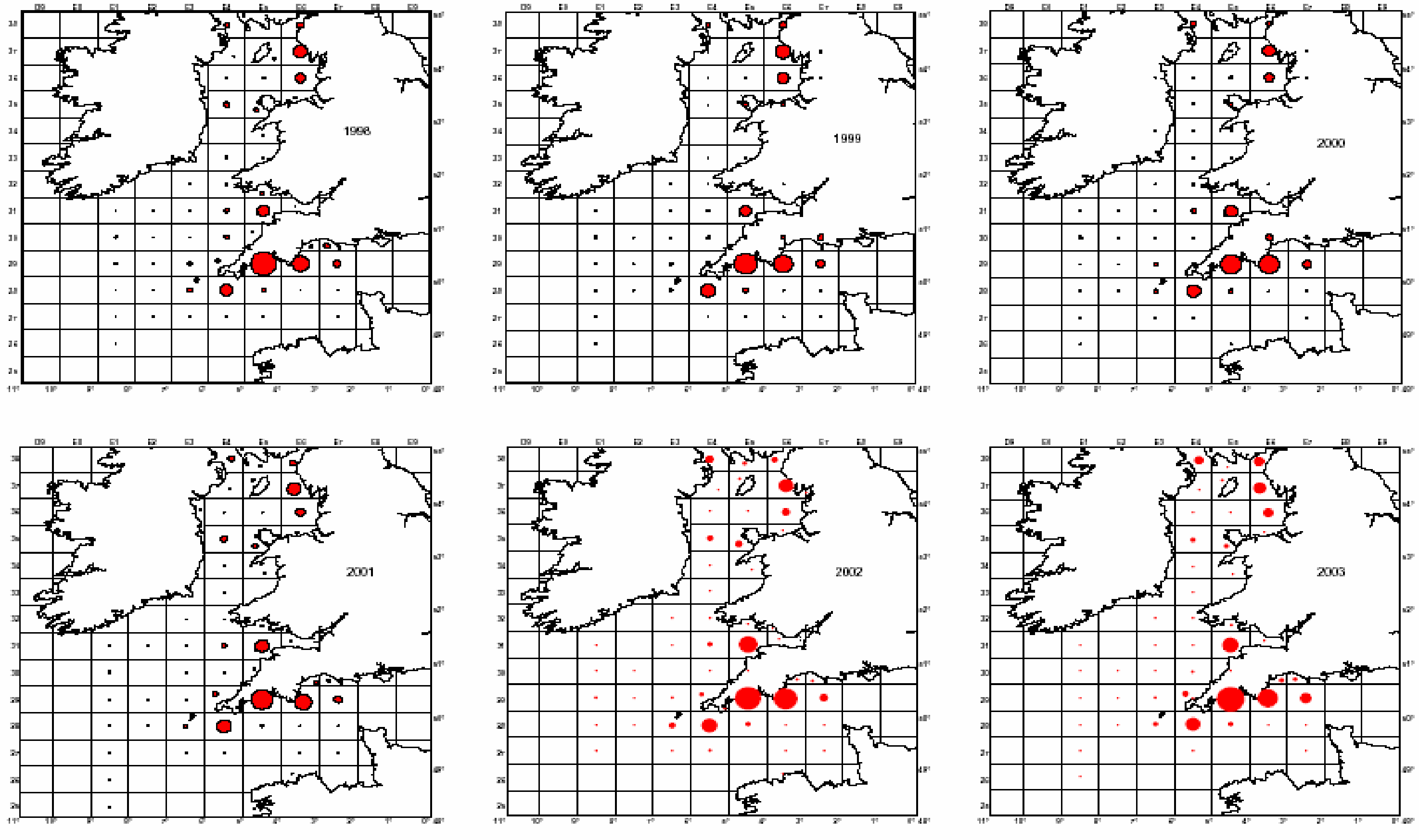
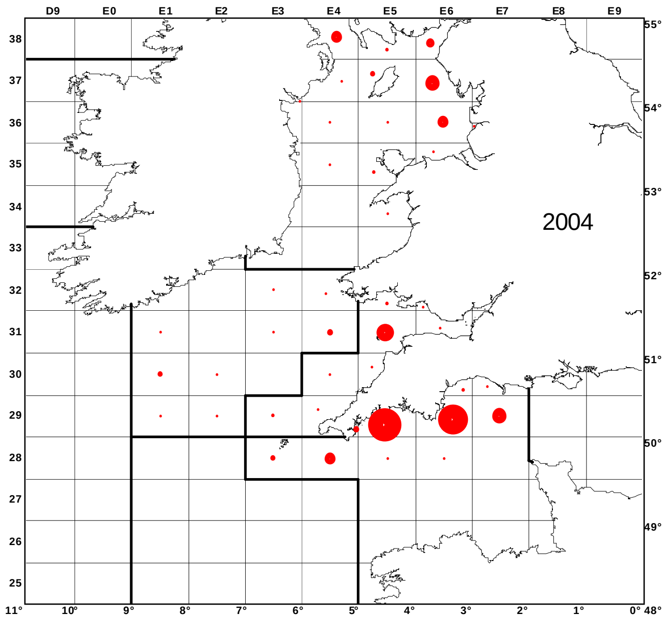


FIGURE C

FIGURE C (continued)



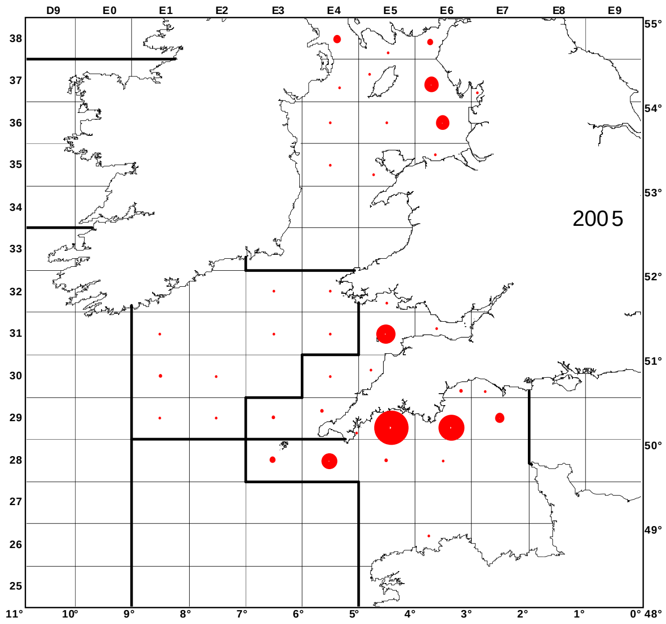


TABLE B. VIIfg plaice - Assessment parameters used

	1991*	992*	1993*	1994	1995	1996	1997	1998	1999	2000
Assessment Age Range	1-8+	1-8+	1-9+	1-9+	1-9+	1-9+	1-9+	1-9+	1-9+	1-9+
Fbar Age Range	3-8	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6	3-6
Assessment Method	L.S.	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA
Tuning Fleets										
UK otter yrs	81-90	81-91	81-92	81-93	89-94	89-95	89-96	89-97	89-98	89-99
Ages	2-8	2-8	2-8	2-8	1-8	1-8	1-8	1-8	1-8	1-8
UK beam yrs					90-94	90-95	90-96	90-97	90-98	90-99
Ages					1-8	1-8	2-8	2-8	2-8	2-8
Bel beam yrs	77-90	77-91	77-92	77-93	77-94	86-95	87-96	77-97	77-98	
Ages	3-8	3-8	3-8	3-8	3-8	3-8	3-8	3-8	3-8	
UK-BTS yrs			88-92	88-93	88-94	88-95	90-96	90-97	90-98	90-99
Ages			1-4	1-5	1-5	2-5	1-5	1-5	1-5	1-5
UK PHHT yrs									93-98	
Ages									2-8	
Time taper		20yr tri	20yr tri	20yr tri	20yr tri	None	None	None	None	None
Power model ages		1	1	1	0	1-5	1-5	1-5	1-5	1-5
P shrinkage		TRUE	TRUE	TRUE	FALSE	TRUE	TRUE	TRUE	TRUE	TRUE
Q plateau age		7	7	7	7	7	7	7	7	7
F shrinkage S.E		0.3	0.8	0.8	0.8	1.5	1.5	1.5	1.5	0.5
Num yrs		5	5	5	5	5	5	5	5	5
Num ages		5	5	5	4	4	4	4	4	4
Fleet S.E.		0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
* Early version of XSA and age/year ranges used not specified. Assumed all years used but age range used uncertain.										

TABLE B. (continued) VIIfg plaice - Assessment parameters used

	2001	**2002**	**2003**	**2004**	**2005**	
Assessment Age Range	1-9+	1-9+	1-9+	1-9+	1-9+	
Fbar Age Range	3-6	3-6	3-6	3-6	3-6	
Assessment Method	XSA	XSA	XSA	XSA	XSA	
Tuning Fleets						
UK otter yrs	89-00	89-01	89-02	89-03	89-04	
Ages	1-8	1-8	1-8	1-8	4-8	
UK beam yrs	90-00	90-01	90-02	90-03	90-04	
Ages	2-8	2-8	2-8	2-8	4-8	
Bel beam yrs						
Ages						
UK-BTS yrs	90-00	90-01	90-02	90-03	90-04	
Ages	1-5	1-5	1-5	1-5	1-5	
UK PHHT yrs						
Ages						
Time taper	None	None	None	None	None	
Power model ages	1-5	1-5	1-5	1-5	1-5	
P shrinkage	TRUE	TRUE	TRUE	TRUE	TRUE	
Q plateau age	7	7	7	7	7	
F shrinkage S.E	0.5	0.5	0.5	0.5	2.5	
Num yrs	5	5	5	5	5	
Num ages	4	4	4	4	4	
Fleet S.E.	0.3	0.3	0.3	0.3	0.5	

APPENDIX 1 – Beam trawl surveys of the Bristol Channel (ICES division VIIf).

1. HISTORY OF THE SURVEY

The CEFAS near-west groundfish survey has taken place every autumn since 1988, and covers the Irish Sea (ICES division VIIa), Bristol Channel (VIIf) and parts of the Celtic Sea (VIIg). Equivalent spring surveys were also conducted between 1993 and 1999. The survey was initially designed to provide abundance indices for pre-recruit (1 and 2 year old) plaice (Pleuronectes platessa) and sole (Solea solea), while also providing abundance and length data for all species caught, and age and other biological data for commercially important species. R.V. Corystes has been used for all the near-west groundfish surveys except the 1996 and 1999 spring surveys, where F.V. Carhelmar was used instead.

2. CURRENT SURVEY OBJECTIVES

The primary objectives of the Irish Sea beam trawl survey are to (a) carry out a 4m beam-trawl survey of groundfish to i) obtain fisheries independent data on the distribution and abundance of commercial flatfish species, and ii) derive age compositions of sole and plaice for use in the assessment of stock size; and (b) to collect biological data, including maturity and weight at age, for sole, plaice, lemon sole and other commercially important species. The epibenthic by-catch from these catches has been quantified since 1997, and these surveys are also used to collect biological samples in support of other CEFAS projects and training courses.

3. SURVEY METHODS

The standard gear used is a 4m beam trawl with chain mat, flip up rope, and a 40mm codend liner to retain small fish. The gear is towed at 4 knots (over the ground) for 30 minutes, averaging 2 nautical miles per tow. Fishing is only carried out in daylight, shooting after sunrise and hauling no later than sunset, as the distribution of some species is known to vary diurnally.

Once onboard the catch is sorted to species level, with the exception of small gobies and sandeels, which are identified to genus. Plaice, sole, dab, and elasmobranchs are sorted by sex, all fish categories weighed, and total lengths are measured to the full centimetre below, or half centimetre if the species is pelagic. Area stratified samples of selected species are sampled for weight, length, sex, maturity, and otoliths or scales removed for ageing.

32 stations were consistently fished in VIIf in the period 1993–2003 (see map), although the presence of static fishing gear etc. may prevent the sampling of certain stations. For more information about this survey see Parker-Humphreys (2004).

4. ABUNDANCE INDEX CALCULATION

The abundance index is calculated by allocating the appropriate ages to the fish that are caught. This gives the age composition (AC) of the catch, and this is used in the appropriate working group analysis.

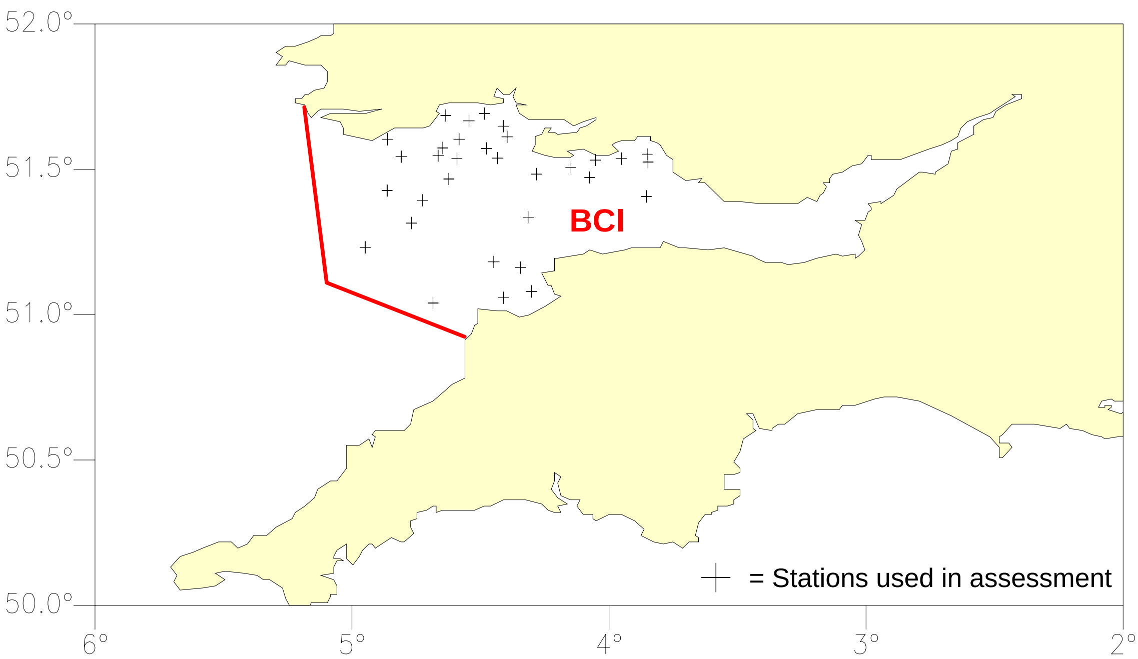
The AC’s are calculated by proportioning a length distribution (LD) to an appropriate age length key (ALK). To account for possible population differences within sector BCI (Bristol Channel inner), biological samples are taken from two depth-bands of < 20m, and > 19m. Where appropriate the ALK’s are separated by sex, and this allows a particular ‘sector, depth-band and sex’ ALK to be raised to the corresponding LD to give an accurate AC for that particular habitat. The AC’s can then be combined as required to give results in the form of ‘numbers at age, per distance or time’.

The table below show the stratifications used to calculate the 'near-west ground fish survey' abundance indices.

		ALK stratified by			LD stratified by			
Species	**Sector**	**Sector**	**Depth band**	**Sex**	**Sector**	**Depth band**	**Sex**	**Used in assessment?**
Plaice	BCI	✓	X	✓	✓	✓	✓	✓
Sole	BCI	✓	X	✓	✓	✓	✓	✓
Whiting	BCI	✓	X	X	✓	✓	X	✓

5. MAP OF THE SURVEY GRID

Additional stations have been sampled throughout the time period, but as these stations are not consistently fished, they are excluded from this map.



6. SUMMARY

AREA COVERED	-	ICES DIVISION VIIF
Target species	-	Flatfish, particularly pre-recruit plaice and sole
Time period	-	September-October. 1988 to present.
Gear used	-	One 4m beam trawl with chain mat, flip-up ropes and 40mm cod-end liner
Mean towing speed	-	4 knots over the ground
Tow duration	-	30 minutes
Vessel used	-	R.V. Corystes

7. REFERENCES

Parker-Humphreys, M (2004). Distribution and relative abundance of demersal fishes from beam trawl survey in the Bristol Channel (ICES Division VIIf) 1993-2001. *Science series Technical Report*, CEFAS, Lowestoft. **123**.

Stock Annex 5 - WGSSDS-Sole VIIe (WesternChannel)

Stock specific documentation of standard assessment procedures used by ICES.

Stock:	Sole (*Solea solea*) : Division VIIe
Working Group:	Assessment of Southern Shelf Demersal Stocks
Date created:	7^{th} July 2003
Last updated:	5^{th} July 2007 (MP-H)

A. General

A.1 Stock definition

The management area for this stock is strictly that for area VIIe. Biologically speaking however the picture is much less clear. Sole in general are relatively sedentary once settled at which point the management unit becomes well defined. However, the sources of recruits are much more poorly defined, as are the nursery areas. There is good evidence to suggest that the stock is split into two biological stocks on either side of the Herd Deep, with likely relatively little exchange between the two. The southern population is almost exclusively exploited by the French with the UK exploiting the lion's share of the northern population. Additionally, tagging information suggests that during years of strong sole recruitment in areas VIIf&g some juveniles may migrate to VIIe. The stock boundary to VIId is also likely to be poorly defined as it represents no natural boundary to sole movement

Figure A shows the spawning areas for VIIe sole

A.2 Fishery

The principal gears used for sole in the Western Channel are otter- and beam-trawls, for the UK fleet and entangling nets and otter-trawls for the French fleet. In recent years, UK vessels have accounted for around three quarters of the total international landings, with France taking approximately a quarter and Belgian vessels the remainder. UK landings were low and stable between 1950 and the mid-1970s, but increased rapidly after 1978 due to the replacement of otter-trawlers by beam-trawlers. Since the UK fleet is the major component of the international landings, they follow a similar trend. Sole is the target species of an offshore beam-trawl fleet, which is concentrated off the south Devon & Cornish coasts, and also catches plaice and anglerfish. In recent years a winter fishery targeting cuttlefish has developed for the English beam-trawl fleet in the Western Channel, lasting from November to the end of March. This has taken some of the reliance of the fleet away from sole, but sole still represents a substantial portion of the catch during this time so it is not clear to what degree the switch to cuttle-fishing has reduced fishing mortality on sole.

Discarding of sole in this fishery is thought to be minor. Landings of sole reached a high level above 1,400t in the 1980's, boosted initially by high recruitment in the late 1970s, followed by an increase in exploitation. Landings declined between 1988 and 1991, following the recruitment of 3 below-average year classes (1986-88); since 1991 they have fluctuated between 800 t and 1100t. Substantial quantities of sole caught in VIIe have been reported to two rectangles in VIId in order to avoid quota restrictions. Corrections for this misreporting were first made during the 2002WG, but misreporting to other areas has been more difficult to identify. In addition, black landings are likely to have occurred to various degrees since quotas became restrictive in the late 1980's.

A.3 Ecosystem aspects

B. Data

B.1 Commercial Catch

From 1995WG to 2005WG the International landings for the stock were based entirely on English quarterly sampling effort and then raised to quarterly international landings, but since 2006WG French age data from 2002 onwards has been included. Numbers at age prior to 1994 are calculated by raising the UK age composition to UK and Channel Island Catches, adding the French age composition data, and finally raising the resulting age composition to the total international landings.

Numbers at age 1 in the catch are low or zero in most years and most likely reflect variation in the sampling, rather than variation in the stock itself. Therefore, these were not considered to add useful information and are replaced by zeros.

Table A shows the history of the derivation of catch numbers at age.

B.2 Biological

Weights at age.

Total international catch and stock weights at age are calculated as the weighted mean of the annual weight at age data (weighted by catch numbers), and smoothed in-year using a quadratic fit so that :

$$Wt = a + b*Age + c*Age^2$$

where catch weights at age are mid-year values, and stock weights at age are 1 January values. Catch weights at age have been scaled to give a SOP of 100%, and the same scaling has been applied to the stock weights at age. Catch numbers at age 1 are replaced by zeros, but the catch weights at age 1 were retained since they are part of the smoothing procedure and do not affect the assessment. They are also essential for the medium-term forecast.

A smoother is applied to sampled catch weights at age to adjust for variation in the weight at age that may result from low levels of sampling rather than differences in growth rate between cohorts. It also allows estimation of the stock weights at age by extrapolation of the curve rather than by using quarter 1 samples, which may be sparse.

Natural mortality and maturity at age.

Natural mortality is assumed constant over ages and years at 0.1. This is consistent with the natural mortality estimates used for sole by other ICES working groups (WGNSSK: IV, VIId, WGNSDS: VIIa, WGSSDS: VIIfg, VIIIa,b) and consistent with estimates of M reported in Horwood (1993) for VIIfg sole as well as other stocks and papers cited therin.

The maturity ogive applied to all years is, a combined sex maturity ogive taken from area VIIfg attributed to Pawson & Harley, WD presented to WGSSDS in 1997. Prior to 1997 maturity was taken to be knife-edge at age 3.

Age	1	2	3	4	5	6,7, …12+
Prop. mature	0.00	0.14	0.45	0.88	0.98	1.00

Proportion of F and M before spawning are both been set to zero to reflect the SSB calculation date of 1 January.

B.3 Surveys

Currently the only available survey for this stock is the Western Channel Beam trawl Survey conducted by the UK in late September, early October. The survey covers an relatively small area of VIIe from Start Point through to the middle of Lyme Bay and out to the edges of the Hurd Deep covering the immediate area of fishing for the Brixham fleet, but omitting Start Bay which these days contributes significantly to the landings of sole in VIIe. Sampling started originally in 1984 on the chartered commercial fishing vessel ‘Bogey One’, replaced in 1988 by the ‘Carhelmar’ and moved to the research vessel ‘Corystes’ in 2002 to 2004. Concerns were raised regarding differences in catchability between the Carhelmar and Corystes, and in 2003 the survey was carried out on the original vessel in addition to the Corystes. From 2005 onwards the survey has been moved back to the original vessel, and as a result of intersessional investigations the 2003 data were replaced with those collected on the Carhelmar. Therefore the time has only 2002 and 2004 data being collected on the Corystes.

The survey CPUE shows a decline from 1986 to 1995 in line with the commercial data. Numbers of sole caught per effort by the UK-WECBTS survey are given in Table 3.1.8. The abundance indices at ages 1 and 2 show little overall trend, but ages 3 to 6 indicate a decline over the series, despite intermittent peaks and troughs. The 1989 year-class is indicated to be strong at all ages and this year-class can also be traced through the catch at age matrix.

Appendix 1 provides a history of the survey and details the survey methodology and objectives.

B.4 Commercial fleet effort and LPUE

In the early part of the century the fishery for VIIe sole was largely prosecuted by otter trawlers and inshore netters. During the mid to late 70’s landings sharply increased with a considerable increase in nominal effort as the beamtrawl fleet developed. Otter trawl effort declined with levels in 2002 being about half that of effort found in the late seventies. Beam trawl effort in terms of hours fished has continued to rise since 1988, but at a slower rate than previously due to licensing and quota restrictions, but boat size and power as well as beam sizes have also increased suggesting that the effective effort has continued to rise more sharply than suggested by the effort data alone.

LPUE has declined since the late eighties in both the otter and beamtrawl fleets suggesting a marked decline in the SSB of this stock. Interestingly the catch-at-age information for these fleets does not suggest a marked decline in the age structure over this time suggesting the decline may be associated with environmental impacts rather than fishing, but given the uncertainty in current landings data it is difficult to distinguish between the potential causes of the discrepancy between the lpue and catch-at-age data. Little information is currently available regarding the development of the French fishery on this stock on the southern side of the Channel.

The UK beam trawl fleet in recent years has been landing large quantities of cuttlefish during the winter months. Investigations of the landings data indicated that mis-reporting was particularly high during the period of the cuttlefish fishery indicating that lpue was unlikely to be substantially lower than during the remainder of the year, justifying the inclusion of all trips in the lpue time series. Similarly, there was no indication of differences in lpue for those trips split between divisions (misreporting to VIId) so that trips reporting to VIIe as well as those reporting to the two adjacent rectangles in VIId were included in the derivation of the tuning fleets.

UK beam-trawl effort has climbed markedly since 1992. Otter trawl effort has stabilised following its decline during the 80’s and early 90’s.

FIGURES B & C show plots of UK effort for 1995-2006 by ICES rectangle for beam and trawl gears.

B.5 Other relevant data

C. Historical Stock development

The earliest available landings information by age for this stock is 1969, at which time landings were 353 mainly attributable to otter trawlers. The response of the stock to the increased effort in the late 70's appears to have been a decline in SSB after an initial increase in stock size to its maximum in 1980 as a consequence of particularly good recruitment in 1976. The decline as assessed by XSA occurred despite subsequent good recruitment in 1980, 84, 86 and 90 leading to an apparently depressed recruitment period since 1991. It is unclear weather this reduction in recruitment is linked to the decline in SSB, environmental effects, or is an artefact of the misreporting of landings due to the TAC constraints introduced in 1987, and becoming restrictive in 1989.

Tuning data

Currently four (WG 2007) commercial tuning fleets are used in conjunction with the survey index in the assessment. These are the UK combined beam trawl fleet, the UK combined otter trawl fleet and two historic fleets that end in 1987. Prior to 2004 two commercial tuning fleets were used in conjunction with the survey index in the assessment. These were the UK combined beam trawl fleet and the UK otter trawl fleet. At the 2002 WG the beamtrawl fleet was split into <24m and >24m boats, but catch at age data was not available in a disaggregated form, so that the same age composition was used for both fleets, which gave an unnecessarily heavy weighting to the beamtrawl fleet in the assessment. Prior to 2001 the beamtrawl tuning fleets were split into offshore and inshore fleets by rectangle, but analysis suggested the size of vessel was a better indicator of area fished than rectangle due to the frequent miss reporting of catches in this fishery. The age of tuning for the commercial series are currently 2-11.

Fisheries independent tuning data is provided by the Quarter 4 UK-WECBTS-survey described under section B.3 of the Annex. Ages used in the tuning are 1-9.

TABLE B shows the history of VIIe sole assessments and details the parameters used

D. Short term projection

Software: Multi Fleet Deterministic Projection (MFDP)

Age based short term projections are conducted for a 3 year period using initial stock numbers derived from XSA analyses. Numbers at age 1 are considered poorly estimated and are generally overwritten using a geometric mean of past recruitment values. Age 2 is often replaced with geometric mean reduced by natural mortality.

The exploitation pattern is typically an un-scaled 3 year arithmetic mean, though alternative options may be used depending on recent F trajectories and the working groups perception of the fishery.

Catch and stock weights at age are generally taken as the mean of the last 3 years. Maturity ogive and natural mortality estimates are those used in the assessment method.

E. Medium term projections

Software: MLA miscellany

Input values to the medium term forecast are the same as those used in the short term forecast. Any stock recruit relationship is poorly defined and whilst a Beverton Holt SRR has been assumed in earlier years, a simple geometric mean may now be considered more appropriate, though it remains unclear whether the full time series or a reduced time series from 1991 should be used.

F. Yield and biomass per recruit / long term projections

Software: Multi Fleet Yield per Recruit (MFYPR)

Yield per recruit calculations are conducted using the same input values as those used for the short-term forecasts.

G. Biological reference points

Biological reference points in this stock were set in 1998 as described in the table below along with the reasoning. Reference points needed to be amended in 2001, due to a change in the assessment methodology. Increasing the plus group lead to an increase in the absolute levels of SSB for which reference points needed to be recalculated.

	WG(1998)/ACFM(1998)	SINCE WG(2001)/ACFM (2001)
		Age range extended from 1-10+ to 1-12+
$\mathbf{F}_{lim}$	0.36 ($\mathbf{F}_{loss}$ WG98)	0.28 ($\mathbf{F}_{loss}$ WG01)
$\mathbf{F}_{pa}$	0.26 ($\mathbf{F}_{lim}$*0.72)	0.20 ($\mathbf{F}_{lim}$*0.72)
$\mathbf{B}_{lim}$	1800t ($\mathbf{B}_{loss}$= B_{73} WG98)	2000t ($\mathbf{B}_{loss}$= B_{00} WG01)
$\mathbf{B}_{pa}$	2500t ($\mathbf{B}_{lim}$*1.4)	2800t (Historical development)

The 2003 WG suggested that due to the uncertainty in the landings information biological reference points or current SSB estimates were uncertain and management should instead be based on fishing mortalities.

H. Other issues

A management plan was agreed for VIIe sole in 2007:

Council Regulation (EC) No 509/2007 establishes a multi-annual plan for the sustainable exploitation of VIIe sole. Years 2007-2009 are deemed a recovery plan, with subsequent years being deemed management plan. For 2008 the TAC is required to be at a value whose application will result in a 20% reduction in F compared to Fbar (03-05). If this value exceeds a 15% change in TAC, a 15% change in TAC shall be implemented.

I. References

Horwood 1993

Pawson and Harley 1997

FIGURE A - Spawning areas for VIIe sole

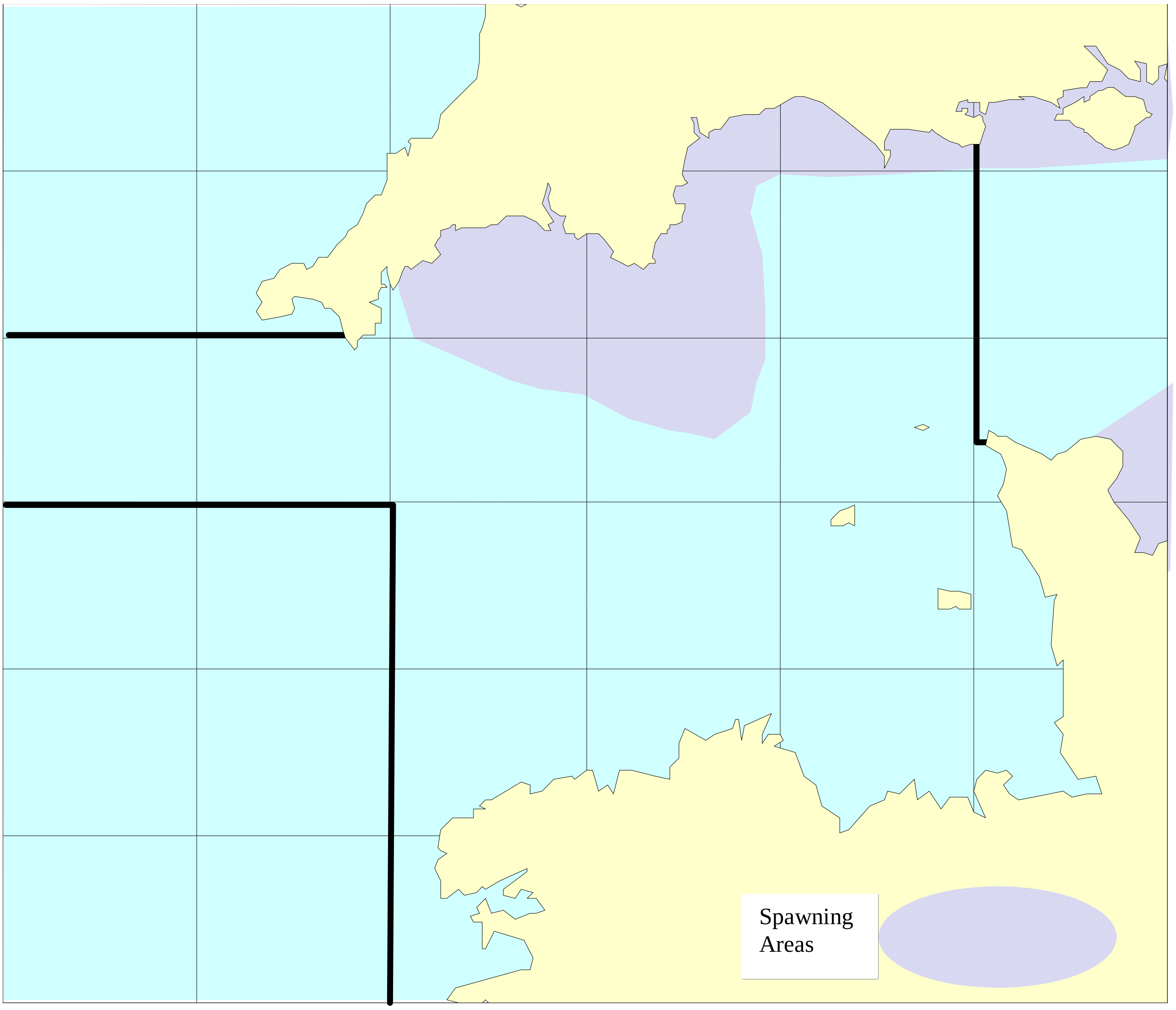


TABLE A. VIIE SOLE - CATCH DERIVATION TABLE FOR ASSESSMENT YEARS 1981-2007					
		source			
Year of WG	*Data*	*UK*	*France*	*derivation of international landings*	*% sampled*
1981	*length composition*	quarterly	quarterly	UK ALKs applied to French LDs	95
	ALK	quarterly	-	UK+France raised to total international	
	Age composition	quarterly	-		
1982		As for 1981	As for 1981	As for 1981	99
1983		As for 1981	As for 1981	As for 1981	92
1984		As for 1981	As for 1981	As for 1981	96
1985		As for 1981	As for 1981	As for 1981	96
1986		As for 1981	As for 1981	As for 1981	96
1987	*length composition*	quarterly	quarterly	UK+France raised to total international	95
	ALK	quarterly	quarterly		
	Age composition	quarterly	quarterly		
1988		As for 1987	As for 1987	As for 1987	96
1989		As for 1987	As for 1987	As for 1987	95
1990		As for 1987	As for 1987	As for 1987	94
1991		As for 1987	As for 1987	As for 1987	96
1992		As for 1987	As for 1987	As for 1987	97
1993		As for 1987	As for 1987	As for 1987	94
1994	*length composition*	quarterly	quarterly	UK ALKs applied to French LDs	92
	ALK	quarterly	-	UK+France raised to total international	
	Age composition	quarterly	-		
1995	*length composition*	quarterly	-	UK raised to total international	81
	ALK	quarterly	-		
	Age composition	quarterly	-		
1996		As for 1995	-	As for 1995	78
1997		As for 1995	-	As for 1995	73
1998		As for 1995	-	As for 1995	64
1999		As for 1995	-	As for 1995	57
2000		As for 1995	-	As for 1995	56
2001		As for 1995	-	As for 1995	59
2002		As for 1995	-	As for 1995	60
2003		As for 1995	-	As for 1995	65
2004		As for 1995	-	As for 1995	69
2005		As for 1995	-	As for 1995	
2006		As for 1995	quarterly	UK and French raised to total international	95
2007		As for 1995	As for 2006	As for 2006	96

Figure.B

Beam trawl effort (hours fished) based on total demersal landings of all UK vessels over 10 metres

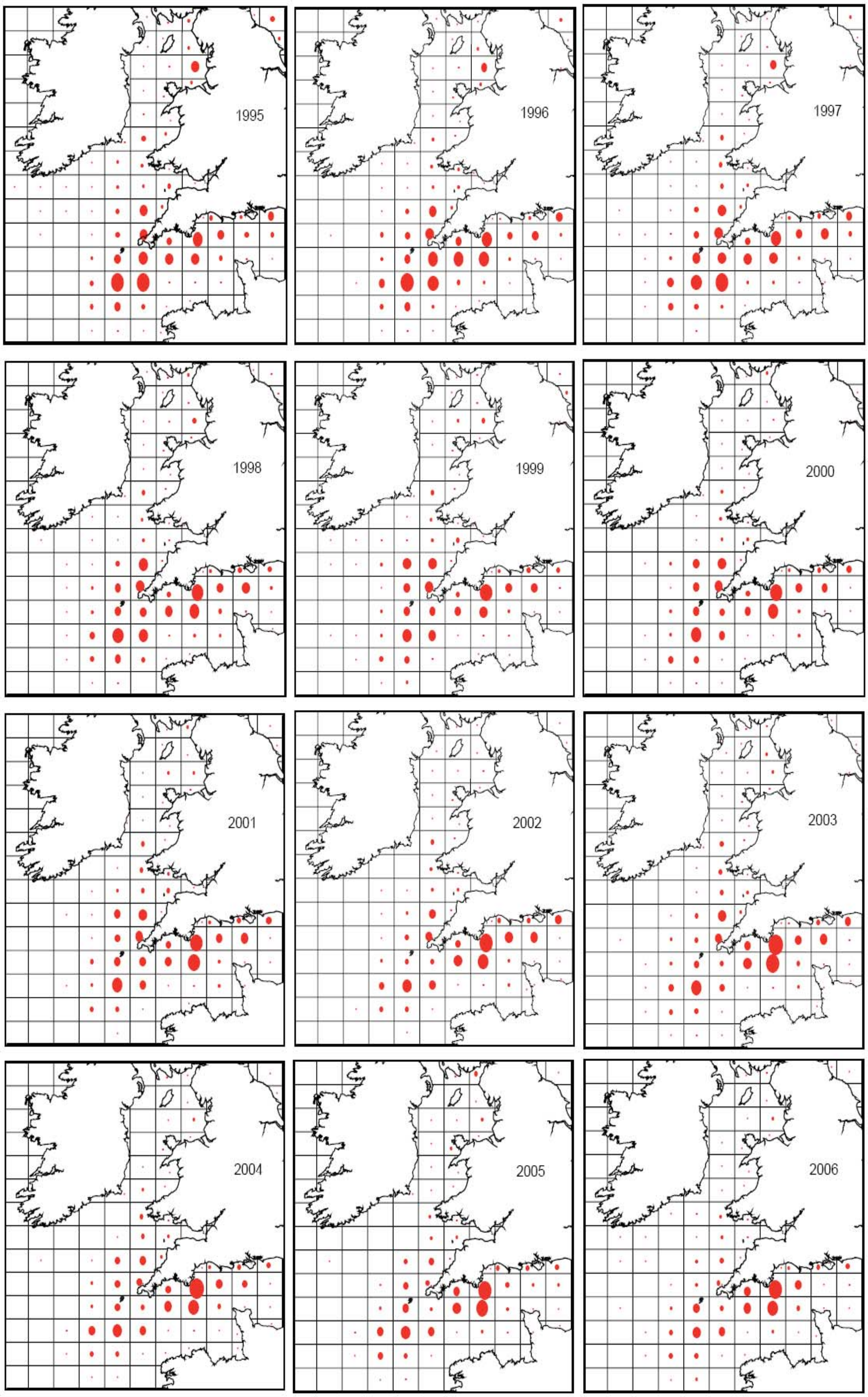


FIGURE C

Otter trawl effort (hours fished) based on total demersal landings of all UK vessels over 10 metres

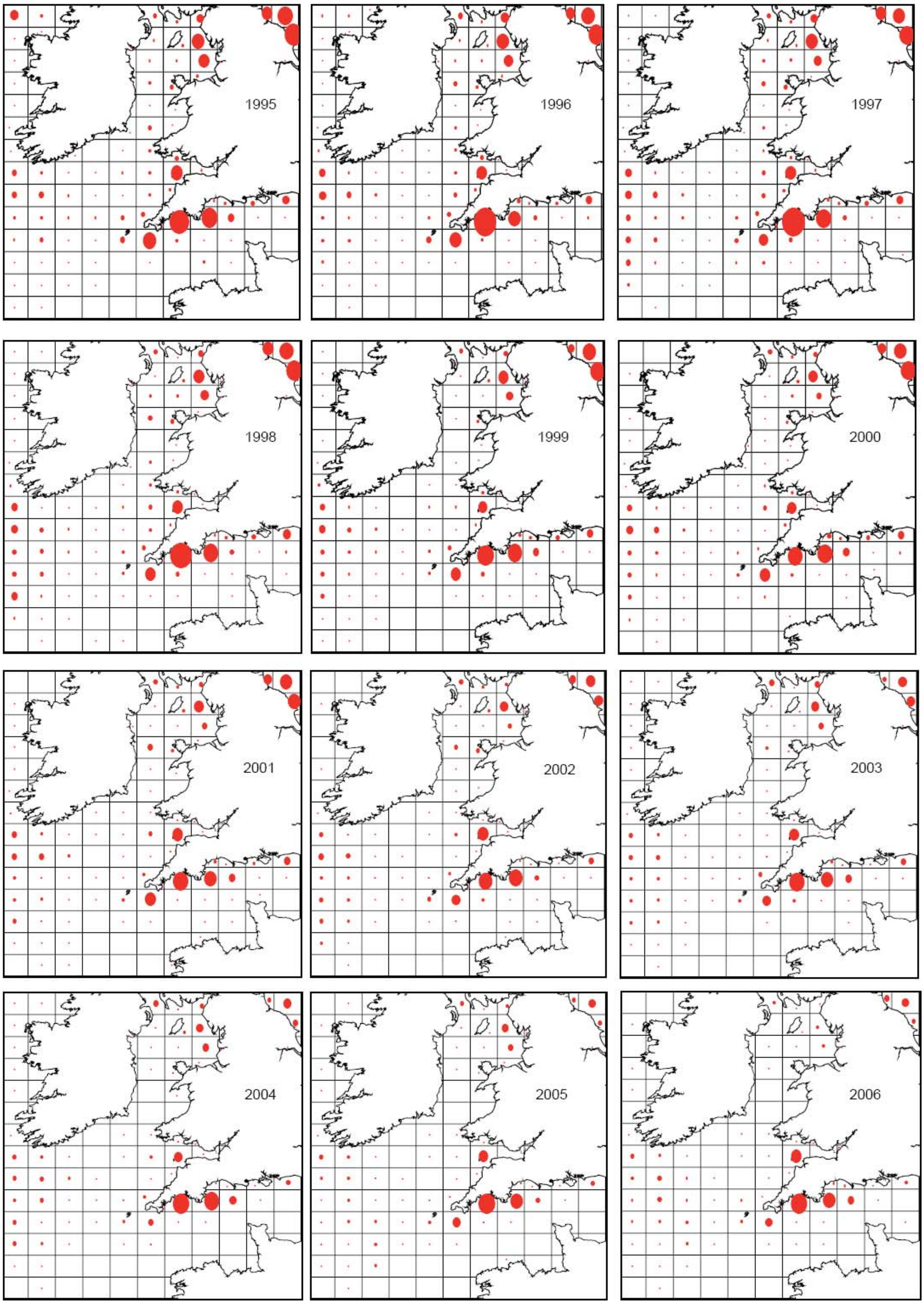


TABLE B - History of VIIe sole assessments

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007			
Assmnt Age Range	1-9+	1-9+	1-9+	1-10+	1-10+	1-10+	1-10+	1-10+	1-10+	1-10+	1-12+	1-12+	1-12+	1-12+	1-12+	1-12+	1-12+			
Fbar Age Range	F(3-8)	F(3-7)	F(3-7)	F(3-7)	F(3-7)	F(3-7)	F(3-7)	F(3-7)	F(3-7)	F(3-7)	F(3-7)	F(3-7)	F(3-7)	F(3-7)	F(3-7)	F(3-7)	F(3-7)			
Assmnt Method	L.S.	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA	XSA			
Tuning Fleets																				
UK Inshore beam **Ages**	1983-92 2-9	1973-92 2-9	1973-92 2-9	1973-93 2-9	1973-93 2-9	1986-95 2-9	1987-96 2-9	1983-97 2-9	1984-98 2-9	1986-99 2-9	1986-00 2-11			1973-87 2-11	1973-87 2-11	1973-87 2-11	1973-87 2-11			
UK Offshore beam **Ages**	1983-92 3-9	1973-92 3-9	1973-92 3-9	1973-93 3-9	1973-93 3-9	1986-95 3-9	1987-96 3-9	1983-97 3-9	1984-98 3-9	1986-99 3-9	1986-00 3-11			1973-87 3-11	1973-87 2-11	1973-87 2-11	1973-87 2-11			
UK < 24m beamtr **Ages**												1989-01 2-11								
UK > 24m beamtr **Ages**												1988-01 2-11								
UK combined beam **Ages**													1989-02 2-11	1988-03 2-11	1988-04 2-11	1988-05 2-11	1988-06 2-11			
UK otter trawl **Ages**												1988-01 2-11	1988-02 2-11	1988-03 2-11	1988-04 2-11	1988-05 2-11	1988-06 2-11			
UK WECBTS yrs **Ages**		1984-92 2-6	1984-92 2-6	1984-93 1-6	1984-93 1-6	1986-95 1-6	1987-96 1-6	1983-97 1-6	1984-98 1-6	1984-99 1-6	1984-00 1-6	1984-01 1-6	1984-02 1-6	1984-03 1-9	1984-04 2-11	1984-05 2-11	1984-06 2-11			
Time taper		20yr tri	20yr tri	20yr tri	20yr tri	No	No	No	No	No	No	No	No	No	No	No	No			
Power model ages		1	1-2	1-4	1-6	1-6	1-6	1-6	1-6	1-6	1-6	1-6	1-6	1-6	No	No	No			
P shrinkage		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes			
Q plateau age		8	5	6	7	7	7	7	7	7	9	9	9	9	9	8	8			
F shrinkage S.E		0.3	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5			
Num yrs		5	5	5	5	5	5	5	5	5	5	5	5	5	3	4	5			
Num ages		5	3	5	3	3	3	3	3	3	5	5	5	5	3	4	5			
Fleet S.E.		0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	1.0	1.0			

APPENDIX 1 - Beam trawl surveys of the western English Channel (ICES Division VIIe)

1. HISTORY OF THE SURVEY

Complaints from the fishing industry in the south- west about the lack of scientific investigation and knowledge of the local sole stock provided the catalyst for the survey in VIIe. Following enquiries of the local fishery officers and normal tendering procedures, a skipper-owned 300-hp beam trawler – the Bogey 1 - was selected. The first year (1984) the survey consisted of a collection of tows on the main sole grounds. In 1989 the Bogey 1 was replaced with the Carhelmar and the survey continued unchanged until 2002 when R.V. Corystes took over the survey as an extension to its 'near-west groundfish survey'.

Due to the changes occurring through the time series, the surveys completed on R.V. Corystes (2002 onwards) will be described separately to the 'previous' surveys (pre 2002).

2.a. SURVEY OBJECTIVES (1984 to 2001)

To provide independent (of commercial) indices of abundance of all age groups of sole and plaice on the west channel grounds, and an index of recruitment of young (1-3 year old) sole prior to full recruitment to the fishery.

2.b. SURVEY OBJECTIVES (2002 to present)

The primary objectives of the Irish Sea beam trawl survey are to (a) carry out a 4m beam-trawl survey of groundfish to i) obtain fisheries independent data on the distribution and abundance of commercial flatfish species, and ii) derive age compositions of sole and plaice for use in the assessment of stock size; and (b) to collect biological data, including maturity and weight at age, for sole, plaice, lemon sole and other commercially important species. The epibenthic by-catch from these catches has been quantified, and these surveys are also used to collect biological samples in support of other CEFAS projects and training courses.

3.a. SURVEY METHODS (1984 to 2001)

For the years 1984-1988 the vessel was unchanged and was equipped with two 6m chain mat beam trawls with 75mm cod-ends. For the survey hauls one of the cod-ends was fitted with a 60mm liner. In 1989 the Bogey 1 was replaced by the latest design 24m 300hp(220kw) beam trawler Carhelmar. In 1988 two commercial chain mat 4m-beam trawls (measured inside the shoe plates) were purchased by MAFF as dedicated survey gear. Both beams were fitted with the standard flip-up ropes and 75mm cod-end. For years 1989 and 1990 only 1 cod-end was fished with a 40mm liner but from 1991 with the introduction of 80mm cod-ends both were fitted with 40mm liners. The vessel and gear has remained unchanged since 1991.

Between 1989 and 2001 the survey remained relatively unchanged apart from small adjustments to the position of individual hauls to provide an improved spacing. In 1995 two inshore tows in shallow water (8-15m) were introduced. The survey now consists of 58 tows of 30 minutes duration, with a towing speed of 4 knots in an area within 35 miles radius of Start Point. The survey design is stratified by 'distance from the coast' bands, in contrast to the VIIa,f+g survey that is stratified by depth bands. The reason for this is that the coastal shelf with a depth of water less than 40m is relatively narrow and in addition is often fished with fixed gear. The survey bands (in miles) are 0-3, 3-6, 6-12, 12+ inshore, and 12+offshore.

3.b. SURVEY METHODS (2002 to present)

The standard gear used is a single 4m beam-trawl with chain mat, flip up rope, and a 40mm codend liner to retain small fish. The gear is towed at 4 knots (over the ground) for 30 minutes, averaging 2 nautical miles per tow. Fishing is only carried out in daylight, shooting after sunrise and hauling no later than sunset, as the distribution of some species is known to vary diurnally.

Once onboard the catch is sorted to species level, with the exception of small gobies and sandeels, which are identified to genus. Plaice, sole, dab, and elasmobranchs are sorted by sex, all fish categories weighed, and total lengths are measured to the full centimetre below, or half centimetre if the species is pelagic. Area stratified samples of selected species are sampled for weight, length, sex, maturity, and otoliths or scales removed for ageing.

The standard grid of 58 stations was fished in 2002 and 2003 (see map), and although other stations have been fished in this period, they were for exploratory purposes and were not included in the assessment.

4. ABUNDANCE INDEX CALCULATION

Plaice and sole abundance indices are calculated by allocating the appropriate ages to the fish that are caught. This gives the age composition (AC) of the catch, and this is used in the appropriate working group analysis.

The AC's are calculated by proportioning a length distribution (LD) to an appropriate age length key (ALK). To account for possible population differences within ICES Division VIIe, biological samples are taken from sectors stratified by distance from shore (see map). The survey bands (in miles) are 0-3, 3-12, 12+ inshore, and 12+ offshore. Where appropriate the ALK's are separated by sex, and this allows a particular 'sector, depth-band and sex' ALK to be raised to the corresponding LD to give an accurate AC for that particular habitat. The AC's can then be combined as required to give results in the form of 'numbers at age, per distance or time'.

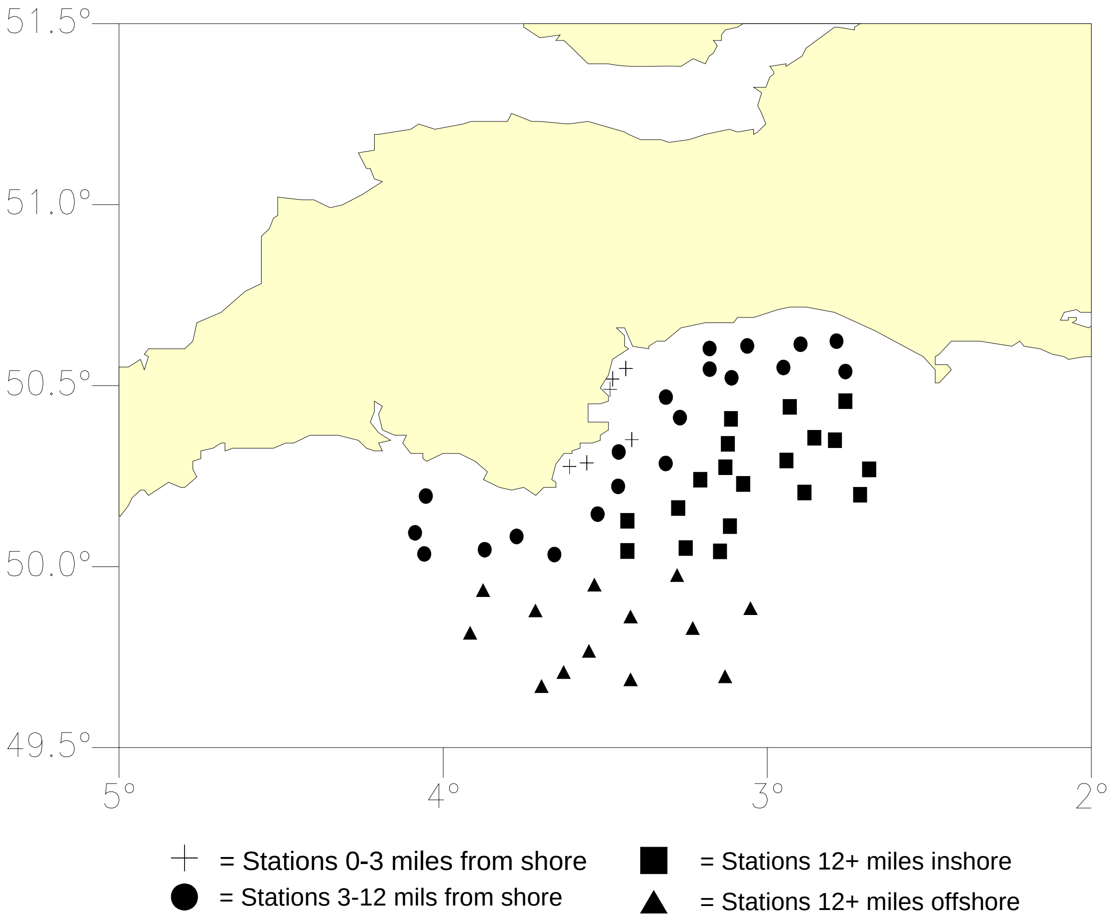
Between 1984 and 1990 a total survey age-length key was applied to the 'grid' length distribution, but from 1990 onwards stratum stratified age-length keys were used.

The table below show the stratifications currently used to calculate the 'near-west ground fish survey' abundance indices.

		ALK stratified by			LD stratified by			
Species	**Sector**	**Sector**	**Depth band**	**Sex**	**Sector**	**Depth band**	**Sex**	**Used in assessment?**
Plaice	VIIe	✓	✓	✓	✓	✓	✓	✓
Sole	VIIe	✓	✓	X	✓	✓	X	✓

5. MAP OF SURVEY GRID

Additional stations have been fished throughout the time period, but as these stations are not consistently fished, they are excluded from this map.



6. SUMMARY

AREA COVERED	-	ICES DIVISION VIIE
Target species	-	Flatfish, particularly pre-recruit plaice and sole
Time period	-	September-October. 1988 to present.
Gear used	-	1984-1988 – 2 * 6m beam trawls
	-	1989-2001 – 2 * 4m beam trawls
		2002-Present – 1* 4m beam trawl
Mean towing speed	-	4 knots over the ground
Tow duration	-	30 minutes
Vessel used	-	1984-1988 - F.V. Bogey 1
	-	1989-2001 - F.V. Carhelmar
	-	2002-Present - R.V. Corystes

Stock Annex 6 – Quality Handbook - Celtic Sea Sole

Stock specific documentation of standard assessment procedures used by ICES.

Stock:	Sole (division VIIf,g)
Working Group:	Assessment of Southern Shelf Demersal Stocks
Date:	29th July 2004
Last updated:	13th July 2007

A. General

A.1 Stock definition

A description of the stock definition of sole in the Celtic Sea was given in the leaflet “Fisheries information – cod, sole, plaice and whiting in the south west of the British Isles” published by CEFAS under a EU funded project (SAMFISH: EU Study Contract 99-009, Improving sampling of western and southern European Atlantic Fisheries) and is taken over here.

In the coastal waters of western England and Wales, sole are found in greatest abundance in the north eastern Irish Sea and the eastern Celtic Sea. The main spawning areas for sole in the Celtic Sea are in deep waters (40-75 m) off Trevose Head, where spawning usually takes place between March and May. Sole nursery grounds are generally located in shallow waters such as estuaries, tidal inlets and sandy bays. Juvenile sole (0 and 1 year old fish) are found chiefly in depths up to 40 m, and adult sole (fish aged 3 plus) are generally found in deeper water. Spawning and nursery grounds are well defined.

Over 6,000 sole were tagged on the nursery grounds of the Bristol Channel and the Irish Sea between 1977 and 1988. The majority of fish tagged in Swansea Bay and Carmarthen Bay were between 15 and 24 cm in length. Most of the recaptures of these tagged fish occurred two or more years after release, which meant that many fish tagged as juveniles were recaptured as adults. The majority of returned fish were reported off the north coasts of Devon and Cornwall, and over a wide area in the eastern Celtic Sea and St. George's Channel. These results suggest that once an adult sole has recruited to an area, it tends to remain there, and that there is only limited movement of sole between the Celtic Sea and adjoining areas.

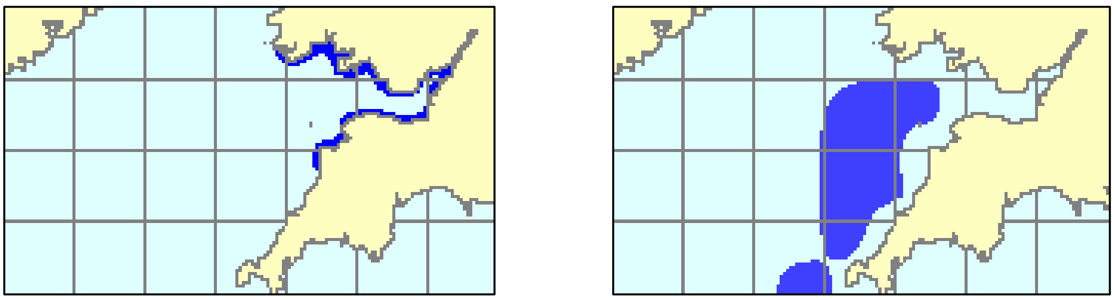


Figure A.1 Nursery and spawning areas of sole in the Celtic Sea (After Coull, K.A., Johnstone, R., and S.I. Rogers. 1998. Fisheries Sensitivity Maps in British Waters. Published and distributed by UKOOA Ltd.)

A.2 Fishery

Fisheries for sole in VIIf,g involve vessels from Belgium, taking approx. two thirds, the UK taking approx. one quarter, and France and Ireland taking minimal amounts of the total landings. Nominal landings are available from 1986 onwards. Sole are mainly targeted by beam trawlers and the fishery is concentrated on the north Cornish coast off Trevose Head and around Lands End. There is an average landing of 1000 tonnes throughout its history (See also figures A.2 and A.3).

Discard information is being collated and it seems to be minor.

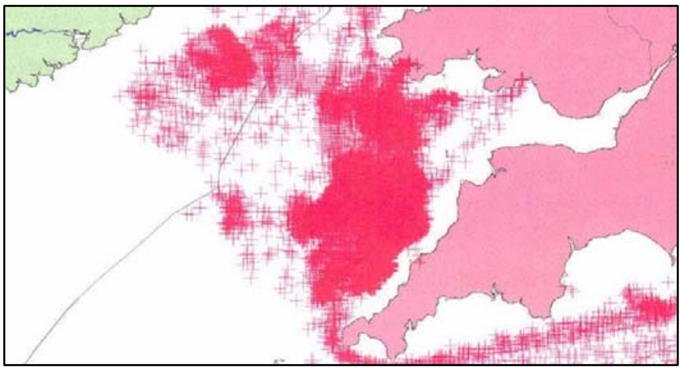


Figure A.2 Effort distribution of the Belgian beam trawl fleet operating in the Celtic Sea. (VMS data 2002)

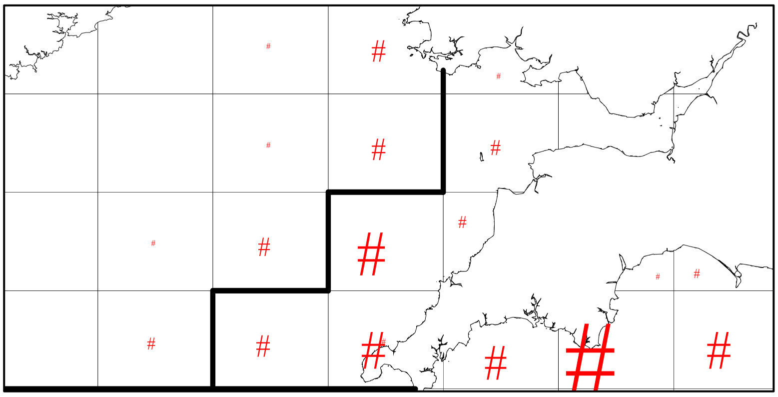


Figure A.3 Effort distribution of the English beam trawl fleet operating in the Celtic Sea. Data based on total demersale landings in 2003

A.3 Management

Celtic Sea sole has been managed by TAC since ??? Other management measures are technical measures including minimum landing size (24 cm since ???) and minimum mesh sizes (80 mm for beam trawlers since ???).

Besides national authorities can impose additional management measures, such as temporal closures, trip catch controls and monthly catch controls.

Council Regulation (EC) No 27/2005, Annex III, part A 12 (b) prohibited fishing in ICES rectangles 30E4, 31E4 and 32E3 during January-March 2005. This prohibition did not apply to Beam trawlers during March.

Council Regulation (EC) No 51/2006, Annex III, part A 4.2 prohibited fishing in ICES rectangles 30E4, 31E4 and 32E3 during February and March 2006 with derogations for vessels using pots, creels or nets with less than 55 mm mesh size. The prohibition does not apply within 6 nautical miles from the base line.

Council Regulation (EC) No 41/2007, Annex III, part A 7.2 prohibited fishing in ICES rectangles 30E4, 31E4 and 32E3 during February and March 2007 with derogations for vessels using pots, creels or nets with less than 55 mm mesh size. The prohibition does not apply within 6 nautical miles from the base line.

A.4 Ecosystem aspects

So far, no ecosystem aspects have been taken into consideration.

B. Data

B.1 Commercial Catch

Quarterly data are available for catch numbers for the Belgian, the Irish and UK fleets. These comprise around 90% of the international landings. Derivation of the age composition is shown in de table below. Since 2005 only catch numbers for Belgian and UK fleets were available. Quarterly total landings are available from France and since 2005 also from Ireland.

Data source:

VIIfg	B	IRE*	UK	Derivation of international landings in VIIfg
Length composition	VIIfg	VIIfg	VIIfg	
ALK	VIIfg	VIIfg	VIIfg	
Age Composition	VIIfg	VIIfg	VIIfg	B, IRE + UK, raised to total international landings*

* Since 2005 no Irish Length compositions or ALK’s therefore since 2005, B + UK age composition raised to total international landing

Numbers at age 1 in the catch are low in most years, therefore these were not considered to add useful information and are replaced by zeros.

Historical compilation of the commercial catch data not included yet.

B.2 Biological

Weights at Age

Catch weights at age are calculated, weighted by national catch numbers at age, and then quadratically smoothed in year (using age = 1.5, 2.5 etc.) and SOP-corrected. The text table below shows the quadratic fit of the data, the R^2 of the fit, the periodicity of the data being collected and the countries that delivered the data to calculate the fit.

Year	Quadratic fit W(t) =	R^2	Periodicity data	Contributing countries
2002	-0.0659 + 0.0825*(AGE+0.5) - 0.0017*(AGE+0.5)²	0.93	Quarterly	B, IRE, UK
2003	0.0503 + 0.0484*(AGE+0.5) - 0.0001*(AGE+0.5)²	0.91	Quarterly	B, IRE, UK
2004	-0.0333 + 0.0671*(AGE+0.5) - 0.0006*(AGE+0.5)²	0.96	Quarterly	B, IRE, UK
2005	-0.0542 + 0.0846*(AGE+0.5) - 0.0019*(AGE+0.5)²	0.96	Quarterly	B, UK
2006	0.0023 + (0.0553*(AGE+0.5) - 0.0003*(AGE+0.5)²	0.95	Quarterly	B, UK

Stock weights at age are the catch weights of the Belgian beam trawl fleet (BEL-BEAM) in the first quarter, smoothed by fitting with a Gompertz function. The text table gives a historical overview of the parameters that have been used in the Gompertz function [$W(t) = a \times \exp(b \times (1 - \exp(c \times t)))$].

Year	Parameter a	Parameter b	Parameter c	R^2
2002	13.89	4.220	-0.3376	
2003	86.14	3.049	-0.1115	0.4
2004	3.77	3.47	-0.196	0.4

Since 2005 Stock weights are the catch weights of the Belgian (BEL-BEAM) and the UK (UKCSBT) beam trawl fleets in the first quarter and smoothed by fitting a quadratic fit.

Year	Quadratic fit W(t) =	R^2	Periodicity data	Contributing countries
2005	-0.0113 + 0.065*(AGE) - 0.0003*(AGE)²	0.96	1st quarter	B, UK
2006	0.0381 + 0.0397*(AGE) + 0.0009*(AGE)²	0.97	1st quarter	B, UK

Stock and catch weights have no explicit trends. The values for 2001 showed a strange convergence and were replaced by the mean of the 2000 and the 2002 weights.

At some ages, the weights in the stock are higher than the weights in the catch. This is because sole caught from spawning concentrations in the 1st quarter are heavier (10 to 15 %) than after spawning.

Historical compilation of the weight at age data not fully included yet.

Natural Mortality and Maturity Ogives

Natural mortality was assumed to be 0.1 for all ages and years. This is consistent with the natural mortality estimates used for sole by other ICES working groups (WGNSSK: IV, VIId, WGNSDS: VIIa, WGSSDS: VIIfg, VIIIa,b) and consistent with estimates of M reported in Horwood (1993).

The maturity ogive applied to all years is, a combined sex maturity ogive taken from area VIIfg attributed to Pawson & Harley, WD presented to WGSSDS in 1997.

Age	1	2	3	4	5	6 and older
	0.00	0.14	0.45	0.88	0.98	1.00

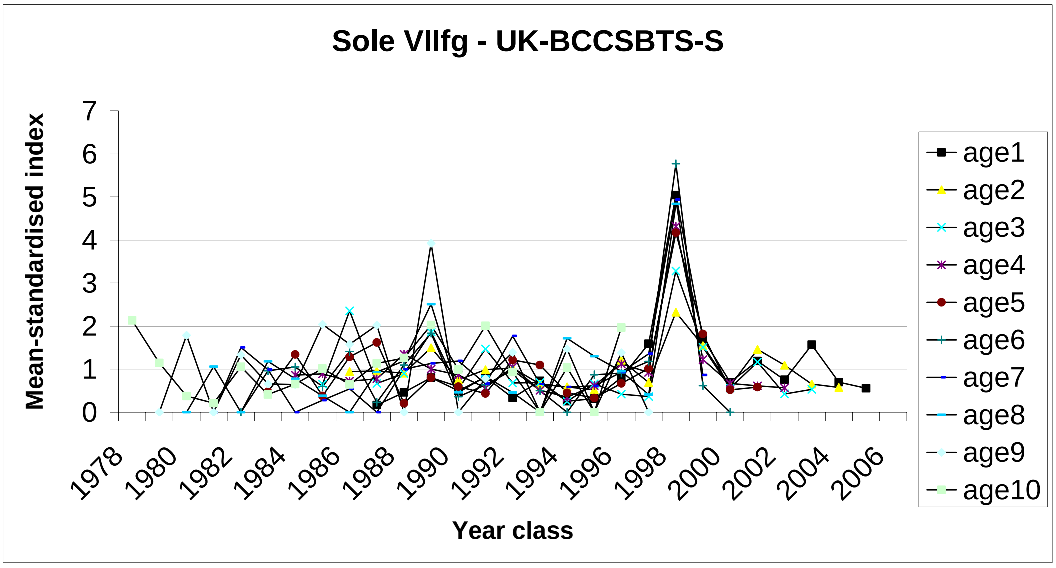
The proportion of M and F before spawning was set to zero.

B.3 Surveys

Abundance indices for Celtic Sea sole are available for one survey, the UK beam trawl survey (UK-BCCSBTS-S). The survey has been conducted in September for approx. 24 days annually since 1988. There are 101 core fishing and hydrographic stations distributed around the Irish Sea, Bristol Channel and Celtic Sea between 50 to 55 deg. N and between the English, Welsh and Irish coasts. The survey is co-ordinated by the ICES BTS WG.

Need to include map with stations,, ….

Abundance indices for the youngest ages (standardised to the mean of the respective ages), together with the VPA recruitment estimates are given in the figure below. The figure shows that the survey is able to track the strength of the year classes.



B.4 Commercial CPUE

Commercial CPUE data are available for a number of fleets and have so far been described in section 4.3.6 of the report.

B.5 Other relevant data

No other relevant data included so far.

C. Historical stock development

After a period (1978-1990) of continuous increases in the fishing mortality (from 0.19 to 0.64), F dropped in the two following years to 0.40. In the period 1995-2003, fishing mortality fluctuated around a high level, except for 2000. Since 2003 fishing mortality has dropped from 0.57 to 0.33 in 2006.

Recruitment has fluctuated around 5 million recruits with occasional strong year classes. The 1998 year class is estimated to be the strongest in the time series.

SSB is estimated to have declined continuously from the highest value of 7900 t in 1971 to the lowest observed in the time series in 1998. The exceptional year class of 1998 had increased SSB to above the long term average, but as the influence of this year class on SSB wanes, SSB has declined.

Tuning Data

XSA tuning data that have been used in recent assessments are those from Belgium beam trawlers (BEL-BEAM), 1971 onwards; from the UK beam trawl fleet (UK-CSBT), Division VIIf, 1991 onwards; and from the UK Corystes September beam-trawl survey (UK-BCCSBTS-S), 1988 onwards. The Belgian beam trawl fleet is temporally discontinued in 2003. This is due to a change in the calculation of the effort statistics from the official logbooks and sale slip notes in the most recent years. Before the next benchmark assessment, a new derivation of these data should become available.

There do exist other tuning data for this stock (e.g. a UK otter trawl fleet), but these have not been included in the assessment as they were not considered to be representative for this stock.

The Irish Groundfish survey, held in the 4th quarter is available since 2003 but is not yet used in the XSA as the time series is too short.

Assessment Methods and Settings

Celtic Sea sole has been assessed with XSA since ??? An overview of this year’s and last year’s settings is given in section 4.3.4.

	1998 assessment			1999 assessment			2000 assessment			2001 assessment			2002 assessment		
Fleets	Years	Ages	α-β	Years	Ages	α-β	Years	Ages	α-β	Years	Ages	α-β	Years	Ages	α-β
BEL-BEAM commercial	89-97	2-9	0-1	89-98	2-9	0-1	86-99	2-9	0-1	86-00	2-9	0-1	86-01	2-9	0-1
UK-CSBT commercial	89-97	2-9	0-1	89-98	2-9	0-1	87-99	3-9	0-1	91-00	2-9	0-1	91-01	2-9	0-1
UK-BCCSBTS-S survey	89-97	1-4	0.75-0.85	89-98	1-4	0.75-0.85	88-99	1-4	0.75-0.85	88-00	1-4	0.75-0.85	88-01	1-4	0.75-0.85

	1998 assessment	1999 assessment	2000 assessment	2001 assessment	2002 assessment
-First data year	1989	1989	1986	1986	1986
-Last data year	1997	1998	1999	2000	2001
-First age	1	1	1	1	1
-Last age	10+	10+	10+	10+	10+
Time series weights	None	None	None	None	None
-Model	Mean q model all ages	Mean q model all ages	Power model (ages 1 & 2)	Power model (ages 1 & 2)	Power model (ages 1 & 2)
-Q plateau set at age	7	7	7	7	7
-Survivors estimates shrunk towards mean F	5 years / 5 ages	5 years / 5 ages	5 years / 5 ages	5 years / 5 ages	5 years / 5 ages
-s.e. of the means	0.5	0.5	1.5	1.5	1.5
-Min s.e. for pop. Estimates	0.3	0.3	0.3	0.3	0.3
-Prior weighting	None	None	None	None	None

	2003 assessment			2004 assessment			2005 assessment			2006 assessment			2007 assessment		
Fleets	Years	Ages	α-β	Years	Ages	α-β	Years	Ages	α-β	Years	Ages	α-β	Years	Ages	α-β
BEL-BEAM commercial	87-02	2-9	0-1	71-03	2-9	0-1	71-03	2-9	0-1	71-03	2-9	0-1	71-03	2-9	0-1
UK-CSBT commercial	91-02	2-9	0-1	91-03	2-9	0-1	91-04	2-9	0-1	91-05	2-9	0-1	91-06	2-9	0-1
UK-BCCSBTS-S survey	88-02	1-4	0.75-0.85	88-03	1-4	0.75-0.85	88-04	1-4	0.75-0.85	88-05	1-9	0.75-0.85	88-06	1-9	0.75-0.85
-First data year	1987			1971			1971			1971			1971		
-Last data year	2002			2003			2004			2005			2006		
-First age	1			1			1			1			1		
-Last age	10+			10+			10+			10+			10+		
Time series weights	None			None			None			None			None		
-Model	Power model (ages 1 & 2)			Power model (ages 1 & 2)			Power model (ages 1 & 2)			Mean q model all ages			Mean q model all ages		
-Q plateau set at age	7			7			7			7			7		
-Survivors estimates shrunk towards mean F	5 years / 5 ages			5 years / 5 ages			5 years / 5 ages			5 years / 5 ages			5 years / 5 ages		
-s.e. of the means	1.5			1.5			1.5			1.5			1.5		
-Min s.e. for pop. Estimates	0.3			0.3			0.3			0.3			0.3		
-Prior weighting	None			None			None			None			None		

A complete overview of the historical settings will be made intersessional.

D. Short term projection

Population numbers for ages 2 and older are taken from the XSA output (estimates of the year = the assessment year minus 1).

GM recruitment is assumed.

Fishing mortality is set at the mean over the last three years, not rescaled. In 2007 assessment rescaled to F 2006.

Weights at age in the catch and in the stock are averaged over the last three years.

E. Medium term projections

Population numbers for ages 2 and older are taken from the prediction output (estimates of the year = the assessment year).

GM recruitment is assumed.

Fishing mortality is set at the mean over the last three years, not rescaled.

Weights at age in the catch and in the stock are averaged over the last three years.

In 2007 no medium term projections done.

F. Yield and biomass per recruit / long term projections

Population numbers for ages 2 and older are taken from the XSA output (estimates of the year = the assessment year minus 1).

GM recruitment is assumed.

Fishing mortality is set at the mean over the last three years, not rescaled In 2007 assessment rescaled to F 2006.

Weights at age in the catch and in the stock are averaged over the last three years.

G. Biological reference points

Biological reference point values are given in the text table below:

	ACFM 98-03
$\mathbf{F}_{lim}$	**0.52** (based on $\mathbf{F}_{loss}$, WG98)
$\mathbf{F}_{pa}$	**0.37** ($\mathbf{F}_{lim}$ x 0.72)
$\mathbf{B}_{lim}$	Not defined
$\mathbf{B}_{pa}$	**2200 t** (based on $\mathbf{B}_{loss}$ (1991), WG98)

In 2004 the WG rejected the biological reference points with the following arguments:

Biomass and F reference points for Celtic Sea sole have been reconsidered during this working group. The basis on which the reference points were set in the past is not valid anymore since there is no stock-recruitment relation for this stock. The more, the highest recruitment has been produced by the lowest biomass.

1) As there is no stock recruitment relationship, the use of a biomass reference point for management purposes is less relevant. Nevertheless, SSB should be maintained (a) within a range were recruitment is not impaired and (b) above the lowest observed biomass (under the condition that SSB has increased afterwards).

2) Using $\mathbf{F}_{loss}$ (now estimated to be 0.84) as a basis for setting reference points cannot be done when there is no stock-recruitment relation. Therefore the current $\mathbf{F}_{pa}$ value cannot be used for management purposes. The assessment indicates that at current levels of fishing mortality, SSB is maintained in the range were recruitment is not impaired and above the lowest observed biomass (Figure 4.3.14). Therefore the WG considers current fishing mortality to be sustainable.

H. Other Issues

No other issues so far

I. References

To be completed intersessional

Stock Annex 7 - Quality Handbook: WGSSDS-*Nephrops* FU 20-22 (Celtic Sea; VIIgh)

Stock specific documentation of standard assessment procedures used by ICES.

Stock:	*Nephrops* (*Nephrops norvegicus*) : Division VIIgh
Working Group:	Assessment of Southern Shelf Demersal Stocks
Date created:	30th June 2007
Last updated:	3rd July 2007

Nephrops in Celtic Sea (Division VIIgh)

A. General

A.1 Stock definition

The management area for this stock is delimited in area VIIgh (FU 20-22; Fig. 1). The management unit is pertinent because of the sedentary feature of *Nephrops*. However, the sources of recruits are much more poorly defined. There is no evidence that the whole exploited area belongs to the same stock or that there are several patches linked in meta-population sense.

A.2 Fishery

Nephrops present particular ground features and in the FU 20-22 are known to occur in several areas of muddy sediment and the stock structure is uncertain. The *Nephrops* fisheries target different areas and have very different size structures in *Nephrops* catches and landings. These fisheries also have differences in non-*Nephrops* by-catch composition.

As for all crustaceans, *Nephrops* grow by successive moults which are to a large extent tied to reproduction. For this species moult occurs twice a year, in spring and autumn until sexual maturity. Once males are sexually mature, they continue to moult twice a year while females moult only once a year in the latter spring/summer right after the hatching of their eggs. In previous references (1970-80's), it is pointed out that maturation of females happens at a median size of 31 mm CL (10 cm of total length) which corresponds to 3.5 years old individuals. There is no specific reference for the sexual maturation of males in the FU 20-22, but biological references on close areas with similar hydrological conditions (FU 15; Western Irish Sea) indicate a first size of functional maturity of 29-31 mm CL.

As reported by the WGNEPH 2004 and the WGSSDS 2005 and 2006, *Nephrops* in FU 20-22 is mainly exploited by trawlers from France, Republic of Ireland and UK although the contribution of other countries is lower. The spatial distribution of landings by statistical rectangles are provided below (Fig. 2-4). It indicates heterogeneous spatial behaviour of the main fleets.

France

No major changes have taken place in the fishery for more than fifteen years apart from the implementation of a new mesh regulation in 2000 which increased the minimum codend mesh size from 80 to 100 mm (in fact, the regulation involves to 90 mm mesh size, but 100 mm meshes are adopted aiming to avoid problems with by-catch composition). The 100 mm mesh size also allows them to switch to finfish (cod, whiting, haddock) when *Nephrops* catch rates are low (e.g. because of diurnal and seasonal variations of catchability for this species or during periods of bad weather). The MLS applied by the French Producers' Organisations is fixed at 11.5 cm total length (*i.e.* 35 mm CL). The total number of vessels from the harbours of the South Brittany remains stable (more than 90 declared *Nephrops* catches from the Celtic Sea in recent years, but around 70 are actually targeting this species). A part of these units (10-15) switch to other *Nephrops* stocks (FU 16; Porcupine bank; Fig. 1) when the meteorological conditions are favourable.

Analytical investigations were carried out on the data collected in 2006 involving in the French trawlers. Global indices for fishing effort and LPUE provided by this fleet (97 trawlers composed by 73 exclusive in Celtic Sea, 16 switching to Porcupine Bank *i.e.* FU 16 and 8 also targeting *Nephrops* in the Bay of Biscay *i.e.* FU 23-24) seem to be pertinent: 97% of vessels*months registered for sales at auction can also be found in logbooks (95% of French landings in 2006). In 2006, almost 50% of French landings occurred in two ICES rectangles (29E3, 30E3). The rectangle 30E3 during the 2nd quarter concentrated 20% of yearly landings.

Republic of Ireland

More than 60 Irish vessels target *Nephrops* in the Celtic Sea. The fishery presents a more typical seasonal profile than the French vessels and most of the landings are made between March and July. These vessels are mid-size multi-purpose trawlers, with a length of 18-23 m and engine power between 250 and 350 kW. Many of the vessels switch between FU 15 and FU 20-22, depending on the tides in the Irish Sea. Other vessels switch from targeting finfish in the winter to *Nephrops* in the spring and early summer. The mesh size used by Irish vessels is 80 mm, and increasingly these vessels are using twin trawls. The MLS applied by Irish trawlers is the European one fixed at 8.5 cm total length (*i.e.* 25 mm CL).

The Irish landings seem to be more concentrated spatially than the French. During the period 2003-2006, 63-67% of the Irish nominal landings were provided by one ICES rectangle (31E3). The Irish fishing effort is located more northerly than the French one.

UK

The UK fishery in the Celtic Sea has generally remained unchanged. Since the early 2000's, the number of UK *Nephrops* directed vessels has increased from around 10 to 15, but their contributions in total landings remains minor.

A.3 Ecosystem aspects

Nephrops occur in discrete patches where the sediment is suitable for them to construct their burrows. There is a larval phase where there may be some mixing with *Nephrops* from other areas depending on the oceanographic conditions, but the mechanisms for this in the Celtic Sea are not currently known.

Cod has been identified as a predator of *Nephrops* in some areas, and the generally low level of the cod stock is likely to have resulted in reduced predation on *Nephrops*.

B. Data

B.1 Commercial Catch

Landings are reported mainly by France and the Republic of Ireland. French landings fluctuated between 2200 and 3800 t. Irish landings rose from around 500 to more than 2000 t in the last 15 years. A part of this trend is due to greater accuracy of reporting. The contribution of French landings has gradually decreased from 80-90% at the end of 80's to 50-60% at the beginning of 2000's. Between 2004 and 2005, French landings remained stable whilst Irish landings steeply increased and the total harvested quantity was the highest during the last decade. The overall fishing profile remains typically seasonal with a dominance of the 2nd and 3rd quarters (60-70%; the other quarters are less productive because of meteorological conditions and of less accessibility of females due to burrowing).

During the recent years, the evolution of the French fishing effort and LPUE was sometimes considerably different from the evolution of the same indicators for the Irish fleet (*e.g.* between 2004 and 2005: -5% of fishing effort and +2% of LPUE for French trawlers against +50% of fishing effort and +25% of LPUE for Irish trawlers). This underlines the divergence of features of the targeting vessels for each country and indicates the great heterogeneity of the area. A direct comparison between both countries cannot be undertaken because the fishing effort is not available in the same unit (France: otter trawlers getting at least 10% of their landing values by targeting this species; Ireland: otter trawl vessels where >30% of monthly landings in live weight were *Nephrops*). Furthermore, the actual fishing areas are different and the Irish fleet is more restricted spatially as already reported by WGSSDS 2005 and 2006.

B.2 Biological

Natural mortality and maturity at age.

A natural mortality of 0.3 is applied to all *Nephrops* males whereas the mortality of females changes at the size of first maturity (occurring at 31 mm CL as explained previously): a value of 0.2 is usually applied on mature individuals.

The L2AGE slicing program usually applied on *Nephrops* stocks allocates length classes into age groups by assuming Von Bertalanffy model of individual growth. This slicing is applied to length distributions by sex. All parameters, L∞ and K by sex, calculated mean sizes by age for each sex, natural mortality and maturity by sex (assumed to be knife-edged for males and s-shaped for females) and combined are given below.

Males and immature females: L∞=68, K=0.17; mature females: L∞=49, K=0.10									
age		1	2	3	4	5	6	7	8+
Size	males	11	20	27	34	39	44	47	51
(CL mm) mm	females	11	20	27	32	33	35	36	37
	males	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
M	females	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
	combined	0.3	0.3	0.3	0.25	0.25	0.25	0.25	0.25
	males	0	0	1	1	1	1	1	1
Maturity	females	0	0	0	0.5	1	1	1	1
	combined	0	0	0.5	0.75	1	1	1	1

Biological sampling

Landings

Length compositions of the landings by sex are provided for the two main fleets, but the time series are different. Sampling of French landings since 1984 has provided length frequencies by sex on a monthly basis. Due to uncertainty of the older data sets, the data for 1984-86 were omitted from further analysis. The Irish sampling program was launched in 2002 under the EU DCR and gave length frequencies for the period 2002-2006 (after simulation undertaken for some missing information in 2004 as explained during WGSSDS 2006).

Discards

French estimation of discards occurred only in several separate years (1985, 1991 and 1997; in 2005, samples for two quarters, 3rd and 4th, were also provided), but only the data collected in

1997 can be included in analytical investigations because of unavailable quarterly data on landings for the first year of discard sampling (1985) whereas data collected in 1991 were considered as unreliable (samples sorted by fishermen). The 1997 French plan onboard showed high spatial and temporal variability of discard size-composition vs. that of landings (CV>30 %).

The heterogeneity of the dataset in addition to that of the harvested area by each country affects the discard rate by fleet (higher for French vessels: 65% in 1997 against 37% for Irish in 2003, but only 11% during the quarters 2 and 3 in 2004) and by sex (stronger in the case of females growing less quickly).

B.3 Surveys

Direct *Nephrops* assessment by trawling are inappropriate because of notable diurnal variations of availability which is higher during dawn and dusk. The most adapted way is based on transect with video and TV runs of burrows (combined with hauls on area and geo-statistical analysis of catches with the aim of separating burrows of *Nephrops* from those of squat lobster), but it needs heavy preliminary arrangements because the spatial heterogeneity of resource requires to well define the survey area and the sampling plan in order to avoid biased results. The current situation will be improved in the future once a data time series has been collected by the Irish specifically designed survey program launched in 2006. However, the Irish and French exploited areas are different. On FU 20-22 the French groundfish survey EVHOE while not focusing on *Nephrops* does provide an indication of the length distributions and the strength of recruitment (Fig. 5). An Irish groundfish survey giving size composition of *Nephrops* catches has also been carried out since 2003. Moreover, a UK bottom trawl survey had occurred on the same area between 1984 and 2004, but only two sampling stations were within FU 20-22 area.

A comparative analysis conducted between LPUE and CPUE of French and Irish vessels with EVHOE indices shows a good agreement between commercial French CPUE and EVHOE series for the period 1997-2005 (R^2=0.65) whilst the relationship is more sparse (R^2=0.36) when the commercial French LPUE are used (Fig. 6). The Irish data are not significantly linked to the French dataset probably due to the difference of harvested area and the short time-series.

FU 20-22 Irish Sampling Summary							
Year	Quarter	Number of samples			Numbers Measured		
		Catch	Discards	Landings	Catch	Discards	Landings
2003	1	1	1		186	417	
2003	2	5	5		4057	3016	
2003	3	3	3		2535	3638	
2003	4	2	1		996	528	
2004	1	0	0		0	0	
2004	2	3	2		1634	2781	
2004	3	7	6		4284	7171	
2004	4	0	0		0	0	
2005	1	1	1		1330	2271	
2005	2	2	2		2208	3238	
2005	3	2	0		1634	0	
2005	4	2	0		1627	0	
2006	1	2	1	2	1891	1152	2252
2006	2	10	2	2	7241	1049	363
2006	3	5	1	0	3178	1101	0
2006	4	9	0	0	8266	0	0

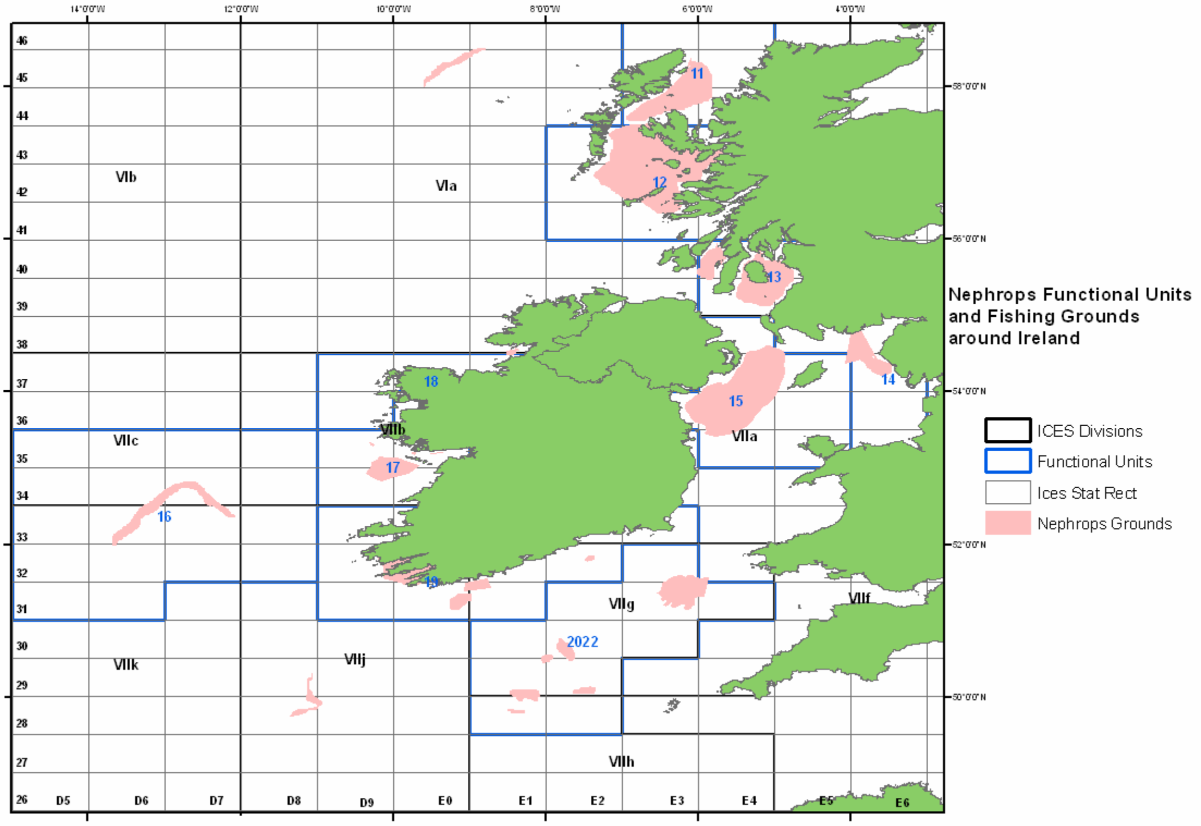


Figure 1. Functional units 20-22 (*Nephrops* grounds in Celtic Sea).

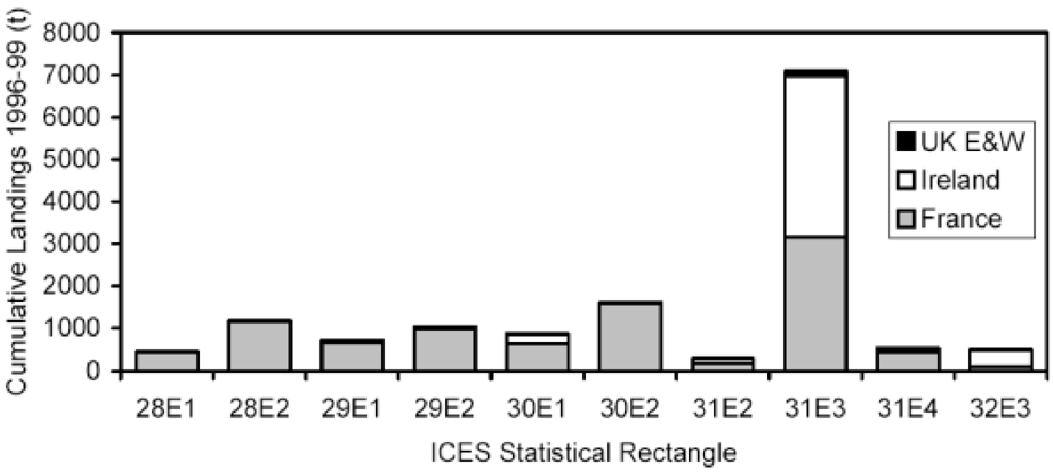


Figure 2. *Nephrops* FU 20-22 (Celtic Sea). Spatial distribution of landings of the main fleets (average value of the period 1996-1999).

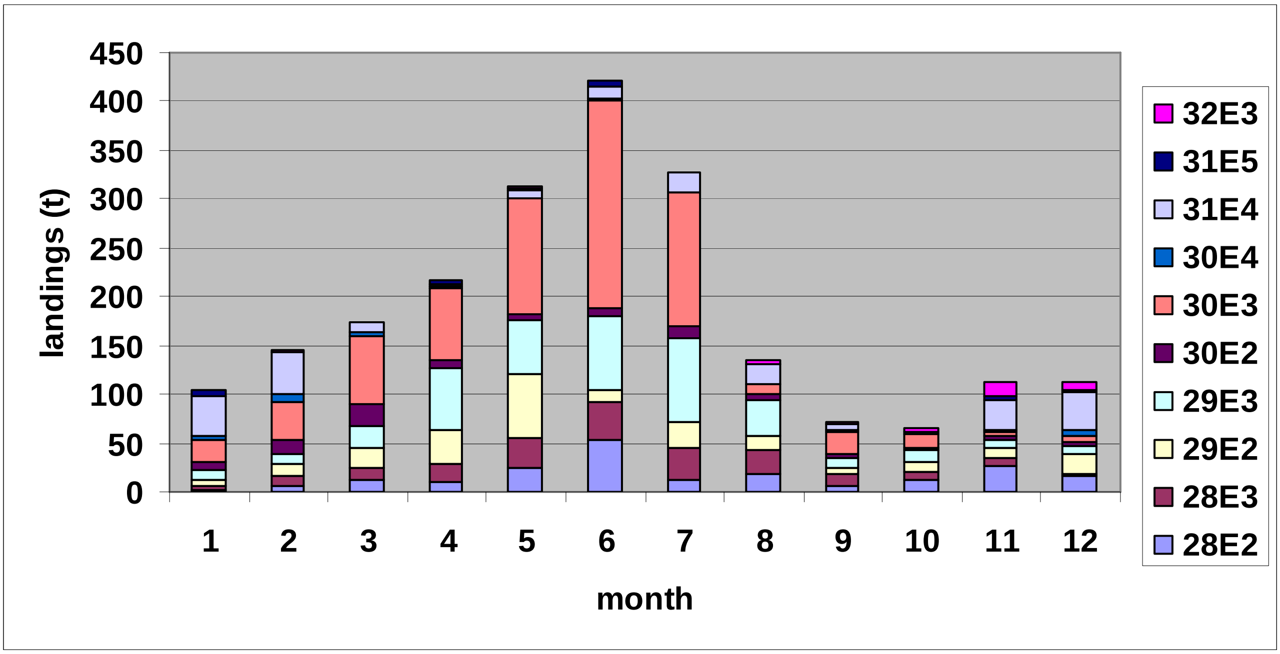


Figure 3. ***Nephrops*** **FU 20-22 (Celtic Sea). Spatial and monthly distribution of French landings (year 2006).**

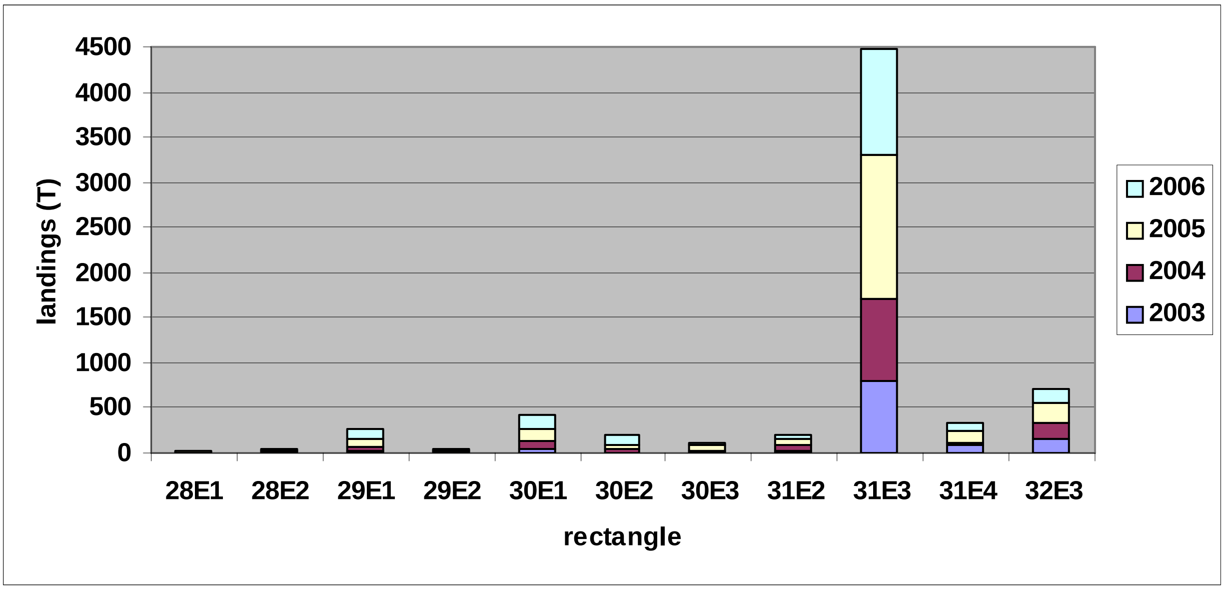


Figure 4. ***Nephrops*** **FU 20-22 (Celtic Sea). Spatial and by year distribution of Irish landings.**

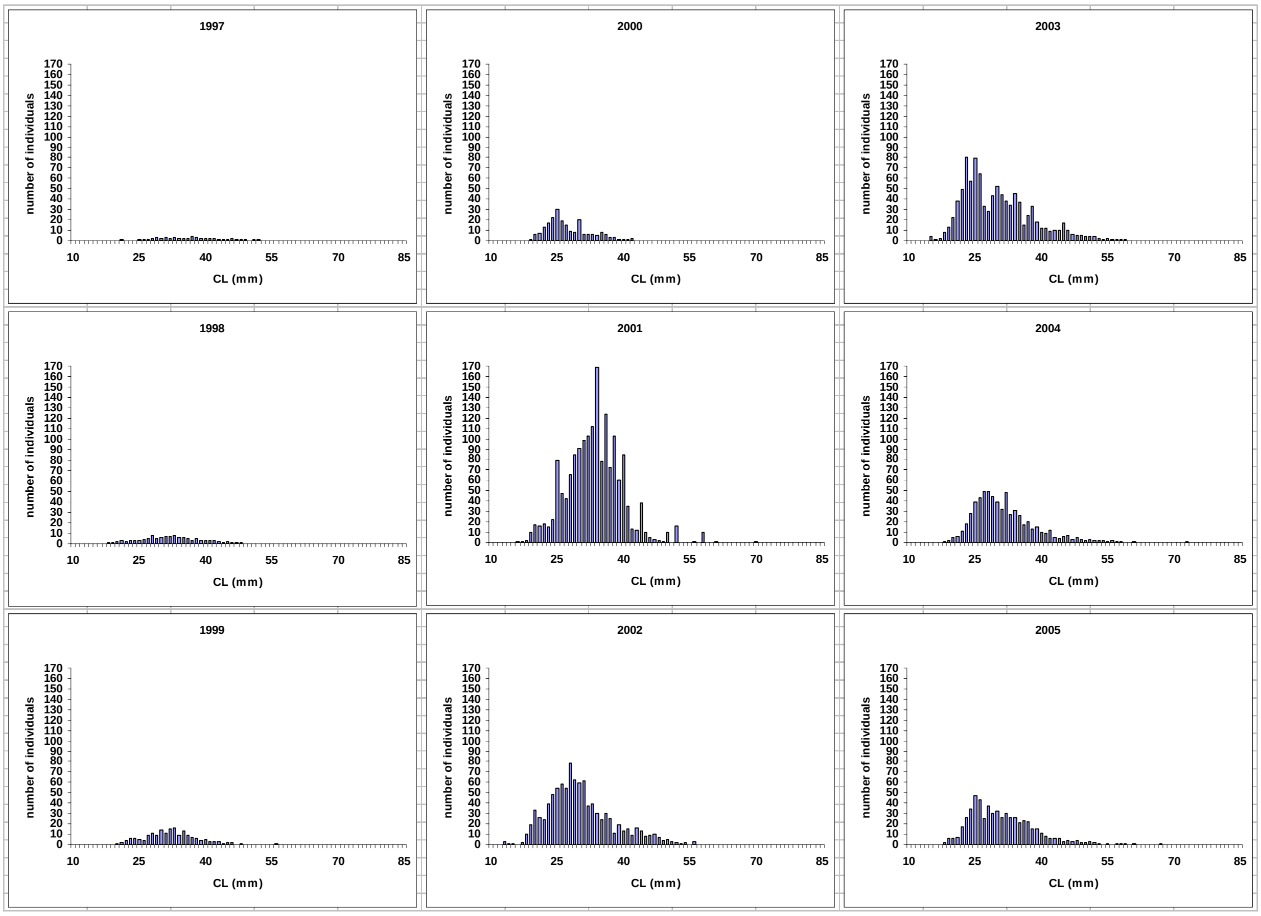


Figure 5. *Nephrops* FU 20-22. Indices of the French groundfish survey EVHOE.

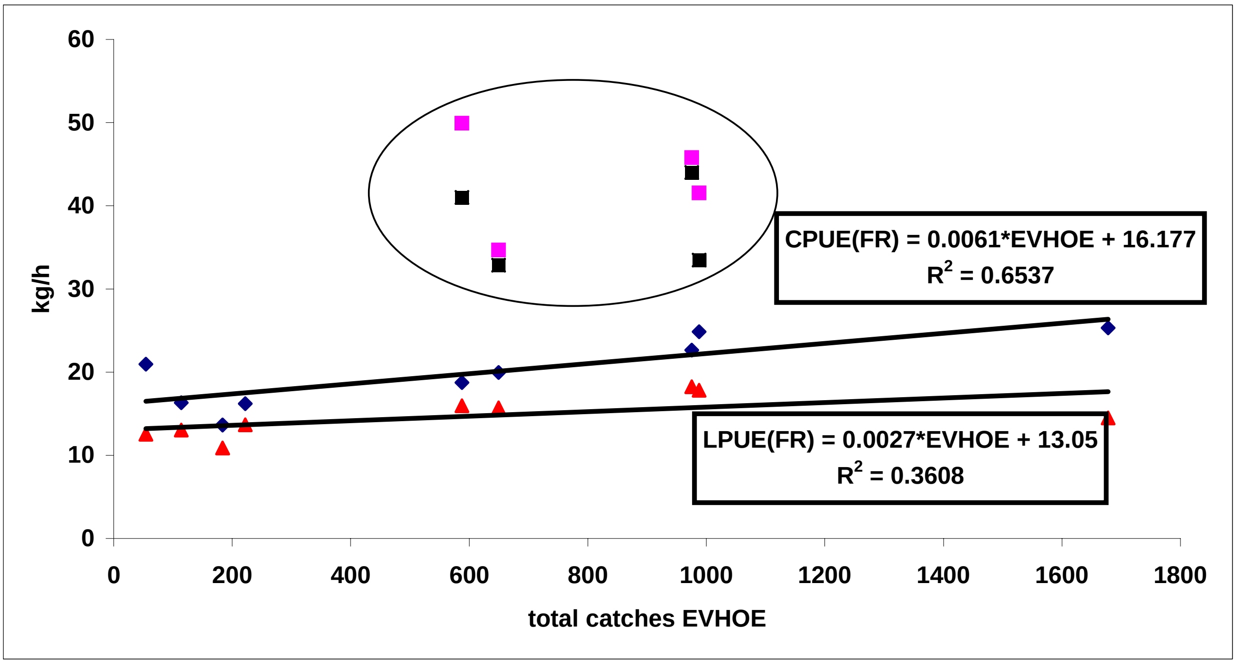


Figure 6. *Nephrops* FU 20-22. Comparison of indices EVHOE and of commercial LPUE and CPUE for French and Irish trawlers.

Annex 8: List of Participants

Working Group on the Assessment of Southern Shelf Demersal Stocks

ICES, Headquarters, 26 June – 5 July 2007

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Annex 9: WGSSDS Technical Minutes

Review of the Working Group on the Assessment of Southern Shelf Demersal Stocks (WGSSDS), 5-6 September 2007

Venue:	ICES, Copenhagen
RG Chair:	Alain Biseau
Reviewers:	Yuri Efimov, Robert Scott (Chair WGNSDS)
Presentation:	Wim Demaré (Chair WGSSDS)

General remarks

The RG commended the WGSSDS for the overall clarity of the report and for the way they have dealt with the numerous terms of reference. The presentation at the beginning of the report of the ToRs and if and where they have been addressed was found very clear and effective.

General statements on possible mis-use of mis/under reported landings are fully supported by the RG. The table showing the type of misreporting, and a qualification is very informative. However for some examples (celtic cod) the information given in this table seemed not to be in accordance with the relevant stock section. This has been dealt with during the RG.

The RG appreciated the way the WG had addressed quite extensively the discards issue (raising problems and lack of historical series). Attempts were made (and discussed) to estimate the history for several stocks.

The graphs showing the trends in fishing effort by main gears and area (or country) over the 1999-2006 period are thought to be very useful and the RG commended the WG for that.

The RG noted that some comments included in the report from the FTFBWG regarding the cod closure did not appear to be confirmed by the data available. Looking at the VMS tracks, the RG did not share the FTFBWG interpretation that the French fishing effort was concentrated on the boundaries of the box but sees the effort widely redistributed.

The RG welcomed the table of all the acronyms to be used for the various commercial fleets and surveys. However some acronyms may change in the text, and in the headings of some tuning fleets. It makes it difficult to follow the text.

The RG noted that the text sometimes suggests more certainty than the WG has in data, especially for the discard data. The RG felt that a difference should be clear between the availability of raised discards information (of a reasonable quality) and some information from scarce samples, too variable to be raised and thus to be used.

The RG appreciate the WG wish to make the report the clearest and shortest possible. However, the RG felt that some important information was left out for that reason. The main conclusion of exploratory runs in the case of a benchmark assessment needs to be shown explicitly and be commented on in the WG report.

General remark for WG's

- Tables on tuning fleet CPUE need a better layout since the cohorts are difficult to follow as they are now. The RG felt it would be easier to be looked at if standardized. Effort values should be kept as the last column on the right. This is true for Surveys but also for commercial data. This can be done directly on the input files without affecting the results.

- Any age reading problems should be checked during the survey, this cannot be dealt with during the WG alone.

Plaice VIIe Benchmark

Assessment: Accepted for trends only (recent estimates doubtful)

Forecast rejected

The RG expressed the need for more explanatory comments on some notable points. The fact that landings in 2006 are estimated to be much higher (+55%) than predicted last year at status quo assumptions needs to be followed by an explanation of the reasons for this. In that particularly case, F for 2006 estimated this year is estimated to be 0.76, while Fsq last year was 0.64 (a 19% increase): this means either that the predictions last year were wrong or than the assumption made for F (or R) has not been revealed true.

Furthermore, the WG estimated discards to be much lower than in other areas. Giving this is quite unusual, the RG urged the WG to provide more explanation.

The RG welcomed the comparison of length distributions by country but would appreciate a more explicit explanatory comment.

The RG discussed the inclusion of a new survey in the assessment, the Fishery-Scientist-Partnership survey. Since the time series is very short (4 years) the traditional diagnostics are thought to be unable to judge the quality and the usefulness of this survey. However, the RG felt that an Industry-Scientist survey could provide useful information given that the scientific scheme is followed (same gear, same protocol etc.). In the case of the VIIe plaice, given that the scientific surveys and the fishery usually takes place on different grounds (more inshore for the surveys on a resident part of the stock, more offshore for the fishery on another part of the stock more subject to emigration) the RG shared the views of the WG that this new survey if kept broadly distributed all over the stock area could be very useful. The RG accepted the use this year of this survey and recommended that the quality of the information given should be checked regularly even though in a case of a benchmark assessment.

The RG noted that catch at age and scientific surveys information show conflicting signals for the reason mentioned above. This is probably the main cause of the retrospective pattern.

The RG recommends the Stock ID (towards a possible merge of VIIe and VIId Plaice stocks) should be investigated outside the respective WGs.

The RG appreciated the presentation of the exploratory analysis and the discussion about each of them. It felt that the choices made by the WG are well documented, and relevant. Keeping use of the historic tuning fleet appeared to be useful to stabilize the fit in the earlier part of the series where, otherwise, only F shrinkage would be applied.

Cod VII e-k Benchmark/Update

Benchmark assessment Accepted

Forecast Accepted

Given the exploitation of the stock, the fishery has been very dependant of the abundance of younger ages since 90% of the total catch is ages 1-3 (70% ages 1-2). Cod appears to look like a short-lived species. This stable high exploitation rate is critical in situations such as the current very low size of the stock.

Review group comments

The RG notes that the assessment is done very much in accordance with last year and would therefore describe it as an update.. The RG encourages the WG to be more specific when commenting on high grading, fleet scrutiny, possible trends in weights at age and retrospective patterns in F for this stock.

The RG agrees with the assessment model used since the input data do not allow for more complicated modelling and the model settings but would appreciate more explanation on the output.

The WG plotted last years RG advice on a changed F age range. No change was made since the different age ranges showed a similar trend. The RG accepts the rational behind this choice, but thinks this plot would do well in the WG report.

The addition of a new groundfish survey was questioned because of the very short time series of this survey. Inclusion in the analysis was accepted given the resulting consistent estimates and the low influence on the final estimates. However, the RG felt that the consistency of this survey should be investigated again when it becomes longer because the use of short time series may harm the retrospective pattern diagnostics.

Discards are high and assumed more or less stable. These are not included in the assessment, although highgrading inferences were made. The RG would appreciate more detailed explanations of this and underreporting issues in the report.

The RG missed comments on the impact of the French revisions in landings figure back to 1999 in the report (as provided for other stocks).

The RG notes that the surveys do not perform well due to low cod catches. As a consequence survivors at younger ages are mostly estimated by the commercial fleets which suffer discarding and high-grading practices. The IBTSWG is asked to investigate the western waters lack of ‘good’ survey data for cod.

The RG shared the views of the WG about the pessimistic forecast. Given the very low recent recruitments, the use of an average R across the whole period appears to be not precautionary. Given that sporadic high recruitments occurred in the past, the RG also felt that the forecast can reveal to be pessimistic if a sudden increase in recruitment negates the assumption of a low incoming recruitment.

The closure of 3 rectangles in the Celtic sea was discussed in relation to the redistribution of effort in adjacent areas where the catch rates of cod are much lower. The RG agreed with the evaluation made by the WG, but also agreed that this input would be most useful in a separate evaluation on the closure. On this point the RG noted that the closure (as it stands since 2005) could not lead to a steady decrease in F but it could only account for a single decline in F in the first year of the closure.

The RG agreed with the comment made on the necessity to ‘protect’ young cod (catch of young cod should be avoided) especially if a ‘good’ recruitment would come.

VIIe sole Update

Update assessment	accepted
Forecast	accepted on the basis of new output

The assessment is a pure update, except for the fact that shrinkage was changed due to inclusion of new age data.

Review group comments

The use of commercial tuning data is unavoidable since there is little information available for older ages from the survey. A lighter shrinkage could be considered in the future (giving 15% of the weight at age 2).

The RG sympathises with the WG on the point of choosing an F in the intermediate year in accordance with the TAC set (implying a 5% reduction compared to Fsq) in order to acknowledge the effort made to effectively restrict the landings in recent years. However this appears to be too sophisticated in regard of the current perception of the accuracy of the estimates. The RG judged a forecast based on Fsq in the intermediate year more reliable.

Furthermore, the WG chair has rerun the prediction for updated weight at age plus data for which the results are shown in Annex 1.

The RG did not agree with the WG comments on the reference points since the SSB decrease (since the peak in 1979) seems to coincide with F > Fpa at stable recruitment.

VII f-g sole Update

Update assessment	accepted
Forecast	accepted

Review group comments

The RG agreed with the WGs scaling of F, but noted that the cod box could not be used as an argument for this. The decrease of F (if any) could have occurred only in 2005 (i.e. the year of the implementation of the first cod closure).

The RG also noted that the estimate for Fmax changed compared to last year (from 0.27 to 0.23, 15%) indicating a possible change in the exploitation pattern. Comparison of the CS5 simulations between this year and last year should therefore be treated with care, or should be done on the basis of recalculations in accordance with this new fishing pattern.

VII f-g plaice Update

Update assessment	accepted
Forecast	accepted

Discards are said to be substantial but no figure could be provided. They were not included in the assessment.

Review group comments

The RG notes that there is a serious lack of discard data, with little surveys going on, covering only very short time series. Improvement of this situation should be part of the advice.

The RG remarks that the use of catchability dependent on stock size is probably not relevant, given the apparently substantial discards. R^2 appear to be high for ages 4-5 in the commercial fleets while rather low at ages 1-5 for the survey. This could be looked into at future assessments.

VIIe-k whiting Exploratory

Exploratory assessment	accepted for trends only
Forecast	rejected

Last year the assessment was accepted as indicative for stock trends only.

Review group comments

The RG welcomed the further exploration of assessment possibilities for this stock but notes a lack of explanatory comments on decisions taken. The RG concludes that a better documentation of the exploration is needed before the assessment can be fully accepted.

Main points for the RGs not accepting the assessment were

- The changed q-plateau.
- Truncation of fleet data for the *Nephrops* fleet. The RG emphasised that reasoning behind truncating should come from the fleet behaviour, not from the diagnostics. Removal of the historic part is not necessarily a logic conclusion when truncating since in the absence of any tuning information, the estimation of F is only given by shrinkage.
- Deletion of year classes (age 1 and 2) needs more explanation. If discarding is the main argument for this, then the inclusion of age 3 needs to be discussed, since this is also affected by discarding.
- In general, relatively poor survey data, conflicting signals from different surveys and questions on XSA settings remain problematic.

The RG deemed the text table on the impact of changes in French landings very useful.

Haddock VII b-k Exploratory

Exploratory assessment	accepted as indicative for trends only
Forecast	no predictions put forward

Misreporting may have been a problem in the last years.

Review group comments

RG concludes that a lot of smaller changes have been made that could be better explained.

As mentioned in general, the RG is of the opinion that problems with ageing keys should be checked during the survey, not corrected at WG level.

The improved raising procedure for discards was welcomed by the RG even though it ads to the variability in the assessment (due to low sampling frequency) and causes some doubts about the raising procedure.

Plaice VII h-k Exploratory

Exploratory assessment	rejected
Forecast	no predictions put forward

The very bad quality of the data make it hard to perform any kind of assessment other than the conclusions drawn by looking at the landing, effort and LPUE data alone. The RG appreciates the efforts to try and improve the analysis but felt that there are not enough bases to accept an assessment.

Recommendations

The RG recommends that further investigation on the stock ID towards a possible merge of VIIe and VIId Plaice stocks should be investigated outside the respective WGs.	
The RG notes that the surveys in western waters do not perform well for cod indices due to low cod catches. As a consequence survivors at younger ages are mostly estimated by the commercial fleets which suffer discarding and high-grading practices.	The IBTSWG is asked to investigate the western waters lack of ‘good’ survey data for cod.

Annex 1

Revised forecast sole VIIe

Table 1 - Sole in VIIe. Input to prediction

MFDP version 1a
Run: SOL-VIIe_RG07_
Time and date: 12:55 07/09/2007
Fbar age range: 3-7

2007

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
1	4373	0.1	0	0	0	0.096	0.000	0.124
2	3957	0.1	0.14	0	0	0.151	0.119	0.178
3	3491	0.1	0.45	0	0	0.205	0.288	0.232
4	2270	0.1	0.88	0	0	0.258	0.371	0.283
5	899	0.1	0.98	0	0	0.309	0.456	0.334
6	925	0.1	1	0	0	0.359	0.482	0.383
7	276	0.1	1	0	0	0.407	0.409	0.431
8	362	0.1	1	0	0	0.455	0.399	0.478
9	361	0.1	1	0	0	0.501	0.432	0.523
10	90	0.1	1	0	0	0.545	0.382	0.567
11	100	0.1	1	0	0	0.589	0.413	0.610
12	256	0.1	1	0	0	0.702	0.413	0.721

2008

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
1	4373	0.1	0	0	0	0.096	0.000	0.124
2	.	0.1	0.14	0	0	0.151	0.119	0.178
3	.	0.1	0.45	0	0	0.205	0.288	0.232
4	.	0.1	0.88	0	0	0.258	0.371	0.283
5	.	0.1	0.98	0	0	0.309	0.456	0.334
6	.	0.1	1	0	0	0.359	0.482	0.383
7	.	0.1	1	0	0	0.407	0.409	0.431
8	.	0.1	1	0	0	0.455	0.399	0.478
9	.	0.1	1	0	0	0.501	0.432	0.523
10	.	0.1	1	0	0	0.545	0.382	0.567
11	.	0.1	1	0	0	0.589	0.413	0.610
12	.	0.1	1	0	0	0.702	0.413	0.721

2009

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
1	4373	0.1	0	0	0	0.096	0.000	0.124
2	.	0.1	0.14	0	0	0.151	0.119	0.178
3	.	0.1	0.45	0	0	0.205	0.288	0.232
4	.	0.1	0.88	0	0	0.258	0.371	0.283
5	.	0.1	0.98	0	0	0.309	0.456	0.334
6	.	0.1	1	0	0	0.359	0.482	0.383
7	.	0.1	1	0	0	0.407	0.409	0.431
8	.	0.1	1	0	0	0.455	0.399	0.478
9	.	0.1	1	0	0	0.501	0.432	0.523
10	.	0.1	1	0	0	0.545	0.382	0.567
11	.	0.1	1	0	0	0.589	0.413	0.610
12	.	0.1	1	0	0	0.702	0.413	0.721

Input units are thousands and kg - output in tonnes

Table 2 - Sole in VIIe. Management option table

MFDP version 1a
Run: SOL-VIIe_RG07_
s7eSTFMFDP Index file 22/707 mph
Time and date: 12:55 07/09/2007
Fbar age range: 3-7

2007				
Biomass	SSB	FMult	FBar	Landings
3674	2270	1	0.4013	944

2008					2009	
Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
3597	2222	0	0	0	4485	3045
.	2222	0.1	0.0401	108	4375	2942
.	2222	0.2	0.0803	211	4268	2843
.	2222	0.3	0.1204	312	4166	2748
.	2222	0.4	0.1605	408	4067	2656
.	2222	0.5	0.2006	501	3971	2568
.	2222	0.6	0.2408	591	3879	2483
.	2222	0.7	0.2809	678	3791	2402
.	2222	0.8	0.321	761	3705	2323
.	2222	0.9	0.3612	842	3623	2247
.	2222	1	0.4013	919	3543	2174
.	2222	1.1	0.4414	995	3467	2104
.	2222	1.2	0.4815	1067	3392	2036
.	2222	1.3	0.5217	1137	3321	1971
.	2222	1.4	0.5618	1204	3252	1908
.	2222	1.5	0.6019	1270	3186	1848
.	2222	1.6	0.642	1333	3122	1790
.	2222	1.7	0.6822	1393	3060	1734
.	2222	1.8	0.7223	1452	3000	1679
.	2222	1.9	0.7624	1509	2942	1627
.	2222	2	0.8026	1564	2886	1577

Input units are thousands and kg - output in tonnes

Table 3 - Sole in VIIe. Management option table, detailed output

MFDP version 1a
Run: SOL-VIIe_RG07_
Time and date: 12:55 07/09/2007
Fbar age range: 3-7

Year:		2007	F multiplier		1	Fbar:	0.4013			
Age	F		CatchNos	Yield		StockNos	Biomass	SSNos(Jar	SSB(Jan)	SSNos(ST	SSB(ST)
	1	0	0	0	4373	420	0	0	0	0
	2	0.1189	423	75	3957	599	554	84	554	84
	3	0.2885	834	193	3491	716	1571	322	1571	322
	4	0.3714	672	190	2270	585	1998	515	1998	515
	5	0.4556	314	105	899	277	881	272	881	272
	6	0.4817	338	129	925	332	925	332	925	332
	7	0.4092	89	38	276	112	276	112	276	112
	8	0.3986	114	54	362	165	362	165	362	165
	9	0.4317	121	63	361	181	361	181	361	181
	10	0.3817	27	15	90	49	90	49	90	49
	11	0.4132	32	20	100	59	100	59	100	59
	12	0.4132	83	60	256	180	256	180	256	180
Total			3047	944	17360	3674	7374	2270	7374	2270

Year:		2008	F multiplier		1	Fbar:	0.4013			
Age	F		CatchNos	Yield		StockNos	Biomass	SSNos(Jar	SSB(Jan)	SSNos(ST	SSB(ST)
	1	0	0	0	4373	420	0	0	0	0
	2	0.1189	423	75	3957	599	554	84	554	84
	3	0.2885	760	176	3179	652	1431	293	1431	293
	4	0.3714	701	199	2367	610	2083	537	2083	537
	5	0.4556	495	165	1417	437	1388	429	1388	429
	6	0.4817	188	72	516	185	516	185	516	185
	7	0.4092	166	71	517	211	517	211	517	211
	8	0.3986	52	25	166	75	166	75	166	75
	9	0.4317	74	39	220	110	220	110	220	110
	10	0.3817	64	36	212	116	212	116	212	116
	11	0.4132	18	11	56	33	56	33	56	33
	12	0.4132	69	50	213	150	213	150	213	150
Total			3010	919	17192	3597	7355	2222	7355	2222

Year:		2009	F multiplier		1	Fbar:	0.4013			
Age	F		CatchNos	Yield		StockNos	Biomass	SSNos(Jar	SSB(Jan)	SSNos(ST	SSB(ST)
	1	0	0	0	4373	420	0	0	0	0
	2	0.1189	423	75	3957	599	554	84	554	84
	3	0.2885	760	176	3179	652	1431	293	1431	293
	4	0.3714	638	181	2156	555	1897	489	1897	489
	5	0.4556	516	172	1477	456	1448	447	1448	447
	6	0.4817	297	114	813	292	813	292	813	292
	7	0.4092	92	40	288	117	288	117	288	117
	8	0.3986	98	47	311	141	311	141	311	141
	9	0.4317	34	18	101	50	101	50	101	50
	10	0.3817	39	22	129	70	129	70	129	70
	11	0.4132	42	26	131	77	131	77	131	77
	12	0.4132	52	37	161	113	161	113	161	113
Total			2991	908	17076	3543	7263	2174	7263	2174

Input units are thousands and kg - output in tonnes

APPENDIX 1

Trends in French Fishing effort in ICES Division VIIfg / Impact of the Trevose closure ? WD to WGSSDS 2007 – Alain Biseau – Ifremer

Summary:

French fishing effort (time fishing) has been dramatically reduced over the 1999-2006 period by around 65% for the gadoids métiers.

This reduction is mostly due to a decrease in the number of vessels involved rather than to a reduction in the mean fishing time per vessel.

It is indubitable that the closure of the cod box has been a strong incentive to this reduction in effort and especially to those vessels which target gadoids.

Note that the analysis is based on data from available log-books; 2007 should be considered as preliminary.

The 2004 December Council decided to implement such a measure, except for the beam-trawlers which are allowed to fish in the closed zone in March.

The 2005 December Council (51/2006) decided to close the 3 rectangles for two months (February and March) for all vessels and gear [except within the 6 miles from the base line].

This closure was set again in last December (EU Council 41/2007) with the same modalities.

This closure, initiated by the Industry in 2004, was anticipated to lead to a 13% decrease in the overall landings of cod of the Celtic stock.

As said in previous documents (Biseau and Bellail, WD WGSSDS2006) and meetings, it is almost impossible to assess - *a posteriori*- the impact of a management measure since lots of other things may have changed simultaneously. Furthermore, when expected a 13% decrease, this should be looked at relative terms, which means a 13% decrease compared to what might have been the landings (F) without the closure.

The Working Document presented in the last WGSSDS(2006) showed changes in the fishing grounds or metiers in 2004-2005 for vessels which used to operate in the three rectangles. This analysis was not repeated this year. But trends in vessels, fishing effort and landings of cod have been studied on a monthly basis to take into account the changes in the time of closure between 2005 and 2006.

Trends are presented for the whole trawlers fishery in Divisions VIIfg and for the gadoids metiers.

Trends in the French Trawlers effort in ICES Divisions VIIfg for the whole 1st Quarter:

Number of French vessels operating in ICES Divisions VIIfg (at least once)
During the 1st Quarter

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	185	183	171	175	162	152	114	102	90	**-18%**	**-45%**	**-25%**	**-33%**
Gadoids	164	146	135	145	151	134	69	64	53	**-18%**	**-61%**	**-49%**	**-52%**

Fishing time (hours) in ICES Divisions VIIfg
During the 1st Quarter

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	120575	130572	126414	102974	96233	85487	61671	63529	39472	**-29%**	**-47%**	**-28%**	**-26%**
Gadoids	67745	58904	59278	61964	51522	35274	20949	24012	18572	**-48%**	**-65%**	**-41%**	**-32%**

Mean Fishing time (hours) by vessel in ICES Divisions VIIfg
During the 1st Quarter

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	652	714	739	588	594	562	541	623	439	**-14%**	**-4%**	**-4%**	**11%**
Gadoids	413	403	439	427	341	263	304	375	350	**-36%**	**-9%**	**15%**	**43%**

Landings of Cod from ICES Divisions VIIfg
During the 1st Quarter

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	2113	1421	1542	2685	1922	873	259	294	320	**-59%**	**-86%**	**-70%**	**-66%**
Gadoids	1816	1154	1269	2501	1585	642	148	173	259	**-65%**	**-90%**	**-77%**	**-73%**

Mean landings of Cod by vessel from ICES Divisions VIIfg
During the 1st Quarter

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	11.4	7.8	9.0	15.3	11.9	5.7	2.3	2.9	3.6	**-50%**	**-75%**	**-60%**	**-50%**
Gadoids	11.1	7.9	9.4	17.2	10.5	4.8	2.1	2.7	4.9	**-57%**	**-76%**	**-55%**	**-44%**

LPUE (kg/h) of Cod in ICES Divisions VIIfg
During the 1st Quarter

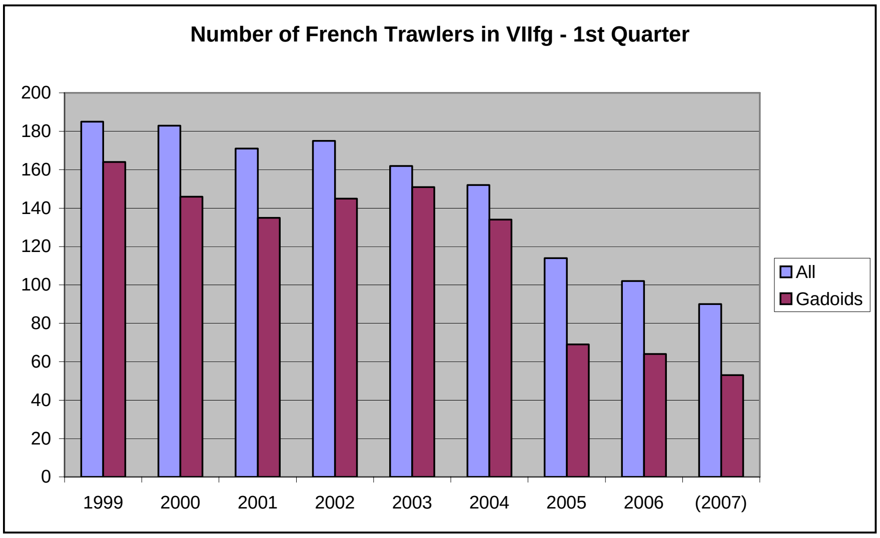
	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	17.5	10.9	12.2	26.1	20.0	10.2	4.2	4.6	8.1	**-42%**	**-74%**	**-59%**	**-55%**
Gadoids	26.8	19.6	21.4	40.4	30.8	18.2	7.1	7.2	13.9	**-32%**	**-73%**	**-61%**	**-60%**

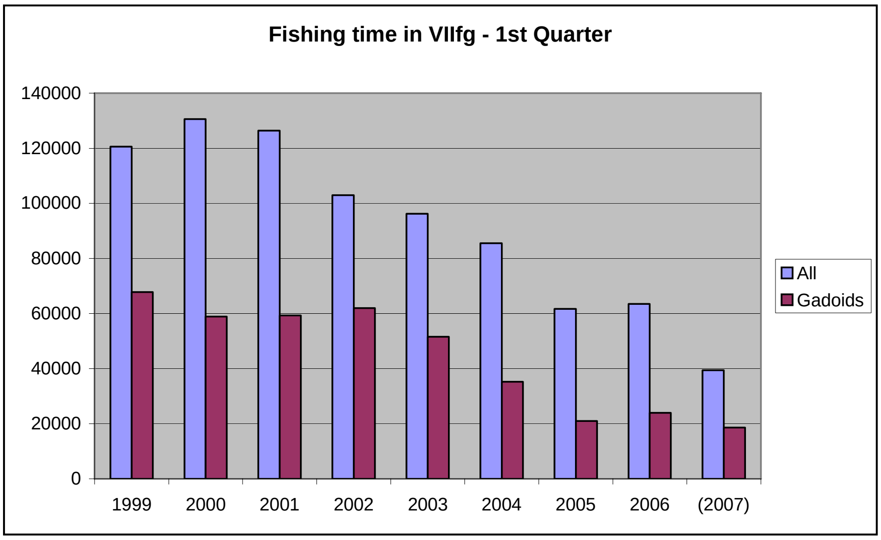
The table above shows the strong reduction in the total number of vessels operated (at least once) in ICES Divisions VIIfg during the first quarter: -45% between 1999 and 2006. This reduction is even greater when considering the vessels involved in the Gadoids fishery: -61% between 1999 and 2006 (–49% between .2004 and 2005). This latter figure appears like an evidence of the dramatic reduction of the Gadoids fishery in those Divisions in the first year of the closure. There has also been a slight reduction between 2005 and 2006.

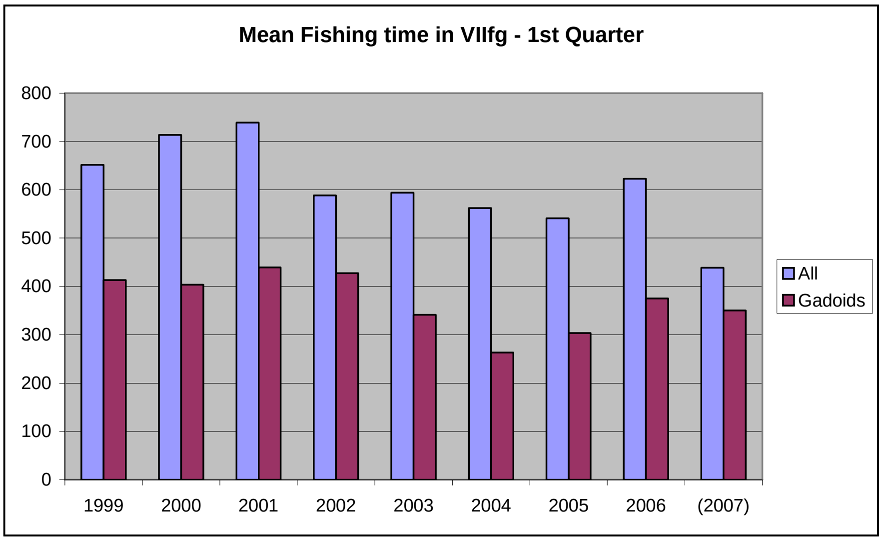
Fishing effort also decreased sharply: -65% over 1999-2006 for the gadoids metier (-41% between 2004 and 2005).

This decrease in effort is more related to the reduction in the number of vessels rather than to a reduction in the mean fishing time per vessel (which has fluctuated with an increase in recent years).

The trends are summarised in the graphs below:







Trends in the French Trawlers effort in ICES Divisions VIIfg in January:

Number of French vessels operating in ICES Divisions VIIfg (at least once) in January

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	128	125	118	122	112	94	94	85	71	**-27%**	**-34%**	**0%**	**-10%**
Gadoids	83	67	75	79	87	60	43	40	33	**-28%**	**-52%**	**-28%**	**-33%**

Fishing time (hours) in ICES Divisions VIIfg in January

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	30558	44838	36971	25428	24801	20210	17715	21679	14206	**-34%**	**-29%**	**-12%**	**7%**
Gadoids	13263	12459	14181	11221	10812	7293	5726	6369	5879	**-45%**	**-52%**	**-21%**	**-13%**

Mean Fishing time (hours) by vessel in ICES Divisions VIIfg in January

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	239	359	313	208	221	215	188	255	200	**-10%**	**7%**	**-12%**	**19%**
Gadoids	160	186	189	142	124	122	133	159	178	**-24%**	**0%**	**10%**	**31%**

Landings of Cod from ICES Divisions VIIfg in January

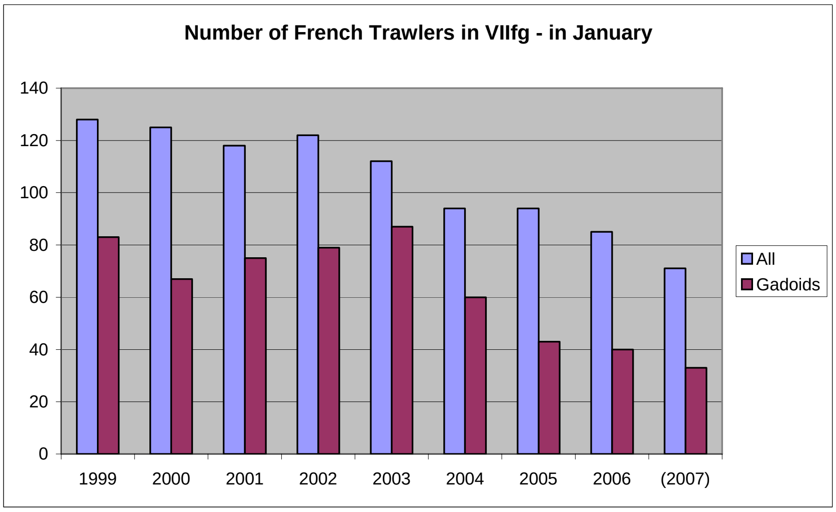
	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	183	155	207	200	307	140	63	75	75	**-23%**	**-59%**	**-55%**	**-46%**
Gadoids	114	57	119	129	193	71	28	22	55	**-38%**	**-81%**	**-61%**	**-69%**

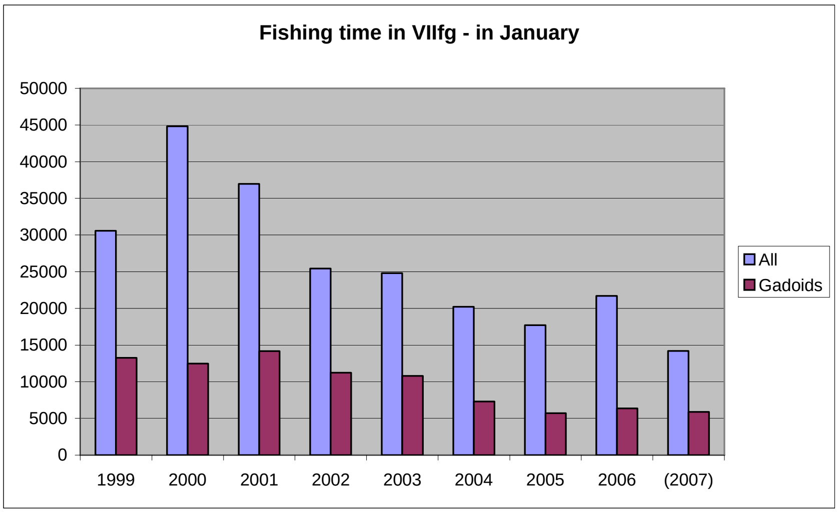
Mean landings of Cod by vessel from ICES Divisions VIIfg in January

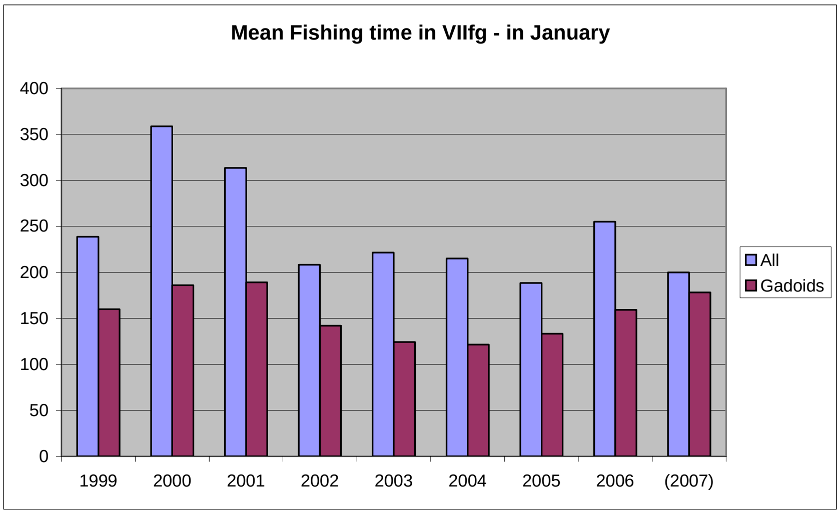
	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	1.4	1.2	1.8	1.6	2.7	1.5	0.7	0.9	1.1	**4%**	**-38%**	**-55%**	**-41%**
Gadoids	1.4	0.9	1.6	1.6	2.2	1.2	0.7	0.6	1.7	**-14%**	**-60%**	**-45%**	**-54%**

LPUE (kg/h) of Cod in ICES Divisions VIIfg in January

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	6.0	3.5	5.6	7.9	12.4	6.9	3.6	3.5	5.3	**16%**	**-42%**	**-49%**	**-50%**
Gadoids	8.6	4.6	8.4	11.5	17.9	9.7	4.9	3.5	9.4	**13%**	**-60%**	**-50%**	**-65%**


Number of French Trawlers in VIIfg - in January
140
120
100
80
60
40
20
0
1999
2000
2001
2002
2003
2004
2005
2006
(2007)
All
Gadoids


Fishing time in VIIfg - in January
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1999
2000
2001
2002
2003
2004
2005
2006
(2007)
All
Gadoids


Mean Fishing time in VIIfg - in January
400
350
300
250
200
150
100
50
0
1999
2000
2001
2002
2003
2004
2005
2006
(2007)
All
Gadoids

Trends in the French Trawlers effort in ICES Divisions VIIfg in February:

Number of French vessels operating in ICES Divisions VIIfg (at least once) in February

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	150	156	139	129	141	130	92	85	65	**-13%**	**-43%**	**-29%**	**-35%**
Gadoids	126	132	103	112	133	109	46	51	40	**-13%**	**-60%**	**-58%**	**-53%**

Fishing time (hours) in ICES Divisions VIIfg in February

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	41453	41193	43085	29364	33642	34542	22021	19471	14090	**-17%**	**-53%**	**-36%**	**-44%**
Gadoids	26321	25725	19981	19122	19995	16288	7649	8321	7364	**-38%**	**-68%**	**-53%**	**-49%**

Mean Fishing time (hours) by vessel in ICES Divisions VIIfg in February

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	276	264	310	228	239	266	239	229	217	**-4%**	**-17%**	**-10%**	**-14%**
Gadoids	209	195	194	171	150	149	166	163	184	**-28%**	**-22%**	**11%**	**9%**

Landings of Cod from ICES Divisions VIIfg in February

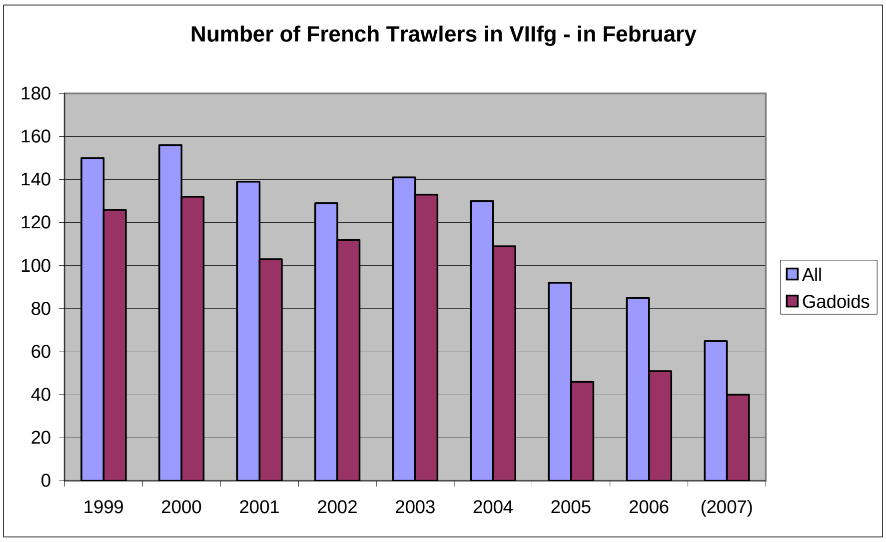
	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	952	635	553	562	955	412	104	117	138	**-57%**	**-88%**	**-75%**	**-72%**
Gadoids	857	556	468	500	831	337	61	81	117	**-61%**	**-91%**	**-82%**	**-76%**

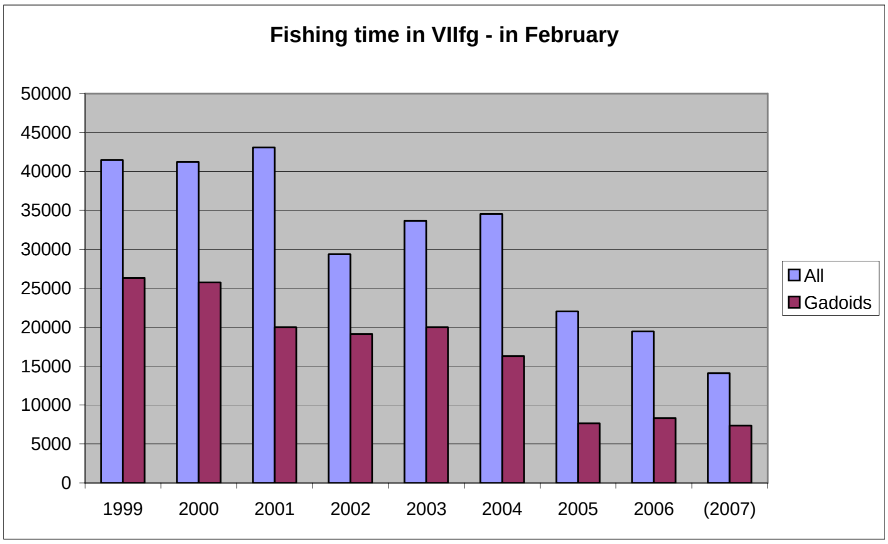
Mean landings of Cod by vessel from ICES Divisions VIIfg in February

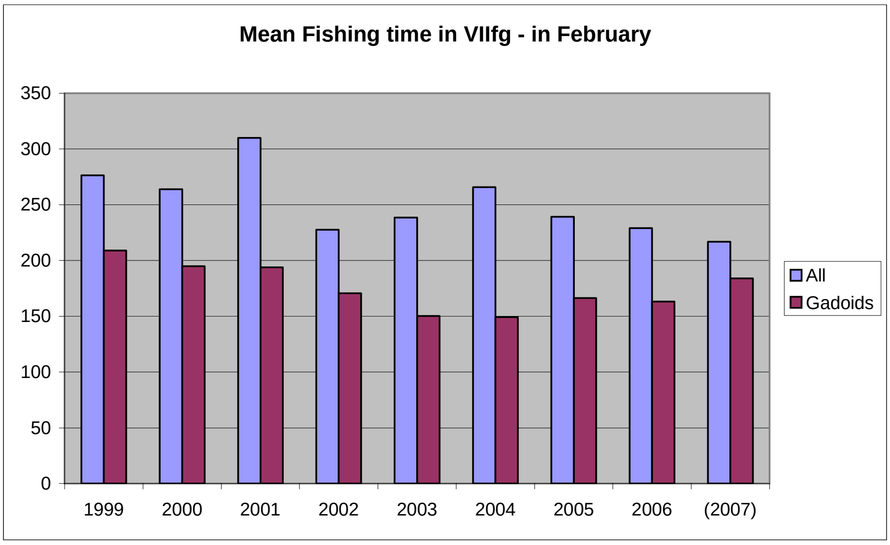
	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	6.3	4.1	4.0	4.4	6.8	3.2	1.1	1.4	2.1	**-50%**	**-78%**	**-64%**	**-57%**
Gadoids	6.8	4.2	4.5	4.5	6.2	3.1	1.3	1.6	2.9	**-55%**	**-77%**	**-57%**	**-49%**

LPUE (kg/h) of Cod in ICES Divisions VIIfg in February

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	23.0	15.4	12.8	19.1	28.4	11.9	4.7	6.0	9.8	**-48%**	**-74%**	**-60%**	**-50%**
Gadoids	32.6	21.6	23.4	26.1	41.6	20.7	8.0	9.7	15.9	**-36%**	**-70%**	**-61%**	**-53%**


Number of French Trawlers in VIIfg - in February
180
160
140
120
100
80
60
40
20
0
1999
2000
2001
2002
2003
2004
2005
2006
(2007)
All
Gadoids


Fishing time in VIIfg - in February
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1999
2000
2001
2002
2003
2004
2005
2006
(2007)
All
Gadoids


Mean Fishing time in VIIfg - in February
350
300
250
200
150
100
50
0
1999
2000
2001
2002
2003
2004
2005
2006
(2007)
All
Gadoids

Trends in the French Trawlers effort in ICES Divisions VIIfg in March:

Number of French vessels operating in ICES Divisions VIIfg (at least once) in March

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	167	159	154	157	133	130	92	79	56	**-22%**	**-53%**	**-29%**	**-39%**
Gadoids	147	99	113	120	113	108	46	49	31	**-27%**	**-67%**	**-57%**	**-55%**

Fishing time (hours) in ICES Divisions VIIfg in March

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	48569	44542	46355	48179	37789	30737	21935	22379	11178	**-37%**	**-54%**	**-29%**	**-27%**
Gadoids	28162	20718	25117	31620	20712	11693	7575	9320	5330	**-58%**	**-67%**	**-35%**	**-20%**

Mean Fishing time (hours) by vessel in ICES Divisions VIIfg in March

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	291	280	301	307	284	236	238	283	200	**-19%**	**-3%**	**1%**	**20%**
Gadoids	192	209	222	264	183	108	165	190	172	**-43%**	**-1%**	**52%**	**76%**

Landings of Cod from ICES Divisions VIIfg in March

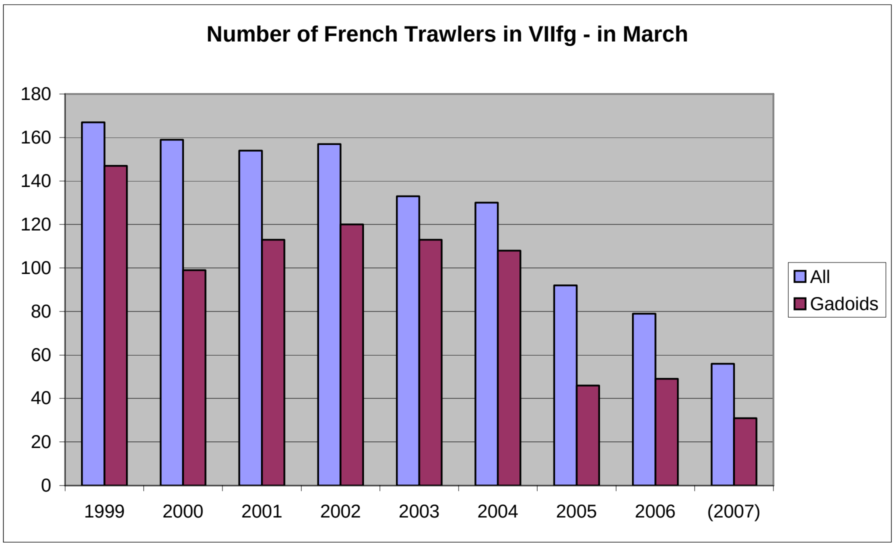
	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	973	637	771	1925	663	311	85	102	97	**-68%**	**-90%**	**-73%**	**-67%**
Gadoids	836	541	675	1866	558	228	54	67	85	**-73%**	**-92%**	**-76%**	**-71%**

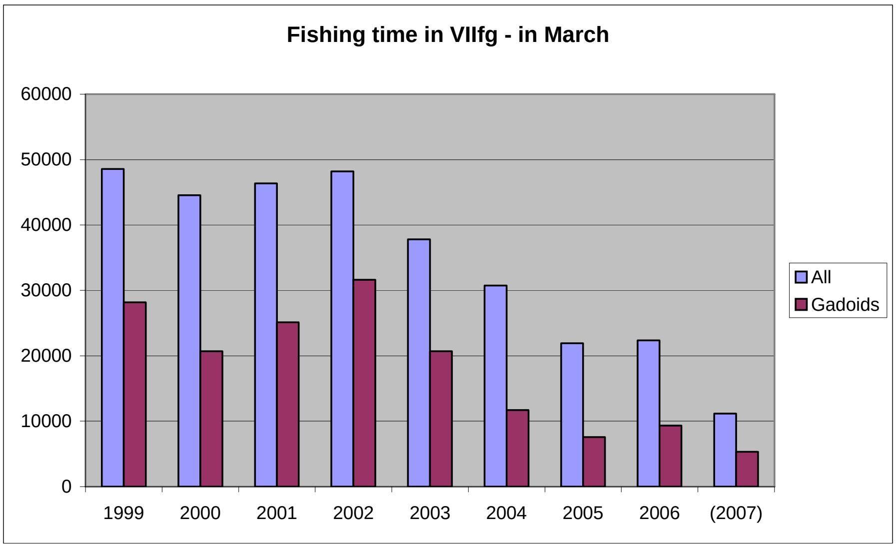
Mean landings of Cod by vessel from ICES Divisions VIIfg in March

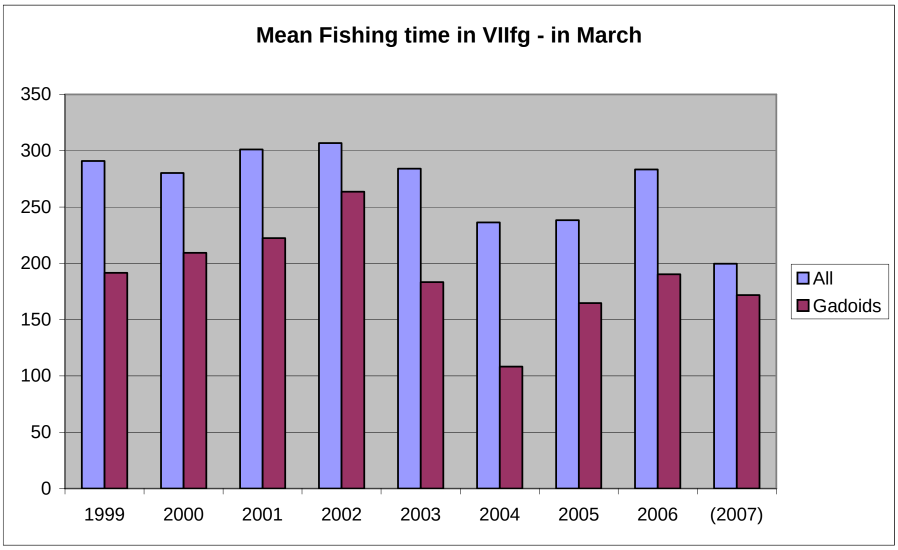
	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	5.8	4.0	5.0	12.3	5.0	2.4	0.9	1.3	1.7	**-59%**	**-78%**	**-61%**	**-46%**
Gadoids	5.7	5.5	6.0	15.6	4.9	2.1	1.2	1.4	2.7	**-63%**	**-76%**	**-44%**	**-35%**

LPUE (kg/h) of Cod in ICES Divisions VIIfg in March

	1999	2000	2001	2002	2003	2004	2005	2006	(2007)	Variation 1999-2004	Variation 1999-2006	Variation 2004-2005	Variation 2004-2006
All	20.0	14.3	16.6	40.0	17.5	10.1	3.9	4.6	8.7	**-49%**	**-77%**	**-62%**	**-55%**
Gadoids	29.7	26.1	26.9	59.0	26.9	19.5	7.1	7.2	15.9	**-34%**	**-76%**	**-63%**	**-63%**


Number of French Trawlers in VIIfg - in March
180
160
140
120
100
80
60
40
20
0
1999
2000
2001
2002
2003
2004
2005
2006
(2007)
All
Gadoids


Fishing time in VIIfg - in March
60000
50000
40000
30000
20000
10000
0
1999
2000
2001
2002
2003
2004
2005
2006
(2007)
All
Gadoids

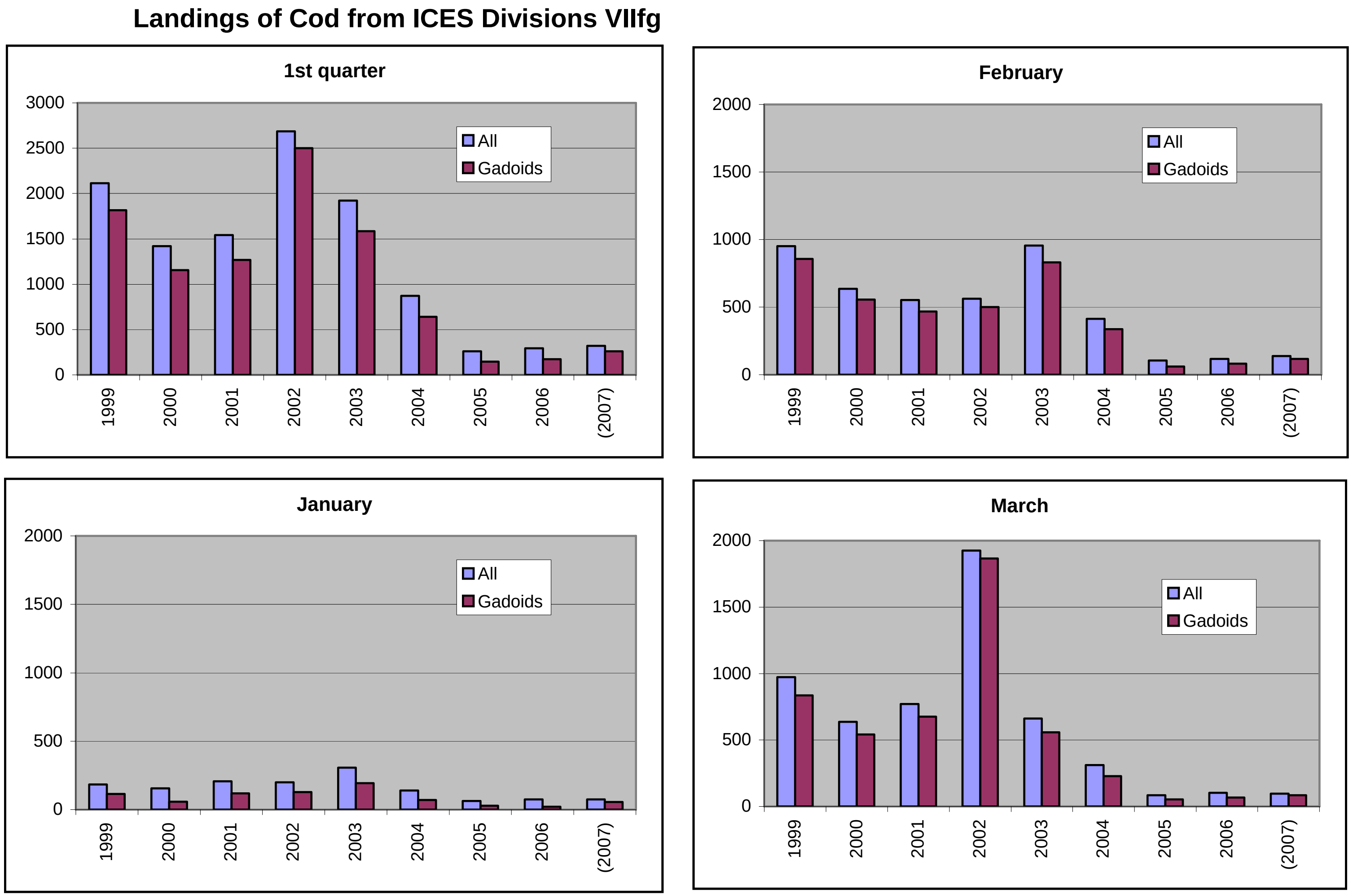

Mean Fishing time in VIIfg - in March
350
300
250
200
150
100
50
0
1999
2000
2001
2002
2003
2004
2005
2006
(2007)
All
Gadoids

The analysis month by month shows that the reduction between 2004 and 2005 (when the closure was implemented) both in the number of vessels and in fishing effort is much higher in February and March than in January.

The number of vessels involved in the Gadoids metier has been reduced by around 58% between 2004 and 2007, and the fishing time by 53% and 35% in February and March respectively.

It should be noticed that the number of vessels involved and the fishing time have fluctuated only slightly since 2005 around this low level.

Landings of cod have been reduced dramatically between 2004 and 2005 for each of the month. In recent years for all of them, the landings of cod have slightly increased, but remained very low [but precise comparison between the most recent years should be considered with cautious because of varied quality of landings data].


Landings of Cod from ICES Divisions VIIfg
1st quarter
3000
2500
2000
1500
1000
500
0
All
Gadoids
1999
2000
2001
2002
2003
2004
2005
2006
(2007)
February
2000
1500
1000
500
0
All
Gadoids
1999
2000
2001
2002
2003
2004
2005
2006
(2007)
January
2000
1500
1000
500
0
All
Gadoids
1999
2000
2001
2002
2003
2004
2005
2006
(2007)
March
2000
1500
1000
500
0
All
Gadoids
1999
2000
2001
2002
2003
2004
2005
2006
(2007)

APPENDIX 2

Effects of 2005-2007 Trevose cod closure on UK demersal fleets

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Summary

1. The Trevose cod closure affects a small fleet of UK vessels using otter trawls, beam trawls, nets and lines. Many are inshore vessels <10m long. The total annual effort of vessels that have fished in the closure area since 2000 represents about a third of the total vessel-days for UK vessels operating in VIIe-k. Their cod landings represent about half the UK total for VIIe-k.

2. The UK fisheries catch a diverse range of species in the Southwest. Cod made up only 5% of the demersal catches of otter trawl, beam trawl and fixed net vessels in VIIf&g during 2000 – 2007, and 2.5% in VIIe-k.

3. During 2000 – 2004 (prior to the introduction of the closure), the closed rectangles yielded only 4 – 10% of the reported UK cod landings from VIIe-k. The total annual UK cod landings from VIIe-k comprised 6 – 11% of the international cod landings in this period.

4. The cod closure in 2005 – 2007 displaced UK vessels away from spawning aggregations of cod and into surrounding areas with typically lower catch-rates of cod. This must have reduced the overall efficiency of these vessels for catching cod.

5. Many vessels (particularly by beam trawlers from the UK and Belgium) fished close to the borders of the closed rectangles during the closure, and fished intensively inside the rectangles when they were re-opened. In 2007 it was noted that catch rates of sole were initially high on reopening but fell off rapidly. This may reflect dispersal from spawning grounds as well as the effects of fishing. In 2006 & 2007, cod had already dispersed by the time the rectangles were re-opened in April, and catch rates were relatively low.

6. In 2006, ICES (ACFM) recommended measures should be put in place to prevent effort increasing outside the closure. However, there is no clear evidence for a general increase in fishing effort (days fished) of UK vessels during the non-closure period to make up any shortfall in cod catches during the closure in 2005-2007.

7. The closure is likely to have resulted in a small (although positive) benefit for managing UK fishing activities in line with the quotas for cod since 2005. However, it is difficult to disentangle the benefits from other factors affecting trends in the fisheries throughout VIIe-k.

8. The closure on its own does not exclude enough UK fishing effort to achieve the relative reduction in fishing mortality advised by ICES but could contribute to a broader package of measures. Analyses carried out by IFREMER show that the major impact of the closure on cod appears to have been on activities of French vessels which take three quarters of the international cod landings.

Purpose of closure

The closure of ICES rectangles 30E4, 31E4 and 32E3 was established in 2005 following an Anglo-French-Irish proposal from the fishing industry in consultation with fishery scientists. A simulation of the effect of re-distribution of fishing effort within VIIf-g indicated a potential 13% reduction in cod landings. In 2005, the three rectangles were closed during January to March, with derogations for beam trawlers in March, and for vessels using pots and creels or nets of mesh size less than 55mm. In 2006, the closure was reduced to February and March only, with the derogation for beam trawlers in March removed. A further amendment in 2006 and 2007 removed that part of 30E4 extending into the 6-mile UK limit, where vessels are able to fish subject to local by-laws controlling vessel size and other aspects of fishing operations.

Previous evaluations of the closure (Biseau and Bellail, 2006; Scott *et al*., 2005 & 2006) indicated that the major impact on cod is likely to be through its impact on French trawlers which take ~75% of the cod landings from VIIe-k. Documents by Biseau and Bellail (2006) and Biseau (2007) show that fishing effort of French gadoid trawlers in Quarter 1 declined by around 32% during 2004 – 2006, mainly due to a decrease in the numbers of vessels involved. The cod closure is thought to have been a strong incentive for this reduction in effort. Quarter-1 effort of this fleet in VIIf&g had already declined by over 40% between 2002 and 2004.

Cod stock affected by closure

The ICES assessment treats all cod within Divisions VIIe-k (Celtic Sea and western Channel) as belonging to a single homogeneous stock. The Trevose closure covers two spawning areas within VIIe-k. The UK Fisheries Science Partnership surveys of Celtic Sea cod carried out during February/March in 2004 – 2006 showed aggregations of cod within the closed rectangles (Fig. 1a; Dann *et al*. 2006), indicating the potential for high catch rates in these rectangles in spring. Egg surveys carried out by Cefas in the 1990s showed a well defined spawning ground for cod off North Cornwall (Trevose), in the rectangles closed to fishing (Fig. 1b). Cod spawning is also known to occur off SE Ireland.

UK fleets affected by the closure

The UK demersal fin-fish fisheries in the English and Welsh coastal regions abutting on ICES Divisions VIIe-k (Celtic Sea and western Channel) are prosecuted by a fleet of 500 – 600 vessels. Many of these are under 10m long, and may use a variety of fishing methods (e.g. trawls, nets, lines or pots) according to season and markets. A detailed description of the coastal fisheries of England and Wales is given by Walmsley and Pawson (2007), and a brief summary for VIIe-k fleets is given in Appendix 1. The under-10m fleet mostly does not provide log-book data, and the landings and effort statistics may only be available as estimates for groups of vessels over variable periods. However as these vessels are affected by the Trevose closure they cannot be ignored in the evaluation. The statistics for <10m vessels have improved over time, and this may affect the absolute figures for landings and effort. The additional controls imposed by the EU Buyers and Sellers Regulation from 2006 onwards, together with improved monitoring and enforcement, may also mean that the data for the recent years when the closure was introduced are more accurate than for earlier years. This may cause some bias in apparent trends over time in effort and landings.

Figures 2 – 7 show the spatial distribution of fishing effort (days absent) and cod landings for UK otter trawlers, fixed-netters and beam trawlers during 2002 – 2007, for February to March (the period of the closure in 2006 & 2007) and for the remainder of the year. The amount of fishing effort and cod landings in the closed rectangles is relatively small compared to the annual total for VIIe-k. However, aggregation of cod on the spawning grounds in spring results in elevated catches in the closed rectangles off Trevose.

UK landings of cod from VIIe-k represented only 6-11% of the international cod landings in 2000 – 2005 (Table 1). The cod landings taken in the three closed rectangles in 2000 – 2004 comprised 4 – 10% of the total UK landings from VIIe-k, with the bulk of this catch taken in February and March (Table 2). Hence the UK vessels that caught cod in the three rectangles during Quarter 1 prior to the closure in 2005 represented a minor component of the international fishery for cod which is dominated by French gadoid trawlers. Whilst the UK cod landings from VIIe-k as a whole have been distributed fairly evenly between otter trawlers, beam trawlers and fixed gears, the distribution between gear types in rectangles 30E4, 31E4 and 32E3 in VIIf&g in Quarter 1 2000 – 2004 was more variable (Table 3).

Effect of the cod closure: information from UK ports

Information on the effect of the closure has been obtained each year from the UK fishing industry, Marine Fisheries Agency staff and Cefas Industry Liaison Officers. Annual reports are given in Annexes 2 - 4. Major effects of the closure have included the following:

- Many vessels (particularly by beam trawlers from the UK and Belgium) fished close to the borders of the closed rectangles during the closure, and fished intensively inside the rectangles when they were re-opened. In 2007 it was noted that catch rates of sole were initially high on reopening but fell off rapidly. (This may reflect dispersal from spawning grounds as well as the effects of fishing.) In 2006 & 2007, cod had already dispersed by the time the rectangles were re-opened in April, and catch rates were relatively low.
- Numbers of Belgian beamers have been reduced in the Celtic Sea during the closure period, many of the vessels moving to the North Sea, Irish Sea or Biscay.
- A number of UK vessels moved into VIIe during the closure. Small vessels with limited range, and which operate from ports in the vicinity of the cod closure, were most affected by the closure.

Effect of the cod closure on UK vessels: analysis of fishery data

Additional information was obtained from an analysis of official records of fishing activities and landings. Previous evaluations of the closure also provided VMS data and vessel over-flight data to show spatial patterns of fishing (Scott *et al*., 2006)

Effect on spatial distribution of fishing

The closure in 2005 – 2007 displaced UK ≥10m and <10m vessels into surrounding areas with typically lower catch-rates of cod. Sightings of vessels of all nationalities in the first Quarter of 2004 to 2006 showed concentrations of beam trawl effort in rectangle 30E4 when the rectangle was open to fishing. Otter trawl effort in divisions VIIf&g was less concentrated into the closure rectangles during the first 3 months of the year, and the spatial distribution of effort therefore appeared less affected by the closed area. VMS data for French, Belgium and UK (E&W) vessels show a similar overall picture, given that the French fleet consists mainly of otter trawlers whereas the Belgian fleet are beam trawlers (Scott *et al* 2006).

Effect on species compositions

The displacement may in some cases have resulted in vessels targeting different types of fish, however the overall species compositions for specific gear types used in VIIf&g in Quarter 1 changed relatively little over the 2000 – 2007 period (Fig. 8). The most obvious difference during 2005 – 2007 has been an increase in the contribution of flatfish in the otter trawl catches, possibly reflecting displacement onto the more traditional flatfish grounds inshore along the north Cornwall coast.

Effect on catch rates

The effect on catch rates was examined by compiling data for a sub-set of 32 otter trawlers, 75 beamers and 19 netters that recorded annual effort in rectangles 30E4, 31E4 or 32E3 during 2005 – 2007 (years of the closure) and during 2000 – 2004. These exclude under-10m vessels not listed by individual vessel registration code in the data base. Not all vessels were recorded in all years. These vessels landed about 50% of the annual UK cod catch from VIIe-k during 2000-2007.

During February and March 2000 – 2004, this sub-set of vessels recorded higher catch rates of cod in the closure rectangles than in the remainder of VIIe-k or VIIf&g in the same months or throughout VIIe-k or VIIf&g during the remainder of the year (Figs 9 & 10). A few vessels continued to fish in the closure in 2005 due to confusion over derogations, and recorded high catch-rates of cod as in previous years. In 2006 and 2007, some effort was also recorded in 30E4 due to the opening of the area within 6 miles of the English coast.

The average catch rates of cod in the rectangles beyond the closure in February and March tended to be similar to the catch rates throughout VIIe-k or VIIf&g during the remainder of the year (Figs 9&10). Displacement of vessels away from spawning aggregations in the closed rectangles in February and March 2005-2007 will therefore have reduced their overall efficiency for catching cod.

A potential outcome of a closure is that vessels may fish harder in other areas and at other times to make up for reduced catch rates. However, there is no evidence for any increase in overall fishing effort (days fished) in the otter trawl and beam trawl fleets either in the rectangles outside the closed area in February and March, or throughout VIIe-k or VIIf&g at other times of year, since the inception of the closure in 2005 (Figs 9&10). Fixed net effort, cod landings and cod LPUE increased slightly after 2005. It is not clear if this is related to the closure, a continuation of a general increase in the use of this gear by UK vessels in the south-west, or the result of more accurate and complete recording of data in the last few years.

Trends in effort and cod landings: UK vessels throughout VIIe-k

Annual days fished by UK otter trawlers and fixed netters throughout VIIe-k declined over the period 2000 – 2005, then increased in 2006 (Fig. 11). These data refer to otter trawl vessels in all mesh bands. Effort of beam trawlers declined slightly from 2003 - 2006. Annual landings of cod declined sharply between 2002 and 2003 then remained stable. The decline in LPUE of otter trawlers and fixed netters after 2002 was less marked than for landings, due to the decline in effort.

Data for Quarter 1 only (the period encompassing the cod closure) cover the period up to and including 2007 (Fig. 12). Otter trawl effort in Quarter 1 declined progressively until 2006, then increased in 2007. Fixed net effort was relatively high in 2006 and 2007. Beam trawl effort declined in Q1 2006, but in 2007 was around average for the period 2000 onwards. Quarter one landings of cod showed a similar pattern to the annual values except for an apparent increase in fixed-net landings in 2006 and 2007. The extent to which recent trends in reported cod landings have been affected by the restrictions imposed by the EU Buyers and Sellers Regulation in 2006 and 2007 and improved enforcement of quotas is unknown.

Results of the "Invest in Fish" bioeconomic model

The "Invest in Fish" project (www.investinfishsw.org.uk) is a 3-year project led by WWF-UK, the National Federation of Fishermen's Organisations and the supermarket chain Marks & Spencer, which aims to agree the measures needed to best sustain fish stocks within the region (Celtic Sea, English Channel and Western Approaches), considerate of the regional economy, local communities and the wider marine environment. The effect of the Trevose closure was examined, however due to the limited information available and the assumptions inherent in the bioeconomic model, the model showed no impact on fish stocks. It was noted that information on catches and discards were recorded at scales too large to allow for area effects to be detected, and that any benefits to the stock would not have had time to feed through the model.

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Table 1. National landings of cod from VIIe-k as used by the ICES Working Group on the Assessment of Southern Shelf Demersal Stocks, 2006 meeting.

Year	Belgium	France	Ireland	UK	Others	Total
2000	208	4690	1302	744	0	6944
2001	347	5914	1091	838	0	8190
2002	555	6897	694	618	0	8764
2003	136	5018	517	346	0	6017
2004	153	2425	663	282	0	3523
2005*	186	1674	835	309	0	3004

*** provisional**

Table 2. Percentage of total UK cod landings from VIIe-k taken in the three closed rectangles in two periods.

Year:	2000	2001	2002	2003	2004
Jan-March	10.8	6.5	6.9	4.9	7.8
Feb-March	10.3	5.5	6.6	4.2	7.2

Table 3: UK percentage composition of cod landings (t), by gear, in (a) the three closed rectangles during Quarter 1 and (b) annual for VIIe-k (2007 data incomplete)

(a) Rectangles 30E4, 31E4, 32E3

	2000	2001	2002	2003	2004
Otter trawl	31	22	2	8	47
Beam trawl	8	41	22	77	16
Fixed nets	61	37	76	15	37
Lines	0.4	0.4	0.2	0.0	0.0
Total landings (t)	81	57	41	17	22

(b) VIIe-k

	2000	2001	2002	2003	2004	2005	2006	(2007)
Otter trawl	38	35	32	34	29	31	32	32
Beam trawl	25	30	22	32	34	33	25	24
Fixed nets	36	35	45	32	37	35	43	44
Lines	1	0	1	2	0	1	1	0
Total landings (t)	751	888	606	338	284	313	372	179

(a) UK Fisheries Science Partnership

(b) Distribution of cod eggs in 1990

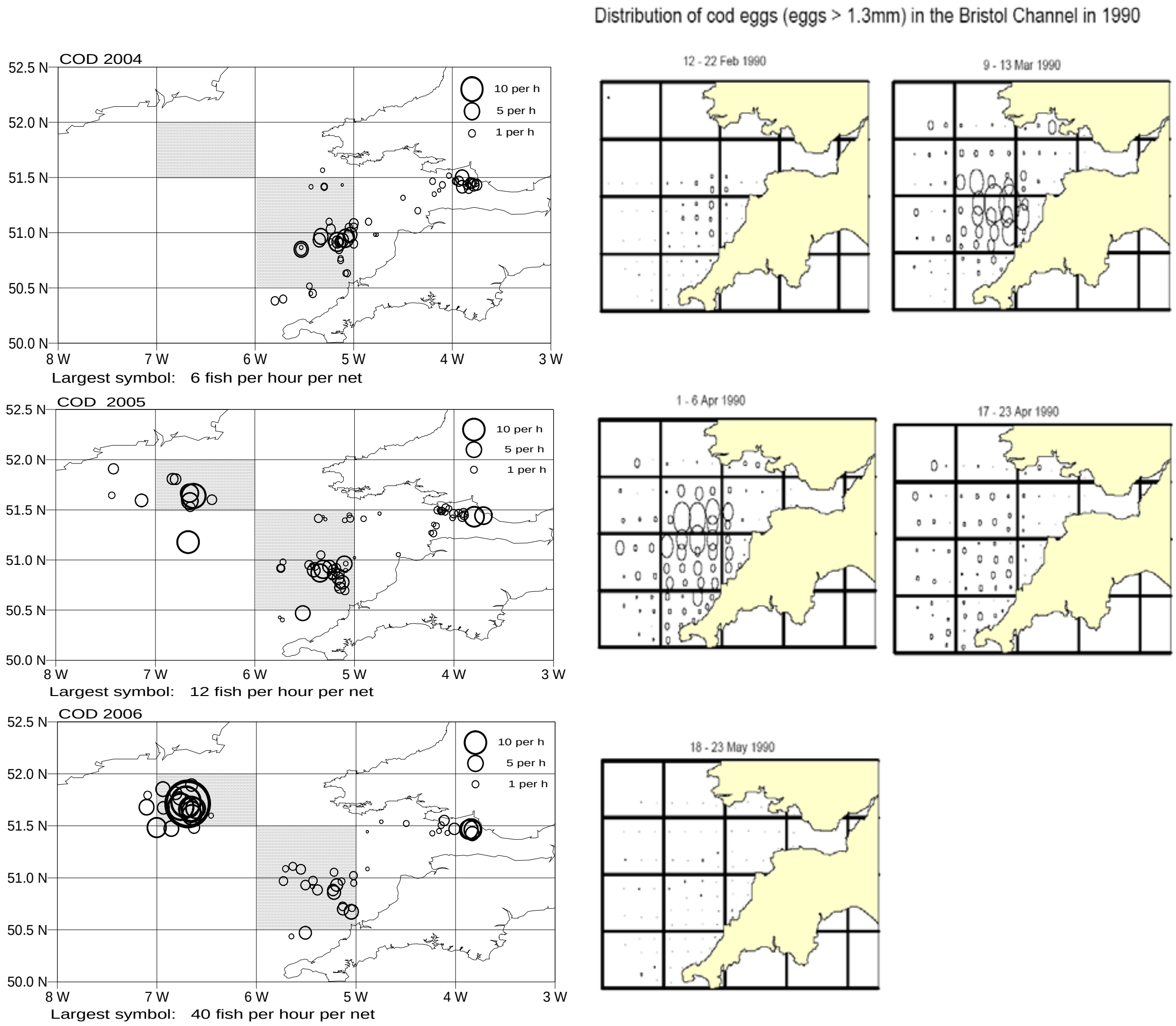


Fig. 1. (a) Distribution of cod in the UK Fisheries Science Partnership western cod surveys in February – March 2004, 2005 and 2006 (Dann *et al*. 2006). Same scale is used for all plots. Areas of circles are proportional to numbers caught per hour towed. The ICES rectangles closed to cod fishing in spring are shaded. The survey did not extend west of 6 degrees in 2004. (b) Distribution of cod eggs in the eastern Celtic Sea in 1990.

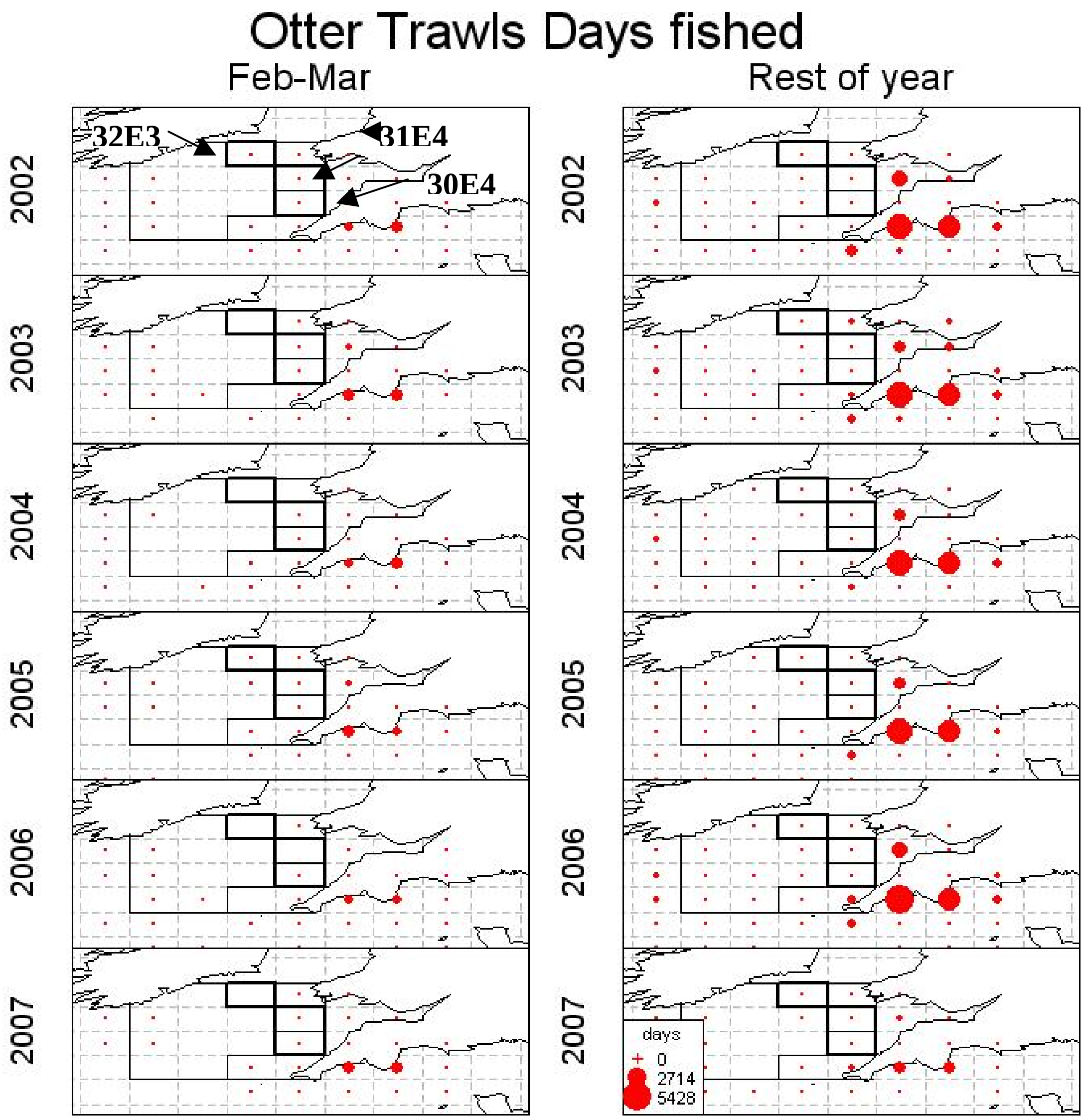


Fig. 2. Fishing effort of UK otter trawls in VIIe-k during 2002 – 2007. Data for “rest of year” in 2007 are incomplete (data to May only). ICES Division boundaries and the three closed rectangles are shown.

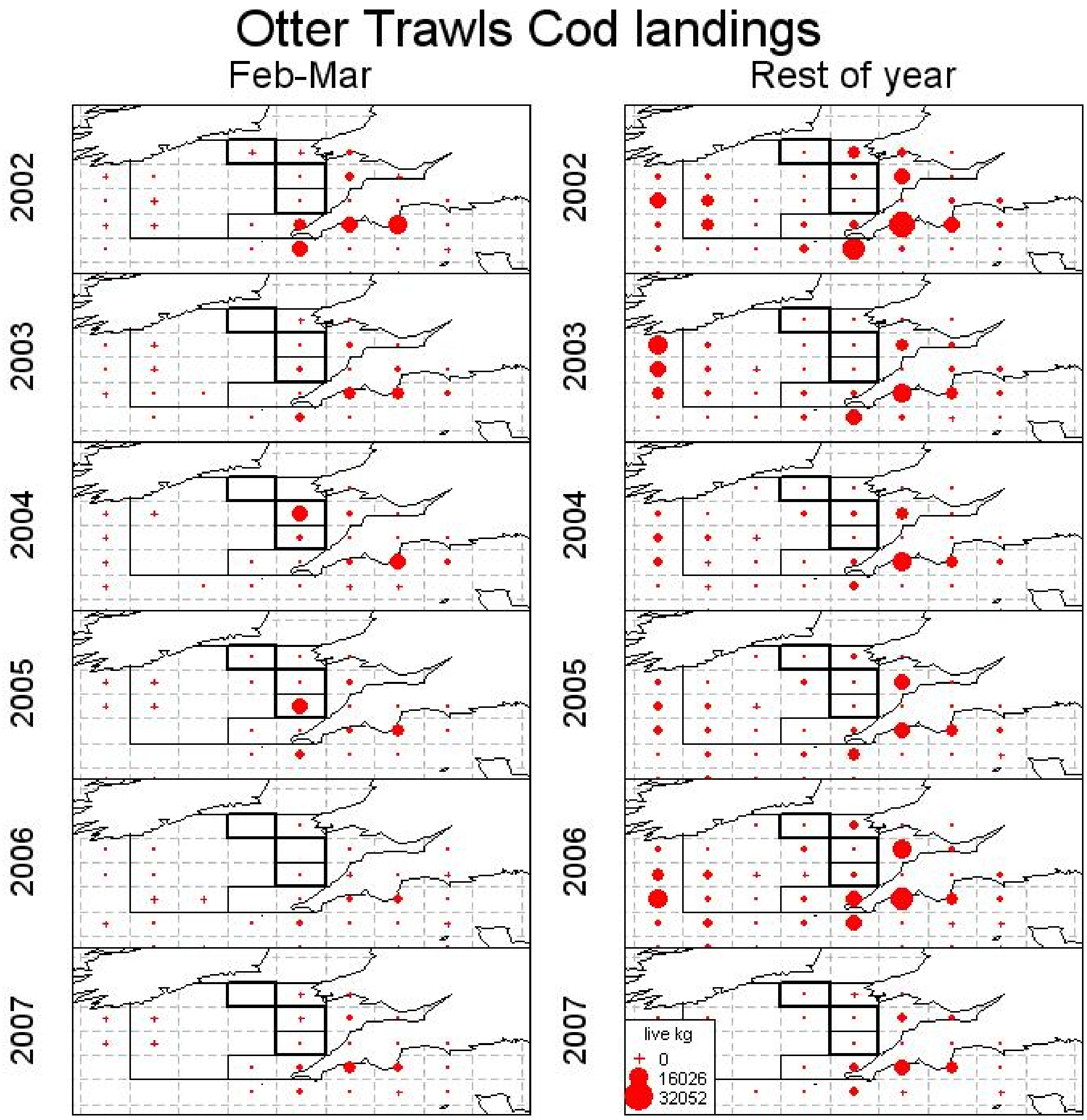


Fig. 3. Cod landings by UK otter trawls in VIIe-k during 2002 – 2007. Data for "rest of year" in 2007 are incomplete (data to May only). ICES Division boundaries and the three closed rectangles are shown.

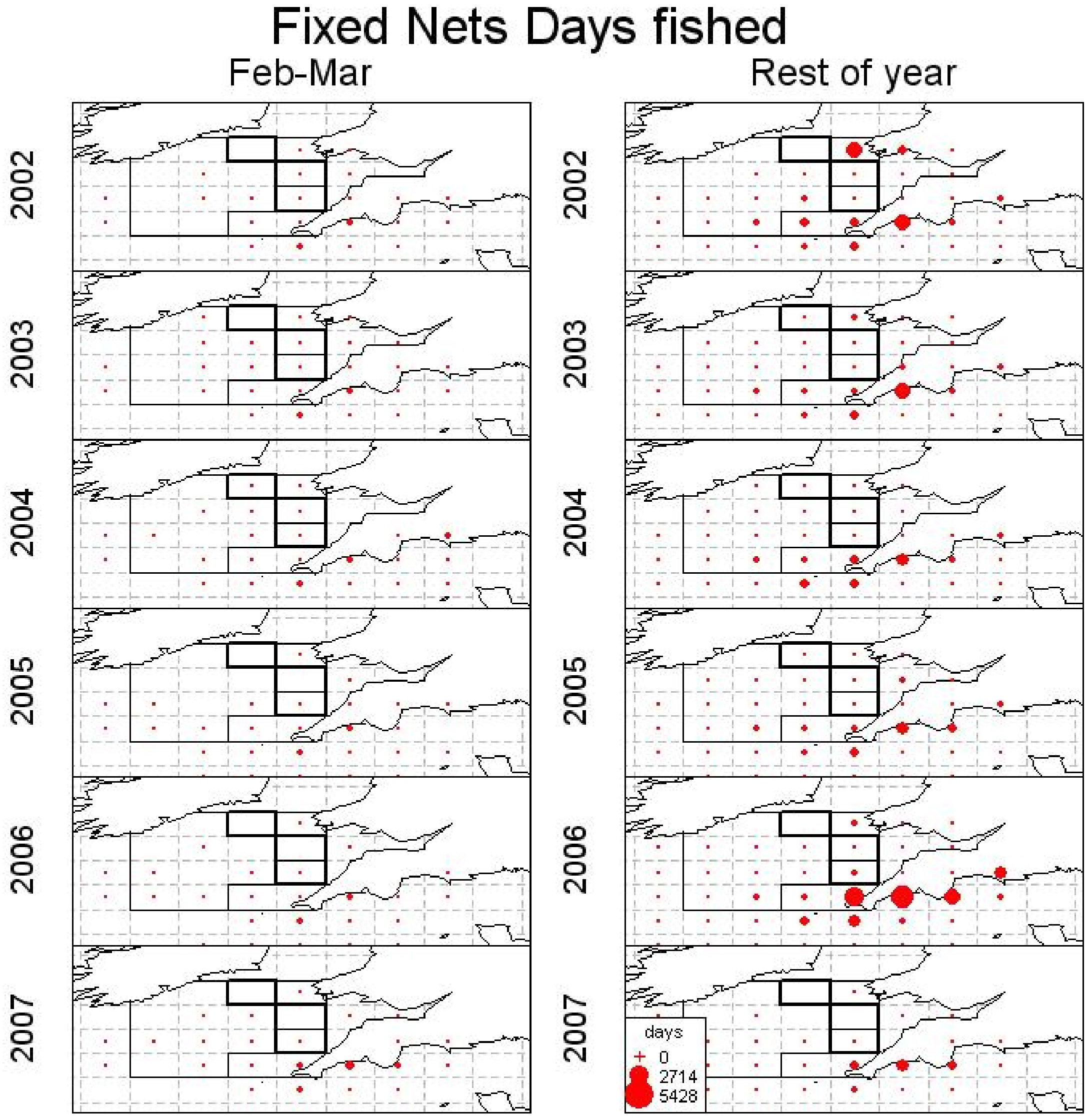


Fig. 4. Fishing effort of UK fixed-netters in VIIe-k during 2002 – 2007. Data for "rest of year" in 2007 are incomplete (data to May only). ICES Division boundaries and the three closed rectangles are shown.

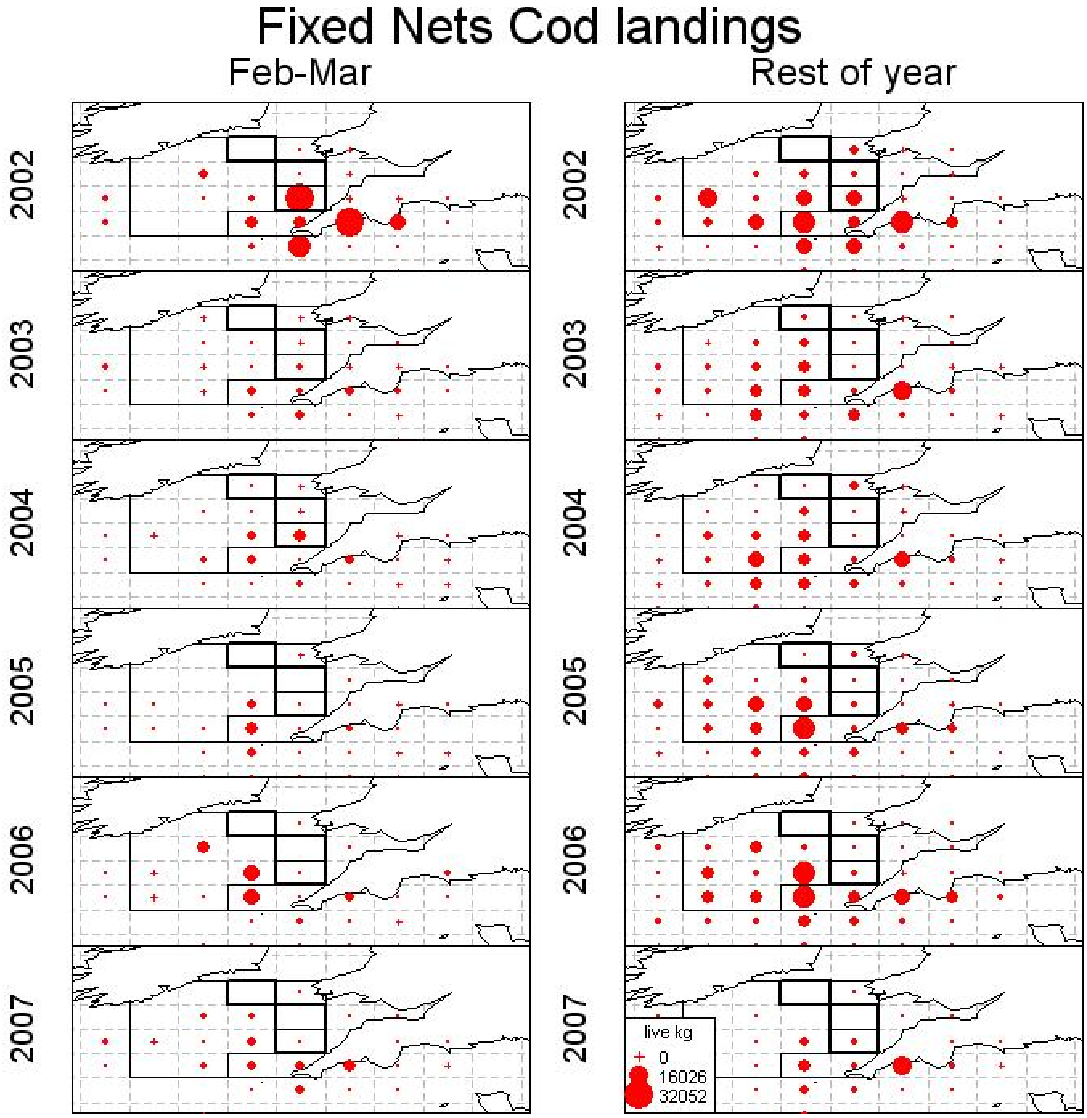


Fig. 5. Cod landings by UK fixed-netters in VIIe-k during 2002 – 2007. Data for "rest of year" in 2007 are incomplete (data to May only). ICES Division boundaries and the three closed rectangles are shown.

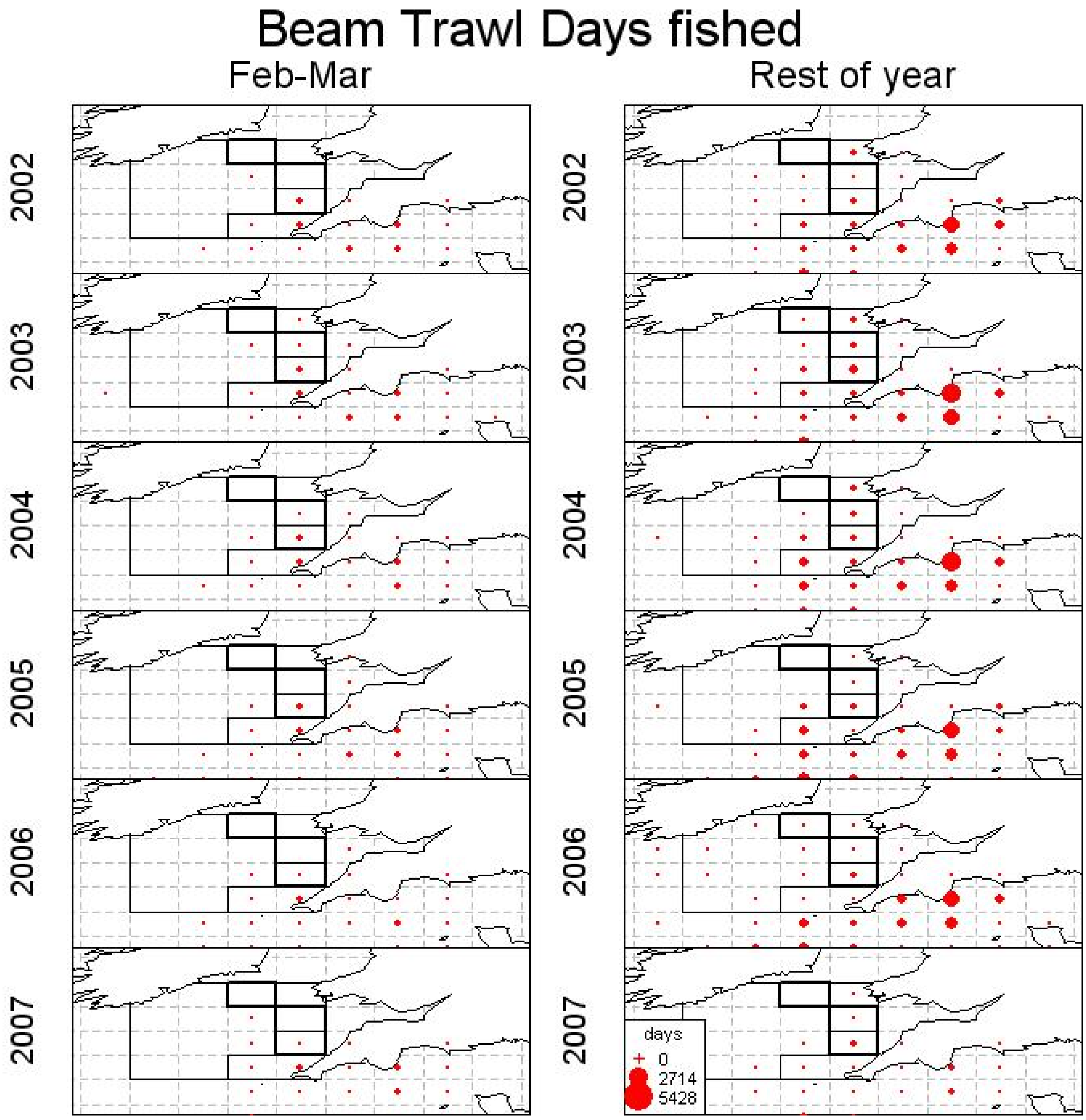


Fig. 6. Fishing effort of UK beam trawlers in VIIe-k during 2002 – 2007. Data for “rest of year” in 2007 are incomplete (data to May only). ICES Division boundaries and the three closed rectangles are shown.

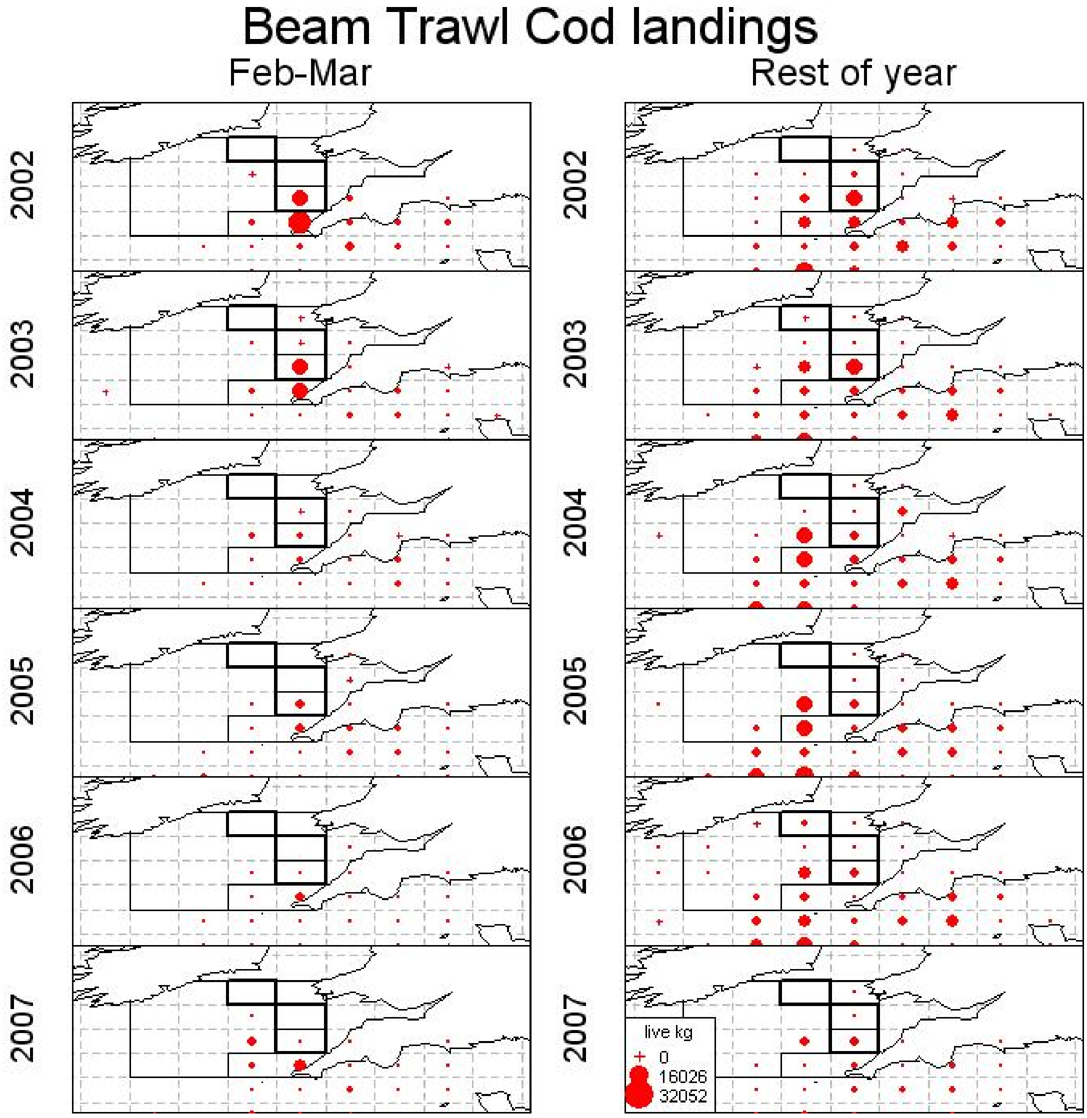
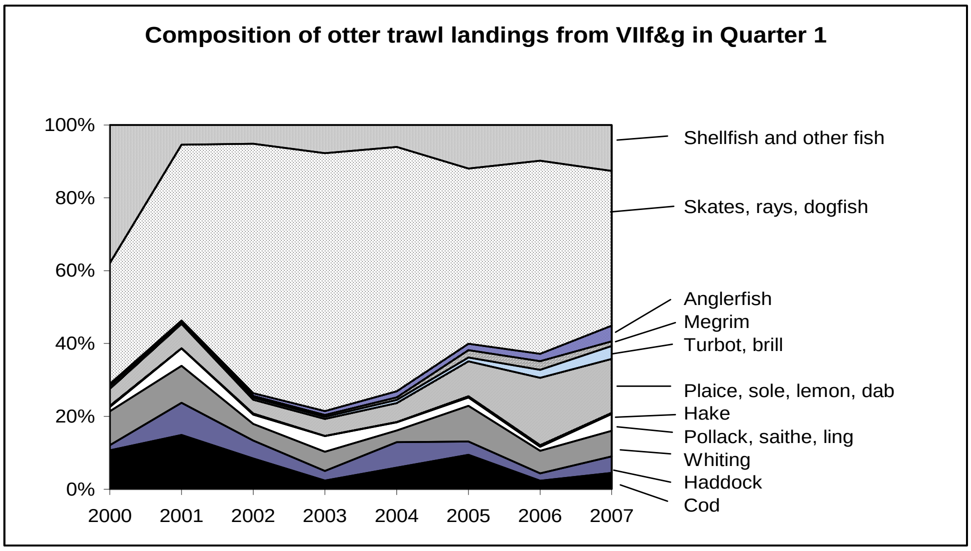
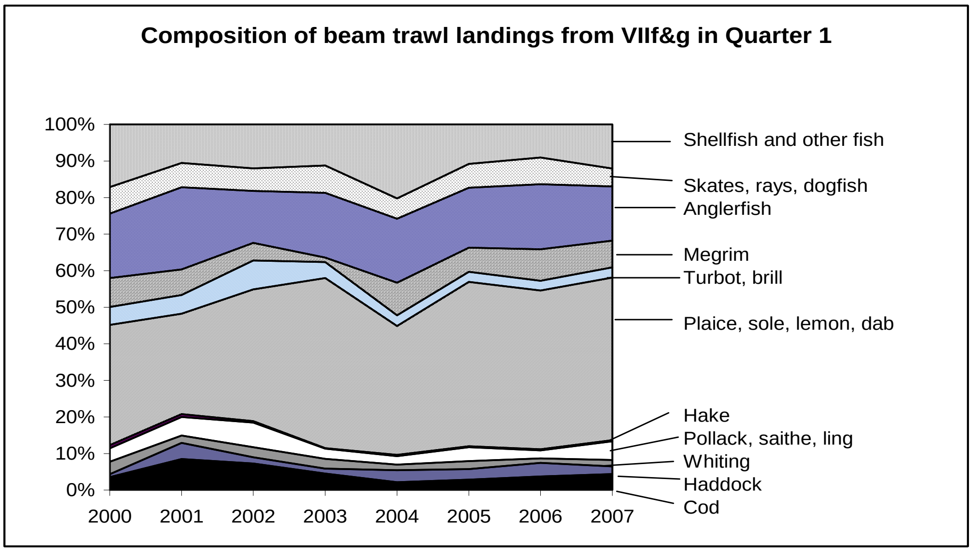


Fig. 7. Cod landings by UK beam trawlers in VIIe-k during 2002 – 2007. Data for "rest of year" in 2007 are incomplete (data to May only). ICES Division boundaries and the three closed rectangles are shown.





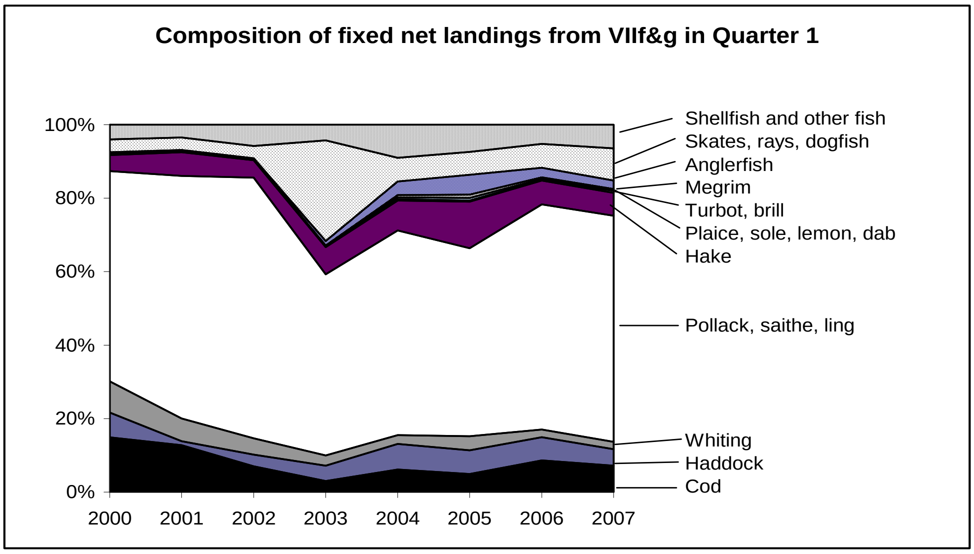


Fig. 8. Percentage composition of Quarter 1 landings of UK otter trawlers, beam trawlers and fixed netters in VIIf&g, 2000 – 2007.

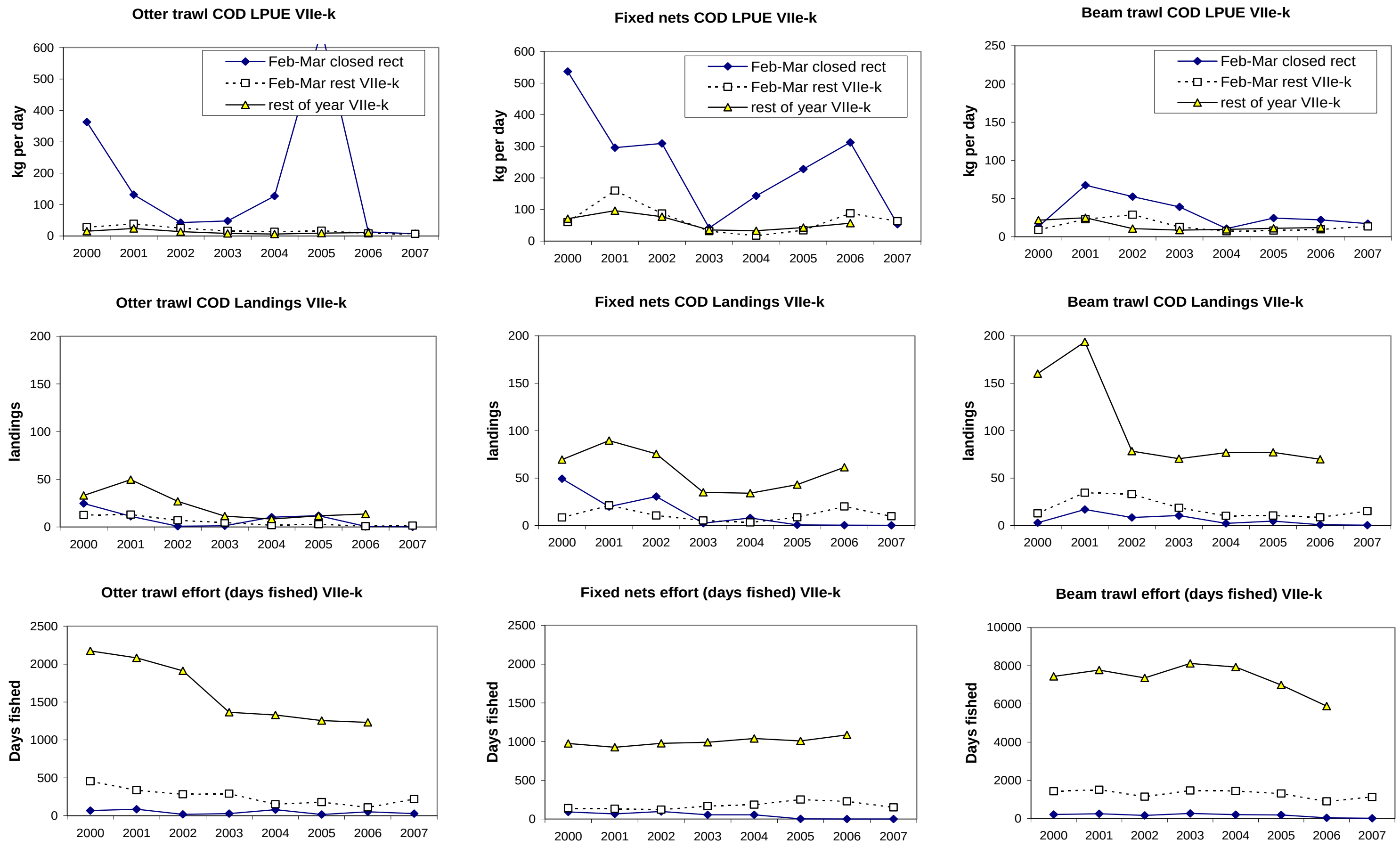


Fig. 9. Trends in cod landings per unit effort, total landings and total effort, for the subset of UK vessels that fished at least once in rectangles 30E4, 31E4 and 32E3 during 2000–04 and 2005-07. Data are for the closed rectangles in Feb-March up to 2004; for the other rectangles in **VIIe-k** in Feb-March each year, and for the whole of **VIIe-k** for the remainder of the year. The large otter trawl LPUE in the closure in 2005 was mainly due to a few vessels that continued to fish there.

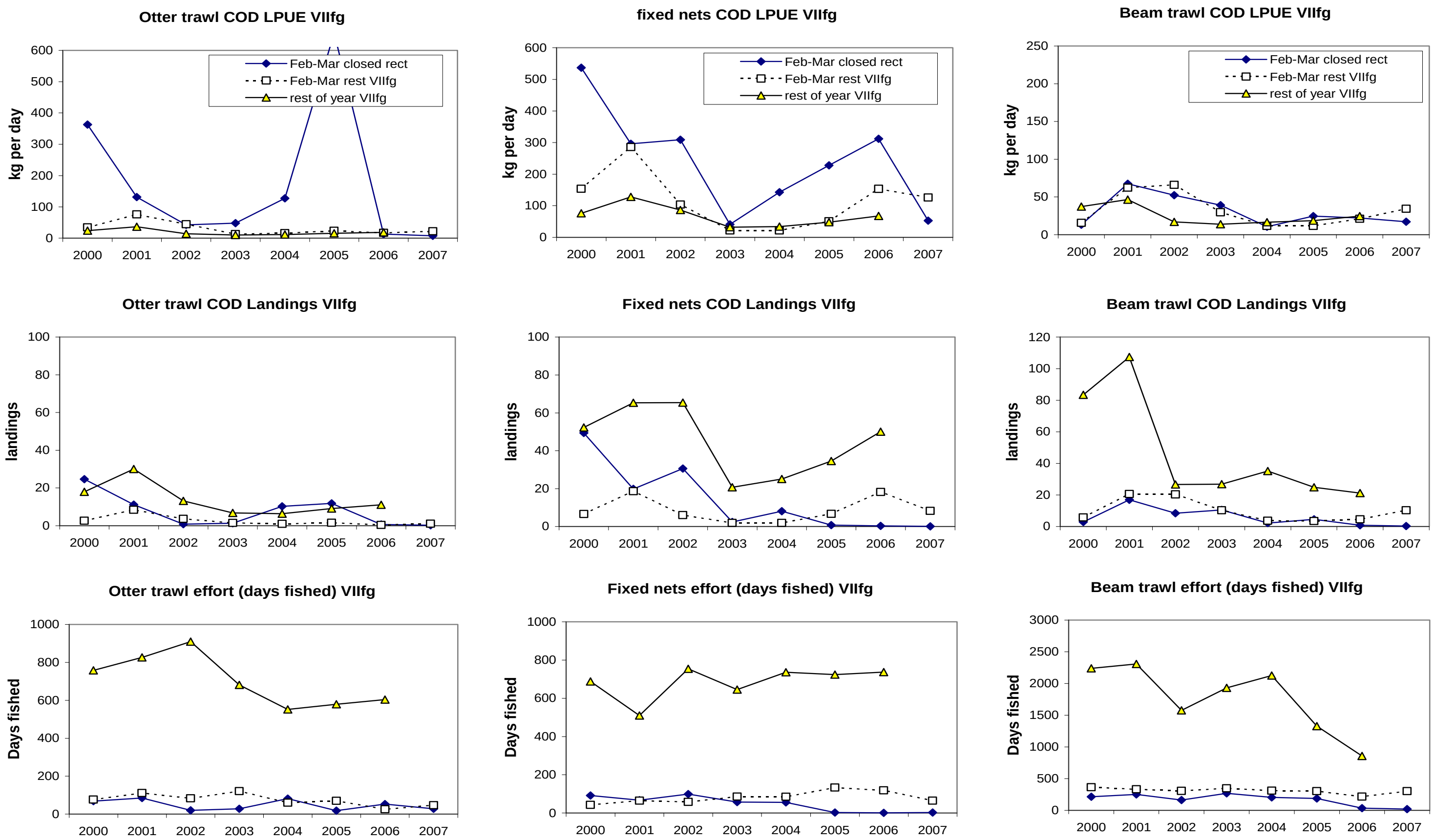


Fig. 10. Trends in cod landings per unit effort, total landings and total effort, for the subset of UK vessels that fished at least once in rectangles 30E4, 31E4 and 32E3 during 2000–04 and 2005-07. Data are for the closed rectangles in Feb-March up to 2004; for the other rectangles in **VIIf&g** in Feb-March each year, and for the whole of **VIIf&g** for the remainder of the year.

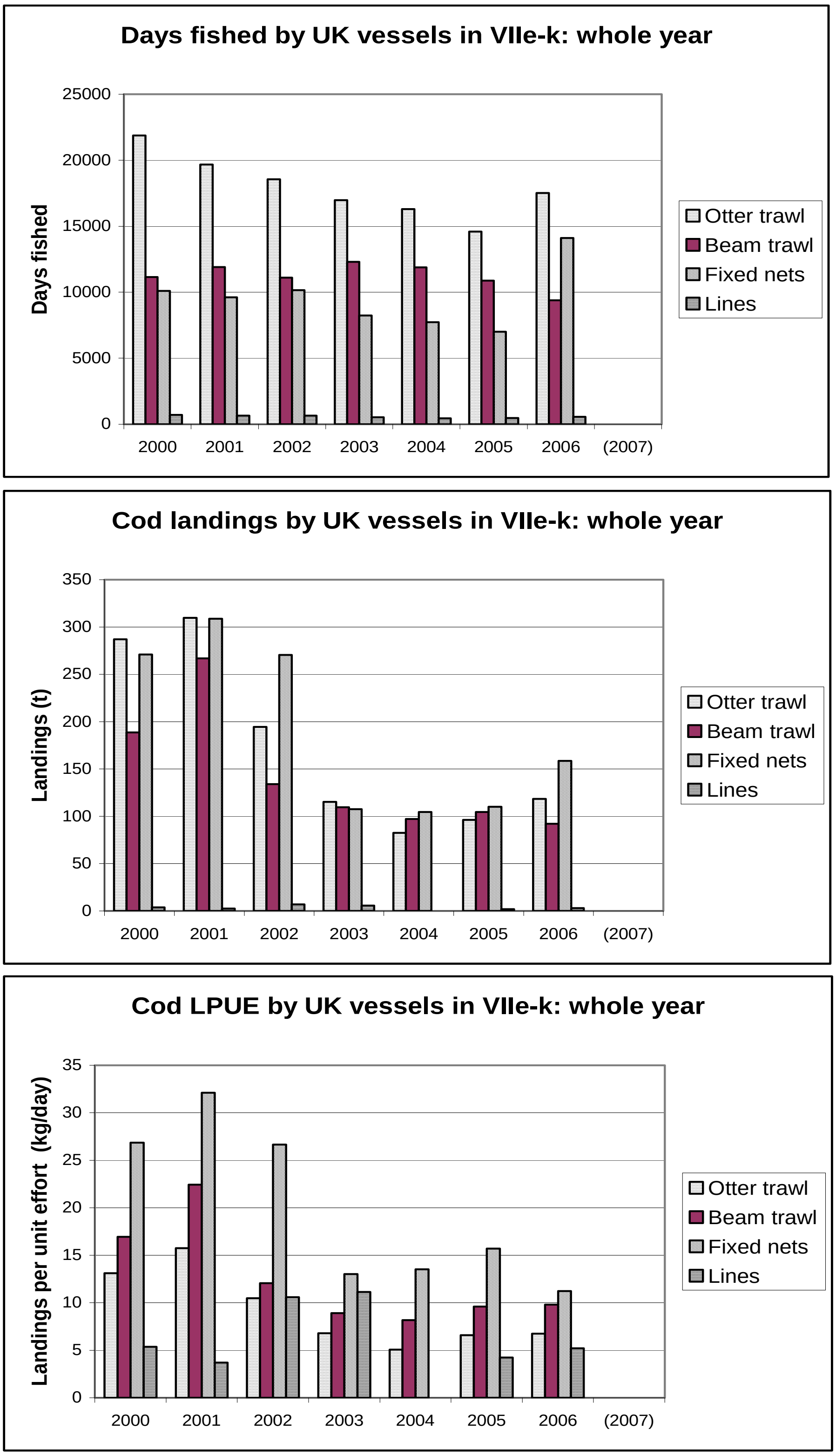


Fig. 11. Trends in annual effort, cod landings and LPUE of cod for UK vessels fishing in VIIe-k.

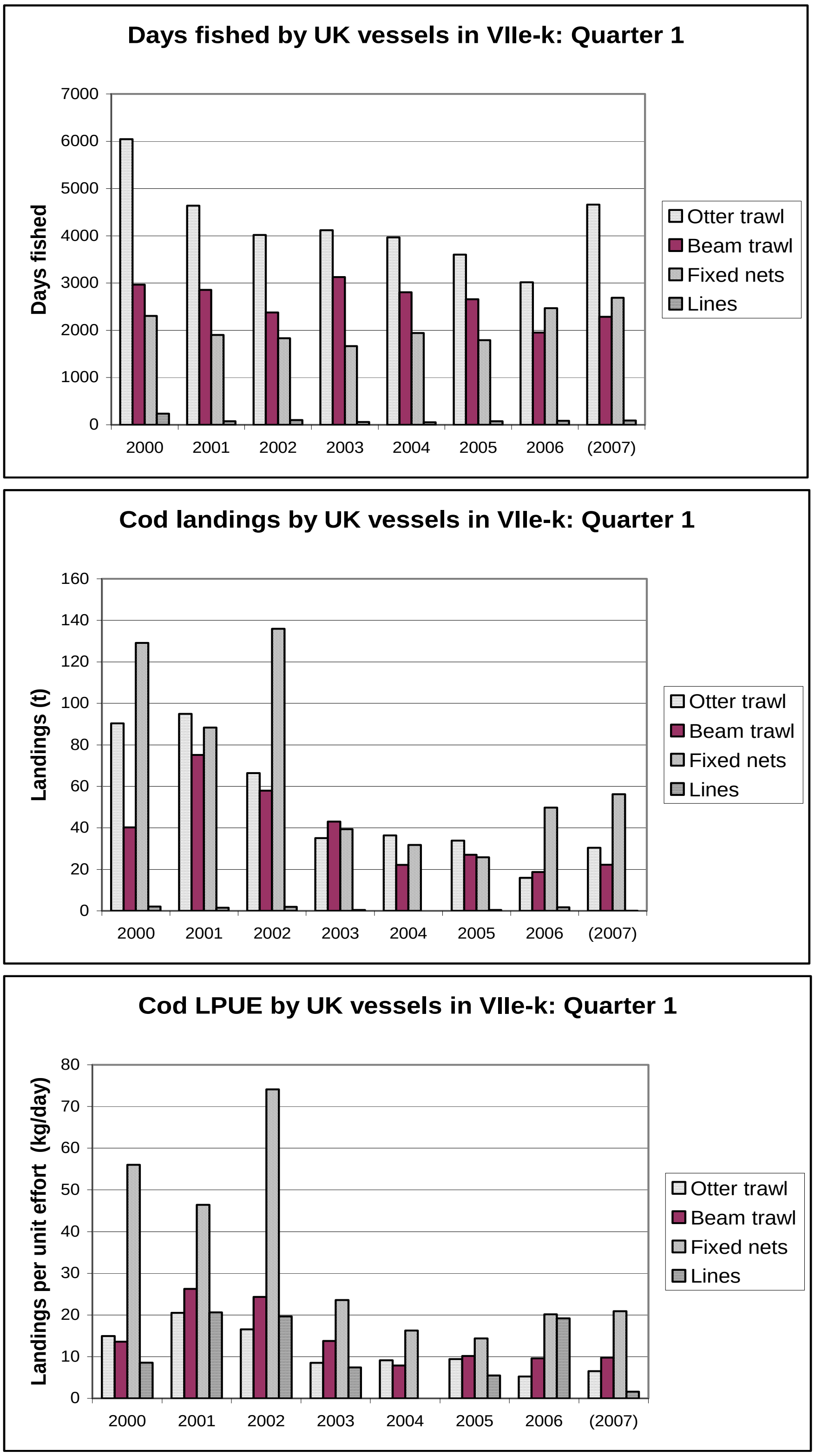


Fig. 12. Trends in Quarter 1 effort, cod landings and LPUE of cod for UK vessels fishing in VIIe-k.

Annex 1: Description of the UK coastal fishery in VIIe-k

The following brief description of the UK demersal fisheries in VIIe-k is extracted from Walmsley and Pawson (2007):

South Wales coast

Flatfish and rays (principally thornback) are taken in fixed nets (e.g. tangle, trammel and stake nets) and otter and beam trawls from spring through to the end of the year. Boats using gill nets and otter trawls take cod and whiting during the colder months. Large-meshed tangle nets are used for rays and large flatfish such as turbot. The ray fishery has expanded since the mid 1980s and is mostly prosecuted by three larger trawlers that work between 3-6 miles from shore. The trawler fleet concentrates its efforts in the Bristol Channel and Cardigan Bay and lands a mixed catch throughout the year. These trawlers (mostly <10 m) fish mostly inshore, and competition outside 6 miles from the coast can be intense, especially during the autumn when the sole fishery attracts visiting beam trawlers from the south coast of Devon and Cornwall and Belgium. The majority of trawling effort is by Devon and Cornwall vessels operating twin rig gear. There is also significant Belgian activity outside the 6 mile line as some Belgian beam trawlers have changed to towing otter trawls (one from each beam), thereby circumventing the requirement to be outside the 12 mile limit when beam trawling.

Cornwall: Rame Head To Bude

Beam trawlers working offshore for monkfish, megrim, lemon sole and sole take the largest part of the whitefish landings. Beam trawling became popular during the early-1980s and was responsible for the increase in landings of flatfish during this period. Otter trawlers exploit more seasonal fisheries, with cod and whiting landed in autumn and winter and flatfish and rays landed all year round. Non-quota species such as squid and lemon sole are very important at certain times of the year. Gill nets, with a mesh size of 120-160 mm are set over rough ground and wrecks for cod, pollack, ling and rays. Small-meshed (<120 mm) tangle nets are set for sole and plaice on smooth grounds, whereas larger ones (>200 mm) are set for rays, turbot, monkfish and brill. Trammel nets are rarely used. Boats of 6-8 m can set over 16 000 m of net, although the average is probably in the region of 3 000 m.

Devon: North and south coasts

Inshore otter and beam trawlers land a wide variety of demersal fish throughout the year, with sole, plaice, rays, turbot and monkfish more commonly landed from September to March. Red mullet and black bream have attracted more interest since the late 1980s, following increasing quota restrictions on other more traditional species. The cuttlefish fishery has become important to the South West industry during the late autumn and early winter. Beam trawlers operating inshore sometimes switch between white fish and dredging for scallops. Some otter trawlers switch between demersal and pelagic fish during the course of the year depending on markets and seasonal abundance. A few boats in this region operate in pairs. Gill and tangle nets are set for sole, plaice, rays, turbot, brill, pollack, cod and spurdogs, though cod nets are more prevalent on the north coast. Nets set around wrecks yield pollack, ling, cod and monkfish. Fixed nets may be set inside the 6 mile zone only where authorised by the Devon SFC byelaws so they do not impede the passage of salmon or sea trout.

Annex 2: Effect on fishing activity of the 2007 Celtic Sea (30E4, 31E4 and 32E3) closure: Feedback received from Cornwall Sea Fisheries Committee (SFC), Plymouth, Brixham, Penryn, Newlyn, Milford Haven and Fleetwood Marine and Fisheries Agency (MFA) offices and Cefas Newlyn.

Contributors:

P Edwards - MFA Plymouth	N Wright - MFA Brixham
D Poulding - MFA Penryn	C Gough - MFA Newlyn
M Slater - MFA Fleetwood	S Cadman - Cornwall SFC
T Allen - MFA Milford Haven	R Forster - Cefas Newlyn

Tom Woods, Cefas,
20/06/07

For the duration of the closure beam trawl activity was reported to be high on all borders of the closed area, particularly the inshore areas and the border with 31E3. Landings into Milford Haven by Belgium vessels dropped significantly with vessels reportedly either tying up or choosing to fish elsewhere (Irish Sea, southern North Sea or Bay of Biscay).

Brixham and Plymouth MFA reported that some beam trawl vessels that would normally have fished in the area affected by the closure fished instead in VIIe. One contributor reported that some Brixham vessels may have been tempted to stay away when the area reopened due to a combination of high megrim prices and the risk of suffering gear damage when fishing the rough ground in the Trevose area.

On opening, fishing effort within the area was intense (a significant number of Belgium beam trawl vessels in addition to UK vessels) with good catches of sole being made. Reports indicate that catch rates of sole were initially high (approximately 20-30 boxes of retained per day) during the first week of the area being open. However, by the end of the week catch rates dropped significantly (approximately 2-4 boxes of retained sole per day) and within two weeks of the area reopening sole had all but dispersed. Most of the Brixham and Plymouth beam trawl fleet were present in the area during the first week of opening. The majority of vessels completed 1-3 trips in the area before turning their attention elsewhere (VIIe).

One MFA contributor reported that following reopening of the area landings of beam caught cod were not significantly greater than would normally be expected for this gear type.

The 2007 closure was considered to be generally well received by the Industry, although feedback has been mixed with some skippers complaining that the concentration of vessels around the borders of the area resulted in areas of ground being overworked. Some inshore vessels from Padstow complained that the closure removed their main fishing grounds with the next suitable ground requiring a long steam. In addition there was some gear conflict within the 6-mile limit off the north Cornish coast, where some Cornish beam trawl vessels with historic rights towed over static gear. No problems were reported offshore, although this may have been due to netters avoiding deploying gear in areas where there was high probability of it being towed away.

In addition to fishing effort being restricted by the closure landings by <10m vessels were limited by sole and plaice quota restrictions.

Summary:

- Intense fishing activity in area on reopening on 1st April.
- Borders of area fished intensively for the duration of the closure.

- No significant increase in landings of cod by beam trawl vessels fishing in the area on reopening.
- Some Brixham and Plymouth vessels displaced to VIIe.
- Belgium beam trawl vessels displaced elsewhere (Irish Sea, North Sea and Bay of Biscay) for the duration of the closure.

Annex 3 Effect on fishing activity of the 2006 Celtic Sea (30E4, 31E4 and 32E3) closure: Feedback received from Cornish Fish Producers Organisation (CFPO), Cornwall Sea Fisheries Committee (SFC), Plymouth, Brixham, Penryn, Newlyn, Milford Haven and Fleetwood Marine Fisheries Agency (MFA) offices.

Contributors:
P Edwards - MFA Plymouth
D Poulding - MFA Penryn
B Johns - MFA Milford Haven
A Wheeler - Cornish FPO
N Wright - MFA Brixham
C Billson - MFA Newlyn
M Slater - MFA Fleetwood
S Cadman - Cornwall SFC
Tom Woods, Cefas,
14/06/06

Anecdotal evidence suggests that some vessels operating from north Cornwall and Devon experienced some inconvenience as a result of the closed area. Although the area within the 6-mile limit remained open some Padstow and Newquay vessels were displaced to fishing grounds further south, with some vessels reportedly relocating to Newlyn and/or Plymouth rather than steam long distances, with high fuel prices being an issue.

Cornwall SFC reported that instead of netting for cod, etc. some multi-geared vessels tried trawling both inside and outside the district but struggled to profit. SFC also reported that the level of beam trawl activity by small or historically entitled vessels to fish within the 6 mile limit was not significantly different to what would have been expected had the area remained open. Large beam trawl vessels excluded from the closed area were reportedly operating close to the 6 mile limit and left little ground for static gear. Skippers from Padstow and Newquay were most affected.

A number of MFA contributors reported an increase in fishing activity within the rectangles when they reopened. Satellite tracking showed vessels were fishing right up to the limits of the closed area for the duration of the closure. Two MFA contributors reported that on the area reopening, landings of cod from the area were insignificant. This was reportedly due to either there being no cod in the area in the first place or any cod that were there had moved out of the area before it reopened.

Plymouth MFA reported that vessels continued to fish in other parts of VIIf&g, with some vessels choosing to fish in VIId. However, the contributor considered that fishing within VIId was possibly due to factors unrelated to the closure.

Brixham MFA reported that a number of beam trawl vessels that would conventionally target the VIIf&g sole fishery fished in VIIe instead, targeting the cuttlefish fishery due to good prices.

Milford and Fleetwood MFA contributors reported that Belgium beam trawl activity in VIIf&g and VIIa was much reduced compared to previous years with vessels fishing instead in the eastern Channel and southern North Sea.
With regards to Welsh inshore vessels there have been no reported effects. This may be due to the majority of vessels targeting the scallop fishery.

As reported following the 2005 closure, some feedback suggests that North Devon fishermen were by and large in favour of the closed area. In addition, it was felt that the 2006 closure was better received by the Industry than the previous years closure, partly due to <10m vessels being better catered for and also because the closure was administered more effectively. The area was, however, considered (by the Industry) too large. In addition, feedback received from the CFPO suggests that the Industry favours an exemption for <10m vessels allowing them to fish in the closed area.

Summary:

- Intense fishing activity in area on reopening on 1st April.
- Displacement of some North Cornwall and Devon inshore vessels.
- Fewer visiting beam trawlers observed in VIIf&g.
- Increased fishing activity in VIIe, eastern Channel and southern North Sea.
- 2006 closure better received by Industry than 2005 closure.

Annex 4a: Effect on fishing activity of the 2005 Celtic Sea (30E4, 31E4 and 32E3) closure: Feedback received from Plymouth, Newlyn, Milford Haven and Fleetwood Sea Fisheries Inspectorate (SFI) offices, and Cefas Catch Sampling Officers at Newlyn.

Contributors:
P Whitby - SFI Plymouth
D Munday - SFI Newlyn
B Johns - SFI Milford Haven
M Slater - SFI Fleetwood
J Ashworth - Cefas Newlyn
Andrew Wheeler - Cornish FPO
Tom Woods, Cefas,
10/10/05

Anecdotal evidence suggests that under-10m vessels operating from North Cornwall and Devon experienced some inconvenience as a result of the closed area encompassing inshore waters within 30E4. For the duration of the closure many of these vessels fished in 29E4 and 30E5.

Newlyn SFI reported that fewer visiting beamers were observed off Trevose, and cod and sole landings to Padstow were down on the same period in 2004.

Belgium beam trawlers may have changed gear type, from beam to trawl, in order to fish within the 6 and 12 mile limits. However, this is unverified and if true may be due to increasing fuel costs rather than closed areas.

Some feedback suggests that North Devon fishermen were by and large in favour of the closed area. However, the area was considered too large and it was suggested that closing subsquares of the rectangles would be equally effective.

The lack of Belgium vessels landing into Milford Haven in January and February was noticeable. It was thought some vessels did not steam round from the north Sea as was customary at that time of year and the rest fished in VIIa.

All contributors made reference to Defra providing insufficient advice and guidance regarding details of the closure. This contributed to the closure being ineffective in January with some under 10m vessel operators believing there was a derogation for their vessels. There was also confusion regarding whether the closure extended into 6 and 12 mile limits. In the resulting confusion some vessels continued to fish in the area.

Comprehensive advice and guidelines became available and the closure was effective in February.

On the 1st March the area was opened to beam trawlers. SFI reported that within hours of opening the area, satellite monitoring showed intense fishing activity by beam trawlers and the area was reported as ‘taking a hammering’.

Summary:

- The closure was effective for February only.
- Intense fishing activity in area on reopening to beam trawlers on 1st March.
- Failure to deliver adequate information and guidance resulted in confusion and continued fishing activity.
- Displacement of some North Cornwall and Devon inshore vessels.
- Fewer visiting beam trawlers observed in VIIf&g.
- Reduction in cod and sole landings to Padstow.

Annex 4b: Cornish Fish Producers, Organisation report on the perceived effects on British fishing vessels of the closure of statistical rectangles 30E4, 31E4 and 32E3 during February and March 2005.

Andrew Wheeler. Cornish Fish Producers Organisation LTD.

07/10/05

The following opinion of the effects of these closures has stemmed from communications with fishermen from Cornwall, Devon and Wales who traditionally fish in these areas.

Statistical rectangle 32E3. The closure of this rectangle had little if any perceived adverse effect on British fishing vessels. Cornish netting boats have fished in this rectangle in the past during these months, but the continued decrease in area VII B-K cod quota has meant that they now do not have enough quota to enable them to prosecute a targeted cod fishery despite the known accumulations of cod in the rectangle in the winter months.

Statistical rectangle 31E4. The closure of this rectangle affected the fishing activities of a number of UK trawlers and beam trawlers based in Bideford, Ilfracombe and Milford Haven. The north eastern corner of this rectangle, closer to the Welsh coast, is an area that is traditionally fished all year round by vessels from these ports. The effect of the closure was to deflect fishing effort further eastwards into the Bristol Channel. Several fishermen aired their concerns over the negative impact the closure would have on their incomes at a time when the prevailing weather conditions prevent them from fishing further west. They felt hemmed-in by the closure which in effect completely closed off the Bristol Channel west of 5 degrees west

Statistical rectangle 30E4. The closure of this rectangle affected the fishing activities of a number of gill netters based in Padstow, and to a lesser extent beam trawlers based in Newlyn and trawlers from Bideford and Padstow. However, whilst the closure affected netters and trawlers for both February & March, beam trawlers were only excluded for February because of the derogation allowing them to fish in the area during March.

Netting activity. The lack of cod quota again denies over 10m netters the option to prosecute a targeted cod fishery in this rectangle. Several netters that may otherwise have targeted pollack and ling on wrecks in this rectangle during February and March, were either displaced further west to fish wrecks, or move from wreck netting to hake netting. The relatively small numbers of vessels involved meant that the impact of displaced fishing effort on the activities of other vessels was probably minimal.

Beam trawling activity. Several beam trawlers based in Newlyn that traditionally fish in this rectangle were displaced further west, with most effort being expended around the western and southern edges of the rectangle. The impact this displacement had on other fishing activities is difficult to measure, but it would inevitably have led to a certain amount of increased concentration of fishing activity outside the closed area, and a subsequent possible negative interaction with static gear fishermen. The same can be said of displaced French trawling activity.

Trawling activity. Trawlers based in Bideford and Ilfracombe were again forced to fish east of 5 degrees west by the closure, but were less adversely affected by the closure of this rectangle than the closure of 31E4. A handful of under 10m vessels from Padstow were displaced from traditional grounds at a time when the prevailing weather conditions and small vessel size prevented them from fishing further afield. The owners of these vessels were particularly vocal in their arguments that under 10m vessels should not be subject to these restrictions.

Affect of closures on landings. Without entering into a detailed investigation of past and present landing statistics, or speaking directly to fishermen, it is difficult to estimate what impact the closures had on the landings of fish.

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APPENDIX 3

Working Document to WGSSDS 2007

Date	25 June 2007
Subject	**Impact of the temporal closure of ICES rectangles 30E4, 31E4 and 32E3 (Celtic Sea) on the Belgian fishery behaviour**
Author	Wim Demaré

Introduction

In 2004 French, Irish and UK fisheries organisations sat together to work out a plan for the reduction of fishing mortality on Celtic Sea cod. There initial aim was to reduce fishing mortality on cod by 20% by means of temporal closures. After a round of consultations with scientists the industry proposed to close three rectangles in the Celtic Sea during the first quarter of 2005. On average these rectangles accounted for 13% of the Celtic Sea cod landings. Scientists stressed however that the direct impact of this measure on the status of cod would be almost impossible to measure (see for example the working documents of WGSSDS in 2006 and 2007 from Biseau and Bellail).

The European authorities welcomed the initiative from the industry and have introduced temporal closures in the Celtic Sea since. During the first quarter of 2005 three rectangles in the Celtic Sea (30E4, 31E4 and 32E3) were closed for fishing except for vessels using pots and creels, or nets with mesh size less than 55mm. During March 2005, derogation was also given to beam trawlers. During February and March 2006, the same three rectangles in the Celtic Sea were closed for fishing except for vessels using pots and creels, or nets with mesh size less than 55mm.

Traditionally ICES rectangles 30E4 and 31E4 have been major flatfish fishing grounds for the Belgian beam trawlers, especially during the first quarter. Since the closure, the Belgian fishery behaviour changed in the Celtic Sea.

Yearly trend of effort for the Belgian beam trawlers operating in the Celtic Sea

In 2004 and 2005, the number of beam trawlers operating in the Celtic Sea increased considerable compared to the period before (Figure 1). This was mainly due to effort limitations in areas other than the Celtic Sea. Due to effort limitations in the Eastern

English Channel in 2004 and 2005 (in addition to effort limitations that were already in place in the North Sea and the Irish Sea), Belgian vessels searched for alternative fishing grounds. Given that the Celtic Sea is one of the few flatfish fishing grounds without stringent effort limitations, vessels moved their effort to the Celtic Sea. Since 2006, effort limitations in the Eastern English Channel were alleviated for beam trawlers so that vessels that were fishing traditionally on these fishing grounds moved their effort back from the Celtic Sea into the Eastern English Channel.

Total fishing hours peaked in 2004 (Figure 1), when effort limitations were imposed on beam trawlers operating in the Eastern English Channel. In 2005, the total fishing hours declined again, although the number of vessels operating in the Celtic Sea increased compared to 2004. This can be explained by the closure introduced in 2005. Since the closure the average number of hours fished per vessel has decreased (Figure 2).

Note that 9 vessels were decommissioned between August 2005 and November 2006. Over the period 2000-04, these vessels accounted on average for 17.6% of the total kWdays in the Celtic Sea.

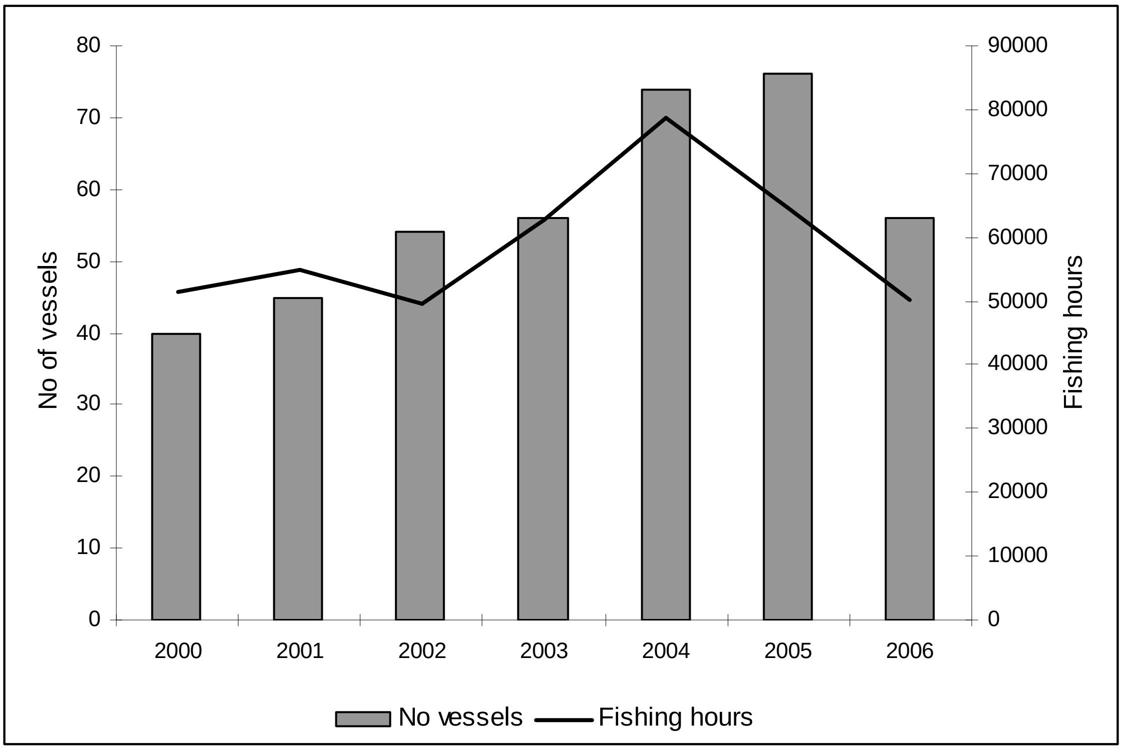

Figure 1 – Number of Belgian beam trawlers operating in the Celtic Sea and the total number of hours fished.

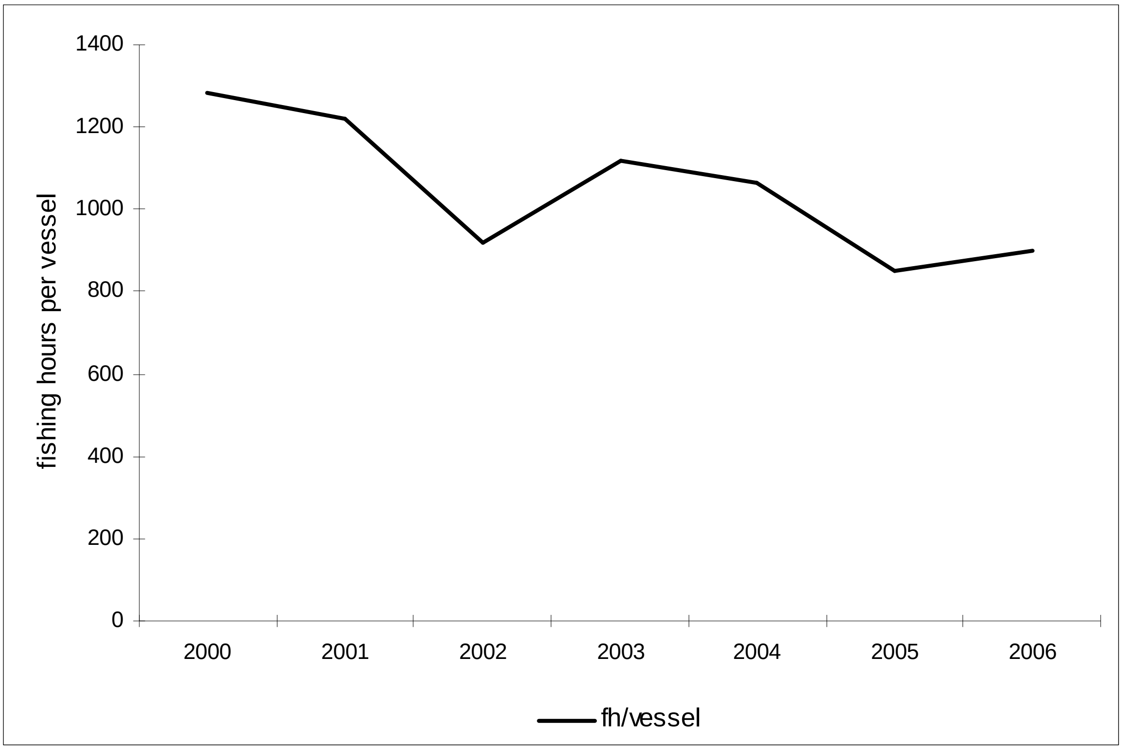

Figure 2 – Average hours fished per vessel.

Monthly trends in fishing hours and catches

Before the introduction of the closure in 2005, fishing activity of flatfish directed beam trawlers peaked during the first quarter (Figure 3, rectangles). Since then fishing activity shifted mainly to periods just after the closure (i.e. mostly March and April in 2005, Figure 3, triangles; and mostly April in 2006, Figure 3, circles). ICES rectangles 30E4 and 31E4 are the main fishing grounds for Belgian beam trawlers (Figure 3, open symbols).

The LPUE of cod (kg cod landed by fishing hour) by month for the period before the closure, for 2005 and for 2006 is presented in Figure 4. February and March give the highest landing rates of cod. In this aspect these months are best suited for closure.

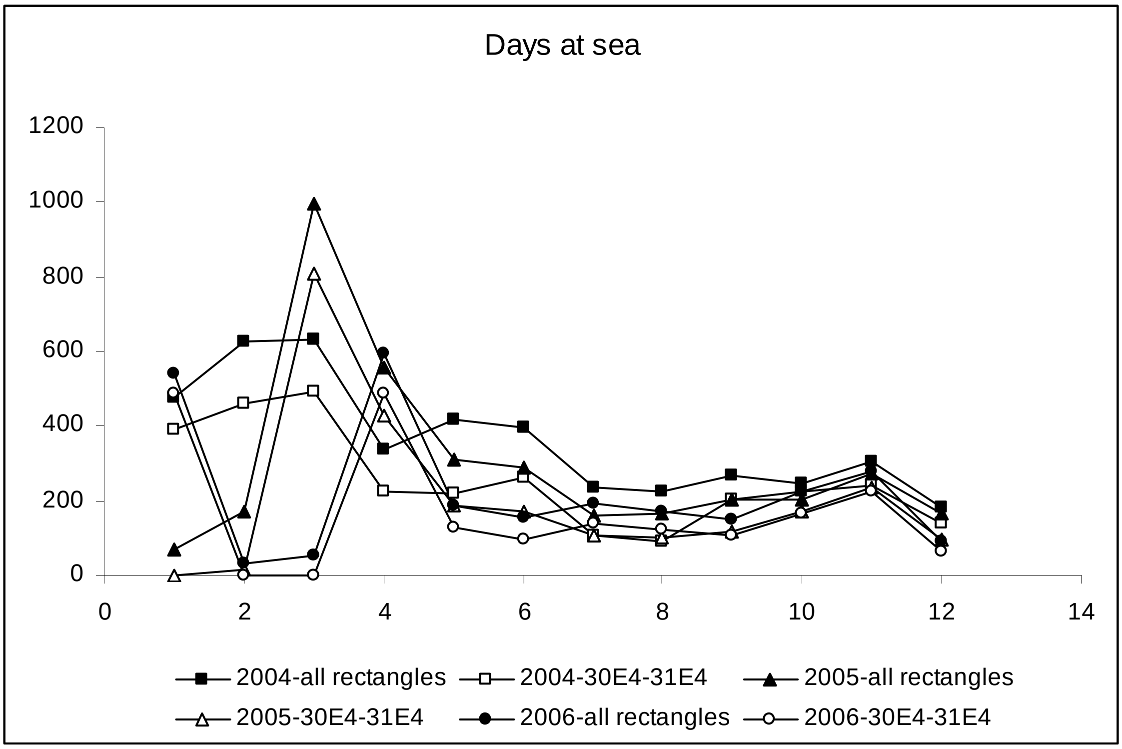

Figure 3– Monthly effort (days at sea) of the Belgian beam trawl fleet operating in the Celtic Sea (ICES Divisions VIIf and g) for the period 2004-2006. The open symbols are the landings from ICES rectangles 30E4 and 31E4, closed symbols are for the total area. Rectangles 30E4 and 31E4 account for the major part of the effort in the area (compare closed with open symbols). Rectangles 30E4 and 31E4 were closed for the beam trawl fishery in January-February 2005 and in February-March 2006.

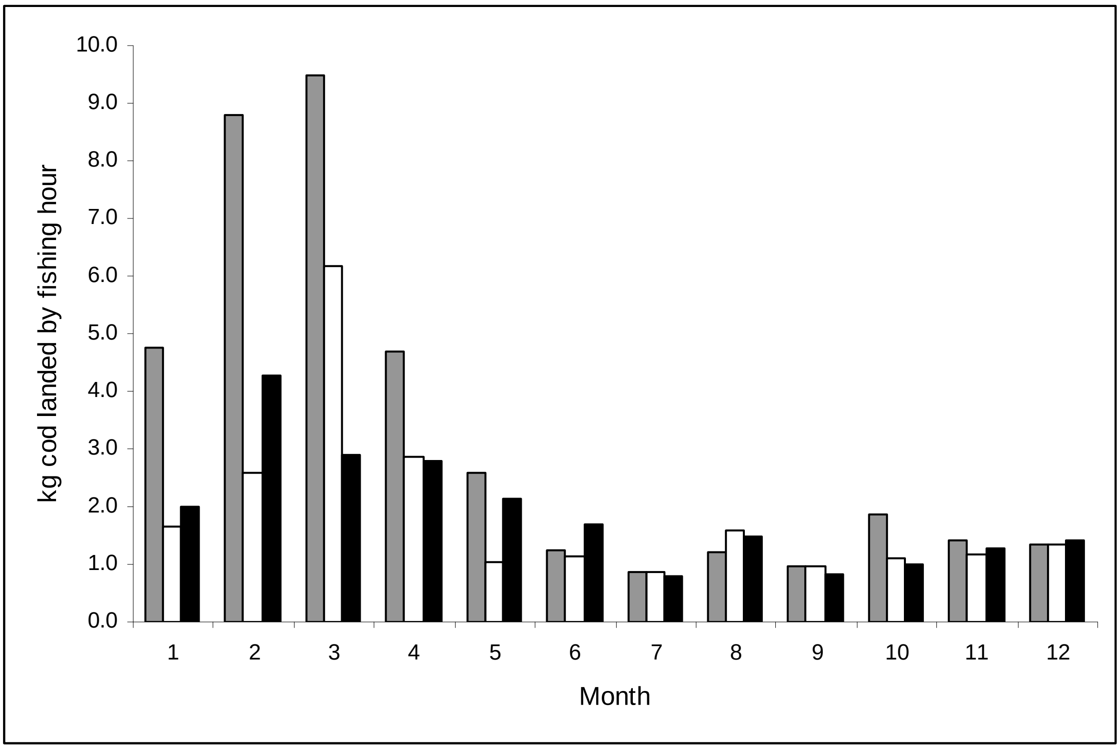

Figure 4 – Monthly LPUE of Celtic Sea cod for Belgian beam trawlers (grey bars: average of 2001-2004; white bars: 2005; and black bars: 2006).

Conclusion

Due to effort limitations in the Eastern English Channel in 2004 and 2005, the number of Belgian vessels operating in the Celtic Sea increased during these two years.

The average number of hours fished per vessel decreased since the introduction of the temporal box closure in 2005. Belgian effort was also displaced mainly to periods just after the closure.

9 Belgian vessels (accounting for approximately 17.6% of the total kWdays in the Celtic Sea) were decommissioned between August 2005 and November 2006.

APPENDIX 4

A summary of the impact of the closed areas in the Celtic Sea on Irish landings and effort.

The analysis presented is based on logbook operations and is preliminary in nature. Table 1 summarise the annual effort and landings for cod VIIe-k. The analysis includes landings and effort for some rectangles in the southern part of VIIa (i.e. rectangles 33E1-4) which is considered part of the Celtic Sea stock and where there is possibly area mis-reporting of landings and effort. The results suggest that the closed rectangles have had little impact on the annual proportions of cod landings from and mobile gear effort in the rectangles.

Table 2 gives the monthly Irish landings for cod VIIe-k (+VIIa i.e. rectangles 33E1-4) by all gears broken down into inside and outside the closed rectangles. These indicate that the close area and period accounted for up to around 20% of the total landings by month in the past in more recent years the relative contribution has been much less. The proportion of total monthly cod landings during the closure was generally low (<7%). Table 3 gives the monthly Irish effort in VIIe-k (+VIIa i.e. rectangles 33E1-4) by all gears broken down into inside and outside the closed rectangles. This shows something similar to the landings indicating that there is some effort reported during the closed period although effort amounts are low relative to other areas.

Figure 1 gives the historical trend in effort from the 3 closed rectangles by fleet segment. This indicates that the closed areas in 2005 and 2007 may have had some impact on the activities of the Irish fleet. Effort in 2005 and 2007was around 50% of that exerted in the same rectangles in previous years although the closure had apparently little impact on effort in 2006.

The main conclusion is that the closed rectangles have had limited impact on Irish fishing activity since 2005 and despite the closures effort and landings are still being reported from closed rectangles. It is not clear whether this is a misspecification in the logbooks or not. It is also evident that the relative importance of these rectangles to overall Irish landings has never been particularly high.

Table 1: Landings and effort for cod VIIe-k(+VIIa i.e. rectangles 33E1-4) broken down into inside and outside the closed rectangles.

	Landings in Tonnes VIIe-k + VIIaS rectangles				Mobile Gear Effort in hours VIIe-k + VIIaS rectangles			
year	Closed Rect.	Other Rect.	Total (t)	% of Annual landings	Closed Rect.	Other Rect.	Total ('000 hrs)	% of total effort
1995	125	1,024	1,149	11%	13.8	129.0	142.8	10%
1996	163	1,714	1,877	9%	10.5	179.5	189.9	6%
1997	75	1,275	1,349	6%	12.9	198.8	211.7	6%
1998	112	1,405	1,517	7%	12.5	222.9	235.4	5%
1999	152	963	1,115	14%	9.6	152.2	161.8	6%
2000	109	830	939	12%	11.0	179.4	190.5	6%
2001	93	819	912	10%	14.8	195.9	210.7	7%
2002	38	915	953	4%	11.8	234.9	246.7	5%
2003	36	520	556	6%	16.0	279.2	295.2	5%
2004	41	538	579	7%	15.9	269.9	285.8	6%
2005	59	1,273	1,331	4%	18.9	271.5	290.4	7%
2006	60	861	921	7%	18.3	249.3	267.5	7%
2007	16	693	709	2%	1.4	59.6	60.9	2%

Table 2: Monthly landings for cod VIIe-k(+VIIa i.e. rectangles 33E1-4) broken down into inside and outside the closed rectangles.

Rectangle	Year	1	2	3	4	5	6	7	8	9	10	11	12	Total
Closed	1995	2	15	56	27	8	8	2	1	1	2	1	1	125
	1996	4	22	102	18	7	3	1	0	0	1	2	2	163
	1997	13	3	23	8	5	2	3	3	2	5	4	3	75
	1998	3	30	45	6	4	4	5	4	3	5	2	1	112
	1999	8	39	63	4	8	9	6	4	3	4	5	1	152
	2000	5	27	50	7	5	5	5	2	2	1	1	0	109
	2001	3	13	46	10	5	7	3	1	3	1	0	0	93
	2002	1	3	13	8	2	1	1	2	3	3	1	0	38
	2003	1	5	10	4	3	3	2	2	2	1	2	2	36
	2004	1	5	9	9	2	3	5	2	1	1	2	1	41
	2005	0	5	2	19	5	5	5	5	4	3	3	2	59
	2006	5	7	7	15	3	5	6	2	4	4	1	0	60
	2007	7	4	4										16
Open	1995	80	126	220	172	98	72	62	51	44	33	34	32	1024
	1996	49	293	508	204	146	140	169	61	57	21	38	28	1714
	1997	89	32	176	199	188	127	148	77	82	64	65	28	1275
	1998	45	150	275	147	189	135	137	93	75	54	67	38	1405
	1999	70	225	279	43	73	57	38	33	33	45	45	22	963
	2000	47	123	157	65	74	71	62	59	48	40	61	24	830
	2001	67	144	169	92	93	78	58	36	32	29	16	4	819
	2002	19	89	303	155	72	76	61	41	33	30	25	11	915
	2003	23	94	108	74	44	33	29	25	25	23	13	30	520
	2004	29	68	74	60	44	36	44	40	33	35	48	28	538
	2005	21	475	310	54	59	88	50	41	39	43	44	50	1273
	2006	97	122	174	96	75	103	51	46	31	38	24	3	861
	2007	99	262	332										693

Percetntage of total montly landings from closed rectangles			
2005	1%	1%	1%
2006	5%	6%	4%
2007	7%	2%	1%

Table 3: Monthly effort for all Irish mobile gears in VIIe-k(+VIIa i.e. rectangles 33E1-4) broken down into inside and outside the closed rectangles.

Rectangle.	Year	1	2	3	4	5	6	7	8	9	10	11	12	Grand Tota
Closed	1995	649	1,319	2,648	2,525	1,957	1,768	427	438	368	692	648	358	13,797
	1996	809	990	2,573	1,283	604	725	286	272	372	699	1,194	656	10,463
	1997	2,192	261	1,653	1,080	1,526	875	700	497	715	1,426	1,360	643	12,927
	1998	568	1,399	1,296	1,003	1,234	1,219	1,092	1,177	1,200	1,217	590	473	12,466
	1999	750	794	1,181	421	443	722	924	891	1,113	730	1,376	275	9,619
	2000	582	1,503	1,269	1,337	1,747	1,117	1,351	768	586	401	279	87	11,026
	2001	654	1,461	2,062	1,480	1,502	1,207	878	770	1,510	841	1,221	1,188	14,770
	2002	599	822	1,958	1,728	862	484	258	725	1,551	1,579	790	470	11,823
	2003	682	1,320	2,032	1,486	1,707	1,868	1,830	1,209	984	1,357	768	725	15,967
	2004	609	1,413	2,201	2,002	1,674	1,863	1,660	1,123	635	1,208	977	534	15,899
	2005	209	582	1,259	4,268	2,843	2,091	1,796	1,141	1,146	1,038	1,417	1,099	18,888
	2006	1,453	1,396	956	3,756	1,395	1,626	1,639	768	1,738	1,590	1,568	368	18,252
	2007	716	333	304										1,353
Other	1995	8,780	8,918	14,453	17,824	14,510	14,403	9,957	8,845	9,948	7,952	8,364	5,048	129,001
	1996	5,691	16,994	20,521	18,745	18,952	23,547	22,638	13,415	12,366	8,978	10,393	7,217	179,458
	1997	14,864	4,233	19,449	24,166	22,954	18,014	23,384	12,770	18,536	15,352	17,067	8,029	198,817
	1998	11,656	17,874	24,678	19,691	30,806	21,353	21,887	17,106	17,428	14,015	16,460	9,977	222,930
	1999	13,474	19,673	16,867	10,157	12,823	14,021	11,657	10,335	9,631	13,882	12,917	6,716	152,151
	2000	9,954	12,352	26,394	19,144	22,842	18,850	17,047	14,203	13,106	7,828	12,786	4,935	179,438
	2001	13,949	23,119	16,970	12,871	23,211	19,260	17,741	14,234	14,528	12,479	18,158	9,409	195,926
	2002	7,951	11,935	23,703	22,727	19,679	24,655	26,452	21,371	27,041	21,202	17,518	10,671	234,904
	2003	14,244	18,237	26,682	28,407	28,240	25,646	27,033	24,612	24,342	26,983	16,629	18,136	279,190
	2004	19,467	23,013	21,401	22,655	27,865	24,624	27,775	19,499	20,542	19,695	29,563	13,838	269,938
	2005	12,932	26,957	24,275	23,377	23,664	33,853	24,774	18,331	19,485	21,248	21,291	21,323	271,508
	2006	17,810	23,801	24,466	24,136	23,273	29,671	22,257	18,217	16,791	22,565	18,533	7,758	249,278
	2007	15,742	18,333	25,515										59,590

Percetntage of total montly effort from closed rectangles			
2005	2%	2%	5%
2006	8%	6%	4%
2007	4%	2%	1%

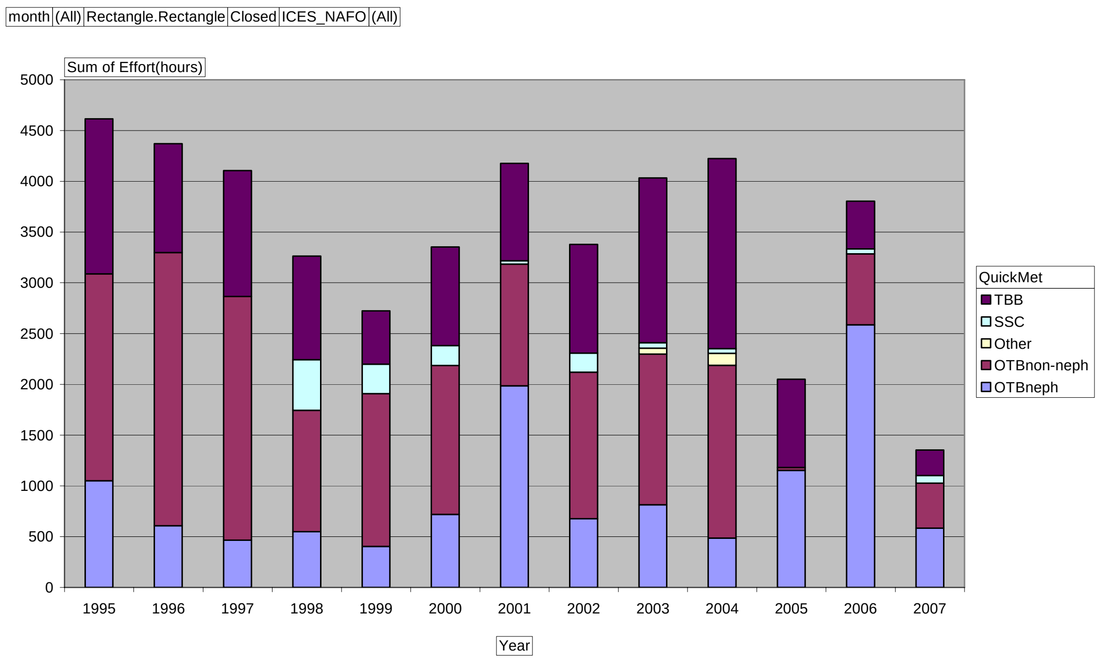

Figure 1: Effort for all Irish mobile gears in Jan, Feb and March in rectangles 32E4, 31E4 and 30E4 from 1995-2007.