ICES WGBIE REPORT 2015

ICES ADVISORY COMMITTEE

ICES CM/ACOM:11

REF. ACOM

Report of the Working Group for the Bay of Biscay and the Iberian waters Ecoregion (WGBIE)

04–10 May 2015

ICES HQ, Copenhagen, Denmark

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

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

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

Recommended format for purposes of citation:

ICES. 2015. Report of the Working Group for the Bay of Biscay and the Iberian waters Ecoregion (WGBIE), 04-10 May 2015, ICES HQ, Copenhagen, Denmark. ICES CM/ACOM:11. 503 pp.

Contents

Executive Summary

The ICES Working Group for the Bay of Biscay and the Iberic waters Ecoregion (WGBIE) met in Copenhagen, Denmark during 4–10 May 2015. There were 22 stocks in its remit distributed from ICES Divisions IIIa to IXa though mostly distributed in Sub Areas VII, VIII and IX. There were 21 participants. The group was tasked with carrying out stock assessments and catch forecasts and providing a first draft of the ICES advice for 2015 for 7 stocks. For the remaining stocks, the group had to update catch information and indices of abundance when needed. Depending on the result of this update, namely if it would change the perception of the stock, the working group had (or not) to draft a new advice.

Analytical assessments using age-structured models were conducted for the northern and southern stocks of megrim and the Bay of Biscay sole, whereas the two hake stocks and one southern stock of anglerfish were assessed using models that allow the use of only length-structured data (no age data). A surplus-production model, without age or length structure, was used to assess the second southern stocks of anglerfish. No analytical assessments have been provided for the northern stocks of anglerfish after 2006. This is mostly due to ageing problems and to an increase in discards in recent years, for which there is no reliable data at the stock level. The state of stocks for which no analytical assessment could be performed was inferred from examination of commercial LPUE or CPUE data and from survey information.

Three *nephrops* stocks from the Bay of Biscay and the Iberian waters are scheduled for benchmark assessments at the end of 2016. The WGBIE meeting spent some time planning this benchmark (see Annex 06) together with longer term benchmarks (2017 and after, see section 1.) for sea bass in the Bay of Biscay and all anglerfish stocks assessed by the WG. For the northern megrim stock, the group recommend to schedule an inter-benchmark meeting before the end of 2015, in order to incorporate missing discard data and develop a prediction framework based on the current assessment model.

A recurrent issue significantly constrained the group's ability to address the terms of reference this year. Despite an ICES datacall with a deadline of 3 weeks before the meeting, data for several stocks were only available at the start of the meeting which lead to increase in workload during the working group, as in that case, the assessments could not be carried out in National Laboratories prior to the meeting as mentioned in the ToRs. **This is an important matter of concerns for the group members**.

Section 1 of the report presents a summary by stock and discusses general issues. Section 2 provides descriptions of the relevant fishing fleets and surveys used in the assessment of the stocks. Sections 3 to 18 contain the single stock assessments.

1 Introduction

1.1 Participants

NAME	COUNTRY
Esther Abad	Spain
Ricardo Alpoim	Portugal
Michel Bertignac	France (Chair)
Maria de Fatima Borges	Portugal
Santiago Cerviño	Spain
Anne Cooper	ICES Secretariat
Mickael Drogou	France
Spyros Fifas	France
Hans Gerritsen	Ireland
Joao Figueiredo Pereira	Portugal
Dorleta Garcia	Spain
Ane Iriondo	Spain
Muriel Lissardy	France
Simon Northridge	United Kingdom
Iñaki Quincoces	Spain
Lisa Readdy	United Kingdom
Camilo Saavedra	Spain
Paz Sampedro	Spain
Cristina Silva	Portugal
Audric Vigier	France
Yolanda Vila	Spain

Contact details for each participant are given in Annex 1.

1.2 Terms of Reference

2014/2/ACOM12. The **Working Working Group for the Bay of Biscay and Iberian waters Ecoregion** (WGBIE), chaired by Michel Bertignac (France), will meet in the ICES Secretariat, 4–10 May 2015 to:

a) Address generic ToRs for Regional and Species Working Groups (see table below)

b) Assess the progress on the benchmark preparation of Nephrops;

The assessments will be carried out on the basis of the stock annex in National Laboratories, prior to the meeting. The data to perform the assessment should be available on the 10 April 2015 according to the Data call 2015, which was send out on 3 February 2015. This will be coordinated as indicated in the table below.

WGBIE will report by 1 June 2015 for the attention of ACOM. The group will report on the ACOM guidelines on reopening procedure of the advice before 14 October and will report on reopened advice before 29 October.

Fish Stock	Stock Name	Stock Coordinator	Assess. Coord. 1	Assess. Coord. 2	Advice
anp-78ab	Anglerfish (L. piscatorius) in Divisions VIIb-k and VIIIa,b	Spain	Spain	UK	Same advice or Update
anb-78ab	Anglerfish (Lophius budegassa) in Divisions VIIb-k and VIIIa,b	UK	UK	Spain	Same advice or Update
anb-8c9a	Anglerfish (Lophius budegassa) in Divisions VIIIc and IXa	Portugal	Portugal	Spain	Update
anp-8c9a	Anglerfish (L. piscatorius) in Divisions VIIIc and IXa	Spain	Spain	Portugal	Update
bss-8ab	Sea bass in Divisions VIIIa,b	France	France	none	No new assessment
bss-8c9a	Sea bass in Divisions VIIIc and IXa	France	France	none	No new assessment
hke-nrtn	Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock);	Spain	Spain	none	Update
hke-soth	Hake in Division VIIIc and IXa (Southern stock);	Spain	Spain	Portugal	Update
mgb-8c9a	Megrim (Lepidorhombus boscii) in Divisions VIIIc and IXa	Spain	Spain	none	Update
mgw-8c9a	Megrim (Lepidorhombus whiffiagonis) in Divisions VIIIc and IXa	Spain	Spain	none	Update
mgw-78	Megrim (L. whiffiagonis) in Subarea VII & Divisions VIIIa,b,d,e	Spain	Spain	none	Same advice or Update
sol-bisc	Sole in Divisions VIIIa,b,d (Bay of Biscay)	France	France	none	Update
ple-89a	Plaice in Subarea VIII and Division IXa	Ireland	Ireland	none	No new assessment
whg-89a	Whiting in Subarea VIII and Division IXa	Ireland	Ireland	none	No new assessment
pol-89a	Pollack in Subarea VIII and Division IXa	France	France	none	No new assessment
sol-8c9a	Sole in Divisions VIIIc and IXa	Portugal	Portugal	none	No new assessment
nep-2324	Nephrops in Divisions VIIIa,b (Bay of Biscay, FU 23, 24)	France	France	none	Biennial 2d year
nep-25	Nephrops in North Galicia (FU 25)	Spain	Spain	none	Biennial 2d year
nep-31	Nephrops in the Cantabrian Sea (FU 31)	Spain	Spain	none	Biennial 2d year
nep-2627	Nephrops in West Galicia and North Portugal (FU 26-27)	Spain	Spain	Portugal	Biennial 2d year
nep-2829	Nephrops in South-West and South Portugal (FU 28-29)	Portugal	Portugal	Spain	Biennial 2d year
nep-30	Nephrops in Gulf of Cadiz (FU 30)	Spain	Spain	Portugal	Biennial 2d year

1.3 Summary by Stock

The stocks assessed within WGBIE are distributed from ICES Division IIIa to IXa (Figure 1.1). Figure 1.2 shows the distribution areas of the *Nephrops* Functional Units (FUs).

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

Both species are caught on the same grounds and by the same fleets and are usually not separated by species in the landings. Anglerfish is an important component of mixed fisheries taking hake, megrim, sole, cod, plaice and *Nephrops*. Spain and France together contribute about 80% of total stock landings. The TAC for both species combined was set at 42 496 t for 2014 and 2015. For 2014, landings were estimated at 36 200 t close to the record level estimated for 2013.

Age determination problems and an increase in discards in recent years have prevented the performance of an analytical assessment since 2007. Since then, the assessment is based on examining commercial LPUEs and survey data (biomass, abundance indices and length distributions from surveys). Four surveys are available, covering the whole distribution area of the stocks and with little overlap between them.

For *L. piscatorius* the available data indicate that the biomass has been increasing as a consequence of the good recruitment observed in 2001, 2002 and 2004 and has stabilised in recent years. There is evidence of good recruitments in 2008, 2009, 2010 and 2011. 2008 and 2009 recruitments have entered the fishery giving one of the higher yields of the time series. Recruitment in 2012 and 2013 were lower than in previous years but there is indication that the 2014 recruitment could be high.

For *L. budegassa* survey data give indication that the biomass has increased since the mid 2000's as a consequence of several good incoming recruitments. A strong recruitment was observed in 2008. The EVHOE-WIBTS-Q4 shows evidence of large recruitment in 2011, 2012 and 2013 and slightly lower level for 2014. Length frequency distributions from the two available surveys show contradictory signals for 2009, 2011 and 2012 recruitments, but the working group considers that the trend of EVHOE is more representative due to the larger coverage of the survey.

In view of available data, the WG considers that fishing at present level should not harm both stocks. More details on the anglerfish assessment can be found in Section 3.

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

Both species are caught in mixed bottom trawl fisheries and in artisanal fisheries using mainly fixed nets. The two species are usually landed together for the majority of commercial categories and they are recorded together in the ports' statistics. Landings of both species combined in 2014 were 2 989 t. The combined TAC was set at 2 629 t in 2014 and 2987t in 2015.

The two species are assessed separately, using a surplus-production model (software ASPIC), tuned with commercial LPUE series for *L. budegassa* and a length based SS3 implementation for *L. piscatorius*.

Biomass of *L. piscatorius* decreased during the 1980s and early 1990s, but has progressively increased over the last two decades to 7 814 tonnes in 2014. No biomass reference points have been determined for this stock. Fishing mortality peaked during the late

1980's but has since declined close to F_{MSY} (0.19) from 2011 to 2013. F increased in 2014 to 0.25. Recruitment has been relatively low in recent years and shows little evidence of strong year classes since 2001.

Trends in relative biomass of *L. budegassa* indicate a steady decrease since the beginning of the series until 2001. Since then a slight recovery was observed and in 2015 the biomass is estimated to be at 98% of B_{MSY}. Fishing mortality remained at high levels between late eighties and late nineties, dropping after that. In 2014, fishing mortality is estimated to be below F_{MSY}.

Although the stocks are assessed separately, they are managed together.

More details are provided in Section 4.

Megrim *(Lepidorhombus whiffiagonis)* in Divisions VIIb-k and VIIIa,b,d

L. whiffiagonis in Div. VIIb-k and VIIIa,b,d is caught in a mixed demersal fishery catching anglerfish, hake and *Nephrops*, both as a targeted species and as valuable bycatch. The 2014 and 2015 TAC were set at 19 101 t, including a 5% contribution of L. boscii in the landings for which stock there is no assessment. Landings in recent years were relatively stable around 15 000t. Discarding of smaller megrim is substantial and also includes individuals above the minimum landing size of 20 cm. The discards were variable, between 2 000 and 4 000 t

After several years without assessment, a Bayesian catch at age model was investigated during a benchmark held in 2012. Due to underlying issues with the catch at age data, it was concluded that the model could only be considered to be indicative of trends in the fishery. For this year assessment, the use of the Bayesian statistical catch-at-age model gives very promising results and the model is able to address the heterogeneity in the Northern Megrim data in a very satisfactory way. The model fit to the data is adequate and the WG considers that the current assessment can be fully accepted and not only as indicator of trend. However, some work is still needed in order to develop the basis for short term projection and that is the reason why, in this year assessment, no projections have been carried out directly from the assessment. The development of framework for projections based on the bayesian stock assessment model will be conducted during an Inter Benchmark planned at the end of 2015 and made available to the WG next year. Catch, landing and discard data and survey indices do not appear to indicate the presence of important change in trends of recruitment or the overall biomass.

Details of the available data and analysis carried out during the WG are provided in Section 5.

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

Southern megrims *L. whiffiagonis* and *L. boscii* are caught in mixed fisheries targeting demersal fish including hake, anglerfish and *Nephrops* and are not separated by species in the landings. The majority of the catches are taken by Spanish trawlers. Landings of both species combined in 2014 were 1531 t (of which 80% correspond to *L. whiffiagonis*). The agreed combined TAC for megrim and four-spot megrim in ICES Divisions VIIIc and IXa was 2257 t in 2014 and 1377 t in 2015.

The species are assessed separately, using XSA.

For *L. whiffiagonis* the assessment indicates that fishing mortality has increased since 2011. The SSB values in 2007-2010 were the lowest in the series but since 2011, SSB has increased to a value close to the average of the historical series. After a very high recruitment (at age 1) in 2010 the recruitment has decreased to an average value.

For *L. boscii* the assessment indicates that SSB decreased gradually from 1989 to 2001, the lowest value in the series, and has since increased. In 2014 the SSB is estimated to be one of the highest of the series. Recruitment has fluctuated around 45 million fish during all the series. Very weak year classes are found in 1993 and 1998. The highest value occurred in 2014 at 121 millions but needs to be confirmed when more data will be available. Estimates of fishing mortality values show two different periods: an initial period with values around 0.5 from 1989 to 1996 followed by a decreasing trend with the lowest value estimated in 2012 (F=0.22). In 2013 and 2014, F has increased (F=0.39 in 2014).

Details of the assessments are presented in Section 6.

Sole in Divisions VIIIa,b (Bay of Biscay)

Bay of Biscay sole is caught in ICES Divisions VIIIa and b. The fishery has two main components: one is a French gillnet fishery directed at sole (about two thirds of total catch) and the other one is a trawl fishery (French otter or twin trawlers and Belgian beam trawlers). The 2014 TAC was set at 3800 t and the 2015 TAC is the same at 3800 t. Landings in 2014 were 3 924 t.

Discards are not included in the assessment. Discards are considered to be low for the ages included in the assessment, which starts at age 2.

In 2013, a benchmark workshop recommended the inclusion of the ORHAGO survey in order to provide such information and this inclusion was accepted. This year, an attempt was made to update the reference points following the framework of WKMSYREF2 and WKMSYREF2. However, the group did not have enough confidence in the results to propose new reference points. The group considers that the current Fmsy proxy is not appropriate and suggests that further work is needed.

Since 1984, fishing mortality has gradually increased, peaking in 2002 and decreased substantially the following two years. After 2005, F was stable around 0.42 (= Fpa). In 2014 F is estimated at 0.49, above Fpa and Fmsy. The SSB trend in earlier years increases from 1984 to a high value in 1993. Afterwards SSB shows a continuous decrease until 2003, the lowest value of the series. SSB has been increasing and was above Bpa from 2010 to 2013. In 2014, SSB has dropped again below Bpa at 10 600t. The recruitment values are lower since 1993. Between 2004 and 2008 the series is stable around 17 or 18 million and the 2007 year class is the highest value since 1984. The 2010 and 2011 values are closed to the GM93-12 (21.8 million). However, the 2012 and 2013 values are the lowest of the series (11.1 million and 10.7 million respectively). In 2014, the recruitment increased to 25 million.

As in last year, the group considers that, with the inclusion of the ORHAGO survey, the estimate of the recruitment for last year (2014 in this year assessment) has improved compared to previous assessment and decided to keep the value estimated by the assessment model.

Details on the assessment are in Section 7.

Sole in subdivisions VIIIc and IXa

Portugal and Spain are the main participants in this fisheries. *Solea solea* is mainly caught with gillnets and trammel nets. In Portugal *Solea solea* is caught together with and other similar species *Solea senegalensis* and *Pegusa lascaris* and it is only in recent years that official catches are reported separated by species. In 2014, total landings of *solea solea* were 681 t. The available information is insufficient to evaluate stock trends and exploitation status. Therefore, the state of the sole in Divisions VIIIc and IXa is unknown. New data (landings) available for this stock do not change the perception of its status.

Details on the assessment are in Section 8

Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock)

Hake is caught in nearly all fisheries in Subareas VII and VIII and also in some fisheries in Subareas IV and VI. In recent years, Spain accounted for the main part of the landings, followed by France. Stock landings have been steadily increasing throughout the last decade, from 36 700 t in 2001 to 89 800 t in 2014, the highest value since 1963. In 2014, landings were above the 2014 TAC (81 800 t).

The stock had a benchmark assessment in February 2014 (WKSOUTH, 2014). One of the main objectives of the workshop was to address a strong retrospective pattern which appeared in 2013 assessment. It was felt that this pattern was mainly due to changes in the size of hake caught by the majority of the fleets which the assessment model had difficulties to cope with. Most of the benchmark workshop was thus focused on obtaining the most appropriate way to account for the changes in retention and selectivity for the two most influential fleets and the group agreed that the model was an improvement in terms of taking into account the changes in stock structure and accepted the assessment model with the proviso that the model be developed and fine tuned as more data and information become available

This year, the assessment was carried out following the stock annex revised during the benchmark and although the retrospective patterns are still present, they are less important than last year and limited to the recent years. The recruitment appears to fluctuate without substantial trend over the whole series. The recruitment estimated for 2008 is the highest in the whole series (700 million). In 2014, the recruitment decreased below mean level (240 million). From high levels at the start of the series (100 000 t in 1980), the SSB has decreased steadily to a low level at the end of the 90s (25 000 t in 1998). Since that year, SSB has increased to the highest value of the series in 2012 (218 000 t) and decreased slightly in 2013 and 2014. The fishing mortality is calculated as the average annual F for sizes 15–80 cm. This measure of F is nearly identical to the average F for ages 1–5. Values of F increased from values around 0.5-0.6 in the late 70s and early 80s to values around 1.0 during the 90s. They declined sharply afterwards to 0.34 in 2012 and increased up to 0.34 in 2014.

Details about the assessment of this stock are provided in Section 9.

Hake in Divisions VIIIc and IXa

Hake in Divisions VIIIc and IXa is caught in a mixed fishery by Spanish and Portuguese trawlers and artisanal fleets. Spain accounts for the main part of the landings. Total landings in 2013 were 11 661 t and 12 011 t in 2014. Total discards in 2013 were 2 553 t and 2 602 t in 2014.

The southern hake stock had a benchmark assessment in February 2014 (WKSOUTH). One of the main issues addressed during the benchmark workshop was related to the difficulties encountered by the GADGET model in its search for the set of parameters that maximise the likelihood function. The work confirmed that the model fitting procedure is finding a genuine optimum and can thus continue to be used as the assessment model. Further work to improve the optimisation characteristics of the model has been suggested.

The recruitment (age 0) is highly variable and presents two different periods: one from 1982 to 2003 with mean figures around 70 million, ranging from 40 to 120, and a recent period from 2004 to latest with a mean of 121 million ranging from 70 to 180 million. Fishing mortality increased from the beginning of the time series (F=0.36 in 1982) peaking in 1995 at 1.18; declining to 0.78 in 1999 and remaining relatively stable until 2009 (F=1.01). F then progressively decreased to reach 0.68 in 2014. The SSB was very high at the beginning of the time series with values around 40 000 t, then decreased to a minimum of 5 800t in 1998. Since then biomass has continuously increased, reaching 18 840 t in 2014, slightly above the 2012 figure (17 400 t)

Details on the assessment of this stock are in Section 10.

Nephrops in ICES Division VIIIa,b

There are two Functional Units in ICES Division VIIIa,b: FU 23 (Bay of Biscay North) and FU 24 (Bay of Biscay South), see Figure 1.2. *Nephrops* in these FUs are exploited by French trawlers almost exclusively. Landings declined until 2000, from 5 900 t in 1988 to 3 100 t in 2000. After that year, they increased again to around 3 700 t, staying at that level for some time. Since 2006 landings have been around 3,300 t. In 2012 and 2013, a reduction in the landings occurred (2 520 t in 2012, 2 380 t in 2013) followed by an increase at 2 800 t in 2014. The agreed TAC for 2015 was 3 899 t.

A French regulation increased the minimum landing size in 2006 and several effort and gear selectivity regulations have also been put in place in recent years. The use of selective devices for trawlers targeting *Nephrops* became compulsory in 2008. All these measures are expected to be contributing in various ways to the changing patterns of landings and discards observed recently. In general, discards values after year 2000 have been higher than in earlier years, although sampling only occurred on a regular basis starting from 2003, so information about discards is considerably weaker for the earlier period.

This stock underwent an inter-benchmark protocol in 2012. The outcome of this process was inconclusive with a recommendation that the work undertaken should be considered in a full benchmark setting.

No quantitative analytical assessment was carried out this year, however, based on the stability of the commercial LPUEs in recent years, the WG considered that the perception of the stock was not changed compared to last year assessment.

Details can be found in Section 11.

Nephrops in ICES Division VIIIc

There are two Functional Units in Division VIIIc (Figure 1.2): FU 25 (North Galicia) and FU 31 (Cantabrian Sea).

Nephrops are caught in the mixed bottom trawl fishery in the North and Northwest Iberian Atlantic. Landings from both FUs have declined dramatically in recent years reaching less than 10t in each FU in 2014, below the TAC in recent years, which has not been restrictive. The TACs were set at 67 t and 60 t for the whole Division VIIIc for 2014 and 2015, respectively.

A recovery plan for southern hake and Iberian *Nephrops* stocks has been in force since 2006. The aim of the recovery plan is to rebuild the stocks within 10 years, with a reduction of 10% in F relatively to the previous year and the TAC set accordingly (Council Regulation (EC) No. 2166/2005).

According to the ICES data-limited approach, both stocks are considered as category 3.1.4. The two stocks are assessed by the analysis of the LPUE series trend. The perception of the stocks is the same as last year indicating an extremely low abundance level.

Additional details are provided in Section 12.

Nephrops in ICES Division IXa

There are five Functional Units in Div. IXa (Figure 1.2): FU 26 (West Galicia); FU 27 (North Portugal); FU 28 (Alentejo, Southwest Portugal); FU 29 (Algarve, South Portugal) and FU 30 (Gulf of Cádiz).

Landings in 2014 from the five FUs combined were 212 t. The TAC set for the whole Division IXa was 221 t and 211 t for 2014 and 2015.

A recovery plan for southern hake and Iberian *Nephrops* stocks has been in force since 2006. The aim of the recovery plan is to rebuild the stocks within 10 years, with a reduction of 10% in F relatively to the previous year and the TAC set accordingly (Council Regulation (EC) No. 2166/2005).

FU 26+27 (West Galicia and North Portugal): The fishery shares the same characteristics of that in Division VIIIc, described above.

Landings are reported by Spain and minor quantities by Portugal. Spanish fleets fish in FU 26 and FU 27, whereas Portuguese artisanal fleets fish with traps in FU 27. Two periods can be distinguished in the time series of landings available 1975-2014. During 1975-1989, the mean landing was 680 t, fluctuating between 575 and 800 t ap-proximately. Since 1990 onwards there has been a marked downward trend in landings, being below 50 t from 2005 to 2011. In the three last years, landings continued to decrease and were below 10 t. Discards rates are negligible.

According to the ICES data-limited approach, this stock is considered as category 3.1.4. These FU 26-27 are assessed by the analysis of the LPUE series trend, as was done in 2012. The perception of the stocks is the same as last year indicating an extremely low abundance level.

FU 28+29 (SW and S Portugal): *Nephrops* is taken by a multi-species and mixed bottom trawl fishery. The trawl fleet comprises two components, one targeting fish operating along the entire coast, and another one targeting crustaceans, operating mainly in the southwest and south, in deep waters. There are two main target species in the crustacean fishery, Norway lobster and deepwater rose shrimp, with different but overlapping depth distributions. In years of high rose shrimp abundance, the fleet directs its effort preferably to this species.

For the time period 1984 to 1992, the recorded landings from FUs 28 and 29 have fluctuated between 420 and 530 t, with a long-term average of about 480 t, falling drastically in the period 1990–1996, down to 132 t. From 1997 to 2005 landings have increased to levels observed during the early 1990s but decreased again in recent years. The value landings in 2009-2011 was approximately at the same level (≈ 150 t), increasing to around 200 t in the years 2012-2014.

According the ICES data-limited approach, this stock is classified in the category 3.2.0. The advice is based on survey and fishery CPUE and effort trends. A standardized effort shows a consistent declining trend since 2005 reaching a historic low in 2009-2010. In the following years, the effort had a slight increase however still remaining at a low level. The fleet standardized CPUE, used as index of biomass, decreased in the period 2006-2011. The update of the index does not change the perception of the stock status, the index has been increasing in recent year.

FU 30 (Gulf of Cádiz): *Nephrops* in the Gulf of Cádiz is caught in a mixed fishery by the trawl fleet. Landings are markedly seasonal with high values from April to September. Landings were reported by Spain and minor quantities by Portugal. Landings increased from 100t in the mid 90s to a higher level at the beginning of the 2000s. Landings have decreased again until 2008 and then remained around 100t from 2008 to 2012. They have dropped to 26 t in 2013 and 15 t in 2014. The reason for this drop is that the quota in 2012 was exceeded and the European Commission applied a sanction which will be paid in 3 years. So, the Nephrops fishery was closed almost whole 2013 and vessels could only went fishing *Nephrops* a few days in summer and winter.

According to the ICES data-limited approach, this stock is considered as category 3.2.0. FU 30 is assessed by the analysis of the LPUE series trend. The update of the LPUE series and abundance survey index shows two conflicting signals. The LPUE decreasing while the survey index is increasing however, WG express concerns over the ability of those two indexes to reflect variations in the abundance in 2013 and 2014. The WG considers that no new information is available to change the perception of the status of the stock.

The five *Nephrops* FUs (assessed as 3 separate stocks) are managed jointly, with a single TAC set for the whole of Division IXa. This may lead to unbalanced exploitation of the individual stocks. The northernmost stocks (FUs 26-27) are at extremely low levels, whereas the southern ones (FUs 28-29 and FU 30) are in better condition. To protect the stock in these Functional Units, management should be implemented at the Functional Unit level.

Additional details can be found in Section 13.

European Seabass in Division VIIIa,b

Seabass in the Bay of Biscay are targeted by France (more than 90% of international landings) by line fisheries which take place mainly from July to October, by nets, pelagic trawlers, and in a mixed bottom trawl fisheries from November to April on pre spawning and spawning grounds when seabass aggregate. Since the late 90s total landings are stable around 2 500 t. Landing of netters have however increased since 2011 due to a decrease of sole quotas from 2011 and a redistribution of effort towards this species combined with good weather condition in 2014. Recreational fisheries are an important part of the total removals but these are not accurately quantified. Discards are known to take place but are not fully quantified. Anecdotal information suggests that discards may be very low in the area.

No stock assessment is carried out for this stock . According to the ICES data-limited approach, this stock was considered as category 5.2.0, so without information on abundance or exploitation. This year, an index of abundance based on standardised LPUEs has been proposed and the WG has suggested to consider the stock as category 3.

Additional details can be found in Section 14.

European Seabass in Division VIIIc, IXa

Spanish and Portuguese vessels represent almost of the total annual landings in the area IXa and VIIIc. Commercial landings represent 917 t in 2014. A peak of landings is observed in the early 90's and in 2013, reaching more than 1 000 t, and lowest landings (637 t) have been observed in 2004. No discards have been observed for this stock by the observer program.

No stock assessment is carried out. No information on abundance or exploitation is available and the stock is considered as category 5.2.0. This year, there are no new data available that change the perception of the stock.

Additional details can be found in Section 15.

Plaice in Subarea VIII and Division IXa

Plaice (*Pleuronectes platessa*) are caught as a bycatch by various fleets and gear types covering small-scale artisanal and trawl fisheries. Portugal and France are the main participants in this fishery with Spain playing a minor role. Present fishery statistics are considered to be preliminary as there are concerns about the reliability of the French data from 2008-09. Landings may also contain misidentified flounder (*Platichthys flesus*) as they are often confounded at sales auctions in Portugal. The quantity of discarding is uncertain. For these reasons, the landings are unlikely to be a good indicator of total removals and ICES considers that it is not possible to quantify the catches.

This stock is currently ranked as a Data Limited Stock in category 5.2 as only landings data are available. This year, there are no new data available that change the perception of the stock.

Additional details can be found in Section 16.

Pollack in Subarea VIII and Division IXa

Landings have been reported by the three countries with quota: France, Spain and Portugal. Pollack is exploited by several type of gears. The main part of the landings are made by gillnets and lines. Since the early 2000s, the landings have been relatively stable between 1 500 t and 2 000 t.

Discards estimates in the Spanish fleet indicate that the discards may be low.

The stock from is currently ranked as a Data Limited Stock in category 5.2 as there is information on landings only. This year, there are no new data available that change the perception of the stock.

Additional details can be found in Section 17.

Whiting in Subarea VIII and Division IXa

Whiting (*Merlangius merlangus*) are caught in mixed demersal fisheries primarily by France and Spain. Present fishery statistics are considered to be preliminary. Total landings in recent years were stable around 2 000 t. Landings may also contain misidentified Pollack (*Pollachius pollachius*). Whiting has never been recorded in Spanish discards and is negligible in Portuguese discards. However there are indications that some discarding occurs in the French fleet.

This species is at the southern extent of its range in the Bay of Biscay and Iberian Peninsula. It is not clear whether this is a separate stock from a biological point of view.

This stock from is currently ranked as a Data Limited Stock in category 5.2 as there is information on landings only. This year, there are no new data available that change the perception of the stock.

1.4 Data available

ICES launched a formal data call for WGBIE for the second time in 2015, in order to prepare the datasets for the working group and progress on the use of InterCatch. Catch (totals and/or age–length structured) and effort data according to species, country, area and métier were requested.

As shown in the table below not all countries managed to deliver data for all species by the deadline : only 30% of stock x country strata were uploaded (22 over 73). At the beginning of the meeting, 78% of stock x country strata (57 over 73) were uploaded either in IC or sent to ICES and stock coordinators as Accession (AC). For some stocks the data was sent directly to the stock coordinators. However, not all the data was available at the start of the meeting, which increased the workload for some stocks during the working group, as in that case, the assessments could not be carried out in National Laboratories prior to the meeting as mentioned in the ToRs. The missing data was however delivered during the WG and the group was able to update the assessment for all stocks that needed an update. Uploading the data into InterCatch was part of the data request but as a result, only few of the stocks among the 23 listed in the datacall used InterCatch as the only tool to compute the model entry files. For all other stocks, InterCatch was partly used (to download un-raised data) or not used at all, the data being also delivered directly to each stock coordinators in worksheet format.

For some stocks, the group noted that some data were very poor and recommends that a basic data check be carried out by the data providers before uploading the data in InterCacth. This includes checking if the total landings are consistent with the historical landing and checking the quality of the length or age frequency distributions.

Stock	Country	Data provided on deadline in IC (Y/N)	Data available at the start of the meeting either in IC or AC (Y/N)
anb-78ab	Belgium	Y	Y
anb-78ab	France	N	N
anb-78ab	Ireland	N	Y
anb-78ab	Netherlands	N	N
anb-78ab	Spain	N	Y
anb-78ab	UK_EW	N	Y
anb-78ab	UK_Sco	N	N
anb-8c9a	Portugal	N	Y
anb-8c9a	Spain	N	Y
anp-78ab	Belgium	Y	Y
anp-78ab	France	N	N
anp-78ab	Ireland	N	Y
anp-78ab	Netherlands	N	N
anp-78ab	Spain	N	Y
anp-78ab	UK_EW	N	Y
anp-78ab	UK_Sco	Y	Y
anp-8c9a	Portugal	N	Y
anp-8c9a	Spain	N	Y
bss-8ab	Belgium	Y	Y
bss-8ab	France	N	Y
bss-8ab	Spain	N	Y
bss-8ab	UK_EW	N	N
bss-8c9a	Portugal	Y	Y
bss-8c9a	Spain	N	Y
gug-89a	Portugal	N	N
gug-89a	Spain	N	N
hke-nrtn	Belgium	Y	Y
hke-nrtn	Denmark	Y	Y
hke-nrtn	France	N	Y
hke-nrtn	Germany	Y	Y
hke-nrtn	Ireland	N	Y
hke-nrtn	Netherlands	Y	Y
hke-nrtn	Norway	N	Y
hke-nrtn	Spain	N	Y
hke-nrtn	Sweden	N	Y
hke-nrtn	UK NI	Y	Y
hke-nrtn	UK_EW	N	Y
hke-nrtn	UK_Sco	Y	Y
hke-soth	France	N	Y
hke-soth	Portugal	Y	Y
hke-soth	Spain	N	Y
hke-soth	UK_Sco	Y	Y

Stock	Country	Data provided on deadline in IC (Y/N)	Data available at the start of the meeting either in IC or AC (Y/N)
mgb-8c9a	Portugal	N	N
mgb-8c9a	Spain	N	Y
mgw-78	Belgium	Y	Y
mgw-78	France	N	N
mgw-78	Ireland	N	Y
mgw-78	Spain	N	N
mgw-78	UK NI	N	N
mgw-78	UK_EW	N	Y
mgw-78	UK_Sco	Y	Y
mgw-8c9a	Portugal	N	N
mgw-8c9a	Spain	N	Y
nep-8ab(23-24)	France	N	N
nep-8c(25)	Spain	N	Y
nep-8c(31)	Spain	N	Y
nep-9a (26-27)	Portugal	Y	Y
nep-9a (26-27)	Spain	N	Y
nep-9a (28-29)	Portugal	Y	Y
nep-9a (28-29)	Spain	N	Y
nep-9a (30)	Portugal	Y	Y
nep-9a (30)	Spain	N	Y
ple-89a	Belgium	Y	Y
ple-89a	France	N	Y
ple-89a	Portugal	N	N
ple-89a	Spain	N	Y
sol-8c9a	Portugal	Y	Y
sol-8c9a	Spain	N	Y
sol-bisc	Belgium	Y	Y
sol-bisc	France	N	N
whg-89a	Belgium	Y	Y
whg-89a	France	N	Y
whg-89a	Spain	N	Y

The main data problems detected by the Working Group and for which action is required are described in the "Stock Data Problems" table included in Annex 07 .

Several stocks assessed by the Group are managed by means of TACs that apply to areas different from those corresponding to individual stocks, notably in Subarea VII, as well as for the *Nephrops* FUs in VIIIc and IXa, or to a combination of species in the cases of anglerfish and megrim.

Biological sampling levels by country and stock are summarised in Table 1.3a and b.

1.5 Stock Data Problems Relevant to Data Collection

WGBIE identified the following issues for further discussion by the WGDATA in relation to stock data problems relevant to data collection. These are listed in the table included in Annex 07 of the report.

1.6 Consideration of protected species bycatch in the context of stock assessment work.

EU policy demands that fisheries management adopts an ecosystem approach, which includes taking account of the impacts of fishing on non-target species. Including protected species in stock assessment advice is also one of the aims of the EU funded project Myfish and this multispecies approach has been also one of the tasks of the ongoing Mareframe project. Simon Northridge gave an overview of the current state of the bycatch policy in the UE and highlighted that at least two species of cetacean – the common dolphin and the harbour porpoise – are regularly caught in a range of fishing gears targeting some of the principal target fish species in the region. There are no agreed measures to determine what an unacceptable level of cetacean bycatch might be, and there are only limited data on bycatch rates in many fisheries. However, certain gear types are considered by the scientific community dealing with marine mammal bycatch, to have relatively high bycatch rates, and some of these rates have been measured. Despite the lack of detailed assessment, there remain widespread public concerns about cetacean bycatch. There are at present no easy ways to integrate advice concerning cetacean bycatch with catch advice. Indeed ICES advice on cetacean bycatch has been widely ignored by managers, and ICES is seeking ways to ensure more integrated ways to present advice, incorporating environmental concerns into catch advice. The group considered how this might be done in the context of cetacean bycatch in the Biscay region and agreed that it would be useful to explore ways in which concerns about bycatch could be conveyed alongside catch advice. It was agreed that the hake stock assessment might provide a useful arena in which to explore some ideas. A multispecies model is being developed which incorporates common and bottlenose dolphins as main predators of hake. This model was presented during the meeting and their details are described into the working document (WD-9). However the model development is not still finished to provide advice in a mixed fisheries context. One possibility might involve looking at the partial effort levels that are currently being derived for different fleet segments and to try to link these with potential cetacean bycatch mortalities, which are known to be fleet segment dependent. Even in the absence of detailed data this might provide a way to explore the feasibility of considering impacts of fishing on non-target and target species simultaneously. However, bycatch rates provided by observers on board are almost the only way to obtain accurate bycatch estimates of the fleet. Therefore, observer programmes are urgently needed to obtain these estimates in Bay of Biscay (as required by the Council Regulation EC 812/2004 for some fleets). In the absence of better information for now, it was agreed that S. Northridge would communicate with the members involved into the assessment of hake stocks who are undertaking work on deriving partial effort levels for hake fleet segments, to link these with likely or actual cetacean bycatch or mortality rates.

1.7 Revision of the MSY reference points

WGBIE attempted a revision of the MSY reference points for the Bay of Biscay sole stock using the guidelines developed under WKMSYREF2 and WKMSYREF3. The WG considered however that due mainly to the uncertainty associated with the stock-recruitment relationship, it was not in a position to propose any new values for the MSY reference points and suggest that this was reconsidered during the ICES workshop on MSY ranges scheduled for next fall.

1.8 Revision of the estimated landings from Spain from 2011 to 2014

Until recent year, the Spanish landings were estimated by combining both biological information and fisheries statistics. These data were obtained, for the biological data, through the sampling of fishing trips and for fisheries statistics, from sales notes of the main landing ports. A gradual decline in sales notes quality was noticed over recent years leading to the development of a new method to estimate landings (see WD 03). This estimation is now based on the raising of the observed LPUE (Landings per Unit Effort) to the total effort, a method similar to the one used to estimate discards.

The method was first applied last year for the 2013 data (WGBIE, 2014) but some concerns were raised by the group as the landings of some species were found inconsistent with the historical series based on the former methodology. WGBIE thus requested that the 2011-2012 data be re-estimated using the new methodology, in order to facilitate comparison with the previous approach.

This year, the data uploaded in InterCatch for 2011 to 2014 were based on the new methodology. For several stocks, the new estimates were considered adequate and are now used for the assessment. For the stocks of southern hake and northern anglerfish (*L. piscatorius* or *L. budegassa*) however, some important discrepancies have been noted for 2011 and 2012, the years for which both methods have been used. In the case of southern hake, the difference in landings is considered unrealistic by the experts from the working group while for anglerfish, the new method leads to an important change in the split of the total landing into the two species. Therefore, for those three stocks, the WG decided not to use this data (the 2011 and 2012 landings) until details of the sampling used and the effects of the new method are clarified.

1.9 Unallocated landings

For some stocks, some landings were uploaded into InterCatch as "Unreported". Those data were uploaded on a year basis, without any allocation to a specific country and trimester. For some stocks, it was necessary to split the data by trimester to get the best possible assessment of the stock status. The group recommends that next year this data be uploaded at the requested level of aggregation.

1.10 Use of InterCatch by WGBIE

Some progress has been made by the group with regards to the use of InterCatch. One stock is using exclusively InterCatch as a tool to compute the model entry files and several stocks are partly using InterCatch in this process. To facilitate the stock coordinators' work in relation to data availability in IC, the WG suggested that once the data from one country has been uploaded and is complete, it would be useful to inform them. This could be done by giving the possibility to the data providers, to acknowledge that their data upload in IC has been completed and by sending an automatic email to the stock coordinators.

1.11 Stock annexes

All stocks assessed by this WG have a stock annex.

1.12 Proposals for future benchmarks

The following table summarises WGBIE proposals for short and long-term benchmarking.

Name	Assement status	Latest Benchmark	Benchmark next year	Planning Year +2	Comments
Anglerfish (Lophius budegassa) in Divisions VIIb-k and VIIIa,b,d	Update	WKFLAT 2012	End of 2016 if possible	Data compilation and length based model development	All Anglerfish together
Anglerfish (Lophius piscatorius) in Divisions VIIb-k and VIIIa,b,d	Update	WKFLAT 2012	End of 2016 if possible	Data compilation and length based model development	All Anglerfish together
Megrim (Lepidorhombus whiffiagonis) in Divisions VIIb-k and VIIIa,b,d	Update	WKFLAT 2012	Inclusion of french discards & development of a projection framework		Interbenchmark in 2015 if possible for application in 2016
Nephrops in Division IXa (FU 28-29)	Biennial (2d year)	IBP Nephrops 2012	2016		
Nephrops in Division IXa (FU 30)	Biennial (2d year)		2016		
Nephrops in Divisions VIIIa,b (Bay of Biscay, FU 23, 24)	Biennial (2d year)	IBP Nephrops 2012	2016		
Anglerfish (Lophius budegassa) in Divisions VIIIc and IXa	Update	WKFLAT 2012	End of 2016 if possible	Data compilation and length based model development	All Anglerfish together
Anglerfish (Lophius piscatorius) in Divisions VIIIc and IXa	Update	WKFLAT 2012	End of 2016 if possible	Data compilation and length based model development	All Anglerfish together
Sea Bass in Divisions VIIIa,b	No new assessment	IBP New 2012	2017	Data compilation and development of an assessment, possibly in conjunction with Sea Bass in Divisions IVbc and VIIa,d-h	With Sea Bass in Divisions IVbc and VIIa,d-h

1.12.1 Benchmark planning

The WG reviewed the situation this year and decided to go ahead with the benchmarks proposed for 2016. The ICES benchmark preparation tables by stock were reviewed during the WG meeting. The WG indentified potential directions of solution to improve the assessments of those stocks without deciding yet on any preferred options. They include the use of Under Water TV surveys for the stocks of *Nephrops* in Gulf of Cadiz (FU 30) and in the Bay of Biscay (FU 23-24) and the use of a survey index to estimates the abundance for the stock of *Nephrops* in South-West and South Portugal (FU 28-29). A preliminary time table for a data analysis workshop and the benchmark workshop has been proposed. Given the data constraints it appears that the end of 2016 would be the best timing for the benchmark workshop. It was however not possible during the WG to make proposal for external experts. The updated tables and relevant comments regarding the 2015 benchmarks are included in Annex 06 ("Benchmark planning for 2016").

1.12.2 Longer-term benchmark planning

WGBIE is also proposing longer term benchmarks and issues that should be addressed in the next round of benchmarks have been listed, even though they are several years in the future. Several benchmarks are thus proposed :

a) For 2017, the group proposed a benchmark for all anglerfish (*Lophius piscatorius* and *L. budegassa*) stocks assessed by WGBIE, preferably in conjunction with the anglerfish stocks in Division IIIa, Subarea IV, VI from the other ICES EWG WGCSE, to address issues related to biology of the species (growth and maturity), compilation of data on discards, commercial tunning series, survey abundance/biomass indices and to develop quantitative stock assessment methods. It was agreed during the WG that ICES will launch a data-call on historical series of discards for the northern stocks next fall and that a scoping meeting will be organised for the beginning of 2016 to assess the availability and quality of the data and start preparing for a benchmark later in the year, 2016, or early in 2017.

b) For the stock of megrim (*Lepidorhombus whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d the WG proposes an inter-benchmark before the end of 2015 to update the assessment model in order to incorporate missing discard data and develop a projection framework based on the output of the Bayesien assessment model specifically developed for that species.

c) For the stock of sea bass in Subarea VIII, the WG proposes a benchmark in conjunction with the stock of sea bass in Divisions IVbc and VIIa,d-h in order to develop an assessment for the Bay of Biscay stock and investigate the possibility to carry out a joint assessment (possibly spatial) with the stock of sea bass in Divisions IVbc and VIIa,d-h.

1.13 Mixed Fisheries considerations

No progress has been made on the development of a mixed-fishery analysis since last year. The WG notes however that the Working Group on Mixed Fisheries Advice that will meet from 25-29 May will update the Iberian mixed fisheries analysis carried out in 2013. The WG also notes that mixed fishery analyses of the Bay of Biscay and Iberian waters will be carried out during an STECF meeting scheduled from 25 to 29 May on the development of a multiannual mixed fishery management plan for the South Western Waters (EWG 15-04)

1.14 Assessment and forecast auditing process

This year WGBIE has carried out internally an audit of individual assessments and forecasts. WGBIE stocks subjected to review are shown in the table below. Following a template provided by ICES secretariat, the choice of assessment model, the model configuration and the data used in the assessments have been checked against the corresponding settings described in the Stock Annex. Not all audit could be completed by the end of the meeting and the remaining stocks were audited after the meeting. No concerns were raised by the auditors.

Fish Stock	Stock Name	Stock Coord.	Advice	Review
anp-78ab	Anglerfish (*L. piscatorius*) in Divisions VIIb-k and VIIIa,b	Spain/UK	Update	Ireland
anb-78ab	Anglerfish (*Lophius budegassa*) in Divisions VIIb-k and VIIIa,b	Spain/UK	Update	Ireland
anb-8c9a	Anglerfish (*Lophius budegassa*) in Divisions VIIIc and IXa	Portugal	Update	Spain
anp-8c9a	Anglerfish (*L. piscatorius*) in Divisions VIIIc and IXa	Spain	Update	UK (EW)
hke-nrtn	Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock);	Spain	Update	France
hke-soth	Hake in Division VIIIc and IXa (Southern stock);	Spain	Update	France
mgb-8c9a	Megrim (*Lepidorhombus boscii*) in Divisions VIIIc and IXa	Spain	Update	France
mgw-8c9a	Megrim (*Lepidorhombus whiffiagonis*) in Divisions VIIIc and IXa	Spain	Update	Portugal
mgw-78	Megrim (*L. whiffiagonis*) in Subarea VII & Divisions VIIIa,b,d,e	Spain	Update	Spain
sol-bisc	Sole in Divisions VIIIa,b,d (Bay of Biscay)	France	Update	Portugal
nep-2324	*Nephrops* in Divisions VIIIa,b (Bay of Biscay, FU 23, 24)	France	Biennial 1st year	UK (EW)
nep-25	*Nephrops* in North Galicia (FU 25)	Spain	Biennial 1st year	France
nep-31	*Nephrops* in the Cantabrian Sea (FU 31)	Spain	Biennial 1st year	France
nep-2627	*Nephrops* in West Galicia and North Portugal (FU 26-27)	Portugal	Biennial 1st year	Spain
nep-2829	*Nephrops* in South-West and South Portugal (FU 28-29)	Portugal	Biennial 1st year	France
nep-30	*Nephrops* in Gulf of Cadiz (FU 30)	Spain/Portugal	Biennial 1st year	France

1.15 Ecosystem overviews

Iñigo Martínez (ICES) requested a review of the draft report "Ecosystem Overview", section Bay of Biscay and Iberian waters, to include considerations from WGBIE. WGBIE had a subgroup meeting to discuss this draft. The subgroup decided to collect comments and suggestions from all WGBIE members which are summarized here. The group wants to express recognition to the effort devoted to the development of this document, which is an important contribution to the future of ICES ecosystem advice.

General comments:

- Improve the map 7.1.2 including MPAs, main Atlantic harbours (some are notably missing – e.g. Vigo) and fishing areas. The area drawn as "catchment area" was not well understood by the group, particularly in relation to the source of the information..
- Extend the trophic interaction section on 7.3.1 considering the key species interactions. Some trophic relationships are fairly well known – e.g. predation of hake and other predators on blue whiting and other notable forage fish, the cannibalism among hake and the known prey of some cetacean species. Moreover, other studies of stomach analysis for other species have been published in this area.
- Update the state of the stocks: there have been many changes since 2011.
- Section 7.4 "State" should be more developed.
- Section 7.4.5 "Birds" could be renamed as "Seabirds and Marine Mammals"; and some additional information could be included such as the local or small-scale surveys that were carried out. The only global survey carried out in the region was the SCANS-II in July 2005; however an observer program operates annually in the North and Northwest of the Iberian Peninsula using the PELACUS acoustic survey of the IEO as an observer platform since 2007; an expedition to estimate the abundance of cetaceans took place in oceanic waters of Portugal during the summer of 2011 supported by the Life project MarPro. Other small-scale initiatives in Galicia and Cadiz are also under development.

Selection of ecosystem considerations from single stock WGBIE reports:

- Environmental conditions have a large influence on Bay of Biscay Sole catches of the fixed-net fishery. Those conditions were especially favourable in 2002. Studies in Vilaine Bay showed a significant positive relationship between the fluvial discharges in winter–spring and the size of the local nursery. This localized effect is not apparent for the whole of the Divisions VIIIa,b stock and the impact of this relationship was therefore not taken into account in stock projections.
- Hake is a top predator, its abundance has implications on the survival of its preys, mainly pelagic species such as blue whiting, horse mackerel, sardine, etc. Many predators feed on juvenile hake, including adult hake (cannibalism) and other top predators as small cetaceans.
- Anglerfish are benthic species that occur on muddy and gravel bottoms. The spawning of the *Lophius* species is very particular, with eggs extruded in a buoyant, gelatinous ribbon. Eggs and larvae drift with ocean currents and juveniles settle on the seabed. This particular spawning strategy leads to highly clumped distributions of eggs and larvae. Oceanographic conditions

can therefore have major impacts on recruitment. Anglerfish are top predators, with a diet that reflects temporal prey availability. Larger fish can migrate over long distances.

- Megrim species generally occur over soft bottoms of the continental shelf. They are common on the outer side of zones with hydrographical instabilities that foster the vertical interchange of organic matter and are missing at the mouth of big rivers. Juveniles of these species feed mostly on detritivore crustaceans inhabiting deep-lying muddy bottoms. Adults of *Lepidorhombus boscii* feed mainly on crustaceans while *L. whiffiagonis* are more ichthyophagous and rates of crustacean in diet decrease with fish size. None of the two species represent an important part of the diet for the main fish predators in the area but they are occasionally present in stomach contents of hake, anglerfish and rays. Both species show a gradual bathymetric distribution with larger individuals occupying shallower waters than juveniles.

Nephrops are limited to muddy habitats. Distribution of suitable sediment defines the distribution of the species. Nephrops are sedentary but they can leave their burrows in search of food and for reproduction. Berried Nephrops stay most of the time inside their burrows. Larvae are pelagic for one month after hatching, then after metamorphosis the small Nephrops settle on the sea bed.

1.16 References

ICES. 2012a. Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim (WGHMM), 10-16 May 2012, ICES Headquarters, Copenhagen. ICES CM 2012/ACOM:11. 599 pp.

ICES. 2012b. Report of the Study Group on Nephrops Surveys (SGNEPS), 6–8 March 2012, Acona, Italy. ICES CM 2012/SSGESST:19. 36 pp.

ICES. 2012c Report of the Inter Benchmark Protocol on Nephrops (IBPNephrops 2012), March 2012, By correspondence. ICES CM 2012/ACOM:42. 5 pp.

ICES. 2010a. Report of the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim (WGHMM), 5 - 11 May 2010, Bilbao, Spain. ICES CM 2010/ACOM:11. 571 pp.

ICES. 2010b ICES Workshop on Iberian mixed fisheries management plan evaluation of Southern hake, Nephrops and anglerfish , 22 - 26 November 2010, Lisbon, Portugal. ICES CM 2010/ ACOM:63. 96 pp.

TABLE 1.3a Biological sampling levels by stock and country. Number of fish measured and aged from landings in 2014

		Angler (L.pisc.)		Angler (L.bude.)		Megrim (L.whiff.)		Megrim (L. boscii)	Sole (S. solea)	
		VIIb–k & VIIIa,b,d	VIIIc & IXa	VIIb–k & VIIIa,b,d	VIIIc & IXa	VIIb–k & VIIIa,b,d	VIIIc & IXa	VIIIc & IXa	VIIIa,b	VIIIc & IXa
Belgium	No. lengths					6136			17899	
	No. ages								273	
	No. samples**					178			105	
E & W (UK)	No. lengths	12104		1886		10505				
	No. ages					741				
	No. samples*	83		41		56				
France	No. lengths	16110		8122		24960			20496	
	No. ages			0		1047			1666	
	No. samples*	995		995		653			176	
Portugal	No. lengths		278		1358		196	1550		
	No. ages***									
	No. samples*		72		88		4	32		
Republic of	No. lengths	7283		2742		13668				
Ireland	No. ages	0		0		1172				
	No. samples**	102		74		97				
Spain	No. lengths	5561	9175	8332	4305	19812	5590	23898		
	No. ages				0	669	1018	852		
	No. samples	78	78	102	231	120	410	419		
Denmark	No. lengths									
	No. ages									
	No. samples									
Total	No. lengths	41058	9453	21082	5663	51168	5786	25448	38395	
	No. ages	0	0	0	0	3629	1018	852	1939	
Total nb. in international landings ('000)		NA	289	NA	442	NA	1185	9720	13262	
Nb. measured as % of annual nb. caught		0.3	3.3	0.2	1.3	NA	0.5	0.3	0.3	

*** Vessels, ** Categories**

***** Ages, surveys, **** Boxes/hauls (for sampling onboard)**

******* Otoliths collected and prepared but not read**

Table 1.3a (continued)

		Hake		Nephrops			Sea Bass		Pollack	Whiting	Plaice
		IIIa, IV, VI, VII & VIIIa,b	VIIIc & IXa	VIIIab FU 23-24	VIIIc FU 25-31	IXa FU 26-30	VIIIab	VIIIc & IXa	VIII & IXa	VIII & IXa	VIII & IXa
Scotland (UK)	No. lengths	1193									
	No. ages										
	No. samples*	52									
E & W (UK)	No. lengths	11728									
	No. ages										
	No. samples*	620									
France	No. lengths			26726			7387				
	No. Ages*****						800				
	No. samples****			630			530				
Portugal	No. lengths		25207			11780					
	No. ages***										
	No. samples*		408			43					
Republic of	No. lengths	24339									
Ireland	No. ages*****										
	No. samples*	622									
Spain	No. lengths	68507	55787		3758	2362					
	No. ages										
	No. samples*	216	559		77	31					
Denmark	No. lengths	12425									
	No. ages										
	No. samples*	606									
Total	No. lengths	105767	80994	26726	3758	14142	7387				
	No. ages	0	0	0	0	0	800				
Total No. in international landings ('000)		NA	11875	121594	195	14175					
Nb. meas. as % of annual nb. caught		NA	0.7	0.0	1.9	0.1					

*** Vessels, ** Categories**

***** Ages, surveys, **** Boxes/hauls (for sampling onboard)**

******* Otoliths collected and prepared but not read**

TABLE 1.3b Biological sampling levels by stock and country. Number of fish measured and aged from discards in 2014

		Angler (L.pisc.)		Angler (L.bude.)		Megrim (L.whiff.)		Megrim (L. boscii)	Sole (S. solea)	
		VIIb–k & VIIIa,b,d	VIIIc & IXa	VIIb–k & VIIIa,b,d	VIIIc & IXa	VIIb–k & VIIIa,b,d	VIIIc & IXa	VIIIc & IXa	VIIIa,b	VIIIc & IXa
Belgium	No. lengths	5857		7358		840				
	No. ages									
	No. samples	347		103		82				
E & W (UK)	No. lengths									
	No. ages									
	No. samples	144		144		144				
France	No. lengths									
	No. ages									
	No. samples									
Portugal (a)	No. lengths		0		1		4	26		
	No. ages									
	No. samples		34		34		34	34		34
Republic of	No. lengths									
Ireland	No. ages									
	No. samples	53		53						
Spain	No. lengths						48	1463		
	No. ages							23		
	No. samples						202	255		
Denmark	No. lengths									
	No. ages									
	No. samples									
Total	No. lengths	5857	0	7358	1	840	52	1489		
	No. ages	0	0	0	0	0	0	23		
Total no. in international discards ('000)										
Nb. meas. as % of annual nb. Discarded										

Table 1.3b (continued)

		Hake		Nephrops			Sea Bass		Pollack	Whiting	Plaice
		IIIa, IV, VI, VII & VIIIa,b	VIIIc & IXa	VIIIab FU 2324	VIIIc FU 2531	IXa FU 26-30	VIIIab	VIIIc & IXa	VIII & IXa	VIII & IXa	VIII & IXa
Scotland (UK)	No. lengths	6227									
	No. ages										
	No. samples	101									
E & W (UK)	No. lengths	325									
	No. ages										
	No. samples	270									
France	No. lengths			2671			160				
	No. Ages										
	No. samples			63			138				
Portugal (a)	No. lengths		1180			7		0	0	0	0
	No. ages										
	No. samples		34			34		34	34	34	34
Republic of	No. lengths	7291									
Ireland	No. ages										
	No. samples	63									
Spain	No. lengths	3043	1970		0	853					
	No. ages										
	No. samples	597	381		95	59					
Denmark	No. lengths	2486									
	No. ages										
	No. samples	127									
Total	No. lengths	16886	3150	2671	0	860	160	0	0	0	0
	No. ages	0	0	0	0	0	0	0	0	0	0
Total no. in international discards ('000)		NA	2602	117929							
Nb. meas. as % of annual nb. Discarded		NA	0.1	0.002							

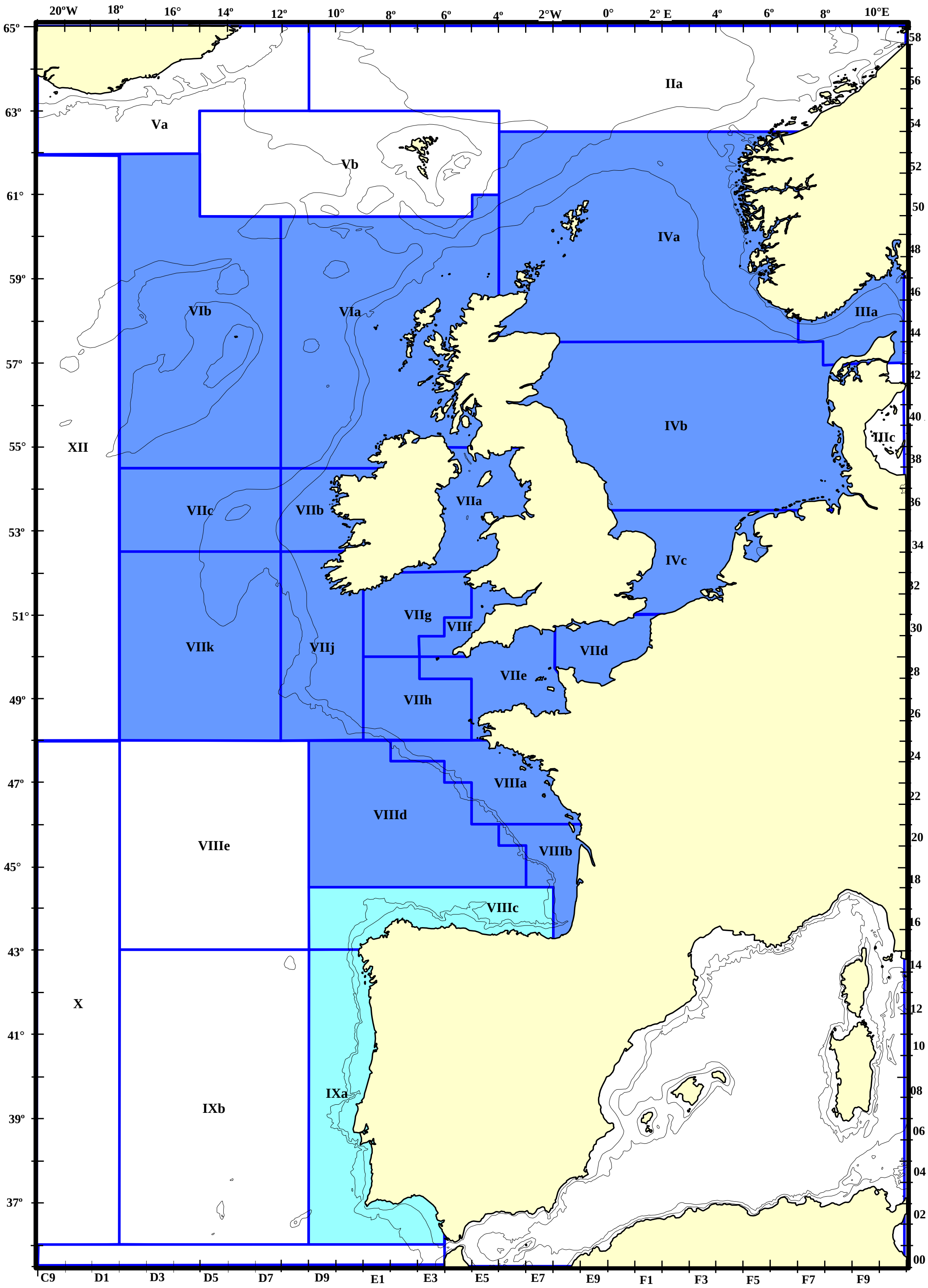


Figure 1.1. Map of ICES Divisions. Northern (IIIa, IV, VI, VII and VIIIabd) and Southern (VIIIc and IXa) Divisions with different shading.

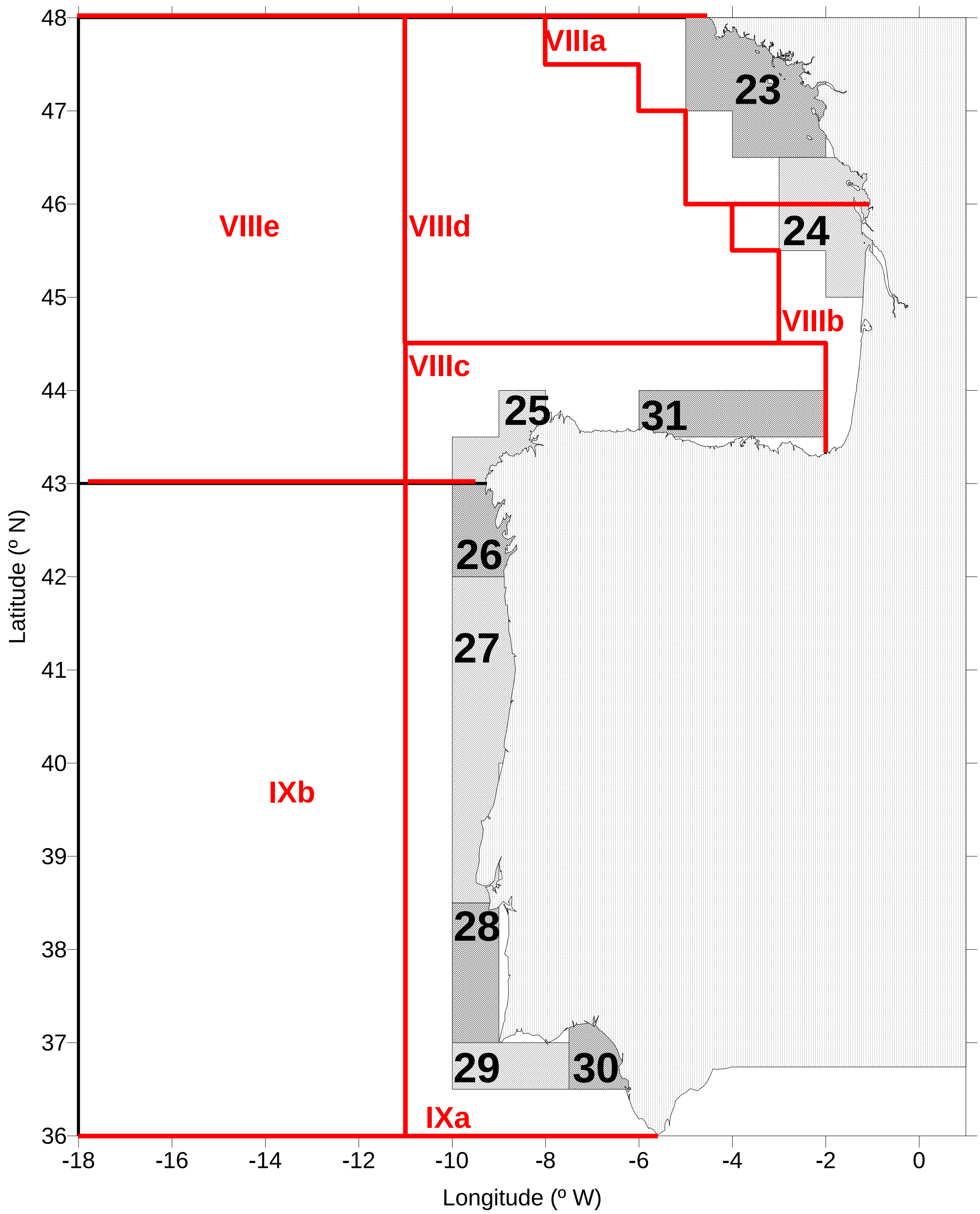


Figure 1.2. ICES Division VIII and IXa. *Nephrops* Functional Units. Division VIIIab (Management Area N): FUs 23-24. Division VIIIc (Management Area O): FUs 25 and 31. Division IXa (Management Area Q): FUs 26-30.

2 Description of Commercial Fisheries and Research Surveys

2.1 Fisheries description

This Section describes the fishery units relevant for the stocks assessed in this WG. Additionally, to facilitate the use of InterCatch, it presents the "fleets" that the WG proposes to use for data submission in InterCatch.

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

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

Under the implementation of the mixed fisheries approach in the ICES WG's new information updating some national fleet segmentations was presented in WGHMM reports in the last few years, from general overviews (ICES, 2004; ICES, 2005) to detailed national descriptions: French fleets (ICES, 2006), Irish fleets (ICES, 2007), and Spanish fleets (ICES, 2008). This new information in relation to the métiers definition did not change the Fishery Units used in the single stock assessments. However, the hierarchical disaggregation of FU into métiers is essential not only for carrying out mixed-fisheries assessments, but also for a deeper understanding of the fisheries behaviour.

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

The EU Data Collection Framework (DCF; Council Regulation (EC) 199/2008; EC Regulation 665/2008; Decision 2008/949/EC) establishes a framework for the collection of economic, biological and transversal data by Member States. One of the most relevant changes of this new period with respect to the previous Data Collection Regulation (DCR; Reg. (EC) No 1639/2001) has been the inclusion of the ecosystem approach by means of moving from stock-based sampling to métier-based sampling. The new DCF defines the métier as "*a group of fishing operations targeting the same species or a similar assemblage of species, using similar gear, during the same period of the year and/or within the same area, and which are characterized by a similar exploitation pattern*". Due to the new sampling design, established since 2009, which can affect the fishery data supplied to this WG, it has been agreed to detail the métiers related with the stocks assessed by this WG, trying to find the correspondence with the Fishing Units.

Data for stock assessment are typically provided to stock coordinators either still according to the old FUs and the traditional tuning fleets or to the DCF métiers. In the case of discards and/or biological data, even though sampling may be done at the DCF métier Level 6, estimates are often re-aggregated to Level 5 due to low sampling levels reached by countries. Thus, this WG agreed to use DCF Level 5 (without mesh size) as the "fleet" level to introduce data in InterCatch. The table below shows the "fleets" to be used for InterCatch and their correspondence with the old Fishery Units and the DCF métiers at Level 6.

FU	Fleet for InterCatch	DCF METIER (Level 6)	DESCRIPTION	FR	IR	SP	UK
FU1	LLS_DEF	LLS_DEF_0_0_0	Set longline directed to demersal fish			X	X
FU2							
FU3	GNS_DEF	GNS_DEF_100-219_0_0	Set gillnet directed to demersal fish (100-219 mm)	X	X	X	
FU4	OTB_DEF	OTB_DEF_70-99_0_0	Bottom otter trawl directed to demersal fish (70-99 mm)		X	X	X
		OTB_DEF_100-119_0_0	Bottom otter trawl directed to demersal fish (100-119 mm)			X	X
FU5	OTB_DEF		Otter trawl directed to demersal Fish shallow water				X
FU6	TBB_DEF		Beam trawl				X
FU8	OTB_CRU						
FU9	OTB_CRU	OTB_CRU_70-99_0_0	Bottom otter trawl directed to crustaceans (70-99 mm)	X	X		X
FU10	OTB_DEF						
FU12	LLS_DEF	LLS_DEF_0_0_0	Set longline directed to demersal fish	X		X	
FU13	GNS_DEF	GNS_DEF_45-59_0_0	Set gillnet directed to demersal fish (45-59 mm)	X			
		GNS_DEF_>=100_0_0	Set gillnet directed to demersal fish (at least 100 mm)	X		X	
FU14	OTB_DEF	OTB_DEF_>=70_0_0	Bottom otter trawl directed to demersal fish (at least 70 mm)	X		X	
	OTB_MCF	OTB_MCF _>=70_0_0	Bottom otter trawl directed to mixed cephalopods and demersal fish (at least 70 mm)			X	
	OTT_DEF	OTT_DEF _>=70_0_0	Multi-rig otter trawl directed to demersal fish (at least 70 mm)	X			
	OTB_CRU	OTB_CRU _>=70_0_0	Bottom otter trawl directed to crustaceans (at least 70 mm)	X			
	OTT_CRU	OTT_CRU _>=70_0_0	Multi-rig otter trawl directed to crustaceans (at least 70 mm)	X			
	OTB_MPD	OTB_MPD _>=70_0_0	Bottom otter trawl directed to mixed pelagic and demersal fish (at least 70 mm)			X	
	PTB_DEF	PTB_DEF _>=70_0_0	Bottom pair trawl directed to demersal fish (at least 70 mm)			X	
FU15	SSC_DEF		Fly shooting seine directed to demersal fish				
FU16	OTB_DEF	OTB_DEF _100-119_0_0	Bottom otter trawl directed to demersal fish (100-119 mm)	X		X	X
	LLS_DEF	LLS_DEF _0_0_0	Set longline directed to demersal fish			X	
	SSC_DEF		Fly shooting seine directed to demersal fish				
FU00	PTM_DEF		Midwater pair trawl directed to demersal fish				

For the Bay of Biscay sole stock, the correspondence with DCF métiers is somewhat complicated because the fleets used are:

Inshore-gillnets (French gillnetters with length < 12 m) (GNx or GTx)

Offshore-gillnets (French gillnetters with length > 12 m) (GNx or GTx)

Inshore-trawlers (French trawlers with length < 12 m) (OTx, TBx, PTx)

Offshore-trawlers (French trawlers with length > 12 m)

In other words, the fleets used correspond to netters and trawlers fishing for sole in the Bay of Biscay, grouped according to vessel length.

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

The Fishery Units operating in the Atlantic Iberian Peninsula waters were described originally in the report of the "Southern hake task force" meeting (STECF, 1994), and have been used for several years in this WG as follows:

COUNTRY	FISHERY UNIT	DESCRIPTION
Spain	Small Gillnet	Gillnet fleet using "beta" gear (60 mm mesh size) for targeting hake in Divisions VIIIc and IXa North
	Gillnet	Gillnet fleet using "volanta" gear (90 mm mesh size) for targeting hake in Division VIIIc
		Gillnet fleet using "rasco"gear (280 mm mesh size) for targeting anglerfish in Division VIIIc
	Long Line	Long line fleet targeting a variety of species (hake, great fork beard, conger) in Division VIIIc
	Northern Artisanal	Miscellaneous fleet exploiting a variety of species in Divisions VIIIc and IXa North
	Southern Artisanal	Miscellaneous fleet exploiting a variety of species in Division IXa South (Gulf of Cádiz)
	Northern Trawl	Miscellaneous fleet operating in Divisions VIIIc and IXa North composed of bottom pair trawlers targeting blue whiting and hake (55 mm mesh size, and 25 m of vertical opening); and two types of bottom otter trawlers (70 mm mesh size): trawlers using the "baca" gear (1.5 of vertical opening) targeting hake, anglerfish, megrim and Nephrops, and trawlers using "jurelera" (often referred to as "HVO", high vertical opening, in the present report) gear (>5m of vertical opening) targeting mackerel and horse mackerel.
	Southern Trawl	Bottom otter trawlers operating in Division IXa South (Gulf of Cádiz) exploiting a variety of species (sparids, cephalopods, sole, hake, horse mackerel, blue whiting, shrimp, Norway lobster).
Portugal	Artisanal	Miscellaneous fleet with two components (inshore and offshore) operating in Portuguese waters of Division IXa involving gillnet (80 mm mesh size), trammel (100 mm mesh size), long line and other gears. Species caught: hake, octopus, pout, horse mackerel and others
	Trawl	Trawl fleet opertaing in Portuguese waters of Division IXa copmpounded by bottom otter trawlers targeting crustaceans (55 mesh size), and bottom oter trawlers targeting different species of fish (65 mm mesh size).

The Spanish and Portuguese fleets operating in the Atlantic Iberian Peninsula shelf were segmented into métiers under the EU project IBERMIX (DG FISH/2004/03-33), and the results were described in Section 2 of the 2007 WGHMM report (ICES, 2007).

The correspondence between Fishing Units and DCF métiers has been also compiled for the southern stocks fleets and is presented in the following table. As for the Celtic-Biscay shelf, sampling inconsistencies among biological and commercial data make the use of the DCF Level 5 preferable to introduce Iberian data in InterCatch. This re-aggregation affects the Spanish gillnet operating in the Northern Spanish waters, because the set gillnet ("*beta*") directed to hake (GNS_DEF_60-79_0_0) and the set gillnet ("volanta") also targeting hake (GNS_DEF_80-99_0_0) must be sampled together. It must taken into account that the set gillnet using more than 280 mm mesh size (GNS_DEF_280_0_0) targets mostly anglerfish and cannot be distinguished at Level 5 (the level proposed for the InterCatch fleets) from the two gillnet métiers previously mentioned (which are directly mainly to hake). So a revision of the current InterCatch fleet proposal may be required in this case (to be decided by the WG by mid-September, as stated at the start of Section 2.1).

COUNTRY	FU	Fleet for InterCatch	METIERS (Level 6)	DESCRIPTION (mesh size in brackets)	SP	PT
	Gillnet		GNS_DEF_80-99_0_0	Set gillnet directed to demersal species (80-99 mm)	X	
		GNS_DEF	GNS_DEF_280_0_0	Set gillnet directed to demersal species (at least 280 mm)	X	
	Northern Arisanal		GNS_DEF_60-79_0_0	Set gillnet directed to demersal fish (60-79 mm)	X	
	Longline	LLS_DEF	LLS_DEF_0_0_0	Set longline directed to demersal fish	X	
Spain	Southern artisanal	LLS_DWS	LLS_DWS_0_0_0	Set longline directed to deep-water species	X	
		PTB_DEF	PTB_DEF _>= 55_0_0	Pair bottom trawl directed to demersal fish (at least 55 mm)	X	
	Northern Trawl	OTB_DEF	OTB_DEF_>=55_0_0	Otter bottom trawl directed to demersal fish (at least 55 mm)	X	
		OTB_MPD	OTB_MPD_>=55_0_0	Otter bottom trawl directed to mixed pelagic and demersal fish (at least 55 mm)	X	
	Southern trawl	OTB_DEM	OTB_DEM_>=55_0_0	Otter bottom trawl directed to demersal species (at least 55 mm)	X	
		GTR_DEF	GTR_DEF_>=100_0_0	Trammel net directed to demersal fish (at least 100 mm)		X
	Artisanal	GNS_DEF	GNS_DEF_80-99_0_0	Set gillnet directed to demersal fish (80-99 mm)		X
Portugal		LLS_DEF	LLS_DEF_0_0_0	Set longline directed to demersal fish		X
		LLS_DWS	LLS_DWS_0_0_0	Set longline directed to deep-water species		X
	Trawl	OTB_CRU	OTB_CRU_>=55_0_0	Otter bottom trawl directed to crustaceans (at least 55 mm)		X
		OTB_DEF	OTB_DEF_60-69_0_0	Otter bottom trawl directed to demersal fish (60-69 mm)		X

2.2 Description of surveys

This section gives a brief description of the surveys referred to in this WG report. The surveys are listed in the following table, including the acronym used by WGHMM in 2010, the DCF acronym and the new ICES survey acronym which will be used throughout this WG report and Stock Annexes. The new survey acronyms used this year were provided by ICES Secretariat, aiming for consistency across all ICES Expert Groups. When ICES Secretariat has not included a survey in the list for which it has provided acronyms, the WGHMM 2010 acronym will remain in use.

Survey	WGHMM 2010 acronym	DCF acronym	ICES survey acronym as of 2011
Spanish groundfish survey – quarter 4	SP-GFS	IBTS-EA-4Q	SpGFS-WIBTS-Q4
Spanish Porcupine groundfish survey	SP-PGFS	IBTS-EA	SpPGFS-WIBTS-Q4
Spanish Cadiz groundfish survey – Autumn	SP-GFS-caut		SPGFS-caut-WIBTS-Q4
Spanish Cadiz groundfish survey – Spring	SP-GFS-cspr		SPGFS-cspr-WIBTS-Q1
Portuguese groundfish survey – October	P-GFS-oct	IBTS-EA-4Q	PtGFS-WIBTS-Q4
Portuguese groundfish survey – July (terminated)	P-GFS-jul		----
Portuguese crustacean trawl survey / Nephrops TV survey offshore Portugal	P-CTS	UWFT (FU 28-29)	PT-CTS (UWTV (FU 28-29))
Portuguese winter groundfish survey/Western IBTS 1st quarter	PESCADA-BD		PtGFS-WIBTS-Q1
French EVHOE groundfish survey	EVHOE	IBTS-EA-4Q	EVHOE-WIBTS-Q4
French RESSGASC groundfish survey (ended in 2002)	RESSGASC		----
French Bay of Biscay sole beam trawl survey	ORHAGO		ORHAGO
French Nephrops survey in Bay of Biscay	LANGOLF		LANGOLF
UK west coast groundfish survey (ended in 2004)	UK-WCGFS		-----
UK Western English Channel Beam Trawl Survey			UK-WECBTS
UK Bottom Trawl Survey			EN-CEFAS-A, B
English fisheries science partnership survey	EW-FSP		FSP-Eng-Monk
Irish groundfish survey	IGFS	IBTS-EA-4Q	IGFS-WIBTS-Q4

A brief description of each survey follows. A general map identifying survey areas can be found in ICES IBTS WG reports.

2.2.1 Spanish groundfish survey (SpGFS-WIBTS-Q4)

The SpGFS-WIBTS-Q4 covers the northern Spanish shelf comprised in ICES Division VIIIc and the northern part of IXa, including the Cantabrian Sea and off Galicia waters.

It is a bottom trawl survey that aims to collect data on the distribution, relative abundance and biology of commercial fish species such as hake, monkfish and white anglerfish, megrim, four-spot megrim, blue whiting and horse mackerel. Abundance indices are estimated by length and in some cases by age, with indices also estimated for *Nephrops*, and data collected for other demersal fish and invertebrates. The survey is ca. 120 hauls and is from 30-800 m depths, usually starts at the end of the 3rd quarter (September) and finishes in the 4th quarter.

2.2.2 Spanish Porcupine groundfish survey (SpPGFS-WIBTS-Q4)

The SpPGFS-WIBTS-Q4 occurs at the end of the 3rd quarter (September) and start of the 4th quarter. It is a bottom trawl survey that aims to collect data on the distribution, relative abundance and biology of commercial fish in ICES Division VIIb-k, which corresponds to the Porcupine Bank and the adjacent area in western Irish waters between 180-800m. The survey area covers 45 880 Km^2 and approximately 80 hauls per year are carried out.

2.2.3 Cadiz groundfish surveys - Spring (SPGFS-cspr-WIBTS-Q1) and Autumn (SPGFS-caut-WIBTS-Q4)

The bottom trawl surveys SPGFS-cspr-WIBTS-Q1 and SPGFS-caut-WIBTS-Q4 occur in the southern part of ICES Division IXa, the Gulf of Cádiz, and collect data on the distribution, relative abundance, and biology of commercial fish species. The area covered is 7 224 Km^2 and extends from 15-800m. The primary species of interest are hake, horse mackerel, wedge sole, sea breams, mackerel and Spanish mackerel. Data and abundance indices are also collected and estimated for other demersal fish species and invertebrates such as rose and red shrimps, *Nephrops* and cephalopod molluscs.

2.2.4 Portuguese groundfish survey October (PtGFS-WIBTS-Q4)

PtGFS-WIBTS-Q4 extends from latitude 41°20' N to 36°30' N (ICES Div. IXa) and from 20 to 500m depth. The survey takes place in Autumn. The main objectives of the survey is to estimate the abundance and study the distribution of the most important commercial species in the Portuguese trawl fishery (hake, horse mackerel, blue whiting, seabream and *Nephrops*), mainly to monitor the abundance and distribution of hake and horse mackerel recruitment. The surveys aim to carry out ca. 90 stations per year.

2.2.5 Portuguese crustacean trawl survey / *Nephrops* TV survey offshore Portugal (PT-CTS (UWTV (FU 28-29))

The PT-CTS (UWTV (FU 28-29)) survey is carried out in May-July and covers the southwest coast (Alentejo or FU 28) and the south coast (Algarve or FU 29). The main objectives are to estimate the abundance, to study the distribution and the biological characteristics of the main crustacean species, namely *Nephrops norvegicus* (Norway lobster), *Parapenaeus longirostris* (rose shrimp) and *Aristeus antennatus* (red shrimp). The average number of stations in the period 1997-2004 was 60. Sediment samples have been collected since 2005 with the aim to study the characteristics of the *Nephrops* fishing grounds. In 2008 and 2009, the crustacean trawl survey conducted in Functional Units 28 and 29, was combined with an experimental video sampling.

2.2.6 Portuguese winter groundfish survey/Western IBTS 1st quarter (PtGFS-WIBTS-Q1)

The PtGFS-WIBTS-Q1survey has been carried out along the Portuguese continental waters from latitude 41°20' N to 36°30' N (ICES Div. IXa) and from 20 to 500m depth. The winter groundfish survey plan comprises 75 fishing stations, 66 at fixed positions and 9 at random. The main aim of the survey is to estimate spawning biomass of hake.

2.2.7 French EVHOE groundfish survey (EVHOE-WIBTS-Q4)

The EVHOE-WIBTS-Q4 survey covers the Celtic Sea with ICES Divisions VIIfghj, and the French part of the Bay of Biscay in divisions VIIIab. The survey is conducted from 15 to 600 m depths, usually in the fourth quarter, starting at the end of the October. The primary species of interest are hake, monkfish, anglerfish, megrim, cod, haddock and whiting, with data also collected for all other demersal and pelagic fish. The sampling strategy is stratified random allocation, the number of set per stratum based on the 4 most important commercial species (hake, monkfishes and megrim) leaving at least two stations per stratum and 140 valid tows are planned every year although this number is dependent on available sea time.

2.2.8 French RESSGASC groundfish survey (RESSGASC)

The RESSGASC survey was conducted in the Bay of Biscay from 1978 to 2002. Over the years 1978-1997 the survey was conducted with quarterly periodicity. It was conducted twice a year after that (in Spring and Autumn). Survey data prior to 1987 are normally excluded from the time series, since there was a change of vessel at that time.

2.2.9 French Bay of Biscay sole beam trawl survey (ORHAGO)

The ORHAGO survey was launched in 2007, with the aim of producing an abundance index and biological parameters such as length distribution for the Bay of Biscay sole. It is usually carried out in November, with approximately 23 days of duration and sampling 70-80 stations. It uses beam trawl gear and is coordinated by the ICES WGBEAM.

2.2.10 French *Nephrops* survey in the Bay of Biscay (LANGOLF)

This survey commenced in 2006 specifically for providing abundance indices of *Nephrops* in the Bay of Biscay. It is carried out on the area of the Central Mud Bank of the Bay of Biscay (ca.11680 km^2), in the second quarter (May apart from the 1st year when the survey occurred in April), using twin trawl, with hours of trawling around dawn and dusk. The whole mud bank is divided to five sedimentary strata and the sampling allocation combines the surface by stratum and the fishing effort concentration. 70-80 experimental hauls are carried out by year. Since the IBP *Nephrops* 2012, this survey is included as tuning series in the stock assessment.

2.2.11 UK west coast groundfish survey (UK-WCGFS)

This survey, which ended in 2004, was conducted in March in the Celtic sea with ca. 62 hauls. It does not include the 0-age group with one of the primary aims to investigate the 1 and 2 age groups. Numbers at age for this abundance index are estimated from length compositions using a mixed distribution by statistical method.

2.2.12 English fisheries science partnership survey (FSP-Eng-Monk)

The FSP-Eng-Monk survey, part of the English fisheries science partnership programme, has been carried out every year since 2003 with 208 valid hauls in 2010. The aims of the survey are to investigate abundance and size composition of anglerfish on the main UK anglerfish fishing grounds off the southwest coast of England within ICES subdivisions VIIe-h.

2.2.13 English Western English Channel Beam Trawl Survey

Since 1989 the survey has 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 or 4 knots in an area within 35 miles radius of Start Point. The objective is to provide indices of abundance, which are independent of commercial fisheries, of all age groups of sole and plaice on the western Channel grounds, and an index of recruitment of young (1-3 year-old) sole prior to full recruitment to the fishery.

2.2.14 English Bottom Trawl Survey

This bottom trawl survey covered the Irish, Celtic Sea and Western English Channel but was it discontinued in 2004.

2.2.15 Irish groundfish survey (IGFS-WIBTS-Q4)

The IGFS-WIBTS-Q4 is carried out in 4th quarter in divisions VIa, VIIbcgj, though only part of VIa and the border of Division VIIc, in depths of 30-600m. The annual target is 170 valid tows of 30 minute duration which are carried out in daylight hours at a speed of 4 knots. Data is collected on the distribution, relative abundance and biological parameters of a large range of commercial fish such as haddock, whiting, plaice and sole with survey data provided also for cod, white and black anglerfish, megrim, lemon sole, hake, saithe, ling, blue whiting and a number of elasmobranchs as well as several pelagics (herring, horse mackerel and mackerel).

3 Anglerfish (*Lophius piscatorius and Lophius budegassa*) in Divisions VIIb-k and VIIIa,b,d

There has been no accepted assessment for either *L. piscatorius* or *L. budegassa* since 2007. The Working Group in 2007 found that the input data showed deficiencies, especially as discarding was known to be increasing and that ageing problems had become more obvious. The stock went through a benchmark process during 2012 (WKFLAT 2012) but no analytical assessment was found acceptable.

L. piscatorius and L. budegassa:

Type of assessment in 2015: Same Advice as Last Year (SALY).

Data revisions this year: 2013 Spanish landings were revised.

Review Group issues:

The RG noted that unless discarding of small fish is taken into account, it may be difficult to develop a length-based analytical assessment for this stock.

3.1 General

3.1.1 Summary of ICES advice for 2015 and management for 2014 and 2015

ICES advice for 2015

Lophius piscatorius

ICES advises that when the precautionary approach is applied, landings in 2016 should be no more than 10 757 tonnes. ICES cannot quantify the corresponding total catches.

Lophius budegassa

ICES advises that when the precautionary approach is applied, landings in 2016 should be no more than 26 691 tonnes. ICES cannot quantify the corresponding total catches.

Management of the two anglerfish species under a combined TAC prevents effective control of the single-species exploitation rates and could potentially lead to overexploitation of either species

Management applicable for 2014 and 2015

The TAC applied to both species and including Division VIIa was set at 42 496 t for 2014 and for 2015.

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

3.1.2 Landings

Landings have increased since 2000 and have fluctuated around 33 000 t since 2003. The landings of both species combined were estimated to be 28 880 t in 2010, 28 357 t in 2011 and 33 373 t in 2012. Estimated landings of 36 855 t in 2013 are at the highest level over the last 10 years and the fourth highest of the time series, landings of 36 200 in 2014, are close to levels seen in 2013 (Table 3.1-1).

There was a revision for the Spanish data for the years 2011 to 2012 due to the new method in estimating the landings. Although the total landings for the two species combined are similar to the previous estimates this has had an impact on how the species are split for assessment purposes. Therefore the WG decided not to use this data until details of the sampling used and the effects of the new method are clarified.

3.1.3 Discards

Estimates of discards have been carried out and new data have been made available to the working group by all countries for the first time. This information shows that an increasing proportion of small fish of both species are caught and discarded. After an extensive analysis of discard data by WKFLAT 2012, discard estimates were considered not to be precise with a high level of uncertainty due to raising methods using very limited sampling, therefore the group decided not to use the discard estimates in the assessment or for advice purposes.

Table 3.1-1. Anglerfish in Divisions VIIb-k and VIIIa,b,d -Total landings from 1984 to 2014 – Working Group estimates

Year	VIIb-k	VIIIa,b,d	Total
1977			19 895
1978			23 445
1979			29 738
1980			38 880
1981			39 450
1982			35 285
1983			38 280
1984	28 847	7 909	36 756
1985	28 491	7 161	35 652
1986	25 987	5 897	31 883
1987	22 295	7 233	29 528
1988	22 494	5 983	28 477
1989	24 674	5 276	29 950
1990	23 434	5 950	29 384
1991	20 256	4 684	24 940
1992	17 412	3 530	20 942
1993	16 517	3 507	20 024
1994	18 023	3 841	21 864
1995	21 822	4 862	26 684
1996	24 153	6 102	30 255
1997	23 928	5 846	29 774
1998	23 295	4 876	28 171
1999	21 845	3 143	24 988
2000	18 129	2 456	20 585
2001	19 534	2 875	22 409
2002	22 648	3 571	26 220
2003	28 552	4 681	33 233
2004	29 510	5 640	35 150
2005	27 908	5 167	33 075
2006	26 795	4 823	31 618
2007	30 121	5 213	35 334
2008	26 724	5 032	31 756
2009	22 733	5 193	27 926
2010	23 338	5 542	28 880
2011	22 458	5 900	28 357
2012	24 370	9 004	33 373
2013*	25 994	10 861	36 855
2014**	27 950	8 251	36 200

* revised
** preliminar

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

3.2.1 Data

3.2.1.1 Commercial Catch

The Working Group estimates of landings of *L. piscatorius* by fishery unit (defined in Section 2 of the report) are given in Table 3.2-1 *Lophius piscatorius* in Divisions VIIb-k and VIIIa,b,d - Landings in tonnes by Fishery Unit.

The landings have declined steadily from 23 666 t in 1986 to 12 766 t in 1992, then increased to 22 162 t in 1996 and declined to 13 941 t in 2000. The landings have increased since then reaching the maximum of the time series in 2007 (28 977 t). The 2008 value shows a 16% drop to 24 376 t. In 2009 the decreasing trend continued with a 24 % drop (18 844 t) and in 2010 landings recovered to historic mean levels at 19 521 t.

The 2011 landings started an increasing trend with landings estimates of 20 370 t. The 2012 landings showed a further increase to 24 409 t. In 2013 a slight decrease of the landings gave a figure of 23 759 t. In 2014 the preliminary data estimated the landings of *L. piscatorius* to be 25 328 t.

3.2.1.2 Commercial LPUE

Effort and LPUE data for the three Spanish fleets and English FU6 were available up to 2014 (Table 3.2-2 *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d- Effort and LPUE data and Figure 3.2-1 *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d- Effort and LPUE data). Fishing effort for most fleets showed a decrease until the mid 1990's. Effort remained relatively stable thereafter, from 2011 to 2014 a sharp decrease in SP-VIGO7 (66 % reduction) and SP-CORUTR7 (83 % reduction) was recorded maybe due to the vessels with in the fleet landing under a different country but operating as in previous years.

All the commercial LPUE series decreased steadily until 1992. Since then, they have increased up to 2007 except for the 2 BAKA fleets. Most showed a decline in 2008. In 2009 and 2010 EW-FU06 and both BAKA fleets showed an increasing trend but SP-VIGO7 and SP-CORUTR7 showed a decreasing one. In 2011 all available fleets showed an increasing trend that continues in 2012 for all fleets with the exception of EW-FU06. In 2013 Spanish fleets showed the second highest LPUE of the time series and SP-VIGO7, SP-CORUTR7 and EW-FU06 continued decreasing but remaining the fifth highest of the time series. In 2014 SP-VIGO7, SP-CORUTR7 and EW-FU06 showed the highest LPUE's of the time-series.

3.2.1.3 Surveys data

3.2.1.3.1 The French EVHOE-WIBTS-Q4 survey

This survey covers the highest proportion of the area of stock distribution. Standardised biomass and abundance indices are given inFigure 3.2-2 L. *piscatorius* in Divisions VIIb-k and VIIIa,b,d- Time-series of the EVHOE-WIBTS-Q4 survey indices Kg (left) and Nb (right) per 30 minutes tow from 1997 to 2014and the length distributions in Figure 3.2-3 - *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d. Time-series of the EVHOE-WIBTS-Q4 Length distributions in Nb per 30 minutes tow from 1997 to 2014.

The biomass indices show a continuous increase from 2000 to 2007 and a decrease thereafter, with the 2010 index value in between those from 2000 and 2001. In 2011 the indices were as high as the 2005 value and the 2012 value recorded the historical maximum, in 2013 the index was similar to 2011 level and 2014 index similar to 2010 level. Abundance in numbers shows four peaks in 2001, 2002, 2004 and to a lesser extent 2008. Since 2008 the abundance in numbers remains stable. In 2013 and 2014 the abundance in number showed one of the lowest levels in the 2001 – 2014 period.

The length distribution shows that these peaks in numbers of abundance correspond to strong incoming year-classes that can be tracked from year to year with modes between 10-25 cm for the first age group (in 2001, 2002, 2004, 2008, 2009, 2010 ,2011 and 2014), 25 – 45 for the second (2002, 2003, 2005, 2009, 2010, 2011 and 2014) and 45-55 for the third (2003, 2004, 2005, 2010 and 2011), although, the third mode is not as clearly defined.

These year classes are now still present in the recent survey catches at larger sizes and account for the higher biomass index. The length distribution in 2009 and 2010 indicates two good recruitments at the level seen in 2008, although not as strong as in 2001, 2002 and 2004. 2011 and 2012 recruitment seems to be at medium levels. 2013 recruitment is the second lowest since 2001. 2014 recruitment is similar to the 2008 – 2010 levels.

In Figure 3.2-4 and, Figure 3.2-5 the distribution of recruits (identified as individuals of less than 23 cm) show that contrasting with the years 2001, 2002 and 2004 where the recruits were found in both Celtic Sea and Bay of Biscay areas along the shelf, the recruits were found almost only south of the Celtic Sea and in the Bay of Biscay in 2008 and 2009. The results from 2010 to 2012 show a uniform distribution of recruits through the sampling area of the survey. 2013 shows a uniform distribution with low levels of recruitment. In 2014 the recruitment was found only in the Bay of Biscay area.

3.2.1.3.2 The Spanish Porcupine Groundfish Survey (SPPGFS (WIBTS-Q4))

This survey was initiated in 2001 and covers the Porcupine Bank. Standardised biomass and abundance indices are given in Figure 3.2-6 and the length distributions in Figure 3.2-7. Although covering a small area of the total stock distribution, similar pulses of recruitment are detected in 2001 and to a lower extent in the years 2002 to 2004. In 2010 a recruitment level similar to 2002-2004 was found. In 2011 the recruitment level was low and in 2012 the recruitment returned to medium values. In 2013 a revision of the indices for the period 2003-2012 was presented with no effects in the trends of the series. 2013 values are the second higher of the series for both biomass and abundance indices. 2014 values are the maximum of the series for both indices.

3.2.1.3.3 The Irish Groundfish Survey (IGFS-WIBTS-Q4)

Abundance indices in numbers per ten square kilometres from this survey are given in

Table 3.2-3 and length distributions from 2001 to 2014 in Figure 3.2-8 - *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d- Time-series of the IGFS-WIBTS-Q4 Length distributions in Nb per 10 Km^2 from 2001 to 2014. The index shows the same drop as the EVHOE-WIBTS-Q4 and the SPPGFS (WIBTS-Q4) after the peak in 2004. The 2009 index showed a recovery in abundance, although it was still lower than the 2005 value. In 2010 and 2011 a value close to the 2004 maximum has been found. In 2012 a value similar to the 2009 medium level was recorded. In 2013 the value continued in medium levels but higher than in 2012. In 2014 the index shows the maximum of the series with 114.9 Nb/10 Km^2, and the length distribution of the catch shows the highest recruitment of the series.

3.2.2 Conclusion

LPUE's and survey data (biomass, abundance indices and length distributions) give indication that the biomass has been increasing as a consequence of the good recruitment observed in 2001, 2002 and 2004 and has stabilised in recent years. There is evidence of good recruitments in 2008, 2009, 2010 and 2011. 2008 and 2009 recruitments have entered the fishery giving one of the higher yields of the time series. Recruitment in 2012 and 2013 was lower than previous years and this could have implications for the total biomass of the stock in the future but if the very high recruitment of 2014 is confirmed this could offset the expected reduction in biomass.

Preliminary information on discards shows that an increasing proportion of small fish are caught and discarded (WKFLAT12) and results from this year's data available for the first time to the working group shows that around nine percent of the catch is discarded. Due to the low levels of sampling and the uncertainties in the precision of the estimates the group recommends that the discard estimates are not used in the assessment or for advice purposes.

As discard information has been made available to the working group further years submissions will allow for a more extensive analysis of the estimates so that catch information can be presented with confidence

With the discarding of small fish caught, measures should be taken to ensure good survival of the recent recruits such as spatial and technical measures.

The Working Group concludes that in view of the available data, continuing fishing at present level should not harm the stock.

3.2.3 Comments on the assessment

Data from surveys tracking recent good recruitment give scope for the use of length based models for assessment, growth studies and ageing validation that should be initiated as soon as possible.

Table 3.2-1 ***Lophius piscatorius*** **in Divisions VIIb-k and VIIIa,b,d - Landings in tonnes by Fishery Unit.**

	VIIb,c,e-k						VIIIa,b,d				
Year	Gill-Net (Unit 3+13)	Medium/ Deep Trawl (Unit 4)	Shallow Trawl (Unit 5)	Beam Trawl (Unit 6)	Shallow/ medium Neph.Trawl (Unit 8)	Unallocated	Neph.Trawl (Unit 9)	Shallow Trawl (Unit 10)	Medium/ Deep Trawl (Unit 14)	Unallocated	TOTAL VII +VIII
1986	429	13781	2877	1437	1021	0	746	720	2657	0	23666
1987	560	11414	2900	1520	787	0	1035	542	3152	0	21909
1988	643	9812	3105	1814	774	0	927	534	2487	0	20095
1989	781	8448	5259	2998	754	0	673	444	1772	0	21130
1990	1021	8787	3950	1736	880	0	410	391	2578	0	19753
1991	1752	7563	2793	1142	752	0	284	218	1657	0	16160
1992	1773	6254	1492	998	887	0	254	166	942	0	12766
1993	1742	5776	2125	1258	969	0	360	278	950	0	13458
1994	1377	7344	2595	1523	1236	0	261	198	1586	0	16120
1995	1915	8461	3195	1805	1242	0	501	429	1954	228	19730
1996	2244	9796	2658	2189	1149	138	441	379	2229	938	22162
1997	2538	9225	2945	2031	964	39	429	376	2045	1068	21660
1998	3398	8714	2138	1722	812	3	397	149	1699	542	19572
1999	3162	9037	2369	1409	780	19	98	116	1259	0	18250
2000	2034	7067	1642	1434	726	6	91	77	863	0	13941
2001	2002	7880	2293	1978	886	17	146	76	1402	0	16681
2002	2719	9465	2609	1836	924	22	247	96	1908	0	19826
2003	3498	12332	2786	1983	974	81	470	168	2575	0	24865
2004	5004	12770	2642	2460	852	14	457	218	3296	0	27714
2005	5154	11556	2400	2388	594	7	342	165	2936	2	25543
2006	3741	13409	2216	2421	700	3	429	218	2758	2	25898
2007	4594	14949	2382	2836	660	11	286	244	3015	0	28977
2008	5107	11766	1885	1990	491	10	227	325	2573	1	24376
2009	3957	9938	358	1880	48	16	221	0	2153	275	18844
2010	3398	9851	539	2503	21	31	301	0	2373	504	19521
2011	2152	8968	548	3019	12	1658	231	0	2285	1497	20370
2012	2905	10392	513	3231	14	1260	195	0	3731	2168	24409
2013*	2045	11118	392	3081	71	1191	216	0	4245	1400	23759
2014**	2681	15018	494	2568	102	342	286	0	3754	84	25328

* revised

** preliminar

Table 3.2-2 *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d- Effort and LPUE data

EFFORT	SP-VIGO7 in Sub-Area VII ('000 days*HP)	SP-CORUTR7 in Sub-Area VII ('000 days*HP)	French Benthic trawlers* Celtic Sea FU04 ('000 hrs)	French Benthic Twin Trawls Celtic Sea ('000 hrs)	French Benthic trawlers* Bay of Biscay FU14 ('000 hrs)	French Benthic Twin Trawls Bay of Biscay ('000 hrs)	EW FU06 Beam trawlers in VII ('00 days)	SP-BAKON7 (days)	SP-BAKON8 (days)
1986	6 875	9 527	418	N/A	123	N/A	N/A		
1987	6 662	10 453	349	N/A	199	N/A	N/A		
1988	6 547	10 886	334	N/A	150	N/A	N/A		
1989	7 585	10 483	378	N/A	187	N/A	N/A		
1990	8 021	9 630	380	N/A	208	N/A	N/A		
1991	7 822	8 522	380	N/A	210	N/A	N/A		
1992	6 370	5 852	331	N/A	186	N/A	100		
1993	5 988	5 001	274	N/A	159	N/A	114	1 094	5 590
1994	5 655	4 990	249	N/A	148	N/A	116	980	5 619
1995	5 070	4 403	287	N/A	174	N/A	127	1 214	4 474
1996	5 416	3 746	196	121	144	19	126	1 170	4 378
1997	5 058	3 738	178	133	133	33	126	540	4 286
1998	5 360	3 684	182	134	117	40	121	1 196	3 002
1999	5 084	3 512	110	110	83	59	115	1 384	2 337
2000	5 519	2 773	165	104	87	49	104	1 850	2 227
2001	5 678	2 356	135	133	61	66	186	1 451	2 118
2002	5 041	2 258	116	120	57	75	111	949	2 107
2003	5 437	2 597	147	136	68	81	166	1 022	2 296
2004	5 347	2 292	160	133	78	89	174	910	2 159
2005	5 246	2 120	127	137	83	121	109	544	2 263
2006	5 392	2 257	140	145	72	101	94	487	2 398
2007	5 812	2 323	149	152	48	127	97	476	2 098
2008	5 432	1 640	118	126	58	113	138	105	2 017
2009	5 155	1 626					75	0	1 807
2010	4 843	1 988					77	138	1 358
2011	4 553	1 725					82	57	1 384
2012	3 276	937					84		1 384
2013	2 683	563					146		1 185
2014	1 530	292					79		1 694

LPUE	Vigo in Sub-Area VII (kg/days*HP)	La Coruna in Sub-Area VII (kg/days*HP)	French Benthic trawlers* Celtic Sea FU04 (kg/10 hrs)	French Benthic Twin Trawls Celtic Sea (kg/10 hrs)	French Benthic trawlers* Bay of Biscay FU14 (kg/10 hrs)	French Benthic Twin Trawls Bay of Biscay (kg/10 hrs)	EW (FU06) Beam trawlers in VII (kg/days)	SP-BAKON7 (kg/day)	SP-BAKON8 (kg/day)
1986	286	383	143		131				
1987	235	326	142		119				
1988	182	272	132		110				
1989	210	236	102		61				
1990	206	228	104		85				
1991	184	234	82		55				
1992	188	200	56		35		94		
1993	268	172	60		42		93	60	23
1994	289	187	111		75		81	73	44
1995	410	131	131		84		77	99	56
1996	520	212	117	159	81	113	110	130	70
1997	440	245	105	133	78	84	117	132	71
1998	451	193	95	113	60	66	111	134	66
1999	428	136	52	76	42	44	95	125	34
2000	203	182	87	73	34	45	109	186	31
2001	239	170	103	119	56	85	82	184	61
2002	469	218	138	152	69	120	123	218	72
2003	598	286	191	186	102	154	80	274	76
2004	563	249	134	188	87	172	93	249	119
2005	591	356	170	146	99	133	144	287	100
2006	568	383	183	196	108	137	175	221	89
2007	611	409	233	214	118	151	202	261	71
2008	466	542	214	190	97	122	106	171	101
2009	350	252					198		144
2010	298	454					250	217	132
2011	417	384					266	484	157
2012	599	526					235		212
2013	649	724					136		246
2014	683	891					263		100

Table 3.2-3 - *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d– Abundance indices in Nb/sq Km from 2003 to 2014 from the IGFS-WIBTS-Q4.

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Nb/sqKm	69.3	94.4	67.5	33.1	21.1	19.4	45.2	83.6	80.8	49.6	60.1	114.9

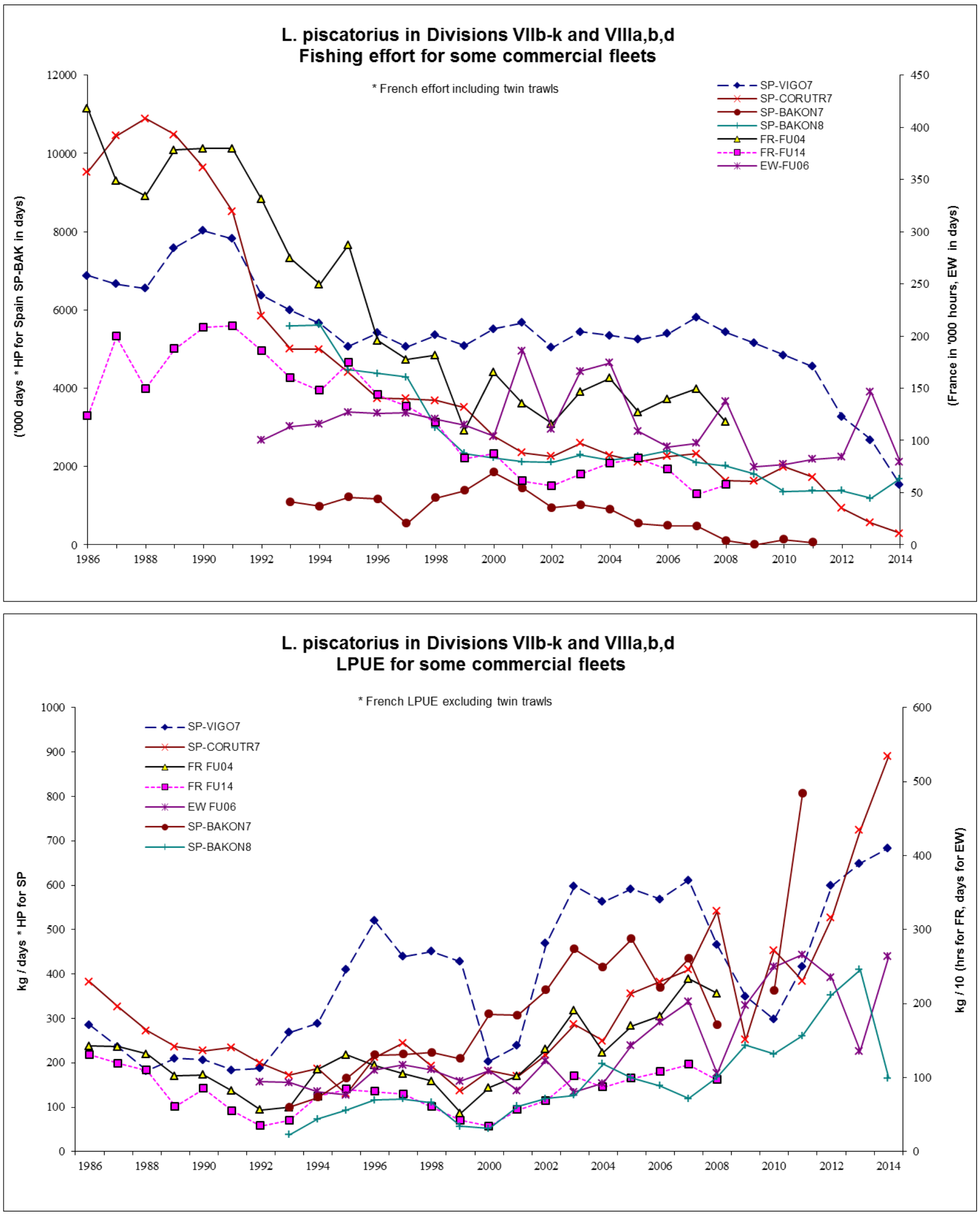


Figure 3.2-1 ***L. piscatorius*** **in Divisions VIIb-k and VIIIa,b,d- Effort and LPUE data**

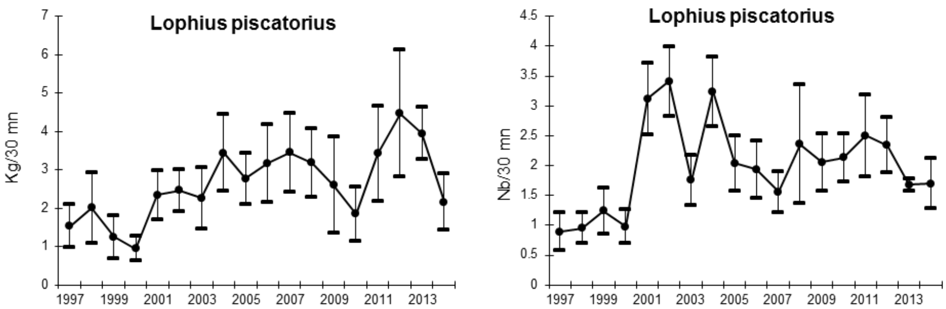


Figure 3.2-2 ***L. piscatorius*** **in Divisions VIIb-k and VIIIa,b,d- Time-series of the EVHOE-WIBTS-Q4 survey indices Kg (left) and Nb (right) per 30 minutes tow from 1997 to 2014**

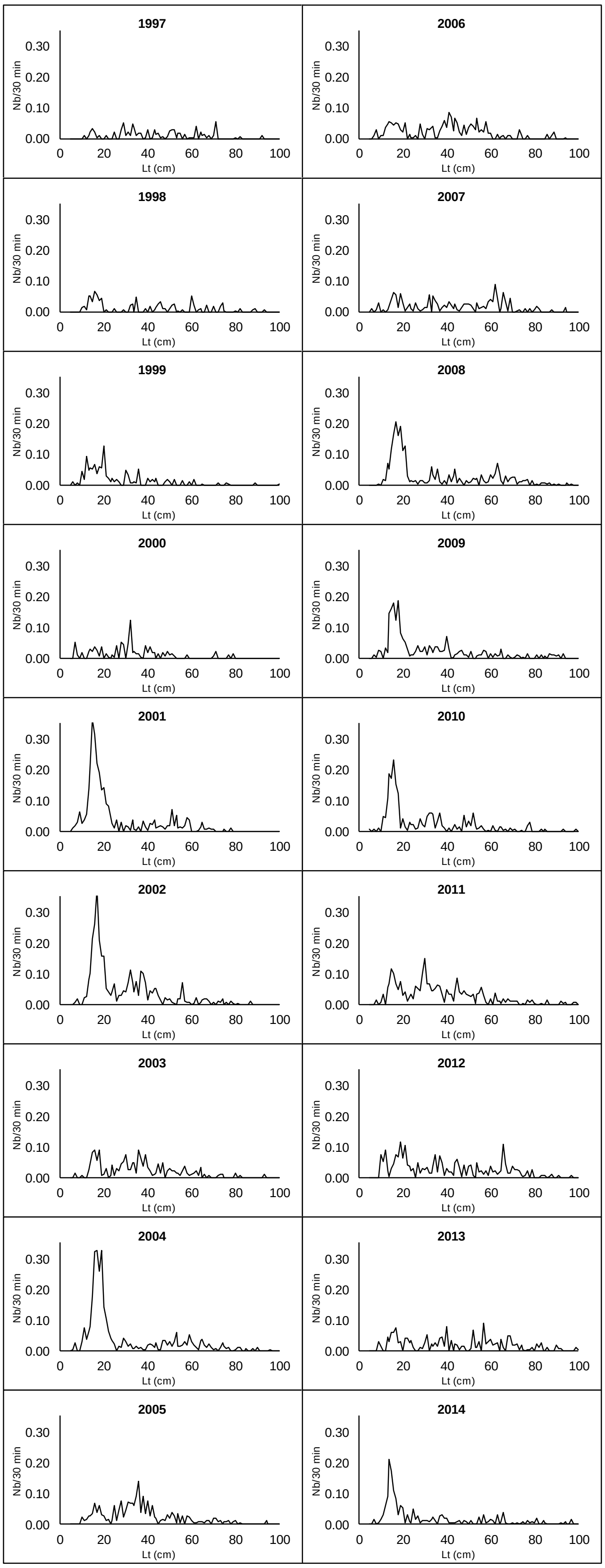


Figure 3.2-3 - *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d. Time-series of the EVHOE-WIBTS-Q4 Length distributions in Nb per 30 minutes tow from 1997 to 2014

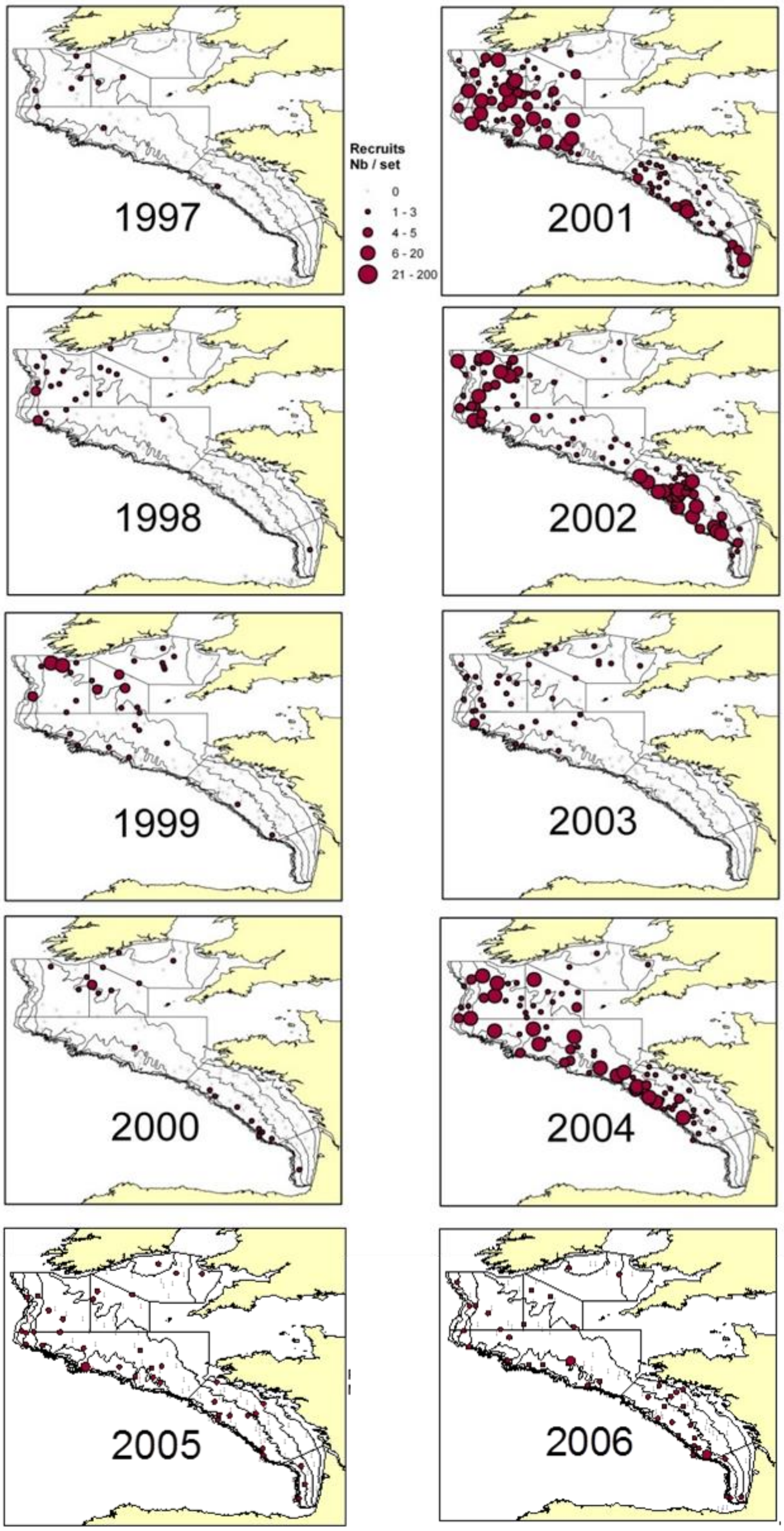


Figure 3.2-4 – *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d, distribution of recruits (lt < 23 cm) in Nb per 30m observed in the EVHOE-WIBTS-Q4 surveys from 1997 to 2006.

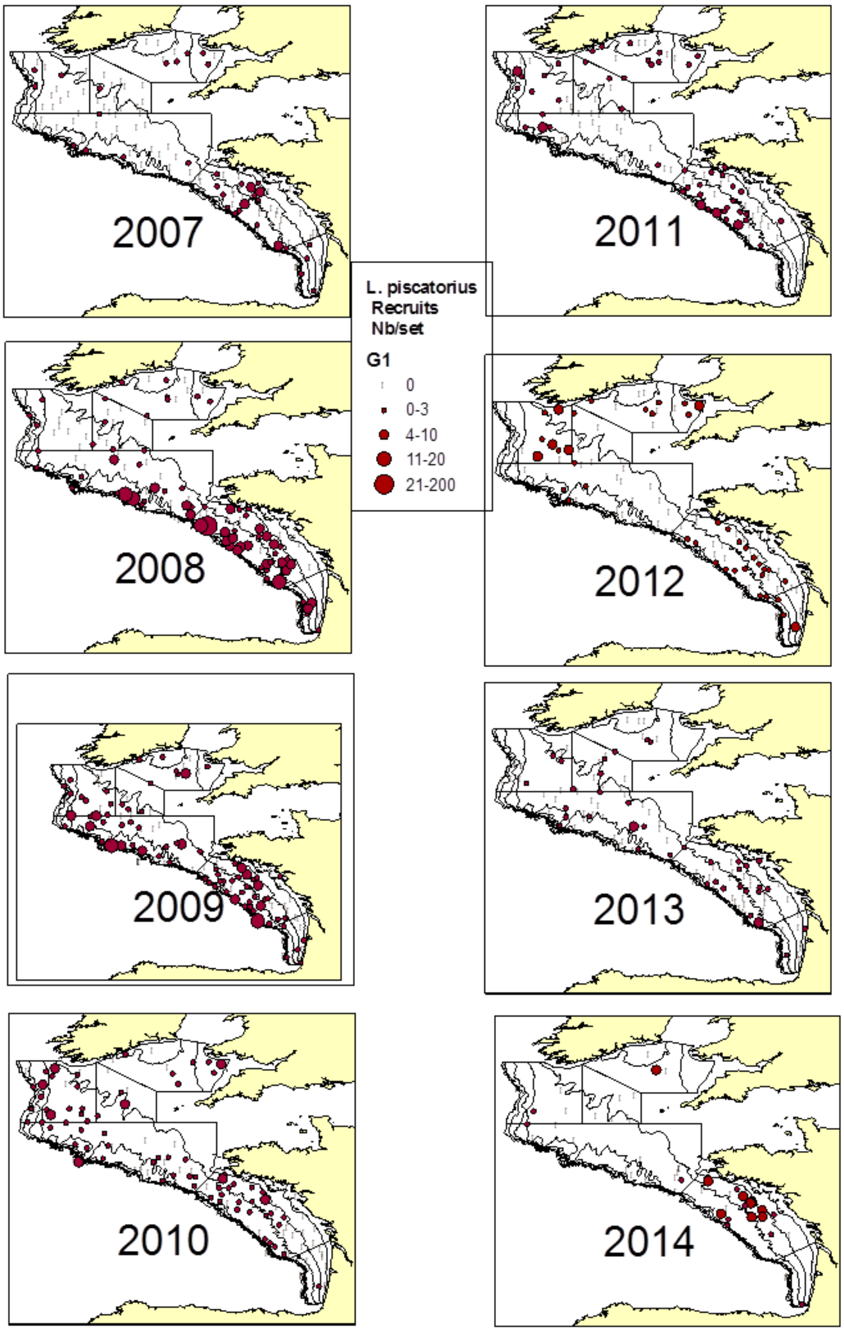


Figure 3.2-5 – L. piscatorius in Divisions VIIb-k and VIIIa,b,d, distribution of recruits (lt < 23 cm) in Nb per 30m observed in the EVHOE-WIBTS-Q4 surveys from 2006 to 2014.

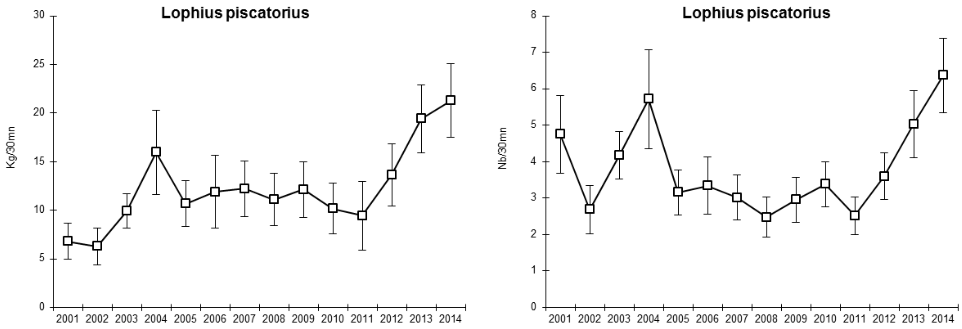


Figure 3.2-6 - *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d- Time-series of the SPPGFS (WIBTS-Q4) survey indices Kg (left) and Nb (right) per 30 minutes tow from 2001 to 2014

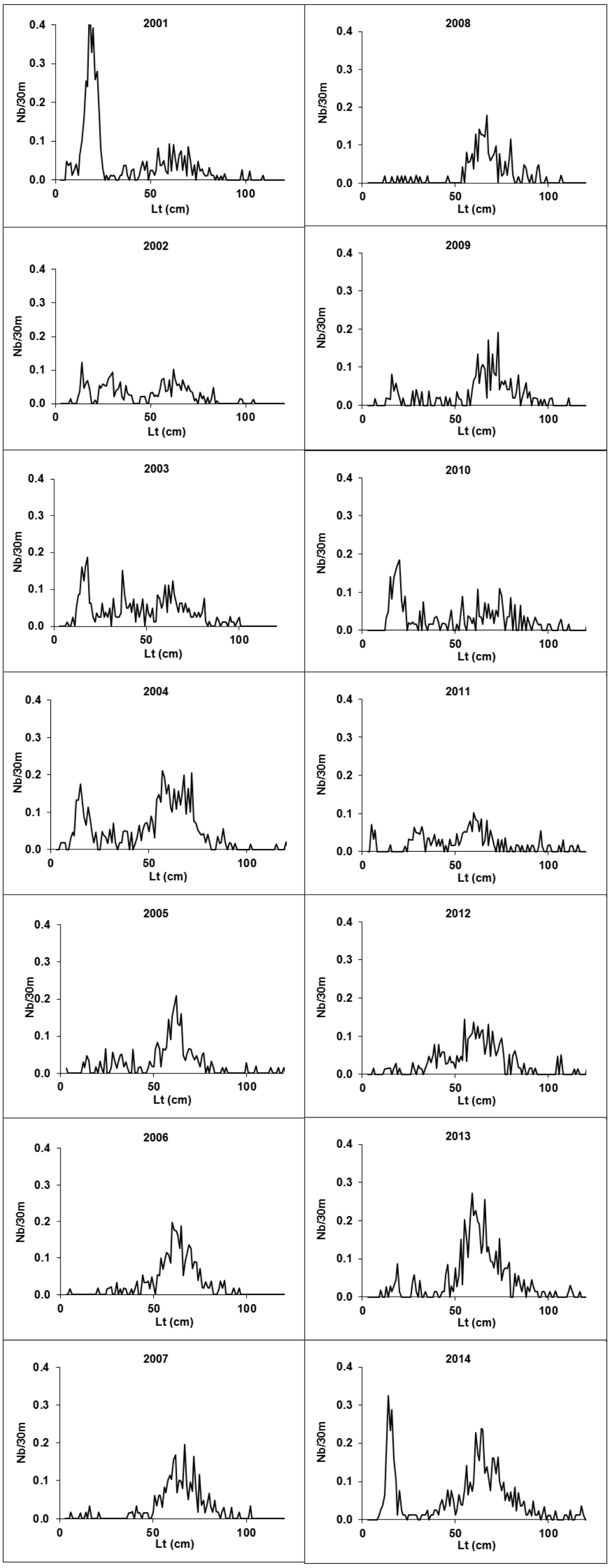


Figure 3.2-7 - *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d- Time-series of the SPPGFS (WIBTS-Q4) Length distributions in Nb per 30 minutes tow from 2001 to 2014

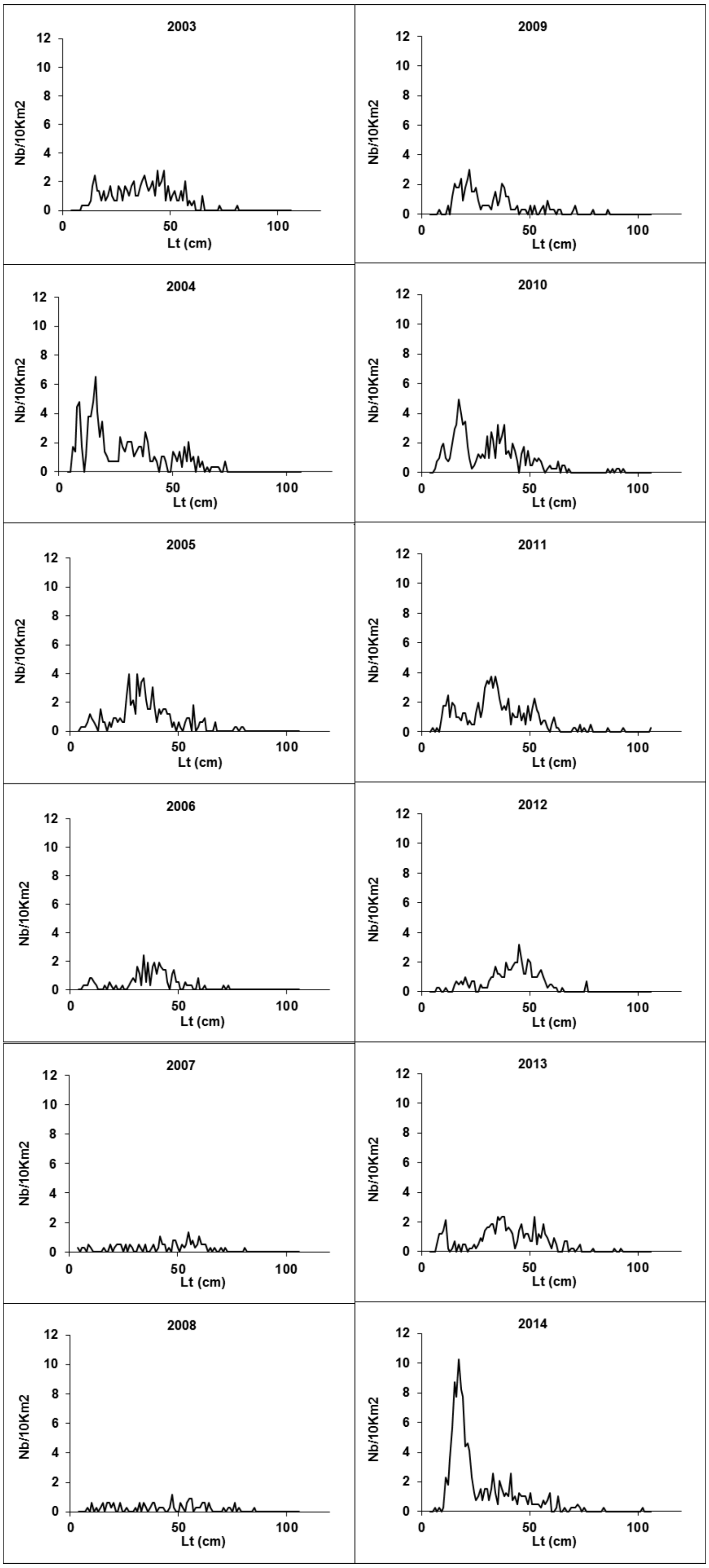


Figure 3.2-8 - *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d- Time-series of the IGFS-WIBTS-Q4 Length distributions in Nb per 10 Km² from 2001 to 2014

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

3.3.1 Data

3.3.1.1 Commercial Catch

The Working Group estimates of landings of *L. budegassa* by fishery unit (defined in Section 2) are given in Table 3.3-1.

The landings have fluctuated over the studied period between 5 720 t to 12 789 t with a succession of high (1989-1991, 1998 and 2009 -2014) and low values (1994, 2001 and 2006). The total estimated landings dropped from 2003 to 2006 and since then have risen to the highest of the time-series with an estimated landings value of 12 789 t in 2013. Landings in 2014 dropped to 10 872 t but is still the second highest of the time-series.

3.3.1.2 Commercial Effort and LPUE

Effort and LPUE data were available in 2014 for the three Spanish fleets, and for the English EW-FU06 (Table 3.3-2 and figure 3.3-1). Fishing effort for most fleets shows a decrease until the early 2000's. Effort remained relatively stable thereafter, with the exception of SP-BAKON7 which disappeared in 2009 but reappeared again in 2010 with 2008 effort levels and disappeared thereafter. From 2011 to 2013 a sharp decrease in SP-VIGO7 (41 % reduction) and SP-CORUTR7 (77 % reduction) was recorded and the decline continues, this may be due to the vessels with in the fleet landing under a different flag but operating as in previous years.

LPUEs have fluctuated over the time-series with increasing trends since 2006 and conflicting trends for the most recent period. In 2012 the LPUE for the SP-VIGO7 fleet was the highest of the time-series, the other fleets SP-CORUTR7 and SP-BAKON8 showed their series maximum in 2013 and the EW-FU06 in 2014.

3.3.1.3 Surveys data

3.3.1.3.1 The French EVHOE-WIBTS-Q4 survey

This survey covers the highest proportion of the area of stock distribution. Standardised biomass and abundance indices are given in Figure 3.3-1. The biomass index shows patterns of increase and decrease over the time-series, with a continuous increase from 2005 to its maximum value in 2008 followed again by a decrease to 2003-2005 levels. The most recent year continues the decline in biomass, since 2012, to just above the average of the time series. The abundance index shows a similar pattern reach its highest values in the time series in 2008 and 2013. In 2009 and 2010 the indices returned to 2004-2005 levels, the most recent year shows a decline in abundance but again remains above the mean level for the time-series.

The length distributions (Figure 3.3-2.) show that the abovementioned results correspond to strong incoming year-classes from 2004 until 2008 that can be tracked from year to year with modes between 10-17 cm for the first age group (since 2004), 18 – 32 for the second (2005, 2007 and 2008), 33-45 for the third and 50-55 for the fourth (more obvious in 2008).

For 2009 the length distribution does not show a strong signal of recruitment nor can the signal from 2008's strong recruitment be followed. 2010 shows a medium level recruitment and 2011, 2012 and 2013 gives the strongest signals of the time series for recruits.

The localisation of juveniles (individuals less than 16 cm) caught during the survey from 1997 to 2008 show two nursery areas one in the western Celtic Sea and another in the north-western area of the Bay of Biscay (Figure 3.3-3**Error! Reference source not found.** and Figure 3.3-4), in some of the years, juveniles are also found in a more southern area of the Bay of Biscay in deeper waters. In 2010 to 2014 the normal pattern was found again with a more confined distribution in the western Celtic Sea.

3.3.1.3.2 The English Fisheries Science Partnership survey.

This survey samples a fraction of each of the areas VIIe, VIIf, VIIg and VIIh and was discontinued in 2013. The survey covers a restricted area of the species distribution but the pulses of recruitment observed in the EVHOE-WIBTS-Q4 surveys are also present in the FSP-ENG-MONK survey in the following year. Length distribution of *L. budegassa* catches are available and presented in Figure 3.3-5.

For 2009 the English survey has recorded its historical maximum for recruitment and the good recruitment can be tracked from 2008. In 2010 to 2012 the recruitment returned to low levels and the good recruitments from 2008 and 2009 can be followed.

The first mode of this survey's length distributions tends to be found at slightly larger lengths than the first mode of the EVHOE-WIBTS-Q4 survey and strong recruitment signal according to EVHOE-WIBTS-Q4 in a given year tends to be followed by a strong signal around 16-28 cm for this survey in the following year. However the strong incoming year-class from the EVHOE-WIBTS-Q4 in 2011 does not appear in the FSP-ENG-MONK in 2012.

3.3.1.3.3 Other surveys

The coverage of the other surveys (IGFS-WIBTS-Q4 and SPPGFS (WIBTS-Q4)) are mostly outside the preferred area of the distribution of the species. Therefore information is scarce. However, in recent years the Irish Groundfish Survey (IGFS-WIBTS-Q4) has shown similar patterns to that seen in the EVHOE-WIBTS-Q4 survey, suggesting a possible expansion or northerly movement of the stocks distribution. Length distributions (figure 3.3-7) and index of abundance,

Table 3.2-3, in numbers per ten square kilometres from this survey are presented.

The abundance index shows a similar drop after the peak in 2013 in the final year as that shown in the EVHOE-WIBTS-Q4. The estimated abundance in 2013 and 2014 were the highest and second highest of the time-series, respectively. The length distributions also show similar recruitment patterns in the last two years of the survey with 2013 giving the highest abundance of the time-series.

3.3.2 Conclusion

Survey data give indication that the biomass has shown a continuous increase since the mid 2000's as a consequence of several good incoming recruitments. There is good evidence of a strong incoming recruitment for 2008. The EVHOE-WIBTS-Q4 shows evidence of a medium level of recruitment in 2010 and in the most recent year and record strong recruitment from 2011 to 2013. Length frequency distributions from two of the available surveys, EVHOE-WIBTS-Q4 and FSP-ENG-MONK, show contradictory signals for 2009, 2011 and 2012 recruitments, but the working group considers that the trend of the EVHOE-WIBTS-Q4 is more representative due to the larger coverage of the survey.

Preliminary information on discards shows that an increasing proportion of small fish are caught and discarded (WKFLAT12) and results from this year's data available for the first time to the working group shows that around 11 percent of the catch is discarded. Due to the low levels of sampling and the uncertainties in the precision of the estimates the group recommends that the discard estimates are not used in the assessment or for advice purposes.

As discard information has been made available to the working group further years submissions will allow for a more extensive analysis of the estimates so that catch information can be presented with confidence

With the large recruitments predicted from the surveys, EVHOE-WIBTS-Q4 and IGFS-WIBTS-Q4, in 2013 and the discarding of small fish caught, measures should be taken to ensure good survival of the recent recruits such as spatial and technical measures.

The Working Group concludes that in view of the available data, continuing fishing at present level should not harm the stock.

3.3.3 Comments on the assessment

As for *L. piscatorius*, data from surveys tracking recent good recruitment give scope for growth studies and ageing validation that should be initiated as soon as possible. It is noted that this should be easier than for *L. piscatorius* given the length distribution observed in recent years in the EVHOE-WIBTS-Q4 survey and the last four years in the English Fisheries Science Partnership programme FSP-ENG-MONK survey.

Table 3.3-1 ***Lophius budegassa*** **in Divisions VIIb-k and VIIIa,b,d - Landings in tonnes by Fishery Unit.**

	VIIb,c,e-k						VIIIa,b,d				
Year	Gill-Net (Unit 3+13)	Medium/ Deep Trawl (Unit 4)	Shallow Trawl (Unit 5)	Beam Trawl (Unit 6)	Shallow/ medium Neph.Trawl (Unit 8)	Unallocated	Neph.Trawl (Unit 9)	Shallow Trawl (Unit 10)	Medium/ Deep Trawl (Unit 14)	Unallocated	TOTAL VII +VIII
1986	23	5 126	348	540	406	0	443	150	1 181	0	8 217
1987	30	3 493	696	462	434	0	483	116	1 904	0	7 619
1988	34	4 072	1 095	751	394	0	435	102	1 498	0	8 382
1989	40	4 398	976	505	515	0	446	112	1 829	0	8 820
1990	53	4 818	631	905	653	0	550	156	1 865	0	9 632
1991	0	4 416	934	397	507	0	475	117	1 933	0	8 780
1992	0	4 808	301	305	594	0	459	191	1 518	0	8 176
1993	0	3 415	429	405	399	0	433	101	1 385	0	6 566
1994	0	2 935	265	209	540	0	232	49	1 515	0	5 744
1995	10	3 963	455	159	617	0	312	62	1 286	90	6 953
1996	118	4 587	477	245	524	28	374	109	1 239	392	8 092
1997	134	4 836	602	132	474	9	313	17	1 128	471	8 114
1998	179	5 565	246	230	288	1	258	72	1 454	305	8 599
1999	18	4 311	119	282	338	0	144	76	1 450	0	6 739
2000	57	4 489	161	284	228	0	124	31	1 270	0	6 645
2001	41	3 758	107	266	306	0	121	29	1 100	0	5 728
2002	30	4 272	147	251	372	0	112	14	1 195	0	6 394
2003	92	5 748	337	342	376	5	195	26	1 248	0	8 368
2004	122	4 684	242	343	376	0	254	9	1 407	0	7 436
2005	73	4 837	162	409	329	0	235	56	1 431	0	7 532
2006	9	3 661	145	271	218	0	286	1	1 128	1	5 720
2007	92	3 874	168	306	250	0	243	0	1 424	0	6 357
2008	21	4 620	187	392	254	0	235	0	1 669	0	7 379
2009	72	5 963	24	441	36	0	354	0	2 047	145	9 082
2010	224	6 137	9	597	27	0	379	0	1 763	223	9 359
2011	172	3 562	11	591	16	1 747	378	0	1 413	96	7 988
2012	110	4 314	6	483	6	1 135	275	0	2 250	384	9 546
2013	155	5 683	4	551	64	1 425	559	0	3 564	784	12 789
2014	719	5 048	27	595	74	282	730	0	3 176	221	10 872

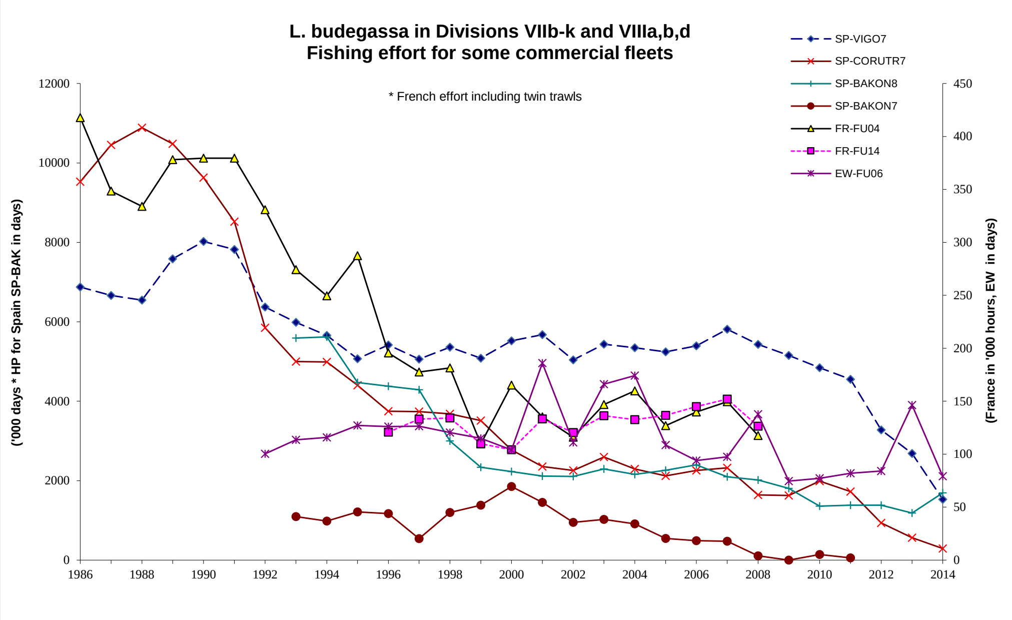
Table 3.3-3 *L. budegassa* in Divisions VIIb-k and VIIIa,b,d- Effort and LPUE data

EFFORT	SP-VIGO7 in Division VII	SP-CORUTR7 in Division VII	French Benthic trawlers* Celtic Sea FU04	French Benthic Twin Trawls Celtic Sea	French Benthic trawlers* Bay of Biscay FU14	French Benthic Twin Trawls Bay of Biscay	EW FU06 Beam trawlers in VII	SP-BAKON7	SP-BAKON8
	('000 days*HP)	('000 days*HP)	('000 hrs)	('000 hrs)	('000 hrs)	('000 hrs)	('00 days)	(days)	(days)
1986	6 875	9 527	418	N/A	123	N/A	N/A		
1987	6 662	10 453	349	N/A	199	N/A	N/A		
1988	6 547	10 886	334	N/A	150	N/A	N/A		
1989	7 585	10 483	378	N/A	187	N/A	N/A		
1990	8 021	9 630	380	N/A	208	N/A	N/A		
1991	7 822	8 522	380	N/A	210	N/A	N/A		
1992	6 370	5 852	331	N/A	186	N/A	100		
1993	5 988	5 001	274	N/A	159	N/A	114	1 094	5 590
1994	5 655	4 990	249	N/A	148	N/A	116	980	5 619
1995	5 070	4 403	287	N/A	174	N/A	127	1 214	4 474
1996	5 416	3 746	196	121	144	19	126	1 170	4 378
1997	5 058	3 738	178	133	133	33	126	540	4 286
1998	5 360	3 684	182	134	117	40	121	1 196	3 002
1999	5 084	3 512	110	110	83	59	115	1 384	2 337
2000	5 519	2 773	165	104	87	49	104	1 850	2 227
2001	5 678	2 356	135	133	61	66	186	1 451	2 118
2002	5 041	2 258	116	120	57	75	111	949	2 107
2003	5 437	2 597	147	136	68	81	166	1 022	2 296
2004	5 347	2 292	160	133	78	89	174	910	2 159
2005	5 246	2 120	127	137	83	121	109	544	2 263
2006	5 392	2 257	140	145	72	101	94	487	2 398
2007	5 812	2 323	149	152	48	127	97	476	2 098
2008	5 432	1 640	118	126	58	113	138	105	2 017
2009	5 155	1 626					75	0	1 807
2010	4 843	1 988					77	138	1 358
2011	4 553	1 725					82	57	1 384
2012	3 276	937					84		1 384
2013	2 683	563					146		1 185
2014	1530	292					79		1694

LPUE	Vigo in Division VII	La Coruna in Division VII	French Benthic trawlers* Celtic Sea FU04	French Benthic Twin Trawls Celtic Sea	French Benthic trawlers* Bay of Biscay FU14	French Benthic Twin Trawls Bay of Biscay	EW (FU06) Beam trawlers in VII	SP-BAKON7	SP-BAKON8
	(kg/days*HP)	(kg/days*HP)	(kg/10 hrs)	(kg/10 hrs)	(kg/10 hrs)	(kg/10 hrs)	(kg/days)	(kg/day)	(kg/day)
1986	339	37	38		51				
1987	294	16	25		48				
1988	265	42	39		53				
1989	272	25	47		65				
1990	250	29	52		62				
1991	231	30	44		54				
1992	248	14	48		53		28		
1993	194	15	43		50		30	51	55
1994	203	20	44		60		11	108	61
1995	286	8	51		47		7	120	49
1996	304	12	47	65	42	58	12	173	57
1997	383	12	50	63	44	48	7	273	42
1998	319	9	54	64	62	68	15	229	78
1999	369	9	38	55	57	63	12	329	85
2000	257	19	61	50	57	73	9	265	56
2001	304	3	37	41	49	71	5	198	37
2002	389	30	46	48	40	66	8	232	71
2003	600	16	57	53	45	64	7	242	65
2004	490	13	38	46	35	55	6	185	92
2005	522	18	59	56	43	58	13	140	72
2006	479	13	25	27	44	56	8	179	70
2007	393	11	31	28	50	64	10	256	70
2008	547	5	48	43	68	86	16	248	74
2009	666	18					30		118
2010	584	19					34	326	117
2011	590	45					32	590	112
2012	692	42					25		204
2013	509	47					13		387
2014	560	39					46		317

Table 3.3-4 - *L. budegassa* in Divisions VIIb-k and VIIIa,b,d– Abundance indices in Nb/10 Km^2 from the IGFS-WIBTS-Q4.

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Nb/sqKm	10.1	39.1	22.1	16.0	12.5	34.1	30.9	41.2	23.7	14.7	80.9	60.2



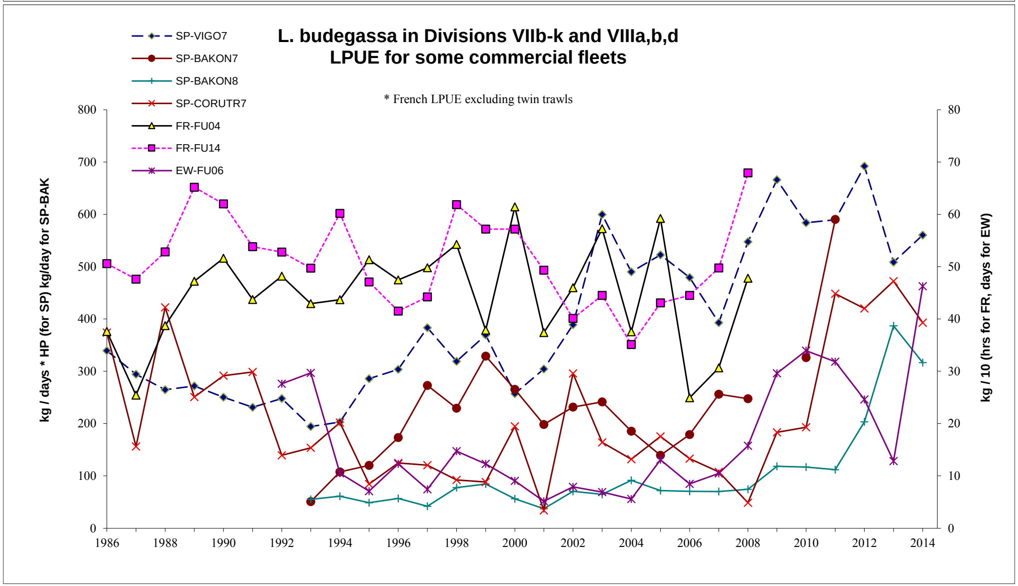


Figure 3.3-6 ***L. budegassa*** **in Divisions VIIb-k and VIIIa,b,d- Effort and LPUE data**

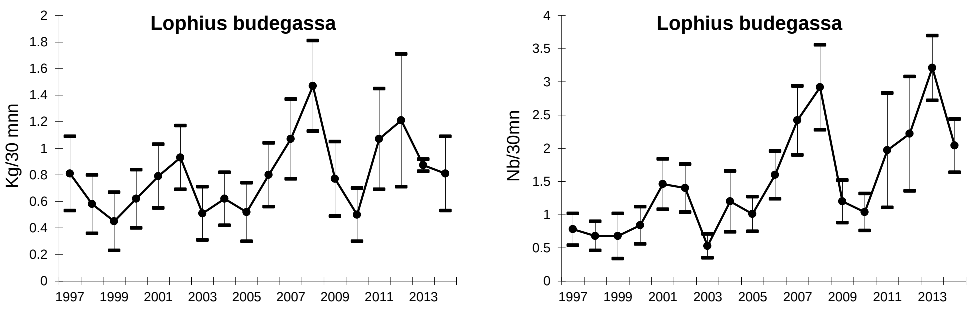


Figure 3.3-7 ***L. budegassa*** **in Divisions VIIb-k and VIIIa,b,d- Time-series of the EVHOE-WIBTS-Q4 survey's indices Kg (left) and Nb (right) per 30 minutes tow from 1997 to 2011**

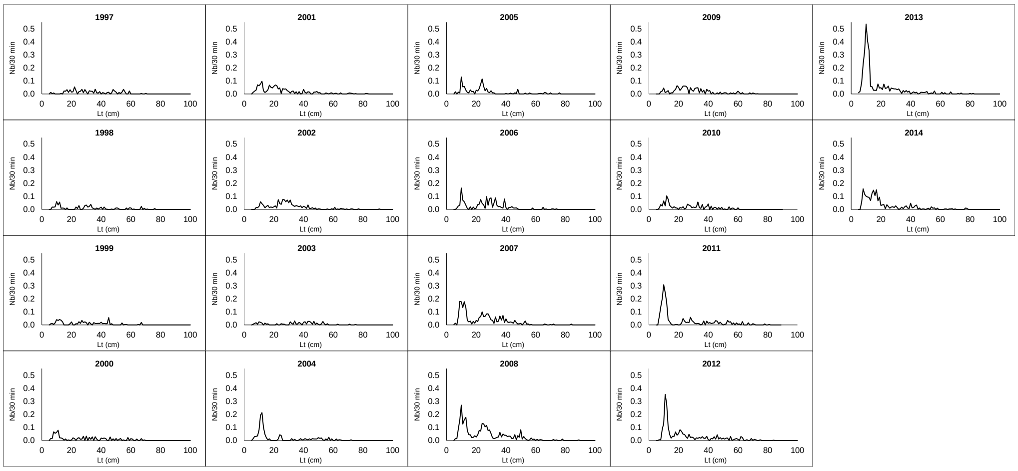


Figure 3.3-8 - *L. budegassa* in Divisions VIIb-k and VIIIa,b,d- Time-series of the EVHOE-WIBTS-Q4 length distributions in Nb per 30 minutes tow from 1997 to 2011.

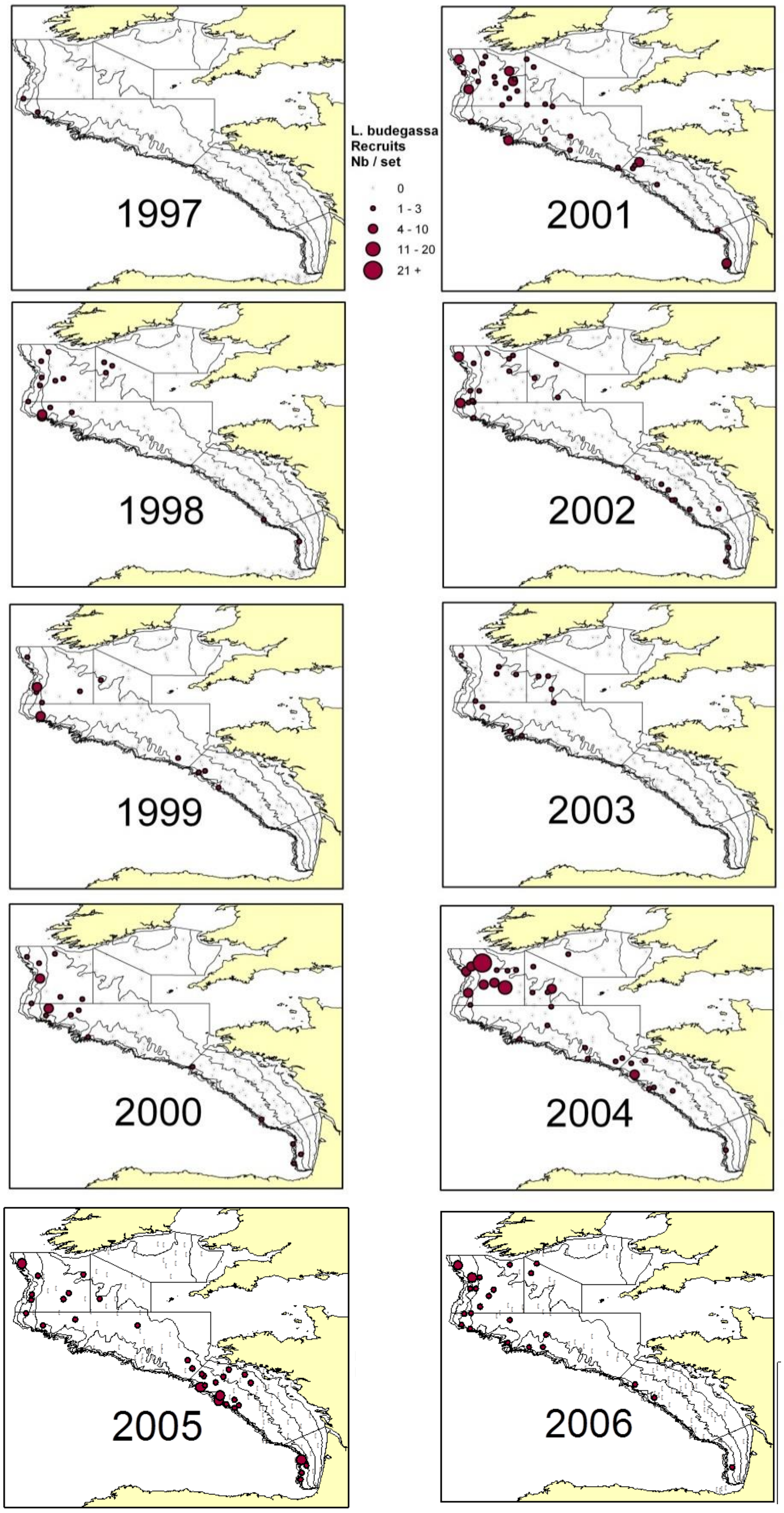


Figure 3.3-9 – *L. budegassa* in Divisions VIIb-k and VIIIa,b,d, distribution of recruits (lt < 16 cm) in Nb per 30m observed in the EVHOE-WIBTS-Q4 surveys from 1997 to 2006.

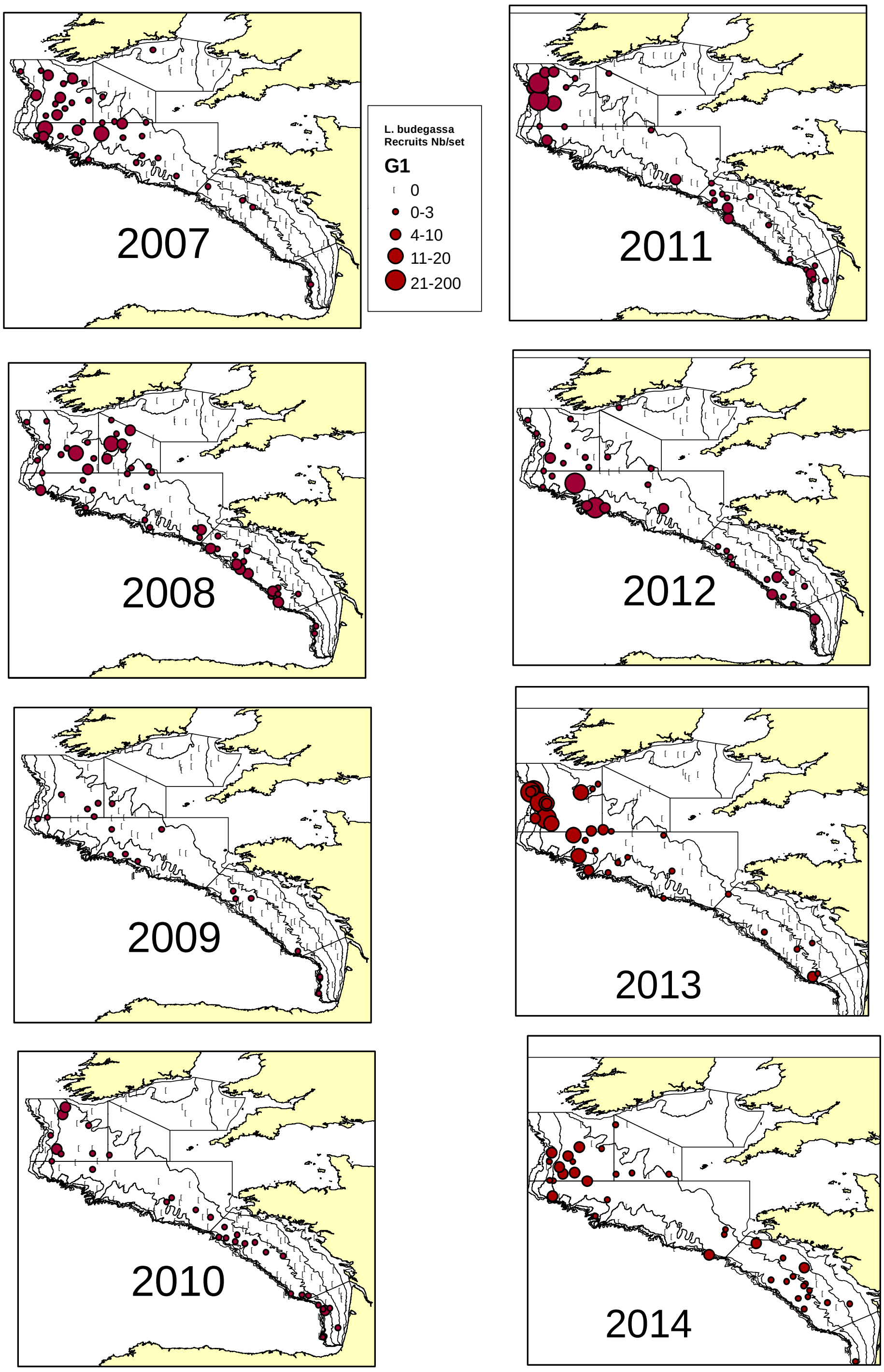


Figure 3.3-10 – *L. budegassa* in Divisions VIIb-k and VIIIa,b,d, distribution of recruits (lt < 16 cm) in Nb per 30m observed in the EVHOE-WIBTS-Q4 surveys from 2007 to 2014.

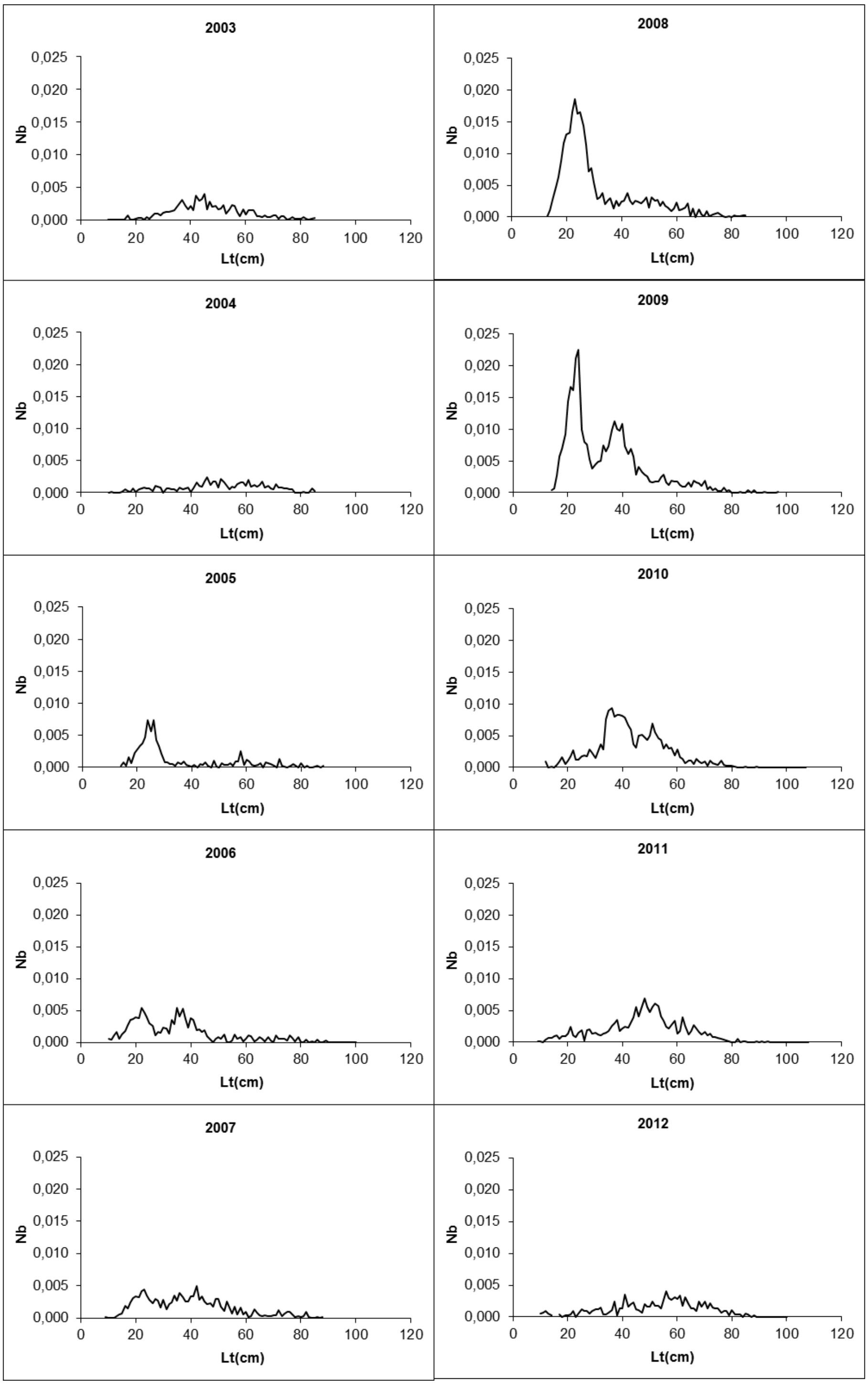


Figure 3.3-11 - ***L. budegassa*** **in Divisions VIIb-k and VIIIa,b,d- Time-series of the FSP-ENG-MONK length distributions in Nb per 30 minutes tow from 2003 to 2012.**

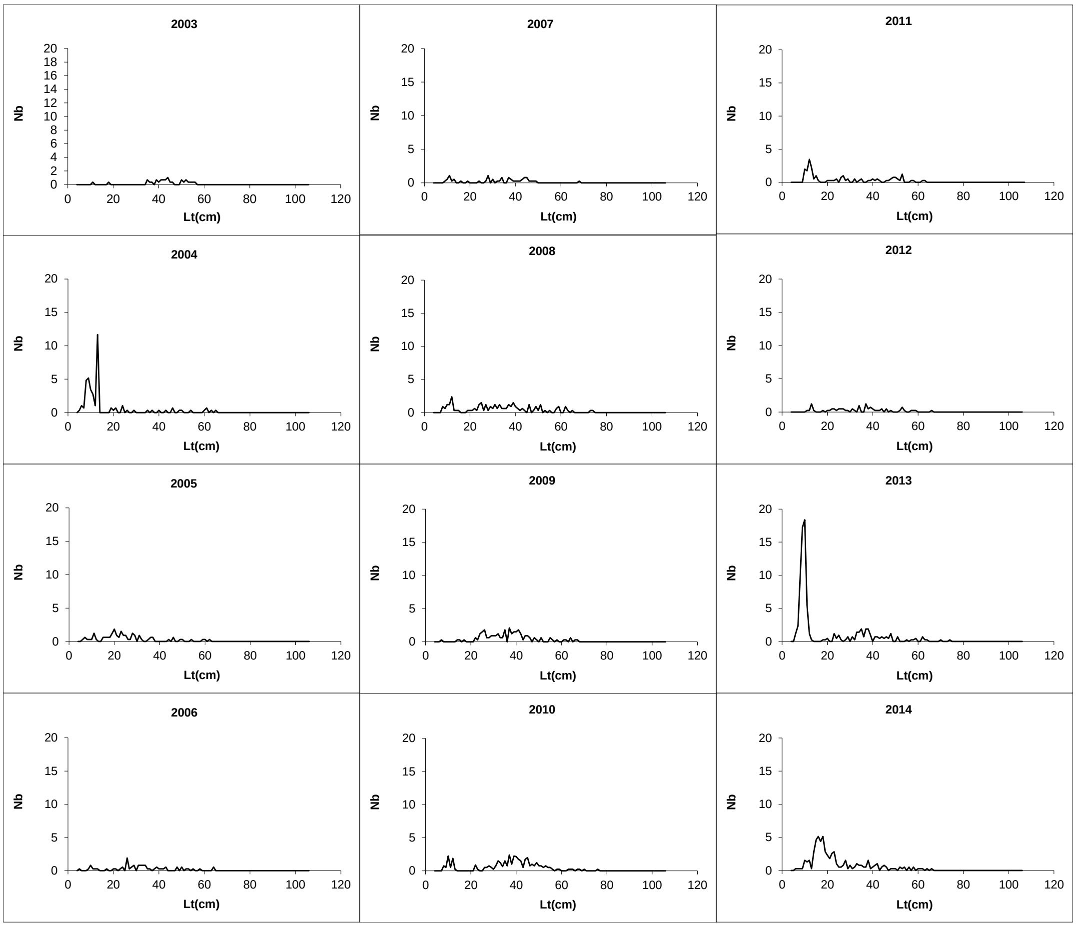


Figure 3.3-7 - *L. budegassa* in Divisions VIIb-k and VIIIa,b,d- Time-series of the IGFS-WIBTS-Q4 length distributions in Nb per 10 km² from 2003 to 2014.

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

L. piscatorius and L. budegassa

Type of assessment in 2015: Update (the assessment models and settings were approved in the benchmark WKFLAT-2012).

Software used: SS3 for *L. piscatorius* and ASPIC for *L. budegassa.*

Data revisions this year:

For both stocks, *Lophius piscatorius* and *L. budegassa*, the following data were revised: Spanish landings and length distribution of landings for the period 2011-2013. Spanish LPUE SP-CORTR8c-PORT landings, effort, and length distribution from 2009 to 2013. Portuguese LPUE series in 2012 and 2013. Unallocated landings estimates in years 2011, 2012 and 2013.

4.1 General

Two species of anglerfish, *Lophius piscatorius* and *L. budegassa*, are found in ICES Divisions VIIIc and IXa. Both species are caught in mixed bottom trawl fisheries and in artisanal fisheries using mainly fixed nets.

The two species are not usually landed separately, for the majority of the commercial categories, and they are recorded together in the ports' statistics. Therefore, estimates of each species in Spanish landings from Divisions VIIIc and IXa and Portuguese landings of Division IXa are derived from their relative proportions in market samples.

The total anglerfish landings are given in Table 4.1.1 by ICES division, country and fishing gear. Landings increasing in the early eighties and reaching maximum in 1986 (9433 t) and 1988 (10 021 t), and decreasing after that to the minimum in 2001 (1801 t) and 2002 (1802 t). From 2002 to 2005 landings increased reaching 4541 t. In 2002-2005 period landings increased reaching 4,541 t., this period was followed by a another one where landings gradually declined and in 2011 landings were less than half of the 2005 amount (2085 t). From 2011 to 2014 landings slightly increased to 2989 t (2001 t of *L. piscatorius* and 988 t of *L. budegassa*).

The species proportion in the landings has changed since 1986. In the beginning of the time series (1980-1986) *L. piscatorius* represented more than 70% of the total anglerfish landings. After 1986 the proportion of *L. piscatorius* decreased and in 1999-2002 both species had approximately the same weight in the annual landings. Since then the *L. piscatorius* proportion increased. The mean proportion of *L. piscatorius* in the landings from 2005 to 2014 is 66%.

ICES performs assessments for each species separately. The benchmark assessment of anglerfish in Division VIIIc and IXa was carried out in 2012, a new assessment using Stock Synthesis (SS3) for *L. piscatorius* was approved and new settings and data were incorporate to the ASPIC model for *L. budegassa.*

The ageing estimation problems, detected in a previous benchmarck (see WGHMM2007 report) continue unsolved for *L. piscatorius* (ICES, 2012a) and no new studies were carried out for *L. budegassa*. The grow pattern inferred from mark-recapture and length composition analysis (Landa *et al*., 2008) was used in the assessment of *L. piscatorius*.

4.2 Summary of ICES advice for 2015 and management for 2014 and 2015

ICES advice for 2015:

As both species of anglerfish are caught in the same fisheries and are subject to a combined TAC, the same multiplicative factor for current fishing mortality is assumed for both species. The change is driven by *L. piscatorius,* as it is the species in poorest condition. Following the ICES MSY approach implies fishing mortality to be increased by 14%.

ICES advises the following landings for 2015 on the basis of the MSY approach:

L. piscatorius: less than 1937 t; L. budegassa: less than 1050 t; Combined anglerfish: less than 2987 t.

Management applicable for 2014 and 2015:

The two species are managed under a common TAC that was set at 2629 t for 2014 and 2987 t for 2015. The reported landings in 2014 were 114% of the established TAC.

There is no minimal landing size for anglerfish but an EU Council Regulation (2406/96) laying down common marketing standards for certain fishery products fixes a minimum weight of 500 g for anglerfish. In Spain this minimum weight was put into effect in 2000.

Management considerations

Lophius piscatorius and *L. budegassa* are subject to a common TAC, so the joint status of these species should be taken into account when formulating management advice. Both species of anglerfish are reported together because of their similarity but are assessed separately.

It should be noted that both anglerfish are essentially caught in mixed fisheries. Hence, management measures applied to these species may have implications for other stocks and viceversa. It is necessary to take into account that a recovery plan for hake and *Nephrops* is taking place in the same area.

Although these stocks are assessed separately they are managed together. Due to the differences in the current status of the individual stocks, it is difficult to give common advice.

Table 4.1.1 ANGLERFISH (*L. piscatorius* and *L. budegassa*) - Divisions VIIIc and IXa.
Tonnes landed by the main fishing fleets for 1978-2014 as determined by the Working Group.

	Div. VIIIc				Div. IXa						Div. VIIIc+IXa		Div. VIIIc+IXa
	SPAIN				SPAIN			PORTUGAL					
Year	Trawl	Gillnet	Others	TOTAL	Trawl	Gillnet	Others	Trawl	Artisanal	TOTAL	SUBTOTAL	Unallocated	TOTAL
1978	n/a	n/a		n/a	506			n/a	222	728	n/a		
1979	n/a	n/a		n/a	625			n/a	435	1 060	n/a		
1980	4 008	1 477		5 485	786			n/a	654	1 440	6 926		6 926
1981	3 909	2 240		6 149	1 040			n/a	679	1 719	7 867		7 867
1982	2 742	3 095		5 837	1 716			n/a	598	2 314	8 151		8 151
1983	4 269	1 911		6 180	1 426			n/a	888	2 314	8 494		8 494
1984	3 600	1 866		5 466	1 136			409	950	2 495	7 961		7 961
1985	2 679	2 495		5 174	977			466	1 355	2 798	7 972		7 972
1986	3 052	3 209		6 261	1 049			367	1 757	3 172	9 433		9 433
1987	3 174	2 571		5 745	1 133			426	1 668	3 227	8 973		8 973
1988	3 583	3 263		6 846	1 254			344	1 577	3 175	10 021		10 021
1989	2 291	2 498		4 789	1 111			531	1 142	2 785	7 574		7 574
1990	1 930	1 127		3 057	1 124			713	1 231	3 068	6 124		6 124
1991	1 993	854		2 847	878			533	1 545	2 956	5 802		5 802
1992	1 668	1 068		2 736	786			363	1 610	2 758	5 493		5 493
1993	1 360	959		2 319	699			306	1 231	2 237	4 556		4 556
1994	1 232	1 028		2 260	629			149	549	1 327	3 587		3 587
1995	1 755	677		2 432	814			134	297	1 245	3 677		3 677
1996	2 146	850		2 995	749			265	574	1 589	4 584		4 584
1997	2 249	1 389		3 638	838			191	860	1 889	5 527		5 527
1998	1 660	1 507		3 167	865			209	829	1 903	5 070		5 070
1999	1 116	1 140		2 256	750			119	692	1 561	3 817		3 817
2000	710	612		1 322	485			146	675	1 306	2 628		2 628
2001	614	364		978	247			117	459	823	1 801		1 801
2002	559	415		974	344			104	380	828	1 802		1 802
2003	1 190	771		1 961	617			96	529	1 242	3 203		3 203
2004	1 510	1 389		2 898	549			77	602	1 229	4 127		4 127
2005	1 651	1 719		3 370	653			60	458	1 171	4 541		4 541
2006	1 490	1 371		2 861	801			68	381	1 250	4 111		4 111
2007	1 327	1 076		2 404	866			78	303	1 247	3 651		3 651
2008	1 280	1 238		2 518	473			50	246	770	3 288		3 288
2009	1 151	1 207		2 358	386			43	262	691	3 049		3 049
2010	665	1 036		1 701	355			72	203	630	2 331		2 331
2011	458	515	105	1 160	216	88	146	122	199	770	1 930	154	2 085
2012	432	549	89	1 131	163	60	132	161	533	1 049	2 180	339	2 519
2013	495	732	52	1 400	142	85	140	114	412	893	2 293	288	2 582
2014	545	954	35	1 653	211	93	8	143	408	863	2 516	474	2 989

n/a: not available

4.3 Anglerfish (*L. piscatorius*) in Divisions VIIIc and IXa

4.3.1 General

4.3.1.1 Ecosystem aspects

The ecosystem aspects of the stock are common with *L. budegassa* and are described in the Stock Annex.

4.3.1.2 Fishery description

L. piscatorius is mainly caught by Spanish and Portuguese bottom trawlers and gillnet fisheries. For some gillnet fishery, it is an important target species, while it is also a by catch of the trawl fishery targeting hake or crustaceans (see Stock Annex).

The length distribution of the landings is considerably different between both fisheries, with the gillnet landings showing higher mean lengths compared to the trawl landings. Since 2001 to 2014, the Spanish landings were on average 46% from the trawl fleet (mean lengths in 2014 of 65 cm and 59 cm in Divisions VIIIc and IXa, respectively) and 54 % from the gillnet fishery (mean length of 78 cm in Division VIIIc in 2014). For the same period, Portuguese landings were on average 11 % from bottom trawlers (mean length of 45 cm in 2014) and 80 % from the artisanal fleet (mean length of 65 cm in 2014).

4.3.2 Data

4.3.2.1 Commercial catches and discards

Total landings by country and gear for the period 1978-2014, as estimated by the WG, are given in Table 4.3.1. A revision of Spanish landings for the period 2011-2013 were provided to the WG. The new methodology of estimation of landings explained in *Castro*, 2015 (WD-03, ICES 2015a) is considered appropriate for the estimation of the stock landings of this species and new values are consistent with the time series of landings, being the new series accepted to do the assessment. Unallocated landings for this stock were available for the first time for the years 2011, 2012 and 2014 and a revision of unallocated landings for 2013 were also presented. The unallocated values are considered realistic and are taken into account for the assessment. Since 2011 there was an increasing trend in official landing with increases of 10 % and 32 % in 2013 and 2014 respectively. Unallocated landings represent between 7 and 20 % of total landings and not a specific trend was observed.

Spanish discards estimates of *L. piscatorius* in weight and associated coefficient of variation (CV) are shown in the Table 4.3.2. For the available time series anglerfish discards represent less than 18% of Spanish trawl catches. The maximum value of the time series occurred in 2013 with 66 t. The Spanish gillnet fleet discards value are only available for 2013 and 2014 with quantities of 144 t and 0 t respectively. The occasional high and the zero value of discards reported for the gillnet fleet could be related with a very low sampling level. *L. piscatorius* discards in the Portuguese trawl fisheries are considered negligible (Fernández&Prista, 2012; Prista *et al.*, 2014). Based on the partial information on the Spanish and Portuguese discards the WG concluded that discards could be considered negligible.

4.3.2.2 Biological sampling

The procedure for sampling of this species is the same as for *L. budegassa* (see Stock Annex).

The sampling levels for 2014 are shown in Table 1.3. The métier sampling adopted in Spain and Portugal in 2009, following the requirement of the EU Data Collection Framework, can have an effect in the provided data. Spanish sampling levels are similar to previous years but an important reduction of Portuguese sampling levels was observed in 2009-2011, since 2012 Portugal increased the sampling effort.

Length composition

Table 4.3.3 gives the available annual length compositions by ICES division, country and gear and adjusted length composition for total stock landings for 2014.The annual length compositions for all fleets combined for the period 1986–2014 are presented in Figure 4.3.1.

Landings in number, the mean length and mean weight in the landings between 1986 and 2014 are showed in Table 4.3.4. The lowest total number in landings (year 2001) is 4% of the maximum value (year 1988). After 2001, increases were observed up to 2006, with decreases every year since then to year 2011. Mean lengths and mean weights in the landings increased sharply between 1995 and 2000. In 2002 low values of mean lengths and mean weights were observed, around the minimum of the time series, due to the increase in smaller individuals. After that, increases were observed reaching 71 cm in 2010. In 2014 the mean weight and mean length of landings were at the highest values of the time series.

Biological information

The growth pattern used in the assessment follows a *von*Bertalanffy model with fixed k=0.11 and L_{inf} estimated by the model. Length-weight relationship, maturity ogive and natural mortality used in the assessment are described in the Stock Annex.

4.3.2.3 Abundance indices from surveys

Spanish and Portuguese survey results for the period 1983–2014 are summarized in Table 4.3.5.

The abundance index from Spanish survey Sp-GFS-WIBTS-Q4 is shown in Figure 4.3.2. Since 2000 the highest abundance values were detected in 2001 and 2006, since this year a downward trend was observed. In 2011, the abundance and biomass indices decreased by 44% and 40%, respectively, relative to 2010 values. In 2013 an increase in the index in biomass and in number was observed. Since 2013 the Sp-GFS-WIBTS-Q4 is conducted using a different vessel. The results of two inter-calibration experiments carried out between the two oceanographic vessels in 2012 and 2014 indicated that catches of white anglerfish has not been affected by the change of the vessel.

Landings, effort and LPUE data are given in Table 4.3.6 and Figure 4.3.3 for Spanish trawlers (Division VIIIc) from the ports of Santander and Avilés since 1986, for A Coruña since 1982 and for the Portuguese trawlers (Division IXa) since 1989. A Coruña fleet series (landings, effort and LPUE) were updated to incorporate years at the beginning of the series (1982-1985). Three series are presented for A Coruña fleet: A Coruña port for trips that are exclusively landed in the port, A Coruña trucks for trips that are landed in other ports and A Coruña fleet that takes into account all the trips of the fleet. For 2014 only information for A Coruña port was provided. Also a review of A Coruña port series for the period 2009-2013 is available to the WG (WD WD-04, ICES 2015a). Although A Coruña port is a potential abundance series to be used in the assessment a previous analysis of the whole time series must be done before taking it into account. The A Coruña fleet index, used in the assessment as abundance index from 1982 to 2012, is not available for 2013 and 2014.

For the Portuguese fleets, until 2011 most logbooks were filled in paper but have thereafter been progressively replaced by e-logbooks. In 2013 more than 90% of the logbooks are being completed in the electronic version. The LPUEs series were revised from 2012 onwards. To revise the series backwards further refinement of the algorithm is required.

For each fleet the proportion of the landings in the stock is also given in the table. In 2007 a data series from the artisanal fleet from the port of Cedeira in Division VIIIc was provided. This LPUE series is annually standardized to incorporate a new year data, latest available standardized series, from 1999 to 2011, is presented. Due to the reduction in the number of vessels of Cedeira fleet, this tuning series could not be considered as a representative abundance index of the stock and it is no longer recorded. Standardized effort provided for Portuguese trawl fleets (1989-2008) and their corresponding LPUEs are also given in Table 4.3.6, but not represented in Figure 4.3.3.

All fleets show a general decrease in landings during the eighties and early nineties. A slight landings increase in 1996 and 1997 can be observed in all fleets. From 2000 to 2005 Spanish fleets of A Coruña, Avilés and Cedeira show an increase in landings while the Portuguese fleets are stabilized at low levels. Since 2005 to 2009 landings from A Coruña and Cedeira fleets showed an overall decreasing trend. Proportion in total landings is higher for the Cedeira and A Coruña fleets. Landings for both Portuguese fleets increased in 2011.

Effort trends show a general decline since the mid nineties in all trawl fleets. In last five years they kept low effort values with some slight fluctuations. The artisanal fleet of Cedeira despite fluctuations along the time series shows an overall increasing trend until 2008. After this year the effort sharply declined to the minimum value of the series in 2011. From 2007 to 2011 the effort from A Coruña fleet was reduced by 47%, showing the lowest values of the series in 2011. The Portuguese Crustacean fleet shows high effort values in 2001 and 2002 that might be related to a change in the target species due to very high abundance of rose shrimp during that period.

LPUEs from all available fleets show a general decline during the eighties and early nineties followed by some increase. From 2002 to 2005 LPUEs increased for all fleets. This general LPUE trend is consistent between fleets including the artisanal fleet. In 2009 and 2010 an important increase of Cedeira LPUE was observed. Portuguese fleets shown a one-off increase in 2011.

4.3.3 Assessment

A new model assessment was adopted in 2012 benchmark (WKFLAT2012). The assessment approved in the WGHMM2012 was updated with 2014 data.

4.3.3.1 Input data

Input data used in the assessment are presented in the Stock Annex.

Due to the problems described in previous section (see Commercial catch-effort data), the A Coruña-fleet and Cedeira-fleet abundance indices for 2013 and 2014 were not included in the assessment.

4.3.3.2 Model

The Stock Synthesis 3 (SS3) software was selected to be used in the assessment (Methot, 2000). The description of the model including the structure, settings, and parameters assumptions are provided in the Stock Annex.

4.3.3.3 Assessment results

The model diagnosis is carried out means the analysis of residuals of abundance indices. Residual plots of the fits to the abundance indices are shown in Figure 4.3.4. Although some minor trends have been detected, as it happens for A Coruña indices from 1995 to 2000, it can be considered that the model follows trends of the abundance indices used in the model (A Coruña, Cedeira and the Spanish survey). Pearson residual plots are presented for the model fits to the length-composition data of the abundance indices (Figure 4.3.5). There were not detected specific patterns in any of the abundance indices. Some high positive residual are evident for A Coruña indices in the first and second quarter. Nevertheless, the model fits reasonably well.

The model estimates size-based selectivity functions for commercial fleets (Figure 4.3.6) and for population abundance indices (Figure 4.3.7). All the selection patterns were assumed constant over the time. The selection pattern for the Spanish trawl fleet is efficient for a wide range of lengths, since the smaller fishes until very large individuals. The Spanish artisanal fleet is most efficient in a narrow length range and for large fish, mainly from 75 to 90 cm. The Portuguese trawl fleet selection pattern indicates that this fishery is most efficient in the length range between 30 and 60 cm. This selection pattern shows strange selection over larger fish that could be an effect of an insufficient length sampling.

The selection patterns are equal for all quarters in A Coruña and Cedeira indices. For A Coruña index the selection pattern has a wide length range while Cedeira index shows the selectivity is directed to larger individuals. The Spanish survey index shows well defined selectivity to the smaller individuals.

4.3.3.4 Historic trends in biomass, fishing mortality and recruitment

Table 4.3.7 and Figure 4.3.8 provide the summary of results from the assessment model and observed landings. Maximum values of recruitment are recorded at the beginning of the time series (1982, 1986 and 1987) with values over the 4 millions. Along the time series other high recruitment values were detected in 1989, 1994 and 2001. Since 2006 the recruitment has been below 1 million except in 2010 and 2014. Landings steadily decreased from 3.6 Kt in 2005 to 1.1 Kt in 2011, coinciding with the decrease in F, from 0.38 in 2005 to 0.17 in 2011. Respect to 2013 landings and F increased in 2014 by 32%. From 2005 to 2012 SSB was at stable medium values around 6.5 kt, increasing to 7.8 kt in 2014.

4.3.3.5 Retrospective pattern for SSB, fishing mortality, yield and recruitment

In order to assess the consistency of the assessment from year to year, a retrospective analysis was carried out. It was conducted by removing one year (2014), two years (2014 and 2013), three years (2014, 2013, 2012) and four years (2014, 2013, 2012, 2011) of data while using the same model configuration (Figure 4.3.9). All the retrospective analysis runs were similar in the estimates of recruitment. Although there is some uncertainty in recent recruitment estimates no consistent bias was observed. Retrospective analysis showed an underestimation of the SSB in the final years an overestimation of F. Nevertheless, there was no strong retrospective pattern and the assessment was accepted for projections.

4.3.4 Catch options and prognosis

4.3.4.1 Short-term projections

This year the projections were performed on the basis of present assessment.

For fishing mortality, the F *status quo* equal to 0.21, estimated as the average of fishing mortality the last three years $F_{2012\text{-}2014}$ over lengths 30-130 cm, was used for 2015. In the case of recruitment, the geometric mean of the whole period (1980-2014) was used following one of the options indicated in the Stock Annex.

Projected landings in 2016 and SSB at the beginning of 2017 for different management options in 2016 are presented in Table 4.3.8. Under F *status quo* scenario in 2016 is expected a decrease in landings with respect to 2015, and an increase in SSB in 2017 with respect to 2016.

4.3.4.2 Yield and biomass per recruit analysis

The summary table of Yield and SSB per recruit analysis is given in Table 4.3.9 and in Figure 4.3.10. The F that maximizes the yield per recruit, F_{max}, is estimated at 0.29 which is over Fsq (0.21) and which corresponds to a SPR level of 12 %.

The $F_{0.1}$, rate of fishing mortality at which the slope of the YPR curve falls to 10% of its value at the origin, is equal to 0.19 and it is corresponding with a SPR level of 24%. The fishing mortality of $F_{30\%}$, $_{35\%}$ and $_{40\%}$ is estimated in 0.15, 0.13 and 0.11 respectively.

The *status quo* F is below Fmax and above from any of the reference points based on SSB per recruit analysis (Figure 4.3.10).

4.3.5 Biological Reference Points of stock biomass and yield.

F_{MSY} has been set to 0.19, the value proposed by the Working Group in 2012 based on $F_{0.1}$. No proposals for MSY-Btrigger has been presented. $F_{0.1}$ is still estimated equal to 0.19 in the present assessment (Table 4.3.9).

Framework	Reference point	Value	Technical basis	Source
MSY approach	MSY Bt_{rigger}	Not defined.		ICES, 2012b
	F_{MSY}	0.19	$F_{0.1}$	
Precautionary approach	B_{lim}	Not defined.		
	B_{pa}	Not defined.		
	F_{lim}	Not defined.		
	F_{pa}	Not defined.		

4.3.6 Comments on the assessment

The spawning stock biomass has increased since 2011. Fishing mortality in 2014 has increased by 47 % related to 2011. An increase in landings occurred from 1.1 kt in 2011 to 2.0 kt in 2014.

4.3.6.1 Quality considerations

The available unallocated landings, for years 2011 -2014, are included into the present stock assessment, as the estimates were considered realistic information. However the importance of unallocated landings is difficult to assess and the results of the assessment could be affected by the inclusion of these data.

Uncertainty of the assessment model may have increased due to the missing data for commercial abundance indices in 2012, 2013 and 2014.

4.3.7 Management considerations

Management considerations are describing for both anglerfish stocks in section 4.2.

4.3.8 References

Fernández, A.C. and Prista, N. 2012. Portuguese discard data on angler shouthern *Lophius piscatorius* and blackbellied angler *Lophius budegassa* (2004-2010). Working document-07 presented at WKFLAT2012. ICES CM: ACOM: 46.

ICES, 2012a. Report of the Anglerfish (*Lophius piscatorius*) *illicia* and otoliths exchange 2011. 61 pp.

ICES. 2012b. Report of the Benchmark Workshop on the Flatfish Species and Anglerfish (WKFLAT), 1–8 March 2012, Bilbao, Spain. ICES CM 2012/ACOM:46.

Landa, L., Duarte, R. and I. Quincoces. 2008. Growth of white anglerfish (*Lophius piscatorius*) tagged in the Northeast Atlantic, and a review of age studies on anglerfish. ICES Journal of Marine Science 65: 72–80.

Prista, N., Fernandes, A., Pereira, J, Silva, C., Alpoim, R. and F. Borges. Discards of WGBIE species by the Portuguese bottom otter trawl operating in the ICES division IXa (2004-2013). Working Document presented at WGBIE2014.

Table 4.3.1. ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Tonnes landed by the main fishing fleets for 1978-2014 as determined by the Working Group.

	Div. VIIIc				Div. IXa						Div. VIIIc+IXa		Div. VIIIc+IXa
	SPAIN				SPAIN			PORTUGAL					
Year	Trawl	Gillnet	Others	TOTAL	Trawl	Gillnet	Others	Trawl	Artisanal	TOTAL	SUBTOTAL	Unallocated	TOTAL
1978	n/a	n/a		n/a	258				115	373			
1979	n/a	n/a		n/a	319				225	544			
1980	2 806	1 270		4 076	401				339	740	4 816		4 816
1981	2 750	1 931		4 681	535				352	887	5 568		5 568
1982	1 915	2 682		4 597	875				310	1 185	5 782		5 782
1983	3 205	1 723		4 928	726				460	1 186	6 114		6 114
1984	3 086	1 690		4 776	578			186	492	1 256	6 032		6 032
1985	2 313	2 372		4 685	540			212	702	1 454	6 139		6 139
1986	2 499	2 624		5 123	670			167	910	1 747	6 870		6 870
1987	2 080	1 683		3 763	320			194	864	1 378	5 141		5 141
1988	2 525	2 253		4 778	570			157	817	1 543	6 321		6 321
1989	1 643	2 147		3 790	347			259	600	1 206	4 996		4 996
1990	1 439	985		2 424	435			326	606	1 366	3 790		3 790
1991	1 490	778		2 268	319			224	829	1 372	3 640		3 640
1992	1 217	1 011		2 228	301			76	778	1 154	3 382		3 382
1993	844	666		1 510	72			111	636	819	2 329		2 329
1994	690	827		1 517	154			70	266	490	2 007		2 007
1995	830	572		1 403	199			66	166	431	1 834		1 834
1996	1 306	745		2 050	407			133	365	905	2 955		2 955
1997	1 449	1 191		2 640	315			110	650	1 075	3 714		3 714
1998	912	1 359		2 271	184			28	497	710	2 981		2 981
1999	551	1 013		1 564	79			9	285	374	1 938		1 938
2000	269	538		808	107			4	340	451	1 259		1 259
2001	231	294		525	57			16	190	263	788		788
2002	385	341		726	110			29	168	307	1 032		1 032
2003	911	722		1 633	312			29	305	645	2 278		2 278
2004	1 260	1 269		2 528	264			27	335	626	3 154		3 154
2005	1 378	1 622		3 000	371			29	244	643	3 644		3 644
2006	1 166	1 247		2 413	260			29	260	549	2 963		2 963
2007	955	1 009		1 964	181			13	192	386	2 350		2 350
2008	894	1 168		2 062	138			11	127	275	2 337		2 337
2009	850	1 058		1 909	213			10	148	371	2 280		2 280
2010	313	955		1 268	158			2	119	279	1 547		1 547
2011	243	483	73	799	59	28	48	46	80	260	1 060	80	1 140
2012	271	527	67	866	54	20	42	6	163	285	1 151	230	1 381
2013	274	718	38	1 029	47	30	50	15	154	296	1 325	190	1 516
2014	358	947	28	1 334	91	47	4	30	122	294	1 628	374	2 001

n/a: not available

Table 4.3.2. ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Weight and percentage of discards for Spanish fleets.

	Trawl			Gillnet	
Year	Weight (t)	CV	% Catches	Weight (t)	% Catches
1994	20.9	34.05	2.4		
1995	n/a	n/a	n/a		
1996	n/a	n/a	n/a		
1997	5.4	68.13	0.3		
1998	n/a	n/a	n/a		
1999	0.8	71.30	0.1		
2000	5.7	33.64	1.5		
2001	n/a	n/a	n/a		
2002	n/a	n/a	n/a		
2003	25.1	54.42	2.0		
2004	48.2	32.53	3.1		
2005	44.1	30.97	2.5		
2006	43.7	48.33	3.0		
2007	17.1	28.44	1.5		
2008	4.9	56.47	0.5		
2009	20.0	26.11	3.6		
2010	11.5	36.87	2.4		
2011	22.6	19.27	7.0		
2012	62.6	43.65	11.4		
2013	65.8	n/a	17.0	143.8	62.0
2014	24.4	n/a	5.2	0.0	0.0

n/a: not available
CV: coefficient of variation

Table 4.3.3. ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.

Length composition by fleet and ajusted length composition for total landings (thousands) in 2014.
Ajusted TOTAL: ajusted to landings from fleets without length compostion.

	Div. VIIIc			Div. IXa				Div. VIIIc+IXa	
	SPAIN			SPAIN	PORTUGAL				
Length (cm)	Trawl	Gillnet	TOTAL	Trawl	Trawl	Artisanal	TOTAL	TOTAL	Ajusted TOTAL
14	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00
15	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00
16	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00
17	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00
18	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00
19	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00
20	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00
21	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00
22	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00
23	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00
24	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00
25	0.000	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00
26	0.000	0.000	0.000	0.110	0.000	0.00	0.11	0.11	0.11
27	0.000	0.000	0.000	0.036	0.000	0.00	0.04	0.04	0.04
28	0.035	0.000	0.035	0.159	0.000	0.00	0.16	0.19	0.21
29	0.093	0.000	0.093	0.226	0.000	0.00	0.23	0.32	0.34
30	0.077	0.000	0.077	0.300	0.000	0.00	0.30	0.38	0.40
31	0.342	0.000	0.342	0.359	0.000	0.00	0.36	0.70	0.74
32	0.650	0.000	0.650	0.185	0.267	0.00	0.45	1.10	1.16
33	0.948	0.000	0.948	0.301	0.877	0.67	1.85	2.80	2.88
34	1.075	0.000	1.075	0.727	1.276	0.00	2.00	3.08	3.17
35	1.031	0.000	1.031	0.236	2.433	0.00	2.67	3.70	3.78
36	1.184	0.000	1.184	0.669	1.257	0.00	1.93	3.11	3.23
37	1.296	0.000	1.296	0.567	0.294	0.00	0.86	2.16	2.27
38	1.238	0.000	1.238	0.842	0.862	0.00	1.70	2.94	3.10
39	1.110	0.000	1.110	0.217	0.808	0.08	1.11	2.22	2.33
40	0.806	0.000	0.806	0.472	1.242	0.00	1.71	2.52	2.60
41	0.781	0.000	0.781	0.199	0.350	0.04	0.59	1.37	1.46
42	1.001	0.000	1.001	0.596	0.312	0.73	1.64	2.64	2.78
43	0.937	0.000	0.937	0.221	0.519	5.42	6.16	7.09	7.18
44	0.821	0.000	0.821	0.457	0.198	0.00	0.66	1.48	1.59
45	0.776	0.014	0.790	0.201	0.194	0.05	0.44	1.23	1.32
46	0.555	0.000	0.555	0.310	0.446	0.59	1.34	1.90	1.95
47	0.719	0.000	0.719	0.307	0.300	0.65	1.25	1.97	2.05
48	0.841	0.086	0.927	0.382	0.251	0.10	0.73	1.66	1.76
49	0.764	0.044	0.808	0.359	0.039	0.07	0.47	1.28	1.38
50	0.921	0.186	1.107	0.589	0.067	0.12	0.78	1.88	2.01
51	0.920	0.067	0.987	0.128	0.882	0.37	1.38	2.37	2.49
52	1.126	0.196	1.322	0.415	0.483	0.07	0.97	2.29	2.42
53	1.079	0.294	1.374	0.581	0.272	0.46	1.31	2.69	2.84
54	0.614	0.295	0.909	0.375	0.406	1.60	2.38	3.29	3.37
55	0.951	0.374	1.325	0.460	0.000	0.04	0.50	1.82	1.94
56	1.116	0.777	1.893	0.153	0.132	0.00	0.28	2.18	2.32
57	1.152	0.507	1.659	0.384	0.348	0.10	0.83	2.49	2.62
58	0.789	1.105	1.895	0.543	0.345	0.00	0.89	2.78	2.94
59	1.140	0.689	1.829	0.340	0.068	0.19	0.60	2.43	2.60
60	1.204	1.511	2.714	0.186	0.251	0.11	0.55	3.26	3.43
61	1.197	1.874	3.071	0.396	0.035	0.16	0.59	3.66	3.88
62	1.449	2.422	3.871	0.186	0.135	0.13	0.45	4.33	4.56
63	1.551	2.199	3.750	0.360	0.000	0.13	0.49	4.24	4.49
64	1.979	3.064	5.043	0.347	0.039	0.13	0.51	5.56	5.89
65	1.928	3.526	5.454	0.335	0.209	0.00	0.54	6.00	6.32
66	1.558	2.722	4.280	0.271	0.067	0.33	0.67	4.95	5.19
67	2.328	4.070	6.398	0.272	0.238	0.40	0.91	7.31	7.68
68	1.818	4.187	6.005	0.316	0.000	0.00	0.32	6.32	6.65
69	2.331	4.917	7.248	0.349	0.241	0.19	0.78	8.03	8.45
70	2.740	5.499	8.239	0.369	0.067	0.18	0.62	8.86	9.30
71	1.874	4.840	6.715	0.463	0.000	0.43	0.90	7.61	7.96
72	1.802	5.895	7.697	0.286	0.000	0.20	0.49	8.19	8.61
73	1.854	5.505	7.358	0.224	0.035	0.08	0.34	7.70	8.08
74	1.876	5.205	7.080	0.366	0.000	0.17	0.54	7.62	7.98
75	1.189	6.764	7.953	0.231	0.027	0.00	0.26	8.21	8.61
76	1.047	4.726	5.773	0.306	0.000	0.21	0.52	6.29	6.61
77	1.510	4.287	5.797	0.048	0.000	0.25	0.30	6.10	6.42
78	1.472	3.580	5.052	0.309	0.000	0.20	0.51	5.56	5.83
79	1.210	4.232	5.442	0.424	0.000	0.09	0.51	5.95	6.27
80	1.416	3.924	5.340	0.428	0.035	0.27	0.73	6.07	6.40
81	1.144	2.882	4.026	0.171	0.000	0.99	1.16	5.18	5.43
82	1.165	3.069	4.234	0.342	0.000	0.05	0.39	4.63	4.89
83	0.875	3.120	3.995	0.300	0.035	0.25	0.59	4.58	4.81
84	1.040	2.558	3.598	0.226	0.000	0.17	0.40	3.99	4.24
85	1.410	1.863	3.273	0.249	0.000	0.13	0.38	3.66	3.89
86	0.935	2.351	3.286	0.104	0.021	0.08	0.20	3.49	3.69
87	0.647	2.287	2.934	0.214	0.076	0.07	0.36	3.30	3.49
88	0.845	2.142	2.986	0.323	0.000	0.09	0.41	3.40	3.58
89	0.593	2.002	2.595	0.026	0.000	0.00	0.03	2.62	2.79
90	1.041	2.700	3.741	0.160	0.000	0.13	0.29	4.03	4.26
91	0.876	1.566	2.443	0.057	0.000	0.58	0.64	3.08	3.23
92	0.779	1.647	2.426	0.137	0.000	0.00	0.14	2.56	2.72
93	0.612	1.666	2.278	0.107	0.028	0.05	0.18	2.46	2.61
94	0.362	1.533	1.895	0.127	0.000	0.07	0.20	2.09	2.20
95	0.264	1.697	1.962	0.205	0.000	0.13	0.34	2.30	2.43
96	0.474	1.168	1.642	0.160	0.000	0.13	0.29	1.93	2.04
97	0.241	1.609	1.850	0.035	0.000	0.04	0.08	1.92	2.02
98	0.250	1.173	1.423	0.065	0.000	0.00	0.07	1.49	1.58
99	0.198	1.515	1.712	0.037	0.035	0.20	0.27	1.99	2.08
100+	1.507	8.836	10.343	0.509	0.296	3.39	4.20	14.54	15.11
TOTAL	77	137	214	22	17	22	61	275	289
Tonnes	358	947	1 306	91	30	122	285	1 590	1 628
Mean Weight (g)	4 624	6 917	6 089	4 063	1 792	5 666	4 681	5 778	5 630
Mean length (cm)	65.5	78.0	73.5	59.0	45.2	65.0	57.3	69.9	70.0
Measured weight (t)	n/a	n/a	n/a	n/a	0.5	1.1	n/a	n/a	n/a

Table 4.3.4. ANGLERFISH (*L. piscatorius*). Divisions VIIIc and IXa.
Numbers, mean weight and mean length of landings between 1986 and 2014.

Year	Total (thousands)	Mean Weight (g)	Mean Length (cm)
1986	1 872	3 670	61
1987	2 806	1 832	44
1988	2 853	2 216	50
1989	1 821	2 744	54
1990	1 677	2 261	49
1991	1 657	2 197	50
1992	1 256	2 692	54
1993	857	2 719	54
1994	704	2 850	54
1995	876	2 093	48
1996	1 153	2 564	52
1997	1 043	3 560	60
1998	583	5 113	68
1999	290	6 674	71
2000	190	6 885	72
2001	127	6 189	64
2002	381	2 766	50
2003	784	2 907	54
2004	809	3 456	61
2005	856	4 259	63
2006	923	3 211	58
2007	553	4 251	62
2008	540	4 327	63
2009	492	4 630	64
2010	288	5 569	71
2011	249	4 252	62
2012	244	4 711	65
2013	269	4 929	66
2014	289	5 630	70

Table 4.3.5. ANGLERFISH (*L. piscatorius*). Divisions VIIIc and IXa.
Abundance indices from Spanish and Portuguese surveys.

	SpGFS-WIBTS-Q4 September-October (total area Miño-Bidasoa)					PtGFS-WIBTS-Q4 October		
Year	Hauls	kg/30 min		nº/30 min		Hauls	kg/60 min	nº/60 min
		Yst	se	Yst	se			
1983	145	2.03	0.29	3.50	0.46	117	n/a	n/a
1984	111	2.60	0.47	2.90	0.55	na	n/a	n/a
1985	97	1.33	0.36	1.90	0.26	150	n/a	n/a
1986	92	4.28	0.80	10.70	1.40	117	n/a	n/a
1987	ns	ns	ns	ns	ns	81	n/a	n/a
1988	101	3.33	0.70	1.50	0.25	98	n/a	n/a
1989	91	0.44	0.08	2.40	0.30	138	0.09	0.07
1990	120	1.19	0.22	1.20	0.22	123	0.46	0.05
1991	107	0.71	0.22	0.50	0.09	99	+	+
1992	116	0.76	0.15	1.18	0.16	59	0.09	0.01
1993	109	0.88	0.16	1.20	0.14	65	0.08	0.01
1994	118	1.66	0.62	3.70	0.49	94	+	0.02
1995	116	2.19	0.32	5.70	0.69	88	0.05	0.03
1996*	114	1.54	0.26	1.40	0.16	71	0.27	0.18
1997	116	1.69	0.39	0.67	0.11	58	0.49	0.03
1998	114	1.40	0.37	0.39	0.08	96	+	+
1999*	116	0.75	0.23	0.36	0.06	79	+	+
2000	113	0.57	0.19	0.88	0.18	78	+	+
2001	113	1.09	0.24	2.88	0.28	58	+	+
2002	110	1.34	0.21	2.76	0.29	67	0.06	0.04
2003*	112	1.67	0.40	1.41	0.16	80	0.29	0.15
2004*	114	2.09	0.32	2.71	0.32	79	0.16	0.12
2005	116	3.05	0.54	2.04	0.19	87	0.12	0.04
2006	115	1.88	0.40	2.86	0.30	88	+	+
2007	117	1.65	0.25	2.56	0.25	96	+	+
2008	115	1.85	0.37	1.96	0.35	87	+	+
2009	117	1.07	0.17	1.91	0.17	93	+	+
2010	114	1.29	0.25	1.95	0.28	87	+	+
2011	114	0.77	0.16	1.09	0.18	86	+	+
2012	115	1.11	0.27	1.06	0.14	ns	ns	ns
2013**	114	2.09	0.64	2.30	0.30	93	0.34	0.02
2014**	116	1.56	0.36	1.24	0.17	81	0.00	0.00

Yst = stratified mean
se = standard error
ns = no survey
n/a = not available
+ = less than 0.01
* For Portuguese Surveys - R/V Capricornio, other years R/V Noruega
** For Spanish Surveys - R/V Miguel Oliver, other years R/V Coornide de Saavedra

Table 4.3.6. ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Landings, fishing effort and landings per unit effort for trawl and gillnet fleets.
For landings the percentage relative to total annual stock landings is given.

	AVILÉS: SP-AVITR8C				SANTANDER: SP-SANTR8C				CEDEIRA: SP-CEDGNS8C			
Year	LANDINGS (t)	%	EFFORT (days*100hp)	LPUE (kg/day*100hp)	LANDINGS (t)	%	EFFORT (days*100hp)	LPUE (kg/day*100hp)	LANDINGS (t)	%	EFFORT (soaking days)	LPUE (kg/soaking)
1986	500	7	10 845	46.1	516	8	18 153	28.4				
1987	500	10	8 309	60.2	529	10	14 995	35.3				
1988	401	6	9 047	44.3	387	6	16 660	23.3				
1989	214	4	8 063	26.5	305	6	17 607	17.3				
1990	260	7	8 497	30.6	278	7	20 469	13.6				
1991	245	7	7 681	31.9	281	8	22 391	12.6				
1992	198	6	--	--	222	7	22 833	9.7				
1993	76	3	7 635	9.9	186	8	21 370	8.7				
1994	116	6	9 620	12.0	188	9	22 772	8.2				
1995	192	10	6 146	31.2	186	10	14 046	13.2				
1996	322	11	4 525	71.1	270	9	12 071	22.4				
1997	345	9	5 061	68.1	381	10	11 776	32.3				
1998	286	10	5 929	48.3	316	11	10 646	29.7				
1999	108	6	6 829	15.8	182	9	10 349	17.6	342	18	4 582	74.5
2000	28	2	4 453	6.3	75	6	8 779	8.6	140	11	2 981	46.8
2001	23	3	1 838	12.5	54	7	3 053	17.6	87	11	1 932	44.8
2002	75	7	2 748	27.5	57	6	3 975	14.3	130	13	2 398	54.3
2003	111	5	2 526	44.0	85	4	3 837	22.1	159	7	2 703	59.0
2004	216	7	--	--	106	3	3 776	28.1	382	12	4 677	81.6
2005	278	8	--	--	59	2	1 404	41.9	434	12	3 325	130.4
2006	148	5	--	--	89	3	2 718	32.7	415	14	3 911	106.2
2007	101	4	--	--	103	4	4 334	23.8	233	10	3 976	58.6
2008	99	4	--	--	--	--	--	--	228	10	5 133	44.3
2009	69	3	--	--	35	2	1 125	31.3	183	8	2 300	79.5
2010	--	--	--	--	44	3	1 628	27.1	231	15	1 880	122.7
2011	--	--	--	--	44	4	--	--	60	6	522	115.9
2012	--	--	--	--	22	2	--	--	63	5	--	--

	CORUÑA-PORT: SP-CORTR8C-PORT+C58				CORUÑA TRUCKS: SP-CORTR8C-TRUCKS				CORUÑA FLEET: SP-CORTR8C-FLEET			
Year	LANDINGS (t)	%	EFFORT (days*100hp)	LPUE (kg/day*100hp)	LANDINGS (t)	%	EFFORT (days*100hp)	LPUE (kg/day*100hp)	LANDINGS (t)	%	EFFORT (days*100hp)	LPUE (kg/day*100hp)
1982	1618	28	63 313	26					1618	28	63 313	25.6
1983	1490	24	51 008	29					1490	24	51 008	29.2
1984	1560	26	48 665	32					1560	26	48 665	32.1
1985	1134	18	45 157	25					1134	18	45 157	25.1
1986	825	12	40 420	20					825	12	40 420	20.4
1987	618	12	34 651	18					618	12	34 651	17.8
1988	656	10	41 481	16					656	10	41 481	15.8
1989	508	10	44 410	11					508	10	44 410	11.4
1990	550	15	44 403	12					550	15	44 403	12.4
1991	491	13	40 429	12					491	13	40 429	12.1
1992	432	13	38 899	11					432	13	38 899	11.1
1993	385	17	44 478	9					385	17	44 478	8.7
1994	245	12	39 602	6	63	3	12 795	5	309	15	52 397	5.9
1995	260	14	41 476	6	57	3	10 232	6	316	17	51 708	6.1
1996	413	14	35 709	12	83	3	8 791	9	496	17	44 501	11.2
1997	411	11	35 494	12	59	2	9 108	6	470	13	44 602	10.5
1998	138	5	29 508	5	30	1	--	--	168	6	--	--
1999	168	9	30 131	6	--	--	--	--	--	--	--	--
2000	85	7	30 079	3	2	0	--	--	88	7	--	--
2001	84	11	29 935	3	--	--	--	--	--	--	--	--
2002	130	13	21 948	6	61	6	6 747	9	191	19	28 695	6.7
2003	228	10	18 519	12	115	5	7 608	15	342	15	26 127	13.1
2004	277	9	19 198	14	162	5	10 342	16	439	14	29 540	14.9
2005	391	11	20 663	19	248	7	10 302	24	639	18	30 965	20.6
2006	242	8	19 264	13	273	9	12 866	21	515	17	32 130	16.0
2007	222	9	21 651	10	233	10	13 187	18	455	19	34 838	13.1
2008	274	12	20 212	14	153	7	9 812	16	428	18	30 024	14.2
2009	165	7	16 152	10	152	7	12 930	12	317	14	29 092	10.9
2010	129	8	16 680	8	70	5	9 003	8	165	11	22 746	7.3
2011	92	8	12 835	7	--	--	--	--	146	13	18 617	7.9
2012	132	10	14 446	9	--	--	--	--	142	10	21 110	6.7
2013	122	8	14 736	8	--	--	--	--	--	--	--	--
2014	114	6	18 060	6	--	--	--	--	--	--	--	--

	PORTUGAL CRUSTACEANS: PT-CRUST						PORTUGAL FISH: PT-FISH					
Year	LANDINGS (t)	%	EFFORT (1000 hours)	EFFORT (1000 hauls)	LPUE (kg/hour)	LPUE (kg/haul)	LANDINGS (t)	%	EFFORT (1000 hours)	EFFORT (1000 hauls)	LPUE (kg/hour)	LPUE (kg/haul)
1989	85	2	76	23	1.1	3.7	175	3	52	18	3.3	9.9
1990	106	3	90	20	1.2	5.2	219	6	61	17	3.6	12.8
1991	73	2	83	17	0.9	4.4	151	4	57	15	2.6	9.8
1992	25	1	71	15	0.3	1.6	51	2	49	14	1.0	3.7
1993	36	2	75	13	0.5	2.7	75	3	56	13	1.3	5.7
1994	23	1	41	8	0.6	3.0	47	2	36	10	1.3	4.9
1995	22	1	38	8	0.6	2.8	45	2	41	9	1.1	4.9
1996	45	2	64	14	0.7	3.1	88	3	54	12	1.6	7.1
1997	51	1	43	11	1.2	4.5	59	2	27	9	2.2	6.7
1998	11	<1	48	11	0.2	1.0	17	1	35	10	0.5	1.8
1999	3	<1	24	8	0.1	0.4	6	<1	18	6	0.3	1.0
2000	2	<1	42	10	0.0	0.2	2	<1	19	6	0.1	0.4
2001	9	1	85	18	0.1	0.5	7	1	19	5	0.4	1.4
2002	18	2	62	10	0.3	1.9	11	1	14	4	0.8	2.4
2003	13	1	42	10	0.3	1.3	16	1	17	6	0.9	2.8
2004	12	<1	21	7	0.6	1.9	14	<1	14	4	1.0	3.3
2005	12	<1	20	5	0.6	2.2	17	<1	13	4	1.3	4.7
2006	13	<1	22	5	0.6	2.4	16	1	12	4	1.3	4.2
2007	7	<1	22	6	0.3	1.1	6	<1	8	3	0.8	2.1
2008	6	<1	14	4	0.4	1.5	5	<1	5	2	1.0	2.9
2009	5	<1	15	--	0.3	--	5	<1	6	--	0.7	--
2010	1	<1	21	--	0.0	--	1	<1	14	--	0.1	--
2011	24	2	18	--	1.3	--	22	2	9	--	2.4	--
2012	3	<1	36	--	0.1	--	3	<1	27	--	0.1	--
2013	8	<1	27	--	0.3	--	7	<1	12	--	0.6	--
2014	16	<1	32	--	0.5	--	14	<1	22	--	0.7	--

Table 4.3.7. ANGLERFISH (*L. piscatorius*) - Division VIIIc and IXa.
Summary of the assessment results.

Year	Recruit Age0 (thousands)	Total Biomass (t)	Total SSB (t)	Landings (t)	Yield/SSB	F (30-130 cm)
1980	432	13 372	7 382	4 817	0.65	0.33
1981	1 688	15 076	9 772	5 566	0.57	0.33
1982	6 776	14 557	11 092	5 782	0.52	0.37
1983	2 928	13 604	10 119	6 113	0.60	0.51
1984	797	13 549	8 405	6 031	0.72	0.53
1985	1 692	12 901	8 220	6 139	0.75	0.55
1986	5 997	10 841	7 783	6 870	0.88	0.83
1987	4 080	7 466	4 881	5 139	1.05	0.95
1988	1 627	7 391	3 304	6 321	1.91	1.47
1989	3 007	5 782	2 495	4 995	2.00	1.22
1990	2 397	4 758	2 267	3 790	1.67	0.89
1991	922	4 669	2 127	3 640	1.71	0.87
1992	1 171	4 424	2 114	3 382	1.60	0.92
1993	1 392	3 538	1 914	2 329	1.22	0.69
1994	2 887	3 368	1 865	2 007	1.08	0.59
1995	2 168	3 909	1 949	1 835	0.94	0.39
1996	452	5 779	2 776	2 956	1.06	0.43
1997	209	6 901	3 847	3 715	0.97	0.48
1998	180	6 357	4 360	2 981	0.68	0.39
1999	482	5 437	4 322	1 939	0.45	0.30
2000	569	4 771	4 047	1 256	0.31	0.25
2001	3 165	4 510	3 762	788	0.21	0.19
2002	1 593	5 229	3 849	1 034	0.27	0.20
2003	397	7 310	4 435	2 279	0.51	0.31
2004	1 749	8 744	5 581	3 156	0.57	0.33
2005	1 126	9 063	6 586	3 646	0.55	0.38
2006	1 364	8 592	6 387	2 932	0.46	0.37
2007	583	8 237	6 071	2 349	0.39	0.31
2008	512	8 386	6 238	2 338	0.37	0.29
2009	707	8 297	6 489	2 280	0.35	0.29
2010	1 009	7 860	6 440	1 548	0.24	0.21
2011	896	7 978	6 541	1 140	0.17	0.17
2012	374	8 648	6 946	1 382	0.20	0.18
2013	553	9 171	7 384	1 516	0.21	0.19
2014	1 040	9 375	7 814	2 002	0.26	0.25

Table 4.3.8. ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Catch option table.

SSB(2015)	Rec proj	F(30-130cm)	Land(2015)	SSB(2016)
7 546	1 121	0.21	1 508	7438

Fmult	Fland (30-130cm)	Landings(2016)	SSB(2017)
0	0	0	9055
0.1	0.02	163	8888
0.2	0.04	322	8725
0.3	0.06	478	8565
0.4	0.08	630	8409
0.5	0.1	779	8256
0.6	0.12	925	8107
0.7	0.15	1068	7960
0.8	0.17	1207	7817
0.9	0.19	1343	7677
1	0.21	1477	7540
1.1	0.23	1607	7406
1.2	0.25	1735	7275
1.3	0.27	1860	7147
1.4	0.29	1982	7021
1.5	0.31	2102	6898
1.6	0.33	2219	6778
1.7	0.35	2333	6660
1.8	0.37	2445	6545
1.9	0.39	2555	6432
2	0.42	2662	6322

Table 4.3.9. ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Yield and SSB per recruit summary table.

SPR level	Fmult	F(30-130cm)	YPR(land)	SSB/R
1.00	0.0	0.00	0.00	52.72
0.84	0.1	0.02	0.49	44.19
0.71	0.2	0.04	0.89	37.18
0.60	0.3	0.06	1.20	31.40
0.51	0.4	0.08	1.44	26.62
0.43	0.5	0.10	1.63	22.66
0.37	0.6	0.12	1.78	19.37
0.32	0.7	0.15	1.90	16.63
0.27	0.8	0.17	1.99	14.34
0.24	0.9	0.19	2.05	12.42
0.21	1.0	0.21	2.10	10.81
0.18	1.1	0.23	2.13	9.45
0.16	1.2	0.25	2.15	8.30
0.14	1.3	0.27	2.16	7.32
0.12	1.4	0.29	2.16	6.49
0.11	1.5	0.31	2.16	5.78
0.10	1.6	0.33	2.15	5.17
0.09	1.7	0.35	2.14	4.64
0.08	1.8	0.37	2.13	4.19
0.07	1.9	0.39	2.11	3.79
0.07	2.0	0.42	2.10	3.45

	SPR level	Fmult	F(30-130cm)	YPR(land)	SSB/R
Fmax	0.12	1.40	0.29	2.16	6.45
F0.1	0.24	0.90	0.19	2.05	12.42
F40%	0.40	0.55	0.11	1.71	21.10
F35%	0.35	0.63	0.13	1.82	18.49
F30%	0.30	0.73	0.15	1.93	15.90

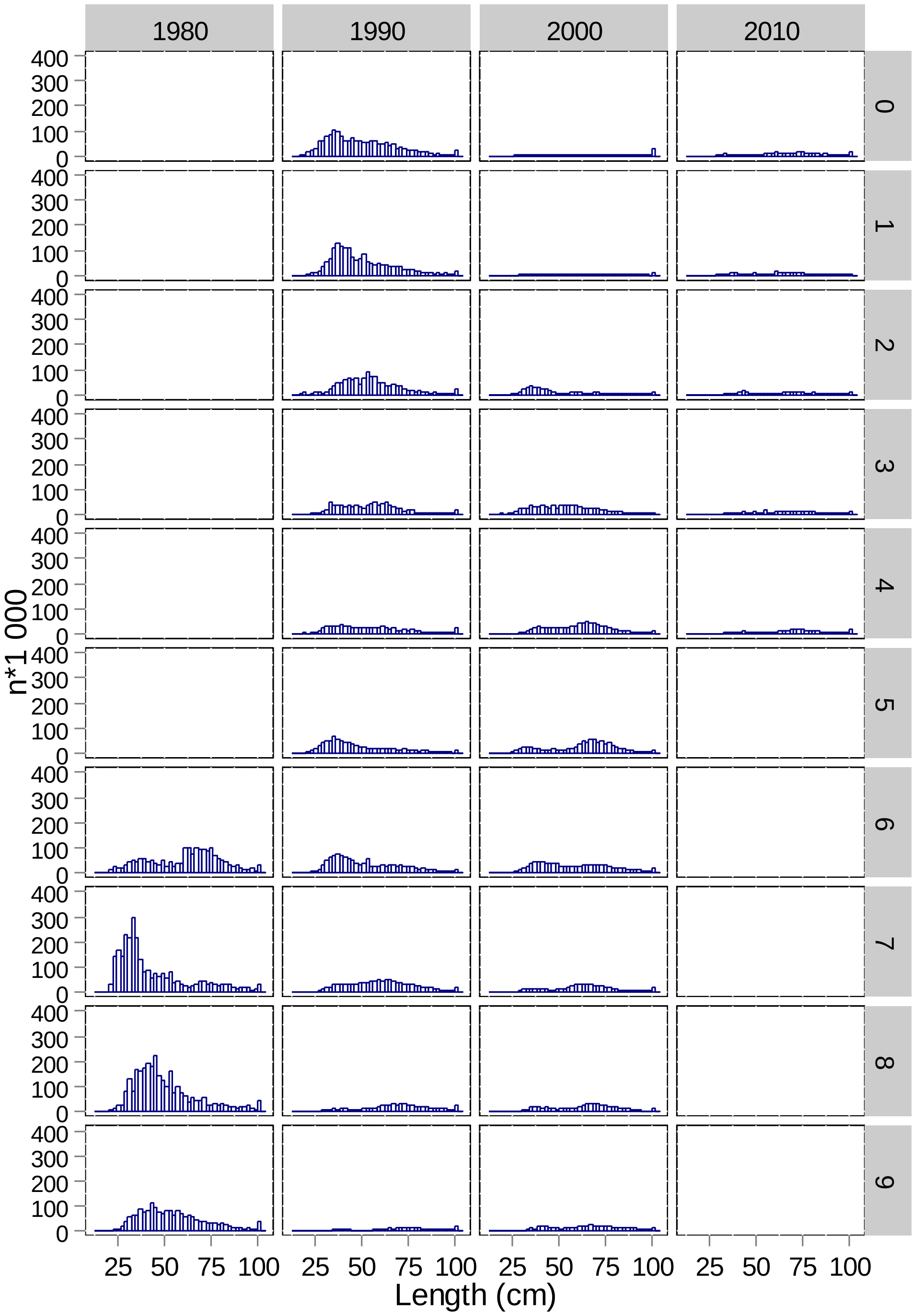


Figure 4.3.1. ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa. Length distributions of landings (thousands for 1986 to 2014).

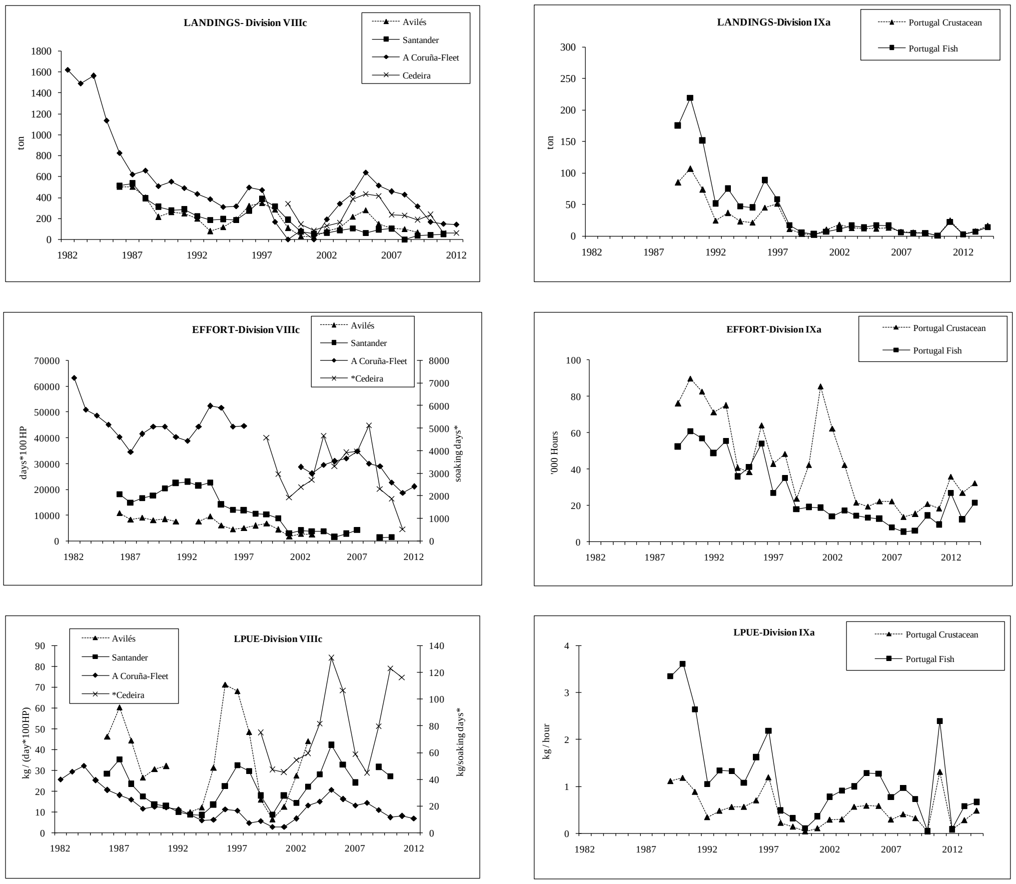


Figure 4.3.2 ANGLERFISH (L. piscatorius) - Divisions VIIIc and IXa. Trawl and gillnet landings, effort and LPUE data between 1986-2014.

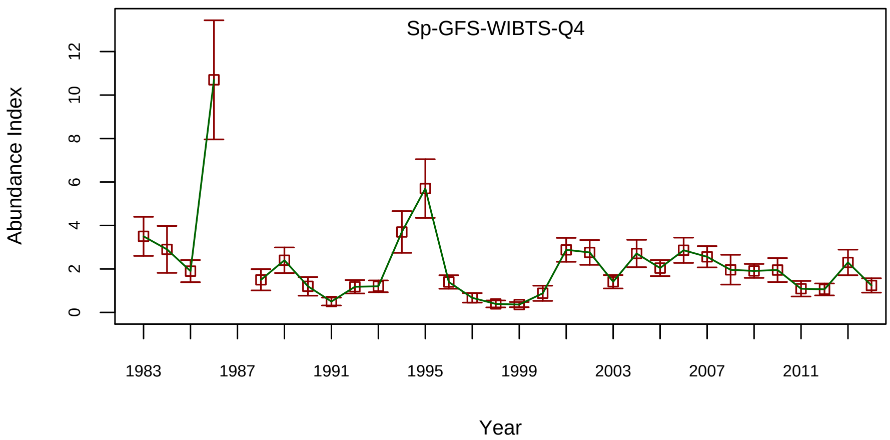


Figure 4.3.3 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.

Abundance index from survey Sp-GFS-WIBTS-Q4 in numbers/30 min. Bars represent 95% confidence intervals.

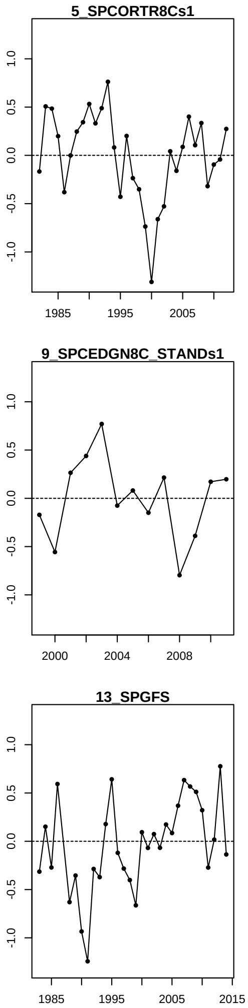


Figure 4.3.4 **ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.**

Residuals of the fits to the surveys in log(abundance indices). A Coruña and Cedeira are by quarters.

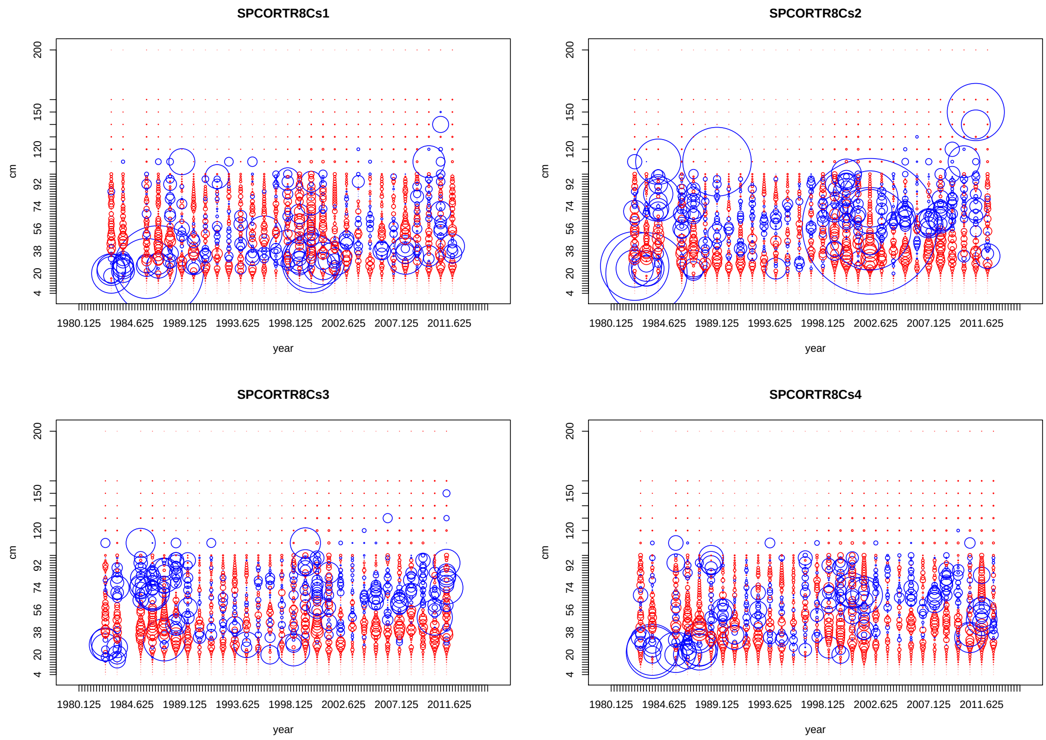


Figure 4.3.5 **ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.**

Pearson residuals of the fit to the length distributions of the abundance indices. Blue=positive residuals and red=negative residuals.

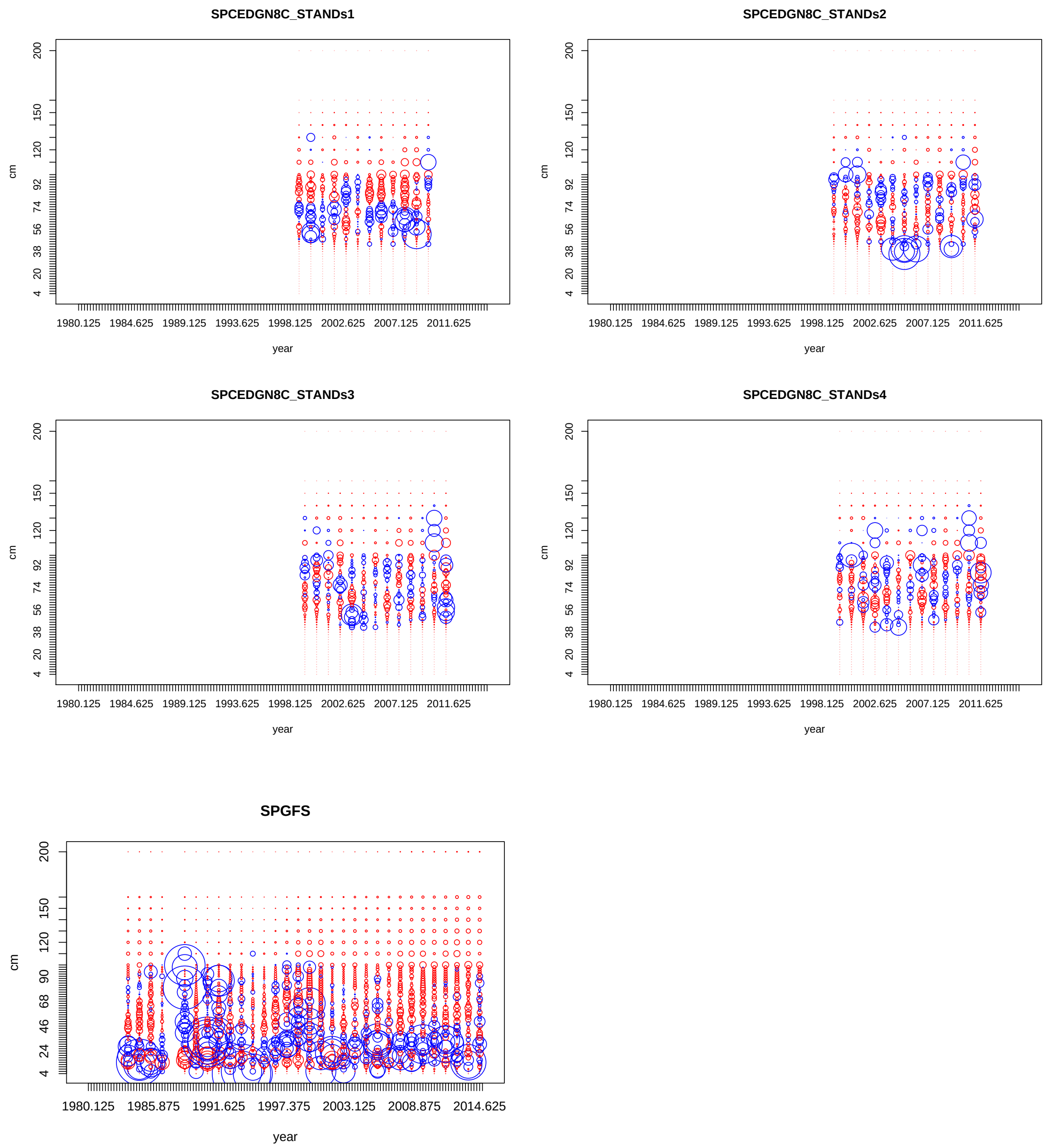


Figure 4.3.5 (continued)

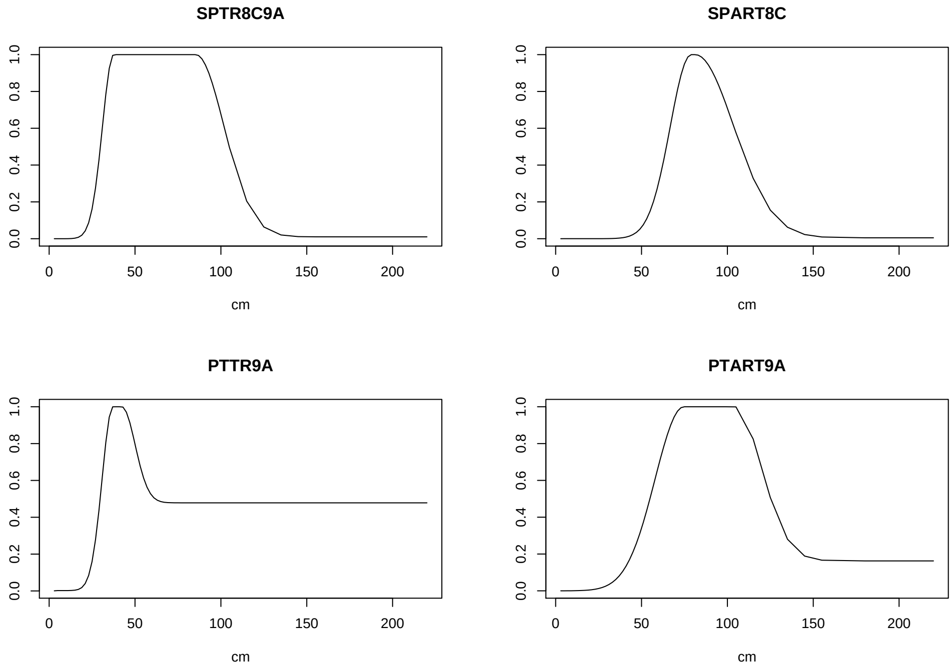


Figure 4.3.6 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.

Relative selection patterns at length by fishery estimated by SS3.

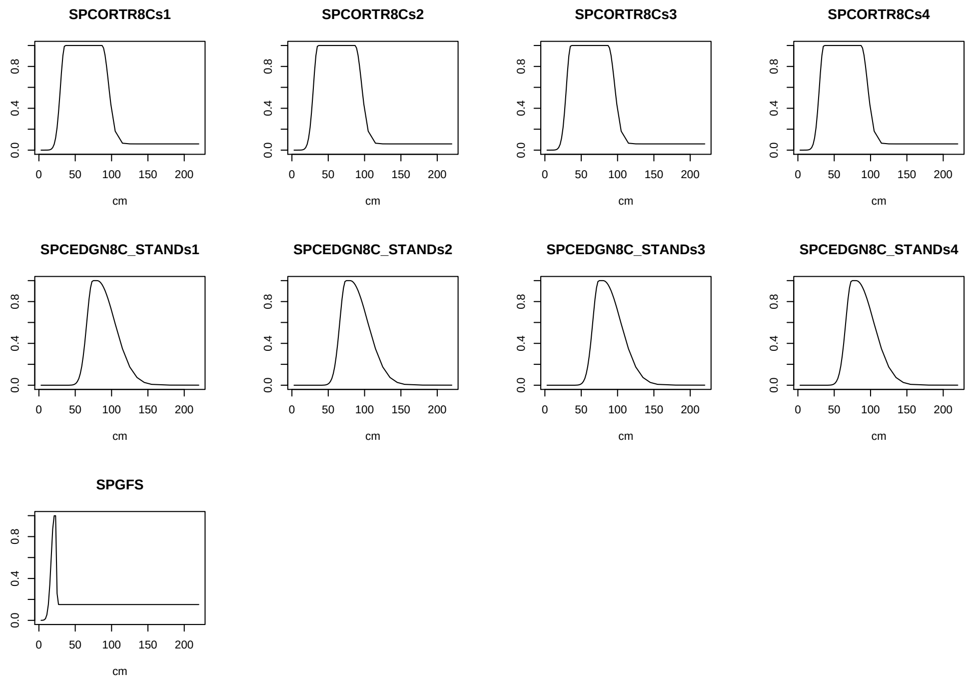


Figure 4.3.7 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.

Relative selection patterns at length by abundance index estimated by SS3. A Coruña and Cedeira indices are by quarter.

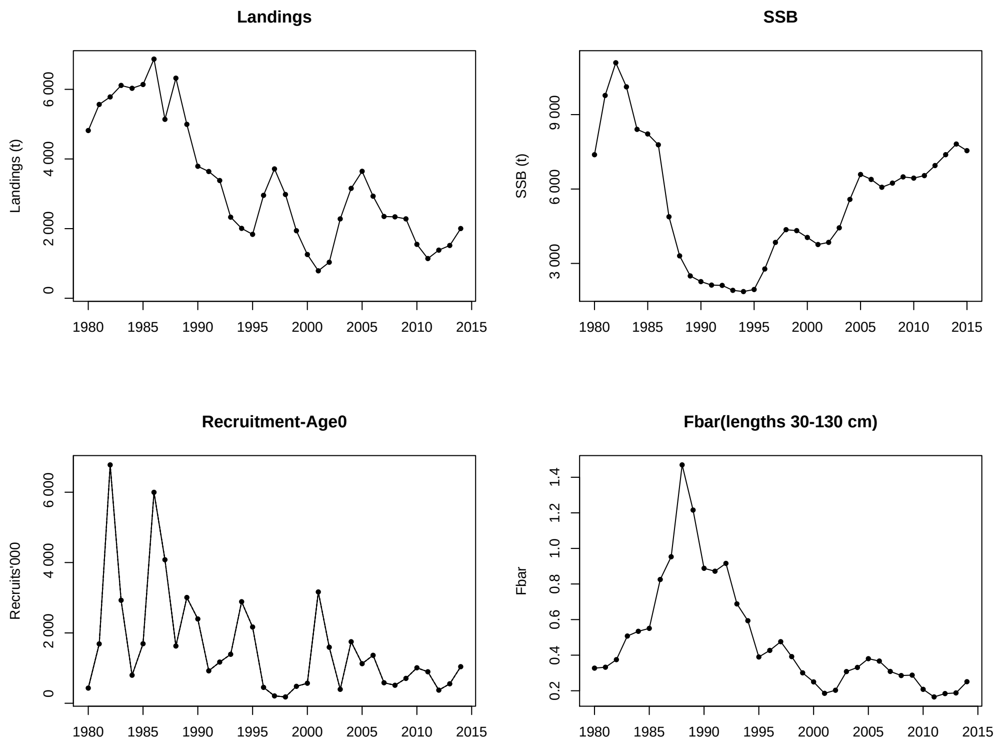


Figure 4.3.8 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.

Summary plots of stock trends.

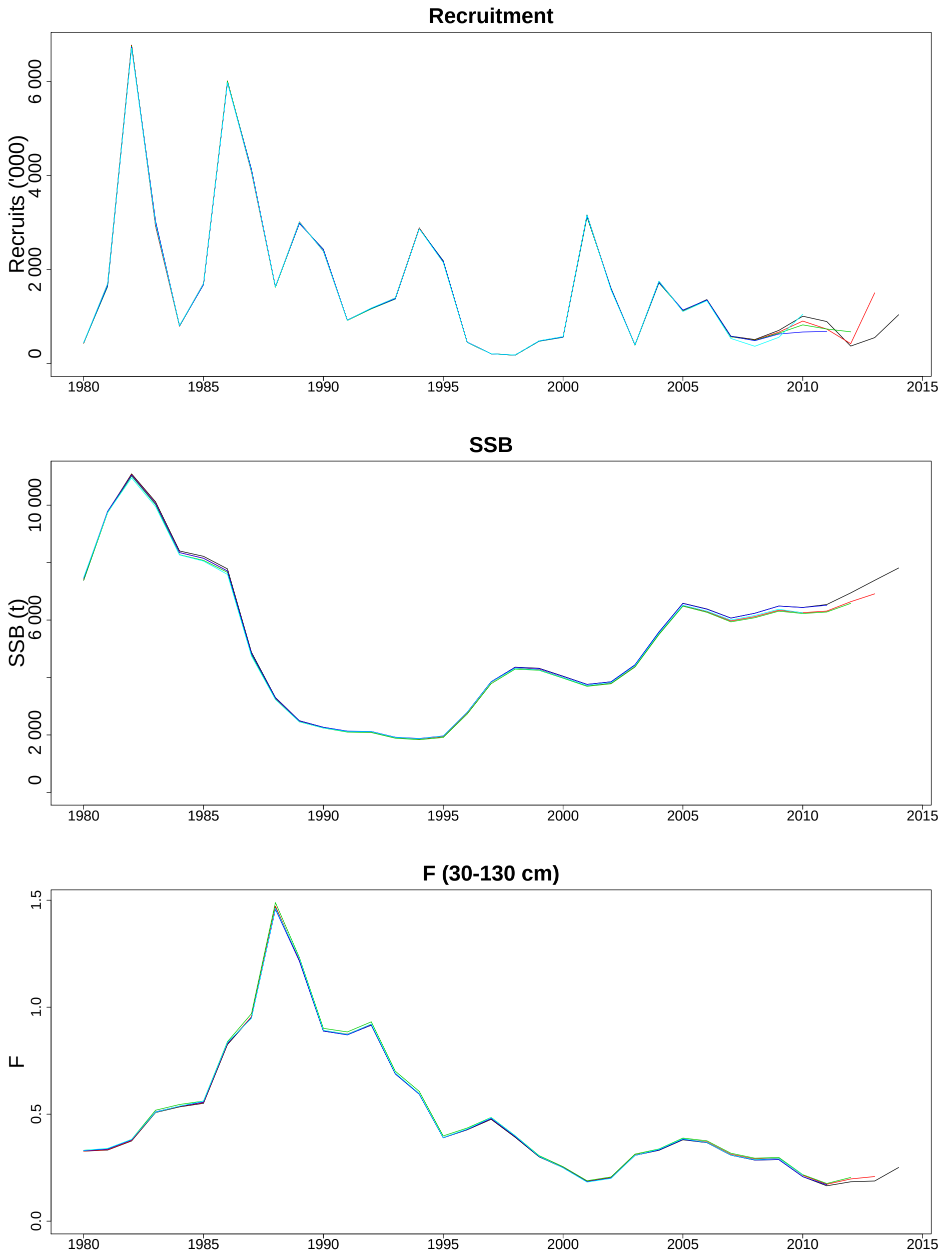


Figure 4.3.9 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.

Retrospective plots from SS3.

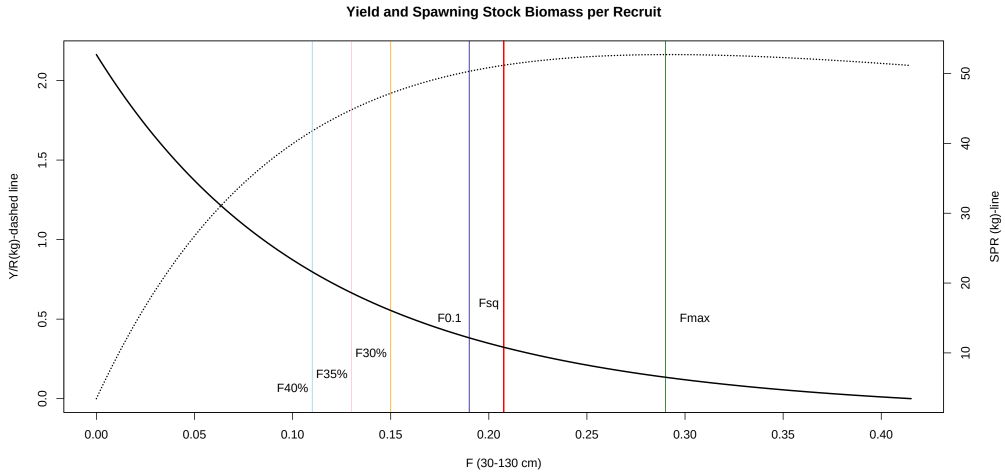


Figure 4.3.10 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.

Yield and SSB per recruit plot. Estimated reference points and Fsq are indicated.

4.4 Anglerfish (*Lophius budegassa*) in Divisions VIIIc and IXa

4.4.1 General

4.4.1.1 Ecosystem aspects

Biological/ecosystem aspects are common with *L. piscatorius* and are described in the Stock Annex.

4.4.2 Fishery description

L. budegassa is caught by Spanish and Portuguese bottom trawlers and gillnet fisheries. As *L. piscatorius*, *L. budegassa* is an important target species for the artisanal fleet, while it is a by catch for the trawl fleet targeting hake or crustaceans (see Stock Annex).

The length distribution of the landings is considerably different between both fisheries, with the gillnet landings showing higher mean lengths compared to the trawl landings. Since 2005, the Spanish landings were on average split 74% from the trawl fleet (mean lengths in 2014 of 40 cm in both Divisions VIIIc and IXa), 20% from the gillnet fleet (mean length of 61 cm in 2014 in Division VIIIc) and 6% from others fleets. Portuguese landings, for the same period, were on average split, 29 % from the trawl fleet (mean length of 44 cm in 2014) and 71% from the artisanal fleet (mean length of 48 cm in 2014).

4.4.3 Data

4.4.3.1 Commercial catches and discards

Total landings of *L. budegassa* by country and gear for the period 1978–2014, as estimated by the Working Group, are given in Table 4.4.1. See historical landings analysis in the Stock Annex. A revision of Spanish landings for the period 2011-2013 were provided to the WG. The new methodology of estimation of landings explained in Castro 2014 (WD03) is considered appropriate for the estimation of the stock landings of this species and new values are consistent with the time series of landings, being the new series accepted to do the assessment. Unallocated landings for this stock were available for the first time for the years 2011, 2012 and 2014 and a revision of unallocated landings for 2013 were also presented. The unallocated values were considered realistic and are taken into account for the assessment. From 2002 to 2007 landings increased to 1 301 t, decreasing afterwards to levels between 770 - 784 t in 2009-2012. In 2012 landings reached 1 139 t, but since then decreased been 988 t in 2014.

Spanish trawl discards estimates of *L. budegassa* in weight and associated coefficient of variation (CV) are shown in Table 4.4.2. The estimated Spanish discards rate observed from 1994 to 2014, shows two picks, in 2006 (92 t) and 2010 (61 t). The coefficient of variation for weight data varied from 24% to 99%.

Sampling effort and percentage of occurrence of *L. budegassa* discards in the trawl Portuguese fisheries were presented for the 2004-2013 period (Prista et al. 2014 – WD3 WGBIE 2014). The maximum occurrence of discards in the trawl fleet targeting fish was 2% (sampling effort varies between 50 and 194 hauls per year). The maximum occurrence of discards in the trawl fleet targeting crustaceans was 8% (sampling effort varies between 28 and 111 hauls per year). Due to the low frequency of discards, it is not possible apply to anglerfish, the algorithm used in the WD for hake, at that moment discards estimates have not been calculated. The same situation was observed in 2014.

Partial information on the Spanish and Portuguese discards was available and the WG concluded that discards could be considered negligible.

4.4.3.2 Biological sampling

The procedure for sampling of this species is the same as for *L. piscatorius* (see Stock Annex).

The sampling levels for 2014 are shown in Table 1.3. The métier sampling adopted in Spain and Portugal in 2014, following the requirement of EU Data Collection Framework, can have an effect on the provided data. Spanish sampling levels are similar to previous years but an important reduction of Portuguese sampling levels was observed in 2009-2011, since 2012 Portugal increased the sampling effort.

Length composition

Table 4.4.3 gives the annual length compositions by ICES division, country and gear and the adjusted length composition for total stock landings (excluding unallocated landings, length composition are not used in the actual assessment of *L. budegassa*) for 2014. The annual length compositions between 1986 and 2014 are presented in Figure 4.4.1.

In 2002 an increase of smaller individuals is apparent (around 30-35 cm), that is confirmed in the 2003 length distribution. In 2006 and 2007 there was an increase in the number of smaller individuals which was confirmed by the lowest annual mean lengths (37 and 39 cm) observed since 1986. From 2008 to 2013 these small fish were not observed, in 2014 a small mode was observed at smaller lengths decreasing the annual mean length. The total annual landings in numbers and the annual mean length and mean weight are in Table 4.4.4.

In 2005 the total number of landed individuals was low, being 9% of the maximum value (year 1987). In 2006 and 2007 the number of landed fish more than doubled the 2005 number. The number of landed fish decreased to a minimum in 2009. In 2010 and 2011 the number increased, but since then have been decreasing being in recent years at minimum levels. The mean weight continued at relative high levels.

4.4.3.3 Abundance indices from surveys

Spanish and Portuguese survey results for the period 1983–2014 are summarized in Table 4.4.5. The Portuguese survey was not performed in 2012. Considering the very small amount of caught anglerfish in the two surveys, these indices were not considered to reflect the change in the abundance of this species.

4.4.3.4 Commercial catch–effort data

Landings, effort and LPUE data are given in Table 4.4.6 and Figure 4.4.2 for Spanish trawlers from ports of Santander, Avilés and A Coruña (all in Division VIIIc) since 1986 and for Portuguese trawlers (Division IXa) since 1989. For each fleet the proportion related to the total landings is also given in the table.

In 2013-2014 Spain only provided information for A Coruña port series. Effort data in 2013 for this tuning fleet was calculated using the information from electronic logbooks and following different criteria than those established for previous years. In order to check the consistency of the Spanish time series a backward revision of the time series should be realized to compare the different methods of estimating and sources of information employed.

Three LPUE series were presented in the past for the A Coruña fleet: "A Coruña port" for trips that are exclusively landed in the port, "A Coruña trucks" for trips that are landed in other ports and "A Coruña fleet" that takes into account all the trips of the fleet. The LPUE series used in the assessment (A Coruña fleet) was not update for 2013-2014. The new revision was carried out only for the A Coruña port series, it was not possible during the WG to analyze the potentiality of using this series for the assessment instead of the incomplete A Coruña fleet series.

For the Portuguese fleets, until 2011 most log-books were filled in paper but have thereafter been progressively replaced by e-logbooks. Since 2013 more than 90% of the logbooks are being completed in the electronic version. The LPUE series were revised from 2012 onwards. To revise the series backwards further refinement of the algorithms is required.

Excluding the Avilés and Santander fleets, from the late eighties to mid-nineties the overall trend in landings for all fleets was decreasing. A slight increase was observed from 1995 to 1998 in all fleets. The A Coruña trawler fleet showed in 2002 the most important drop in landings and in relative proportion of total landings. The lowest observed landings for both trawlers and gillnets was in 2009. From 2010 to 2012 an increase in catches were observed specially in the Portuguese fleets but decrease in recent years.

Effort trends are analysed in section 4.3.2.4.

LPUEs of Spanish Aviles and Santander fleets show high values during the second half of the 90's, while the Portuguese fleets have fluctuated. Spite the variability, from 2000 to 2005, a decreasing trend was observed for all fleets, since then a slightly increasing trend can be observed. From 2010 to 2012 an increase in catches rates were observed specially in the Portuguese fleets. In 2013 and 2014 LPUEs decrease, in the case of the Portuguese crustacean fleet the value is still high but for Portuguese groundfish fleet is around the mean.

4.4.4 Assessment

In WKFLAT2012 the assessment of the status of each anglerfish species was carried out separately, the white anglerfish based on SS3 model and the black anglerfish based on ASPIC (Prager, 1994; Prager, 2004). This year an update of that assessment was carried out.

4.4.4.1 Input data

At the WKFLAT2012 it was accepted, as the basis for advice, to run the ASPIC model with the following data series. Except for the Spanish fleet 'A Coruña', all series were updated till 2014 for this assessment:

- Spanish fleet 'A Coruña': the longest of the potential tuning series and represents the bulk of the fishery (SPCORTR8c: 1982-2012).
- Portuguese Trawler fleet directing to crustaceans (PT.crust.tr: 1989-2014).
- Portuguese Trawler fleet directing to groundfish (PT.fish.tr: 1989-2014).

The input data are presented in Table 4.4.7.

4.4.4.2 Model

The ASPIC (version 5.34.8) model (which implements the Schaeffer population growth model) was used for the WKFLAT 2012 assessment. Runs were performed conditioning on yield rather than on effort. The model options, the starting estimates and the minimum and maximum constraints of each parameter are indicated in the input file (Table 4.4.7).

4.4.4.3 Assessment results

During the WGHMM 2013, using the Stock Annex/WKFLAT2012 settings, with the inclusion of the new 2011 and 2012 data, the fit of the ASPIC model gets worse than the one performed at the benchmark. The model continued to show strong sensitivity to the starting guess settings (*B1/K*, *MSY*, *K*, seed and q's) leading to different levels of B/Bmsy and F/Fmsy, nevertheless it keeps the trends in the relative biomass and fishing mortality.

It was suggested, by the ADGBBI (June 2013), that until the next benchmark that WG explores the sensitivity of B/Bmsy and F/Fmsy (like retrospective pattern) by keeping the *B1/K* fixed (e.g. at the current value or based on some expert judgment about the state of the stock in the beginning of the time series). Following this suggestion in the WGBIE 2014 the *B1/K* was fixed at 0.6. Fixing *B1/K* the model became stable and is no more sensitivity to the starting guess settings of *MSY, K and* seed. This value seems reasonable but don´t have a strong scientific basis, it was also the value agreed in the benchmark for the starting guess.

The correlation coefficient between input fleets is acceptable but the *r* square between observed and fitted CPUE values are low (assessment results were uploaded in the ICES SharePoint in the Data folder). Point estimates and bias-corrected bootstrap confidence intervals for parameters are presented in Table 4.4.8, whereas Figure 4.4.3 plots observed and estimated CPUEs for each of the series used in the model. B_{2015}/B_{MSY} and F_{2014}/F_{MSY} have respectively 1.93% and -0.33% of bias and both have more than 17% relative inter-quartile ranges. Biomass in 2015 is estimated to be 98% of B_{MSY} with 95% bias-corrected confidence interval between 74% and 122%. Fishing mortality in 2014 is estimated to be 0.59 times F_{MSY} with 95% bias-corrected confidence interval between 0.45 and 0.83 times F_{MSY}. MSY is estimated to be 1749 t with 95% CI from 1535 t to 1886 t.

Trends in relative biomass (Figure 4.4.4) indicate a steady decrease since the beginning of the series till 2001, since then a slight recovery was observed, been in 2015 at 98% of B_{MSY}. Fishing mortality remained at high levels between late eighties and late nineties, dropping after that. In 2014, fishing mortality is estimated to be below F_{MSY}.

Comparison between the 2012 benchmark, the 2013, 2014 and the 2015 update assessments are showed in Table 4.4.9 and Figure 4.4.5. Fixing B1/K at 0.60 don´t change the trend of the previous assessments and the 2014 and 2015 results are in the middle of the previous assessments.

A retrospective analysis was done taking one each time to the accepted assessment (Figure 4.4.6). Despite some retro patron in all series the model show a good stability.

4.4.4.4 Sensitive analyses

The sensitive analysis was carried out to show the effect of changing *B1/K* value to 0.9, 0.8, 0.7, 0.6, 0.5 and 0.4 (Figure 4.4.7).

Fixing B1/K the model stabilises and the result of changing the value of the fixed B1/K don´t change the F/FMSY and B/BMSY trends but just rescale the time series. In the fixed B1/K at 0.4 scenarios, MSY estimates are at or near the maximum bound, to fix this error some unrealistic value of the MSY boundaries need to be assumed.

As in 2014 the *B1/K* was fixed at 0.6, this was the value agreed at the benchmark for the starting value. This value is reasonable as it is thought that the fishery started late 70's early 80's, but there is no strong scientific basis.

4.4.5 Projections

Projections were performed based on the "benchmark settings" with B1/K fixed at 0.60 ASPIC estimates. The projected B/B_{MSY} and yield are presented in Table 8.4.10, where each column corresponds to a fishing mortality scenario. Projections were performed for F *status quo* (assumed as the average of the last 3 years - F 2012-2014), F_{MSY} and with zero catches. A set of projections were performed with the necessary F reductions to obtain 2016 yield for both anglerfish species combined corresponding to the 2015 TAC (2987 t) and +/-15% 2015 TAC. Projections using the same multiplicative factor of F_{MSY} for *L. piscatorius* in the scenario MSY approach was also performed. The reason for this projection scenario is that *L. piscatorius* F_{2014} or F_{sq} are above F_{MSY} and *L. budegassa* F_{2014} are below F_{MSY}, so this stock will drive the management strategy.

For *L. budegassa*, fishing mortality equal to F *status quo* in 2016 is expected to keep the stock around B_{MSY} in 2017. The biomass is expected to increase in near future under all fishing mortality scenarios examined (Table 4.4.10).

4.4.6 Biological Reference Points

WKFLAT (ICES, 2012) endorsed the basis for MSY reference points previously assumed by ICES (i.e. F_{MSY} based on the ASPIC output and a proxy for MSY Btrigger as 50% of B_{MSY} of the ASPIC output).

Framework	Reference point	Value	Technical basis
MSY approach	MSY Btrigger	50% BMSY	BMSY is implicitly estimated from the surplus production model (ICES, 2012).
	FMSY	Relative value.	Implicit, estimated from the surplus production model (ICES, 2012). Fishing mortality values are expressed relative to FMSY.
Precautionary approach	Blim	Not defined	
	Bpa	Not defined	
	Flim	Not defined	
	Fpa	Not defined	
Management plan	SSBMGT	Not defined	
	FMGT	Not defined	

4.4.7 Comments on the assessment

Fixing *B1/K* the model became stable and is no more sensitivity to the starting guess settings. The *B1/K* was fixed at 0.6, this was the value agreed at the benchmark for the starting value. This value is reasonable as it is thought that the fishery started late 70's early 80's, but there is no strong scientific basis.

During the benchmark (WKFLAT 2012) the same model (SS3) applied to the white anglerfish was tested for the black anglerfish with some promising results but need to be tested more carefully before its application. SS3 is a length-based model so the length sampling is key information for this stock. A benchmark for this stock was considered during the WG (see section 1).

4.4.8 Quality considerations

Three LPUE series were presented in the past for the A Coruña fleet: "A Coruña port" for trips that are exclusively landed in the port, "A Coruña trucks" for trips that are landed in other ports and "A Coruña fleet" that takes into account all the trips of the fleet. The LPUE series used in the assessment (A Coruña fleet) was not update for 2013-2014. The new revision was carried out only for the A Coruña port series, it was not possible during the WG to analyze the potentiality of using this series for the assessment instead of the incomplete A Coruña fleet series.

For the Portuguese fleets, until 2011 most log-books were filled in paper but have thereafter been progressively replaced by e-logbooks. Since 2013 more than 90% of the log-books are being completed in the electronic version. The LPUE series were revised from 2012 onwards. To revise the series backwards further refinement of the algorithms is required.

4.4.9 Management considerations

Management considerations are in section 4.2.

Table 4.4.1. ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Tonnes landed by the main fishing fleets for 1978-2014 as determined by the Working Group.

	Div. VIIIc				Div. IXa						Div. VIIIc+IXa		
	SPAIN				SPAIN			PORTUGAL					
Year	Trawl	Gillnet	Others	TOTAL	Trawl	Gillnet	Others	Trawl	Artisanal	TOTAL	SUBTOTAL	Unallocated	TOTAL
1978	n/a	n/a		n/a	248			n/a	107	355	355		355
1979	n/a	n/a		n/a	306			n/a	210	516	516		516
1980	1203	207		1409	385			n/a	315	700	2110		2110
1981	1159	309		1468	505			n/a	327	832	2300		2300
1982	827	413		1240	841			n/a	288	1129	2369		2369
1983	1064	188		1252	699			n/a	428	1127	2379		2379
1984	514	176		690	558			223	458	1239	1929		1929
1985	366	123		489	437			254	653	1344	1833		1833
1986	553	585		1138	379			200	847	1425	2563		2563
1987	1094	888		1982	813			232	804	1849	3832		3832
1988	1058	1010		2068	684			188	760	1632	3700		3700
1989	648	351		999	764			272	542	1579	2578		2578
1990	491	142		633	689			387	625	1701	2334		2334
1991	503	76		579	559			309	716	1584	2162		2162
1992	451	57		508	485			287	832	1603	2111		2111
1993	516	292		809	627			196	596	1418	2227		2227
1994	542	201		743	475			79	283	837	1580		1580
1995	924	104		1029	615			68	131	814	1843		1843
1996	840	105		945	342			133	210	684	1629		1629
1997	800	198		998	524			81	210	815	1813		1813
1998	748	148		896	681			181	332	1194	2089		2089
1999	565	127		692	671			110	406	1187	1879		1879
2000	441	73		514	377			142	336	855	1369		1369
2001	383	69		452	190			101	269	560	1013		1013
2002	173	74		248	234			75	213	522	770		770
2003	279	49		329	305			68	224	597	926		926
2004	250	120		370	285			50	267	603	973		973
2005	273	97		370	283			31	214	527	897		897
2006	323	124		447	541			39	121	701	1148		1148
2007	372	68		440	684			66	111	861	1301		1301
2008	386	70		456	336			40	119	495	951		951
2009	301	148		449	172			34	114	320	769		769
2010	352	81		432	197			70	84	351	784		784
2011	214	115	32	361	157	60	98	75	119	510	871	74	945
2012	161	83	22	265	109	40	90	156	370	765	1030	109	1139
2013	221	135	14	370	95	55	90.0	100	258	598	968	98	1066
2014	187	126	7	319	120	47	3.9	113	286	569	888	100	988

n/a: not available

Table 4.4.2. ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Weight and percentage of discards for Spanish trawl and gillnet fleets.

TRAWL

Year	Weight (t)	CV	% Trawl Catches	% Total Catches
1994	6.1	24.4	0.6	0.4
1995	n/a	n/a	n/a	n/a
1996	n/a	n/a	n/a	n/a
1997	21.3	35.2	1.6	1.2
1998	n/a	n/a	n/a	n/a
1999	19.7	43.7	1.6	1.0
2000	8.7	35.1	1.1	0.6
2001	n/a	n/a	n/a	n/a
2002	n/a	n/a	n/a	n/a
2003	1.1	53.6	0.2	0.1
2004	8.1	70.2	1.5	0.8
2005	13.6	45.6	2.4	1.5
2006	92.0	56.8	9.6	8.0
2007	0.3	98.8	0.0	0.0
2008	1.9	59.4	0.3	0.2
2009	29.3	53.8	5.8	3.8
2010	61.2	63.2	10.0	7.8
2011	12.4	33.2	3.2	1.3
2012	5.8	52.8	2.1	0.5
2013	22.3	n/a	6.6	2.1
2014	27.8	n/a	8.3	2.8

GILLNETS

Year	Weight (t)	CV	% Gillnets Catches	% Total Catches
2014	0.1	n/a	0.03	0.01

n/a: not available

CV: coefficient of variation

Table 4.4.3 ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Length composition by fleet for landings in 2014 (thousands).
Ajusted Total: Ajusted to landings from fleets without length composition.

	Div. VIIIc			Div. IXa				Div. VIIIc+IXa	
	SPAIN			SPAIN	PORTUGAL				Adjusted
Length (cm)	Trawl	Gillnet	TOTAL	Trawl	Trawl	Artisanal	TOTAL	TOTAL	TOTAL
14	0.000	0.000	0.000	0.178	0.000	0.000	0.178	0.178	0.202
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.178	0.000	0.000	0.178	0.178	0.202
17	0.000	0.000	0.000	0.356	0.000	0.000	0.356	0.356	0.404
18	0.000	0.000	0.000	0.356	0.000	0.000	0.356	0.356	0.404
19	0.000	0.000	0.000	0.534	0.000	0.000	0.534	0.534	0.605
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21	0.000	0.000	0.000	0.356	0.000	0.000	0.356	0.356	0.404
22	0.000	0.000	0.000	0.178	0.000	0.000	0.178	0.178	0.202
23	0.000	0.000	0.000	31.938	0.000	0.000	31.938	31.938	36.201
24	0.000	0.000	0.000	32.421	0.000	0.000	32.421	32.421	36.748
25	0.000	0.000	0.000	0.028	0.000	0.000	0.028	0.028	0.032
26	0.000	0.000	0.000	0.500	0.000	0.000	0.500	0.500	0.567
27	0.000	0.000	0.000	0.339	0.000	0.000	0.339	0.339	0.384
28	0.025	0.000	0.025	0.422	0.000	0.000	0.422	0.447	0.507
29	0.216	0.000	0.216	0.686	0.129	0.000	0.815	1.031	1.151
30	0.507	0.000	0.507	2.235	0.034	0.000	2.269	2.776	3.142
31	0.923	0.000	0.923	0.928	0.188	6.900	8.016	8.939	9.186
32	0.904	0.000	0.904	1.525	0.720	13.924	16.169	17.073	17.397
33	1.493	0.000	1.493	0.826	1.299	0.000	2.125	3.618	3.927
34	1.529	0.000	1.529	1.802	3.071	7.103	11.976	13.505	13.950
35	2.567	0.000	2.567	0.756	2.776	7.235	10.767	13.334	13.778
36	3.321	0.000	3.321	1.281	5.800	0.218	7.299	10.620	11.234
37	3.341	0.000	3.341	1.048	5.320	0.866	7.234	10.575	11.161
38	4.255	0.000	4.255	1.719	5.729	2.308	9.756	14.011	14.808
39	4.883	0.000	4.883	0.777	5.012	1.744	7.532	12.415	13.171
40	6.626	0.000	6.626	1.582	3.835	1.946	7.363	13.989	15.085
41	6.890	0.000	6.890	0.935	5.057	1.510	7.502	14.392	15.437
42	7.320	0.000	7.320	0.921	2.050	4.651	7.622	14.942	16.042
43	5.452	0.000	5.452	0.556	2.312	2.289	5.157	10.609	11.411
44	5.027	0.075	5.102	0.947	1.775	2.243	4.965	10.067	10.874
45	3.424	0.000	3.424	0.825	2.300	9.283	12.408	15.832	16.399
46	2.931	0.059	2.990	0.839	2.403	6.685	9.927	12.917	13.428
47	2.969	0.025	2.994	1.368	2.729	2.869	6.965	9.959	10.542
48	2.513	0.042	2.555	1.225	2.388	1.691	5.304	7.859	8.363
49	2.828	0.000	2.828	0.864	1.382	2.971	5.217	8.045	8.538
50	2.027	0.145	2.172	1.115	1.715	3.223	6.053	8.225	8.664
51	1.661	0.236	1.897	0.835	1.817	4.093	6.746	8.643	9.007
52	2.148	0.508	2.656	0.905	1.498	1.704	4.107	6.763	7.239
53	1.757	0.394	2.151	1.347	1.041	4.721	7.109	9.260	9.727
54	1.172	0.488	1.660	0.792	0.994	1.182	2.968	4.628	4.955
55	1.514	0.354	1.868	0.273	0.703	0.694	1.671	3.539	3.824
56	1.090	0.769	1.859	0.372	1.252	0.403	2.027	3.886	4.183
57	1.332	0.548	1.880	0.193	1.066	0.343	1.602	3.482	3.759
58	1.431	0.696	2.127	1.180	0.676	0.593	2.448	4.575	5.017
59	1.421	0.815	2.236	0.151	0.543	0.203	0.897	3.133	3.451
60	1.336	0.902	2.238	0.339	0.401	0.835	1.575	3.813	4.157
61	0.783	0.396	1.179	0.207	0.476	0.218	0.901	2.080	2.265
62	0.959	0.538	1.497	0.741	0.928	1.000	2.669	4.166	4.465
63	0.971	0.518	1.489	0.155	0.236	1.787	2.178	3.667	3.886
64	1.097	0.387	1.484	0.193	0.303	1.216	1.713	3.197	3.421
65	1.094	0.232	1.326	0.216	0.145	1.419	1.781	3.107	3.312
66	1.039	0.590	1.629	0.379	0.232	0.797	1.408	3.037	3.305
67	1.206	0.410	1.616	1.256	0.239	0.632	2.128	3.744	4.127
68	0.779	0.167	0.946	0.267	0.133	0.987	1.388	2.334	2.496
69	0.593	0.483	1.076	0.339	0.586	0.094	1.018	2.094	2.283
70	0.535	0.427	0.962	0.270	0.374	3.509	4.153	5.115	5.279
71	0.541	0.109	0.650	0.352	0.096	2.681	3.129	3.779	3.913
72	0.486	0.263	0.749	0.709	0.270	1.228	2.207	2.956	3.150
73	0.488	0.218	0.706	0.550	0.039	0.240	0.829	1.535	1.703
74	0.303	0.165	0.468	0.830	0.111	0.465	1.407	1.875	2.048
75	0.452	0.088	0.540	0.276	0.089	1.663	2.028	2.568	2.676
76	0.175	0.061	0.236	0.435	0.000	0.118	0.553	0.789	0.878
77	0.153	0.075	0.228	0.386	0.055	0.930	1.370	1.598	1.680
78	0.162	0.037	0.199	0.320	0.017	0.293	0.630	0.829	0.898
79	0.239	0.035	0.274	0.257	0.017	0.347	0.621	0.895	0.966
80	0.114	0.040	0.154	0.337	0.000	0.263	0.600	0.754	0.819
81	0.119	0.054	0.173	0.151	0.096	0.202	0.448	0.621	0.665
82	0.043	0.008	0.051	0.189	0.096	0.211	0.496	0.547	0.579
83	0.084	0.048	0.132	0.091	0.000	0.207	0.298	0.430	0.460
84	0.102	0.000	0.102	0.276	0.014	0.922	1.212	1.314	1.364
85	0.000	0.000	0.000	0.070	0.000	0.967	1.037	1.037	1.046
86	0.000	0.000	0.000	0.072	0.000	0.094	0.166	0.166	0.175
87	0.000	0.000	0.000	0.151	0.000	0.124	0.275	0.275	0.295
88	0.086	0.000	0.086	0.025	0.022	0.146	0.193	0.279	0.294
89	0.023	0.000	0.023	0.184	0.000	0.234	0.418	0.441	0.468
90	0.000	0.032	0.032	0.062	0.096	0.124	0.282	0.314	0.326
91	0.000	0.000	0.000	0.023	0.000	0.000	0.023	0.023	0.026
92	0.000	0.000	0.000	0.046	0.000	0.234	0.280	0.280	0.286
93	0.000	0.000	0.000	0.053	0.000	0.118	0.171	0.171	0.178
94	0.000	0.000	0.000	0.065	0.000	0.000	0.065	0.065	0.074
95	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
96	0.000	0.000	0.000	0.023	0.000	0.000	0.023	0.023	0.026
97	0.000	0.000	0.000	0.000	0.000	1.621	1.621	1.621	1.621
98	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
99	0.000	0.000	0.000	0.023	0.000	0.000	0.023	0.023	0.026
100+	0.000	0.000	0.000	0.000	0.038	0.359	0.397	0.397	0.397
TOTAL	99	11	111	109	73	120	302	412	442
Landings (t)	187	126	312	120	113	286	518	831	888
Mean Weight (g)	1875	10992	2816	1099	1551	2385	1719	2014	2011
Mean Length (cm)	46.7	61.4	48.2	33.3	43.9	48.1	41.7	43.5	43.3
Measured weight (t)	n/a	n/a	n/a	n/a	1.1	1.5	2.6	n/a	n/a

n/a: not available

Table 4.4.4 ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Number, mean weight and mean length of landings between 1986 and 2014.

	Total (thousands)	Mean Weight (g)	Mean Length (cm)
1986	1704	1504	43
1987	4673	820	34
1988	2653	1395	43
1989	1815	1420	44
1990	1590	1468	44
1991	1672	1294	42
1992	1497	1410	45
1993	1238	1799	48
1994	1063	1486	44
1995	1583	1157	40
1996	1146	1422	44
1997	1452	1248	41
1998	1554	1380	42
1999	1268	1487	42
2000	680	2010	47
2001	435	2329	49
2002	514	1497	41
2003	507	1826	46
2004	468	1974	47
2005	408	2198	49
2006	1030	1115	37
2007	1036	1255	39
2008	503	1889	48
2009	298	2585	51
2010	387	1940	45
2011	531	1641	43
2012	435	2366	49
2013	361	2678	50
2014	442	2011	43

Table 4.4.5 ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Abundance indices from Spanish and Portuguese surveys.

	SpGFS-WIBTS-Q4					PtGFS-WIBTS-Q4		
	September-October (total area Miño-Bidasoa)					October		
Year	Hauls	kg/30 min		N/30 min		Hauls	N/60 min	kg/60 min
		Yst	Sst	Yst	Sst			
1983	145	0.68	0.17	0.50	0.09	117	n/a	n/a
1984	111	0.60	0.17	0.60	0.11	na	n/a	n/a
1985	97	0.46	0.11	0.50	0.07	150	n/a	n/a
1986	92	1.42	0.32	2.50	0.33	117	n/a	n/a
1987	ns	ns	ns	ns	ns	81	n/a	n/a
1988	101	2.27	0.38	1.50	0.21	98	n/a	n/a
1989	91	0.45	0.10	0.90	0.21	138	0.23	0.19
1990	120	1.52	0.47	1.50	0.22	123	0.11	0.17
1991	107	0.83	0.14	0.60	0.10	99	+	0.02
1992	116	1.16	0.19	0.80	0.11	59	+	+
1993	109	0.90	0.20	0.90	0.13	65	0.02	0.04
1994	118	0.75	0.17	1.00	0.12	94	0.06	0.09
1995	116	0.72	0.12	1.00	0.11	88	0.02	0.08
1996*	114	0.95	0.17	1.30	0.18	71	0.27	0.50
1997	116	1.16	0.20	0.97	0.11	58	0.03	0.01
1998	114	0.88	0.18	0.57	0.09	96	0.02	0.12
1999*	116	0.43	0.12	0.26	0.06	79	0.08	0.07
2000	113	0.66	0.18	0.40	0.08	78	0.13	0.13
2001	113	0.19	0.06	0.52	0.10	58	+	+
2002	110	0.26	0.09	0.33	0.07	67	0	0
2003*	112	0.36	0.11	0.35	0.10	80	0.22	0.21
2004*	114	0.76	0.23	0.44	0.12	79	0.14	0.21
2005	116	0.64	0.20	1.62	0.30	87	0.01	+
2006	115	1.08	0.22	1.16	0.19	88	0.02	0.46
2007	117	0.59	0.12	0.48	0.08	96	0.02	0.03
2008	115	0.35	0.09	0.29	0.05	87	0.07	0.36
2009	117	0.30	0.08	0.35	0.08	93	0.02	+
2010	127	0.35	0.09	0.53	0.09	87	0.09	0.18
2011	111	0.63	0.15	0.52	0.08	86	0.02	0.06
2012	115	0.61	0.10	0.74	0.11	ns	ns	ns
2013**	114	1.27	0.36	1.40	0.35	93	0.02	0.03
2014**	116	1.57	0.36	1.24	0.17	81	0.00	0.00

Yst = stratified mean
Sst = mean standar error
ns = no survey
n/a = not available
+ = less than 0.01
* For Portuguese Surveys - R/V Capricornio, other years R/V Noruega
** For Spain Surveys - R/V Miguel Oliver, other years R/V Cornide Saavedra

Table 4.4.6 ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Landings, fishing effort, standardized fishing effort, landings per unit effort and standardized landings per unit effort for trawl and gillnet fleets.
For landings the percentage relative to total annual stock landings is given.

	Avilés, SP-AVITR8C				Santander, SP-SANTR8C				Standardized Cedeira, STAND-SP-CEDGNS8C			
Year	LANDINGS	%	EFFORT (days*100hp)	LPUE (kg/day*100hp)	LANDINGS	%	EFFORT (days*100hp)	LPUE (kg/day*100hp)	LANDINGS	%	EFFORT (soaking days)	LPUE (kg/soaking day)
1986	64	3	10845	5.9	21	1	18153	1.1	--	--	--	--
1987	85	2	8309	10.3	16	0	14995	1.1	--	--	--	--
1988	125	3	9047	13.9	30	1	16660	1.8	--	--	--	--
1989	119	5	8063	14.7	32	1	17607	1.8	--	--	--	--
1990	58	2	8497	6.8	40	2	20469	1.9	--	--	--	--
1991	52	2	7681	6.7	62	3	22391	2.8	--	--	--	--
1992	33	2	--	--	107	5	22833.0	4.7	--	--	--	--
1993	53	2	7635	7.0	143	6	21370	6.7	--	--	--	--
1994	65	4	9620	6.7	196	12	22772	8.6	--	--	--	--
1995	141	8	6146	23.0	126	7	14046	9.0	--	--	--	--
1996	162	10	4525	35.8	89	5	12071	7.4	--	--	--	--
1997	143	8	5061	28.3	122	7	11776	10.4	--	--	--	--
1998	91	4	5929	15.3	114	5	10646	10.7	--	--	--	--
1999	41	2	6829	5.9	67	4	10349	6.5	14	1	4 582	3.0
2000	23	2	4453	5.1	44	3	8779	5.0	4	<1	2 981	1.3
2001	12	1	1838	6.7	28	3	3053	9.3	6	1	1 932	3.0
2002	11	1	2748	4.1	16	2	3975	4.1	7	1	2 398	3.0
2003	9	1	2526	3.6	15	2	3837	4.0	3	<1	2 703	0.9
2004	32	3	--	--	23	2	3776.0	6.0	5	1	4 677	1.1
2005	54	6	--	--	7	1	1404.0	4.9	2	<1	3 325	0.7
2006	16	1	--	--	18	2	2717.5	6.8	4	<1	3 911	1.0
2007	11	1	--	--	19	1	4333.7	4.5	2	<1	3 976	0.6
2008	10	1	--	--	--	--	--	--	0	<1	5 133	0.1
2009	5	1	--	--	8	1	1124.8	6.8	4	1	2 300	1.7
2010	--	--	--	--	19.4	2	1627.8	11.9	4	1	1 880	2.1
2011	--	--	--	--	36.4	4	--	--	1	<1	522	1.3
2012	--	--	--	--	21.8	2	--	--	4	<1	--	--

	A Coruña-Port, SP-CORTR8C-PORT				A Coruña-Trucks, SP-CORTR8C-TRUCKS				A Coruña-Fleet, SP-CORTR8C-FLEET			
Year	LANDINGS	%	EFFORT (days*100hp)	LPUE (kg/day*100hp)	LANDINGS	%	EFFORT (days*100hp)	LPUE (kg/day*100hp)	LANDINGS	%	EFFORT (days*100hp)	LPUE (kg/day*100hp)
1982	655	28	63 313	10.3	--	--	--	--	655	28	63 313	10.3
1983	765	32	51 008	15.0	--	--	--	--	765	32	51 008	15.0
1984	574	30	48 665	11.8	--	--	--	--	574	30	48 665	11.8
1985	253	14	45 157	5.6	--	--	--	--	253	14	45 157	5.6
1986	352	14	40 420	8.7	--	--	--	--	352	14	40 420	8.7
1987	673	18	34 651	19.4	--	--	--	--	673	18	34 651	19.4
1988	570	15	41 481	13.7	--	--	--	--	570	15	41 481	13.7
1989	344	13	44 410	7.7	--	--	--	--	344	13	44 410	7.7
1990	288	12	44 403	6.5	--	--	--	--	288	12	44 403	6.5
1991	225	10	40 429	5.6	--	--	--	--	225	10	40 429	5.6
1992	211	10	38 899	5.4	--	--	--	--	211	10	38 899	5.4
1993	199	9	44 478	4.5	--	--	--	--	199	9	44 478	4.5
1994	166	11	39 602	4.2	37	2	12 795	2.9	204	13	52 397	3.9
1995	353	19	41 476	8.5	75	4	10 232	7.3	428	23	51 708	8.3
1996	334	21	35 709	9.4	68	4	8 791	7.8	403	25	44 501	9.0
1997	298	16	35 494	8.4	43	2	9 108	4.8	341	19	44 602	7.7
1998	323	15	29 508	10.9	72	3	--	--	394	19	--	--
1999	374	20	30 131	12.4	--	--	--	--	--	--	--	--
2000	287	21	30 079	9.6	6	0	--	--	293	21	--	--
2001	281	28	29 935	9.4	--	--	--	--	--	--	--	--
2002	76	10	21 948	3.5	31	4	6 747	4.6	107	14	28 695	3.7
2003	85	9	18 519	4.6	43	5	7 608	5.6	128	14	26 127	4.9
2004	68	7	19 198	3.5	40	4	10 342	3.8	107	11	29 540	3.6
2005	54	6	20 663	2.6	32	4	10 302	3.1	86	10	30 965	2.8
2006	70	6	19 264	3.6	81	7	12 866	6.3	151	13	32 130	4.7
2007	109	8	21 651	5.1	113	9	13 187	8.6	223	17	34 838	6.4
2008	163	17	20 212	8.1	98	10	9 812	10.0	261	27	30 024	8.7
2009	80	10	16 152	5.0	67	9	12 930	5.2	147	19	29 092	5.1
2010	74	9	16 680	4.4	87	11	9 003	9.7	199	25	22 746	8.7
2011	64	7	12 835	5.0	--	--	--	--	144	15	18 617	7.7
2012	102	9	14 446	7.0	--	--	--	--	172	15	21 110	8.2
2013	88	8	14 736	6.0	--	--	--	--	--	--	--	--
2014	79	8	18 060	4.4	--	--	--	--	--	--	--	--

	Portugal Crustacean, PT-TRC9A						Portugal Fish, PT-TRF9A					
Year	LANDINGS	%	EFFORT (1000 hours)	EFFORT (1000 hauls)	LPUE (kg/hour)	LPUE (kg/haul)	LANDINGS	%	EFFORT (1000 hours)	EFFORT (1000 hauls)	LPUE (kg/hour)	LPUE (kg/haul)
1989	89	3	76	23	1.17	3.92	183	7	52	18	3.51	10.4
1990	127	5	90	20	1.41	6.19	261	11	61	17	4.29	15.2
1991	101	5	83	17	1.22	6.05	208	10	57	15	3.65	13.5
1992	94	4	71	15	1.32	6.19	193	9	49	14	3.97	14.1
1993	64	3	75	13	0.85	4.78	132	6	56	13	2.37	10.1
1994	26	2	41	8	0.64	3.38	53	3	36	10	1.50	5.5
1995	22	1	38	8	0.58	2.84	46	2	41	9	1.11	5.0
1996	45	3	64	14	0.70	3.11	88	5	54	12	1.62	7.1
1997	38	2	43	11	0.88	3.32	43	2	27	9	1.60	4.9
1998	70	3	48	11	1.45	6.30	111	5	35	10	3.16	11.5
1999	41	2	24	8	1.72	5.00	69	4	18	6	3.85	12.2
2000	66	5	42	10	1.56	6.55	76	6	19	6	4.04	12.6
2001	59	6	85	18	0.69	3.21	42	4	19	5	2.27	8.5
2002	47	6	62	10	0.75	4.81	28	4	14	4	2.00	6.2
2003	30	3	42	10	0.71	3.11	38	4	17	6	2.17	6.7
2004	23	2	21	7	1.07	3.51	27	3	14	4	1.90	6.2
2005	12	1	20	5	0.63	2.42	19	2	13	4	1.38	5.0
2006	18	2	22	5	0.80	3.31	22	2	12	4	1.73	5.6
2007	34	3	22	6	1.53	5.61	31	2	8	3	3.98	10.5
2008	21	2	14	4	1.50	5.40	19	2	5	2	3.56	10.6
2009	18	2	15	--	1.14	--	16	2	6	--	2.65	--
2010	37	5	21	--	1.75	--	34	4	14	--	2.37	--
2011	39	4	18	--	2.15	--	36	4	9	--	3.91	--
2012	81	7	36	--	2.26	--	75	7	16	--	4.73	--
2013	52	5	27	--	1.92	--	48	4	12	--	3.95	--
2014	59	6	32	--	1.82	--	54	5	22	--	2.51	--

Table 4.4.7 ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa.
ASPIC input settings and data (landings in tonnes, SPCORTR8c LPUE in kg/days*100HP, PT LPUEs in tonnes/hour trawl).

FIT ## Run type (FIT, BOT, or IRF)
Southern Anglerfish - ank
LOGISTIC YLD SSE
2 ## Verbosity
1000 95 ## Number of bootstrap trials, <= 1000
1 10000 ## 0=no MC search, 1=search, 2=repeated srch; N trials
1.0000E-08 ## Convergence crit. for simplex
3.0000E-08 8 ## Convergence crit. for restarts, N restarts
1.0000E-04 ## Conv. crit. for F; N steps/yr for gen. model
8.0000 ## Maximum F when cond. on yield
1.0 ## Stat weight for B1>K as residual (usually 0 or 1)
3 ## Number of fisheries (data series)
8.5900E-01 1.2000E+00 9.8100E-01 ## Statistical weights for data series
0.6 ## B1/K (starting guess, usually 0 to 1)
1.81126E+03 ## MSY (starting guess)
1.81126E+04 ## K (carrying capacity) (starting guess)
8.2523E-04 1.1196E-07 2.7279E-07 ## q (starting guesses -- 1 per data series)
1 1 1 1 1 1 ## Estimate flags (0 or 1) (B1/K,MSY,K,q1...qn)
1.81126E+02 3.62252E+03 ## Min and max constraints -- MSY
1.81126E+03 3.62252E+05 ## Min and max constraints -- K
1025957 ## Random number seed
35 ## Number of years of data in each series

SPCORTR8c			PT.crust.tr		PT.fish.tr	
CC			I1		I1	
1980	-1.00E+00	2.11E+03	1980	-1.00E+00	1980	-1.00E+00
1981	-1.00E+00	2.30E+03	1981	-1.00E+00	1981	-1.00E+00
1982	1.03E+01	2.37E+03	1982	-1.00E+00	1982	-1.00E+00
1983	1.50E+01	2.38E+03	1983	-1.00E+00	1983	-1.00E+00
1984	1.18E+01	1.93E+03	1984	-1.00E+00	1984	-1.00E+00
1985	5.61E+00	1.83E+03	1985	-1.00E+00	1985	-1.00E+00
1986	8.71E+00	2.56E+03	1986	-1.00E+00	1986	-1.00E+00
1987	1.94E+01	3.83E+03	1987	-1.00E+00	1987	-1.00E+00
1988	1.37E+01	3.70E+03	1988	-1.00E+00	1988	-1.00E+00
1989	7.74E+00	2.58E+03	1989	1.17E-03	1989	3.51E-03
1990	6.49E+00	2.33E+03	1990	1.41E-03	1990	4.29E-03
1991	5.56E+00	2.16E+03	1991	1.22E-03	1991	3.65E-03
1992	5.41E+00	2.11E+03	1992	1.32E-03	1992	3.97E-03
1993	4.47E+00	2.23E+03	1993	8.53E-04	1993	2.37E-03
1994	3.89E+00	1.58E+03	1994	6.37E-04	1994	1.50E-03
1995	8.28E+00	1.84E+03	1995	5.82E-04	1995	1.11E-03
1996	9.05E+00	1.63E+03	1996	7.03E-04	1996	1.62E-03
1997	7.65E+00	1.81E+03	1997	8.79E-04	1997	1.60E-03
1998	1.09E+01	2.09E+03	1998	1.45E-03	1998	3.16E-03
1999	1.24E+01	1.88E+03	1999	1.72E-03	1999	3.85E-03
2000	9.55E+00	1.37E+03	2000	1.56E-03	2000	4.04E-03
2001	9.40E+00	1.01E+03	2001	6.86E-04	2001	2.27E-03
2002	3.74E+00	7.70E+02	2002	7.54E-04	2002	2.00E-03
2003	4.89E+00	9.26E+02	2003	7.14E-04	2003	2.17E-03
2004	3.63E+00	9.72E+02	2004	1.07E-03	2004	1.90E-03
2005	2.76E+00	8.97E+02	2005	6.34E-04	2005	1.38E-03
2006	4.69E+00	1.15E+03	2006	8.01E-04	2006	1.73E-03
2007	6.39E+00	1.30E+03	2007	1.53E-03	2007	3.98E-03
2008	8.69E+00	9.51E+02	2008	1.50E-03	2008	3.56E-03
2009	5.05E+00	7.69E+02	2009	1.14E-03	2009	2.65E-03
2010	8.75E+00	7.84E+02	2010	1.75E-03	2010	2.37E-03
2011	7.71E+00	9.45E+02	2011	2.15E-03	2011	3.91E-03
2012	8.17E+00	1.14E+03	2012	2.26E-03	2012	4.73E-03
2013	-1.00E+00	1.07E+03	2013	1.92E-03	2013	3.95E-03
2014	-1.00E+00	9.88E+02	2014	1.82E-03	2014	2.51E-03

Table 4.4.8 ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa.

ASPIC results: parameter estimates, non parametric bootstrap relative bias and bias corrected confidence interval, interquartil (IQ) range and relative range. Ye(2015): equilibrium yield available in 2015; Y(Fmsy): yield availabe at Fmsy in 2015; Ye2015/MSY: equilibrium yield available in 2015 as proportion of MSY;fmsy (1): fishing effort rate at MSY for SPCORTR8c; fmsy (2): fishing effort rate at MSY for P-TRC; fmsy (3): fishing effort rate at MSY for P-TRF (K, MSY, Yield, and Biomass in tonnes).

	WG2015 (WKFLAT2012/Stock Annex settings), B1/K fixed at 0.60								
			Bootstrap Confidence Interval						
Parameter	Point estimates	Relative bias	Lower 80%	Higher 80%	Lower 95%	Higher 95%		IQ-Range	Relative IQ-Range
B1/K	0.60	0.00%	0.60	0.60	0.60	0.60		0.00	0.00%
K	38600	2.06%	31940	50880	29390	60050		9083	23.50%
q(1)	5.15E-04	2.37%	3.48E-04	6.69E-04	2.77E-04	7.80E-04		1.71E-04	33.10%
q(2)	8.65E-08	2.15%	5.86E-08	1.14E-07	4.39E-08	1.34E-07		2.96E-08	34.20%
q(3)	1.99E-07	2.27%	1.35E-07	2.66E-07	1.08E-07	3.11E-07		7.13E-08	35.80%
MSY	1749	0.59%	1592	1837	1535	1886		120	6.90%
Ye(2014)	1748	-0.96%	1637	1853	1548	1909		103	5.90%
Y.(Fmsy)	1027	-0.03%	1015	1043	1009	1050		13	1.30%
Bmsy	19300	2.06%	15970	25440	14700	30020		4541	23.50%
Fmsy	0.091	2.58%	0.064	0.115	0.053	0.129		0.026	29.00%
fmsy(1)	176	1.69%	153	205.8	139.9	223.2		26.89	15.30%
fmsy(2)	1047000	2.23%	898700	1235000	818900	1355000		168800	16.10%
fmsy(3)	455300	2.29%	394300	546100	358800	604400		80560	17.70%
B./Bmsy	0.98	1.93%	0.81	1.14	0.74	1.22		0.17	17.10%
F./Fmsy	0.59	-0.33%	0.49	0.75	0.45	0.83		0.13	22.30%
Ye./MSY	1.00	-1.54%	1.00	1.00	0.99	1.00		0.00	0.00%
q2/q1	1.68E-04	0.14%	1.47E-04	1.92E-04	1.38E-04	2.07E-04		2.34E-05	13.90%
q3/q1	3.87E-04	0.19%	3.35E-04	4.43E-04	3.12E-04	4.75E-04		5.87E-05	15.20%

Table 4.4.9 ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa.

(K, MSY, Yield, and Biomass in tonnes)

Outputs	WKFLAT2012	WG2013 Benchmark Settings	WG2014 Benchmark Settings	WG2014 Bench. Set. B1/K fixed	WG2015 Benchmark Settings	WG2015 Bench. Set. B1/K fixed
B1/K	0.93	0.44	0.44	0.60	0.19	0.60
MSY	1375	1881	1900	1633	3622	1749
K	43910	58390	59360	47260	101800	38600
q(1)	3.09E-04	4.22E-04	4.22E-04	4.08E-04	5.33E-04	5.15E-04
q(2)	4.85E-08	6.78E-08	6.78E-08	6.57E-08	8.78E-08	8.65E-08
q(3)	1.17E-07	1.58E-07	1.58E-07	1.53E-07	2.02E-07	1.99E-07
TOF	1.07E+01	1.14E+01	1.14E+01	1.14E+01	1.18E+01	1.19E+01
mse	1.60E-01	1.57E-01	1.57E-01	1.55E-01	1.53E-01	1.53E-01
rmse	4.01E-01	3.96E-01	3.96E-01	3.93E-01	3.91E-01	3.91E-01
CI	0.5015	0.2162	0.2114	0.3080	0.1013	0.3345
CN	1.0000	0.9438	0.9356	1.0000	0.6994	1.0000
Rest	111	19	8	7	82	7
Error	0	0	0	0	11	0
r sq 1	0.181	0.165	0.165	0.169	0.139	0.148
rsq 2	0.010	0.132	0.131	0.125	0.366	0.336
rsq 3	0.052	0.029	0.028	0.031	0.106	0.121
Y.@Fmsy	1436	1300	1352	1463	1476	1718
Bmsy	21950	29190	29680	23630	50890	19300
Fmsy	0.063	0.064	0.064	0.069	0.071	0.091
B./Bmsy	1.040	0.684	0.705	0.893	0.399	0.982
F./Fmsy	0.522	0.806	0.589	0.539	0.706	0.587

B./Bmsy: By+1/Bmsy

F./Fmsy: Fy/Fmsy

Y.@Fmsy: yield fishing at Fmsy for the next year of the assessment.

ERROR 11: Estimate of MSY is at or near maximum bound, 3.622E+03

Table 4.4.10. ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.

Point estimates of B/BMSY(from 2015 to 2019) and Yield (from 2015 to 2018) for projections with F status quo (Fsq), FMSY, zero catches. Reductions to obtain yields equal to 2015 TAC, and +/- 15% 2015 TAC are also presented. The value of F2015/FMSY is equal to Fsq (mean F of 2012-2014) in all scenarios proposed. Values for F/FMSY are also given.

Fishing mortality trends in relation to F_{MSY}

year	*L. piscatorius* MSYApproach	Fsq	F_{MSY}	zero catches	-15% TAC= 2539 t	TAC=2987 t	+15% TAC = 3435 t
2015	0.660	0.660	0.660	0.660	0.660	0.660	0.660
2016	0.594	0.660	1.000	0.000	0.627	0.747	0.871
2017	0.594	0.660	1.000	0.000	0.594	0.594	0.594
2018	0.594	0.660	1.000	0.000	0.594	0.594	0.594

Biomass trends in relation to B_{MSY}

year	*L. piscatorius* MSYApproach	Fsq	F_{MSY}	zero catches	-15% TAC= 2539 t	TAC=2987 t	+15% TAC = 3435 t
2015	0.982	0.982	0.982	0.982	0.982	0.982	0.982
2016	1.013	1.013	1.013	1.013	1.013	1.013	1.013
2017	1.048	1.042	1.012	1.103	1.045	1.034	1.023
2018	1.081	1.069	1.011	1.191	1.078	1.068	1.057
2019	1.112	1.094	1.010	1.277	1.109	1.099	1.090

Yield

year	*L. piscatorius* MSYApproach	Fsq	F_{MSY}	zero catches	-15% TAC= 2539 t	TAC=2987 t	+15% TAC = 3435 t
2015	1150.0	1150.0	1150.0	1150.0	1150.0	1150.0	1150.0
2016	1070.0	1185.0	1770.0	0.0	1127.0	1337.0	1550.0
2017	1105.0	1218.0	1768.0	0.0	1102.0	1091.0	1080.0
2018	1138.0	1248.0	1766.0	0.0	1135.0	1125.0	1115.0

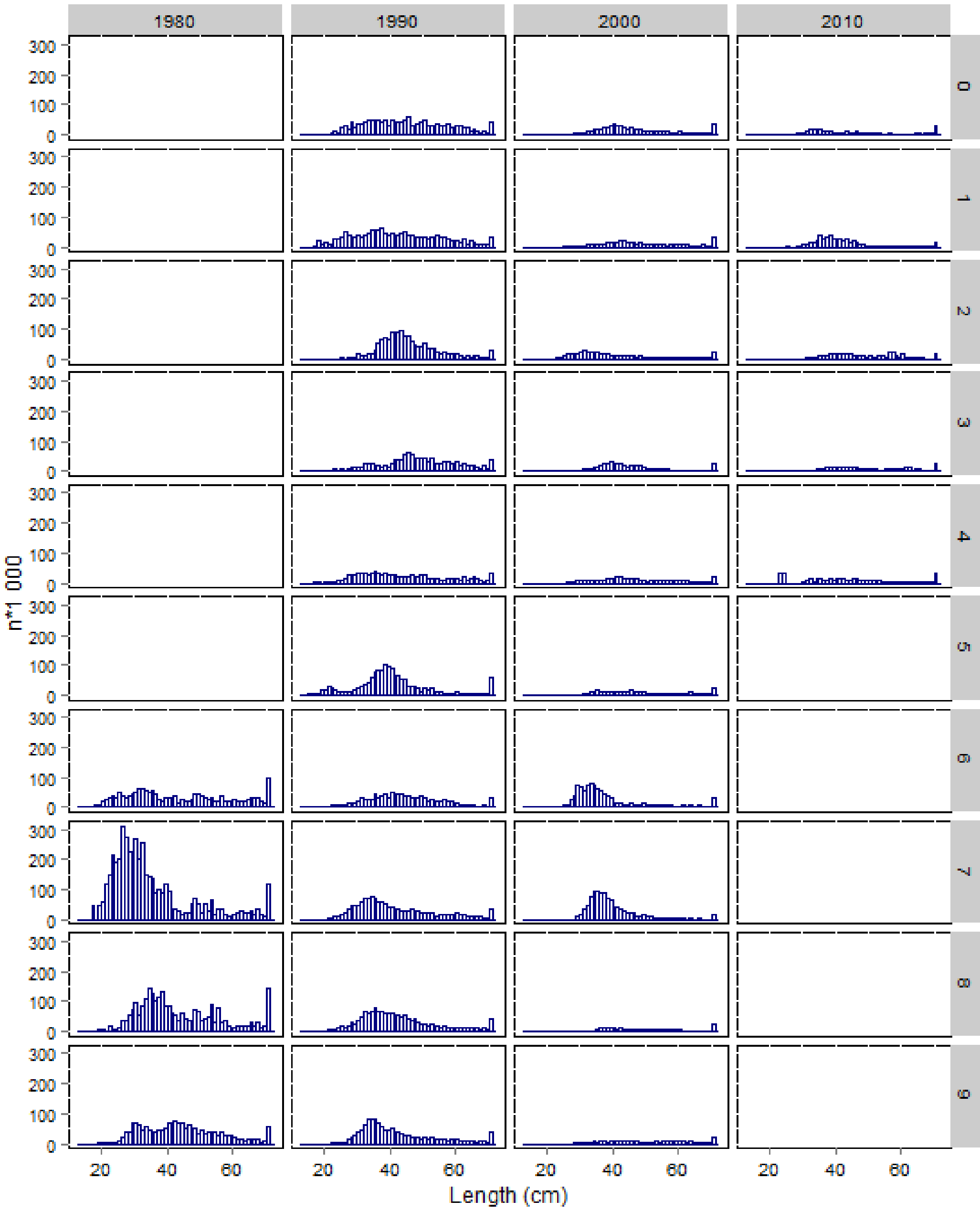


Figure 4.4.1 ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa. Length distributions of landings (thousands for 1986 to 2014).

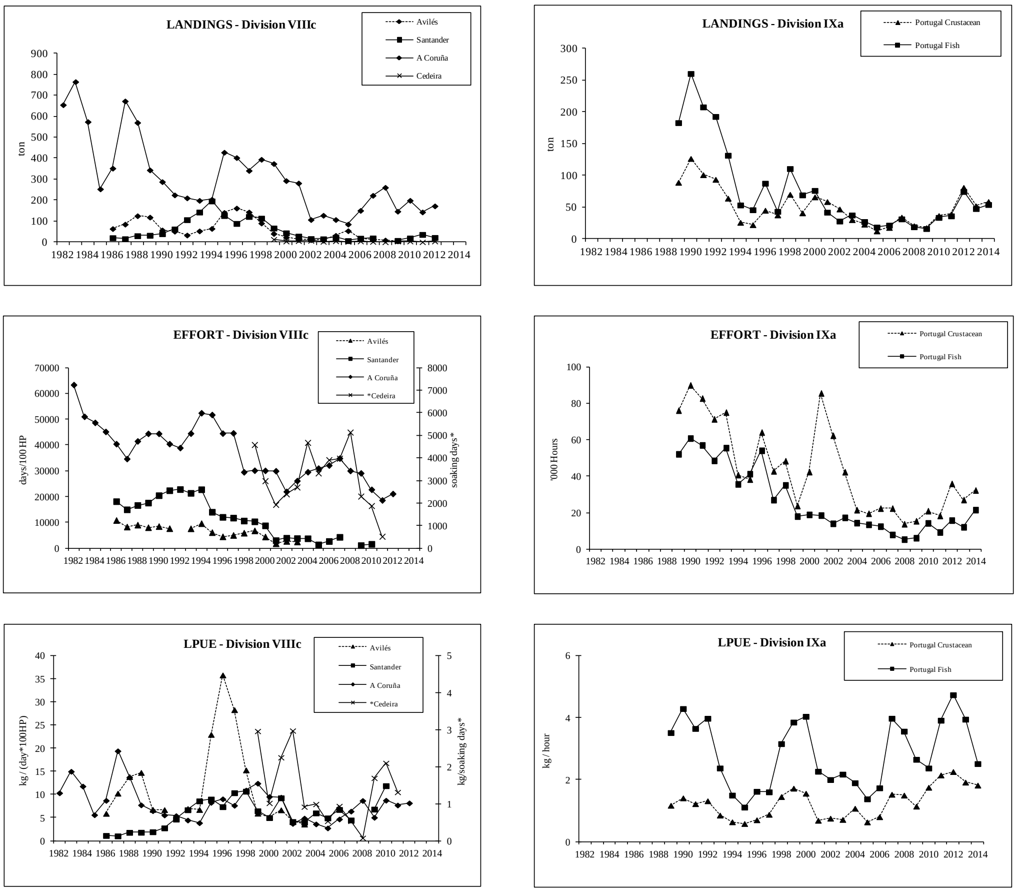


Figure 4.4.2 ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa. Trawl and gillnet landings, effort and LPUE data between 1986-2014.

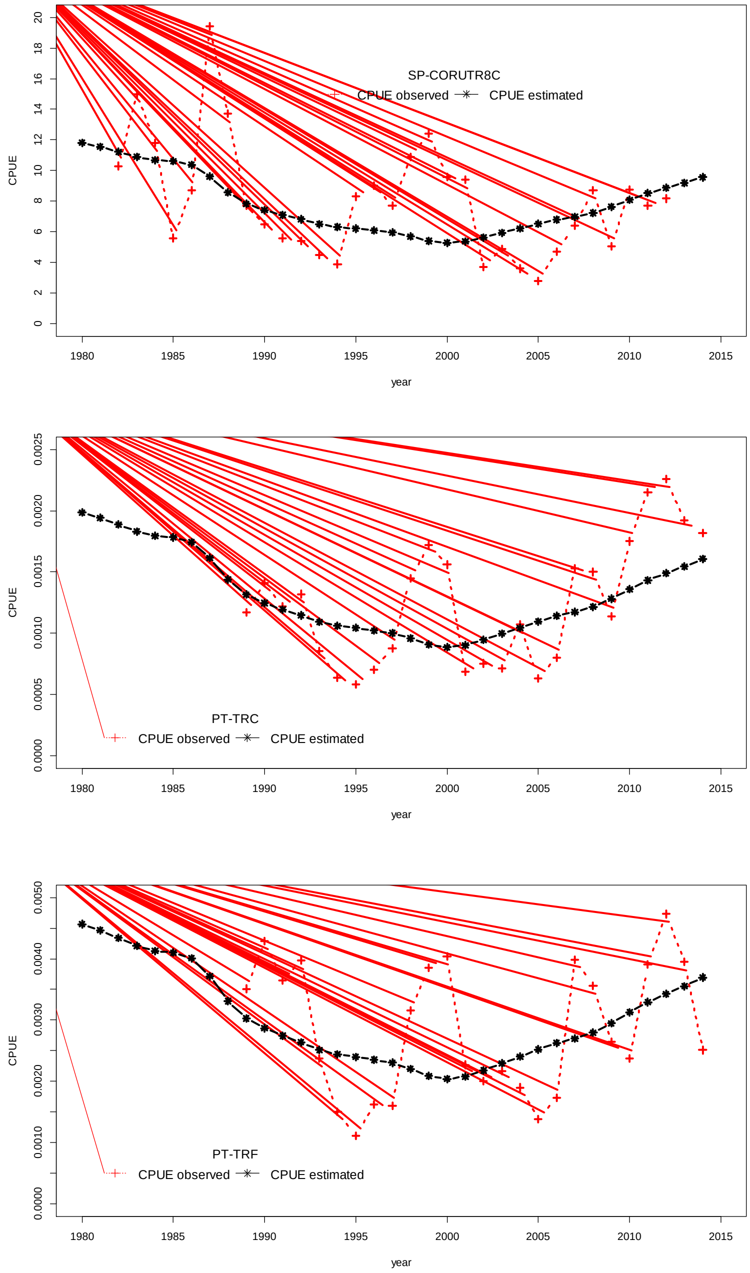


Figure 4.4.3. ANGLERFISH (*L. budegassa*)– Divisions VIIIc and IXa. Observed CPUE for the three commercial fleets and estimated values by the model.

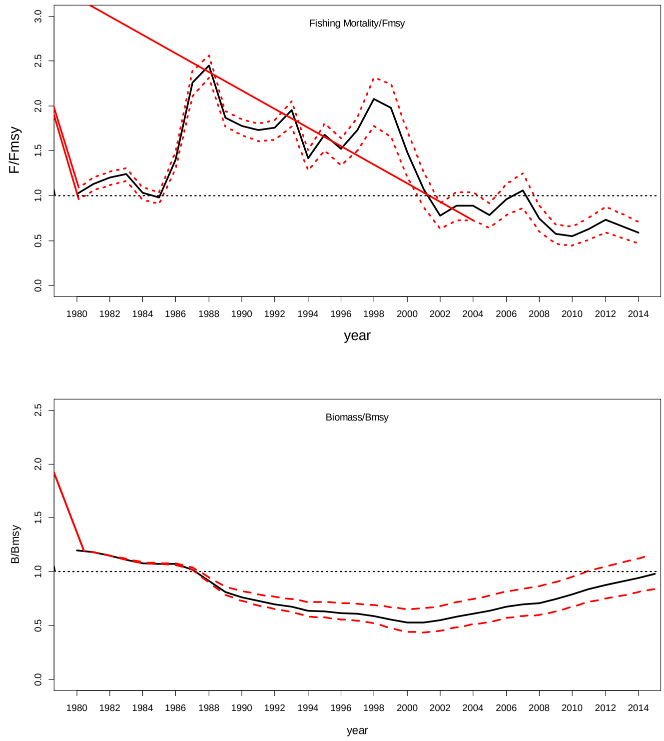


Figure 4.4.4. ANGLERFISH (*L. budegassa*) – Divisions VIIIc and IXa. Confidence intervals (80%) of the F/FMSY and B/BMSY ratios.

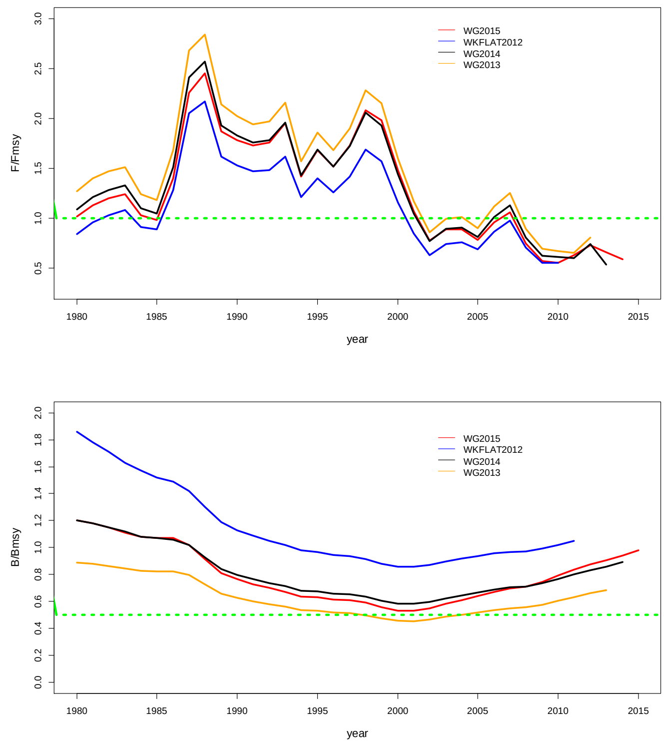


Figure 4.4.5. ANGLERFISH (*L. budegassa*) – Divisions VIIIc and IXa. Trends of the F/FMSY and B/BMSY ratios from the, 2012 benchmark, 2013, 2014 and 2015 WG assessments.

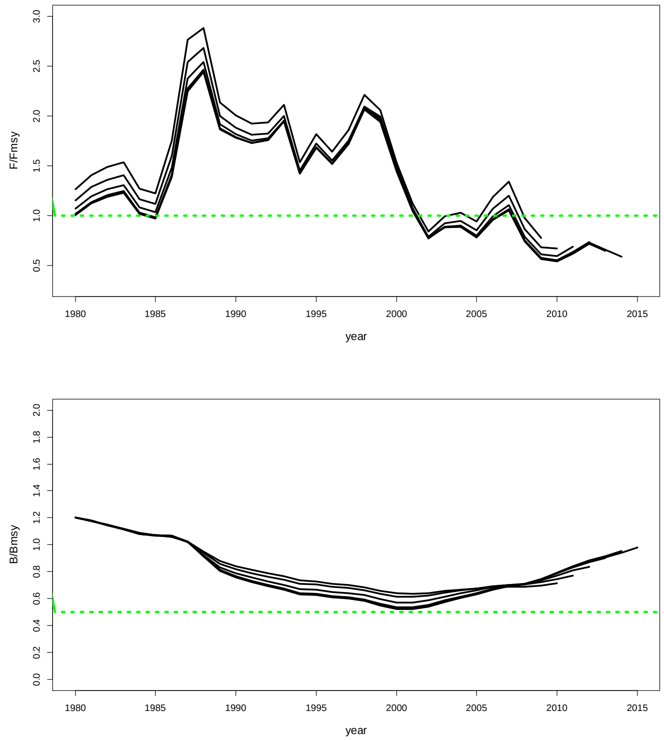


Figure 4.4.6 ANGLERFISH (*L. budegassa*) – Divisions VIIIc and IXa. Retro analysis of the F/FMSY and B/BMSY ratios of 2015 WG assessment.

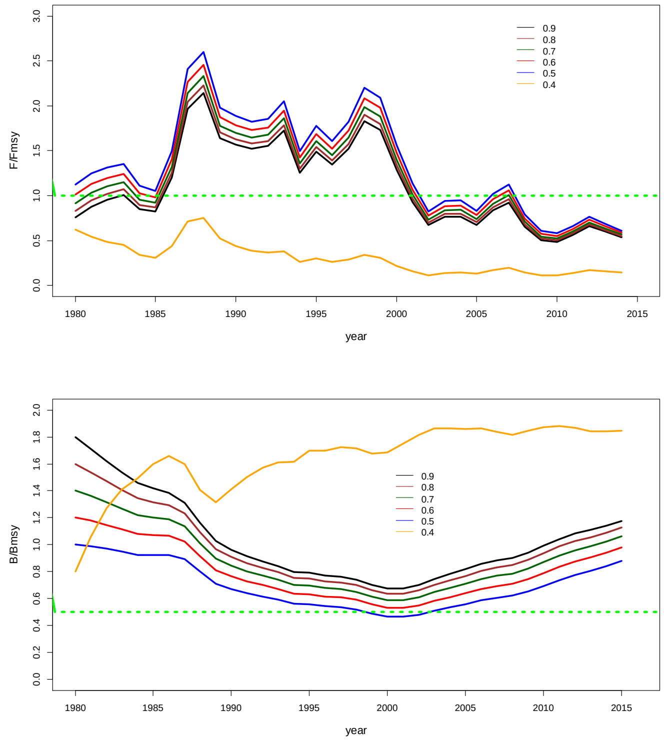


Figure 4.4.7 ANGLERFISH (L. budegassa) – Divisions VIIIc and IXa. Sensentive analysis of the F/FMSY and B/BMSY ratios of 2015 WG assessment.

5 Megrim (*Lepidorhombus whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d

Assessment type: An Update assessment has been done for this stock. This stock was benchmarked in 2012 in WKFLAT. This type of assessment is based on trends in SSB from the assessment, which includes surveys and commercial data, and a more detailed trend study on abundance of age groups from surveys and commercial fleets.

Data revisions this year: French 2013 landing revision and Spanish landings revision from 2011 to 2013 has been carried out. French discard data for 2014 are provided but not included in the assessment.

5.1 General

5.1.1 Fishery description

Megrim in the Celtic Sea, west of Ireland, and in the Bay of Biscay are caught in a mixed fishery predominantly by French followed by Spanish, UK and Irish demersal vessels. In 2014, the four countries together have reported around 96% of the total landings (Table 5.1.1.1.). Estimates of total landings (including unreported or miss-reported landings) and catches (landings+discards) as used by the Working Group up to 2014 are shown in Table 5.1.1.2. In 2012, Spanish official data for years 2011 to 2014 were included.

5.1.2 Summary of ICES Advice for 2015 and Management applicable for 2014 and 2015

ICES advice for 2015

ICES advises on the basis of the approach for data-limited stocks, but cannot quantify the resulting catches. The implied landings should be no more than 15 180 tonnes.

Management applicable for 2014 & 2015

The 2014 TAC was set at 19 101 t and 2015 TAC 19 101 t, including a 5% contribution of *L. boscii* in the landings for which stock there is no assessment.

The minimum landing size of megrim was reduced from 25 to 20 cm length in 2000.

5.2 Data

5.2.1 Commercial catches and discards

Stock catches for the period 1984-2014, as estimated by the WG, are given in Table 5.1.1.2.

Spanish data from 2011 to 2014 has been provided by SGP, the official national administration responsible for fishery statistics. In previous years catches have been estimated by the WG based on IEO and AZTI scientific estimations.

During Benchmark 2012, France landing data series were reviewed from 1999 onwards and final landings were provided for 2010 and 2011. Minor revisions were made for the Irish and Spanish landings and they are included in this revised data series.

Landings in 2014 are lower than in 2013 (16%), reaching up to 13 280 t.

Ireland, Spain, UK and Belgium provided discard data. France provided also discard data for 2014 that they were not provided since 1999, as data appeared to be very uncertain in relation to sampling level affecting their representatively. The group states strongly the importance of incorporating annual estimates of discards to obtain consistent data along the whole data series. Maybe also discards could explain some possible recruitment that could not be completely registered in the catch at age matrix and LPUEs.

Discard data available by country and the procedure to derive them are summarised in Table 5.2.1.1. The discards decrease in year 2000 can be partly explained by the reduction in the minimum landing size from 25 cm to 20 cm. Since 2000, an increasing trend in the discards has been observed until 2004. In 2005, the decrease in the number of small fish resulted in a large decrease of discards (Figure 5.2.1.1). In 2006 discards increased again around 23 %, with a fluctuating trend in the following years. In 2014 discards decreased again 47% in weigth.

In the following table the discard ratio from catches in weight of the most recent years is presented.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Discard ratio (%)	11	13	15	20	27	17	22	17	19	16	25	22	19	21	14

5.2.2 Biological sampling

Age and Length distribution provided by countries are explained in Stock Annex- Meg 78 (Annex E).

Age

France and Spain provided ALKs and consequently completed number and weights at age up to 2014. Ireland and UK (England and Wales) provided number at age for discards and landings up to 2014.

Age distribution for landings and discards from 1999 to 2014 are presented in Figure 5.2.2.1.

Lengths

Table 5.2.2.1 shows the available original length composition of landings by Fishing Unit in 2014. The length compositions of the landings show an increase between 1990 and 1992 and, subsequently, a constant decrease until a rapid increase starting in 2000 (Figure 5.2.1.1) due to the change in MLS. Up to 2006, mean lengths stay relatively stable in the recent years with a decrease in length of discards. In 2013 and 2014 the mean length of landings and discards remains stable.

5.2.3 Surveys data

UK survey Deep Waters (UK-WCGFS-D, Depth > 180 m) and UK Survey Shallow Waters (UK-WCGFS-S, Depth < 180 m) indices for the period 1987–2004 and French EVHOE survey (EVHOE-WIBTS-Q4) results for the period 1997–2014 are summarised in Table 5.2.3.1.

The UK-WCGFS-D and UK-WCGFS-S show the same pattern in the indices for ages 2 and 3 since 1997; in agreement with the high values of EVHOE-WIBTS-Q4 age 1 index for the years 1998 and 2000. These high indices in the Deep component of the UK Surveys are even more remarkable in 2003 for all ages and in 2004 for the younger ages.

EVHOE-WIBTS-Q4 indices for age 1+2 showed no evident general trend. Oscillations of high and low values are present from 2002 to 2007. In 2007 indices decreased sharply with a slight increase till 2010. From 2010 it remains quite stable with a slight increase in 2014 (Figure 5.2.3.2). In Figure 5.2.3.3 the time series of the age composition of abundances from 2007 to 2014 is presented.

An abundance index in ages was provided for Irish Groundfish Survey (IGFS-WIBTS-Q4) from 2003-2014. For the last five years of the data series, the survey provides the lowest values of older ages and a sharp decrease of medium age individuals. For the younger ages, it is quite stable in the last five years.

A revised abundance index in ages was provided for the Spanish Porcupine Ground Fish Survey (SpPGFS-WIBTS-Q4) from 2001 to 2014 due to a change in the calculation methodology of the tow trawling time. In Figure 5.2.3.4 the time series of the age composition of abundances from 2007 to 2014 is presented.

When comparing Spanish, French and Irish survey biomass indices some contradictory signals are detected (Figure 5.2.3.1). The EVHOE-WIBTS-Q4 index decreased from 2001 until 2005 and since then has sharply increased until 2011. In the last years until 2014, it slightly decreased. The SpPGFS-WIBTS-Q4 Porcupine survey (SP-PGFS) shows fluctuation trends from year 2003 to 2008. Afterwards, an increasing trend is observed until 2014.

Irish Ground Fish Survey (IGFS-WIBTS-Q4) gives the highest estimates in 2005 with a decrease in trend to 2007 and increasing again till 2009 in agreement with EVHOE-WIBTS-Q4. In 2010 a sharp decreased occurred in contradiction with the French and Spanish surveys. In 2011 a slight increase occurred in agreement with Spanish survey and in 2012 and 2013 a decreased was observed again with a slight in 2014.

For a more detailed inspection of the abundances indices of different age groups, these were inspected along the whole data series for surveys (Figure 5.2.3.2). Ages groups were identified as: i) age 1+age 2; ii) age 3+age 4+age 5 and iii) age 6+age 7 +age 8+age 9+age 10+. The most abundant age group was ii) at the beginning and the end of the data series for all the surveys but it shows a decreasing trend in the last three years. Age group i) appear most abundant during years 2005 to 2008. As a consequence it is difficult to conclude on the recent abundance trends by age group.

It must be noted that the areas covered by the three surveys almost do not overlap (Figure 5.2.3.5). There is some overlap between the northern component of EVHOE-WIBTS-Q4 and the southern coverage of IGFS-WIBTS-Q4, whereas the eastern boundary of SP-PGFS essentially coincides with the western one of IGFS-WIBTS-Q4.

5.2.4 Commercial catch and effort data

For 2012 Benchmark, a new Irish trawler index was provided as the result of the revision carried out for the Irish Otter trawl fleet. Irish beam trawl (TBB) data is limited to TBB with mesh sizes of 80-89mm, larger mesh sizes are disused since 2006.

The general level of effort is described in Figure 5.2.4.1. SP-CORUTR7 and SP-VIGOTR7 fleets have decreased sharply until 1993, since then it has been decreasing slightly. SP-VIGOTR7 showed a very slight increase in 2007, decreasing slightly till

2014. SP-CANTAB7 remains quite stable since 1991 and decreased slightly since 2000. In 2009, no effort has been deployed by this fleet but in 2010, some trips were recorded, for the last four years no effort was deployed. The effort of the French benthic trawlers fleet in the Celtic Sea decreased from 1991 to 1994, then increased in 1995-1996 and decreasing again in 1999. Since then, effort has been fluctuating up and down for the last 10 years. Since French logbook data were only partially available since 1999, only the LPUE data can be considered.

Commercial series of catch-at-age and effort data were available for three Spanish fleets in Subarea VII (Figure 5.2.4.2): A Coruña (SP-CORUTR7) from 1984–2014, Cantábrico (SP-CANTAB7) from 1984–2010 as no effort has been deployed by this fleet in subarea VII during the last four years and Vigo (SP-VIGOTR7) from 1984–2014. The CPUE of SP-CORUTR7 has fluctuated until 1990, when it started to decrease, with a slight increase in 2003 and a peak in CPUE in 2011 and decrease again in 2014. Over the same period, SP-VIGOTR7 has remained relatively stable until 1999, reaching in 2004 the historical maximum. In the last years it was fluctuations with a decrease in 2014. SP-CANTAB7 has been fluctuating up to 1999 and then a general increasing trend is observed. No LPUE value is available for this fleet in 2009, as no effort was deployed. In 2010, LPUEs increased as a result of some trips being deployed in area VII but in 2011, but afterwards no effort was deployed.

From 1985 to 2008, LPUEs from four French trawling fleets: FR-FU04, Benthic Bay of Biscay, Gadoids Western Approaches and *Nephrops* Western Approaches were available. (Table 5.2.4.1.& Figure 5.2.4.3). No data for 2009, 2010 and 2011 were provided as effort deployed by these fleet was considered, at the time of the analysis, unreliable.

The LPUE of all Irish beam trawlers fleets oscillates up and down since 2000 to 2006 following a decreasing trend. From 2007 an increase in the LPUE is observed with a slight decrease in 2014 (Figure 5.2.4.4).

Summarizing no particular LPUE changes have been observed, so no stock changes is observed.

An analysis of the abundance indices of different age groups in data series for commercial fleets was carried out (Figure 5.2.4.5). Ages groups were identified as: i) age 1+age 2; ii) age 3+age 4+age 5 and iii) age 6+age 7+age 8+age 9+age 10+. For Spanish and Irish commercial fleets, the most abundant age group was ii) at the beginning and the end of the data series. Age group i) appear more abundant than older ages (ii) during years 2003 and 2004 in the Spanish fleet. French fleets appear to land mostly old individual at the beginning of the data series, while same quantities of medium age fish (group ii) and old fish (group iii) are presented till 2008. In general a marked decrease in abundance index of old fish was observed for French fleet. In 2014, a decrease is observed in Spanish and Irish fleets but the proportion of age groups catches is maintained.

Based on age groups of commercial fleets, summarizing no particular LPUE changes have been observed, so no stock changes is observed.

5.3 Assessment

No analytical assessment is available for this stock since 2007 consequently no forecast is either provided. This stock was Benchmarked in 2012 and a Bayesian statistical catch-at-age model was tested. Absolute values of the assessment were not accepted by the Group due to the lack of confidence on the data and deficiencies of then available data.

This year, an update assessment has been conducted using data up to year 2014, according to the settings presented in the Stock Annex. A short term projection has also been presented as a trial and results seem to be promising. However, projection script developed by Fernandez el al., (2010) should be reviewed for its use in the advice.

5.3.1 Data Exploratory Analysis

In summary, the stock catch-at-age matrix shows three periods: 1984–1989; 1990–1998 and 1999–2014.

The data analyzed consist of landed, discarded and catch numbers-at-age and abundance indices-at-age. Five of the available fleets were considered appropriate to inclusion in the assessment model as tuning fleets: Spanish Porcupine survey (SpPGFS_WIBTS-Q4), French Survey (EVHOE-WIBTSQ4), Vigo commercial trawl cpue series separated in two periods: 1984–1998 (VIGO84) and 1999–2010 (VIGO99), and Irish Otter trawlers lpue (IRTBB), based on their representativeness of megrim stock abundance. An exploratory data analyses was performed to examine their ability to track cohorts through time.

Several exploratory analyses were carried out on the data with the software R. The analysis of the standardized log abundance indices revealed no special trend in EVHOE-WIBTSQ4 survey (Figure 5.3.1.1). Otherwise, in SpPGFS-WIBTS-Q4 negative values for old ages from 2007 to 2011, but positive for old ages from 2012 to 2014. The analysis of the standardized log abundance indices revealed year trends for VIGO99 and the same decrease in the index of old individuals was detected by this fleet in 2008 and 2009. In 1999 and 2000, VIGO99 showed negative high values for ages 1 and 2 but in the last years positive values of ages 1-3 and bigger ages 7-9. IRTBB and SpPGFS-WIBTS-Q4 were the fleets that showed more positive values for older ages from year 2010 onwards.

The time-series of catch at age (Figure 5.3.1.2) showed very low catches of ages 1–5 from 1984 to 1989. From 2004 to 2010, the catch of older ages (>6) was remarkably low, whereas catches of ages 1 and 2 increased markedly from 2003. This could be a result of an underestimation of catches of these ages (specially age 1) before this year, probably, due to the sparseness of discard data in that period. For ages 6 and older, large discrepancies in the amount caught before and after 1990 are apparent, with large catches of these ages before 1990 and a decrease to almost no individuals caught at the end of the data series.

The analysis of the landings are presented since 1990 (Figure 5.3.1.3). Landings of ages 1 and 2 decreased from the beginning of the series to the last years where negative values have increased from 2009 onwards. In fact, the proportion of older ages in the landings decreased significantly from 2004 to 2009, as already discussed in relation to the catch. In 2014, ages 1 increased a lot (mainly from the Irish fleet) and older ages decreased.

The signal coming from the discard data showed that at the beginning of the data series discards of age 1 was low (Figure 5.3.1.4). Discards of this age increased along the data series, particularly from 2003 onwards. Ages 4, 5, and 6 appeared to be highly discarded in year 2004. From year 2010 to 2013, ages 1 to 3 appear to be highly discarded but in 2014 general discards decrease again.

5.3.2 Model

The model explored during the benchmark is an adaptation of one developed originally for the southern hake stock, published in Fernández *et al*. (2010). It is a statistical catch-at-age model that allows incorporating data at different levels of aggregation in different years and also allows for missing discards data by certain fleets and/or in some years. These are all relevant features in the megrim stock.

The model is described in Stock Annex of this report and also in WKFLAT 2012 report.

5.3.3 Results

The model results were analysed looking at three different kinds of plots: convergence plots (to analyse the convergence behaviour of the MCMC chains), diagnostic plots (to analyse the goodness of the fit) and, finally, plots of the models estimates (displaying the estimated stock status over time).

The prior settings for this run are listed in Table 5.3.3.1 and are the ones chosen in the Benchmark as the best one among the different model configurations run.

In order to be sure that the model has produced a representative sample of the posterior distribution, the MCMC chain was examined for behaviour ("convergence" properties). This was done by examining trace plots and autocorrelation plots for most parameters in the model (Figure 5.3.3.1 to Figure 5.3.3.3). The trace and autocorrelation plots showed a good behaviour in the run carried out with the model, giving support to the reliability of the outputs from the MCMC simulation conducted.

Model diagnostics plots examined were: prior-posterior plots and time series and bubble plots of the residuals. Prior-posterior distributions are shown in Figures 5.3.3.4. Posterior distributions for log-population abundance in first assessment year (1984), log-f(y) and log-catchabilities of abundance indices were much more concentrated than the priors and were often centred at different places. This indicated that the model was able to extract information from the data in order to substantially revise the prior distribution. In these cases, the model fits are mostly driven by the data, with the prior having only a small influence. The posterior distributions for log-rSPD ord log-rOTD in the first assessment year (1984) were similar to the prior distributions in most of the cases. This was especially true for log-rOTD, were data directly associated with it was not available to the model. This indicates that the available data does not contain very much information concerning these parameters and that the priors have to be chosen carefully trying to be realistic.

Time series of estimated spawning stock biomass (SSB), reference fishing mortality (Fbar), recruits and catch, landings and discards are shown in Figure 5.3.3.5. The SSB shows an overall decreasing trend from the start of the series in 1984 to 2005 with a marked increasing trend till 2014. The uncertainty in the SSB was low in the whole time series. The median recruitment fluctuated between 200000 and 300000 thousand in the whole series without any trend. As expected, uncertainty in recruitment estimates is largest at the end of the time series, as those years correspond to cohorts that are still passing through the population and additional information about them will be gained in future years. The fishing mortality showed three marked periods which coincide with the data periods, 1984-1989, 1990-1998 and 1999-2013. The lowest Fbar was observed in the first period and the highest one in the year 2005 and then it decreases until 2014 with small uncertainty. Overall, the catches showed very weak decreasing trend. The landings decreased in a higher proportion than the catches and the discards showed a decreasing trend. The uncertainty was small in all the years.

5.4 Retrospective pattern

Retrospective analysis was conducted for 4 years, the retrospective time series of most relevant indicators are shown in Figures 5.4.1. In terms of SSB, two groups were distinguished: one corresponding to the two shortest time series (removing the 2 and 3 final years) and a second one with the two longest time series (until 2013 and removing 1 year). The SSB estimates were very similar throughout the entire time series and there was an upward revision of SSB. The recruitment estimates towards the end of the time series showed significant revisions in the retrospective analysis, but this is something common, as recruitment in the most recent year(s) is usually not correctly estimated by assessment models. The fishing mortality was revised downwards year by year.

5.5 Short term forecasts

As it was mentioned in last year´s report conclusions, this year trial short term projection has been developed and implemented inter-sessionally. Short-term projections have been made using Rscript developed by Fernández et al. (2010).

Results are still very preliminary as some outputs of the projection were inconsistent with the stock dynamic estimated by the assessment model. However, this script could be used as a basis to develop a projection framework in the future Inter-benchmark proposed by the working group.

5.6 Conclusions

The use of the Bayesian statistical catch-at-age model gives very promising results and the model is able to address the heterogeneity in the Northern Megrim data in a very satisfactory way. The model fit to the data is adequate and the WG considers that the current assessment could be fully accepted and not only as indicator of trend as in the last benchmark. Besides, the basis for short term projection was developed and projections have been carried out for the assessment but this work should be reviewed by ICES.

In the context of this review, as missing discard data from France would be provided, the WG consider important to include this data into the stock assessment model. This will need a revision of the code of the Bayesian model.

Discard data from France have been provided to the WG for year 2014, but they are not included in the assessment. They are not included because there is only one year of data. However, currently the model estimates discard data for countries that do not provide this information.

Catch, landing and discard data and survey indices do not appear to indicate the presence of important change in trends of recruitment or the overall biomass.

In the context of the current trend analysis and in view of available data, the Group concludes that the stock appears stable at the present level of fishing.Biological reference points

The calculation of possible reference points was not considered appropriate at this time due to the lack of analytical assessment.

5.7 Recommendations on the procedure for assessment updates and further work

It needs to be pointed out that stock data from countries should be available one month before the group starts as it was set, otherwise there is not enough time during the group to make preliminary runs to obtain the best fit of the model.

Due to this year data call, France delivered discard data for year 2014.The group appreciates delivering annual estimates of discards to explain some of the recruitment processes detected in the analysis and not completely registered in the catch at age matrix and LPUEs. Taking advantage of this first deliver, the group will try to obtain a reliable time series of French discard data and afterwards, evaluate the possibility to adapt the Bayesian model to include the new discard data.

An interbenchmark is proposed to include new discard French data into the assessment model and develop projection framework. If results and projections are appropriate a proposal to change stock category from category 3.2 to category 1 would be done.

Some recommendations are done in Annex O.

Table 5.1.1.1. .Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Nominal landings and catches (t) by country provided by the Working Group.

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
France			4896	5056	5206	5452	4336	3709	4104	3640	3214	3945	4146	4333	4232	3751
Spain			10242	8772	9247	9482	7127	7780	7349	6526	5624	6129	5572	5472	4870	4615
U.K. (England & Wales)			2048	1600	1956	1451	1380	1617	1982	2131	2309	2658	2493	2875	2492	2193
U.K. (Scotland)																
Ireland			1563	1561	995	2548	1381	1956	2113	2592	2420	2927	2699	1420	2621	2597
Belgium			178	125	173	300	147	32	52	40	117	203	199	130	129	149
Unallocated																
Total landings	16659	17865	18927	17114	17577	19233	14371	15094	15600	14929	13685	15862	15109	14230	14345	13304
Total discards	2169	1732	2321	1705	1725	2582	3284	3282	2988	3108	2700	3206	3026	3066	5371	3297
Total catches	18828	19597	21248	18819	19302	21815	17655	18376	18588	18037	16385	19068	18135	17296	19716	16601
Agreed TAC (1)				16460	18100	18100	18100	18100	18100	21460	20330	22590	21200	25000	25000	20000

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
France	4173	3645	2929	3203	2758	2787	2726	2733	2383	1316	1728	1599	2268	4551	4310
Spain	6047	7575	8797	8340	7526	5841	5916	6895	5402	8062	7095	3847	3997	4827	3318
U.K. (England & Wales)	2185	1710	1787	1732	1622	1764	1509	1462	1387	1842	1810	1845	1744	2918	2753
U.K. (Scotland)															176
Ireland	2512	2767	2413	2249	2288	2155	1751	1763	1514	1918	2283	2227	3047	3038	2391
Belgium	115	80	62	163	106	156	99	195	167	209	261	330	609	538	179
Unallocated												2074	1080		150
Total landings	15032	15778	15987	15687	14300	12703	12000	13048	10853	13348	13177	11923	12745	15872	13277
Total discards	1870	2261	2813	4008	5240	2578	3368	2703	2531	2604	4406	3340	2908	4137	2179
Total catches	16902	18039	18800	19696	19540	15281	15369	15751	13384	15952	17583	15263	15653	20008	15456
Agreed TAC (1)	20000	16800	14900	16000	20200	21500	20400	20400	20400	20400	20106	20106	19101	19101	19101

Table 5.1.1.2. Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Nominal landings and catches (t) provided by the Working Group.

	Total landings	Total discards	Total catches	Agreed TAC (1)
1984	16659	2169	18828	
1985	17865	1732	19597	
1986	18927	2321	21248	
1987	17114	1705	18819	16460
1988	17577	1725	19302	18100
1989	19233	2582	21815	18100
1990	14370	3284	17654	18100
1991	15094	3282	18376	18100
1992	15600	2988	18588	18100
1993	14929	3108	18037	21460
1994	13684	2700	16384	20330
1995	15862	3206	19068	22590
1996	15109	3026	18135	21200
1997	14230	3066	17296	25000
1998	14345	5371	19716	25000
1999	13305	3297	16602	20000
2000	15031	1870	16901	20000
2001	15778	2262	18040	16800
2002	15987	2813	18800	14900
2003	15687	4008	19695	16000
2004	14300	5240	19539	20200
2005	12703	2578	15281	21500
2006	12000	3368	15369	20425
2007	13048	2703	15750	20425
2008	10853	2531	13384	20425
2009	13348	2604	15952	20425
2010	13177	4406	17583	20106
2011(*)	11923	3340	15263	20106
2012(*)	12745	2902	15647	19101
2013(*)	15809	4137	19946	19101
2014(*)	13277	2179	15456	19101

(1) for both megrim species and VIIa included.

(*) Spanish official data are included.

Table 5.2.1.1 Megrim (*L.whiffiagonis*) in VIIb-k and VIIIa,b,d. Discards information and derivation.

	FR	SP	IR	UK
1984	**FR84-85**	-	-	-
1985	**FR84-85**	-	-	-
1986	(FR84-85)	(SP87)	-	-
1987	(FR84-85)	**SP87**	-	-
1988	(FR84-85)	**SP88**	-	-
1989	(FR84-85)	(SP88)	-	-
1990	(FR84-85)	(SP88)	-	-
1991	**FR91**	(SP94)	-	-
1992	(FR91)	(SP94)	-	-
1993	(FR91)	(SP94)	-	-
1994	(FR91)	**SP94**	-	-
1995	(FR91)	(SP94)	**IR**	-
1996	(FR91)	(SP94)	**IR**	-
1997	(FR91)	(SP94)	**IR**	-
1998	(FR91)	(SP94)	**IR**	-
1999	-	**SP99**	**IR**	-
2000	-	**SP00**	**IR**	**UK**
2001	-	**SP01**	**IR**	**UK**
2002	-	(SP01)	**IR**	**UK**
2003	-	**SP03**	**IR**	**UK**
2004	-	**SP04**	**IR**	**UK**
2005	-	**SP05**	**IR**	**UK**
2006	-	**SP06**	**IR**	**UK**
2007	-	**SP07**	**IR**	**UK**
2008	-	**SP08**	**IR**	**UK**
2009	-	**SP09**	**IR**	**UK**
2010	-	**SP10**	**IR**	**UK**
2011	-	**SP11 (*)**	**IR**	**UK**
2012	-	**SP12 (*)**	**IR**	**UK**
2013	-	**SP13 (*)**	**IR**	**UK**
2014	**FR14**	**SP14 (*)**	**IR**	**UK**

- In bold: years where discards sampling programs provided information

- In (): years for which the length distribution of discards has been derived

(*) Scientific estimates were provided

Table 5.2.2.1 Megrim (*L.whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Length composition by fleet (thousands).

Length	FRANCE		SPAIN		IRELAND	UNITED KINGDOM		
class (cm)	OTB_CRU_>=70_0_0 OTB_DEF_>=70_0_0 VII	OTB_CRU_100_119_0_0 OTB_DEF_100_119_0_0 OTB_DEF_70_99_0_0 VIII	OTB_DEF_70-99_0_0. Otter trawl-med&deep VII	OTB_DEF_70_0_0. Otter trawl-med&deep VIIIabd	ALL FISHING UNITS	FU03:Fixed nets	FU05:Otter trawl-shallow	FU06:Beam trawl-all depths
10			0	0	0	0	0	0
11			0	0	0	0	0	0
12			0	0	0	0	0	0
13			0	0	0	0	0	0
14			0	0	0	0	0	0
15			0	0	0	0	0	0
16			0	0	0	0	0	0
17			0	0	0	0	0	0
18			0	0	0	0	0	0
19	0	0	0	4	0	0	0	0
20	0	0	0	22	3	0	0	0
21	8	0	0	75	8	0	0	0
22	0	0	0	115	40	0	0	0
23	58	0	20	186	79	0	0	0
24	0	0	153	218	96	0	0	8
25	118	5	829	200	129	0	0	7
26	0	0	1614	183	166	0	0	44
27	140	93	1794	199	195	0	0	102
28	0	0	1518	211	305	0	1	165
29	242	270	1227	186	346	0	8	264
30	0	0	986	203	443	1	19	256
31	227	558	768	197	502	0	41	197
32	0	0	630	187	468	0	54	178
33	219	611	545	140	506	0	65	211
34	0	0	444	104	458	0	70	198
35	215	562	366	77	450	0	57	178
36	0	0	289	63	478	0	60	177
37	205	481	239	50	389	0	55	152
38	0	0	206	46	362	0	49	134
39	172	366	173	35	278	0	35	95
40	0	0	155	31	223	0	25	79
41	144	292	135	24	190	0	16	74
42	0	0	110	21	125	0	11	56
43	137	237	93	16	112	0	8	42
44	0	0	107	10	121	1	5	43
45	108	211	60	7	59	0	3	44
46	0	0	61	5	73	1	2	33
47	106	187	39	2	54	0	2	26
48	0	0	35	1	37	0	1	26
49	52	120	24	2	26	0	0	12
50	0	0	20	1	20	0	0	16
51	36	61	10	0	16	0	0	7
52	0	0	6	0	11	0	0	6
53	10	27	3	0	11	0	0	5
54	0	0	4	0	3	0	0	6
55	6	11	1	0	7	0	0	1
56	0	0	1	0	3	0	0	2
57	2	2	0	0	1	0	0	0
58	0	0	0	0	0	0	0	1
59	0	2	0	0	0	0	0	0
60			0	0	0	0	0	0
61			0	0	0	0	0	0
62			0	0	0	0	0	0
63			0	0	0	0	0	0
64			0	0	0	0	0	0
65			0	0	0	0	0	0
66			0	0	0	0	0	0
67			0	0	0	0	0	0
68			0	0	0	0	0	0
69			0	0	0	0	0	0
70			0	0	0	0	0	0
TOTAL	2205	4097	12666	2822	6794	7	588	2845

Table 5.2.3.1. Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Abundance Indices for UK-WCGFS-D, UK-WCGFS-S, IGFS, SP-PGFS and FR- EVHOE.

		UK-WCGFS-D							**Effort in hours**	
		Age								
	Effort	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1987	100		863	5758	0	0	0	95	1753	151
1988	100	8	256	59	49	0	228	1008	1262	632
1989	100		70	188	471	2540	788	3067	680	1060
1990	100	8	526	1745	553	2584	1985	974	1154	974
1991	100		415	1375	1250	989	912	1677	593	731
1992	100	7	28	425	414	349	189	206	132	121
1993	100		122	382	1758	1505	728	739	666	718
1994	100		69	1593	1542	2663	1325	1278	825	595
1995	100	47	582	747	1755	1686	1303	548	281	421
1996	100	15	69	475	549	1580	1231	870	327	117
1997	100		329	751	1702	1518	541	149	47	17
1998	100		120	797	1432	1134	866	242	246	13
1999	100		237	270	734	760	302	94	33	17
2000	100		143	1004	619	681	395	67	35	13
2001	100	20	384	690	1426	581	460	376	226	45
2002	100		162	2680	1915	1349	761	690	315	104
2003	100		330	1705	3149	2662	1451	676	417	179
2004	100	168	1001	1382	1069	897	628	208	47	
		UK-WCGFS-S							**Effort in hours**	
		Age								
	Effort	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1987	100		499	3082	641	891	180	794	264	587
1988	100		47	55	585	95	367	0	50	93
1989	100		616	574	547	1540	576	361	297	198
1990	100		375	1057	816	661	1220	195	454	176
1991	100	2	373	829	822	394	460	550	178	293
1992	100		149	278	323	193	109	164	93	36
1993	100		470	877	1140	601	327	321	143	233
1994	100		74	1000	1301	998	521	374	185	153
1995	100	28	435	878	1167	1054	805	488	359	130
1996	100	2	64	401	389	823	592	372	152	43
1997	100	3	284	1028	550	540	289	202	75	29
1998	100	4	30	438	665	381	209	97	48	21
1999	100		69	82	222	214	103	53	41	20
2000	100		72	377	249	313	169	81	52	20
2001	100	2	131	297	594	104	145	122	80	37
2002	100		134	808	506	757	339	326	181	82
2003	100	5	184	289	639	416	328	113	102	36
2004	100	50	343	467	270	394	303	124	49	21
		FR-EVHOE								
		Age								
	Effort	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1997	100	0.77	3.92	2.47	1.47	1.59	0.91	0.61	0.35	0.15
1998	100	1.61	0.66	4.48	3.07	1.52	0.98	0.84	0.43	0.14
1999	100	0.54	3.48	0.72	2.14	3.38	1.66	0.70	0.30	0.27
2000	100	1.38	2.79	2.64	1.35	1.22	0.73	0.40	0.28	0.14
2001	100	0.94	0.51	1.87	2.36	2.72	1.87	1.40	0.38	0.22
2002	100	3.12	2.28	4.24	3.18	1.67	0.68	0.49	0.23	0.10
2003	100	2.53	2.95	2.40	3.21	0.67	0.65	0.25	0.19	0.11
2004	100	0.97	4.64	1.70	0.96	0.77	0.66	0.33	0.25	0.12
2005	100	0.86	3.48	2.94	0.91	0.57	0.48	0.13	0.07	0.12
2006	100	2.77	5.06	3.25	0.25	0.86	0.36	0.38	0.21	0.07
2007	100	4.05	3.91	1.63	1.39	2.03	0.66	0.43	0.24	0.10
2008	100	0.54	5.52	3.72	2.05	0.69	0.38	0.22	0.06	0.01
2009	100	1.55	3.09	7.90	0.94	0.45	0.21	0.06	0.01	0.00
2010	100	2.71	2.67	2.75	4.59	1.20	0.54	0.25	0.21	0.13
2011	100	0.08	5.03	5.17	3.63	1.60	0.97	0.27	0.04	0.12
2012	100	1.26	3.89	7.87	1.89	0.94	0.78	0.66	0.08	0.03
2013	100	0.89	3.34	3.93	4.63	0.49	0.52	0.35	0.04	0.07
2014	100	0.43	4.17	2.09	4.81	1.49	0.40	0.10	0.03	

		IGFS									
		Age									
	Effort	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
2003	100	0	152	316	368	238	96	36	14	5	2
2004	100	0	153	461	595	454	162	57	30	12	3
2005	100	29	414	643	431	370	215	68	44	18	17
2006	100	44	505	548	481	215	154	68	10	7	5
2007	100	1	100	293	125	91	70	25	7	7	3
2008	100	5	140	481	349	101	66	60	17	12	5
2009	100	3	1	234	371	455	346	159	53	44	23
2010	100	6	1	128	377	259	173	90	38	13	10
2011	100	5	2	121	333	331	144	69	40	25	30
2012	100	4	24	141	140	108	52	36	16	9	33
2013	100	9	31	132	93	83	58	30	10	8	22
2014	100	40	62	143	106	56	57	52	22	23	17

		SP-PGFS							
		Age							
	Effort	0	1	2	3	4	5	6	7+
2001	100	43	1770	2208	2842	3434	1941	1357	740
2002	100	6	1069	2502	3168	3997	2237	1107	515
2003	100	11	1081	2913	4105	5262	2789	1284	636
2004	100	7	719	3457	5498	5569	3071	1125	828
2005	100	77	633	626	2279	8249	4959	2605	688
2006	100	5	1776	1443	3275	4719	3312	901	383
2007	100	30	4856	6990	3556	3622	1814	852	399
2008	100	14	260	2219	5406	4010	1807	1219	428
2009	100	6	534	661	5320	7097	1635	877	606
2010	100	39	318	2158	2557	6723	2313	494	476
2011	100	37	393	1174	2510	3940	5141	1452	626
2012	100	5	157	692	3759	2862	3207	2926	1902
2013	100	6	1473	1184	1174	1619	3703	2657	2579
2014	100	39	243	3174	1001	2286	4400	3409	2198

Table 5.2.3.1 (cont). Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Abundance Indices by kilograms and numbers by 30 minutes haul duration.

	FR-EVHOEFS Abundance Indices	
	kg/30'	Nb/30'
1997	1.98	12.35
1998	2.20	13.96
1999	1.82	13.43
2000	1.42	11.14
2001	2.21	17.04
2002	2.03	16.55
2003	1.77	13.14
2004	1.50	10.67
2005	1.43	9.88
2006	1.7	15.63
2007	1.96	14.6
2008	2.05	13.65
2009	2.5	14.8
2010	2.57	15.53
2011	3.21	17.14
2012	2.97	17.69
2013	2.91	14.58
2014	2.13	13.82

	SP-PGFS	
AÑO	kg/30'	Nb/30'
2001	6.80	143.34
2002	6.66	146.00
2003	8.16	180.81
2004	9.01	202.72
2005	9.81	201.19
2006	7.64	158.14
2007	9.15	221.18
2008	8.46	153.61
2009	11.96	167.34
2010	11.47	150.76
2011	11.89	152.72
2012	13.03	155.08
2013	12.82	143.96
2014	15.78	166.68

IGFS Abundance Indices	
2003	1227
2004	1926
2005	2254
2006	2039
2007	725
2008	1238
2009	1724
2010	1103
2011	1116
2012	583
2013	497
2014	593

Table 5.2.4.1. Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. French and Spanish CPUEs for different bottom trawl fleets.

	French (single and twin bottom trawls combined) CPUE (kg/h)				Spanish CPUE (kg/(100day*100 hp))			Irish LPUE ('000 h)
	Benthic Bay of Biscay	Benthic Western Approaches	Gadoids Western Approaches	Nephrops Western Approaches	A Coruña -VII	Cantábrico- VII	Vigo-VII	Otter trawlers
1984					16.3	130.1	99.1	-
1985	3.0	5.3	4.7	4.7	9.8	39.5	108.9	-
1986	3.2	4.8	2.8	4.4	21.1	52.8	105.1	-
1987	3.3	5.1	2.7	4.5	8.3	80.7	96.2	-
1988	3.8	5.8	3.0	4.1	9.8	78.3	106.1	-
1989	3.6	5.5	2.6	4.2	14.6	48.1	92.1	-
1990	3.1	4.2	1.8	3.4	15.1	18.4	73.8	-
1991	2.6	4.0	1.3	2.8	12.9	25.9	85.4	-
1992	2.5	4.5	1.5	3.4	6.9	32.8	105.6	-
1993	1.9	4.6	1.2	3.5	5.1	33.5	92.3	-
1994	1.9	4.2	1.2	3.4	7.4	52.7	78.7	-
1995	2.3	4.9	1.4	3.4	7.8	61.3	94.3	13.7
1996	2.6	5.0	1.4	3.5	3.9	58.4	79.3	13.6
1997	3.3	5.6	1.2	3.0	3.0	46.9	96.0	12.1
1998	2.9	6.5	1.5	3.6	2.4	35.7	82.4	10.0
1999	3.0	6.3	0.9	3.4	1.1	32.5	137.0	11.3
2000	2.9	6.8	0.6	4.0	5.5	45.0	128.9	13.4
2001	2.2	6.8	0.7	4.1	1.3	75.6	131.2	13.1
2002	2.1	6.8	0.5	3.2	1.3	76.4	185.3	12.2
2003	1.8	5.8	0.6	3.2	11.2	54.0	192.1	8.2
2004	1.8	4.6	0.5	3.4	3.3	60.0	211.0	9.3
2005	1.9	5.1	0.4	4.2	1.7	58.46	135.3	10.0
2006	2.5	4.8	0.3	3.6	1.4	76.42	146.1	7.5
2007	2.4	5.1	0.4	2.9	2.4	87.86	144.3	8.5
2008	2.2	4.6	0.5	3.1	3.0	37.58	114.0	8.4
2009	NA	NA	NA	NA	8.3	0.00	173.2	10.3
2010	NA	NA	NA	NA	7.9	38.78	198.3	11.8
2011	NA	NA	NA	NA	19.7	0.0	151.2	13.5
2012	NA	NA	NA	NA	6.4	0.0	135.3	19.3
2013	NA	NA	NA	NA	10.0	0.0	210.2	19.4
2014	NA	NA	NA	NA	3.4	0.0	116.7	15.4

(*) LPUEs, no discards available

Table 5.3.3.1. Prior distributions of final run. $LN(\mu,\psi)$ denotes the lognormal distribution with median μ and coefficient of variation ψ, and $\Gamma(u,v)$ denotes the Gamma distribution with mean u/v and variance u/v^2.

Parameter and prior distribution	Values used in prior settings
$N(y,1) \sim LN(medrec,2)$	$medrec = 250000$
$N(1984,a) \sim LN(medrec \exp[-(a-1)M - \sum_{j=1}^{a-1} medF(j)],2), a = 2,\ldots,9$	$medrec$ as above, $M = 0.2$, $medF = (0.05,0.1,0.3,0.3,0.3,0.3,0.3,0.3,0.3)$
$N(1984,10+) \sim LN(medrec \exp[-9M - \sum_{j=1}^{9} medF(j)]/\{1-\exp[-M - medF(9)]\}, 2)$	$medrec, M, medrecF$ as above
$f(y) \sim LN(med_f, CV_f)$	$med_f = 0.3, CV_f = 1$
$\rho \sim Uniform(0,1)$	
$r_L(1984,a) \sim LN(medr_L(a),1), a = 1,\ldots,8$	$medr_L = (0.0005,0.05,1,1,1,1,1,1)$
$r_L(y,9) = r_L(y,10+) = 1$	
$r_{SPD}(1984,a) \sim LN(medr_{SPD}(a),1), a = 1,\ldots,7$	$medr_{SPD} = (0.002,0.02,0.02,0.02,0.01,0.01,0.01)$
$r_{IRD}(1984,a) \sim LN(medr_{IRD}(a),1), a = 1,\ldots,8$	$medr_{IRD} = (0.001,0.01,0.01,0.01, 0.005,0.005,0.005,0.001)$
$r_{UKD}(1984,a) \sim LN(medr_{UKD}(a),1), a = 1,\ldots,8$	$medr_{UKD} = (0.00001,0.001,0.001,0.001, 0.001,0.001,0.001,0.001)$
$r_{OTD}(1984,a) \sim LN(medr_{OTD}(a),1), a = 1,\ldots,8$	$medr_{OTD} = (0.002,0.02,0.02,0.02, 0.01,0.01,0.01,0.002)$
$r_{SPD}(y,7) = r_{SPD}(y,a) = r_{IRD}(y,a) = r_{UKD}(y,a) = r_{OTD}(y,a) = 0,\ a = 8,9,10+$	
$\tau_C(a), \tau_L(a), a = 1,2,3; \tau_D(a), a = 1,\ldots,8$	$\Gamma(4,0.345)$
$\tau_C(a), \tau_L(a), a = 4,\ldots,10+$	$\Gamma(10,0.1)$
$\tau_{SPD}(a), a = 1,\ldots,7; \tau_{IRD}(a), \tau_{UKD}(a), a = 1,\ldots,8$	$\Gamma(4,0.345)$
$\log[q_k(a)] \sim N(\mu_{Ik}, \tau_{Ik}), a \le 8$, index $k = 1,\ldots,5$	$\mu_{Ik} = -7,\ \tau_{Ik} = 0.2$
$q_k(a) = q_k(8), a > 8$, indices k with ages > 8	

$\tau_k(a)$, index $k = 1,\ldots,5$	$\Gamma(4,0.345)$

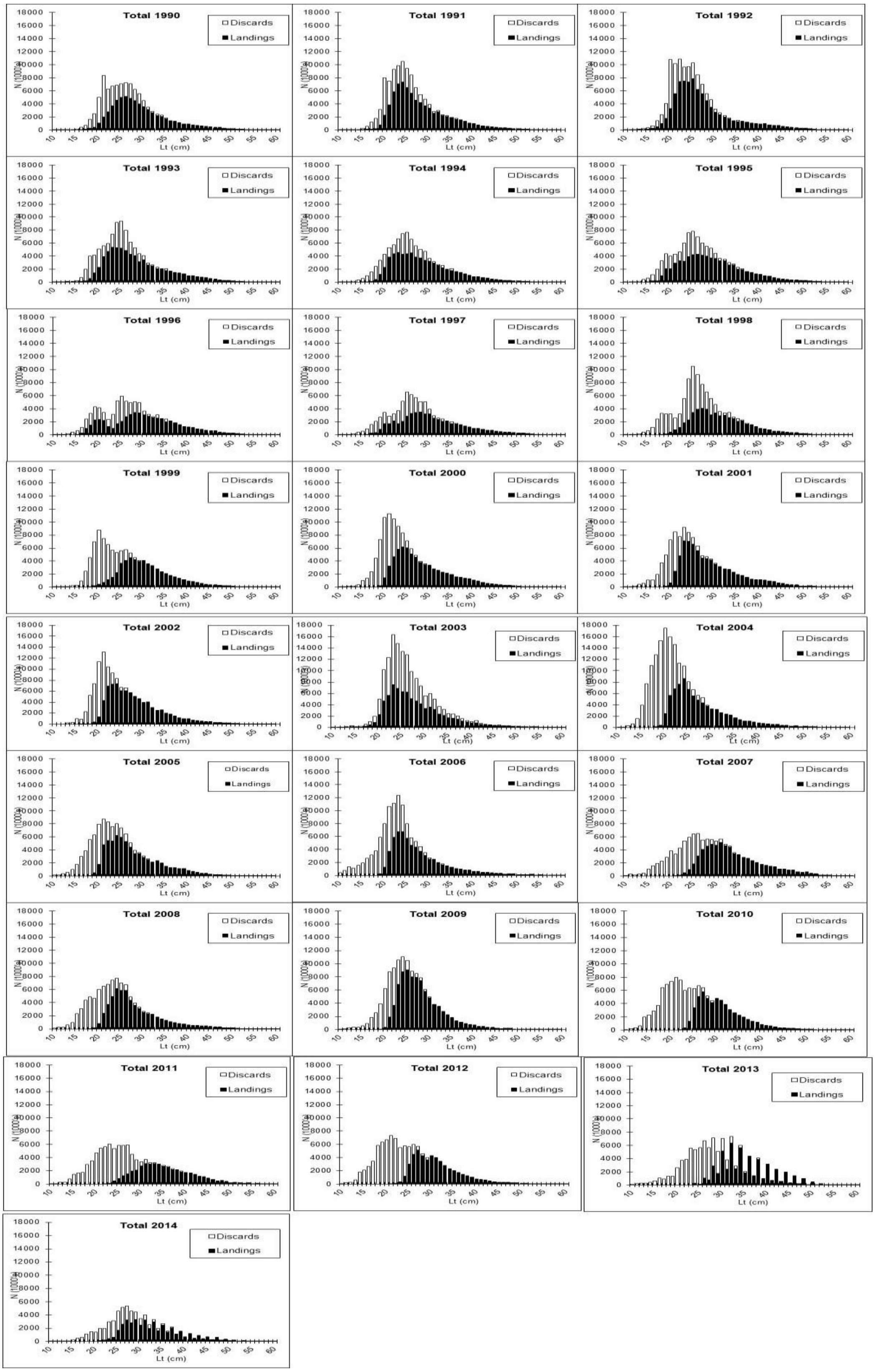


Figure 5.2.1.1. Megrim (*L.whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Length composition of catches for the years 1990 to 2014. Numbers of individuals in thousand tons.

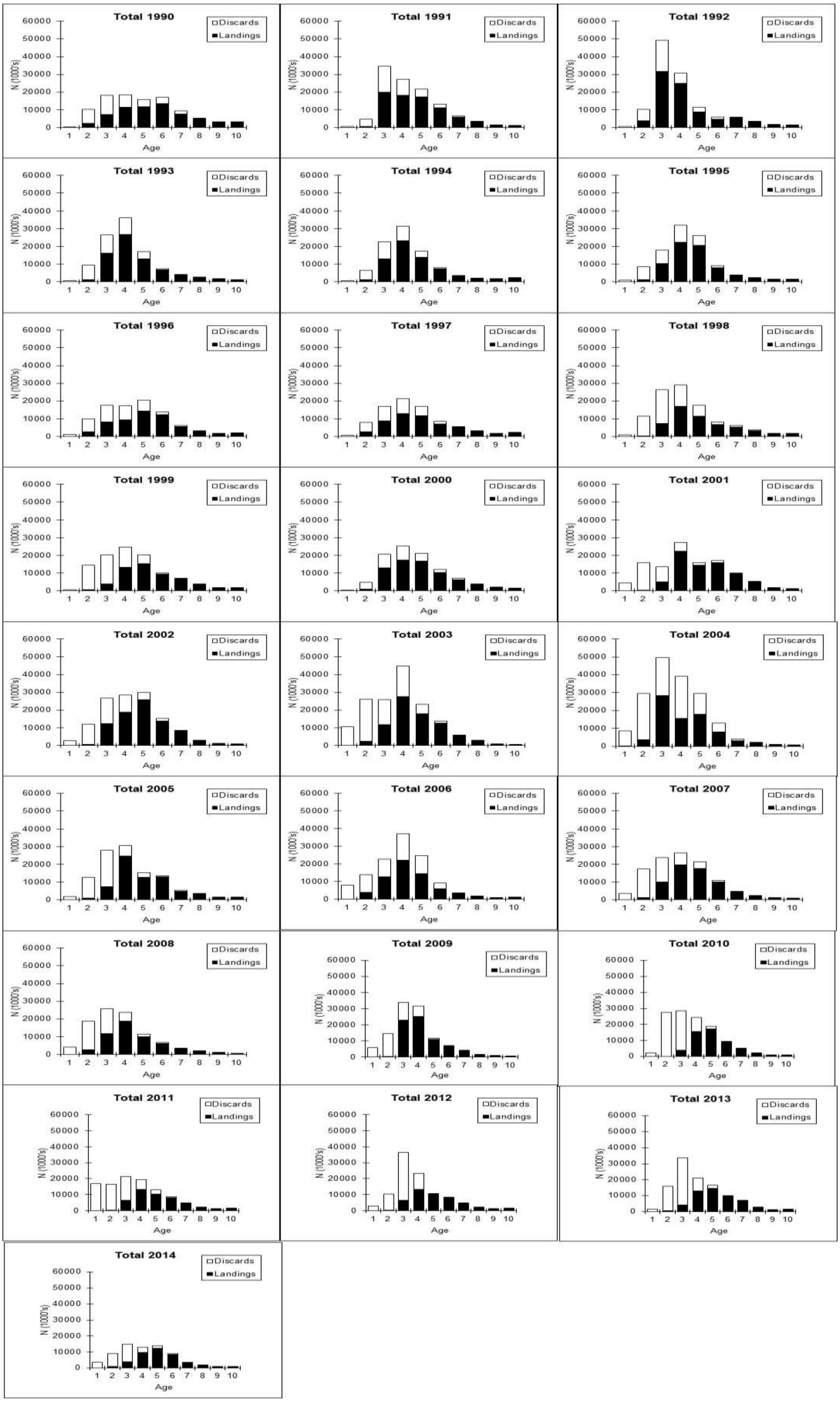


Figure 5.2.2.1. Megrim (*L.whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Age composition of catches for the years 1990 to 2014.

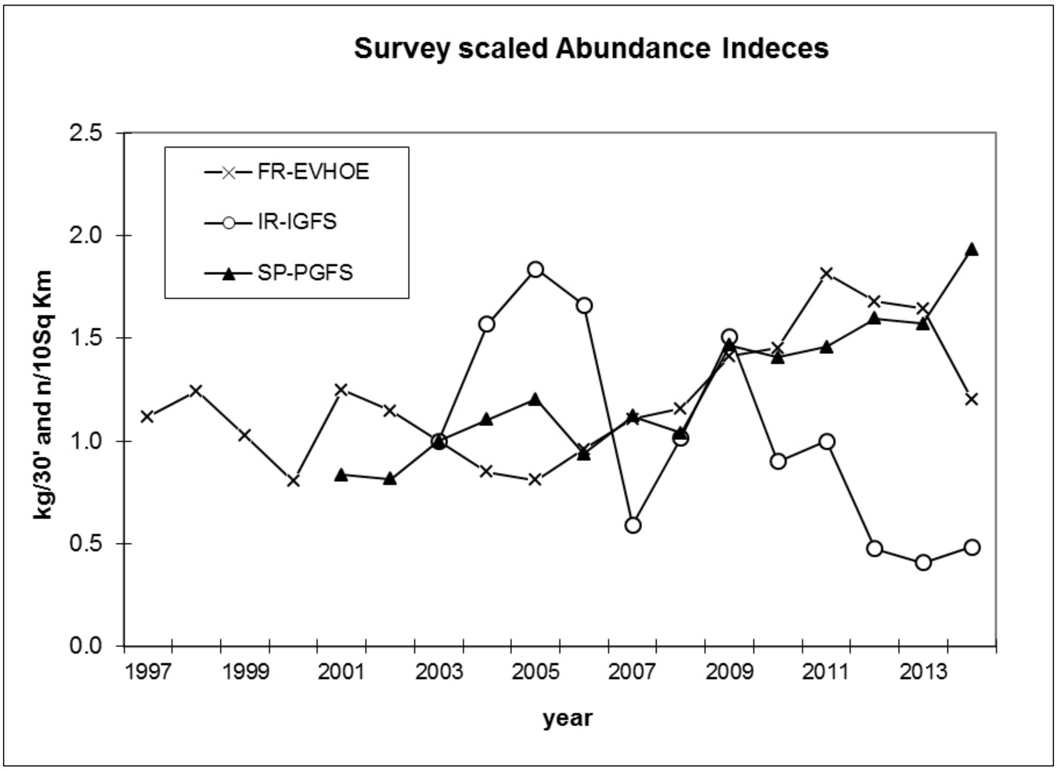


Figure 5.2.3.1. Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Scaled Biomass Indices for FR-EVHOE, SP-PGFS and IR-IGFS.

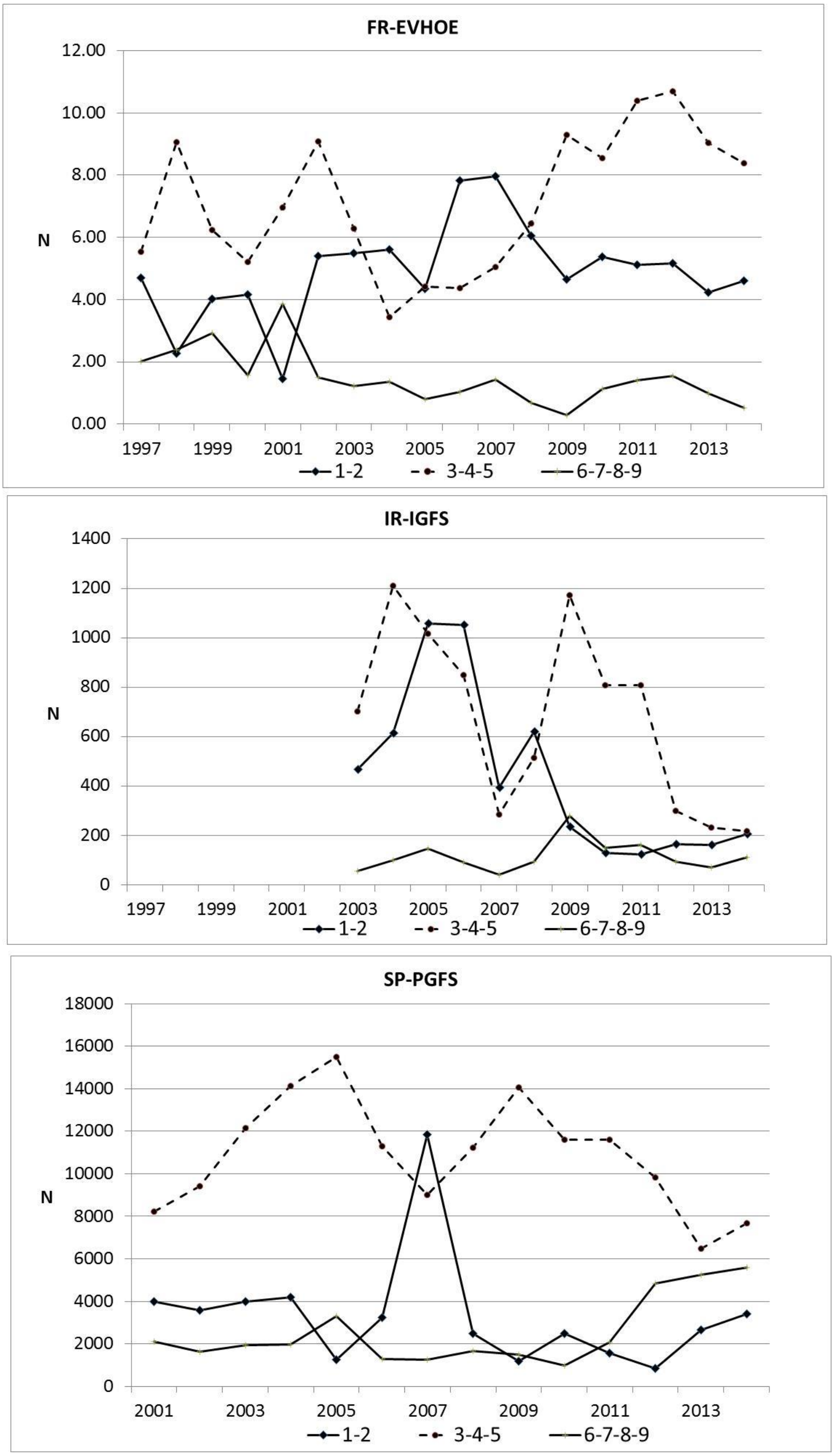


Figure 5.2.3.2. Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Abundance Indices for EVHOE, IGFS and SP-PGFS by ages grouped: i) 1+2; ii) 3+4+5 and iii) 6+7+8+9+10+.

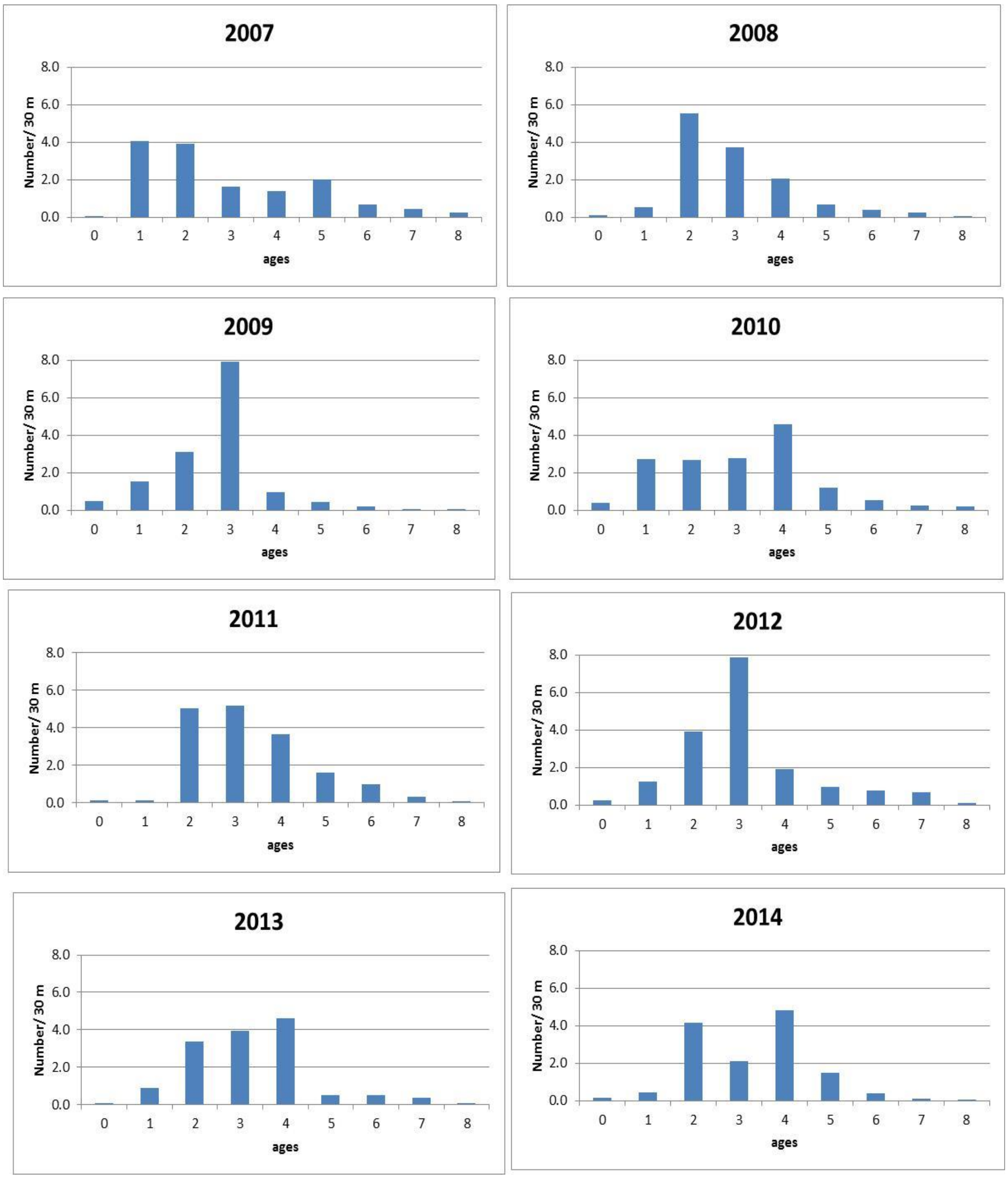


Figure 5.2.3.3. Megrim (L. whiffiagonis) in Divisions VIIb-k and VIIIa,b,d. Age composition of FR-EVHOE survey in abundance (numbers/30min haul).

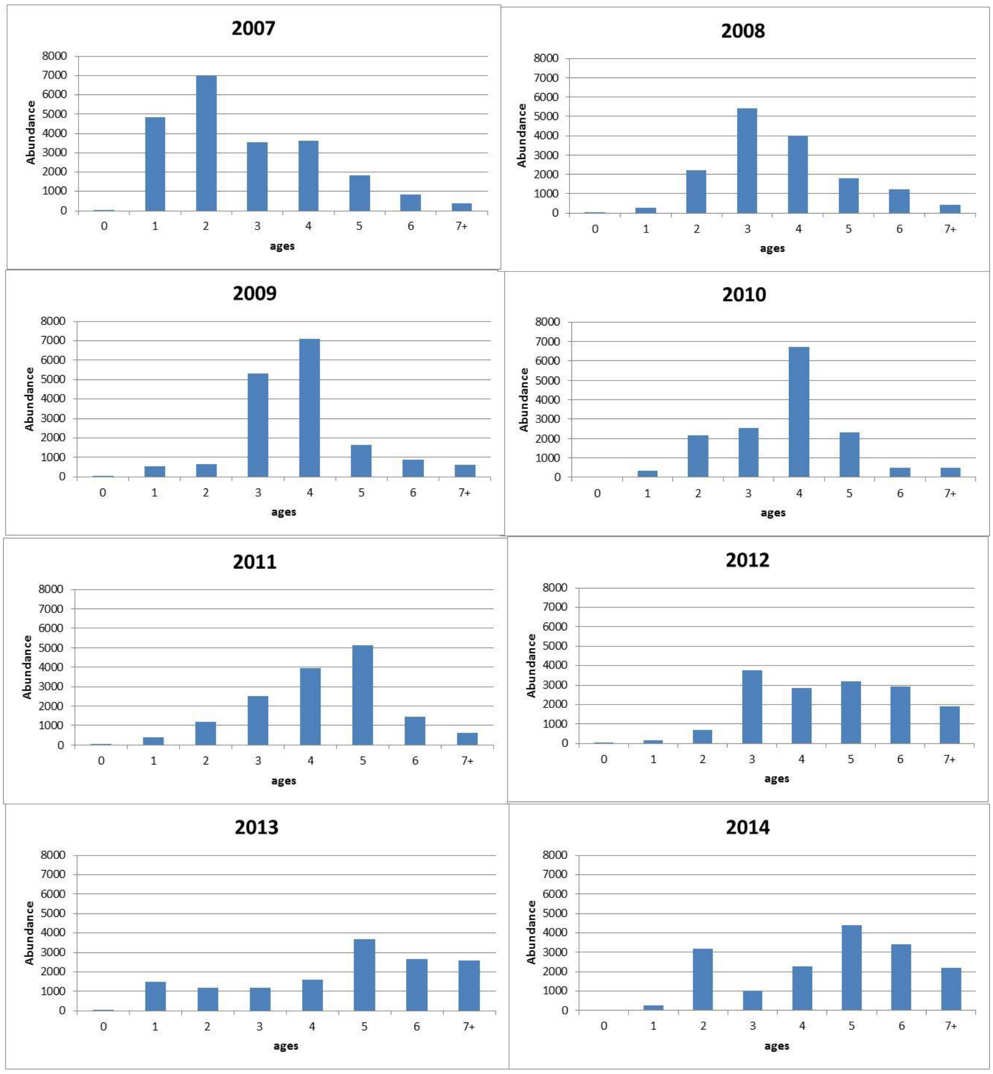


Figure 5.2.3.4. **Megrim (L. whiffiagonis) in Divisions VIIb-k and VIIIa,b,d. Age composition of SP-PORCUPINE survey in abundance (numbers).**

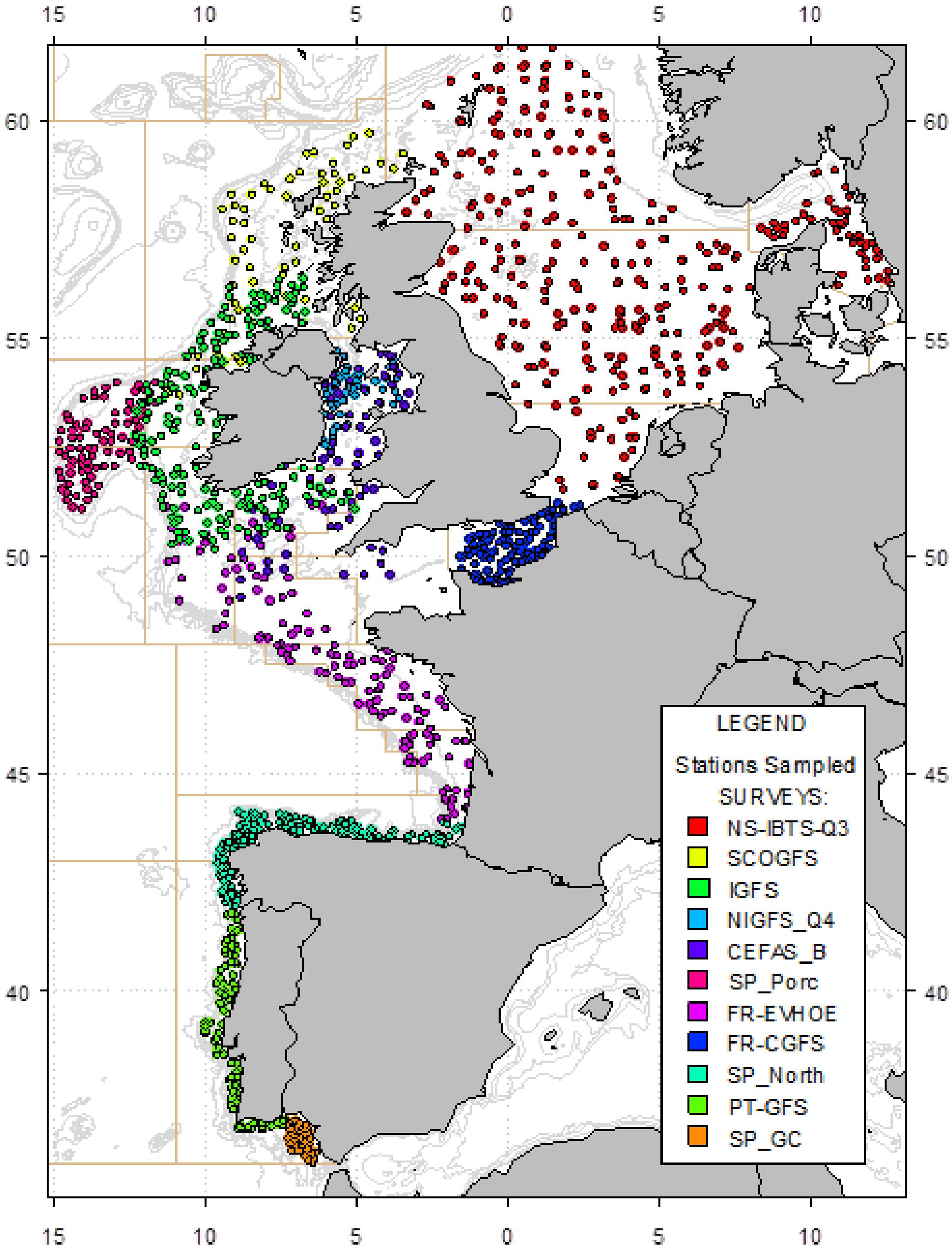


Figure 5.2.3.5. Station positions for the IBTS Surveys carried out in the Western and North Sea Area in the autumn/winter of 2008. (From IBTSWG 2009 Report). Just to be used as general location of the Surveys.

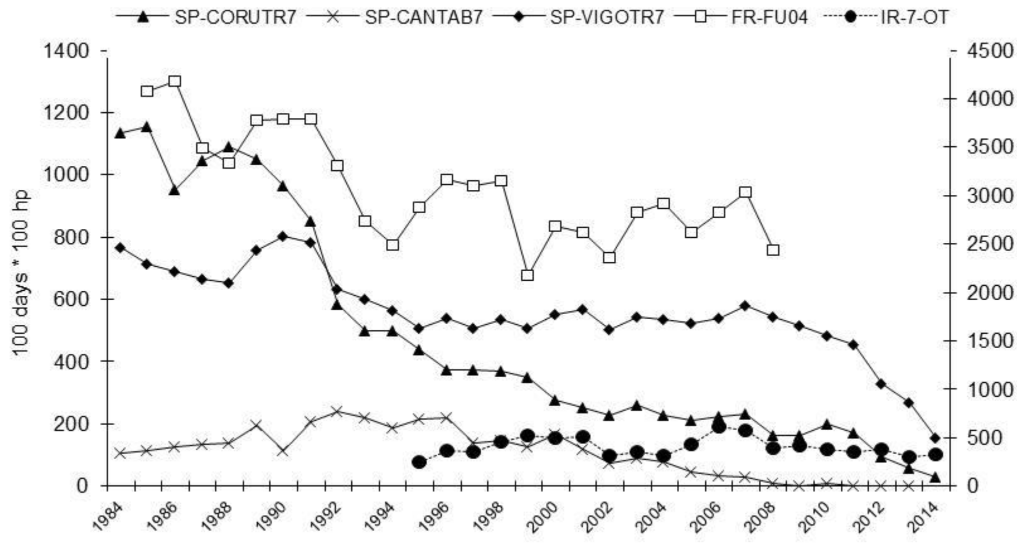


Figure 5.2.4.1. Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Evolution of effort for different bottom trawler fleets.

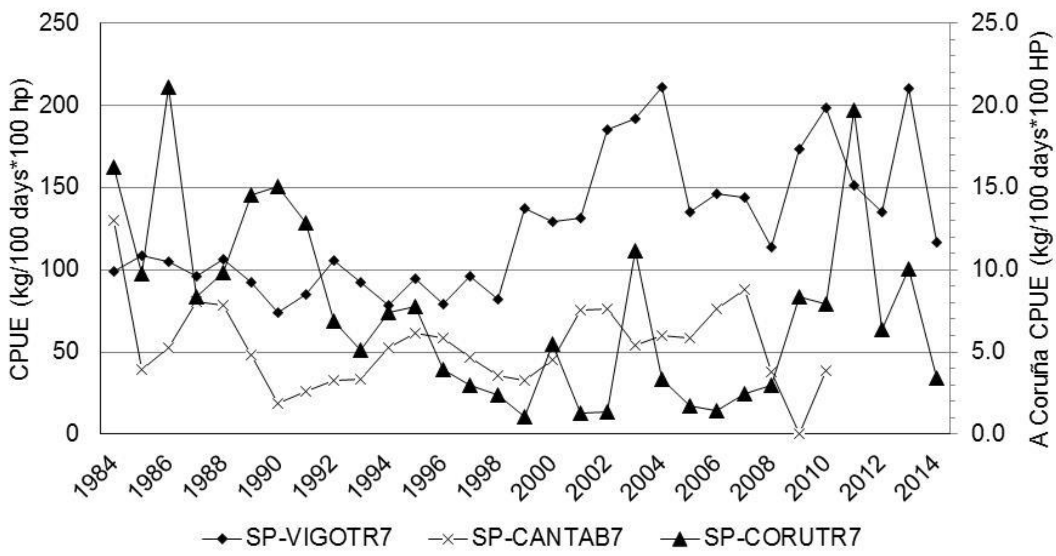


Figure 5.2.4.2. Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. Spanish CPUE for different bottom trawler fleets.

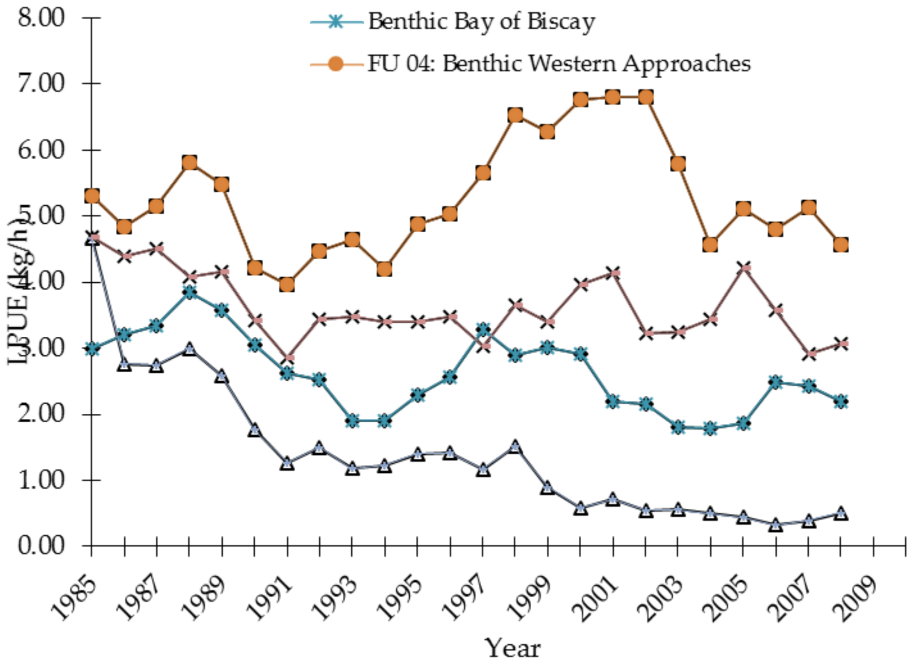


Figure 5.2.4.3. Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. French LPUE for different bottom trawler fleet.

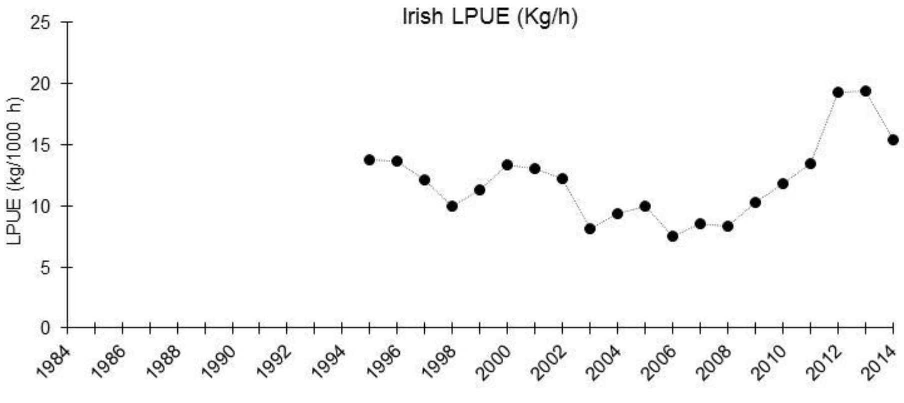


Figure 5.2.4.4. Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. Irish LPUE for beam trawl fleet.

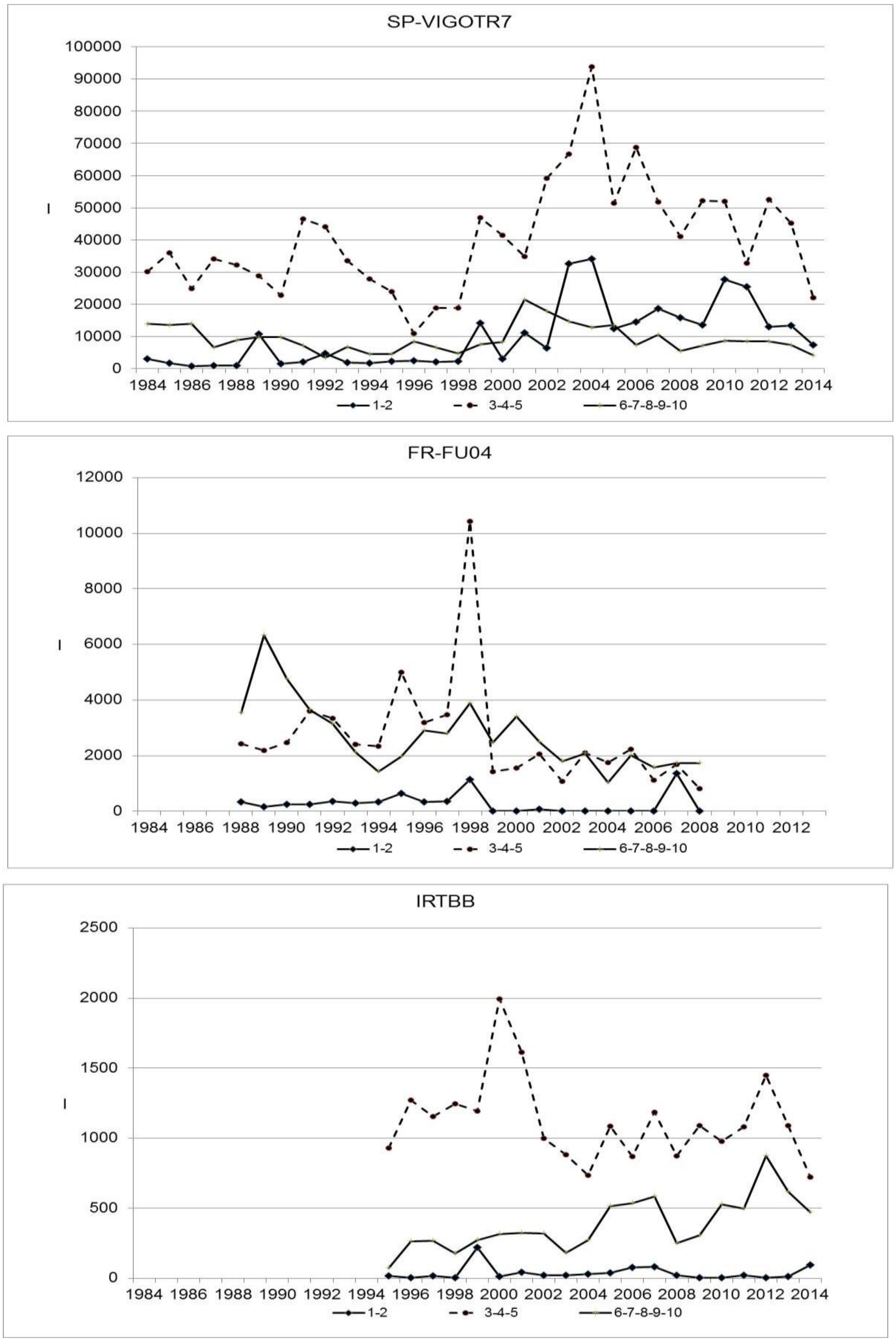


Figure 5.2.4.5. Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Abundance Indices for SP-VIGOTR7, FR-FU04 and IRTBB by ages grouped: i) 1+2; ii) 3+4+5 and iii) 6+7+8+9+10^{+}.

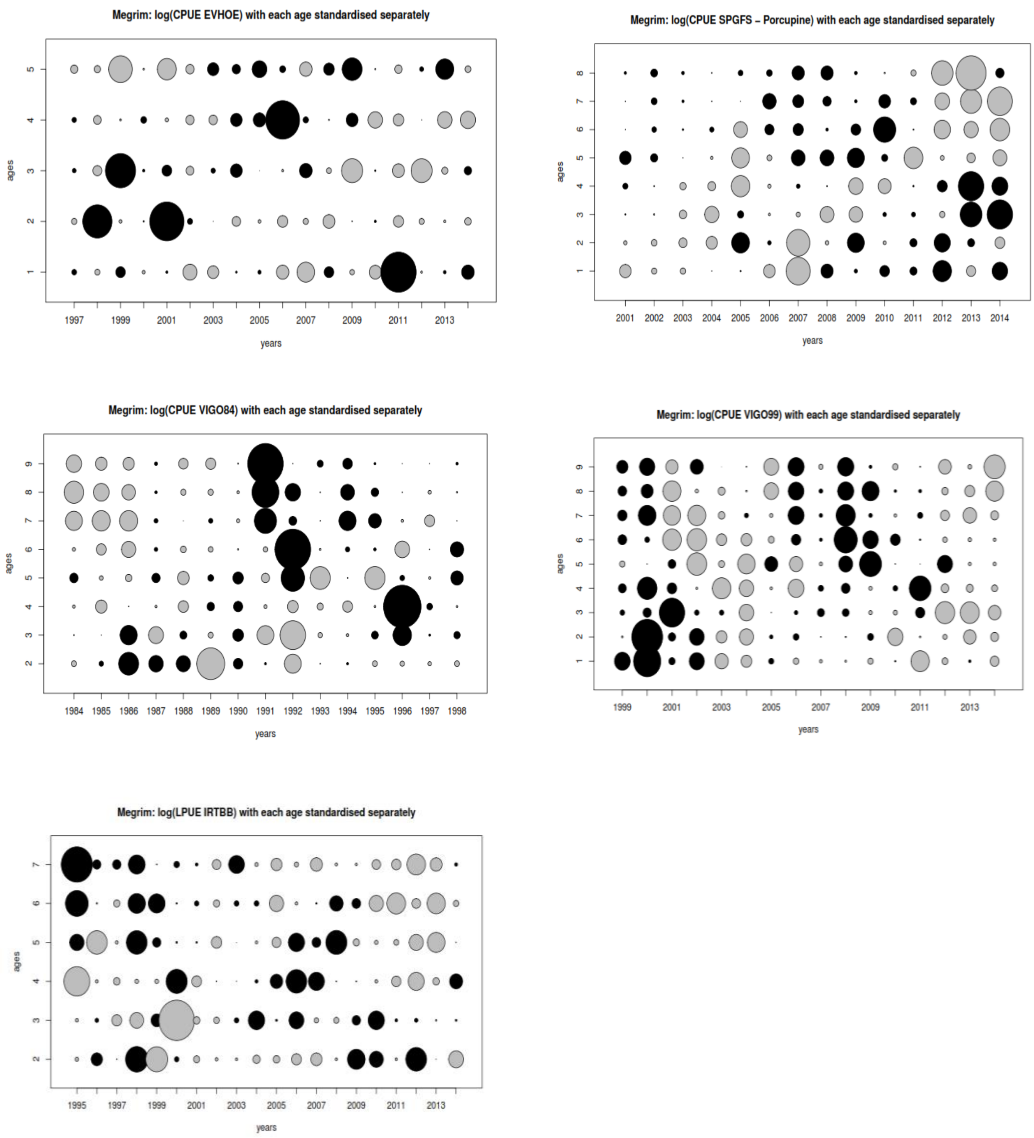


Figure 5.3.1.1. Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Bubble plots of the standardized log abundance indices of the surveys and commercial fleets used as tuning fleets.

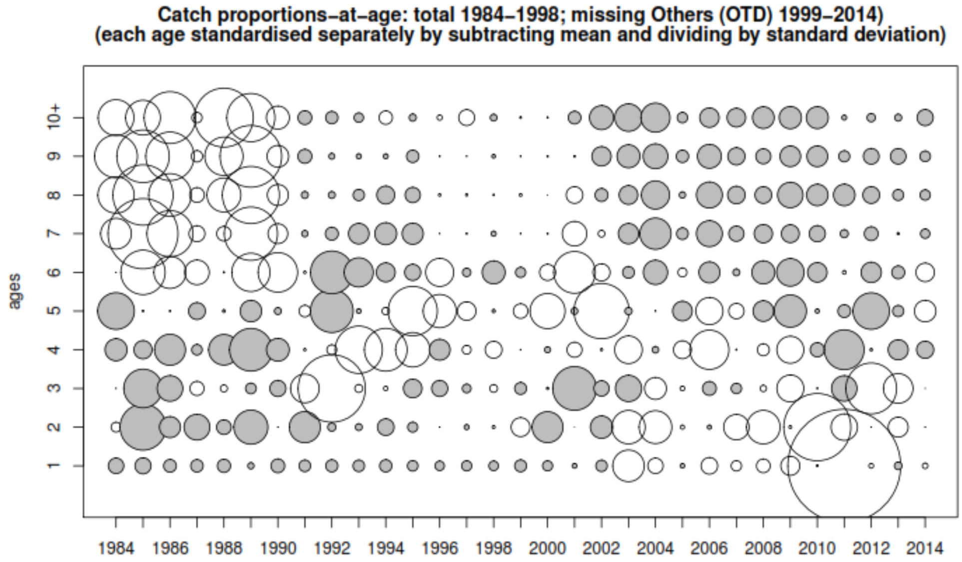


Figure 5.3.1.2. Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Bubble plots for catch numbers at age from 1984 to 2014.

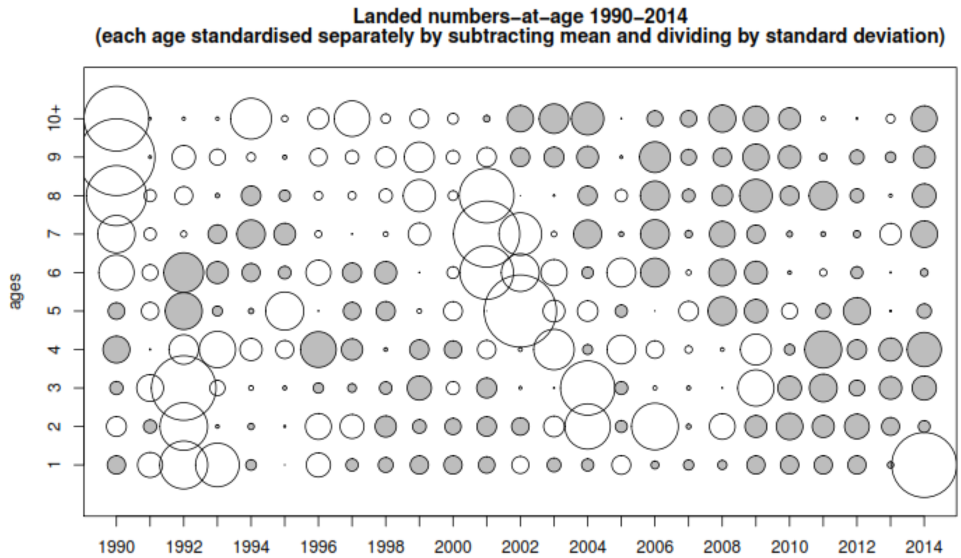


Figure 5.3.1.3. Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Bubble plots for landing numbers at age from 1990 to 2014.

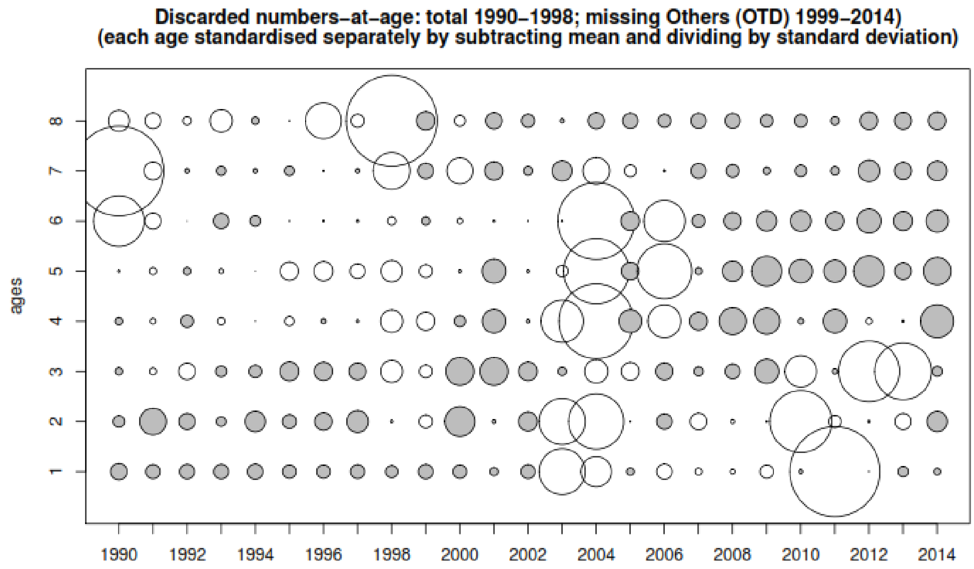


Figure 5.3.1.4. Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Bubble plots for discarded numbers at age from 1990 to 2014.

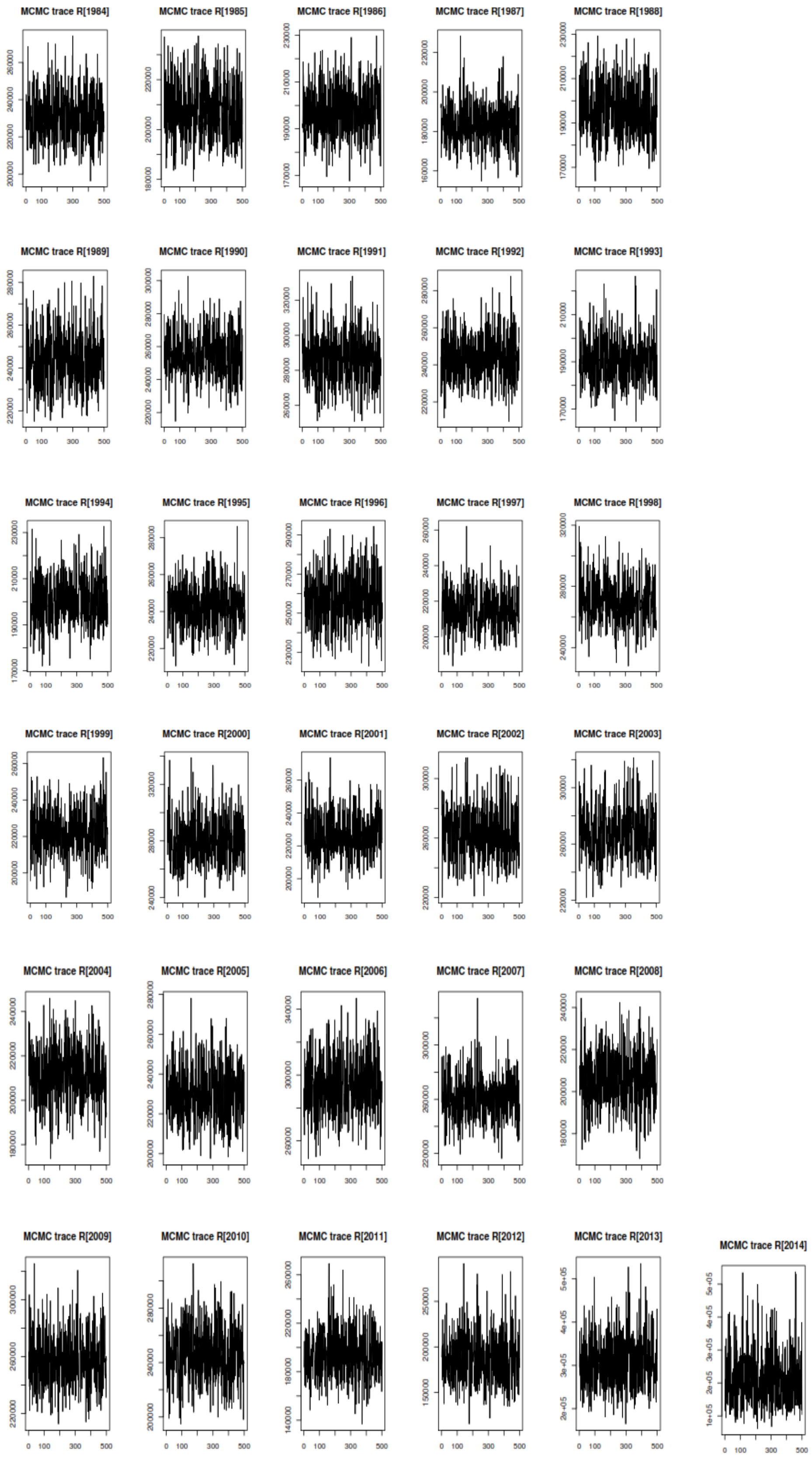


Figure 5.3.3.1. Trace plots of recruitmen draws from 1984 to 2014.

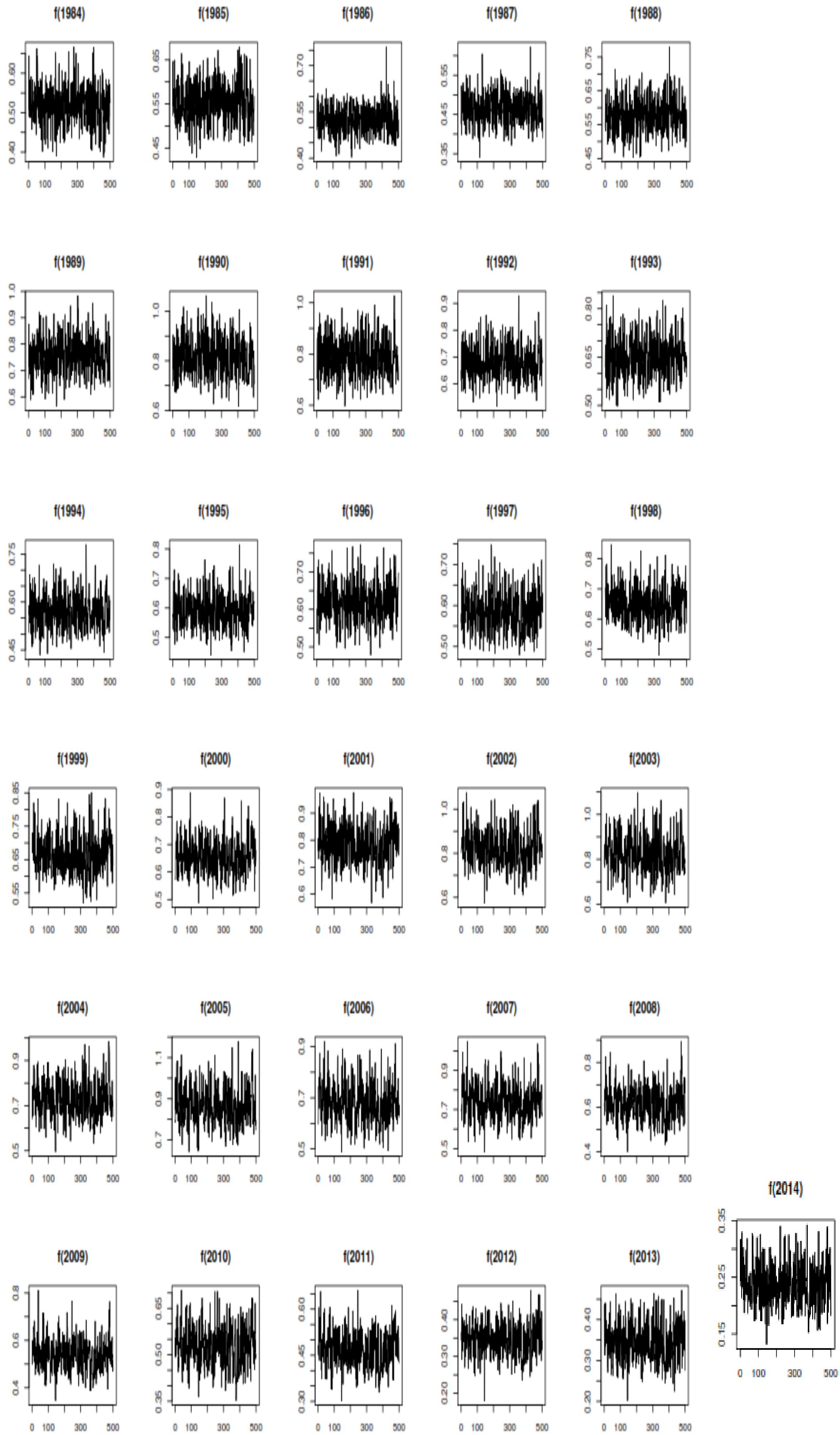


Figure 5.3.3.2. Trace plots of f(y) fishing mortality in ages 9 and 10 from 1984 to 2014.

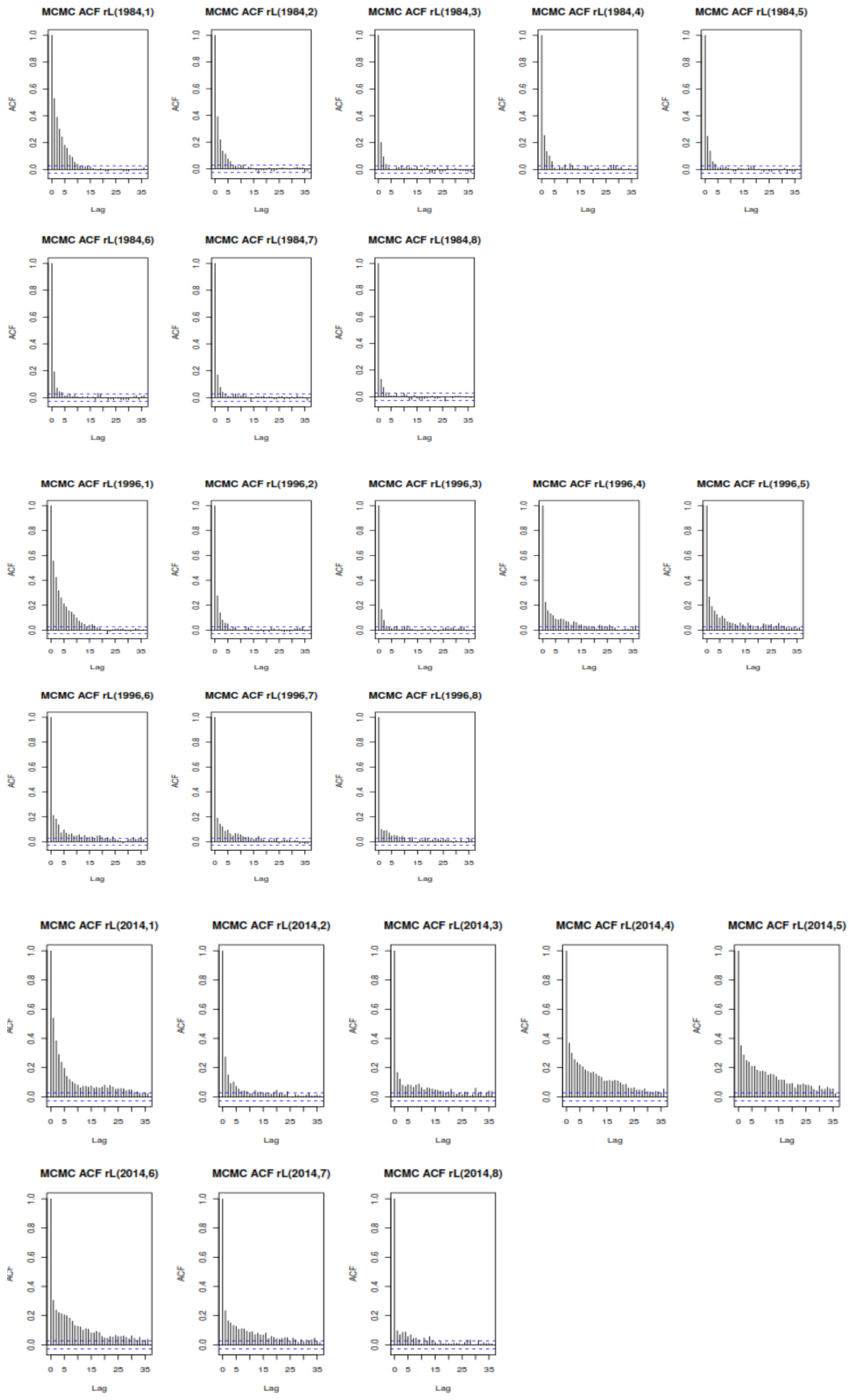


Figure 5.3.3.3. Autocorrelation plots of rL for years 1984, 1996 and 2014.

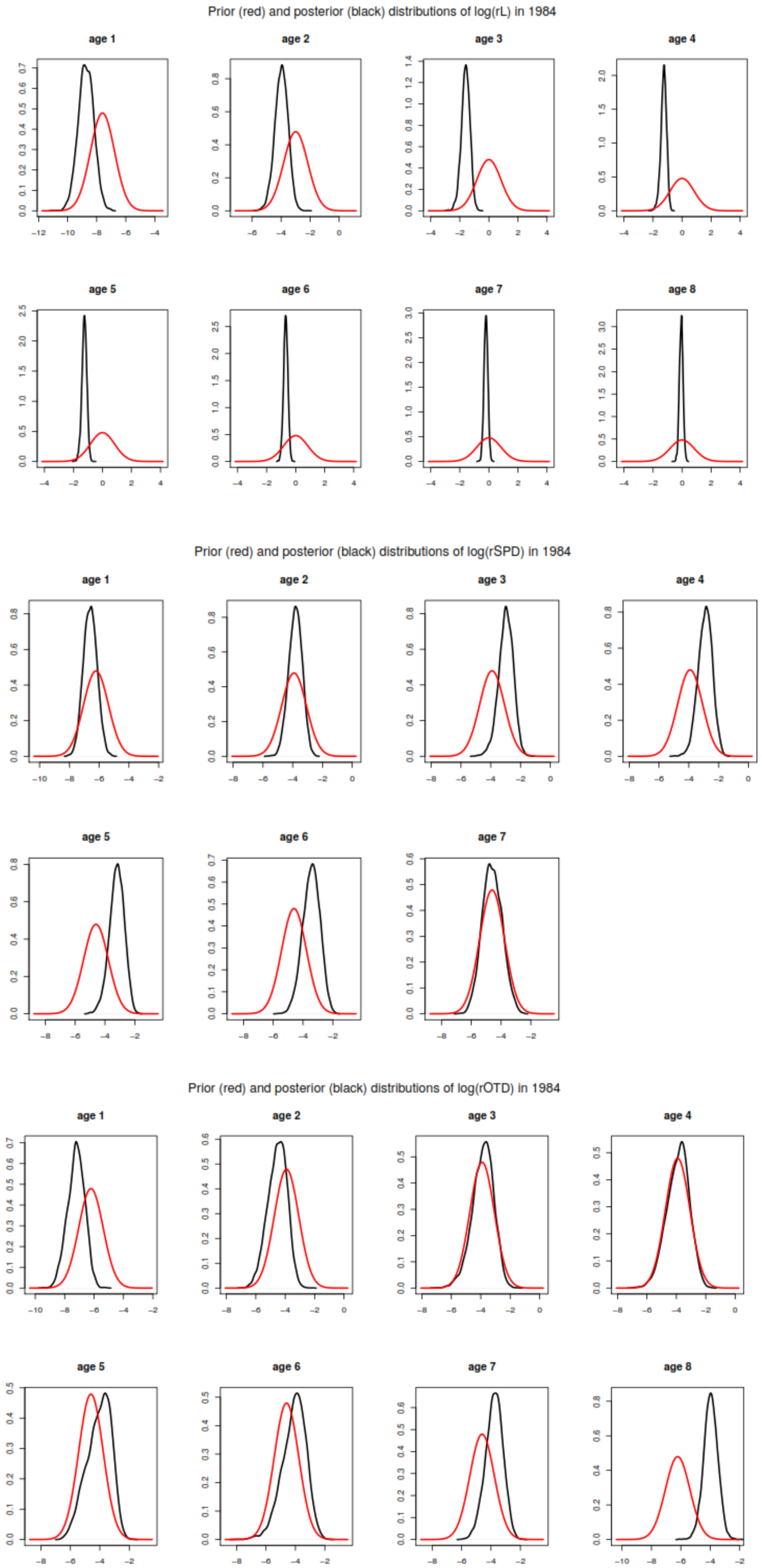


Figure 5.3.3.4. Prior (red) and posterior distribution of log (N) in 1984, log (rSPD) at age in 1984 and log (rOTD) at age in 1984.

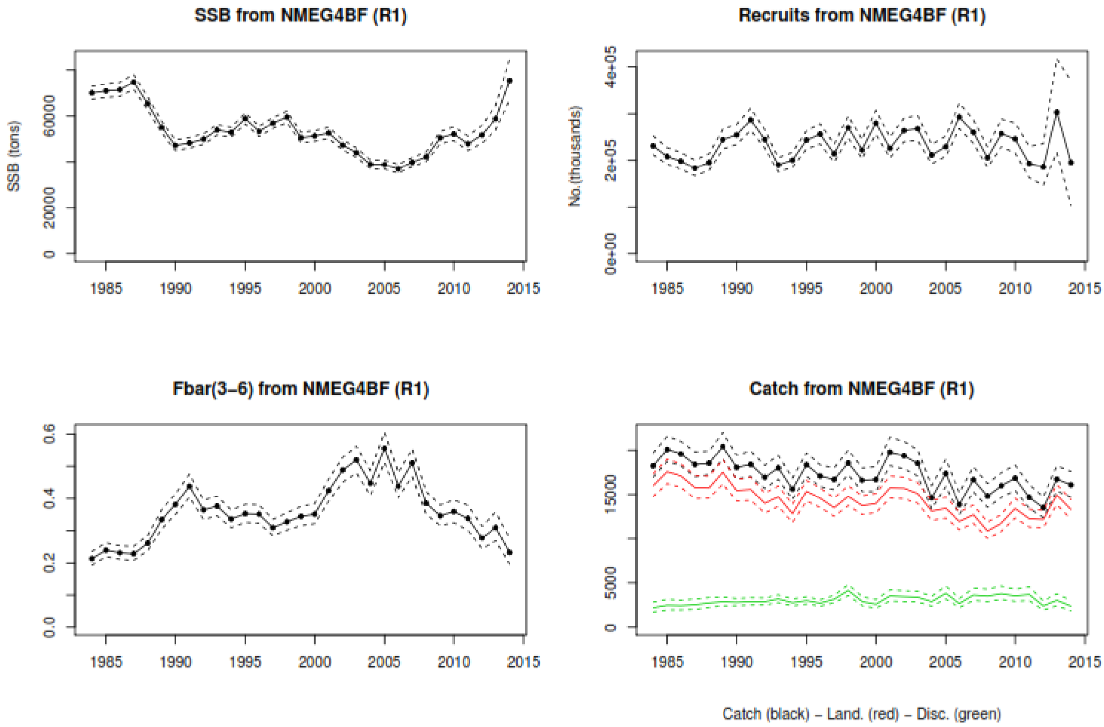


Figure 5.3.3.5. Time series of spawning stock biomass (SSB), recruits, Fbar, catch, landings and discards from 1984 to 2014. The solid dotted lines correspond with the median of the distribution and the dashed lines with 5% and 95% quantiles.

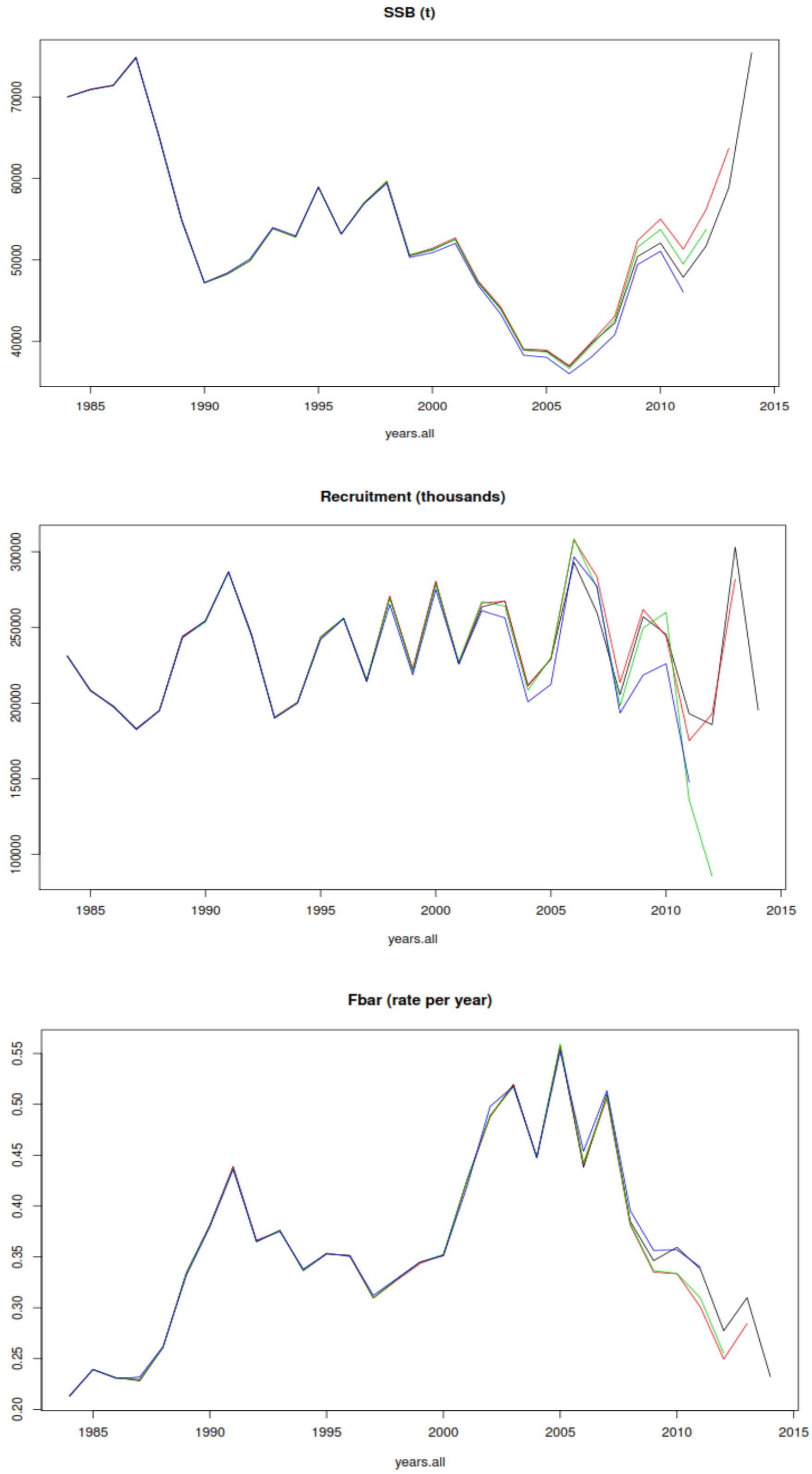


Figure 5.4.1. Time series of median SSB, recruitment and Fbar in retrospective analysis.

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

Lepidorhombus whiffiagonis:

Type of assessment in 2015: Update.

Data revisions this year:

Spanish landings and Spanish length distributions of landings for the period 2011-2013.

Spanish efforts and LPUEs for commercial fleets in 2013.

Portuguese efforts and LPUEs for commercial fleet in 2012 and 2013.

Unallocated landings estimates in years 2011, 2012 and 2013.

Review Group issues for *L.whiffiagonis*: Following recommendations from RG in 2014, the following action were taken:

Year 2013 has been included in Figure 6.1.6.

Lepidorhombus boscii:

Type of assessment in 2015: Update.

Data revisions this year:

Spanish landings and Spanish length distributions of landings for the period 2011-2013.

Spanish efforts and LPUEs for commercial fleets in 2013.

Portuguese efforts and LPUEs for commercial fleet in 2012 and 2013.

Unallocated landings estimates in years 2011, 2012 and 2013.

Review Group issues for *L. boscii*:

Year 2013 has been included in Figure 6.2.6.

General

See Stock annex general aspects related to megrim assessment.

Ecosystem aspects

See Stock annex for ecosystem aspects related to megrim assessment.

Fishery description

See Stock annex for fishery description.

Summary of ICES advice for 2015 and management for 2014 and 2015

ICES advice for 2015(as extracted from ICES Advice 2014, Book 7):

Because the two megrim species (*L. whiffiagonis* and *L. boscii*) are not separated in the landings, the advice of the two stocks is linked. Fsq is above FMSY for L. boscii and at FMSY level for *L. whiffiagonis*. To get fishing mortality for both stocks at or below FMSY, the F multiplier of *L. boscii* is applied to both stocks.

For *L. boscii*, following the ICES MSY approach implies fishing mortality to be reduced to 0.17 (FMSY),, resulting in landings of no more than 821 t in 2015. If discard rates do not change from the average of the last 12 years (2002–2013), this implies catches of no more than 1036 t.This is expected to lead to an SSB of 6677 t in 2016. *For L. whiffiagonis*, the ICES MSY approach implies a reduction in fishing mortality to 0.11, resulting in catches of no more than 208 t in 2015. Considering that no discard ban is in place in 2015 and if the discarding rate remains at the mean of the last three years, this would result in landings of no more 192 t. This is expected to lead to an SSB of 1343 t in 2016.

Management applicable for 2014 and 2015:

The agreed combined TAC for megrim and four-spot megrim in ICES Divisions VIIIc and IXa was 2257 t in 2014 and 1377 t in 2015.

6.1 Megrim (*L. whiffiagonis)* in Divisions VIIIc and IXa

6.1.1 General

See general section for both species.

6.1.2 Data

6.1.2.1 Commercial catches and discards

Working Group estimates of landings, discards and catches for the period 1986 to 2014 are given in Table 6.1.1. Estimates of catches presently include an unallocated landing category. These estimates are considered the best information available at this time. However, given that the method of calculating them changed in 2013, the WG recommended to review the time series of unallocated landings for this stock following the same criteria. Data revised have been provided for period 2011-2013. Because this method is better to calculate the proportion between the two megrims species due to the improvement in the allocation of sampling trips, data revised have been used in the assessment. The total estimated international landings in Divisions VIIIc and IXa for 2014 was 377 t. Landings reached a peak of 977 t in 1990, followed by a steady decline to 117 t in 2002. Some increase in landings has been observed since then, but landings have again decreased annually since 2007 till 2010 were the lowest value of the entire series occurred. Since 2011, the stock is increasing again. 2011 and 2014 values represent important increments. Historical landings for both species combined are shown in Figure 6.1.1. In 2014, international landings are 1531 t, being a increase in relation to the previous year.

Discards estimates were available from "observers on board sampling programme" for Spain in the years displayed in Table 6.1.2(a). Discards in number represent between 10-45% of the total catch, with the exception of the year 2007 when discards have been very low and 2011 with discards extremely high. Following recommendations, during the Benchmark WKSOUTH in 2014, an effort was made to complete the time-series back until 1986 in years without samplings. Total discards are given in tons in Table 6.1.1 and in numbers at age in Table 6.1.2(b), these data are included in the assessment model.

6.1.2.2 Biological sampling

Annual length compositions of total stock landings are displayed in Figure 6.1.2 for the period 1986 – 2014 and in Table 6.1.3. (a)Unallocated value is raised to total length distribution. ,. The bulk of sampled specimens corresponds to fish of 21-36 cm.

Sampling levels for both species are given in Table 1.3.

Mean lengths and mean weights in landings since 1990 are shown in Table 6.1.3(b). The mean length and mean weight values in 2013 are the highest in the historic series.

Age compositions of catches are presented in Table 6.1.4 and weights-at-age of catches in Table 6.1.5, from 1986 to 2014. These values were also used as the weights-at-age in the stock.

More biological information and the parameters used in the length-weight relationship, natural mortality and maturity ogive are shown in the stock annex.

6.1.2.3 Abundance indices from surveys

Two Portuguese (PtGFS-WIBTS-Q4, also called "October" survey, and PT-CTS (UWTV (FU 28-29)), also called "Crustacean" survey) and one Spanish (SpGFS-WIBTS-Q4) survey indices are summarised in Table 6.1.6. In 2012, Portuguese surveys were not conducted due to budgetary constraints of national scope turned unfeasible to repair the R/V.

As noted in the Stock Annex, indices from these Portuguese surveys are not considered representative of megrim abundance, due to the very low catch rates.

The Spanish survey (SpGFS-WIBTS-Q4) covers the distribution area and depth strata of this species in Spanish waters (covering both VIIIc and IXa). Total biomass and abundance indices from this survey were higher during the period 1988 - 1990, subsequently declining to lower mean levels, which are common through the rest of the time series. There has been an overall declining trend in the abundance index after year 2000, with the values for 2008 and 2009 being the two lowest in the entire series. Since then, there is a general increasing trend. (Figure 6.1.3(a), bottom right panel). In 2013 the survey was carried out in a new vessel and with new fishing doors. This year the abundance indices are high for flatfish and benthic species. Although there was an inter-calibration exercise between both vessels, the results were not consistent with the results of the inter-calibration, therefore the working group decided not to include the abundance index value for that year in the assessment model. In 2014 the gear used was similar to the gear used in the survey before 2013. A new inter-calibration exercise was conducted in 2014. The index for 2014 was found consistent with the index before 2013 and the working group decided to use it. However for 2013 the index is still inconsistent with the time series and the group decided not to include it.

The Spanish survey recruitment indices for ages 0 and 1 indicate an extremely weak year class in 1993, followed by better recruitments, except for relatively low values for the 1997 and 1998 year classes. The 1999 year class appears to be relatively strong compared to those from previous years, but the 2000 to 2005 year classes again appear to be low. The survey indicates extremely low values at age 0 for years 2006-2008, with 2006 and 2008 being equal worst with 1993 in the historic series. In 2009, the age 0 index is the highest after 2001, whereas the age 1 index is the second lowest in the series. In 2010, there is a very important increase in age 1, being the highest value since 1996. In 2014 ages 0 is in a medium level in relation to historical values and age 1 is a low level.

Catch numbers-at-age per unit effort and effort values for the Spanish survey are given in Table 6.1.7. In addition, Figure 6.1.3(b) displays a bubble plot of log (survey indices-at-age), with the values for each age standardised by subtracting the mean and dividing by the standard deviation over the years. The size of the bubbles is related to the magnitude of the standardised value, with white and black bubbles corresponding to positive and negative values, respectively. The figure indicates that the survey is quite good at tracking cohorts through time and highlights the weakness of the last few cohorts. The big age 1 index in 2010 is also detected in this figure and can be followed through the following years..

6.1.2.4 Commercial catch–effort data

The commercial LPUE and effort data of the Portuguese trawlers fishing in Division IXa covers the period 1988 – 2014 (Table 6.1.8 and Figure 6.1.3(a)).

It is known that the Northern Spanish coastal bottom otter trawl fleet is a fleet deploying a variety of fishing strategies with different target species. In fact, these fishing strategies are identified under the current DCF sampling programme, so that they can be then re-aggregated under two DFC métiers: bottom otter trawl targeting demersal species (OB_DEF_>=55_0_0) and OTB targeting pelagic stocks accompanied by some demersal species (OTB_MPD_>55_0_0). Therefore, the LPUE of these métiers was recovered backwards (until 1986) and two new time-series of bottom otter trawl targeting demersal species, one per port (A Coruña and Avilés), were provided to the Benchmark WKSOUTH in 2014. These new tuning fleets (SP-LCGOTBDEF and SP-AVSOTBDEF) were accepted to tune the assessment model instead of the old ones A Coruña trawl (SP-CORUTR8c) and Avilés trawl (SP-AVILESTR). The LPUEs and effort values are given in Table 6.1.8 and Figure 6.1.3(a).

Commercial fleets used in the assessment to tune the model

Before 2003, A Coruña (SP-LCGOTBDEF) effort was generally stable. After that year, the trend was similar but in lower values. The 2011 effort value is the lowest in the series. In 2014, effort is the highest value. The LPUE shows relatively high stable values for 1986 – 2002. Since 2003 LPUE shows lower values, is increasing since 2010 till 2012 and the last two years is decreasing.

Avilés (SP-AVSOTBDEF) effort does not present any trend throughout the whole period. The highest value occurred in 1998 and the lowest in 2001. LPUE shows a decreasing from 1986 to 2003. Since then, it has had a further upward and downward fluctuation, with a peak in 2011. Landed numbers-at-age per unit effort and effort data for these fleets are given in Table 6.1.7.

Figure 6.1.3(c) displays bubble plots of standardised log (landed numbers-at-age per unit effort) values for these commercial fleets, with the standardisation performed by subtracting the mean and dividing by the standard deviation over the years. The panel corresponding to A Coruña trawl fleet clearly indicates below average values since about year 2003, in 2011 and 2012 values are above average but in the last two years the values fell again.

Commercial fleets not used in the assessment to tune the model

Portuguese effort values are quite variable, except in 2001 and 2002 when they are significantly lower (Table 6.1.8 and Figure 6.1.3(a)). For the Portuguese fleets, until 2011 most log-books were filled in paper but have thereafter been progressively replaced by e-logbooks. In 2013 more than 90% of the log-books are being completed in the electronic version. The LPUE series were revised from 2012 onwards. To revise the series backwards further refinement of the algorithms is required. The LPUE shows a steep decrease between 1990 and 1992, and has since remained at low levels, with the exception of a peak in 1997-1998. LPUE for 2014 represent an increase in relation to the previous year.

6.1.3 Assessment

An update assessment was conducted, according to the Stock Annex specifications. Assessment years are 1986-2014 and ages 1-7+.

6.1.3.1 Input data

It follows the Stock Annex, incorporating discards and landed numbers-at-age resulting in catch numbers-at-age as input data from 1986 to 2014 and the 2014 indices from A Coruña (SP-LCGOTBDEF) tuning fleet and Avilés tuning fleet (SP-AVSOTBDEF) and Spanish survey (SpGFS-WIBTS-Q4).

6.1.3.2 Model

Data screening

Figure 6.1.4(a) shows catch proportion at age where higher proportions can be observed for ages 1 and 2 till 2000 due to the high discards at these ages in this period. The top panel of Figure 6.1.4(b) shows landings proportions at age, indicating that the bulk of the landings consisted of ages 1 and 2 before 1994, shifting after that mostly to ages 2 to 4. The bottom panel of the same figure displays standardised (subtracting the mean and dividing by the standard deviation over the years) proportions at age, indicating the same change around the mid 1990's, with proportions at age decreasing for ages 1 and 2 and increasing for the older ages. Some weak and strong cohorts can be noticed in this figure, particularly around the mid 1990's. The 2010 year shows an increase in landings of older ages, especially ages 4 to 7+. The high abundance of age 0 in the Spanish survey in 2009 can be tracked following years. Figure 6.1.4(a) shows discards proportion at age, being more abundant for age 1 from 2000 onwards. Before this year, discarding was higher in age 2. Visual inspection of Figures 6.1.3(b) and 6.1.3(c) indicates that all tuning series are good up to age 5 in relation to their internal consistency. Age 6 is harder to track along cohorts, particularly for the Spanish survey and the A Coruña tuning fleet.

Final run

XSA model was selected for use in this assessment. Model description and settings are those detailed in the Stock Annex.

The retrospective analysis shows a small but consistent pattern of overestimation of SSB and underestimation of F and recruitment in recent years (Figure 6.1.5).

6.1.3.3 Assessment results

Diagnostics from the XSA run are presented in Table 6.1.9 and log catchability residuals plotted in Figure 6.1.6. For all tuning fleets the magnitude of the residuals is larger for older ages. Residuals in A Coruña tuning fleet in the last years present mainly positive values. Until 1997 many of the survey residuals were negative, whereas many are positive since 1999. Since 2008, there appears to be a change towards negative survey residuals again. Several year effects are apparent in all tuning series. As has been the case in the last few years the model shows that it hasn't converged, however the differences which activate this criteria was so small (0.00085 difference) and close to zero that we have confidence that the assessment has converged. The results presented correspond to a run of 160 iterations, as increasing the number of iterations led to larger total absolute residuals value between iterations.

Fishing mortality and population numbers at age from the final XSA run are given in Tables 6.1.10 and 6.1.11, respectively, and summary results presented in Table 6.1.12 and Figure 6.1.7(a).

Fishing mortality presents an increasing trend since 2011, which may be explained by the increase in landings in that years. The SSB values in 2007-2010 are the lowest in the series. Since 2011 values are significantly higher and more or less stable. After a very high recruitment (at age 1) value in the series in 2010 and the followings decreases and increase in 2013, the last year the recruitment value shows a decrease.

Bubble plots of standardised (by subtracting the mean and dividing by the standard deviation over the years) estimated F-at-age and relative F-at-age (F-at-age divided by Fbar) are presented in Figure 6.1.7(b). The top panel of the figure indicates that fishing mortality has been lower for all ages since about year 2000. The reduction occurred earlier for ages 1 and 2, at around 1994. In terms of the relative exploitation pattern-at-age (bottom panel of the figure), the most obvious changes are the reduction for ages 1 and 2 around 1994 and the increase for age 3 soon after that. This might be related to discarding practices. There is no clear pattern over time in the age 4 selection, whereas for ages 5 and older there seems to have been an increase during the mid to late 1990's but they have since come back down to lower values. Since 2010, there appears to have been an increase of the relative exploitation towards older ages, with high values above the average for ages 5 to 7+.

6.1.3.4 Year class strength and recruitment estimations

The 2011 year class is estimated to have 3.1 million fish at 1 year of age, based on the Spanish survey (SpGFS-WITBS-Q4) (55% of weight), two commercial fleets SP-LCGOTBDEF (22% of weight) and SP-AVSOTBDEF (17% of weight) and F shrinkage (6%).

The 2012 year class is estimated to have 5.1 million individuals at 1 year of age based on the information from the Spanish survey (SpGFS-WIBTS-Q4) (54% of weight), P-shrinkage (41% of the weight) and F shrinkage (5%).

The 2013 year class is estimated to have 3.9 million fish at 1 year of age, based on the information from the Spanish survey (SpGFS-WIBTS-Q4) (64% of weight), P-shrinkage (31% of the weight) and F shrinkage (5%).

The working group considered that the XSA last year recruitment is poorly estimated. In accordance with the stock annex specifications, GM recruitment is computed over years 1998-2012. 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
2011	3130	XSA	55%	29%	6%
2012	5086	XSA	54%	0%	46%
2013	3250	GM (98-12)			
2014	3250	GM (98-12)			

6.1.3.5 Historic trends in biomass, fishing mortality and recruitment

From Table 6.1.12 and Figure 6.1.7, we see that SSB decreased from 2449 t in 1990 to 1017 t in 1995. From 1996 to 2003, it remained relatively stable at low levels with an average value of around 1200 t. Starting from 2004, SSB is estimated to have been even lower. The values for 2004-2010 are the lowest in the series, with SSB in 2009 and in 2010 (707 t) corresponding to the lowest values. Since 2011, SSB values are increasing, being 1311 t, the 2014 value, the highest of the last years.

After a decline from 2006 (0.39) to 2010 (0.08), the fishing mortality follows an increasing trend up to a value of 0.36 in 2014.

Recruitment (at age 1) varies substantially throughout the time series, but shows a general decline from the high levels seen until the 1992 year class. Since 1998 recruitment has been continuously at low levels (recruitment in 2009 is estimated to be the lowest value of the series). In 2010 a good recruitment occurred, with a value more similar to those estimated for the previous decade. However, in 2011 and 2012, values of recruitments decreased again. 2013 showed a small increase followed by a decrease in the last year.

6.1.3.6 Catch Options and prognosis

Stock projections were calculated according to the settings specified in the Stock Annex.

6.1.3.7 Short-term projections

Short-term projections have been made using MFDP.

The input data for deterministic short-term predictions are shown in Table 6.1.13. The exploitation pattern used was the scaled F-at-age computed for each of the last five years and then the average of these scaled 2010-2014 years was weighted to the final year. This selection pattern was split into selection-at-age of landings and discards (corresponding to Fbar = 0.25 for landings and Fbar=0.02 for discards, being 0.27 for catches).

According with stock annex, GM recruitment is computed over years 1998-2012. Age 2 for 2015 is replaced by GM_{98-12} reduced by total estimated mortality.

Management options for catch prediction are in Table 6.1.14. Figure 6.1.8 shows the short-term forecast summary. The detailed output by age group assuming *status quo* F for 2015-2017 is given in Table 6.1.15 for landings and discards.

Under *status quo* F, landings in 2015 and 2016 are predicted to be 309 t and 281 t respectively, and discards 25 t in both years. SSB would decrease from the 1 104 t estimated for 2015 to 1 002 t in 2016 and to 911 t in 2017.

The contributions of recent year classes to the predicted landings in 2016 and SSB in 2017, assuming GM_{98-12} recruitment, are presented in Table 6.1.16. The assumed GM_{98-12} age 1 recruitment for the 2014 and 2015 year classes contributes 15% to landings in 2016 and 41% to the predicted SSB at the beginning of 2016. Megrim starts to contribute strongly to SSB at 2 years of age (see maturity ogive in Table 6.1.13).

6.1.3.8 Yield and biomass per recruit analysis

The results of the yield- and SSB-per-recruit analyses are in Table 6.1.17 (see also left panel of Figure 6.1.8, which plots yield-per-recruit and SSB-per-recruit versus Fbar). Assuming s*tatus quo* exploitation Fbar = 0.25 for landings and Fbar=0.02 for discards and GM_{98-12} for recruitment, the equilibrium yield would be 201 t of landings and 24 t of discards with an SSB of 780 t.

6.1.4 Biological reference points

The stock-recruitment time series is plotted in Figure 6.1.9.All recruitment values since 1998 have been low, until 2010, with a very high recruitment value, followed by not so higher ones.

See Stock Annex for information about Biological reference points.

The BRP are:

	Type	Value	Technical basis
MSY	MSY Btrigger	910 t	default option; 1.4 Blim
Approach	FMSY	0.17	Fmax as FMSY proxy
	Blim	650 t	just above Bloss in the 2014 benchmark assessment
Precautionary	Bpa	910 t	default option; 1.4 Blim
Approach	Flim		
	Fpa		

6.1.5 Comments on the assessment

The behaviour of commercial fleets with regards to landings of age 1 individuals appears to have changed in time. Hence, data from commercial fleets used for tuning is only taken for ages 3 and older. However, the Spanish survey (SpGFS-WIBTS-Q4) provides good information on age 1 abundance.

Comparison of this assessment with the one performed last year shows that there are minor differences in F and SSB in the last years, maybe due to the increase in landings in 2014 (Figure 6.1.10)

Megrim starts to contribute strongly to SSB at 2 years of age. Around 40% of the predicted SSB in 2016 relies on year classes for which recruitment has been assumed to be GM_{98-12}.

6.1.6 Management considerations.

It should be taken into account that megrim, *L. whiffiagonis,* is caught in mixed fisheries. There is a common TAC for both species of megrim (*L. whiffiagonis* and *L. boscii*), so the joint status of the two species should be taken into consideration when formulating management advice. Megrims are by-catch in mixed fisheries generally directed to white fish. Therefore, fishing mortality of megrims could be influenced by restrictions imposed on demersal mixed fisheries, aimed at preserving and rebuilding the overexploited stocks of southern hake and *Nephrops*.

This is a small stock (average stock SSB since 1986 is 1300 t). Managing according to a very low F for megrim could cause serious difficulties for the exploitation of other stocks in the mixed fishery (choke species effect). Both Iberian megrim stocks are assessed separately but managed together, situation that may produce inconsistencies when these stocks are considered in a mixed fisheries approach. In fact, this effect was observed in the results of the last mixed fisheries analysis developed for Iberian stocks by the WGMIXFISH_METH (ICES, 2013).Of course, any F to be applied for the management of megrim must be in conformity with the precautionary approach.

Working group considers that this stock could be just "the tail" of the much larger stock of megrim in ICES Subarea VII and Divisions VIIIabd. Genetic studies on 16S rDNA gene from several samples from the Atlantic area show that there is not a clear differentiation between the northern and southern stocks considered by ICES (García-Vázquez et al., 2006). This could also explain why a prolonged decrease in F was not reflected in stock increases. One suggested option is to reconsider the stock limits and the inclusion in the Northern megrim stock.

Table. 6.1.1 Megrim (*L. whiffiagonis*) in Divisions VIIIc, IXa. Landings, discards and catch (t).

	Spain landings			Portugal landings	Unallocated	Total landings	Discards	Total catch
Year	VIIIc	IXa***	Total	IXa				
1986	508	98	606	53		659	46	705
1987	404	46	450	47		497	40	537
1988	657	59	716	101		817	42	859
1989	533	45	578	136		714	47	761
1990	841	25	866	111		977	45	1022
1991	494	16	510	104		614	41	655
1992	474	5	479	37		516	42	558
1993	338	7	345	38		383	38	421
1994	440	8	448	31		479	13	492
1995	173	20	193	25		218	40	258
1996	283	21	305	24		329	44	373
1997	298	12	310	46		356	52	408
1998	372	8	380	66		446	36	482
1999	332	4	336	7		343	43	386
2000	238	5	243	10		253	35	288
2001	167	2	169	5		175	19	193
2002	112	3	115	3		117	19	137
2003	113	3	116	17		134	15	148
2004	142	1	144	5		149	11	159
2005	120	1	121	26		147	19	166
2006	173	2	175	35		210	16	226
2007	139	2	141	14		155	0.4	155
**2008	114	2	116	17		133	11	144
2009	74	2	77	7		84	11	94
2010	66	8	74	10		83	5	88
*+2011	242	0	242	34	26	302	69	371
*+2012	151	11	161	18	83	262	31	293
*+2013	128	3	131	11	90	231	18	250
*2014	225	5	231	30	116	377	23	399

+Data revised in WG2015
***IXa is without Gulf of Cádiz
** Data revised in WG2010
* Official data by country and unallocated landings

Table. 6.1.2(a) Megrim (*L. whiffiagonis*) in Divisions VIIIc, IXa. Discard/Total Catch ratio and estimated CV for Spain from sampling on board

Year	1994	1997	1999	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011*	2012	2013	2014
Weight Ratio	0.03	0.14	0.12	0.13	0.11	0.07	0.14	0.08	0.00	0.08	0.13	0.06	0.23	0.12	0.07	0.06
CV	50.83	32.23	33.4	48.41	19.93	29.24	43.17	31.62	55.01	58.8	52.9	61.6	23.7	28.8	30.3	44.7
Number Ratio	0.10	0.38	0.34	0.45	0.26	0.16	0.28	0.21	0.01	0.20	0.36	0.27	0.57	0.37	0.24	0.20

All discard data revised in WG2011

*Data revised in WG2013

Table. 6.1.2(b) Megrim (*L. whiffiagonis*) in Divisions VIIIc, IXa. Discards in numbers at age (thousands) for Spanish trawlers

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1	138	138	138	138	138	138	138	138	104	138	138	41	138	270	27	10
2	339	339	339	339	339	339	339	339	93	339	339	453	339	471	611	338
3	425	425	425	425	425	425	425	425	136	425	425	857	425	284	160	82
4	130	130	130	130	130	130	130	130	51	130	130	142	130	197	73	31
5	10	10	10	10	10	10	10	10	3	10	10	1	10	26	19	9
6	4	4	4	4	4	4	4	4	1	4	4	5	4	6	0	1
7	1	1	1	1	1	1	1	1	0	1	1	3	1	0	0	1

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*	2012	2013	2014
1	10	0	4	20	0	0	0	96	16	12	8	330	442
2	338	239	164	223	19	11	126	142	119	2044	808	53	94
3	82	57	28	61	108	0	86	21	6	346	85	13	16
4	31	12	6	38	115	0	8	15	1	1	41	5	2
5	9	4	5	11	28	0	5	7	2	2	2	0	0
6	1	0	3	4	13	0	2	7	0	0	1	0	0
7	1	0	2	1	4	0	0	3	1	0	1	0	0

Table 6.1.3(a) Megrim (*L. whiffiagonis*) Divisions VIIIc and IXa. Annual length distributions in landings in 2014.

Length (cm)	Total
10	
11	
12	
13	1.5
14	
15	
16	1.5
17	1.0
18	0.0
19	6.2
20	30.2
21	53.2
22	103.4
23	84.4
24	171.0
25	225.2
26	256.3
27	217.9
28	158.8
29	135.3
30	160.7
31	119.1
32	116.5
33	106.4
34	78.5
35	44.0
36	35.7
37	23.0
38	16.4
39	13.6
40	12.9
41	10.9
42	7.1
43	4.7
44	3.5
45	1.7
46	1.7
47	1.8
48	0.4
49	0.4
50+	2.0
Total	2207

Table 6.1.3(b) Megrim (*L. whiffiagonis*) Divisions VIIIc and IXa.

Mean lengths and mean weights in landings since 1990

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Mean length (cm)	22.3	23.5	24.6	23.4	25.1	24.7	24.6	24.6	24.7	25.3	25.8	25.1	26	25.7	26.1	25.3	26.2	26.7	26.6	27.6	29.4	27.6	28.2	29.4	28.6
Mean weight (g)	105	108	129	108	124	121	120	118	119	127	134	124	137	134	137	127	137	148	147	163	187	160	163	188	171

Table 6.1.4 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Catch numbers at age.

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	*2008	2009	2010	2011**	2012**	2013**	2014
AGE																													
1	1352	2359	3316	1099	4569	1357	1401	858	133	848	537	535	416	491	620	378	369	368	210	346	110	90	133	170	149	2054	812	359	469
2	2377	2728	3769	2328	2560	2777	817	2128	568	461	1911	1919	1307	524	282	387	233	299	264	276	526	161	370	111	39	1087	275	152	705
3	798	882	1168	808	905	931	807	442	1835	384	167	1153	1335	1157	671	331	341	277	211	438	582	232	215	159	53	156	834	320	420
4	649	404	748	641	878	700	1130	536	552	630	289	77	891	719	526	253	95	179	247	171	276	297	153	102	112	220	157	612	432
5	505	293	534	505	333	647	595	361	625	245	506	367	218	448	361	221	165	80	187	156	183	142	168	80	97	266	192	81	518
6	202	81	182	191	377	142	78	103	330	70	148	308	329	105	83	161	81	54	102	87	110	81	60	60	81	209	106	61	74
+gp	194	71	130	253	558	59	68	36	119	72	81	116	149	207	161	118	37	48	72	41	36	56	35	29	43	184	139	89	144
TOTALNUM	6077	6818	9847	5825	10180	6613	4896	4464	4162	2710	3639	4475	4645	3651	2704	1849	1321	1305	1293	1515	1823	1059	1134	711	574	4176	2515	1674	2762
TONSLAND	705	537	858	761	1022	655	558	421	492	258	373	408	482	386	288	194	136	149	160	166	226	155	144	95	88	371	293	250	399
SOPCOF %	95	95	95	99	99	100	100	101	100	101	101	100	100	101	101	100	99	101	100	98	100	100	100	101	100	100	100	101	100

* Data revised in WG2010 from original value presented

** Data revised in WG2014 from original value presented

Table 6.1.5 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Catch weights at age (kg).

Mean weight at age

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	*2008	2009	2010	2011**	2012**	2013**	2014
AGE																													
1	0.041	0.046	0.043	0.05	0.04	0.035	0.031	0.03	0.039	0.051	0.04	0.033	0.032	0.033	0.037	0.039	0.038	0.047	0.0480	0.0510	0.057	0.061	0.033	0.031	0.037	0.026	0.027	0.039	0.035
2	0.095	0.079	0.086	0.09	0.091	0.085	0.075	0.07	0.063	0.044	0.08	0.062	0.061	0.058	0.057	0.078	0.07	0.083	0.0820	0.0770	0.082	0.088	0.084	0.088	0.091	0.088	0.089	0.079	0.097
3	0.113	0.086	0.098	0.11	0.121	0.102	0.116	0.1	0.099	0.087	0.08	0.095	0.095	0.084	0.089	0.085	0.111	0.115	0.1090	0.1080	0.11	0.11	0.118	0.135	0.116	0.135	0.138	0.127	0.13
4	0.163	0.142	0.149	0.16	0.165	0.145	0.155	0.15	0.13	0.126	0.13	0.126	0.13	0.118	0.119	0.117	0.115	0.149	0.1300	0.1400	0.15	0.144	0.145	0.16	0.168	0.134	0.164	0.179	0.166
5	0.215	0.175	0.191	0.22	0.206	0.173	0.209	0.19	0.15	0.164	0.16	0.14	0.154	0.159	0.161	0.148	0.162	0.194	0.1570	0.1640	0.174	0.197	0.187	0.189	0.203	0.201	0.172	0.232	0.22
6	0.315	0.311	0.289	0.29	0.24	0.251	0.318	0.24	0.19	0.21	0.21	0.198	0.189	0.216	0.215	0.171	0.205	0.252	0.2030	0.1990	0.223	0.236	0.246	0.246	0.228	0.242	0.228	0.281	0.264
+gp	0.477	0.415	0.424	0.52	0.369	0.42	0.534	0.54	0.344	0.34	0.35	0.341	0.324	0.296	0.296	0.256	0.387	0.382	0.3190	0.3790	0.39	0.366	0.409	0.404	0.37	0.371	0.343	0.391	0.381
SOPCOFAC	0.95	0.954	0.951	1	0.987	1.004	0.998	1.01	1	1.009	1.01	1.001	1.005	1.006	1.011	1.005	0.994	1.006	1.001	0.985	1.003	0.997	1.003	1.006	0.999	0.998	1.003	1.012	0.999

* Data revised in WG2010 from original value presented

** Data revised in WG2014 from original value presented

Table 6.1.6 Megrim (*L. whiffiagonis*) Divisions VIIIc, IXa. Abundance and Recruitment indices from Portuguese and Spanish surveys.

	Biomass Index						Abundance index					Recruitment index		
												At age 1	At age 0	At age 1
	Portugal (k/h)			Spain (k/30 min)			Portugal (n/h)		Spain (n/30 min)			Portugal (n)	Spain (n/30 min)	
	October	Crustaceans	s.e	Mean	s.e.		Crustaceans	s.e.	Mean	s.e.		October		
1983				0.96	0.14	1983			14	2.45	1983		1.88	7.72
1984				1.92	0.34	1984			28	4.57	1984		0.32	16.08
1985				0.89	0.15	1985			9	1.34	1985		0.10	2.74
1986				1.65	0.2	1986			33	6.22	1986		13.78	11.19
1987				ns		1987			ns		1987		ns	ns
1988				3.52	0.64	1988			43	8.82	1988		0.65	16.60
1989				3.13	0.5332	1989			42	7.04	1989		2.90	13.96
1990	0.08			3.08	0.86	1990			28	5.5	1990	5	0.11	9.13
1991	0.11			1.22	0.17	1991			10	1.67	1991	5	1.26	1.38
1992	0.11			1.39	0.2	1992			18	3.35	1992	8	0.01	12.03
1993	0.04			1.46	0.24	1993			15	3.23	1993	1	0.00	2.76
1994	0.05			1.02	0.2	1994			8	1.87	1994 +		0.60	0.05
1995	0.01			1.03	0.16	1995			11	1.86	1995 +		0.41	7.38
A,1996 +				1.64	0.22	A,1996			21	3.6	A,1996 +		0.45	11.26
1997 +		1.41	1.04	1.79	0.25	1997	7.22	4.82	20	3.26	1997 +		0.15	5.91
1998	0.01	0.20	0.09	1.47	0.23	1998	1.09	0.51	14.8	2.64	1998 +		0.02	2.56
A,B,1999 +		0.11	0.11	1.59	0.29	A,B,1999	0.57	0.53	15.5	3.05	A,B,1999 +		0.56	1.26
2000 +		0.06	0.05	1.8	0.35	2000	0.27	0.17	19.4	4.46	2000 +		0.05	6.92
2001	0	0.04	0.03	1.45	0.28	2001	0.07	0.04	12.8	2.77	2001 +		0.19	1.97
2002	0.04	0.07	0.04	1.26	0.24	2002	0.21	0.10	12.1	2.65	2002 +		0.08	2.53
A,2003	0.01	0.07	0.05	0.82	0.16	A,2003	0.16	0.08	7.2	1.26	A,2003	0.05	0.05	1.91
A,2004	0.01	ns		1.08	0.2	A,2004	ns		8.44	1.39	A,2004 +		0.14	1.83
2005	0.01	0.37	0.20	1.29	0.21	2005	0.71	0.35	9.76	1.73	2005 +		0.08	2.21
2006	0.02	0.29	0.18	1.03	0.18	2006	0.43	0.24	6.38	1.16	2006		0.00	0.89
2007	0	0.15	0.09	1.13	0.24	2007	0.49	0.37	6.87	1.52	2007		0.01	1.87
2008	0	0.25	0.11	0.68	0.15	2008	1.49	0.71	4.33	1.07	2008		0.00	0.23
2009	0.00	*0.05	0.03	0.80	0.12	2009	*0.19	0.10	4.17	0.59	2009		0.19	0.20
2010	0.01	0.20	0.10	0.89	0.16	2010	0.56	0.23	10.15	1.97	2010		0.01	7.63
2011	0.00	0.84	0.67	1.83	0.35	2011	1.75	1.30	17.45	3.86	2011		0.00	1.94
2012	ns	ns	ns	1.38	0.19	2012	ns	ns	9.07	1.29	2012		0.03	0.58
**2013	0	0.20	0.13	2.44	0.39	2013	0.43	0.22	15.89	2.58	2013		0.02	3.24
2014	0.02	0.30	0.18	1.34	0.21	2014	0.81	0.41	9.04	1.26	2014		0.40	1.32

+ less than 0.04
ns no survey
A Portuguese October Survey with different vessel and gear (Capricórnio and CAR net)
B Portuguese Crustacean Survey covers partial area only with a different Vessel (Mestre Costeiro)
* Revised in WG2011
** From 2013 new vessel for Spanish survey (Miguel Oliver)

Table 6.1.7 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Tuning data.

FLT01: SP-LCGOTBDEF 1000 Days by 100 HP (thousand)

1986	2014								
1	1	0	1						
1	7							Eff.	
10	13.0	32.1	24.9	24.3	21.5	11.1	6.7	7.1	1986
10	105.5	114.2	46.8	22.4	15.1	7.5	5.8	12.7	1987
10	18.5	55.0	41.2	32.3	22.9	10.2	5.5	11.3	1988
10	4.6	24.4	23.6	25.7	20.8	9.8	5.7	11.9	1989
10	6.1	23.7	25.3	34.1	32.9	17.6	10.5	8.8	1990
10	6.8	31.1	30.5	36.8	32.3	16.0	9.0	9.6	1991
10	1.2	16.6	21.3	31.1	31.1	16.9	13.5	10.2	1992
10	0.2	12.0	15.1	20.7	17.8	8.2	3.9	7.1	1993
10	0.0	4.9	72.9	40.0	58.6	41.7	8.8	8.5	1994
10	65.1	4.1	19.6	42.9	15.4	4.2	2.9	13.4	1995
10	1.4	64.0	3.2	20.6	54.7	17.2	10.1	11.0	1996
10	1.1	37.2	56.8	5.7	29.0	27.0	9.3	12.5	1997
10	0.7	20.1	56.1	69.8	19.8	40.8	18.4	8.2	1998
10	0.8	8.6	44.3	46.5	38.3	10.7	21.4	8.8	1999
10	1.5	7.0	46.7	64.3	61.6	15.6	18.2	10.5	2000
10	2.6	25.7	25.8	31.0	33.4	27.1	19.0	12.1	2001
10	2.0	12.8	43.6	12.1	32.9	17.3	6.9	11.0	2002
10	25.9	19.2	20.0	20.1	12.2	10.0	8.5	10.2	2003
10	2.2	12.0	13.5	20.4	19.2	14.3	13.5	7.0	2004
10	5.7	12.4	27.6	12.6	13.5	8.3	5.6	7.1	2005
10	3.4	17.9	24.8	17.5	13.3	9.5	3.8	7.8	2006
10	12.9	19.2	21.7	27.7	16.7	10.0	8.0	7.3	2007
10	0.2	21.9	20.2	14.9	16.3	5.5	3.8	9.0	2008
10	6.0	17.2	22.6	12.7	8.8	5.9	2.8	8.0	2009
10	1.6	7.0	12.1	25.4	24.5	18.1	10.3	5.8	2010
10	2.3	134.6	27.5	38.0	31.8	15.8	9.3	5.1	2011
10	2.3	108.1	####	68.3	76.2	27.9	18.2	7.6	2012
10	1.6	19.9	54.6	89.3	9.8	7.2	6.8	10.8	2013
10	2.8	33.7	17.9	16.2	17.0	2.6	5.3	13.4	2014

FLT02: SP-AVSOTBDEF 1000 Days by 100 HP (thousand) (*)

1986	2014								
1	1	0	1						
1	7							Eff.	
10	408	516	428	209	182	153	92	3.9	1986
10	590	471	510	242	145	168	55	3.0	1987
10	1458	905	749	357	155	193	85	3.4	1988
10	836	514	539	253	145	174	68	3.3	1989
10	4366	949	225	173	46	50	71	3.2	1990
10	980	855	229	100	84	15	7	3.5	1991
10								10.2	1992
10	1149	1490	91	100	53	25	19	2.4	1993
10	19	176	547	135	133	51	24	4.5	1994
10	41	2	43	140	70	26	14	3.5	1995
10	135	797	14	117	259	74	62	2.3	1996
10	96	880	621	34	153	128	46	2.6	1997
10	16	309	375	233	52	69	38	5.1	1998
10	10	110	398	263	162	38	70	4.9	1999
10	29	54	239	230	146	36	53	2.5	2000
10	37	200	193	122	115	84	85	1.3	2001
10	54	158	239	65	93	53	47	2.0	2002
10	26	84	105	70	31	24	28	2.2	2003
10	53	231	208	248	193	103	60	1.6	2004
10	118	182	309	117	107	59	26	3.0	2005
10	43	182	236	120	83	46	12	2.8	2006
10	25	48	72	93	41	24	20	2.2	2007
10	5	153	85	51	49	18	16	2.0	2008
10	12	41	67	50	39	39	21	2.3	2009
10	50	45	66	160	136	121	62	2.0	2010
10	6	483	95	133	168	134	110	2.2	2011
10	0	28	118	23	29	18	28	2.6	2012
10	11	35	129	279	38	31	62	1.5	2013
10	7	116	64	73	117	22	53	3.0	2014

FLTO3: SPGFS-WIBTS-Q4 (n/30 min)

1988	2014								
1	1	0.75	0.83						
1	7								
1	16.60	12.48	5.18	4.54	2.66	0.74	0.53	101	1988
1	13.96	11.20	5.38	5.64	1.47	0.48	0.43	91	1989
1	9.13	7.69	3.04	3.61	1.26	1.36	1.57	120	1990
1	1.38	3.23	1.45	1.84	0.87	0.23	0.03	107	1991
1	12.03	1.07	1.57	2.24	1.14	0.21	0.15	116	1992
1	2.76	8.79	0.66	1.69	0.85	0.17	0.01	109	1993
1	0.05	0.65	4.24	1.30	0.71	0.27	0.04	118	1994
1	7.38	0.20	0.55	1.65	0.70	0.17	0.10	116	1995
1	11.26	6.45	0.25	1.03	1.00	0.35	0.27	114	1996
1	5.91	7.54	3.44	0.46	0.99	0.39	0.06	116	1997
1	2.56	4.30	4.33	2.08	0.41	0.60	0.15	114	1998
1	1.26	4.47	4.36	2.50	1.46	0.46	0.77	116	1999
1	6.92	2.46	2.84	3.42	2.14	0.70	0.39	113	2000
1	1.97	4.60	1.14	2.31	1.58	0.61	0.40	113	2001
1	2.53	3.15	3.74	0.44	1.38	0.51	0.29	110	2002
1	1.91	1.44	1.66	1.14	0.52	0.26	0.16	112	2003
1	1.83	1.94	1.31	1.30	0.80	0.66	0.47	114	2004
1	2.21	1.58	2.04	1.43	1.57	0.60	0.25	116	2005
1	0.89	1.40	1.57	0.82	0.88	0.61	0.22	115	2006
1	1.87	0.94	1.27	1.24	0.68	0.44	0.42	117	2007
1	0.23	1.54	1.23	0.56	0.52	0.18	0.08	115	2008
1	0.20	0.44	1.52	0.91	0.40	0.30	0.22	117	2009
1	7.63	0.26	0.28	0.75	0.52	0.50	0.21	114	2010
1	1.94	12.47	1.32	0.30	0.63	0.40	0.39	111	2011
1	0.58	2.22	4.81	0.41	0.16	0.30	0.56	115	2012
0	3.24	1.63	3.29	5.63	0.67	0.35	0.87	114	2013
1	1.32	2.80	1.30	1.38	1.21	0.20	0.42	116	2014

Table 6.1.8 Megrim (*L. whiffiagonis*). LPUE data by fleet in Divisions VIIIc and IXa.

	SP-LCGOTBDEF			SP-AVSOTBDEF			Portugal trawl in IXa		
Year	Landings (t)	Effort	LPUE [1]	Landings (t)	Effort	LPUE [1]	Landings (t)	Effort	LPUE [2]
1986	16	7.1	2.24	83	3.9	21.17			
1987	36	12.7	2.85	52	3.0	17.65			
1988	29	11.3	2.59	83	3.4	24.65	74.9	38.5	1.95
1989	24	11.9	2.03	65	3.3	19.76	92.2	44.7	2.06
1990	27	8.8	3.05	120	3.2	36.91	86.0	39.0	2.20
1991	29	9.6	3.05	52	3.5	14.96	85.5	45.0	1.90
1992	32	10.2	3.10	35	2.3	15.46	32.6	50.9	0.64
1993	11	7.1	1.53	45	2.4	18.55	31.7	44.2	0.72
1994	32	8.5	3.79	52	4.5	11.39	25.8	45.8	0.56
1995	12	13.4	0.86	34	3.5	9.72	21.4	37.0	0.58
1996	26	11.0	2.36	39	2.3	17.13	22.2	46.5	0.48
1997	30	12.5	2.43	51	2.6	19.16	41.5	33.4	1.24
1998	30	8.2	3.65	62	5.1	12.19	60.1	43.1	1.39
1999	23	8.8	2.65	63	4.9	12.67	4.3	25.3	0.17
2000	35	10.5	3.33	26	2.5	10.49	6.9	27.0	0.25
2001	28	12.1	2.30	15	1.3	11.15	1.3	43.1	0.03
2002*	22	11.0	2.01	18	2.0	9.14	1.0	31.2	0.03
2003*	18	10.2	1.73	12	2.2	5.72	15.3	40.5	0.38
2004	12	7.0	1.66	23	1.6	14.77	3.4	35.4	0.10
2005	9	7.1	1.29	33	3.0	11.10	19.0	42.6	0.45
2006	11	7.8	1.44	27	2.8	9.62	26.3	40.3	0.65
2007**	13	7.3	1.78	11	2.2	4.85	10.5	43.8	0.24
2008**	12	9.0	1.30	11	2.0	5.27	14.4	38.4	0.37
2009	9	8.0	1.06	11	2.3	5.05	6.0	49.3	0.12
2010	12	5.8	2.02	24	2.0	11.74	7.3	48.0	0.15
2011	17	5.1	3.43	41	2.2	18.67	24.8	49.4	0.50
2012	43	7.6	5.58	11	2.6	4.40	14.5	30.9	0.47
2013***	33	10.8	3.02	16	1.5	11.07	8.1	28.0	0.29
2014	20	13.4	1.47	26	3.0	8.80	25.7	49.2	0.52

[1] LPUE as catch (kg) per fishing day per 100 HP.

[2] LPUE as catch (kg) per hour.

* Effort from Portuguese trawl revised from original value presented

** Effort from Portuguese trawl revised in WG2010 from original value presented

*** Effort from SP-LCGOTBDEF and SP-AVSOTBDEF revised in WG2015 from original value presented

Table 6.1.9. Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Tuning diagnostic

Lowestoft VPA Version 3.1

28/04/2015 14:13

Extended Survivors Analysis

Megrim (L. whiffiagonis.) in Divisions VIIIc and IXa

CPUE data from file fleetw.txt

Catch data for 29 years. 1986 to 2014. Ages 1 to 7.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
SP-LCGOTBDEF	1986	2014	3	6	0	1
SP-AVSOTBDEF	1986	2014	3	6	0	1
SP-GFS	1990	2014	1	6	0.75	0.83

Time series weights :

Tapered time weighting not applied

Catchability analysis :

Catchability dependent on stock size for ages < 3

Regression type = C
Minimum of 5 points used for regression
Survivor estimates shrunk to the population mean for ages < 3

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 = 1.500

Minimum standard error for population
estimates derived from each fleet = .200

Prior weighting not applied

Tuning had not converged after 160 iterations

Total absolute residual between iterations
159 and 160 = .00085

Final year F values

Age	1	2	3	4	5	6
Iteration **	0.1448	0.2268	0.418	0.442	0.4728	0.5333
Iteration **	0.145	0.227	0.418	0.442	0.473	0.533

Regression weights

1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1.00E+00	1	1	1	1

Fishing mortalities

Age	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1	0	0	0	0	0	0	0.519	0.338	0.081	0.145
2	0	0	0	0	0	0	0.219	0.118	0.096	0.227
3	0	0	0	0	0	0	0.218	0.261	0.196	0.418
4	0	0	0	0	0	0	0.388	0.357	0.311	0.442
5	0	0	0	0	0	0	0.436	0.702	0.315	0.473
6	0	0	0	0	0	0	0.693	0.309	0.503	0.533

XSA population numbers (Thousands)

	AGE					
YEAR	1	2	3	4	5	6
2005	2850	2600	1600	1040	896	562
2006	2390	2020	1880	913	699	592
2007	2940	1860	1180	1010	498	406
2008	1760	2330	1380	757	558	279
2009	1550	1320	1570	933	481	305
2010	7620	1120	983	1140	672	322
2011	5600	6110	879	757	833	462
2012	3130	2730	4020	578	421	441
2013	5090	1830	1990	2530	331	171
2014	3850	3840	1360	1340	1520	198

Estimated population abundance at 1st Jan 2015

0	2720	2510	733	704	776

Taper weighted geometric mean of the VPA populations:

4970	3580	2270	1450	861	435

Standard error of the weighted Log(VPA populations) :

0.6425	0.635	0.5295	0.4713	0.4255	0.4522

Log catchability residuals.

Fleet : SP-LCGOTBDEF

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	No data for this fleet at this age								
2	No data for this fleet at this age								
3	-0.53	-0.17	0.05	-0.71	-0.54	-0.54	-0.56	-0.68	0.22
4	-0.4	-0.59	-0.46	-0.15	-0.15	0.05	-0.24	-0.41	0.44
5	-0.42	-0.72	-0.41	-0.73	0.42	0.28	0.37	-0.43	1.12
6	-0.5	-0.8	-0.48	-0.52	-0.2	0.43	0.53	0.08	1.4

Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	-0.52	-1.3	0.05	-0.01	-0.01	0.49	0.49	0.53	-0.3	-0.45
4	-0.08	-0.43	-0.9	0.47	-0.02	0.56	0.22	-0.22	-0.27	-0.28
5	-0.26	0.31	-0.04	0.48	0.12	0.35	-0.07	0.24	-0.31	-0.37
6	-0.35	0.54	0.35	1.2	0.8	-0.27	0	-0.34	-0.58	0.37

Age	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	0.36	0.08	0.36	0.09	0.04	-0.14	0.87	2.03	0.73	0.09
4	-0.48	0.1	0.41	0	-0.42	0.1	1	1.87	0.63	-0.36
5	-0.67	-0.46	0.15	0.06	-0.53	0.14	0.31	1.99	-0.05	-0.88
6	-0.73	-0.7	-0.25	-0.41	-0.39	0.7	0.31	0.76	0.48	-0.57

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	-6.4333	-6.0392	-5.5855	-5.5855
S.E(Log q)	0.6263	0.5535	0.5946	0.6053

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	1.06	-0.246	6.36	0.39	29	0.67	-6.43
4	1.34	-1.154	5.62	0.3	29	0.74	-6.04
5	1.73	-1.652	4.73	0.16	29	1	-5.59
6	1.38	-1.096	5.36	0.23	29	0.83	-5.56
1							

Fleet : SP-AVSOTBDEF

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994
1	No data for this fleet at this age								
2	No data for this fleet at this age								
3	0.5	0.4	1.13	0.62	-0.12	-0.33	99.99	-0.7	0.45
4	0.23	0.25	0.41	0.62	-0.06	-0.49	99.99	-0.4	0.13
5	0.38	0.19	0.14	-0.15	-0.58	-0.12	99.99	-0.69	0.59
6	0.76	0.9	1.06	0.99	-0.47	-1	99.99	-0.18	0.24

Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	-1.52	-1.82	0.66	0.09	0.4	0.31	0.71	0.42	-0.43	0.52
4	-0.43	-0.26	-0.62	0.13	0.17	0.27	0.03	-0.06	-0.57	0.67
5	-0.13	0.51	0.31	0.09	0.21	-0.16	-0.17	-0.09	-0.66	0.63
6	0.05	0.64	0.58	0.38	0.79	-0.76	-0.22	-0.53	-1.09	0.97

Age	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	0.94	0.55	-0.24	-0.26	-0.69	-0.25	0.32	-0.99	-0.23	-0.44
4	0.19	0.46	0.11	-0.31	-0.62	0.38	0.72	-0.77	0.21	-0.41
5	0.01	0.05	-0.29	-0.19	-0.38	0.51	0.64	-0.4	0.07	-0.32
6	-0.17	-0.4	-0.73	-0.48	0.1	1.2	1.09	-0.95	0.63	-0.01

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	-4.6361	-4.4926	-4.2366	-4.2366
S.E(Log q)	0.709	0.4227	0.3809	0.7265

Regression statistics :

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	0.76	1.265	5.38	0.51	28	0.53	-4.64
4	0.82	1.236	4.98	0.66	28	0.35	-4.49
5	0.83	1.24	4.67	0.67	28	0.31	-4.24
6	1.26	-0.688	3.6	0.21	28	0.91	-4.12

Fleet : SP-GFS●

Age		1986	1987	1988	1989	1990	1991	1992	1993	1994	
	1	99.99	99.99	99.99	99.99	-0.18	-0.47	-0.06	-0.01	-1.34	
	2	99.99	99.99	99.99	99.99	0.04	-0.29	-0.56	-0.02	-0.88	
	3	99.99	99.99	99.99	99.99	0.19	-0.76	-0.34	-1.03	0.28	
	4	99.99	99.99	99.99	99.99	0.71	0.14	0.28	0.12	0.1	
	5	99.99	99.99	99.99	99.99	0.52	0.2	0.6	-0.17	0.32	
	6	99.99	99.99	99.99	99.99	0.68	-0.44	-0.57	-0.49	-0.06	
Age		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	1	-0.16	0.04	-0.05	0.05	0.23	0.73	0.15	0.48	0.3	0.17
	2	-0.82	-0.08	-0.03	-0.15	0.39	0.63	0.6	0.38	0.12	0.26
	3	-1.29	-1.19	0.08	0.28	0.54	0.54	0.22	0.87	0.01	0.04
	4	-0.3	-0.46	-0.43	0.04	0.09	0.65	0.6	-0.54	-0.14	-0.03
	5	-0.05	-0.36	-0.09	0.02	0.18	0.26	0.13	0.33	-0.19	-0.26
	6	-0.32	-0.01	-0.51	0.53	1.17	-0.13	-0.56	-0.65	-1	0.59
Age		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
	1	0.48	0.13	0.31	-0.26	-0.19	0.1	-0.11	-0.24	99.99	-0.09
	2	-0.02	0.26	-0.03	0.11	-0.17	-0.36	0.48	0.14	99.99	0
	3	0.58	0.2	0.32	0.09	0.11	-1.16	0.63	0.44	99.99	0.34
	4	0.32	0.06	0.36	-0.25	-0.08	-0.48	-0.77	-0.21	99.99	0.23
	5	0.38	0.15	0.26	-0.12	-0.38	-0.47	-0.29	-0.77	99.99	-0.21
	6	-0.14	-0.14	-0.08	-0.58	-0.18	0.35	0.05	-0.49	99.99	0.08

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	-6.8009	-6.5972	-6.3964	-6.3964
S.E(Log q)	0.624	0.3874	0.3354	0.5157

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	0.53	3.339	7.87	0.7	24	0.4	-7.43
2	0.63	2.631	7.39	0.7	24	0.4	-6.99

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	0.9	0.46	6.89	0.48	24	0.57	-6.8
4	0.71	2.581	6.77	0.79	24	0.25	-6.6
5	0.79	1.547	6.47	0.7	24	0.26	-6.4
6	1.35	-1.088	6.68	0.3	24	0.67	-6.52

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 2013

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-LCGOTBDEF	1	0	0	0	0	0	0
SP-AVSOTBDEF	1	0	0	0	0	0	0
SP-GFS●	2481	0.412	0	0	1	0.635	0.158
P shrinkage mean	3581	0.64				0.31	0.112
F shrinkage mean	1734	1.5				0.055	0.219

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
2725	0.34	0.16	3	0.462	0.145

Age 2 Catchability dependent on age and year class strength

Year class = 2012

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-LCGOTBDEF	1	0	0	0	0	0	0
SP-AVSOTBDEF	1	0	0	0	0	0	0
SP-GFS●	2514	0.408	0	0	1	0.544	0.226
P shrinkage mean	2275	0.53				0.406	0.247
F shrinkage mean	5262	1.5				0.051	0.114

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
2506	0.32	0.13	3	0.395	0.227

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

Year class = 2011

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-LCGOTBDEF	805	0.637	0	0	1	0.219	0.387
SP-AVSOTBDEF	472	0.722	0	0	1	0.171	0.591
SP-GFS●	724	0.357	0.284	0.8	2	0.55	0.422
F shrinkage mean	2027	1.5				0.06	0.172

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
733	0.29	0.19	5	0.669	0.418

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

Year class = 2010

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-LCGOTBDEF	752	0.424	0.531	1.25	2	0.198	0.419
SP-AVSOTBDEF	487	0.371	0.076	0.2	2	0.267	0.589
SP-GFS●	806	0.245	0.088	0.36	3	0.509	0.396
F shrinkage mean	1310	1.5				0.026	0.261

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
704	0.18	0.13	8	0.716	0.442

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

Year class = 2009

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-LCGOTBDEF	1038	0.355	0.801	2.26	3	0.191	0.373
SP-AVSOTBDEF	634	0.273	0.247	0.91	3	0.346	0.553
SP-GFS●	791	0.228	0.166	0.73	4	0.442	0.465
F shrinkage mean	1053	1.5				0.021	0.368

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
776	0.16	0.19	11	1.202	0.473

Age 6 Catchability constant w.r.t. time and age (fixed at the value for age) 5

Year class = 2008

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-LCGOTBDEF	130	0.318	0.547	1.72	4	0.242	0.414
SP-AVSOTBDEF	82	0.26	0.219	0.84	4	0.341	0.599
SP-GFS	88	0.227	0.134	0.59	5	0.392	0.564
F shrinkage mean	119	1.5				0.025	0.447

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
95	0.15	0.16	14	1.047	0.533

Table 6.1.10. Megrim (*L. whiffiagonis*) Div. VIIIc and IXa. Estimates of fisihing mortality at age.

Run title : Megrim (L. whiffiagonis.) in Divisions VIIIc and IXa

At 28/04/2015 14:15

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994
AGE									
1	0.1576	0.2184	0.366	0.1195	0.4746	0.2828	0.1384	0.1945	0.0667
2	0.4026	0.5461	0.647	0.4763	0.4481	0.5994	0.2749	0.3221	0.1907
3	0.2989	0.2545	0.4778	0.2721	0.3421	0.2891	0.3445	0.2345	0.5113
4	0.4375	0.2426	0.3569	0.5287	0.5362	0.4866	0.6873	0.406	0.516
5	0.5955	0.3604	0.5855	0.4364	0.5835	1.0179	1.052	0.4872	1.2489
6	0.4107	0.1737	0.3994	0.4272	0.691	0.5322	0.3014	0.5008	1.2068
+gp	0.4107	0.1737	0.3994	0.4272	0.691	0.5322	0.3014	0.5008	1.2068
FBAR 2- 4	0.3797	0.3477	0.4939	0.4257	0.4421	0.4584	0.4356	0.3209	0.406

Table 8 Fishing mortality (F) at age

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AGE										
1	0.098	0.0603	0.0776	0.1037	0.2149	0.182	0.1205	0.1431	0.1383	0.0706
2	0.3454	0.3334	0.3164	0.2754	0.1841	0.1842	0.1651	0.1014	0.1652	0.1392
3	0.1906	0.2016	0.3447	0.3801	0.4198	0.3801	0.3424	0.2146	0.1684	0.1682
4	0.3284	0.2144	0.1344	0.4918	0.3627	0.342	0.2395	0.1545	0.1667	0.2228
5	0.4559	0.4802	0.4635	0.6882	0.4945	0.3122	0.2348	0.2428	0.1885	0.2632
6	0.4158	0.5554	0.613	1.0372	0.8734	0.1564	0.2226	0.1261	0.1163	0.3902
+gp	0.4158	0.5554	0.613	1.0372	0.8734	0.1564	0.2226	0.1261	0.1163	0.3902
FBAR 2- 4	0.2881	0.2498	0.2652	0.3824	0.3222	0.3021	0.249	0.1568	0.1667	0.1767

Table 8 Fishing mortality (F) at age

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	FBAR 12-14
AGE											
1	0.1438	0.0521	0.0344	0.087	0.1291	0.0218	0.5192	0.3379	0.0812	0.1448	0.188
2	0.125	0.3386	0.1006	0.1934	0.0973	0.0394	0.2191	0.118	0.0964	0.2268	0.1471
3	0.3605	0.4198	0.2448	0.1894	0.1188	0.0614	0.2184	0.2608	0.1961	0.4179	0.2916
4	0.2001	0.4066	0.3932	0.2528	0.1288	0.1149	0.3875	0.3568	0.3106	0.4418	0.3698
5	0.2138	0.3418	0.3787	0.4047	0.203	0.1739	0.4355	0.7023	0.315	0.4726	0.4966
6	0.1876	0.2298	0.2489	0.2713	0.2454	0.3261	0.6929	0.3088	0.5028	0.5329	0.4482
+gp	0.1876	0.2298	0.2489	0.2713	0.2454	0.3261	0.6929	0.3088	0.5028	0.5329	
FBAR 2- 4	0.2285	0.3883	0.2462	0.2119	0.1149	0.0719	0.275	0.2452	0.201	0.3622	

Table 6.1.11. Megrim (*L. whiffiagonis*) Div. VIIIc and IXa. Estimates of stocks numbers at age

Run title : Megrim (L. whiffiagonis.) in Divisions VIIIc and IXa

At 28/04/2015 14:15

Terminal Fs derived using XSA (With F shrinkage)

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

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994
AGE									
1	10246	13287	11958	10783	13363	6089	11979	5364	2277
2	7926	7165	8744	6790	7834	6807	3757	8540	3615
3	3414	4339	3398	3748	3453	4098	3060	2337	5066
4	2024	2073	2754	1725	2338	2008	2512	1775	1513
5	1244	1070	1332	1578	832	1120	1010	1035	969
6	663	561	611	607	835	380	331	289	520
+gp	631	490	433	797	1220	156	287	100	184
TOTAL	26148	28985	29229	26029	29876	20657	22937	19439	14145

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

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AGE										
1	10036	10144	7920	4666	2806	4118	3680	3058	3149	3404
2	1744	7450	7819	6000	3444	1853	2811	2671	2170	2245
3	2446	1011	4370	4666	3730	2345	1262	1951	1976	1506
4	2487	1655	677	2535	2612	2007	1313	733	1289	1367
5	740	1466	1094	484	1269	1488	1167	846	515	893
6	227	384	743	563	199	634	892	756	543	349
+gp	232	208	276	250	387	1224	650	344	481	244
TOTAL	17913	22318	22899	19164	14446	13668	11774	10359	10123	10008

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

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	GMST 98-12
AGE												
1	2854	2393	2940	1763	1551	7623	5605	3130	5086	3846	0	3250
2	2597	2024	1860	2325	1323	1116	6106	2730	1828	3839	2725	
3	1599	1876	1181	1377	1569	983	879	4016	1986	1359	2506	
4	1042	913	1010	757	933	1141	757	578	2533	1337	733	
5	896	699	498	558	481	672	833	421	331	1520	704	
6	562	592	406	279	305	322	462	441	171	198	776	
+gp	264	193	279	162	146	170	402	574	246	381	278	
TOTAL	9814	8690	8174	7221	6309	12025	15042	11890	12182	12480	7722	

Table 6.1.12 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Summary of landings and XSA results.

Run title : Megrim (L. whiffiagonis.) in Divisions VIIIc and IXa

At 28/04/2015 14:15

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS Age 1	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 2- 4
1986	10246	2666	2313	705	0.3047	0.3797
1987	13287	2410	1950	537	0.2754	0.3477
1988	11958	2624	2209	858	0.3883	0.4939
1989	10783	2776	2392	761	0.3182	0.4257
1990	13363	2873	2449	1022	0.4173	0.4421
1991	6089	1856	1657	655	0.3953	0.4584
1992	11979	1867	1594	558	0.3501	0.4356
1993	5364	1610	1438	421	0.2929	0.3209
1994	2277	1322	1241	492	0.3965	0.406
1995	10036	1363	1017	258	0.2536	0.2881
1996	10144	1699	1365	373	0.2734	0.2498
1997	7920	1641	1420	408	0.2873	0.2652
1998	4666	1550	1415	482	0.3406	0.3824
1999	2806	1273	1192	386	0.3238	0.3222
2000	4118	1444	1332	288	0.2161	0.3021
2001	3680	1115	999	194	0.1943	0.249
2002	3058	1029	934	136	0.1457	0.1568
2003	3149	1168	1052	149	0.1416	0.1667
2004	3404	978	852	160	0.1878	0.1767
2005	2854	1023	907	166	0.1831	0.2285
2006	2393	975	868	226	0.2604	0.3883
2007	2940	914	780	155	0.1988	0.2462
2008	1763	765	707	144	0.2037	0.2119
2009	1551	751	707	95	0.1343	0.1149
2010	7623	962	765	88	0.115	0.0719
2011	5605	1331	1181	371	0.3141	0.275
2012	3130	1346	1266	293	0.2314	0.2452
2013	5086	1270	1124	250	0.2224	0.201
2014	3846	1438	1311	399	0.3042	0.3622
Arith. Mean	6039	1519	1325	380	0.2645	0.297
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		

Table 6.1.13. Megrim (*L. whiffiagonis*) in Division VIIIc, IXa. Prediction with management option table: Input data

MFDP version 1a
Run: MEG
Time and date: 11:53 10/06/2015
Fbar age range (Total) : 2-4
Fbar age range Fleet 1 : 2-4

Age	2015	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt	Exploit pattern	Weight DWt
	1	3250	0.2	0.34	0	0	0.033	0.005	0.060	0.231	0.031
	2	2302	0.2	0.9	0	0	0.089	0.118	0.098	0.040	0.062
	3	2506	0.2	1	0	0	0.129	0.252	0.131	0.009	0.087
	4	733	0.2	1	0	0	0.162	0.386	0.162	0.004	0.113
	5	704	0.2	1	0	0	0.206	0.524	0.206	0.001	0.133
	6	776	0.2	1	0	0	0.249	0.660	0.249	0.002	0.134
	7	278	0.2	1	0	0	0.371	0.662	0.371	0.000	0.080

Age	2016	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt	Exploit pattern	Weight DWt
	1	3250	0.2	0.34	0	0	0.033	0.005	0.060	0.231	0.031
	2	.	0.2	0.9	0	0	0.089	0.118	0.098	0.040	0.062
	3	.	0.2	1	0	0	0.129	0.252	0.131	0.009	0.087
	4	.	0.2	1	0	0	0.162	0.386	0.162	0.004	0.113
	5	.	0.2	1	0	0	0.206	0.524	0.206	0.001	0.133
	6	.	0.2	1	0	0	0.249	0.660	0.249	0.002	0.134
	7	.	0.2	1	0	0	0.371	0.662	0.371	0.000	0.080

Age	2017	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt	Exploit pattern	Weight DWt
	1	3250	0.2	0.34	0	0	0.033	0.005	0.060	0.231	0.031
	2	.	0.2	0.9	0	0	0.089	0.118	0.098	0.040	0.062
	3	.	0.2	1	0	0	0.129	0.252	0.131	0.009	0.087
	4	.	0.2	1	0	0	0.162	0.386	0.162	0.004	0.113
	5	.	0.2	1	0	0	0.206	0.524	0.206	0.001	0.133
	6	.	0.2	1	0	0	0.249	0.660	0.249	0.002	0.134
	7	.	0.2	1	0	0	0.371	0.662	0.371	0.000	0.080

Input units are thousands and kg - output in tonnes

Table 6.1.14. Megrim (*L. whiffiagonis*) in Div. VIIIc and IXa catch forecast: management option table

MFDP version 1a
Run: MEG
Time and date: 11:53 10/06/2015
Fbar age range (Total) : 2-4
Fbar age range Fleet 1 : 2-4

2015 Biomass	SSB	Total FMult	Landings FBar	Yield	Discards FBar	Yield
1195	1104	1	0.2521	309	0.0174	25

2016 Biomass	SSB	Total FMult	Landings FBar	Yield	Discards FBar	Yield	2017 Biomass	SSB
1091	1002	0	0.0000	0	0.0000	0	1367	1273
.	1002	0.1	0.0252	34	0.0017	3	1322	1229
.	1002	0.2	0.0504	67	0.0035	5	1280	1187
.	1002	0.3	0.0756	98	0.0052	8	1240	1147
.	1002	0.4	0.1008	128	0.0070	11	1201	1109
.	1002	0.5	0.1260	156	0.0087	13	1164	1072
.	1002	0.6	0.1512	183	0.0104	15	1128	1037
.	1002	0.7	0.1764	209	0.0122	18	1094	1004
.	1002	0.8	0.2017	234	0.0139	20	1062	972
.	1002	0.9	0.2269	258	0.0157	22	1030	941
.	1002	1	0.2521	281	0.0174	25	1000	911
.	1002	1.1	0.2773	302	0.0191	27	971	883
.	1002	1.2	0.3025	323	0.0209	29	944	855
.	1002	1.3	0.3277	343	0.0226	31	917	829
.	1002	1.4	0.3529	362	0.0244	33	891	804
.	1002	1.5	0.3781	381	0.0261	35	867	780
.	1002	1.6	0.4033	398	0.0278	37	843	757
.	1002	1.7	0.4285	415	0.0296	39	821	734
.	1002	1.8	0.4537	431	0.0313	41	799	713
.	1002	1.9	0.4789	446	0.0331	43	778	692
.	1002	2	0.5041	461	0.0348	44	758	672

Input units are thousands and kg - output in tonnes

Table 6.1.15. Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Single option prediction: Detail Tables.

MFDP version 1a
Run: MEG
Time and date: 11:53 10/06/2015
Fbar age range (Total) : 2-4
Fbar age range Fleet 1 : 2-4

Year: 2015 F multiplier: 1 Fleet1 HCFbar: 0.2521 Fleet1 DFbar: 0.0174

Age	Catch F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0.005	13	1	0.2307	608	19	3250	107	1105	36	1105	36
2	0.1182	229	23	0.0398	77	5	2302	204	2072	184	2072	184
3	0.252	506	66	0.0089	18	2	2506	324	2506	324	2506	324
4	0.386	214	35	0.0035	2	0	733	119	733	119	733	119
5	0.524	262	54	0.0009	0	0	704	145	704	145	704	145
6	0.6602	343	85	0.002	1	0	776	193	776	193	776	193
7	0.6622	123	46	0	0	0	278	103	278	103	278	103
Total		1691	309		706	25	10549	1195	8174	1104	8174	1104

Year: 2016 F multiplier: 1 Fleet1 HCFbar: 0.2521 Fleet1 DFbar: 0.0174

Age	Catch F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0.005	13	1	0.2307	608	19	3250	107	1105	36	1105	36
2	0.1182	209	21	0.0398	70	4	2102	187	1892	168	1892	168
3	0.252	325	42	0.0089	11	1	1609	208	1609	208	1609	208
4	0.386	461	75	0.0035	4	0	1581	256	1581	256	1581	256
5	0.524	152	31	0.0009	0	0	407	84	407	84	407	84
6	0.6602	151	38	0.002	0	0	341	85	341	85	341	85
7	0.6622	197	73	0	0	0	445	165	445	165	445	165
Total		1508	281		694	25	9735	1091	7379	1002	7379	1002

Year: 2017 F multiplier: 1 Fleet1 HCFbar: 0.2521 Fleet1 DFbar: 0.0174

Age	Catch F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0.005	13	1	0.2307	608	19	3250	107	1105	36	1105	36
2	0.1182	209	21	0.0398	70	4	2102	187	1892	168	1892	168
3	0.252	297	39	0.0089	10	1	1470	190	1470	190	1470	190
4	0.386	296	48	0.0035	3	0	1015	165	1015	165	1015	165
5	0.524	327	67	0.0009	1	0	877	180	877	180	877	180
6	0.6602	87	22	0.002	0	0	197	49	197	49	197	49
7	0.6622	147	55	0	0	0	332	123	332	123	332	123
Total		1376	252		692	24	9242	1000	6887	911	6887	911

Input units are thousands and kg - output in tonnes

Table	**6.1.16**		**Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa** **Stock numbers of recruits and their source for recent year classes used in** **predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes**				
Year-class			2011	2012	2013	2014	2015
Stock No. (thousands)			3130	5086	3250	3250	3250
of		1 year-olds					
Source			XSA	XSA	GM98-12	GM98-12	GM98-12
Status Quo F:							
% in	2015	landings	10.4	20.2	8.3	6.0	-
% in	2016		10.2	24.6	14.1	8.2	6.6
% in	2015	SSB	10.8	29.3	16.7	3.3	-
% in	2016	SSB	8.4	25.5	20.8	16.8	3.6
% in	2017	SSB	5.4	19.8	18.1	20.9	18.4

GM : geometric mean recruitment

Megrim (*L. whiffiagonis*) in Divisions VIIIc aı : Year-class % contribution to

a) 2016 landings **b) 2017 SSB**

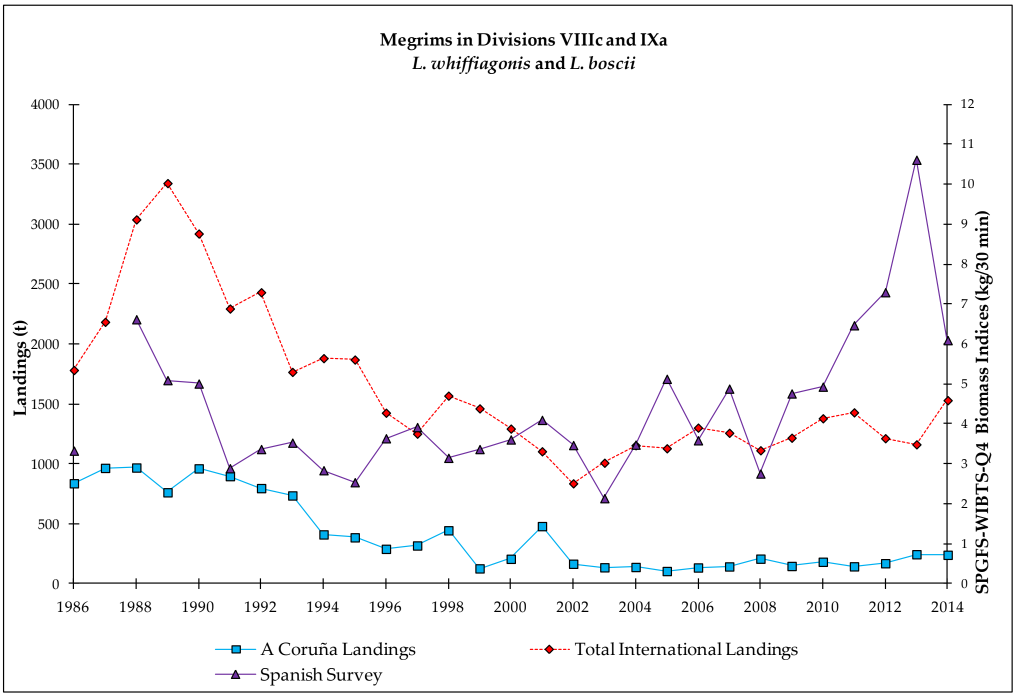
Table 6.1.17. Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa, yield per recruit results.

MFYPR version 2a
Run: MEG
Time and date: 12:14 10/06/2015
Yield per results

Catch	Landings			Discards								
FMult	**Fbar**	**CatchNos**	**Yield**	**Fbar**	**CatchNos**	**Yield**	**StockNos**	**Biomass**	**SpwnNosJan**	**SSBJan**	**SpwnNosSpwn**	**SSBSpwn**
0	0	0	0	0	0	0	5.5167	1.0817	4.7748	1.0528	4.7748	1.0528
0.1	0.0252	0.138	0.0363	0.0017	0.0243	0.0009	4.7083	0.8145	3.9684	0.7858	3.9684	0.7858
0.2	0.0504	0.2174	0.0534	0.0035	0.0478	0.0017	4.1971	0.6551	3.459	0.6265	3.459	0.6265
0.3	0.0756	0.2671	0.0617	0.0052	0.0707	0.0026	3.8368	0.5494	3.1005	0.521	3.1005	0.521
0.4	0.1008	0.3	0.0655	0.007	0.0928	0.0033	3.5643	0.4743	2.8298	0.446	2.8298	0.446
0.5	0.126	0.3223	0.0668	0.0087	0.1143	0.0041	3.3479	0.4182	2.6151	0.3901	2.6151	0.3901
0.6	0.1512	0.3375	0.0668	0.0104	0.1352	0.0048	3.1699	0.3746	2.4388	0.3467	2.4388	0.3467
0.7	0.1764	0.3477	0.0661	0.0122	0.1555	0.0055	3.0194	0.3398	2.29	0.312	2.29	0.312
0.8	0.2017	0.3544	0.0649	0.0139	0.1751	0.0062	2.8897	0.3113	2.1618	0.2836	2.1618	0.2836
0.9	0.2269	0.3585	0.06	0.0157	0.1943	0.0069	2.78	0.2875	2.0497	0.26	2.0497	0.26
1	0.2521	0.3605	0.0618	0.0174	0.2128	0.0075	2.6749	0.2673	1.9503	0.2399	1.9503	0.2399
1.1	0.2773	0.3609	0.0601	0.0191	0.2309	0.0081	2.5843	0.2498	1.8612	0.2226	1.8612	0.2226
1.2	0.3025	0.3601	0.0585	0.0209	0.2484	0.0087	2.5023	0.2347	1.7806	0.2075	1.7806	0.2075
1.3	0.3277	0.3584	0.0568	0.0226	0.2655	0.0093	2.4276	0.2213	1.7073	0.1943	1.7073	0.1943
1.4	0.3529	0.3559	0.0552	0.0244	0.2821	0.0098	2.3591	0.2094	1.6402	0.1826	1.6402	0.1826
1.5	0.3781	0.3527	0.0537	0.0261	0.2982	0.0103	2.2959	0.1988	1.5784	0.1721	1.5784	0.1721
1.6	0.4033	0.3491	0.0521	0.0278	0.3139	0.0109	2.2374	0.1892	1.5212	0.1626	1.5212	0.1626
1.7	0.4285	0.345	0.0507	0.0296	0.3291	0.0114	2.183	0.1805	1.4681	0.154	1.4681	0.154
1.8	0.4537	0.3407	0.0492	0.0313	0.344	0.0118	2.1323	0.1726	1.4187	0.1462	1.4187	0.1462
1.9	0.4789	0.3361	0.0479	0.0331	0.3584	0.0123	2.0848	0.1654	1.3725	0.1391	1.3725	0.1391
2.0	0.5041	0.3312	0.0465	0.0348	0.3724	0.0128	2.0403	0.1587	1.3292	0.1325	1.3292	0.1325

Reference point	F multiplier	Absolute F
Fleet1 Landings Fbar(2-4)	1	0.2521
FMax	0.5484	0.1382
F0.1	0.3069	0.0774
F35%SPR	0.5468	0.1378

Weights in kilograms



*** Spanish Landings of 2008 revised in WG2010 from original value presented**

Figure 6.1.1 Historical landings and biomass indices of Spanish survey of megrims (both species combined).

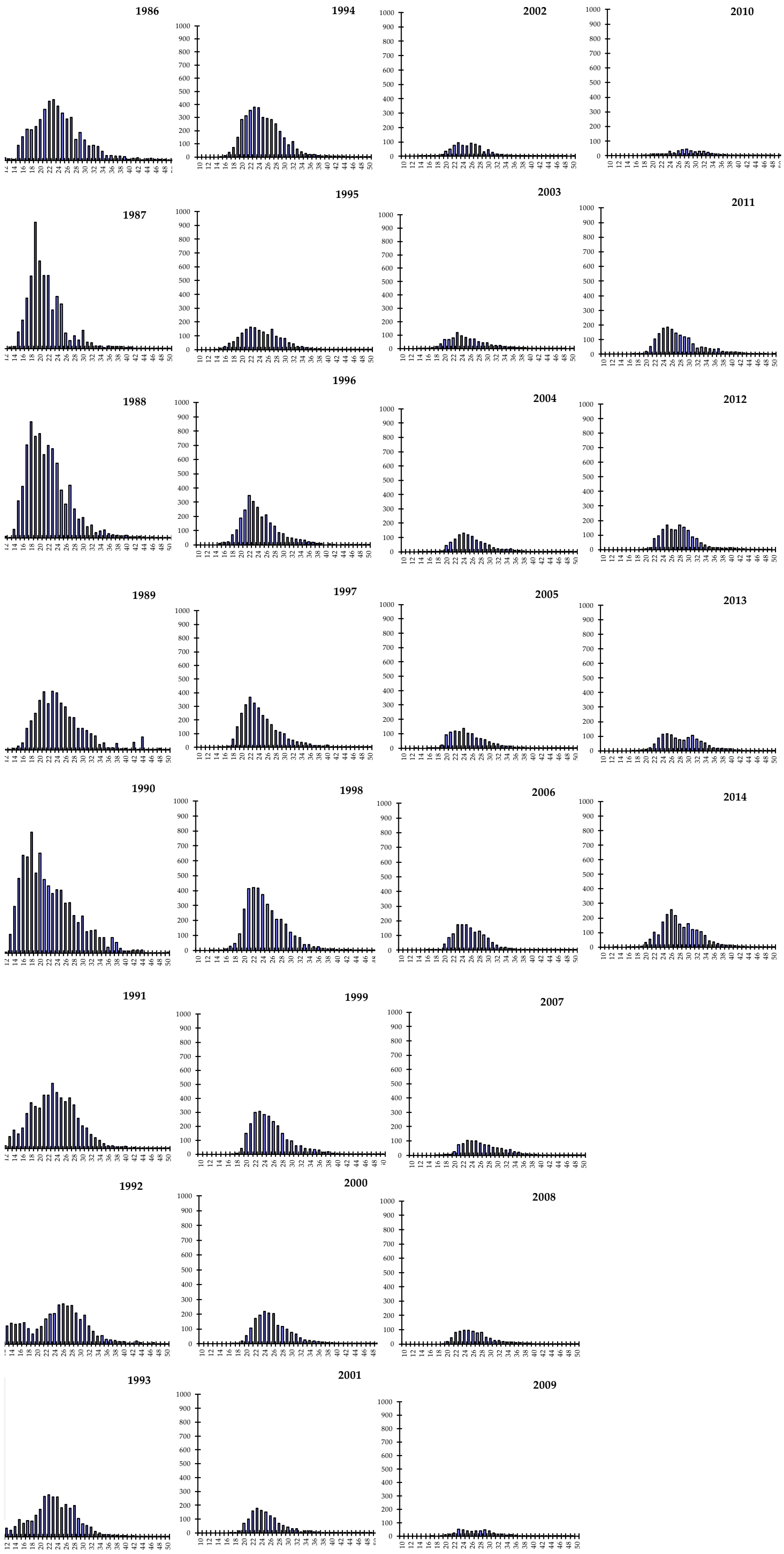
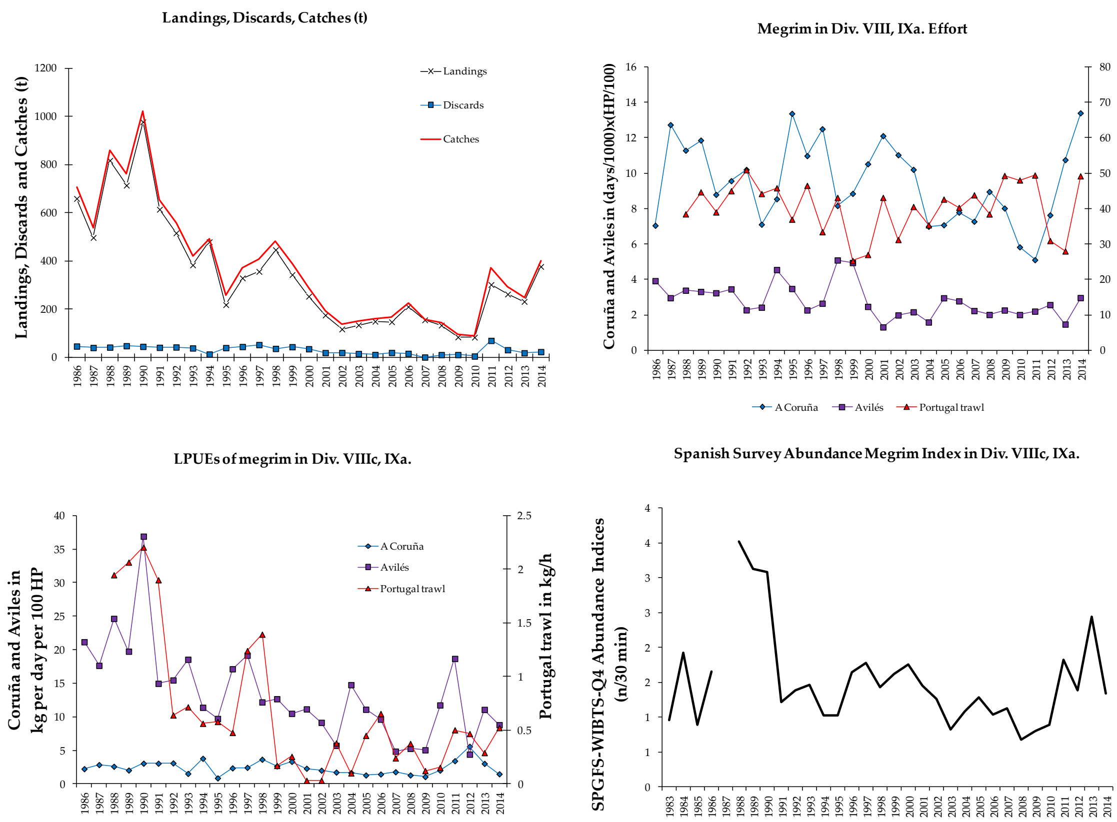


Figure 6.1.2 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Annual length compositions of landings ('000)

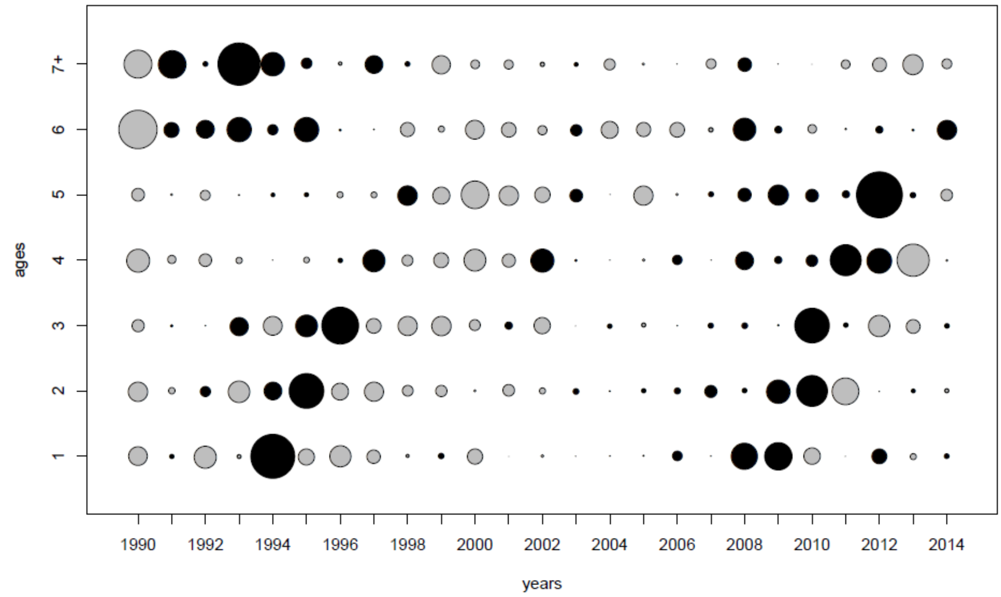


Spanish Landings of 2008 revised in WG2010 from original value presented

*** Portuguese Trawl Effort of 2007 and 2008 revised in WG2010 from original value presented**

Figure 6.1.3(a) Megrim (*L.whiffiagonis*) in Divisions VIIIc, IXa. Catches (t), Efforts, LPUEs and Abundance Indices.

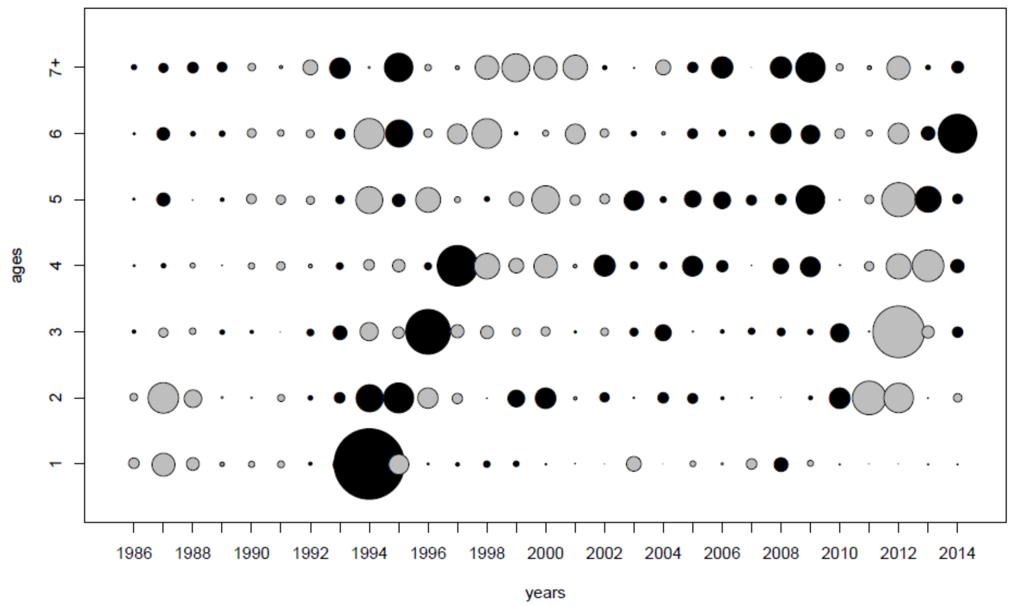
Standardized log (abundance index at age) from survey SpGFS-WIBTS-Q4 (black bubbles means <0)



*** 2013 data not included in the assessment**

Figure 6.1.3(b): Megrim (*L. whiffiagonis*) in Divisions VIIIc & IXa

Standardized log (abundance index at age) from A Coruña fleet (SP-LCGOTBDEF)
(black bubble means < 0)



Standardized log (abundance index at age) from Avilés fleet (SP-AVSOTBDEF)
(black bubble means < 0)

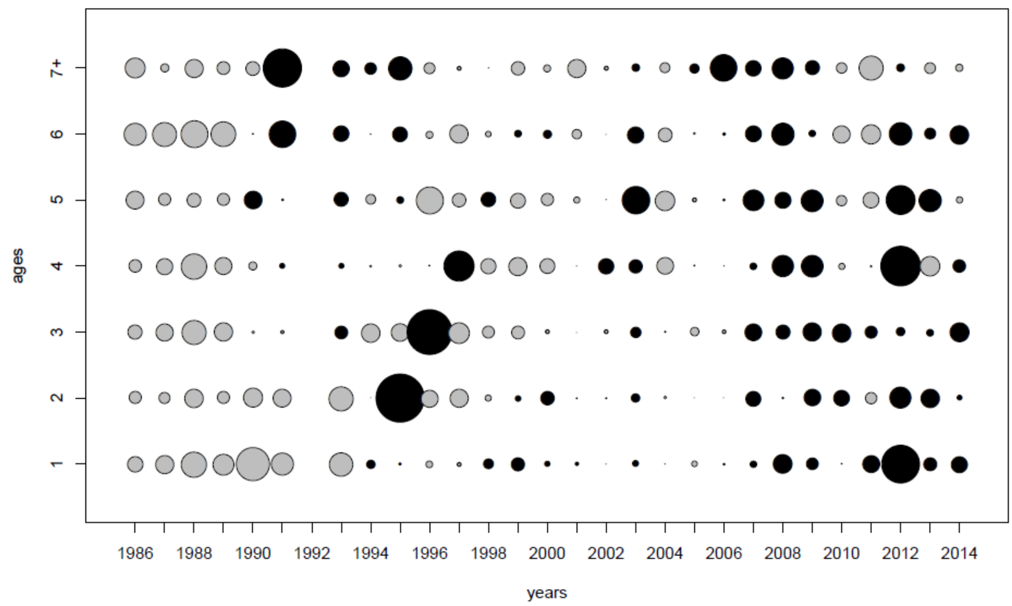
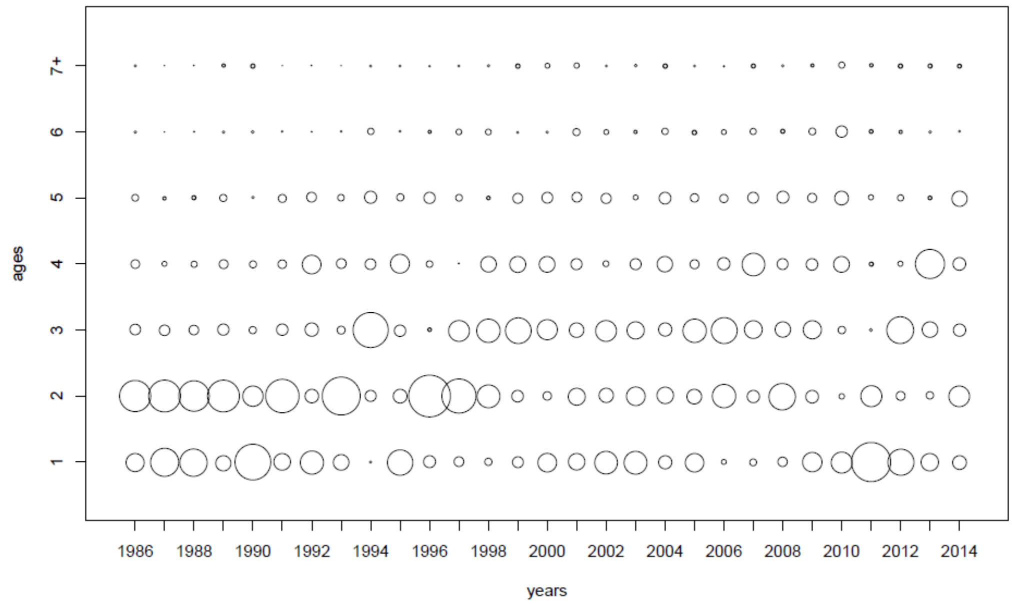


Figure 6.1.3(c): Megrim (*L. whiffiagonis*) in Divisions VIIIc & IXa

Catches proportions at age



Standardized catches proportions at age (black bubble means < 0)

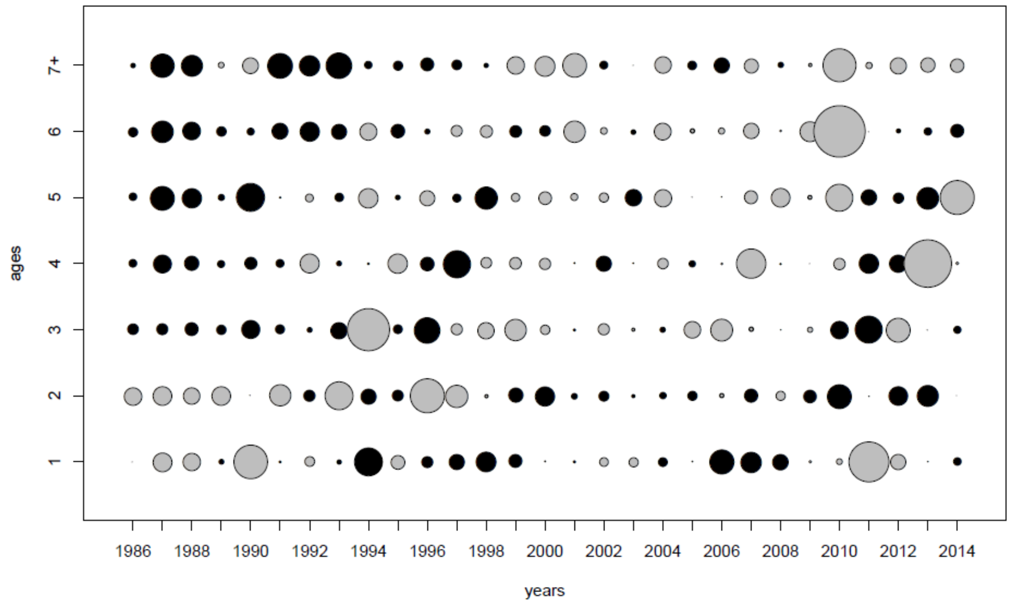
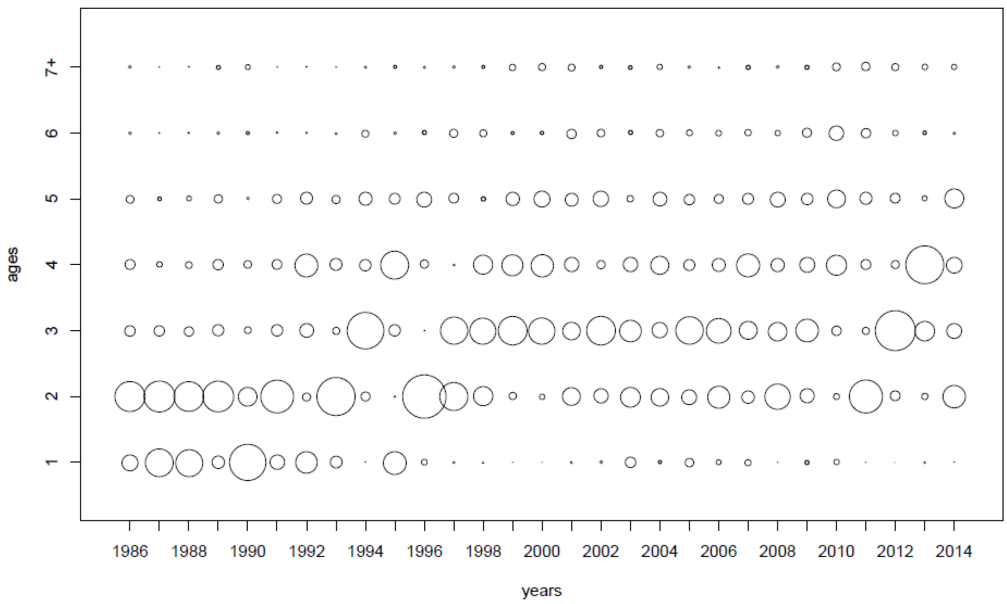


Figure 6.1.4(a). Megrim (*L. whiffiagonis*) in Divisions VIIIc & IXa.

Landings proportions at age



Standardized landings proportions at age (black bubble means < 0)

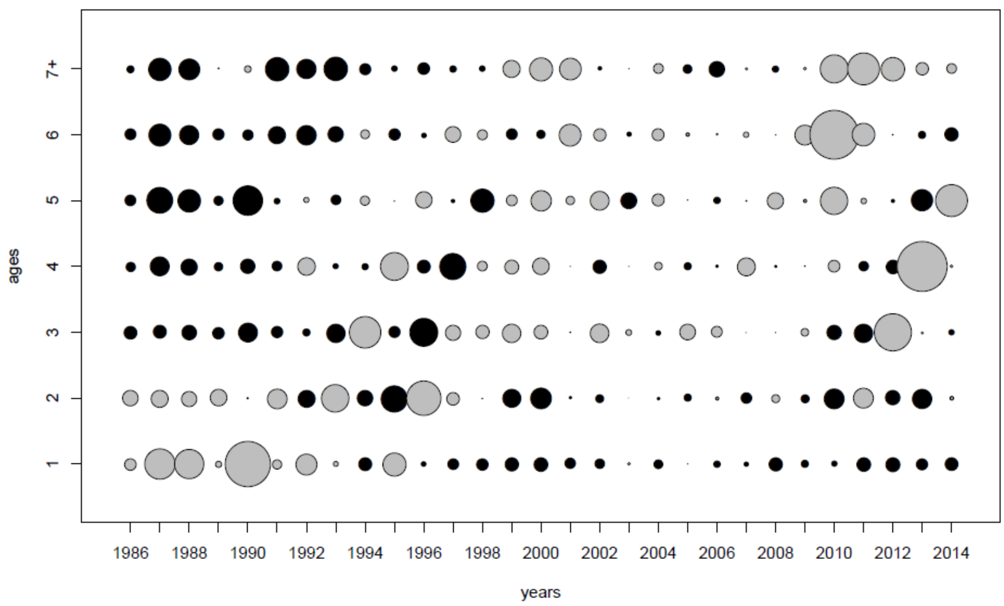
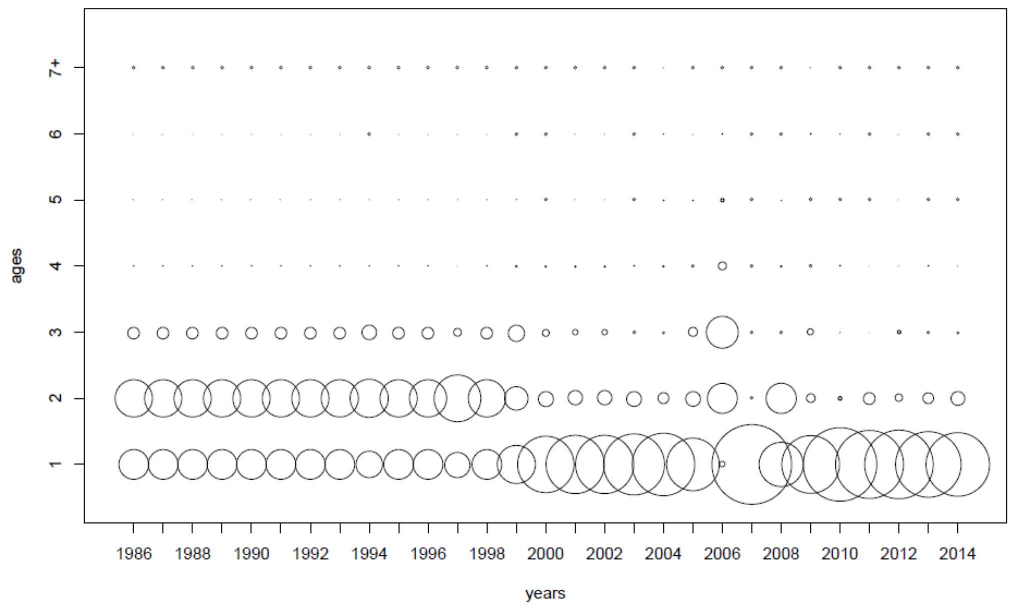


Figure 6.1.4(b). Megrim (*L. whiffiagonis*) in Divisions VIIIc & IXa.

Discards proportions at age



Standardize discards proportions at age (black bubble means < 0)

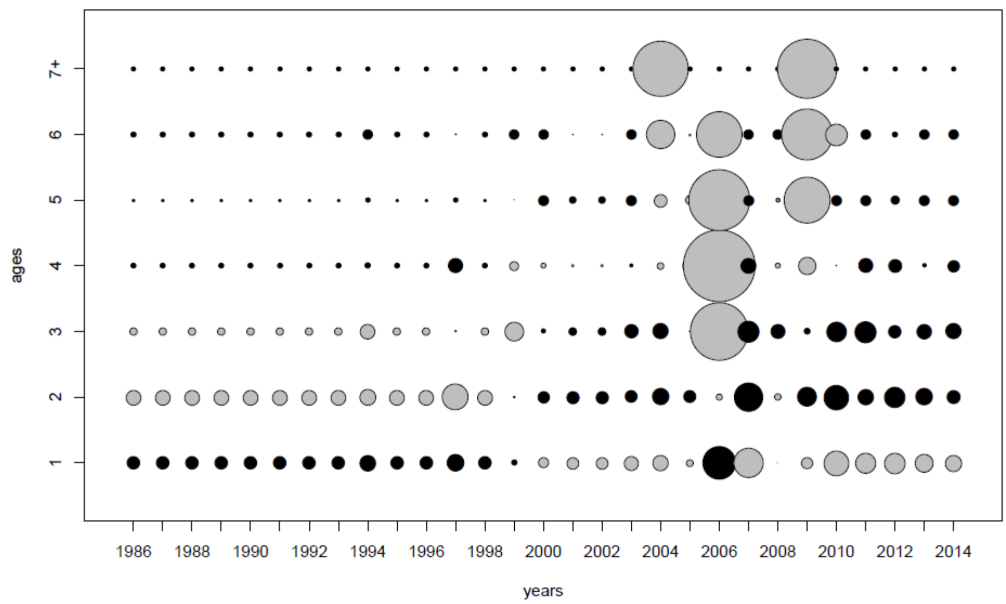


Figure 6.1.4(c). Megrim (*L. whiffiagonis*) in Divisions VIIIc & IXa.

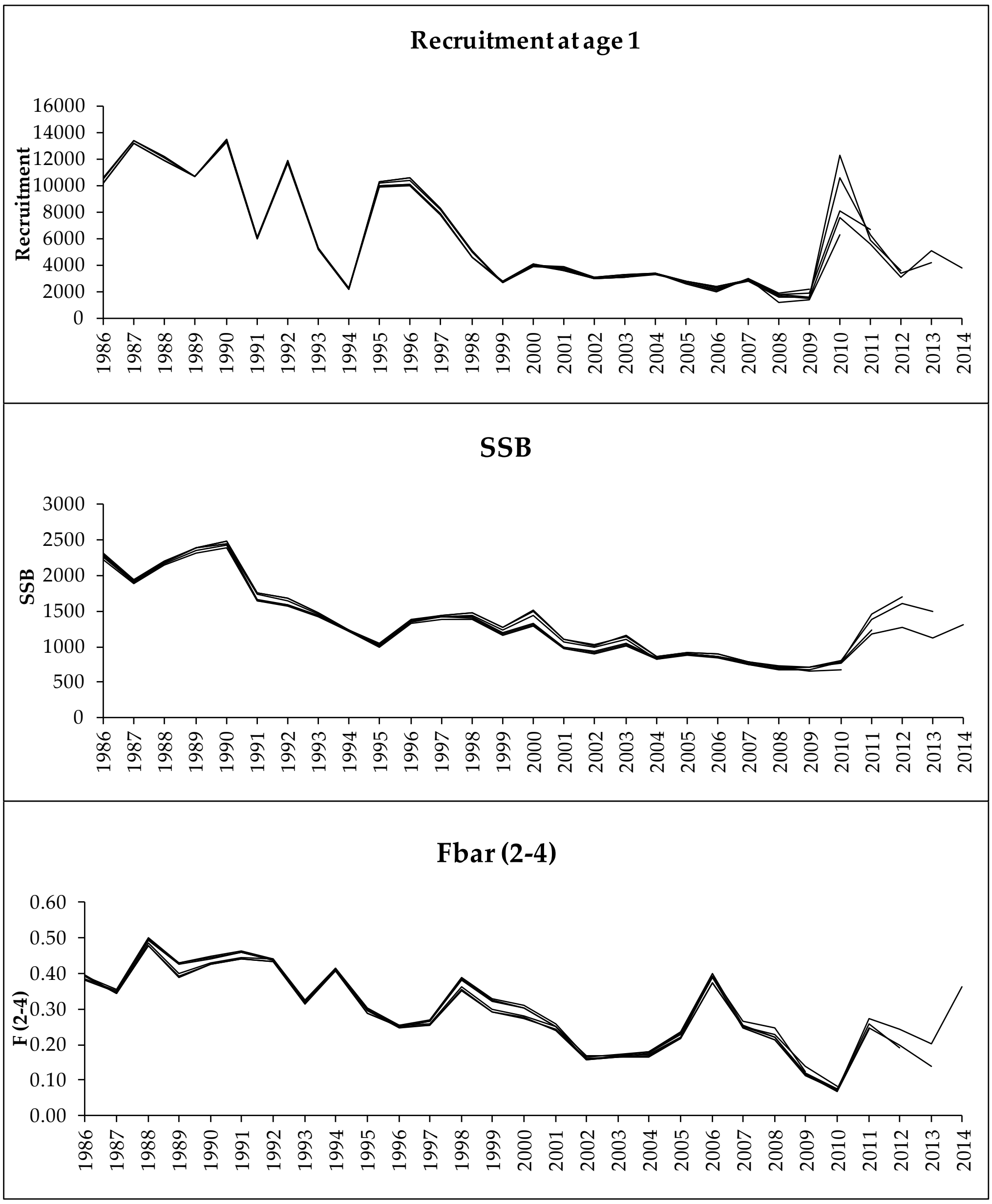


Figure 6.1.5. Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Retrospective XSA

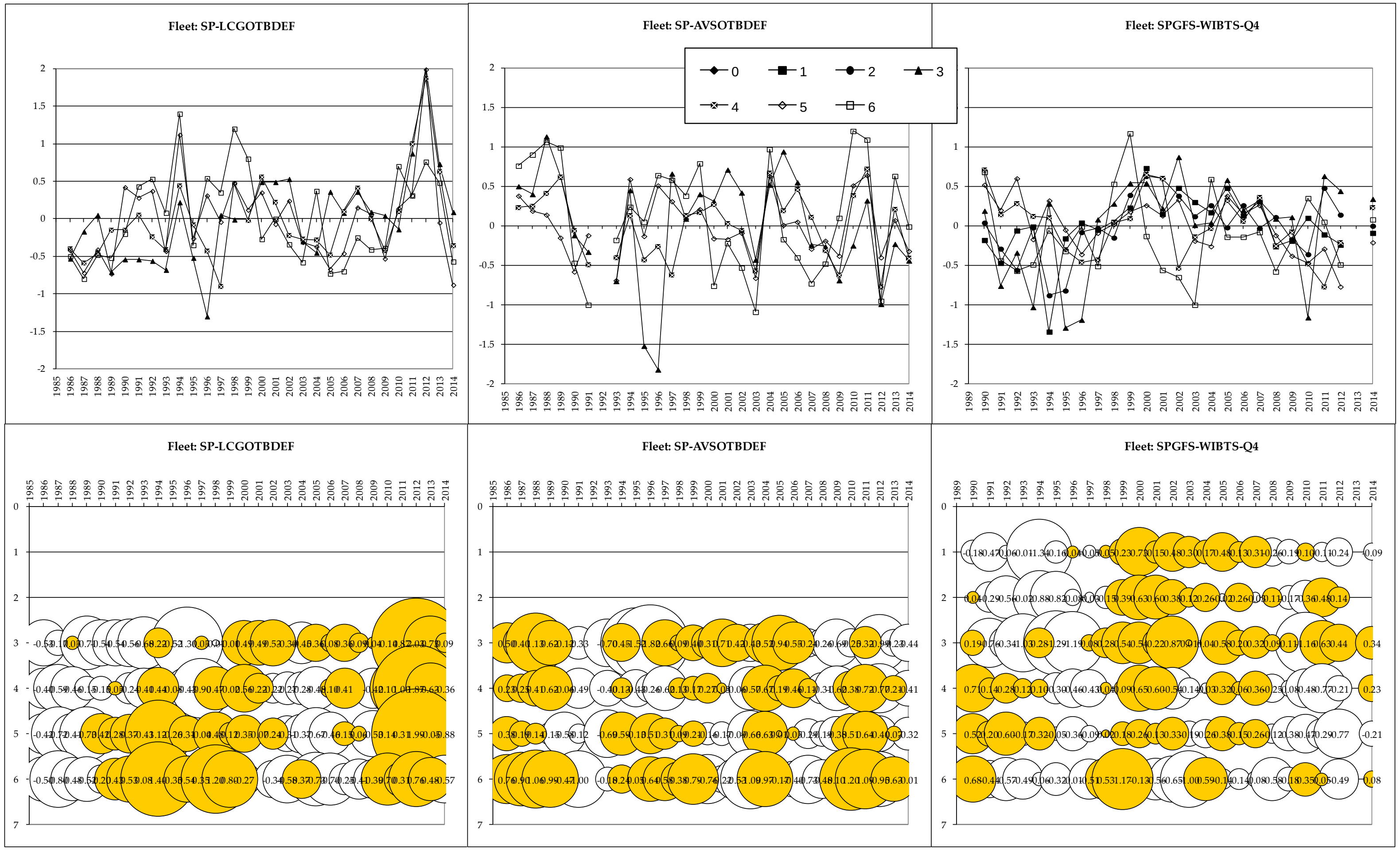


Figure 6.1.6. Megrim in Divisions VIIIc and IXa. LOG CATCHABILITY RESIDUAL PLOTS (XSA)

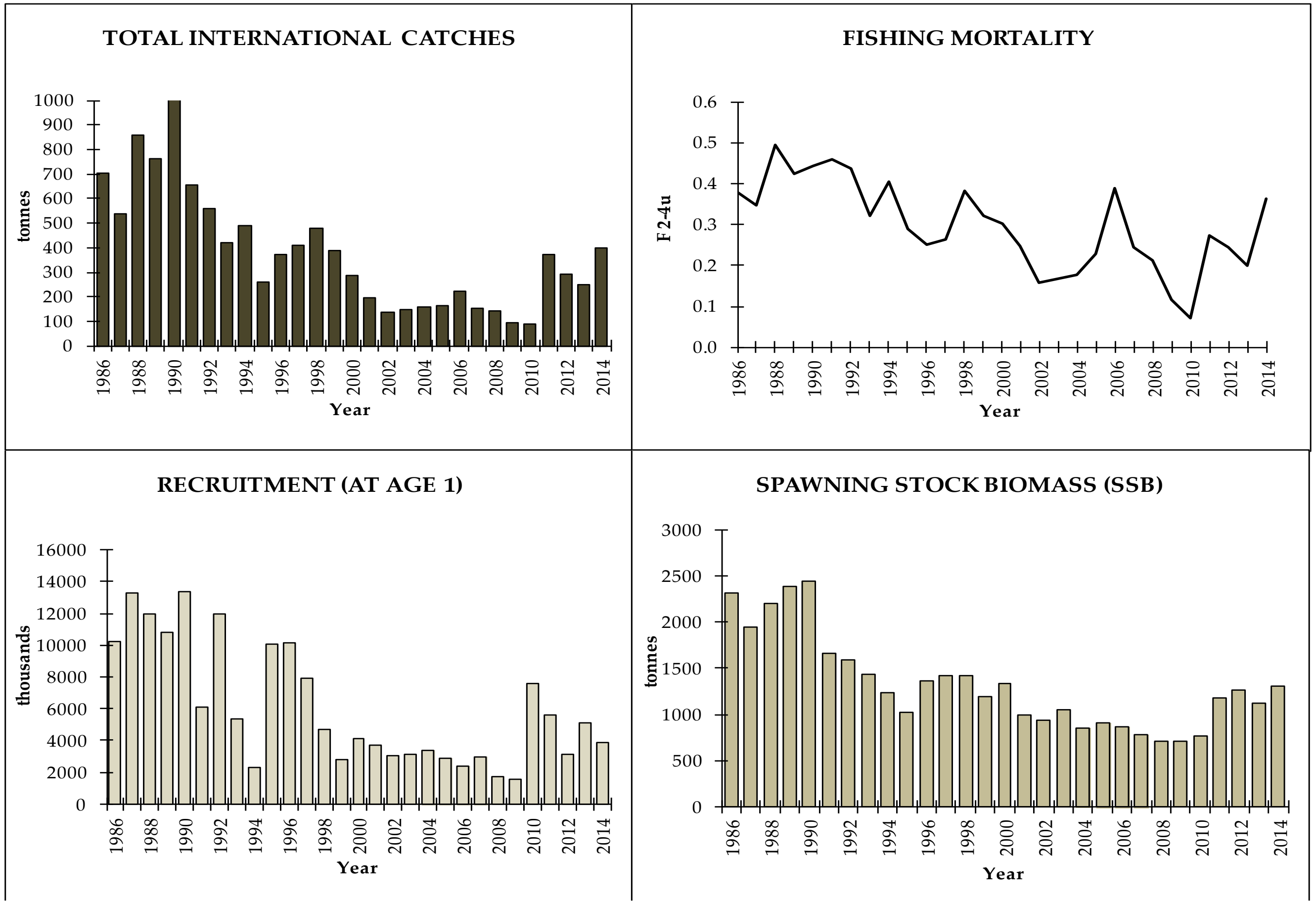
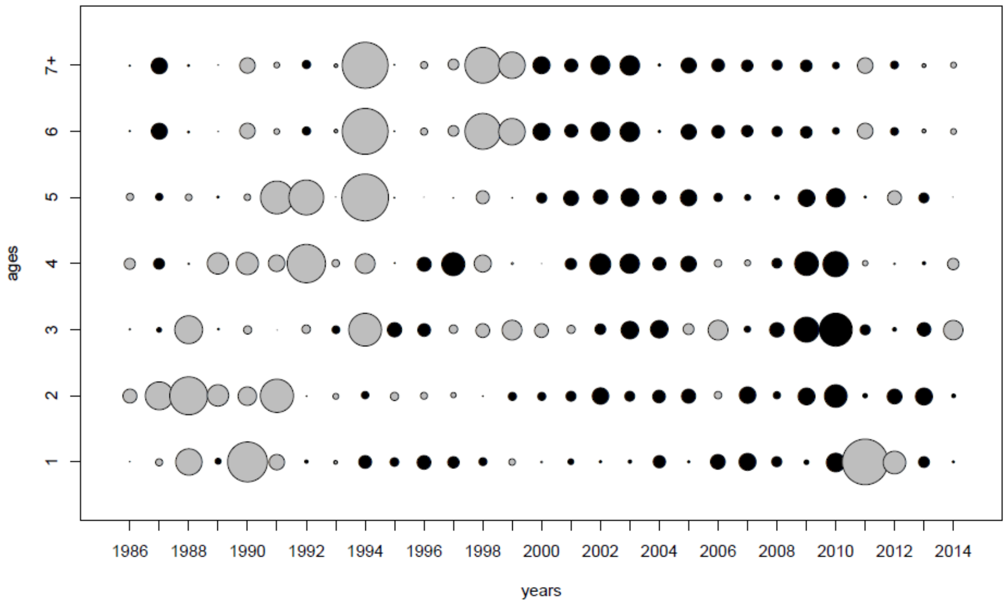


Figure 6.1.7(a) Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Stock Summary

Standardized F-at-age (black bubbles means <0)



Standardized relative F-at-age (black bubble means < 0)

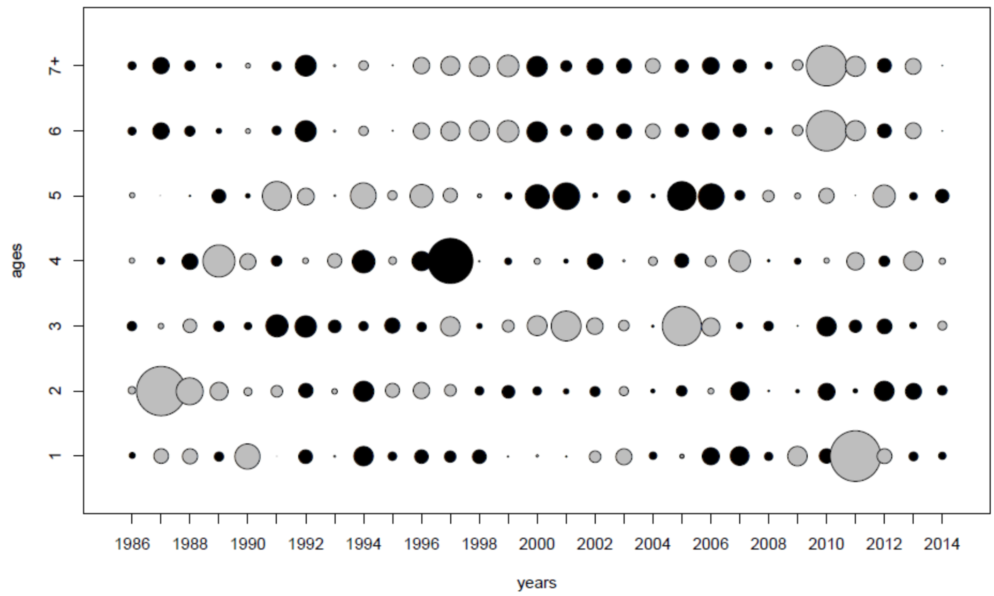
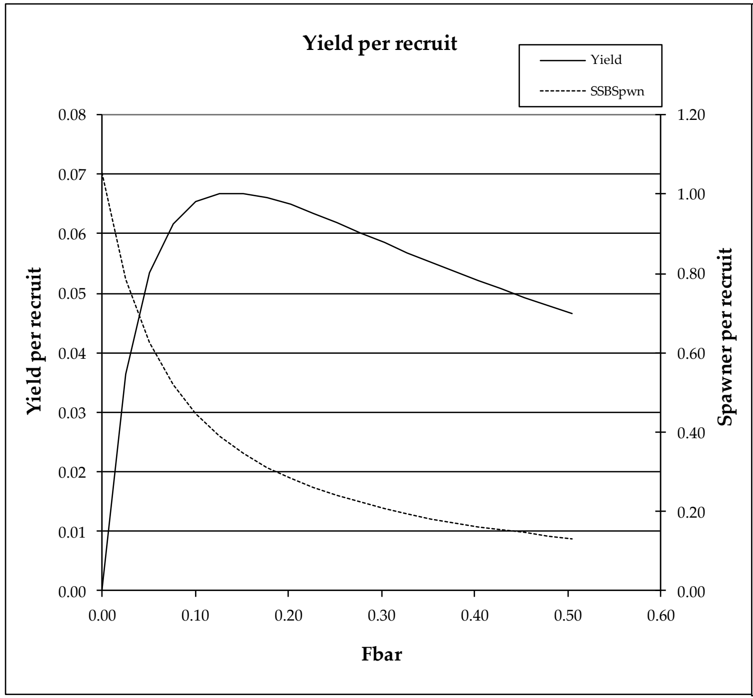
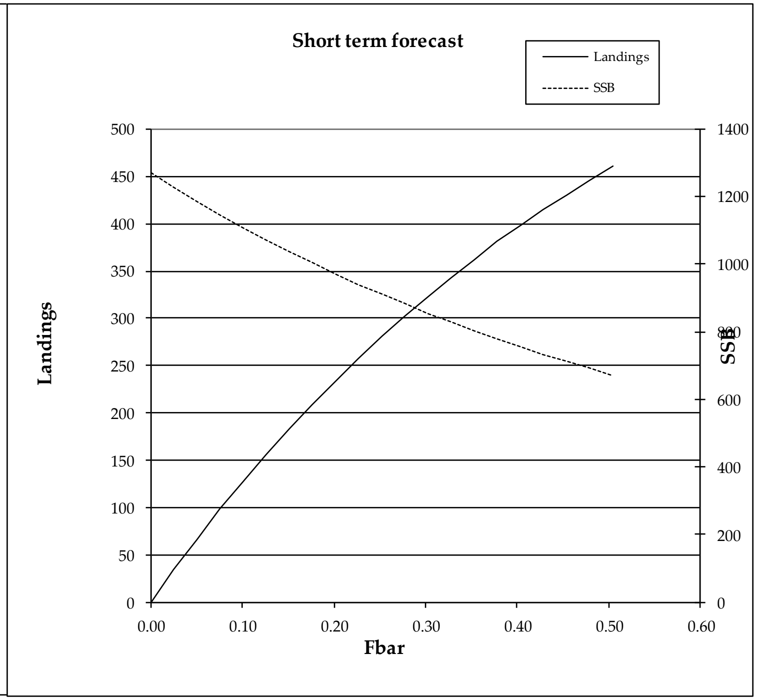


Figure 6.1.7(b): Megrim (*L. whiffiagonis*) in Divisions VIIIc & IXa





MFYPR version 2a
Run: MEG
Time and date: 12:14 10/06/2015

Reference point	F multiplie	Absolute F
Fleet1 Landings Fbar(2-4)	1.0000	0.2521
FMax	0.5484	0.1382
F0.1	0.3069	0.0774
F35%SPR	0.5468	0.1378

MFDP version 1a
Run: MEG
Time and date: 11:53 10/06/2015
Fbar age range (Total) : 2-4
Fbar age range Fleet 1 : 2-4

Input units are thousands and kg - output in tonnes

Figure 6.1.8. Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa, forecast summary

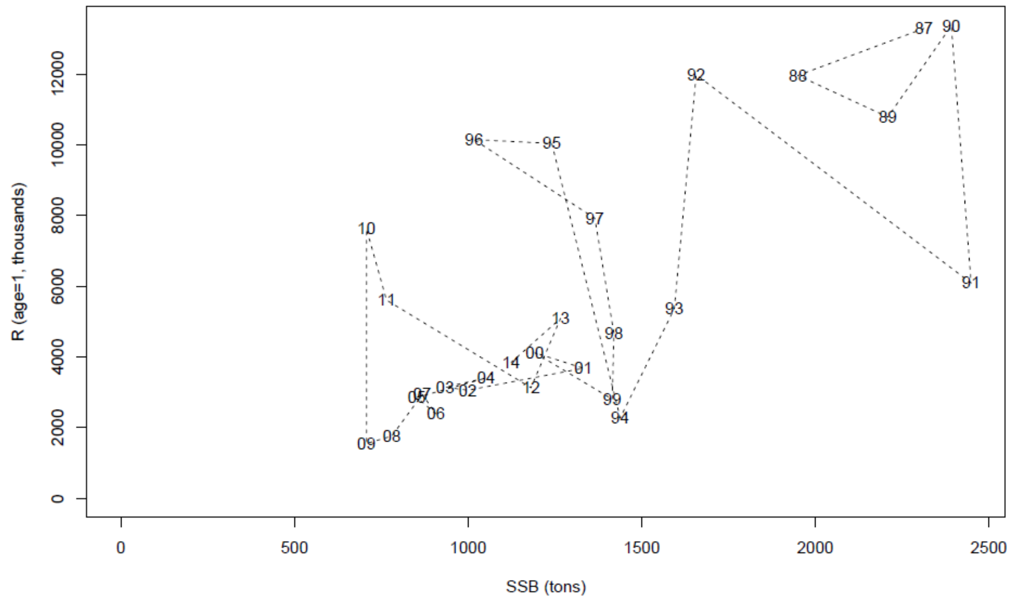


Figure 6.1.9. Megrim (*L.whiffiagonis*) in Divisions VIIIc and IXa. SSB-Recruitment plot.

(numbers in graph, 1987-2014, are recruitment years)

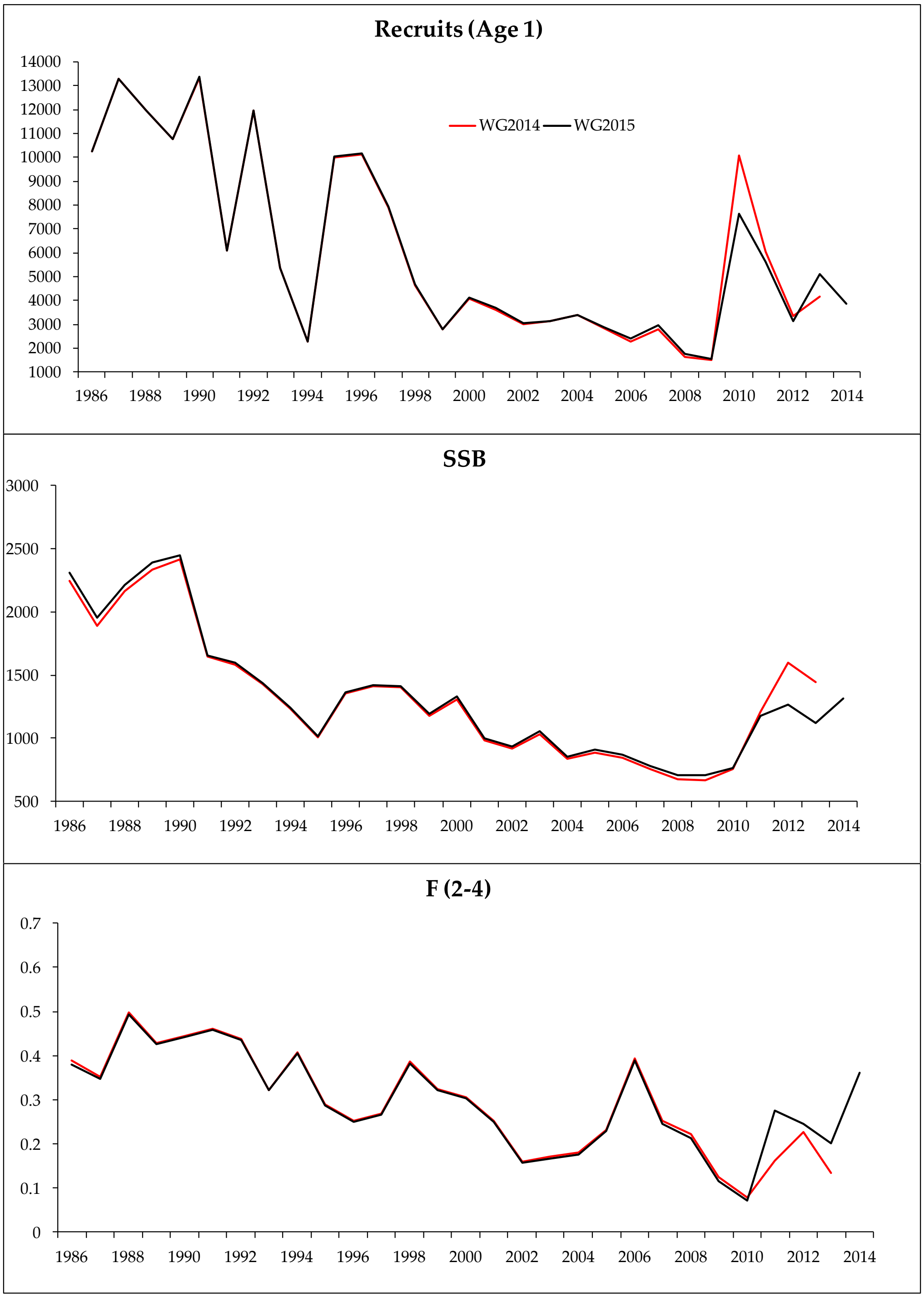


Figure 6.1.10. Megrim (*L. whiffiagonis*) in Div. VIIIc and IXa. Recruits, SSB and F estimates from WG14 and WG15

6.2 Four-spot megrim (*Lepidorhombus boscii*)

6.2.1 General

See general section for both species.

6.2.2 Data

6.2.2.1 Commercial catches and discards

The WG estimates of four-spot megrim international landings, discards and catches for the period 1986 to 2013 are given in Table 6.2.1. Estimates of catches presently include an unallocated landing category. These estimates are considered the best information available at this time. However, given that the method of calculating them changed in 2013, the WG recommended to review the time series of unallocated landings for this stock following the same criteria. Data revised have been provided for period 2011-2013. Because this method is better to calculate the proportion between the two megrims species due to the improvement in the allocation of sampling trips, data revised have been used in the assessment. Landings reached a peak of 2629 t in 1989 and have generally declined since then to their lowest value of 720 t in 2002. There has been some increase again in the last few years. Landings in 2010 are 1297 t, the highest value after 1995. After a similar value in 2011, landings in 2013 are 931 t, a significant drop. In 2014, landings increase to 1154 t.

Discards estimates were available from "observers on board sampling programme" for Spain in the years displayed in Table 6.2.2(a). Discard / Total Catch ratio and CV are also presented, where discards in number represent between 39-67% of the total catch. Following the ICES recommendations in the advice sheet and using the same methodology described for *L. whiffiagonis* in section 6.1.2.1, discards missing data were also estimated for *L. boscii* in the Benchmark WKSOUTH in 2014. Spanish discards in numbers-at-age are shown in Table 6.2.2(b), indicating that the bulk of discards (in numbers) is for ages 1 to 3 Total discards are given in tons in Table 6.2.1

6.2.2.2 Biological sampling

Annual length compositions of total stock landings are given in Figure 6.2.1 and Table 6.2.3(a) for the period 1986-2014. Unallocated value is raised to total length distribution.

.

Mean length and weights in landings since 1990 are shown in the Table 6.2.3(b).

Age compositions of catches are presented in Table 6.2.4 Weights-at-age of catches (given in Table 6.2.5) were also used as weights-at-age in the stock. There is some variability in the weights-at-age through the historical time series.

For more information about biological data see Stock Annex.

6.2.2.3 Abundance indices from surveys

Portuguese and Spanish survey indices are summarised in Table 6.2.6.

Two Portuguese surveys, named "Crustacean"´ (PT-CTS (UWTV(FU28-29))) and "October"´ (PtGFS-WIBTS-Q4), provide indices for 2014. The October survey was conducted with a different vessel and gear in 2003 and 2004. Excluding these two years, the biomass indices from this survey in 2007 and 2011 were the highest observed since 1994, whereas the value in 2010 is the second lowest in the series. In 2011, both the biomass and abundance indices from the Crustacean survey are the highest in the time series. In 2012, Portuguese Survey was not carried out due to budgetary constraints of national scope turned unfeasible to repair the R/V. In 2014 shows a low value of abundance.

Total biomass, abundance and recruitment indices from the Spanish Groundfish Survey (SpGFS-WIBTS-Q4) are also presented in Table 6.2.6. Total biomass indices from this survey generally remained stable after a maximum level in 1988 till 2003, when a very low value was obtained (as done in previous years, the 2003 index has been excluded from the assessment, as it was felt to be too much in contradiction with the rest of the time series). Since then, this was followed by the period of the higher values till present days, with the only exception of 2008. In 2013, the biomass and the abundance indices were the highest of the series. For the same raison that for *L. whiffiagonis*, survey carried out in a new vessel and with new fishing doors, the abundance values of 2013 is not included in the assessment models.

The recruitment index for age 0 in 2005 was very high and also in 2009 and 2014. After two years in low levels, in 2012 the recruitment index shows a small increase, being lower in 2013. The high index in 2009 applies to all ages and not just the recruitment (see Table 6.2.7, which gives abundance indices by age, and Figure 6.2.2, which is a bubble plot of log(abundance index at age) standardised by subtracting the mean and dividing by the standard deviation over the years). It seems to be a "year" effect in 2013 values, probably due to the new vessel. In 2014, only age 1 index is below average, whereas indices for the other ages are very high. From Figure 6.2.2, the survey appears to have been quite good at tracking cohorts, in the last ten years, good cohorts of 2005 and 2009 can be followed, specially the second one.

6.2.2.4 Commercial catch-effort data

Two new commercial tuning indices were provided also for this stock as in the case of *L. whiffiagonis*. The LPUEs of the métiers of bottom otter trawl targeting demersal species, previously describe in section 6.1.2.4, one per port (A Coruña and Avilés), were made available for the benchmark WKSOUTH in 2014. From these new tuning fleets, SP-LCGOTBDEF and SP-AVSOTBDEF, only the first one was accepted to tune the assessment model. The LPUEs and effort values and landed numbers-at-age are given in Table 6.2.7 and Figure 6.2.3(a).

These fleets operate in different areas, each covering only a small part of the distribution of the stock, which may partly explain differences between patterns from these fleets and those from the Spanish survey in some years. Furthermore, commercial catches are mostly composed of ages 3 and 4, while the Spanish survey catches mostly fish of ages 1 and 2.

Table 6.2.8 displays landings (in tonnes), fishing effort and LPUE for the two Spanish trawl fleets just mentioned for the period 1988-2014 and for the Portuguese trawl fleet fishing in Division IXa for the period 1988–2014 (see also Figure 6.2.3). After very high value in 2010, the LPUE of Coruña (SP-LCGOTBDEF) shows in 2014 a similar value to 2012, decreasing in relation to last year. A decrease is observed in the LPUE from Avilés (SP-AVSOTBDEF) in 2014. For the Portuguese fleets, until 2011 most log-books were filled in paper but have thereafter been progressively replaced by e-logbooks. In 2013 more than 90% of the log-books are being completed in the electronic version. The LPUE series were revised from 2012 onwards. To revise the series backwards further refinement of the algorithms is required.

Commercial fleets used in the assessment to tune the model

Because of the trend in the residuals, A Coruña fleet (SP-LCGOTBDEF) was split in two (SP-LCGOTBDEF -1 and SP-LCGOTBDEF-2) for tuning, considering values until 1999 and from 2000 to 2014, as indicated in the Stock Annex. In Figure 6.2.3(b), the bubble plots of log(abundance index at age) standardised by subtracting the mean and dividing by the standard deviation over the years) of these two fleets are presented. Some cohorts can be followed in the time series. The effort of this fleet had been generally stable till year 2009, when effort is declining to its lowest value in the series, reached in 2011. After this year, the effort is increasing, being the 2014 value the highest of the time series.

Commercial fleets not used in the assessment to tune the model

The effort of the Avilés fleet (SP-AVSOTBDEF) present two periods, the first one with a mean value of 3.2 and the second with 2.2 (days/1000)x(HP/100). The value in 2013 is the second lowest in the series, increasing in 2014.

The effort of the Portuguese trawl fleet appears to fluctuate within stable bounds, with the lowest values corresponding to 1999 and 2000. It shows a slightly declining trend through the 1990s until these two lowest years and a slightly increasing one since then.

The LPUE series from the Avilés trawl fleet (SP-AVILESTR) shows a generally upwards trend during all the series. The value in 2013 is a big increase. The LPUE of the Portuguese trawl fleet has generally declined since 1992, with an increase in the last year till 2010, when the values started a decreasing trend. The value in 2014 shows a small increase.

6.2.3 Assessment

An update assessment was conducted, according to the Stock Annex specifications. Assessment years are 1986-2014 and ages 0-7+.

6.2.4 Model

Data screening

Figures 6.2.4(a), (b) and (c) are bubble plots representing catch, landings and discards proportions at age. These plots clearly indicate that the bulk of the landings generally corresponds to ages 2 to 4 and the discards at ages 1-2. The bottom panel of Figures 6.2.4(a), (b) and (c) also present bubble plots corresponding to standardized catch, landings and discards proportions at age, showing that the one corresponding to landings is the best to follow cohorts.

Very weak cohorts corresponding to year classes of 1993 and 1998 can be clearly identified from the standardized landing proportions at age matrix and good cohorts corresponding to year classes of 1991, 1992, 1995 and 2005 can also be tracked.

Final XSA run

Settings for the assessment are those detailed in the Stock Annex.

The retrospective analysis shows no particular worrying features (Figure 6.2.5). The model has a tendency to underestimate F and an overestimate SSB in the last years.

6.2.4.1 Assessment results

Diagnostics from the XSA final run are presented in Table 6.2.9 and log catchability residuals plotted in Figure 6.2.6. Diagnostics and residuals are similar to those found in the previous assessment. Many of the survey residuals are negative until the mid 1990's. After that, positive survey residuals are more abundant in this period.

Table 6.2.10 presents the fishing mortality-at-age estimates. Fbar (=$F_{2\text{-}4}$) is estimated to be 0.39 in 2014.

Population numbers-at-age estimates are presented in Table 6.2.11.

6.2.4.2 Year class strength and recruitment estimations

The 2012 year class estimate is 78 million individuals, obtained by averaging estimates coming from the Spanish survey tuning data (92% of weight)and F-shrinkage (8% weight).

The 2013 year class estimate is 42 million individuals, estimated from the Spanish survey (93% of weight) and F-shrinkage (7% weight).

The 2014 year class estimate is 121 million individuals, obtained a value from the Spanish survey (100% weight).

The working group considered that the XSA last year recruitment is poorly estimated. Following the procedure stated in the Stock Annex, the geometric mean of estimated recruitment over the years 1990-2012 has been used for computation of 2014 and subsequent year classes, for prediction purposes. Working Group estimates of year-class strength used for prediction are:

Recruitment at age 0:

Year class	Thousand	Basis	Survey	Commercial	Shrinkage
2012	77937	XSA	92%	-	8%
2013	41612	XSA	93%	-	7%
2014	43560	GM90-12		-	
2015	43560	GM90-12			

6.2.4.3 Historic trends in biomass, fishing mortality, and recruitment

Estimated fishing mortality and population numbers-at-age from the XSA run are given in Tables 6.2.10 and 6.2.11. Further results, including SSB estimates, are summarised in Table 6.2.12 and Figure 6.2.7(a).

SSB decreased gradually from 6790 t in 1989 to 3316 t in 2001, the lowest value in the series, and has since increased. In 2014 the SSB is estimated at 6725 t, one of the highest.

Recruitment has fluctuated around 45 million fish during all the series. Very weak year classes are found in 1993 and 1998. The second highest value occurred in 2009, while 2014 value is the highest in the series, with 121 million fish.

Estimates of fishing mortality values show two different periods: an initial one with higher values from 1989 to 1996 and, following a decrease in 1997, a second period stabilised at a lower level, with small ups and downs. From 2007, the F has been decreasing till the last two years, especially in the last, when a significant increase has occurred with a value of 0.39.

There seems to be interannual variability in the relative fishing exploitation pattern at age (F over Fbar, see Figure 6.2.7(b), bottom panel), with alternating periods of time with higher and lower relative exploitation pattern on the older ages.

6.2.5 Catch options and prognosis

Stock projections were calculated according to the settings specified in the Stock Annex.

6.2.5.1 Short-term projections

Short-term projections have been made using MFDP software. The input data for deterministic short-term projections are given in Table 6.2.13. The exploitation pattern used was the scaled F-at-age computed for each of the last five years and then the average of these scaled 2010-2014 years was weighted to the final year. This selection pattern was split into selection-at-age of landings and discards (corresponding to Fbar = 0.19 for landings and Fbar=0.11 for discards, being 0.30 for catches). The recruitment in 2014 (age 0) has been replaced by GM, age 1 in 2015 has been recalculated from GM reduced by total estimated mortality.

Table 6.2.14 gives the management options for 2016, and their consequences in terms of projected landings and stock biomass. Figure 6.2.8 (right panel) plots short-term yield and SSB versus Fbar. The detailed output by age group, assuming F *status quo* for 2015-2017, is given in Table 6.2.15 for landings and discards. Under this scenario, projected landings for 2015 and 2016 are 1363 and 1392 t, respectively. Projected discards for the same years are 436 and 393 t.

Under F *status quo*, projected SSB values for 2016 and 2017 are about 6462 t in 2016 and 6075 t in 2017.

The contributions of recent year classes to the projected landings and SSB are presented in Table 6.2.16 (under F *status quo*). The year classes for which GM_{90-12} recruitment is assumed contribute in a 18% to catches in 2016 and with a 41% to SSB in 2017.

6.2.5.2 Yield and biomass per recruit analysis

The analysis is conducted following the Stock Annex specifications and results presented in Table 6.2.17. The left panel of Figure 6.2.8 plots yield-per-recruit and SSB-per-recruit versus Fbar.

Under F s*tatus quo* (Fbar = 0.19 for landings and Fbar=0.11 for discards), yield-per-recruit is 0.02 kg for landings and 0.01 kg for discards and SSB-per-recruit is 0.12 kg. Assuming GM_{90-12} recruitment of 44 million, the equilibrium yield would be around 1080 t of landings and 375 t of discards, with an SSB value of 5345 t.

6.2.5.3 Biological reference points

The stock-recruitment time series is plotted in Figure 6.1.9. See Stock Annex for more information about Biological reference points.

The BRP are:

	Type	Value	Technical basis
MSY	MSY Btrigger	4600 t	default option; 1.4 Blim
Approach	FMSY	0.17	Fmax as FMSY proxy
	Blim	3300 t	Bloss in the 2014 benchmark assessment
Precautionary	Bpa	4600 t	default option; 1.4 Blim
Approach	Flim		
	Fpa		

6.2.6 Comments on the assessment

Two commercial fleets (SP-LCGOTBDEF-1 and SP-LCGOTBDEF-2) and the Spanish survey (SpGFS-WIBTS-Q4) were used for tuning. The commercial fleet data used for tuning corresponds to ages 3 and older, which are not well represented in the survey. The Spanish survey covers a large part of the distribution area of the stock. The survey appears to have been quite good at tracking cohorts.

With the new settings, discards data and new tuning fleets, the model converges. It seems that the convergence issue is solved for this stock.

Comparison of this assessment with the one performed in 2014 shows minor differences except for the recruitment in recent years which have been revised upward (Figure 6.2.10).

6.2.7 Management considerations

This assessment indicates that SSB decreased substantially between 1988 and 2001, the year with lowest SSB, and that there has been a smooth increasing trend from 2001 to present. Fishing at *status quo* F during 2015 and 2016 would result in some biomass decrease from the 2014 value for 2015, and a similar value for 2016.

There is no evidence of reduced recruitment at low stock levels.

As with *L. whiffiagonis,* it should be noted that four-spot megrim (*L. boscii*) is caught in mixed fisheries, and management measures applied to this species may have implications for other stocks. Both species of megrim are subject to a common TAC, so the joint status of these species should be taken into account when formulating management advice.

6.3 Combined Forecast for Megrims (*L. whiffiagonis* and *L. boscii*)

Figure 6.3.1 plots total international landings and estimated stock trends for both species of megrim in the same graph, in order to facilitate comparisons. The two species of megrim are included in the landings from ICES Divisions VIIIc and IXa. Both are taken as by-catch in mixed bottom trawl fisheries.

Assuming status quo F for both species in 2015 (average of estimated F over 2012-2014, corresponding to Fbar= 0.25 for landings and Fbar=0.02 for discards for *L. whiffiagonis* and Fbar = 0.19 for landings and Fbar=0.11 for discards for *L. boscii*), Figure 6.3.2 gives the combined predicted landings for 2016 and individual SSB for 2017, under different multiplying factors of their respective status quo F values. The combined projected values for the two species have been computed as the sum of the individual projected values obtained for each species separately under its assumed exploitation pattern. As usual, the exploitation pattern for each species has been assumed to remain constant during the forecast period.

At status quo F (average F over 2012-2014) for both species, predicted combined catches in 2016 are 1673 t and individual SSBs in 2017 are 911 t for *L. whiffiagonis* and 6075 t for *L. boscii*.

Table 6.2.1. Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Total landings (t).

	Spain landings			Portugal landings	Unallocated	Total landings	Discards	Total catch
Year	VIIIc	IXa***	Total	IXa				
1986	799	197	996	128		1124	284	1408
1987	995	586	1581	107		1688	333	2021
1988	917	1099	2016	207		2223	363	2586
1989	805	1548	2353	276		2629	408	3037
1990	927	798	1725	220		1945	409	2354
1991	841	634	1475	207		1682	447	2129
1992	654	938	1592	324		1916	437	2353
1993	744	419	1163	221		1384	438	1822
1994	665	561	1227	176		1403	517	1920
1995	685	826	1512	141		1652	406	2058
1996	480	448	928	170		1098	368	1466
1997	505	289	794	101		896	308	1204
1998	725	284	1010	113		1123	378	1501
1999	713	298	1011	114		1125	317	1442
2000	674	225	899	142		1041	373	1414
2001	629	177	807	124		931	290	1221
2002	343	247	590	130		720	308	1028
2003	393	314	707	169		876	191	1067
2004	534	295	829	177		1006	348	1354
2005	473	321	794	189		983	375	1358
2006	542	348	891	201		1092	335	1427
2007	591	295	886	218		1104	292	1396
**2008	546	262	808	172		980	202	1182
2009	577	342	919	215		1134	279	1413
2010	616	484	1100	197		1297	265	1562
*+2011	390	384	774	181	172	1128	269	1397
*+2012	240	239	479	98	374	952	369	1321
*+2013	338	283	621	80	230	931	496	1427
*2014	427	313	739	142	273	1154	788	1942

+Data revised in WG2015

***IXa is without Gulf of Cádiz

** Data revised in WG2010

* Official data by country and unallocated landings

Table. 6.2.2(a) Four-spot megrim (*L. boscii*) in Divisions VIIIc, IXa. Discard/Total Catch ratio and estimated CV for Spain from sampling on board

Year	1994	1997	1999	2000	2003	2004	2005	2006	2007	2008	2009	2010	2011*	2012	2013	2014
Weight Ratio	0.30	0.28	0.24	0.29	0.21	0.30	0.32	0.27	0.25	0.20	0.23	0.19	0.24	0.39	0.35	0.41
CV	23.2	11.2	14.4	16.5	10.2	23.1	24.0	48.4	18.3	22.6	21.1	18.8	16.0	15.5	23.2	17.8
Number Ratio	0.50	0.63	0.59	0.61	0.47	0.55	0.55	0.42	0.47	0.42	0.39	0.62	0.50	0.52	0.63	0.67

**All discard data revised in WG2011

*Data revised in WG2013

Table. 6.2.2(b) Four-spot megrim (*L. boscii*) in Divisions VIIIc, IXa. Discards in numbers at age (thousands) for Spanish trawlers

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
0	1289	1289	1289	1289	1289	1289	1289	1289	678	1289	1289	256	1289	2933	354	208
1	3322	3322	3322	3322	3322	3322	3322	3322	2741	3322	3322	3273	3322	3954	6148	5673
2	4322	4322	4322	4322	4322	4322	4322	4322	4134	4322	4322	6099	4322	2734	1207	1750
3	2211	2211	2211	2211	2211	2211	2211	2211	2710	2211	2211	2108	2211	1815	1888	1025
4	605	605	605	605	605	605	605	605	581	605	605	146	605	1088	1218	477
5	94	94	94	94	94	94	94	94	189	94	94	90	94	3	171	67
6	20	20	20	20	20	20	20	20	55	20	20	3	20	0	12	4
7	4	4	4	4	4	4	4	4	11	4	4	0	4	1	2	1

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011*	2012	2013	2014
0	208	238	33	10	1	100	202	2	2879	30	682	275	0
1	5673	4479	6393	3515	1233	3248	2342	1525	10362	5132	5313	5499	5645
2	1750	989	3053	5482	2497	4541	2374	2490	1301	3595	2480	4379	11089
3	1025	495	693	609	1445	757	1384	1970	696	544	1057	3030	2139
4	477	50	163	183	486	105	52	480	283	174	15	707	582
5	67	2	27	56	168	44	10	51	83	37	5	39	161
6	4	0		23	22	7	3	7	11	1	2	12	11
7	1			6	9	1	3		1		0	2	0

Table 6.2.3(a) Four-spot megrim (*L. boscii*) Divisions VIIIc and IXa. Annual length distributions in landings in 2014.

Length (cm)	Total
10	
11	
12	
13	
14	
15	
16	3.7
17	13.2
18	73.4
19	334.3
20	766.7
21	1159.1
22	1385.6
23	1307.3
24	1370.9
25	1014.3
26	769.8
27	453.7
28	422.4
29	254.7
30	173.3
31	96.0
32	65.4
33	32.4
34	19.1
35	7.4
36	5.2
37	1.4
38	2.3
39	0.2
40	0.4
41	0.1
42	
43	
44	0.1
45	
46	0.1
47	
48	
49	
50+	
Total	9732

Table 6.2.3(b) Four-spot megrim (*L. boscii*) Divisions VIIIc and IXa.

Mean lengths and mean weights in landings since 1990

Year	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Mean length (cm)	23.1	23.5	23.8	24.2	23.3	22.3	23	23.3	23.3	23.5	24.2	23.8	23.1
Mean weight (g)	116	118	122	128	111	96	107	112	109	113	121	114	105

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Mean length (cm)	22.9	22.7	22.7	22.9	23.5	23.6	23.6	24.1	23.7	23.7	23.9	24.2
Mean weight (g)	101	98	97.0	99.4	109.1	109.7	110.7	118.4	112.2	112.0	114.0	117.8

Table 6.2.4 Four-spot megrim (*L. boscii*) in Divisions VIIIc, IXa. Catch numbers at age.

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	*2008	2009	2010	2011**	2012**	2013**	2014
AGE																													
0	1289	1289	1289	1289	1289	1289	1289	1289	678	1289	1289	256	1289	2933	354	208	208	238	33	10	1	100	202	2	2879	30	682	275	0
1	3432	5605	4847	4055	4766	4482	4168	3868	2824	4743	3719	3308	3367	3992	6193	5840	5863	4846	6785	3638	1267	3257	2357	1546	10377	5139	5342	5499	5646
2	7797	15902	14414	11462	9506	8001	6989	6656	7049	6527	6458	7343	5526	3895	1862	2888	4139	3791	5568	8004	5232	6147	3935	3136	2364	4397	3260	4919	11954
3	5901	7284	7666	7603	4096	5539	6211	4307	7225	8349	3478	4978	6447	4596	3533	2276	3386	3368	3777	3604	5951	3390	4879	4887	3568	2454	4101	4820	4249
4	4545	4198	5384	6514	4434	2516	5784	4404	2849	6201	4419	890	3545	4996	4000	2870	1220	1526	2602	2024	2639	2705	2204	4640	3817	2833	1926	4113	3214
5	1226	1438	2460	3573	2405	2744	2294	1245	1801	1150	1990	1714	792	1405	2020	1937	454	501	1155	1426	1156	1909	1003	1662	2529	2711	1620	1363	2983
6	869	589	1181	1798	1403	1048	758	655	894	602	224	1069	849	235	797	941	240	447	279	802	274	855	354	640	496	1164	991	846	751
+gp	233	145	467	634	807	483	71	282	457	284	555	443	353	489	840	358	360	142	337	399	228	461	298	222	438	399	422	371	562
TOTALNUM	25292	36450	37708	36928	28706	26102	27564	22706	23777	29145	22132	20001	22168	22541	19599	17318	15870	14859	20536	19907	16748	18824	15232	16735	26468	19127	18344	22206	29359
TONSLAND	1408	2021	2586	3037	2354	2129	2353	1822	1920	2058	1466	1204	1501	1442	1414	1221	1028	1067	1354	1358	1427	1396	1182	1413	1562	1397	1321	1427	1942
SOPCOF %	100	100	100	100	100	99	103	99	100	100	100	102	100	101	100	100	100	101	101	100	101	101	101	100	101	101	101	101	100

* Data revised in WG2010 from original value presented

** Data revised in WG2014 from original value presented

Table 6.2.5 Four-spot megrim (*L. boscii*) in Divisions VIIIc, IXa. Mean weights at age in Catchs (kg).

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	*2008	2009	2010	2011**	2012**	2013**	2014
AGE																													
0	0.004	0.004	0.004	0.004	0.003	0.004	0.004	0.003	0.005	0.004	0.003	0.004	0.004	0.006	0.006	0.004	0.006	0.008	0.006	0.0060	0.006	0.005	0.005	0.004	0.004	0.003	0.009	0.004	0.002
1	0.013	0.027	0.027	0.027	0.019	0.022	0.021	0.014	0.023	0.030	0.023	0.016	0.019	0.018	0.023	0.024	0.024	0.025	0.027	0.021	0.023	0.022	0.017	0.025	0.012	0.02	0.033	0.017	0.024
2	0.034	0.046	0.049	0.055	0.051	0.055	0.052	0.052	0.056	0.046	0.043	0.030	0.040	0.045	0.057	0.050	0.057	0.066	0.053	0.050	0.06	0.045	0.053	0.045	0.056	0.039	0.052	0.045	0.044
3	0.055	0.062	0.069	0.079	0.081	0.097	0.093	0.092	0.082	0.082	0.054	0.063	0.073	0.072	0.066	0.073	0.090	0.088	0.081	0.083	0.091	0.079	0.079	0.069	0.084	0.078	0.076	0.063	0.071
4	0.090	0.089	0.100	0.108	0.134	0.114	0.120	0.136	0.114	0.096	0.106	0.091	0.105	0.090	0.087	0.099	0.109	0.123	0.108	0.108	0.104	0.114	0.112	0.104	0.108	0.099	0.105	0.099	0.101
5	0.129	0.125	0.138	0.144	0.154	0.164	0.159	0.174	0.148	0.143	0.135	0.123	0.137	0.147	0.126	0.122	0.163	0.142	0.131	0.122	0.136	0.123	0.151	0.142	0.141	0.128	0.127	0.131	0.133
6	0.159	0.151	0.167	0.167	0.183	0.190	0.225	0.218	0.178	0.168	0.209	0.180	0.179	0.197	0.169	0.166	0.209	0.201	0.175	0.132	0.176	0.152	0.201	0.175	0.182	0.168	0.159	0.159	0.165
+gp	0.263	0.239	0.280	0.275	0.272	0.263	0.351	0.295	0.243	0.255	0.231	0.252	0.293	0.268	0.228	0.255	0.247	0.247	0.235	0.197	0.233	0.198	0.235	0.288	0.271	0.24	0.199	0.21	0.222
SOPCOFAC	1.0014	1.0022	1.0034	0.9996	1.0009	0.9930	1.0284	0.9892	1.0015	0.9963	0.9993	1.0171	1.0027	1.009	1.001	1.001	0.999	1.013	1.0069	1.0038	1.007	1.011	1.006	1.001	1.01	1.009	1.006	1.007	1.005

* Data revised in WG2010 from original value presented

** Data revised in WG2014 from original value presented

Table 6.2.6 Four-spot megrim (*L. boscii*) Divisions VIIIc, IXa

Abundance and Recruitment indices of Portuguese and Spanish surveys.

	Biomass Index				
	Portugal (k/h)			Spain (k/30 min)	
	October	Crustacean	SE	Mean	SE
1983				0.67	0.13
1984				0.76	0.08
1985				0.71	0.11
1986				1.68	0.28
1987				ns	-
1988				3.10	0.33
1989				1.97	0.28
1990	0.26			1.93	0.14
1991	0.18			1.67	0.17
1992	0.14			1.98	0.20
1993	0.11			2.07	0.25
1994	0.16			1.82	0.23
1995	0.08			1.51	0.12
A,1996	0.10			2.00	0.19
1997	0.06	2.97	1.31	2.17	0.22
1998	0.04	2.66	0.87	1.80	0.20
A,B,1999	+	0.04	0.02	1.93	0.24
2000	0.08	2.18	0.84	1.89	0.28
2001	0.09	1.72	0.75	2.65	0.25
2002	0.02	2.78	1.02	2.21	0.22
A,2003	1.36	3.65	1.20	1.32	0.16
A,2004	1.27	ns		2.40	0.24
2005	0.05	2.62	0.85	3.84	0.41
2006	0.10	1.63	0.56	2.56	0.24
2007	0.14	2.20	0.70	3.75	0.35
2008	0.07	2.50	0.87	2.08	0.22
2009	0.06	*1.50	0.65	3.96	0.32
2010	0.03	4.03	1.44	4.04	0.38
2011	0.14	4.55	1.78	4.64	0.39
2012	ns	ns	ns	5.92	0.47
**2013	0.10	1.45	0.51	8.17	1.13
2014	0.12	1.40	0.56	4.75	0.28

	Abundance index			
	Portugal (n/h)		Spain (n/30 min)	
	Crustacear	SE	Mean	SE
1983			11.80	1.80
1984			15.80	2.00
1985			14.00	1.74
1986			32.60	3.82
1987			ns	-
1988			59.20	6.49
1989			40.75	6.24
1990			40.30	3.00
1991			27.70	2.62
1992			49.10	5.20
1993			43.30	5.39
1994			26.90	3.63
1995			32.30	2.78
A,1996			44.80	4.05
1997	31.57	15.52	43.50	3.84
1998	26.46	10.68	34.30	4.45
A,B,1999	1.23	1.07	29.30	3.22
2000	20.61	8.47	33.00	4.56
2001	17.17	7.08	42.70	3.35
2002	40.61	13.69	34.60	3.33
A,2003	60.80	20.97	16.90	1.54
A,2004	ns		43.94	3.71
2005	34.51	12.03	62.89	6.16
2006	19.89	6.49	41.47	3.02
2007	32.30	11.30	51.10	4.30
2008	26.27	9.60	32.20	3.00
2009	*12.22	5.88	52.83	3.97
2010	63.78	22.64	72.75	6.82
2011	68.56	26.34	69.26	5.72
2012	ns	ns	82.14	5.98
2013	23.81	8.02	119.99	17.48
2014	20.31	8.18	67.42	3.72

	Recruitment index		
	At age 1	**At age 0**	**At age 1**
	Portugal (n)	Spain (n/30 min)	
	October		
1983		0.98	5.74
1984		1.80	7.83
1985		0.15	7.45
1986		2.99	16.36
1987		ns	ns
1988		2.90	24.64
1989		8.49	16.68
1990	153	0.44	19.06
1991	26	2.53	9.25
1992	42	2.37	35.00
1993	8	0.30	21.38
1994	2	3.48	2.94
1995	4	1.92	19.58
A,1996	16	3.57	20.56
1997	1	3.54	13.34
1998	+	0.27	9.57
A,B,1999	+	0.94	7.46
2000	16	1.07	13.96
2001	25	0.59	16.95
2002	1	1.04	9.95
A,2003	8	0.65	4.95
A,2004	5	1.19	21.10
2005	+	4.71	17.70
2006		0.59	14.70
2007		0.88	11.30
2008		0.37	8.13
2009		3.37	7.42
2010		0.65	34.22
2011		0.91	8.90
2012		1.71	11.58
2013		1.32	25.86
2014		3.72	12.32

+ less than 0.04
ns no survey
A Portuguese October Survey with different vessel and gear (Capricórnio and CAR net)
B Portuguese Crustacean Survey covers partial area only with a different Vessel (Mestre Costeiro)
* Revised in WGHMM2011
** From 2013 new vessel for Spanish survey (Miguel Oliver)

Table 6.2.7 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Tuning data

FLT01: SP-LCGOTBDEF1. 1000 Days by 100 HP (thousand)

1986	1999									
1	1	0	1							
1	7								Eff.	
10		98.0	375.9	336.9	251.4	95.4	30.2	13.3	7.1	1986
10		473.1	962.6	565.0	317.7	96.7	31.3	16.0	12.7	1987
10		34.7	202.0	199.7	162.9	75.5	30.2	19.4	11.3	1988
10		11.1	86.3	125.5	135.7	82.8	38.8	22.3	11.9	1989
10		4.6	103.7	60.3	173.8	104.6	72.9	38.4	8.8	1990
10		10.3	89.1	145.1	93.2	189.0	79.9	40.8	9.6	1991
10		0.4	19.5	100.0	168.0	105.2	39.0	2.3	10.2	1992
10		0.1	36.6	98.2	227.4	84.9	46.4	16.7	7.1	1993
10		0.0	62.1	207.7	169.1	155.7	86.6	46.3	8.5	1994
10		1.2	32.9	277.8	301.4	123.8	83.4	24.0	13.4	1995
10		0.8	33.2	34.0	222.2	132.9	20.0	51.4	11.0	1996
10		0.4	22.5	111.1	39.9	142.8	125.3	58.9	12.5	1997
10		0.3	81.6	420.5	349.7	98.2	127.0	62.0	8.2	1998
10		0.3	62.0	209.8	331.2	165.4	32.7	44.6	8.8	1999

FLT02: SP-LCGOTBDEF2. 1000 Days by 100 HP (thousand)

2000	2014									
1	1	0	1							
1	7								Eff.	
10		0.4	70.4	143.7	348.5	303.1	164.1	153.3	10.5	2000
10		14.1	147.9	219.0	475.1	436.2	242.3	82.5	12.1	2001
10		7.1	125.5	214.2	91.2	65.9	44.7	70.0	11.0	2002
10		19.5	287.1	362.6	213.6	75.2	66.6	22.4	10.2	2003
10		29.0	341.5	495.6	440.5	219.1	60.2	81.3	7.0	2004
10		10.4	248.2	383.1	252.6	195.9	114.3	68.4	7.1	2005
10		7.0	364.0	624.8	304.5	150.8	41.3	40.1	7.8	2006
10		1.9	261.0	403.1	415.2	297.7	143.0	82.0	7.3	2007
10		2.7	313.1	726.9	480.7	227.4	87.5	80.5	9.0	2008
10		8.5	145.2	523.6	639.7	226.2	87.4	33.6	8.0	2009
10		0.1	145.7	519.8	743.2	616.4	132.4	105.4	5.8	2010
10		0.0	48.1	224.0	423.8	593.7	323.2	133.0	5.1	2011
10		0.8	107.5	718.6	562.5	504.6	302.1	122.7	7.6	2012
10		0.0	86.9	336.3	806.5	313.4	170.5	64.7	10.8	2013
10		0.1	118.8	332.4	427.1	431.1	98.9	55.0	13.4	2014

FLT03: SPGFS-WIBTS-Q4 (n/30 min)

1988	2014									
1	1	0.8	0.8							
0	7								Eff.	
1	2.9	24.6	20.6	7.3	1.9	1.1	0.4	0.3	101	1988
1	8.5	16.7	8.4	3.6	2.1	1.1	0.3	0.1	91	1989
1	0.4	19.1	13.0	2.2	2.8	1.6	0.7	0.4	120	1990
1	2.5	9.3	9.3	3.7	1.6	1.0	0.2	0.1	107	1991
1	2.4	35.0	4.1	4.1	2.1	1.0	0.4	0.0	116	1992
1	0.3	21.4	16.7	2.3	1.5	0.5	0.4	0.2	109	1993
1	3.5	2.9	11.2	6.3	1.5	0.7	0.4	0.4	118	1994
1	1.9	19.6	2.4	4.4	3.2	0.3	0.2	0.2	116	1995
1	3.6	20.6	14.4	1.4	1.9	2.4	0.3	0.3	114	1996
1	3.5	13.3	14.0	8.7	1.1	1.5	1.0	0.3	116	1997
1	0.3	9.6	10.0	9.2	3.6	0.7	0.8	0.3	114	1998
1	0.9	7.5	10.9	6.0	2.9	1.0	0.2	0.3	116	1999
1	1.1	14.0	5.4	5.2	4.1	1.7	0.6	0.9	113	2000
1	0.6	17.0	12.7	4.7	3.8	2.2	1.0	0.7	113	2001
1	1.0	10.0	12.7	7.4	1.8	0.7	0.3	0.6	110	2002
0	0.7	5.0	4.1	4.1	1.7	0.6	0.5	0.3	112	2003
1	1.2	21.1	11.3	6.1	2.7	0.8	0.2	0.5	114	2004
1	4.7	17.7	22.4	11.2	4.0	1.6	0.6	0.7	116	2005
1	0.6	14.7	13.3	8.2	2.5	1.0	0.5	0.6	115	2006
1	0.9	11.3	21.3	10.2	4.9	1.4	0.7	0.3	117	2007
1	0.4	8.1	11.7	7.9	2.6	0.8	0.5	0.3	115	2008
1	3.4	7.4	13.6	14.1	9.6	3.1	1.1	0.5	117	2009
1	0.6	34.2	16.6	10.8	7.2	2.2	0.5	0.6	114	2010
1	0.9	8.9	33.8	13.8	7.7	2.8	0.9	0.5	111	2011
1	1.7	11.6	22.1	31.1	9.6	3.4	1.7	1.0	115	2012
0	1.3	25.9	29.6	35.7	21.1	3.9	1.5	1.0	114	2013
1	3.7	12.3	21.8	12.1	7.6	8.0	1.1	0.7	116	2014

Table 6.2.8 Four-spot megrim (*L. boscii*). LPUE data by fleet in Divisions VIIIc, IXa.

	SP-LCGOTBDEF			**SP-AVSOTBDEF**			**Portugal trawl in IXa**		
Year	Landings(t)	Effort	LPUE [1]	Landings(t)	Effort	LPUE [1]	Landings(t)	Effort	LPUE [2]
1986	69.0	7.1	9.8	26.5	3.9	6.8			
1987	189.8	12.7	14.9	30.7	3.0	10.4			
1988	78.6	11.3	7.0	47.3	3.4	14.0	146	38.5	3.8
1989	72.9	11.9	6.2	36.1	3.3	10.9	183	44.7	4.1
1990	68.8	8.8	7.8	63.8	3.2	19.7	164	39.0	4.2
1991	94.0	9.6	9.8	42.1	3.5	12.2	166	45.0	3.7
1992	67.2	10.2	6.6	35.2	2.3	15.5	280	50.9	5.5
1993	55.2	7.1	7.8	38.9	2.4	16.1	180	44.2	4.1
1994	90.8	8.5	10.6	63.7	4.5	14.0	146	45.8	3.2
1995	147.6	13.4	11.0	85.9	3.5	24.7	121	37.0	3.3
1996	78.7	11.0	7.2	37.1	2.3	16.4	155	46.5	3.3
1997	99.0	12.5	7.9	49.5	2.6	18.7	76	33.4	2.3
1998	117.4	8.2	14.4	56.2	5.1	11.0	83	43.1	1.9
1999	103.9	8.8	11.7	55.9	4.9	11.3	73	25.3	2.9
2000	172.3	10.5	16.4	34.1	2.5	13.8	93	27.0	3.4
2001	245.0	12.1	20.2	16.5	1.3	12.5	89	43.1	2.1
2002	143.8	11.0	13.0	22.5	2.0	11.3	97	31.2	3.1
2003	118.7	10.2	11.6	12.4	2.2	5.7	117	40.5	2.9
2004	127.3	7.0	18.2	23.5	1.6	14.8	111	35.4	3.1
2005	96.0	7.1	13.6	45.0	3.0	15.2	140	42.6	3.3
2006	123.5	7.8	15.9	32.3	2.8	11.6	149	40.3	3.7
2007*	130.5	7.3	17.9	19.9	2.2	8.9	165	43.8	3.8
2008*	196.8	9.0	22.0	14.5	2.0	7.2	146	38.4	3.8
2009	138.8	8.0	17.3	42.0	2.3	18.5	183	49.3	3.7
2010	170.7	5.8	29.3	51.1	2.0	25.4	150	48.0	3.1
2011	126.9	5.1	24.8	43.1	2.2	19.6	134	49.4	2.7
2012	127.8	7.6	16.7	11.1	2.6	4.3	78	30.9	2.5
2013**	212.8	10.8	19.8	19.5	1.5	13.2	59	28.0	2.1
2014	220.8	13.4	16.5	31.9	3.0	10.7	120	49.2	2.4

[1] LPUE as catch (kg) per fishing day per 100 HP

[2] LPUE as catch (kg) per hour.

* Effort from Portuguese trawl revised in WG2010 from original value presented

** Effort from SP-LCGOTBDEF and SP-AVSOTBDEF revised in WG2015 from original value presented

Table 6.2.9. Four-spot megrim (*L.boscii*) in Divisions VIIIc and IXa. Tuning diagnostic.

Lowestoft VPA Version 3.1

27/04/2015 13:10

Extended Survivors Analysis

Four spot megrim (L. boscii) Division VIIIc and IXa

CPUE data from file fleetb.txt

Catch data for 29 years. 1986 to 2014. Ages 0 to 7.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
SP-LCGOTBDEF1	1986	2014	3	6	0	1
SP-LCGOTBDEF2	2000	2014	3	6	0	1
SP-GFS	1988	2014	0	6	0.75	0.83

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 = 1.500

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

Prior weighting not applied

Tuning converged after 36 iterations

Regression weights

1	1	1	1	1	1	1	1	1	1

Fishing mortalities

Age	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
0	0	0	0.003	0.008	0	0.071	0.001	0.01	0.007	0
1	0.141	0.033	0.088	0.087	0.077	0.209	0.175	0.187	0.101	0.204
2	0.378	0.31	0.219	0.145	0.16	0.162	0.128	0.16	0.263	0.332
3	0.357	0.539	0.339	0.271	0.271	0.276	0.252	0.169	0.376	0.382
4	0.384	0.484	0.505	0.386	0.448	0.352	0.368	0.322	0.255	0.465
5	0.78	0.396	0.799	0.353	0.57	0.472	0.455	0.372	0.398	0.298
6	0.638	0.325	0.578	0.325	0.401	0.329	0.414	0.298	0.339	0.398

XSA population numbers (Thousands)

YEAR	AGE 0	1	2	3	4	5	6
2005	5.33E+04	3.05E+04	2.81E+04	1.33E+04	7.01E+03	2.91E+03	1.88E+03
2006	5.24E+04	4.36E+04	2.17E+04	1.58E+04	7.60E+03	3.91E+03	1.09E+03
2007	3.83E+04	4.29E+04	3.46E+04	1.30E+04	7.54E+03	3.83E+03	2.15E+03
2008	2.84E+04	3.13E+04	3.22E+04	2.27E+04	7.60E+03	3.72E+03	1.41E+03
2009	7.44E+04	2.30E+04	2.35E+04	2.28E+04	1.42E+04	4.23E+03	2.14E+03
2010	4.65E+04	6.09E+04	1.75E+04	1.64E+04	1.42E+04	7.43E+03	1.96E+03
2011	4.23E+04	3.54E+04	4.05E+04	1.22E+04	1.02E+04	8.19E+03	3.79E+03
2012	7.79E+04	3.46E+04	2.44E+04	2.92E+04	7.74E+03	5.77E+03	4.25E+03
2013	4.16E+04	6.32E+04	2.35E+04	1.70E+04	2.02E+04	4.59E+03	3.26E+03
2014	1.21E+05	3.38E+04	4.68E+04	1.48E+04	9.55E+03	1.28E+04	2.53E+03

Estimated population abundance at 1st Jan 2015

0.00E+00	9.90E+04	2.26E+04	2.75E+04	8.26E+03	4.91E+03	7.78E+03

Taper weighted geometric mean of the VPA populations:

4.69E+04	3.70E+04	2.66E+04	1.61E+04	8.86E+03	4.12E+03	1.75E+03

Standard error of the weighted Log(VPA populations) :

0.3523	0.324	0.3714	0.3687	0.4286	0.4725	0.4948

Log catchability residuals.

Fleet : SP-LCGOTBDEF1

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994
0	No data for this fleet at this age								
1	No data for this fleet at this age								
2	No data for this fleet at this age								
3	0.57	0.87	-0.08	-0.41	-0.76	-0.19	-0.45	-0.03	-0.1
4	0.31	0.29	-0.59	-0.53	-0.2	-0.57	-0.08	0.32	0.49
5	0.09	-0.23	-0.81	-0.84	-0.18	0.43	-0.01	-0.25	0.52
6	-0.24	-0.15	-0.42	-0.25	0.1	0.75	-0.02	0.27	0.63

Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0	No data for this fleet at this age									
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	0.36	-0.56	-0.32	0.69	0.42	99.99	99.99	99.99	99.99	99.99
4	0.11	0.03	-0.47	0.63	0.26	99.99	99.99	99.99	99.99	99.99
5	0.78	-0.35	-0.08	0.76	0.17	99.99	99.99	99.99	99.99	99.99
6	0.91	-0.13	0.27	0.47	0.54	99.99	99.99	99.99	99.99	99.99

Age	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
0	No data for this fleet at this age									
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	99.99	99.99	99.99	99.99	99.99	99.99	99.99	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

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	-6.7202	-5.8622	-5.4408	-5.4408
S.E(Log q)	0.5015	0.4136	0.5056	0.4644

Regression statistics :

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	0.57	2.061	8.04	0.66	14	0.26	-6.72
4	0.95	0.2	6.04	0.53	14	0.41	-5.86
5	-46.44	-4.642	140.34	0	14	14.61	-5.44
6	1.11	-0.397	5	0.5	14	0.48	-5.25
1							

Fleet : SP-LCGOTBDEF2

Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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	-0.61	0.33	-0.28	0.2	0.41
4	99.99	99.99	99.99	99.99	99.99	-0.02	0.76	-0.48	-0.37	0.41
5	99.99	99.99	99.99	99.99	99.99	-0.21	1.02	-0.64	-0.22	-0.02
6	99.99	99.99	99.99	99.99	99.99	0.16	0.21	-0.31	-0.01	0.22

Age	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
0	No data for this fleet at this age									
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	0.1	0.5	0.16	0.16	-0.16	0.16	-0.4	-0.14	-0.27	-0.14
4	-0.32	-0.17	0.15	0.24	-0.07	0.04	-0.18	0.36	-0.28	-0.07
5	0.22	-0.51	0.37	-0.07	-0.1	0.3	0.16	0.31	0.06	-0.68
6	0.06	-0.56	0.12	-0.07	-0.44	0.03	0.3	0.07	-0.23	-0.49

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	-5.6818	-5.027	-4.7722	-4.7722
S.E(Log q)	0.3162	0.3358	0.4377	0.2844

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	1.08	-0.314	5.37	0.54	15	0.35	-5.68
4	1.06	-0.265	4.79	0.61	15	0.37	-5.03
5	1.01	-0.046	4.74	0.6	15	0.46	-4.77
6	0.89	0.893	5.15	0.83	15	0.25	-4.84
1							

Fleet : SP-GFS◙

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994
0	99.99	99.99	0.52	1.66	-1.01	0.27	0.28	-1.07	0.86
1	99.99	99.99	0.4	-0.11	0.11	-0.29	0.52	0.1	-1.13
2	99.99	99.99	0.16	-0.33	-0.16	-0.42	-0.85	-0.15	-0.45
3	99.99	99.99	-0.29	-0.83	-0.98	-0.79	-0.53	-0.68	-0.53
4	99.99	99.99	-1.06	-0.6	-0.3	-0.66	-0.33	-0.6	-0.19
5	99.99	99.99	-0.4	-0.55	0.29	-0.06	0.02	-0.78	-0.2
6	99.99	99.99	0.03	-0.04	0.21	-0.37	0.03	0.06	0.03

Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0	0.06	1.02	1.33	-0.85	-0.11	-0.03	-0.67	-0.17	99.99	0.04
1	0.25	0.04	-0.03	0	0.27	0.38	0.47	-0.11	99.99	0.29
2	-0.95	0.09	-0.23	-0.18	0.27	0.08	0.39	0.34	99.99	0.08
3	-0.66	-0.53	0.22	-0.06	-0.07	0.21	0.63	0.47	99.99	0.14
4	-0.4	-0.72	-0.09	0.05	-0.47	0.44	0.88	0.44	99.99	0.16
5	-0.42	0.15	-0.11	0.44	-0.48	-0.2	1.16	-0.08	99.99	-0.42
6	-0.38	0.07	-0.06	-0.03	-0.18	-0.23	-0.08	-0.01	99.99	-0.19

Age	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
0	1.06	-1	-0.29	-0.85	0.39	-0.73	-0.36	-0.33	99.99	0
1	0.39	-0.24	-0.44	-0.46	-0.25	0.41	-0.42	-0.13	99.99	-0.03
2	0.58	0.26	0.2	-0.39	0.09	0.59	0.43	0.54	99.99	0.01
3	0.67	0.33	0.59	-0.28	0.3	0.36	0.89	0.76	99.99	0.66
4	0.31	-0.16	0.54	-0.22	0.53	0.16	0.58	1.03	99.99	0.7
5	0.71	-0.37	0.34	-0.62	0.84	-0.15	-0.02	0.45	99.99	0.46
6	0.1	0.25	0.1	-0.06	0.31	-0.36	-0.44	0.05	99.99	0.22

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	-10.2314	-7.5714	-7.2568	-7.3099	-7.3143	-7.4509	-7.4509
S.E(Log q)	0.7625	0.379	0.4106	0.5707	0.5498	0.4874	0.2074

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	0.63	1.433	10.42	0.39	25	0.47	-10.23
1	0.75	1.284	8.29	0.54	25	0.28	-7.57
2	1.13	-0.486	6.89	0.39	25	0.47	-7.26
3	1.59	-1.205	5.93	0.16	25	0.9	-7.31
4	1.79	-1.711	5.94	0.17	25	0.95	-7.31
5	1.03	-0.142	7.42	0.45	25	0.51	-7.45
6	0.99	0.116	7.49	0.86	25	0.21	-7.49

Terminal year survivor and F summaries :

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

Year class = 2014

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c1	1	0	0	0	0	0	0
SP-CORUTR8c2	1	0	0	0	0	0	0
SP-GFS◎	99022	0.778	0	0	1	1	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
99022	0.78	0	1	0	0

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

Year class = 2013

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c1	1	0	0	0	0	0	0
SP-CORUTR8c2	1	0	0	0	0	0	0
SP-GFS◎	21977	0.386	0	0	1	0.925	0.209
F shrinkage mean	31507	1.5	0.075	0.15			

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
22581	0.37	0.1	2	0.264	0.204

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

Year class = 2012

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c1	1	0	0	0	0	0	0
SP-CORUTR8c2	1	0	0	0	0	0	0
SP-GFS●	25815	0.369	0.137	0.37	2	0.921	0.35
F shrinkage mean	56448	1.5	0.079	0.175			

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
27469	0.36	0.18	3	0.504	0.332

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

Year class = 2011

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c1	1	0	0	0	0	0	0
SP-CORUTR8c2	7183	0.327	0	0	1	0.512	0.429
SP-GFS●	9376	0.304	0.287	0.94	3	0.452	0.344
F shrinkage mean	12396	1.5	0.036	0.27			

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
8261	0.22	0.16	5	0.702	0.382

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

Year class = 2010

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c1	1	0	0	0	0	0	0
SP-CORUTR8c2	4194	0.242	0.101	0.42	2	0.567	0.527
SP-GFS●	5986	0.252	0.314	1.24	4	0.406	0.396
F shrinkage mean	6913	1.5	0.027	0.351			

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
4912	0.18	0.16	7	0.925	0.465

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

Year class = 2009

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c1	1	0	0	0	0	0	0
SP-CORUTR8c2	5513	0.213	0.155	0.73	3	0.559	0.398
SP-GFS●	12583	0.228	0.058	0.26	5	0.422	0.194
F shrinkage mean	4663	1.5	0.019	0.457			

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
7782	0.16	0.16	9	1.018	0.298

Age 6 Catchability constant w.r.t. time and age (fixed at the value for age) 5

Year class = 2008

Fleet	E S	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c1	1	0	0	0	0	0	0
SP-CORUTR8c2	1096	0.185	0.196	1.06	4	0.54	0.483
SP-GFS	1850	0.204	0.172	0.84	6	0.444	0.313
F shrinkage mean	1451	1.5	0.016	0.384			

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
1389	0.14	0.14	11	1.018	0.398

Table 6.2.10 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Estimates of fisihing mortality at age.

Run title : Four spot megrim (L. boscii) Division VIIIc and IXa

At 27/04/2015 13:12

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994
AGE									
0	0.0199	0.0275	0.0251	0.0268	0.0358	0.0225	0.0243	0.0492	0.0156
1	0.0638	0.1132	0.137	0.1029	0.131	0.1683	0.0943	0.0944	0.1451
2	0.2414	0.4666	0.4723	0.552	0.3714	0.3382	0.4293	0.2142	0.2489
3	0.377	0.3733	0.431	0.4925	0.3879	0.3859	0.4806	0.5168	0.3808
4	0.7153	0.5072	0.5252	0.819	0.6039	0.4394	0.9178	0.7645	0.7911
5	0.6222	0.5171	0.6403	0.8207	0.8485	0.9858	0.9531	0.5031	0.8518
6	1.024	0.7061	1.1371	1.6139	0.9419	1.2416	0.8366	0.8116	0.852
+gp	1.024	0.7061	1.1371	1.6139	0.9419	1.2416	0.8366	0.8116	0.852
FBAR 2- 4	0.4446	0.4491	0.4761	0.6212	0.4544	0.3878	0.6092	0.4985	0.4736

Table 8 Fishing mortality (F) at age

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AGE										
0	0.0239	0.0337	0.0093	0.0682	0.0926	0.0109	0.0061	0.0057	0.0051	0.001
1	0.1443	0.0893	0.1136	0.1625	0.3108	0.288	0.2487	0.238	0.1791	0.1974
2	0.5813	0.2986	0.2551	0.2818	0.2868	0.2328	0.2109	0.2803	0.2385	0.3219
3	0.5256	0.7196	0.3969	0.3735	0.4014	0.459	0.4965	0.4098	0.388	0.3971
4	0.6652	0.5923	0.3995	0.5512	0.5596	0.7445	0.8624	0.5463	0.3268	0.593
5	0.9025	0.4627	0.4827	0.763	0.44	0.4626	1.0607	0.3072	0.4535	0.4422
6	0.7956	0.4288	0.4878	0.4706	0.5359	0.4828	0.4075	0.3365	0.5664	0.4948
+gp	0.7956	0.4288	0.4878	0.4706	0.5359	0.4828	0.4075	0.3365	0.5664	0.4948
FBAR 2- 4	0.5907	0.5369	0.3505	0.4022	0.4159	0.4787	0.5233	0.4122	0.3178	0.4373

Table 8 Fishing mortality (F) at age

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	FBAR 12-14
AGE											
0	0.0002	0	0.0029	0.0079	0	0.0709	0.0008	0.0097	0.0073	0	0.0057
1	0.1413	0.0326	0.0877	0.087	0.077	0.2085	0.1747	0.1871	0.1011	0.204	0.164
2	0.3776	0.31	0.2189	0.1453	0.1599	0.162	0.1278	0.1601	0.2631	0.332	0.2517
3	0.3571	0.539	0.3391	0.2707	0.2707	0.2756	0.2523	0.1688	0.3761	0.3821	0.309
4	0.3843	0.4842	0.5051	0.3864	0.4481	0.3518	0.3678	0.3217	0.2552	0.465	0.3473
5	0.7804	0.3958	0.7992	0.3533	0.57	0.4722	0.4553	0.3717	0.3976	0.2978	0.3557
6	0.638	0.325	0.5775	0.3246	0.4008	0.3286	0.4144	0.2976	0.3386	0.3983	0.3448
+gp	0.638	0.325	0.5775	0.3246	0.4008	0.3286	0.4144	0.2976	0.3386	0.3983	
FBAR 2- 4	0.373	0.4444	0.3543	0.2675	0.2929	0.2631	0.2493	0.2169	0.2982	0.3931	

Table 6.2.11 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Estimates of stock numbers at age.

Run title : Four spot megrim (L. boscii) Division VIIIc and IXa

At 27/04/2015 13:12

Terminal Fs derived using XSA (With F shrinkage)

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

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994
AGE									
0	72122	52517	57412	53825	40490	63966	59398	29649	48400
1	61358	57882	41831	45839	42902	31984	51205	47464	23108
2	40177	47130	42318	29863	33861	30813	22131	38152	35361
3	20765	25839	24198	21605	14078	19121	17988	11795	25213
4	9831	11662	14565	12875	10809	7820	10643	9107	5760
5	2925	3936	5749	7053	4647	4838	4126	3480	3471
6	1499	1285	1922	2481	2541	1629	1478	1302	1723
+gp	395	312	745	851	1437	735	136	552	867
TOTAL	209071	200564	188740	174392	150766	160906	167104	141502	143903

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

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AGE										
0	60206	42995	30580	21595	36643	36188	37602	40121	51380	37312
1	39013	48126	34035	24805	16514	27347	29308	30598	32660	41851
2	16364	27649	36038	24872	17262	9909	16786	18711	19747	22355
3	22573	7492	16794	22861	15364	10609	6428	11130	11574	12737
4	14105	10926	2987	9246	12883	8420	5489	3203	6049	6429
5	2138	5938	4947	1640	4362	6027	3274	1897	1519	3572
6	1213	710	3061	2500	626	2300	3107	928	1142	790
+gp	564	1744	1256	1030	1289	2401	1172	1382	359	945
TOTAL	156175	145580	129697	108548	104944	103201	103167	107971	124430	125991

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

YEAR	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	GM 90-12
AGE												
0	53280	52384	38291	28369	74430	46456	42296	77937	41612	120944	0	43560
1	30519	43613	42888	31260	23044	60937	35430	34602	63192	33820	99022	
2	28125	21695	34561	32166	23460	17468	40501	24358	23496	46762	22581	
3	13265	15785	13028	22734	22775	16370	12162	29181	16993	14786	27469	
4	7010	7599	7539	7599	14198	14225	10174	7737	20181	9551	8261	
5	2909	3908	3834	3725	4227	7426	8192	5767	4592	12801	4912	
6	1879	1091	2154	1412	2142	1957	3792	4254	3255	2526	7782	
+gp	924	902	1148	1180	737	1716	1289	1800	1417	1875	2420	
TOTAL	137911	146978	143443	128444	165014	166556	153837	185636	174738	243065	172447	

Table 6.2.12 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Summary of landings and XSA results.

Run title : Four spot megrim (L. boscii) Division VIIIc and IXa

At 27/04/2015 13:12

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS Age 0	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 2- 4
1986	72122	5198	4317	1408	0.3262	0.4446
1987	52517	7342	6066	2021	0.3332	0.4491
1988	57412	7882	6789	2586	0.3809	0.4761
1989	53825	7857	6790	3037	0.4473	0.6212
1990	40490	6824	6045	2354	0.3894	0.4544
1991	63966	6697	5822	2129	0.3657	0.3878
1992	59398	6450	5505	2353	0.4275	0.6092
1993	29649	6114	5403	1822	0.3372	0.4985
1994	48400	6509	5682	1920	0.3379	0.4736
1995	60206	6022	5080	2058	0.4051	0.5907
1996	42995	5340	4523	1466	0.3241	0.5369
1997	30580	4554	4001	1204	0.301	0.3505
1998	21595	5166	4668	1501	0.3215	0.4022
1999	36643	4670	4162	1442	0.3464	0.4159
2000	36188	4539	3932	1414	0.3597	0.4787
2001	37602	3920	3316	1221	0.3682	0.5233
2002	40121	4237	3483	1028	0.2951	0.4122
2003	51380	4827	3828	1067	0.2787	0.3178
2004	37312	5093	4157	1354	0.3257	0.4373
2005	53280	5010	4164	1358	0.3261	0.373
2006	52384	5780	4781	1427	0.2985	0.4444
2007	38291	5605	4732	1396	0.295	0.3543
2008	28369	6149	5467	1182	0.2162	0.2675
2009	74430	6165	5398	1413	0.2617	0.2929
2010	46456	6675	5967	1562	0.2618	0.2631
2011	42296	6366	5660	1397	0.2468	0.2493
2012	77937	7907	6440	1321	0.2051	0.2169
2013	41612	6783	5933	1427	0.2405	0.2982
2014	120944	7661	6725	1942	0.2888	0.3931
Arith. Mean	49945	5977	5132	1649	0.3211	0.4149
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		

Table 6.2.13 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IX

Prediction with management option table: Input data

MFDP version 1a
Run: LDB
Time and date: 08:44 10/06/2015
Fbar age range (Total) : 2-4
Fbar age range Fleet 1 : 2-4

2015 Age	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt	Exploit pattern	Weight DWt
0	43560	0.2	0	0	0	0.004	0.0000	0.003	0.0207	0.004
1	35664	0.2	0.55	0	0	0.021	0.0004	0.034	0.1941	0.021
2	22581	0.2	0.86	0	0	0.047	0.0390	0.068	0.1786	0.042
3	27469	0.2	0.97	0	0	0.074	0.1842	0.084	0.1228	0.056
4	8261	0.2	0.99	0	0	0.102	0.3444	0.106	0.0390	0.080
5	4912	0.2	1	0	0	0.132	0.4382	0.133	0.0113	0.107
6	7782	0.2	1	0	0	0.167	0.3852	0.167	0.0041	0.126
7	2420	0.2	1	0	0	0.228	0.3888	0.228	0.0006	0.139

2016 Age	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt	Exploit pattern	Weight DWt
0	43560	0.2	0	0	0	0.004	0.0000	0.003	0.0207	0.004
1	.	0.2	0.55	0	0	0.021	0.0004	0.034	0.1941	0.021
2	.	0.2	0.86	0	0	0.047	0.0390	0.068	0.1786	0.042
3	.	0.2	0.97	0	0	0.074	0.1842	0.084	0.1228	0.056
4	.	0.2	0.99	0	0	0.102	0.3444	0.106	0.0390	0.080
5	.	0.2	1	0	0	0.132	0.4382	0.133	0.0113	0.107
6	.	0.2	1	0	0	0.167	0.3852	0.167	0.0041	0.126
7	.	0.2	1	0	0	0.228	0.3888	0.228	0.0006	0.139

2017 Age	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt	Exploit pattern	Weight DWt
0	43560	0.2	0	0	0	0.004	0.0000	0.003	0.0207	0.004
1	.	0.2	0.55	0	0	0.021	0.0004	0.034	0.1941	0.021
2	.	0.2	0.86	0	0	0.047	0.0390	0.068	0.1786	0.042
3	.	0.2	0.97	0	0	0.074	0.1842	0.084	0.1228	0.056
4	.	0.2	0.99	0	0	0.102	0.3444	0.106	0.0390	0.080
5	.	0.2	1	0	0	0.132	0.4382	0.133	0.0113	0.107
6	.	0.2	1	0	0	0.167	0.3852	0.167	0.0041	0.126
7	.	0.2	1	0	0	0.228	0.3888	0.228	0.0006	0.139

Input units are thousands and kg - output in tonnes

Table 6.2.14. Megrim (*L. boscii*) in Div. VIIIc and IXa catch forecast: management option table

MFDP version 1a
Run: LDB
Time and date: 08:44 10/06/2015
Fbar age range (Total) : 2-4
Fbar age range Fleet 1 : 2-4

2015		Total	Landings		Discards	
Biomass	SSB	FMult	FBar	Yield	FBar	Yield
7401	6650	1	0.1892	1363	0.1135	436

2016		Total	Landings		Discards		2017	
Biomass	SSB	FMult	FBar	Yield	FBar	Yield	Biomass	SSB
7196	6462	0	0.0000	0	0.0000	0	8964	8186
.	6462	0.1	0.0189	163	0.0113	44	8713	7942
.	6462	0.2	0.0378	320	0.0227	86	8471	7705
.	6462	0.3	0.0568	472	0.0340	128	8237	7476
.	6462	0.4	0.0757	618	0.0454	168	8011	7255
.	6462	0.5	0.0946	759	0.0567	208	7792	7042
.	6462	0.6	0.1135	895	0.0681	247	7580	6835
.	6462	0.7	0.1324	1026	0.0794	284	7375	6636
.	6462	0.8	0.1514	1153	0.0908	321	7177	6443
.	6462	0.9	0.1703	1274	0.1021	357	6986	6256
.	6462	1	0.1892	1392	0.1135	393	6800	6075
.	6462	1.1	0.2081	1505	0.1248	427	6621	5901
.	6462	1.2	0.2270	1614	0.1362	461	6448	5732
.	6462	1.3	0.2460	1720	0.1475	493	6280	5569
.	6462	1.4	0.2649	1822	0.1589	526	6117	5411
.	6462	1.5	0.2838	1920	0.1702	557	5960	5258
.	6462	1.6	0.3027	2014	0.1815	587	5808	5110
.	6462	1.7	0.3216	2106	0.1929	617	5661	4967
.	6462	1.8	0.3406	2194	0.2042	647	5518	4829
.	6462	1.9	0.3595	2279	0.2156	675	5380	4695
.	6462	2	0.3784	2361	0.2269	703	5247	4565

Table 6.2.15 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Single option prediction. Detail Tables.

MFDP version 1a
Run: LDB
Time and date: 08:44 10/06/2015
Fbar age range (Total) : 2-4
Fbar age range Fleet 1 : 2-4

Year: 2015 F multiplier: 1 Fleet1 HCFbar: 0.1892 Fleet1 DFbar: 0.1135

Age	Catch F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
0	0	0	0	0.0207	809	4	43560	192	0	0	0	0
1	0.0004	12	0	0.1941	5720	121	35664	756	19615	416	19615	416
2	0.039	720	49	0.1786	3297	137	22581	1066	19420	917	19420	917
3	0.1842	3969	335	0.1228	2646	147	27469	2044	26645	1982	26645	1982
4	0.3444	2156	228	0.039	244	20	8261	846	8178	837	8178	837
5	0.4382	1583	210	0.0113	41	4	4912	648	4912	648	4912	648
6	0.3852	2265	378	0.0041	24	3	7782	1296	7782	1296	7782	1296
7	0.3888	711	162	0.0006	1	0	2420	553	2420	553	2420	553
Total		11415	1363		12782	436	152649	7401	88972	6650	88972	6650

Year: 2016 F multiplier: 1 Fleet1 HCFbar: 0.1892 Fleet1 DFbar: 0.1135

Age	Catch F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
0	0	0	0	0.0207	809	4	43560	192	0	0	0	0
1	0.0004	12	0	0.1941	5603	119	34933	741	19213	407	19213	407
2	0.039	766	52	0.1786	3510	146	24038	1135	20673	976	20673	976
3	0.1842	2149	181	0.1228	1433	80	14872	1107	14426	1073	14426	1073
4	0.3444	4317	457	0.039	489	39	16545	1694	16379	1677	16379	1677
5	0.4382	1486	197	0.0113	38	4	4610	608	4610	608	4610	608
6	0.3852	747	125	0.0041	8	1	2566	427	2566	427	2566	427
7	0.3888	1662	380	0.0006	3	0	5659	1293	5659	1293	5659	1293
Total		11139	1392		11892	393	146783	7196	83526	6462	83526	6462

Year: 2017 F multiplier: 1 Fleet1 HCFbar: 0.1892 Fleet1 DFbar: 0.1135

Age	Catch F	CatchNos	Yield	DF	DCatchNos	DYield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
0	0	0	0	0.0207	809	4	43560	192	0	0	0	0
1	0.0004	12	0	0.1941	5603	119	34933	741	19213	407	19213	407
2	0.039	751	51	0.1786	3438	143	23546	1111	20249	956	20249	956
3	0.1842	2288	193	0.1228	1525	85	15832	1178	15357	1143	15357	1143
4	0.3444	2337	247	0.039	265	21	8958	917	8868	908	8868	908
5	0.4382	2975	395	0.0113	77	8	9232	1219	9232	1219	9232	1219
6	0.3852	701	117	0.0041	7	1	2408	401	2408	401	2408	401
7	0.3888	1340	306	0.0006	2	0	4562	1042	4562	1042	4562	1042
Total		10403	1310		11726	381	143030	6800	79889	6075	79889	6075

Input units are thousands and kg - output in tonnes

Table 6.2.16 **Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa**
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to catches and SSB (by weight) of these year classes

Year-class	2012	2013	2014	2015	2016
Stock No. (thousands) of 0 year-olds	77937	41612	43560	43560	43560
Source	XSA	XSA	GM90-12	GM90-12	GM90-12
Status Quo F:					
% in 2015 landings	26.8	10.3	6.7	0.2	-
% in 2016	27.8	14.6	11.1	6.7	0.2
% in 2015 SSB	29.8	13.8	6.3	0.0	-
% in 2016 SSB	26.0	16.6	15.1	6.3	0.0
% in 2017 SSB	20.1	14.9	18.8	15.7	6.7

GM : geometric mean recruitment

Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa : Year-class % contribution to

a) 2016 catches **b) 2017 SSB**

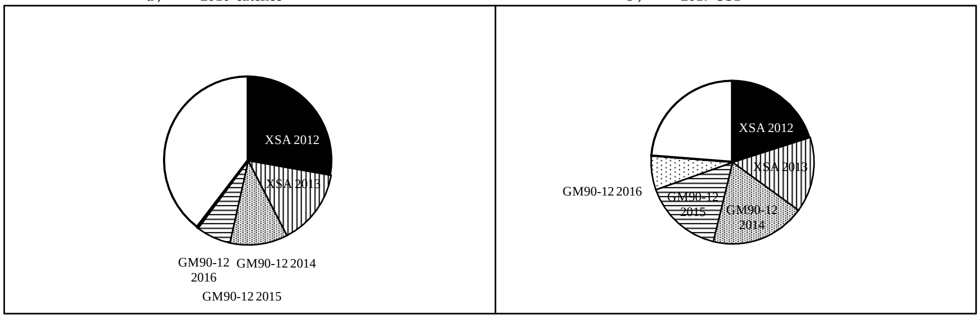


Table 6.2.17 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Yield per recruit results.

MFYPR version 2a
Run: LDB
Time and date: 11:25 10/06/2015
Yield per results

Catch	Landings			Discards								
FMult	Fbar	CatchNos	Yield	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	;pwnNosSpwr	SSBSpwn
0	0	0	0	0	0	0	5.5167	0.5497	4.0334	0.5314	4.0334	0.5314
0.1	0.0189	0.0783	0.0129	0.0113	0.0343	0.0012	4.9556	0.4386	3.4762	0.4205	3.4762	0.4205
0.2	0.0378	0.1279	0.0202	0.0227	0.0665	0.0024	4.5486	0.3614	3.0728	0.3434	3.0728	0.3434
0.3	0.0568	0.1599	0.0243	0.034	0.0969	0.0034	4.2386	0.3051	2.7664	0.2874	2.7664	0.2874
0.4	0.0757	0.1805	0.0264	0.0454	0.1256	0.0043	3.9939	0.2628	2.5252	0.2452	2.5252	0.2452
0.5	0.0946	0.1936	0.0273	0.0567	0.1527	0.0052	3.7952	0.23	2.3299	0.2126	2.3299	0.2126
0.6	0.1135	0.2014	0.0274	0.0681	0.1783	0.006	3.63	0.204	2.1681	0.1867	2.1681	0.1867
0.7	0.1324	0.2054	0.0271	0.0794	0.2026	0.0068	3.4902	0.183	2.0315	0.1659	2.0315	0.1659
0.8	0.1514	0.2069	0.0265	0.0908	0.2255	0.0074	3.37	0.1658	1.9144	0.1488	1.9144	0.1488
0.9	0.1703	0.2064	0.03	0.1021	0.2473	0.0081	3.27	0.1514	1.8128	0.1346	1.8128	0.1346
1	0.1892	0.2045	0.0248	0.1135	0.2679	0.0086	3.1729	0.1393	1.7235	0.1227	1.7235	0.1227
1.1	0.2081	0.2016	0.0239	0.1248	0.2876	0.0092	3.0908	0.1291	1.6444	0.1126	1.6444	0.1126
1.2	0.227	0.198	0.0229	0.1362	0.3062	0.0097	3.0171	0.1202	1.5736	0.1038	1.5736	0.1038
1.3	0.246	0.1939	0.022	0.1475	0.324	0.0101	2.9505	0.1125	1.5099	0.0963	1.5099	0.0963
1.4	0.2649	0.1894	0.021	0.1589	0.3409	0.0105	2.89	0.1058	1.4521	0.0897	1.4521	0.0897
1.5	0.2838	0.1847	0.0201	0.1702	0.357	0.0109	2.8346	0.0998	1.3994	0.0839	1.3994	0.0839
1.6	0.3027	0.1798	0.0192	0.1815	0.3723	0.0113	2.7836	0.0946	1.3511	0.0787	1.3511	0.0787
1.7	0.3216	0.1748	0.0184	0.1929	0.3869	0.0116	2.7366	0.0899	1.3066	0.0741	1.3066	0.0741
1.8	0.3406	0.1698	0.0176	0.2042	0.4009	0.0119	2.6929	0.0856	1.2655	0.07	1.2655	0.07
1.9	0.3595	0.1649	0.0168	0.2156	0.4142	0.0122	2.6523	0.0818	1.2274	0.0663	1.2274	0.0663
2.0	0.3784	0.1600	0.0161	0.2269	0.4270	0.0125	2.6144	0.0784	1.1919	0.063	1.1919	0.063

Reference point	F multiplier	Absolute F
Fleet1 Landings Fbar(2-4)	1	0.1892
FMax	0.5753	0.1088
F0.1	0.376	0.0711
F35%SPR	0.6032	0.1141

Weights in kilograms

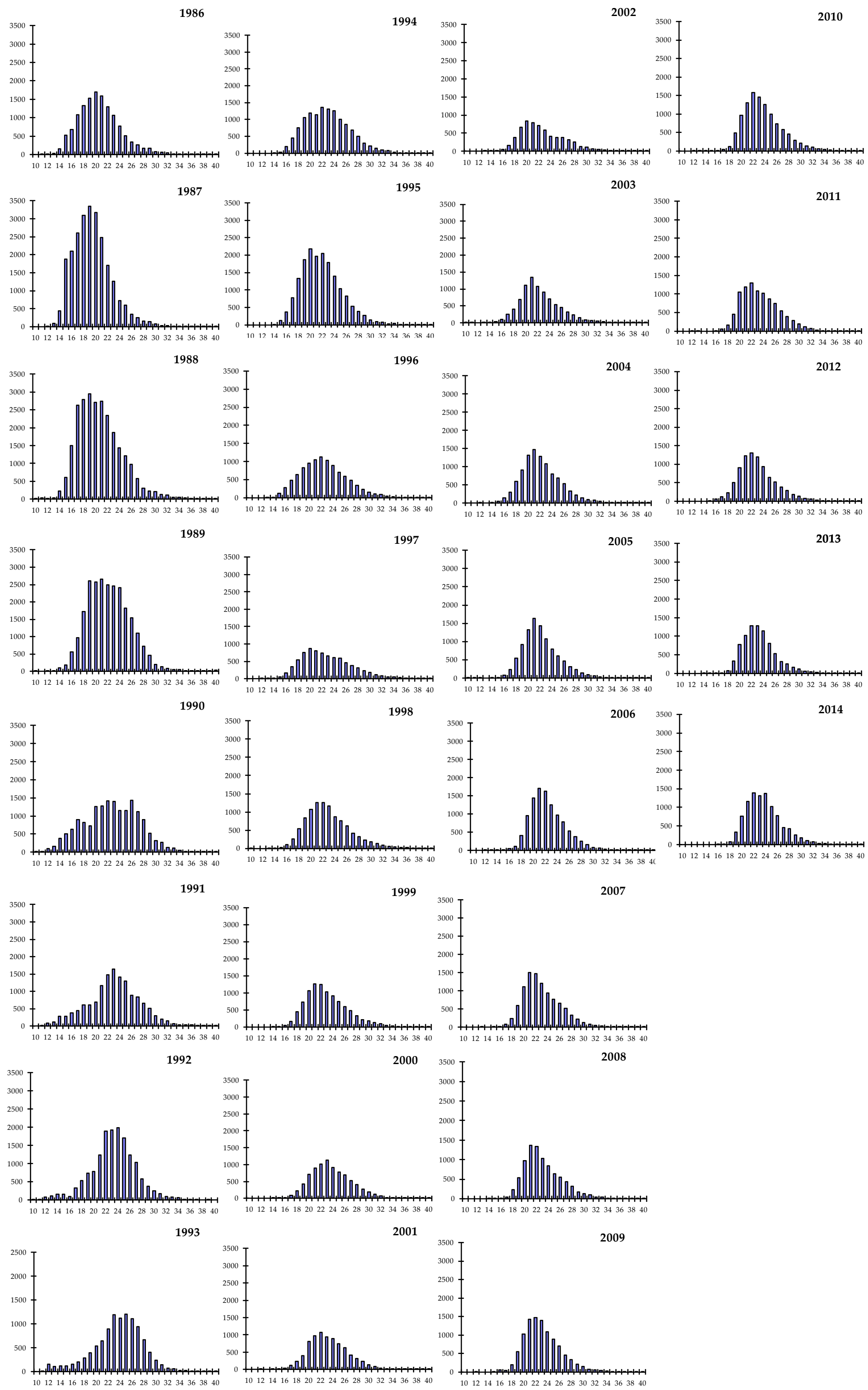


Figure 6.2.1 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Annual length compositions of landings ('000)

Standardized log(abundance index at age) from SpGFS-WIBTS-Q4
(black bubble means < 0)

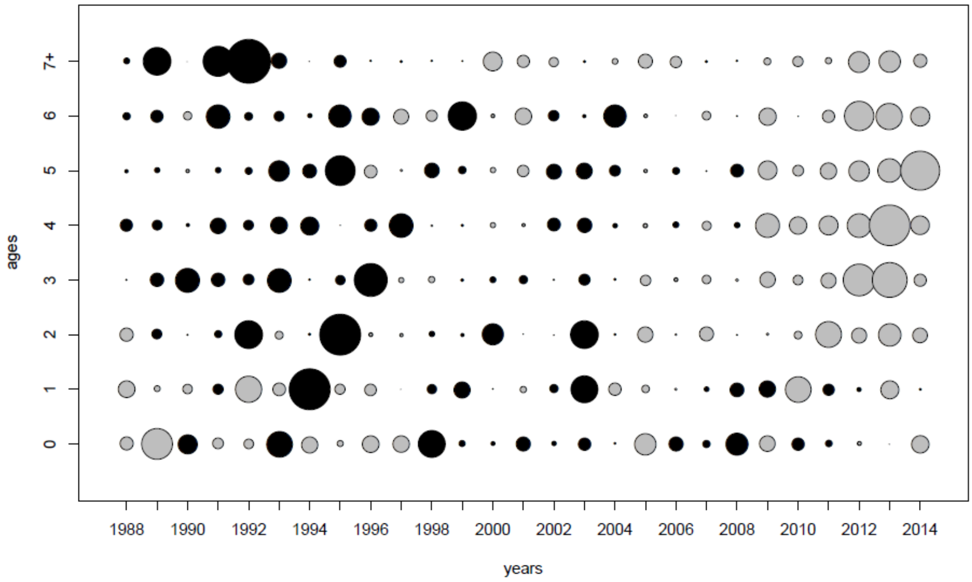
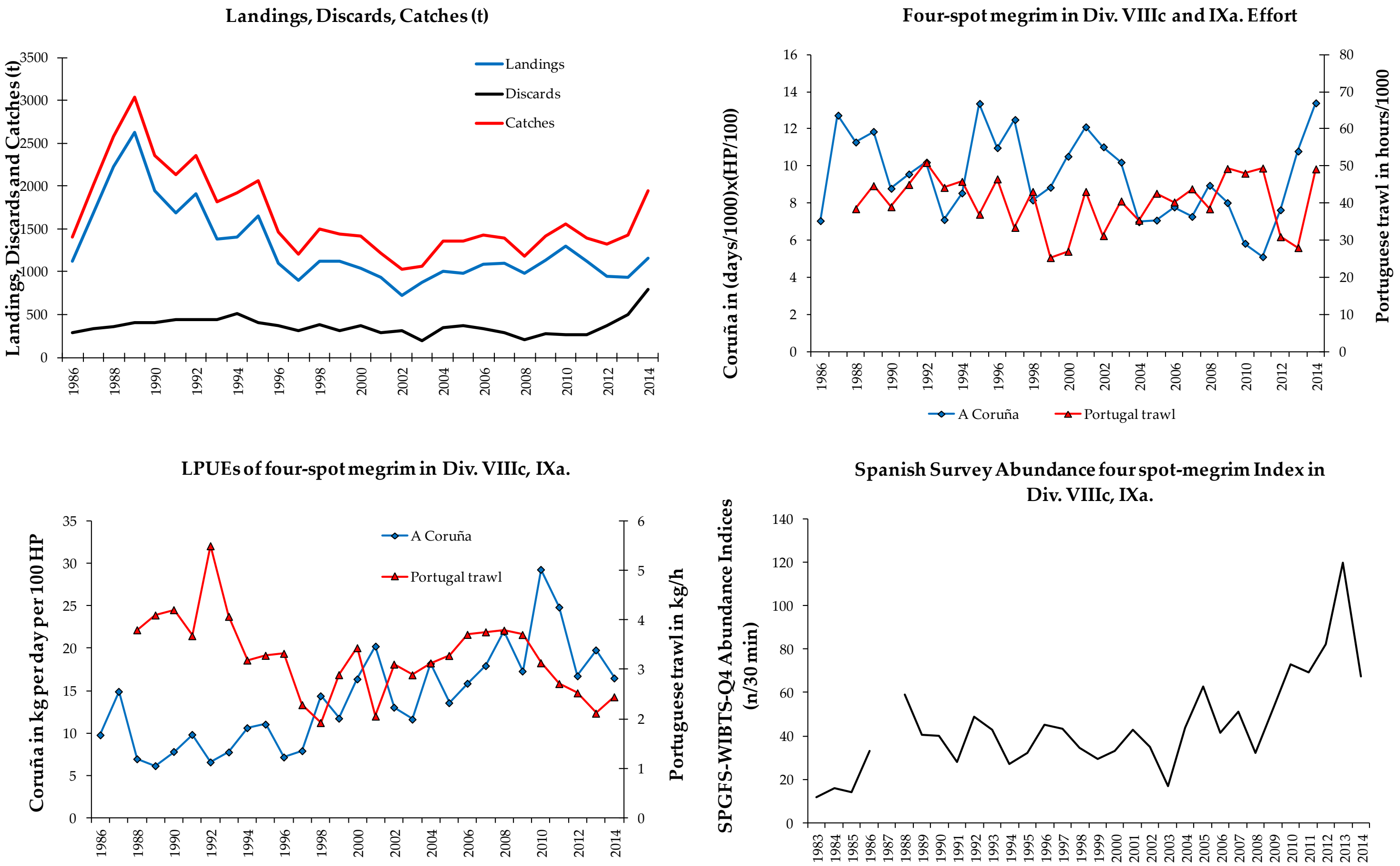


Figure 6.2.2: Four-spot megrim (*L. boscii*) in Divisions VIIIc&IXa

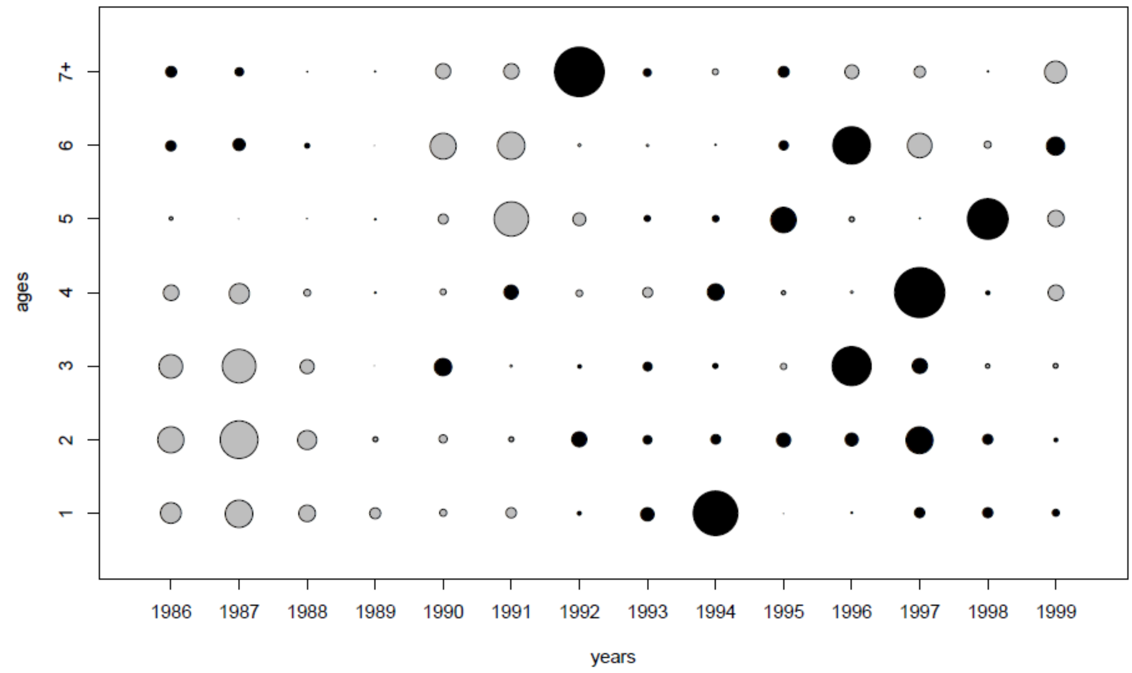


* Spanish Landings of 2008 revised in WG2010 from original value presented

* Portuguese Trawl Effort of 2007 and 2008 revised in WG2010 from original value presented

Figure 6.2.3 Four-spot megrim (*L.boscii*) in Divisions VIIIc and IXa. Landings (t), Efforts, LPUEs and Abundance Indices.

Standardized log(abundance index at age) from SP-LCGOTBDEF-1
(black bubble means < 0)



Standardized log(abundance index at age) from SP-LCGOTBDEF-2
(black bubble means < 0)

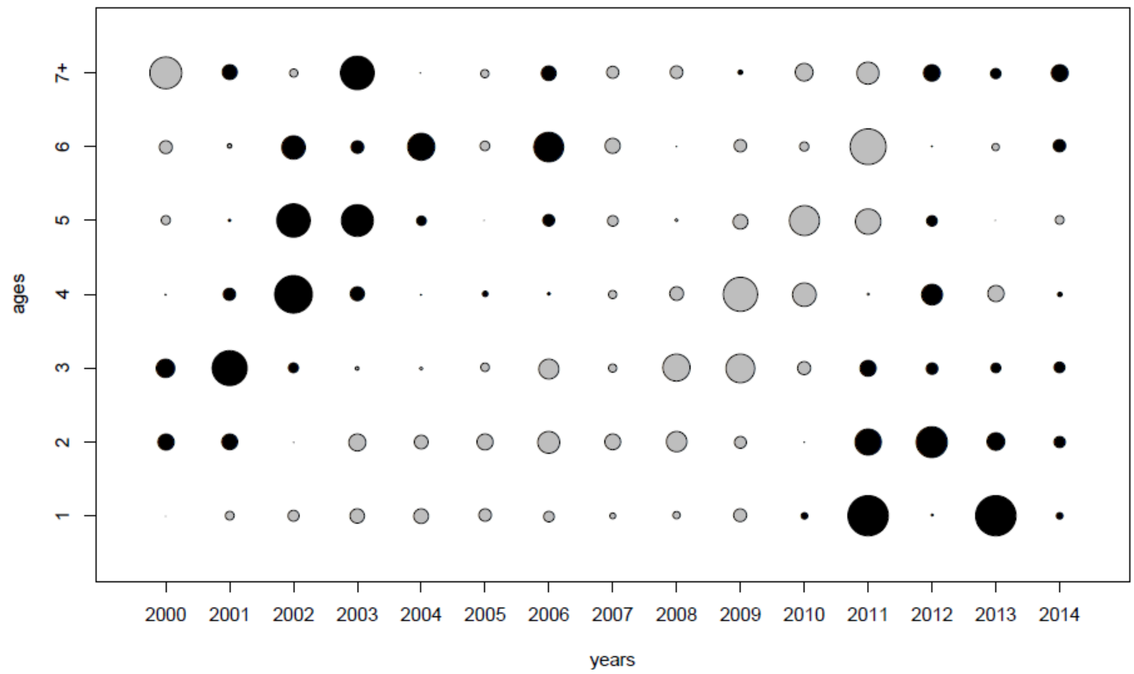
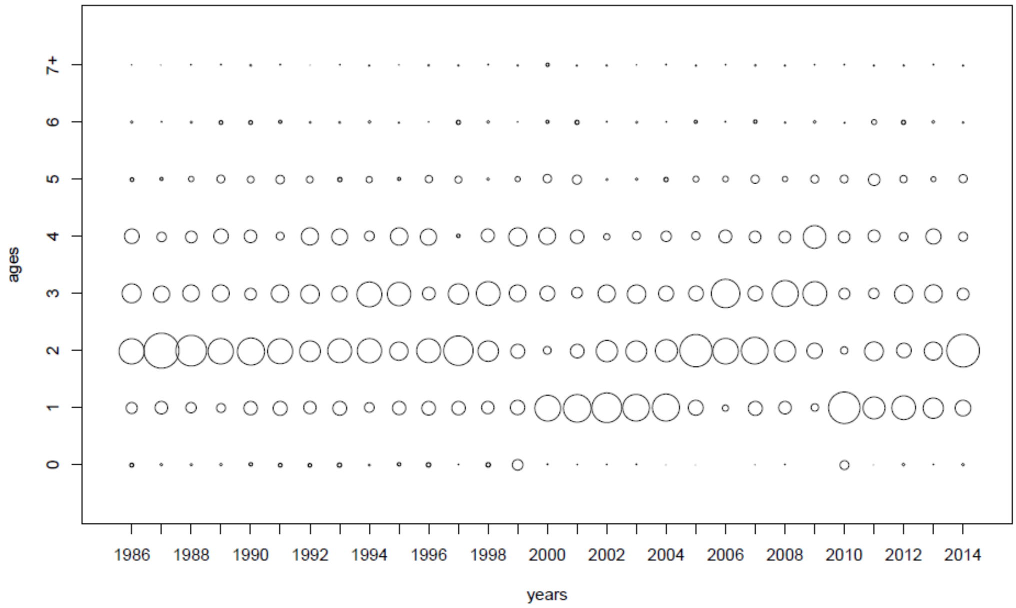


Figure 6.2.3(b): Four-spot megrim (*L. boscii*) in Divisions VIIIc&IXa

Catches proportions at age



Standardized catches proportions at age (black bubble means < 0)

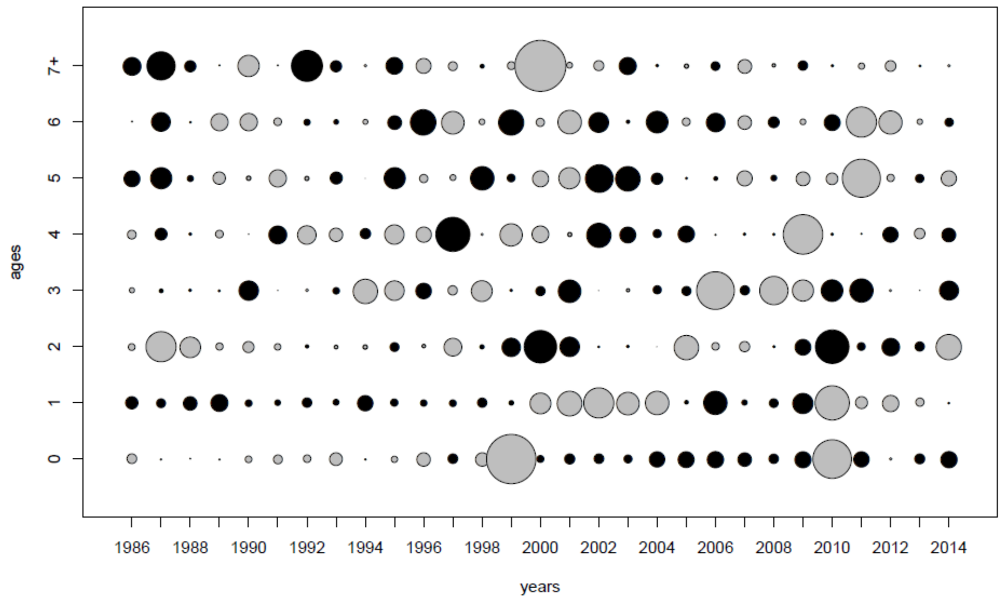
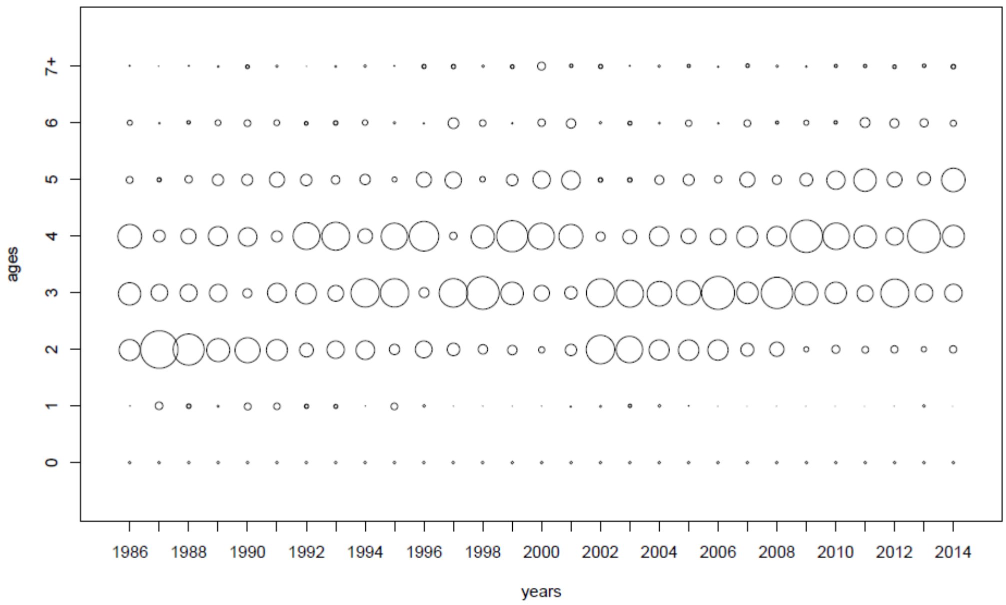


Figure 6.2.4(a). Four-spot megrim (L. boscii) in Divisions VIIIc & IXa.

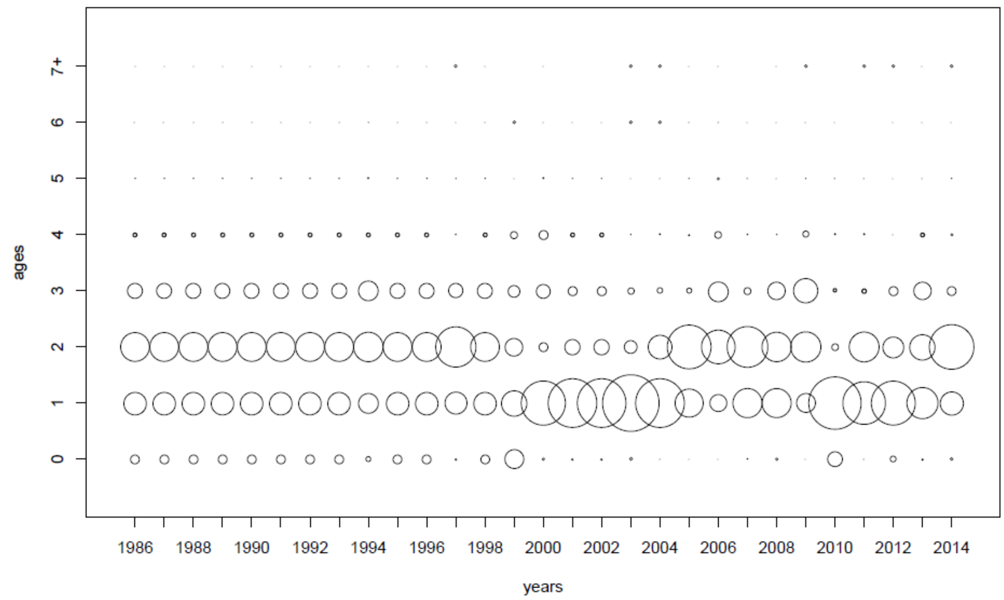
Landings proportions at age



Standardized landings proportions at age (black bubble means < 0)

Figure 6.2.4(b). Four-spot megrim (*L. boscii*) in Divisions VIIIc & IXa.

Discards proportions at age



Standardized discards proportions at age (black bubble means < 0)

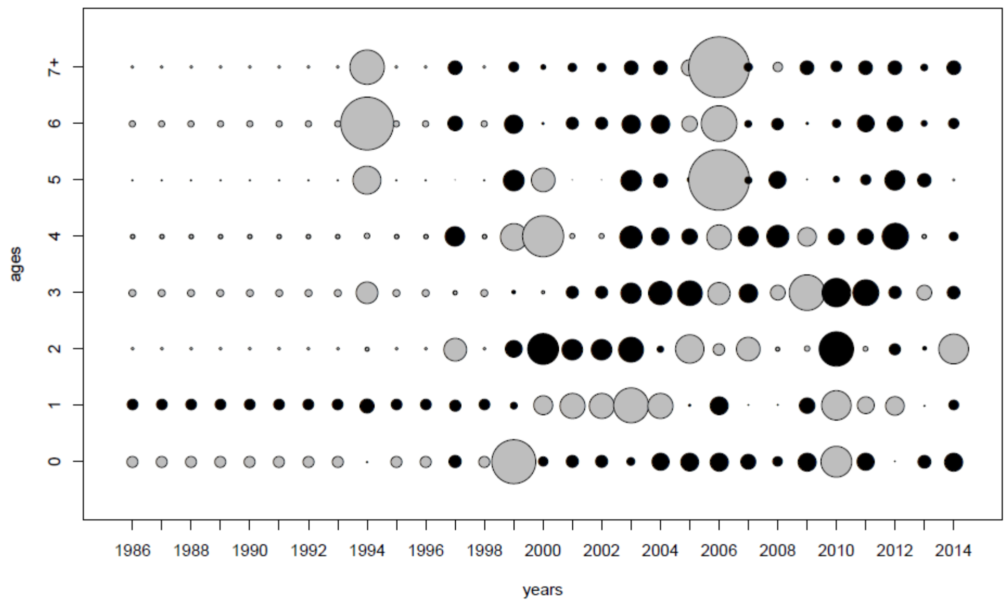


Figure 6.2.4(c). Four-spot megrim (*L. boscii*) in Divisions VIIIc & IXa.

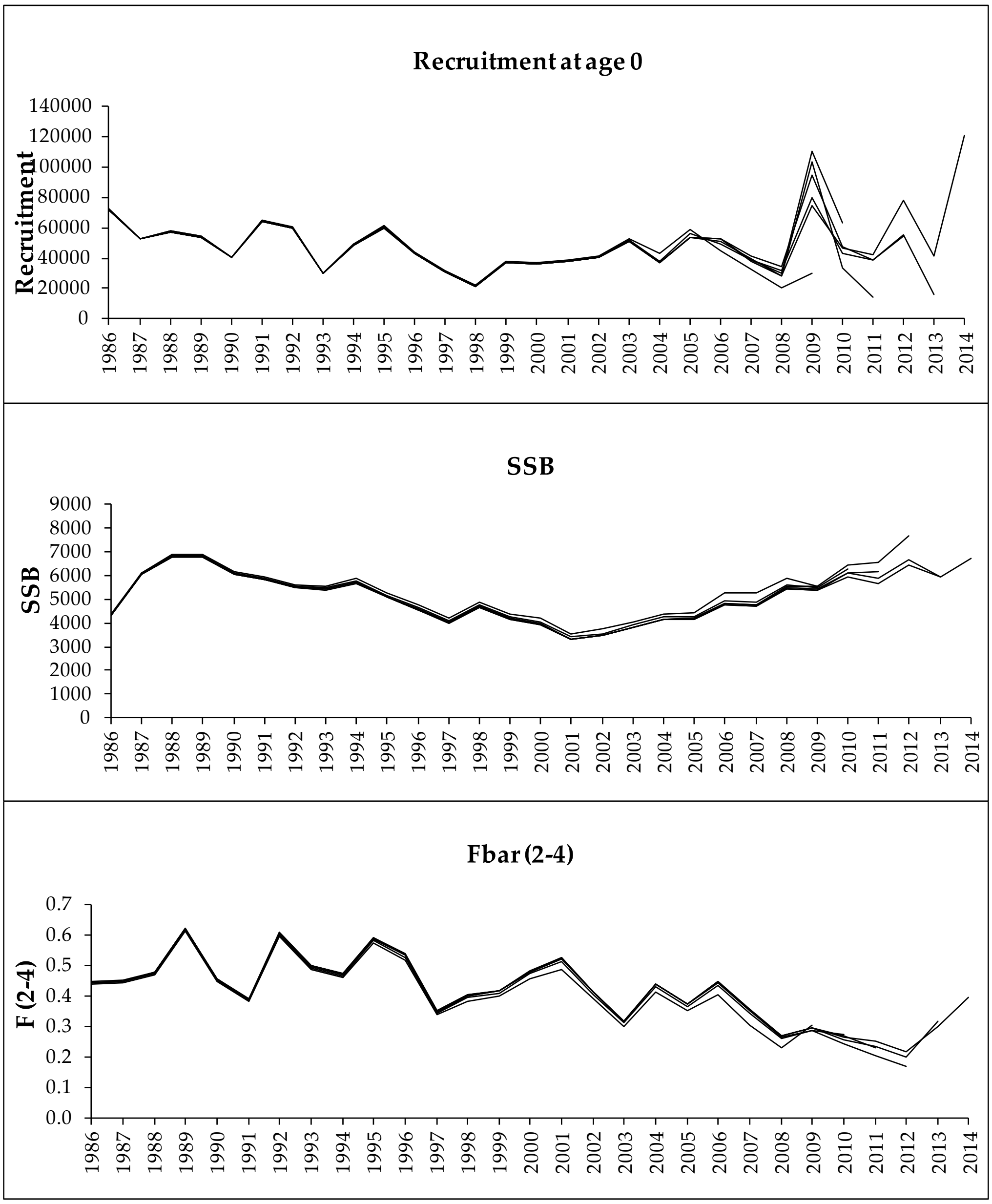


Figure 6.2.5. Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Retrospective XSA

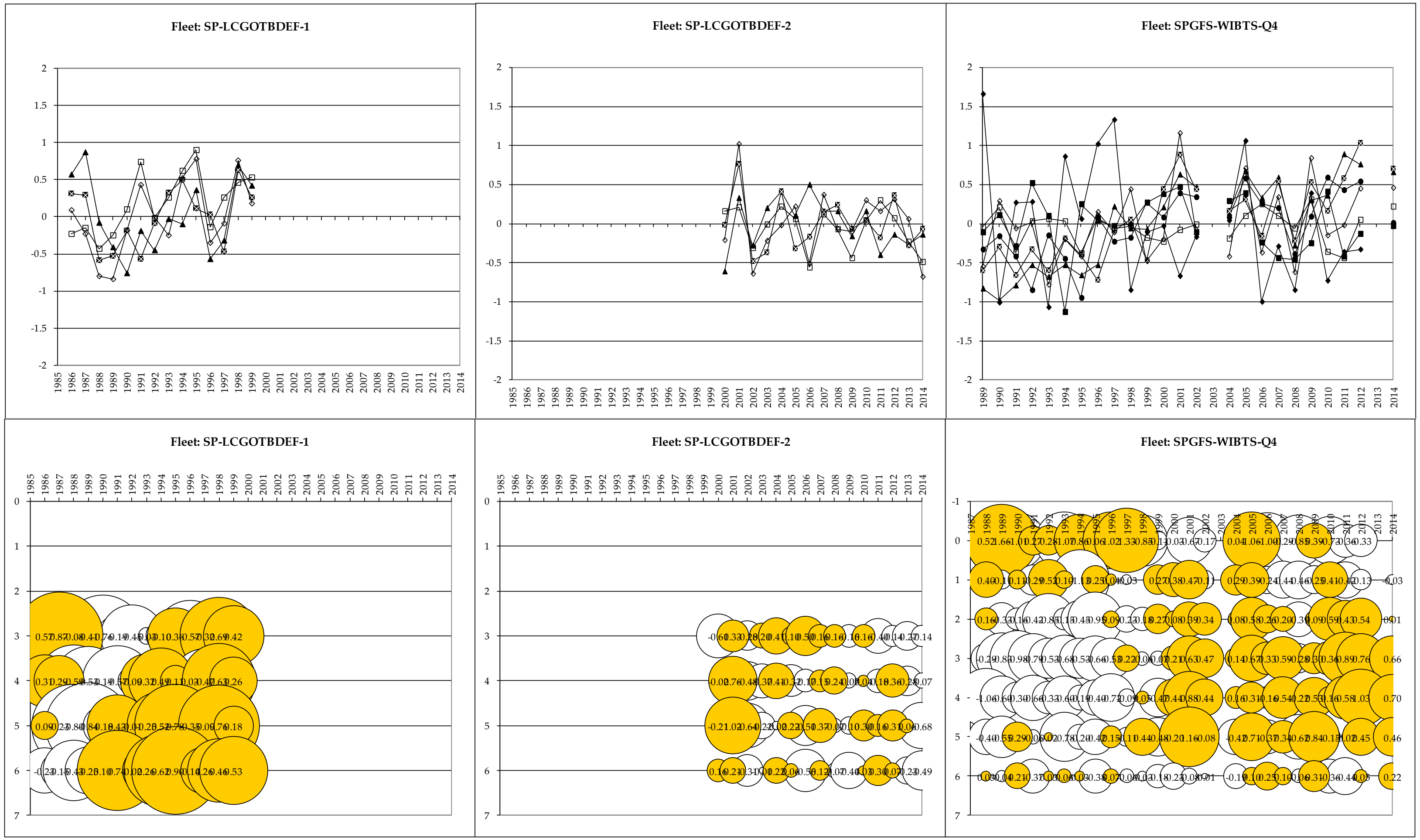


Figure 6.2.6. Four spot megrim (*L. boscii*) in Divisions VIIIc and IXa. LOG CATCHABILITY RESIDUAL PLOTS (XSA)

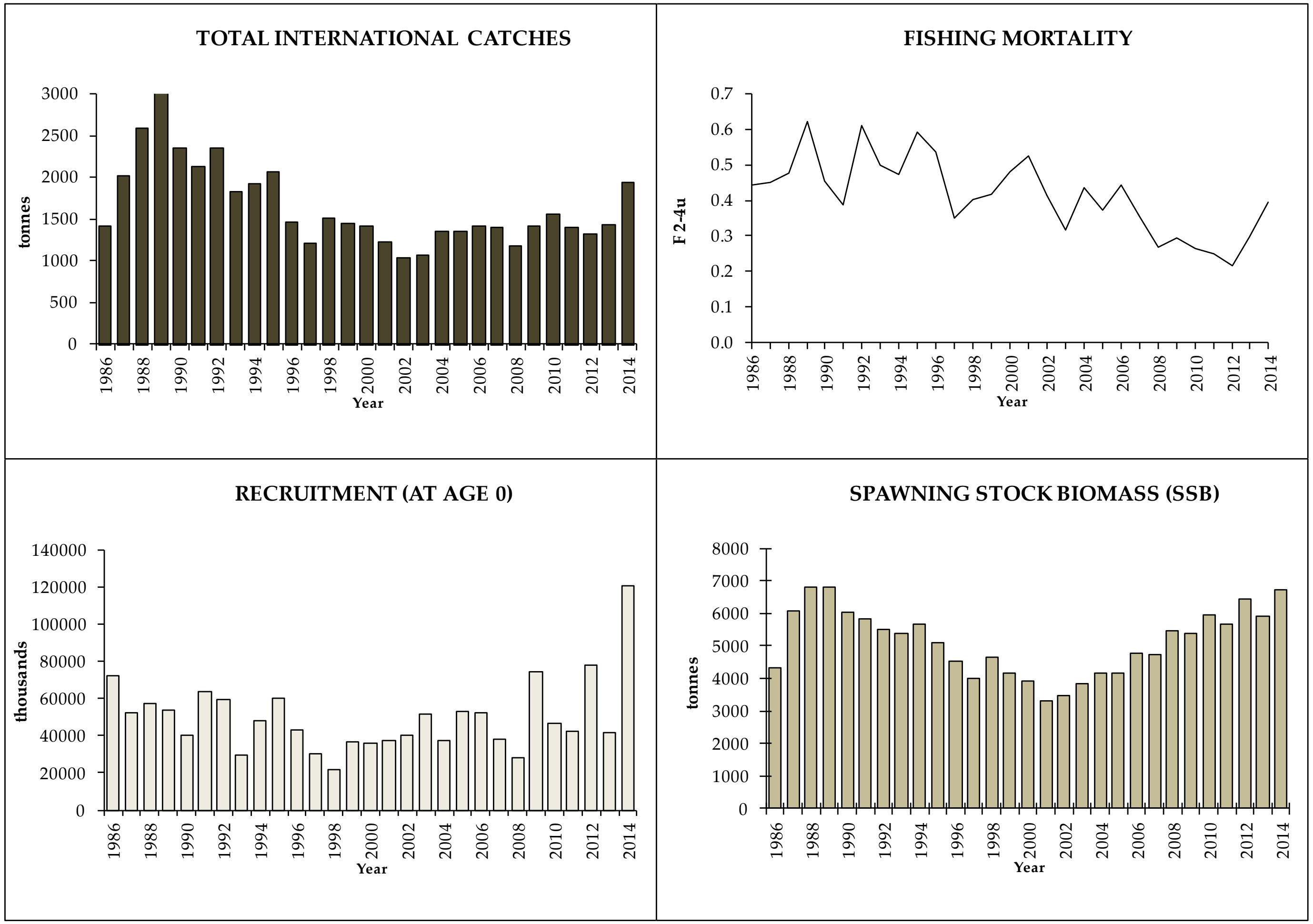
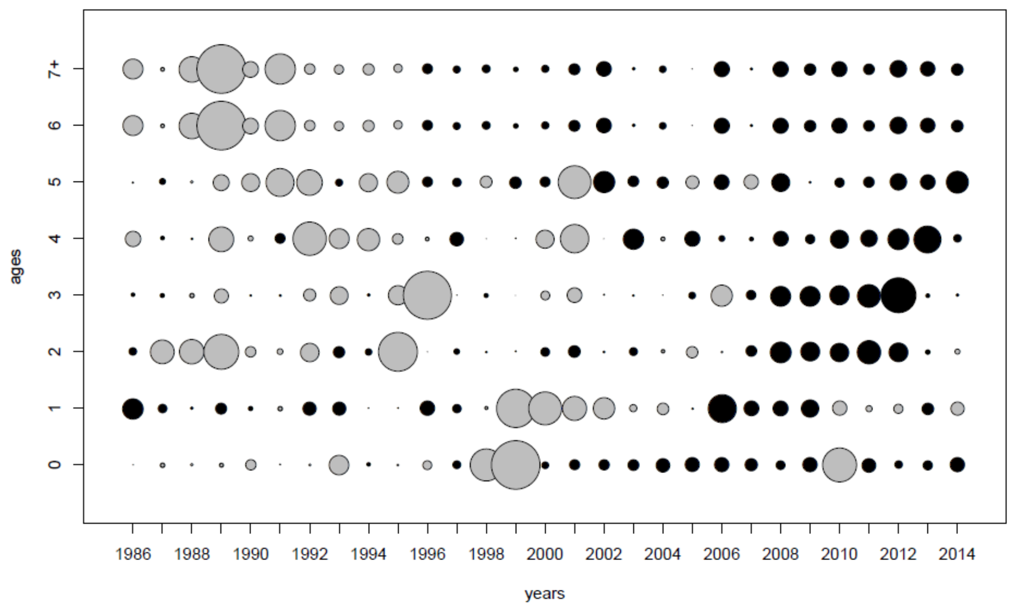


Figure 6.2.7(a). Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Stock Summary

Standardized F-at-age (black bubbles means <0)



Standardized relative F-at-age (black bubble means < 0)

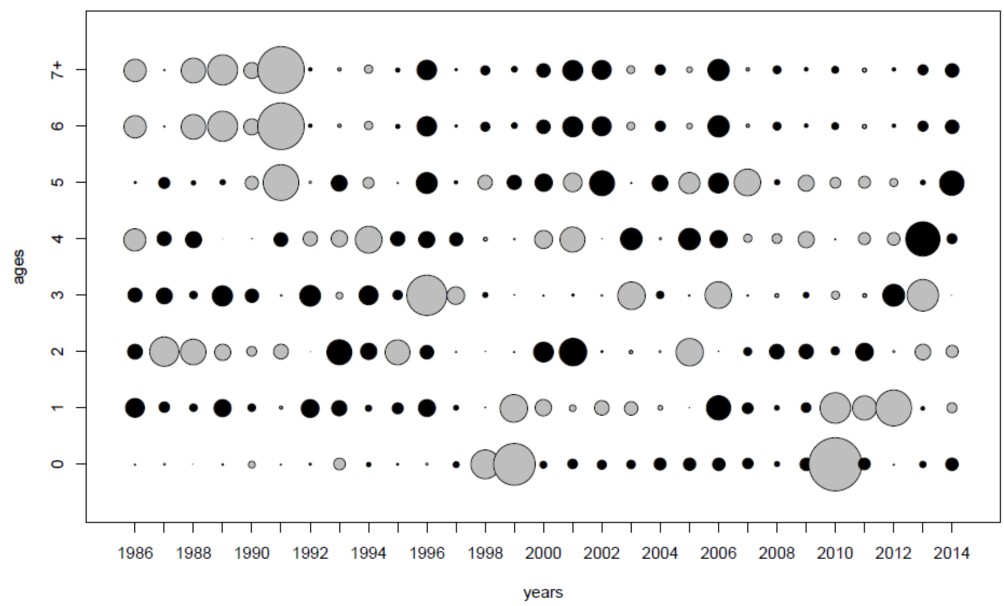
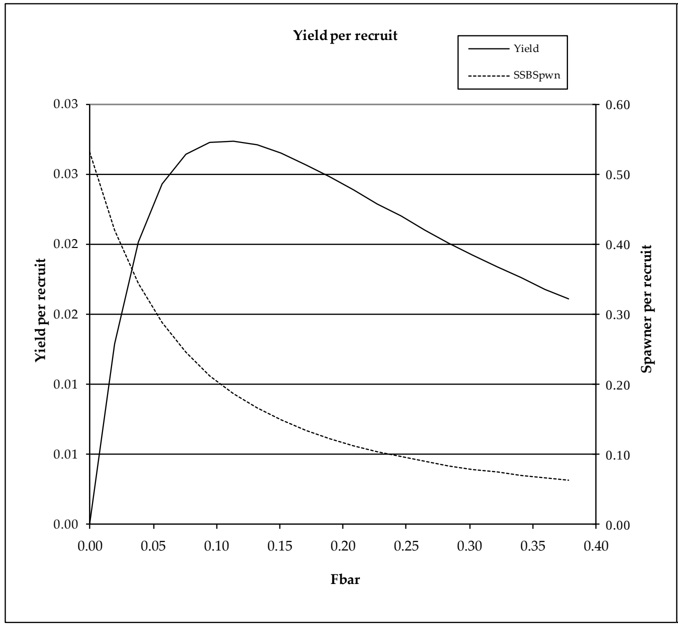
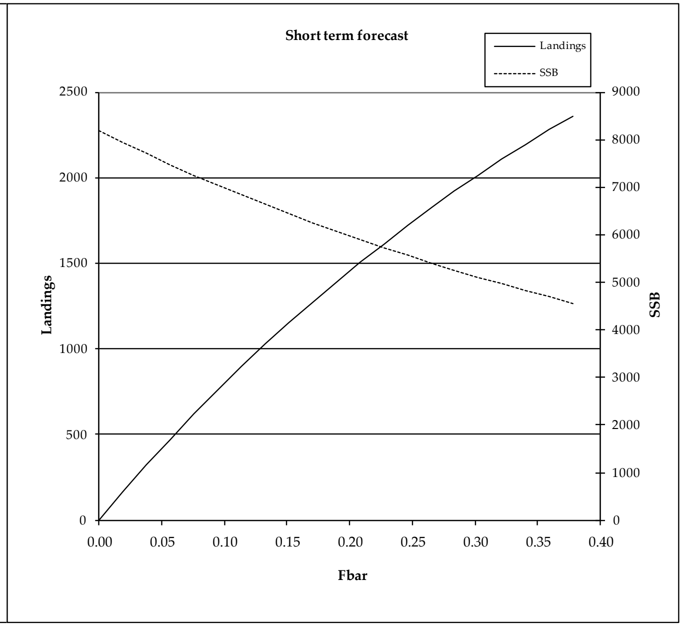


Figure 6.2.7(b): Four-spot megrim (*L. boscii*) in Divisions VIIIc&IXa





MFYPR version 2a
Run: LDB
Time and date: 11:25 10/06/2015

Reference point	F multiplier	Absolute F
Fleet1 Landings Fbar(2-4)	1.0000	0.1892
FMax	0.5753	0.1088
F0.1	0.3760	0.0711
F35%SPR	0.6032	0.1141

MFDP version 1a
Run: LDB
Time and date: 08:44 10/06/2015
Fbar age range (Total) : 2-4
Fbar age range Fleet 1 : 2-4

Input units are thousands and kg - output in tonnes

Figure 6.2.8. Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Forecast summary

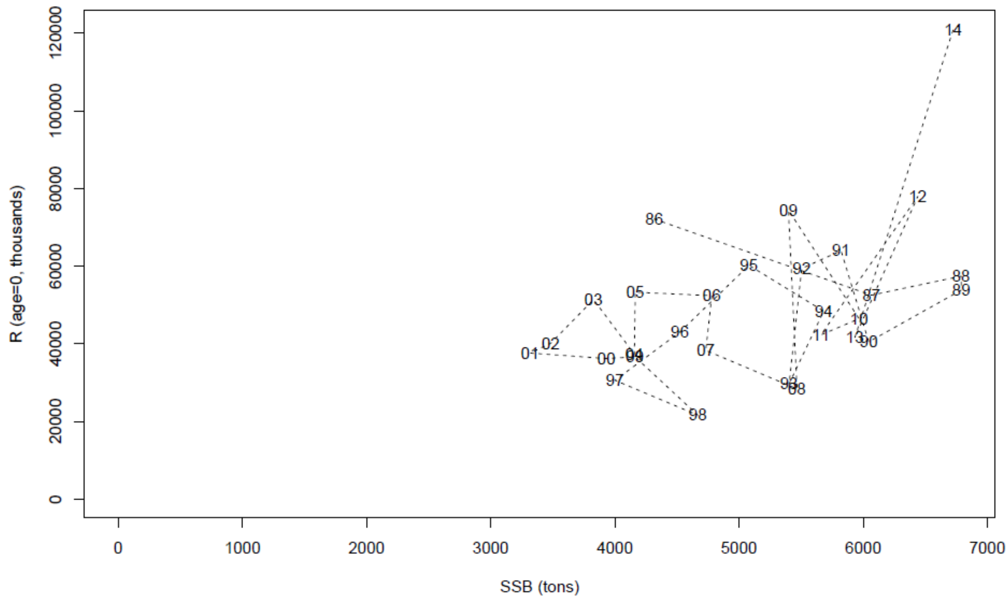


Figure 6.2.9. Four spot megrim (*L.boscii*) in Divisions VIIIc and IXa. SSB-Recruitment plot.

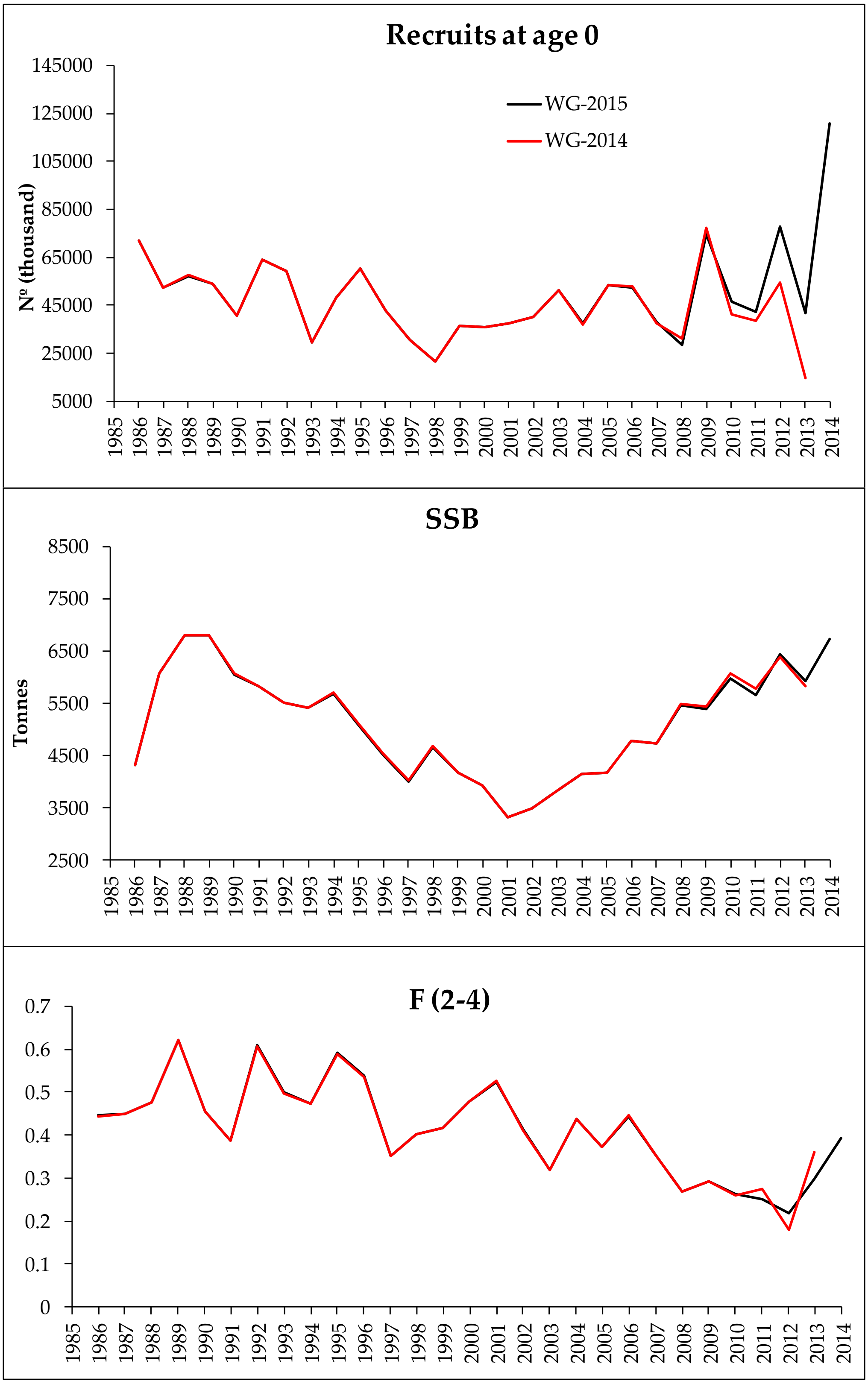


Figure 6.2.10. Four-spot megrim (*L. boscii*). Recruits, SSB and Fs from WG14 and WG15

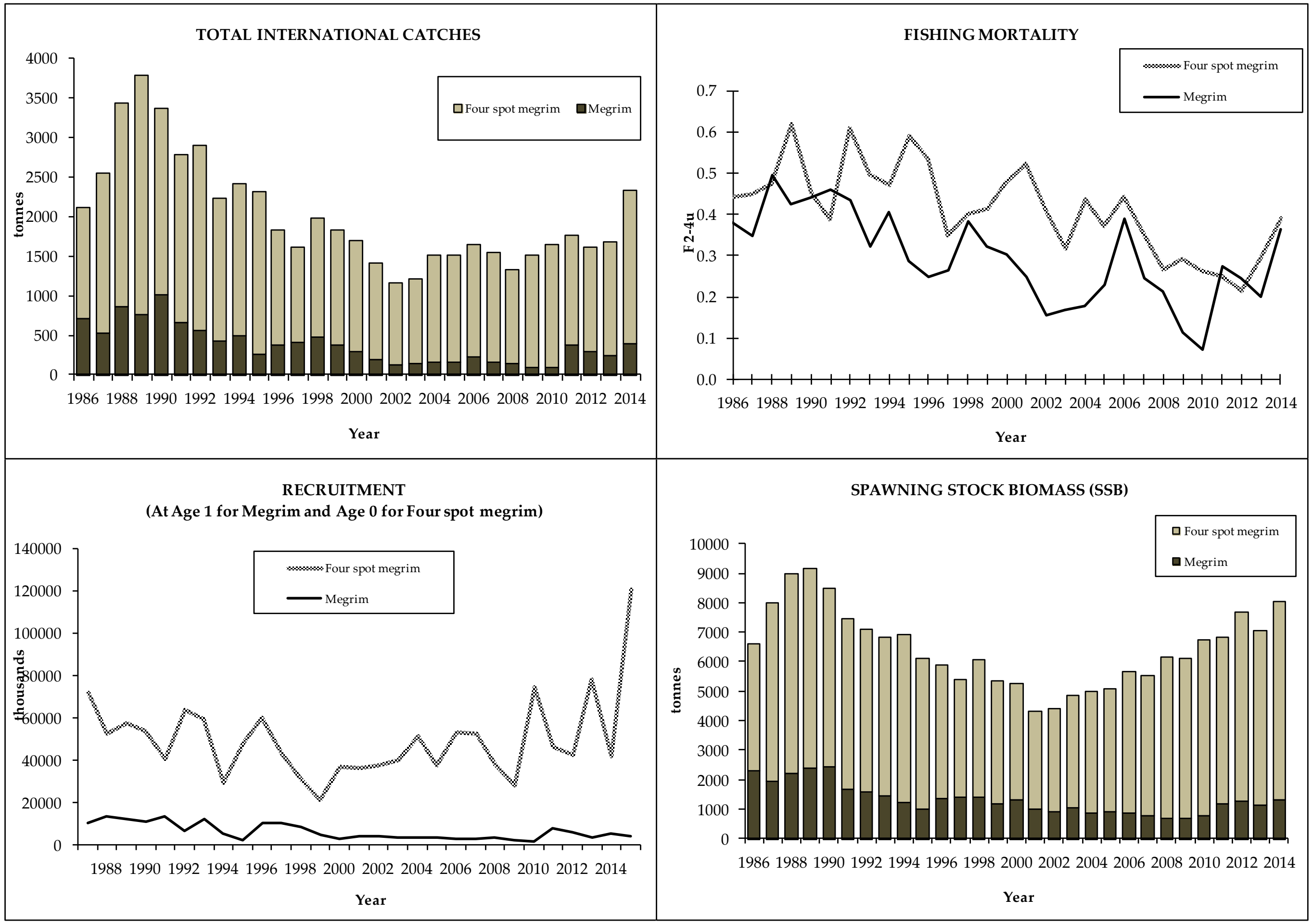


Figure 6.3.1. Stock trends for both stocks. Megrin and Four-spot megrim in Divisions VIIIc and IXa.

Combined Short Term Forecasts assuming status quo in 2014 and 2015

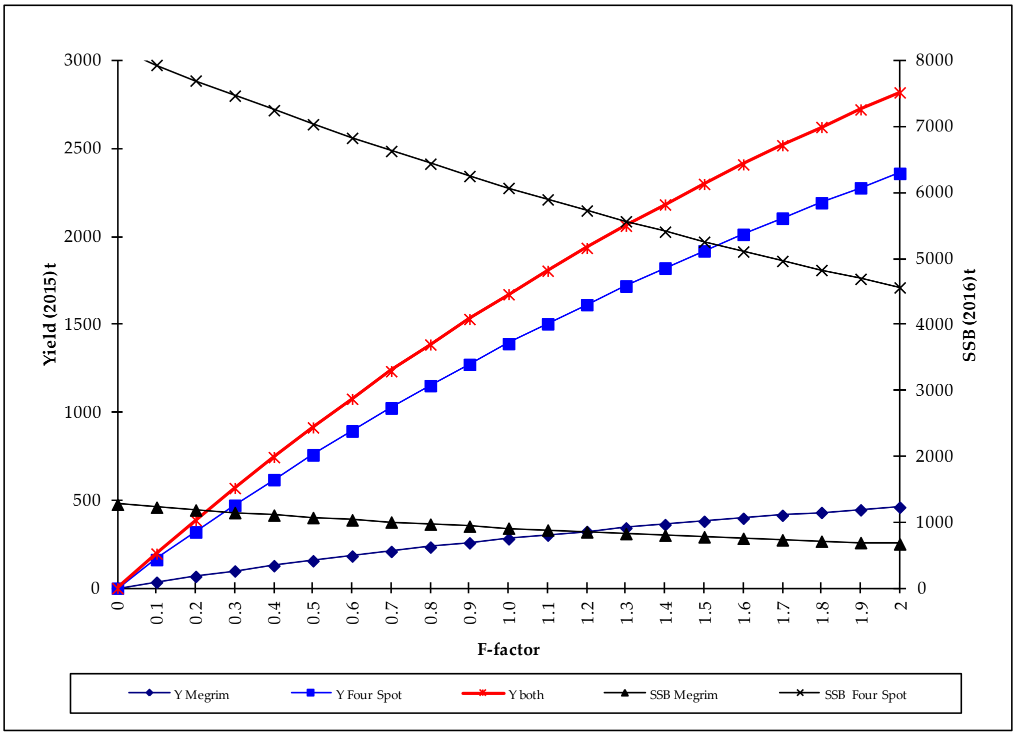


Figure 6.3.2. Megrims (*L. whiffiagonis and L. boscii*) in Divisions VIIIc and IXa.

7 Bay of Biscay Sole

Type of assessment in 2014: update.

Data revisions this year: Compared to last year assessment, there is only very limited change in data due to small revisions of 2013 landings and of 2013 commercial LPUE and survey CPUE.

7.1 General

7.1.1 Ecosystem aspects

See Stock Annex

7.1.2 Fishery description

See Stock Annex

7.1.3 Summary of ICES advice for 2015 and management applicable to 2014 and 2015

ICES advice for 2014:

Since 2010 the ICES advice is to decrease the fishing mortality step by step to the F_{MSY} (0.26 for the Bay of Biscay sole) until 2015.

The advice provided for 2015: ICES advises on the basis of the transition to the MSY approach that catches in 2015 should be no more than 2407 tonnes. All catches are assumed to be landed.

Management applicable to 2014 and 2015

The sole landings in the Bay of Biscay are subject to a TAC regulation. The 2014 TAC was set at 3800 t and the 2015 TAC is the same at 3800 t. The minimum landing size is 24 cm and the minimum mesh size is 70 mm for trawls and 100 mm for fixed nets, when directed on sole. Since 2002, the hake recovery plan has increased the minimum mesh size for trawl to 100 mm in a large part of the Bay of Biscay but since 2006 trawlers using a square mesh panel were allowed to use 70 mm mesh size in this area.

Since the end of 2006, the French vessels must have a Special Fishing Permit when their sole annual landing is above 2 t or be allowed to have more than 100 kg on board.

The Belgian vessel owners get monthly non transferable individual quota for sole and the amount is related to the capacity of the vessel.

A regulation establishing a management plan was adopted in February 2006. The objective was to bring the spawning stock biomass of Bay of Biscay sole above the precautionary level of 13 000 tonnes in 2008 by gradually reducing the fishing mortality rate on the stock. Once this target is reached, the Council has to decide on a long-term target fishing mortality and a rate of reduction in the fishing mortality for application until the target has been reached. However, although the stock was estimated above the SSB target in 2008 by ICES in 2009, the long-term target fishing mortality rate and the associated rate of reduction have not yet been set.

7.2 Data

7.2.1 Commercial catches and discards

The WG estimates of landings and catches are shown in Table 7.1a. The WG landing estimates are the figure obtained by crossing auction sales, available logbooks and data communicated by the administrations of countries involved in the Bay of Biscay sole fishery. The French catches are predominant. Since 2005, the same method has been used to estimate them and, because they are nearly exclusively landed in Bay of Biscay harbours, the record of the auction sales allows us to consider that the reliability of their estimates is satisfactory for the full time-series.

The official landings are lower up to 2008 than the WG landings estimates but they become largely higher in 2009-2010 because since 2009, a new method has been implemented to calculate the French official landings. This important discrepancy in 2009-2010 was likely caused by some assumptions in the algorithm implemented to calculate French official landings in these years which was modified in 2011. Consequently the official and the WG landing estimates are closer since 2011. However, the WG method to estimate landings is considered to continue to provide the best available estimates of the landing series.

The 2013 landings estimate was revised to 4235 t, this is less than a 0.1 % increase.

In 2002, landings increased to 5486 t due to very favourable weather conditions for the fixed nets' fishery (frequent strong swell periods in the first quarter). In the absence of such apparently rare conditions, the landings in 2003-2008 ranged between 4000 t and 4800 t before falling to 3650 t in 2009 and increasing to 4632 t in 2011 (Table 7.1a).

The 2014 landings figure (3934 t) is 12.7 % above the landings predicted by the 2014 WG at status quo mortality (3435 t).

Discards estimates were provided for the French offshore trawler fleet from 1984 to 2003 using the RESSGASC surveys. Because these estimates depend largely on some questionable hypothesis, their monitoring was not continued in 2004 and they are no longer used in the assessment. However, this survey allowed affirmation that the discards of offshore trawlers are low at age 2 and above. This low level has been confirmed by observations at sea in recent years. These observations have also shown that discards of beam trawlers and gillnetters are generally low but that the inshore trawlers fleet may have occasionally high discards of sole. Unfortunately, they are difficult to estimate because the effort data of inshore trawlers are not precise enough to allow estimating them by relevant areas. However, the French and Belgian discards data should be analysed as soon as possible to investigate if these difficulty can be circumvented before a future benchmark.

7.2.2 Biological sampling

The quarterly French sampling for length compositions is by gear (trawl or fixed net) and by boat length (below or over 12 m long). The split of the French landings in these components is made as described in Stock Annex. The 2013 split was slightly revised because of the very small correction in the database (Table 7.1 b).

Length compositions are available on a quarterly basis from 1984 for the French fleets and from 1994 for the Belgian beam trawlers. The 2014 sampling level is given in table 1.3 (section 1). The French length distributions are shown on Figures 7.1 a to d from 1984 onwards. The relative length distribution of landings in 2014 is shown by country in Table 7.2.

Even though age reading from otoliths now uses the same method as in France and Belgium (see Stock Annex), the discrepancy between French and Belgian mean weight at age, noticed by preceding WGs, are still present. Work was carried out in the beginning of 2012 (PGCCDBS, 2012) to compare the age reading methods. The conclusion is that there was no bias between readers from the three countries using otoliths prepared with the staining technique. All readers produced the same age estimates (i.e. no bias) of otoliths with or without staining.

However, a likely effect of the weight at age samples process may also be presumed (weight-length relationship used in France and straight estimate in Belgium) and should be investigated. International age compositions are estimated using the same procedure as in previous years, as described in Stock Annex. International mean weights at age of the catch are French-Belgian quarterly weighted mean weights. The catch numbers at age are shown in Table 7.3 and Figures 7.2 a & b, and the mean catch weight at age in Table 7.4.

7.2.3 Abundance indices from surveys

Since 2007, a new beam trawl survey (ORHAGO) is carried out by France to provide a sole abundance index in the Bay of Biscay. This survey is coordinated by the ICES WGBEAM.

At the 2013 meeting of the WGBEAM 2013, several CPUE series were compared. The one based on all the reference stations and carried out by daylight was estimated to provide the abundance index to retain for the Bay of Biscay sole.

The 2013 WGHMM assessment was carried out according to a 2013 revised stock annex, which adds the ORHAGO survey to the tuning files. This was a consequence of the interim Benchmark during the WGHMM 2013 who considered that the addition of the survey tuning fleet appears to be useful to the assessment.

In 2014 the survey vessel was changed, however the main change is in the way the gear is attached to the boat which provides more stability to the beam trawl.

The figure 7.3 shows the ORHAGO time series by age group excepted at age 0, for which the ORHAGO series is not considered to provide a reliable abundance index. Following the 2013 year class to 2014, the results are consistent because we can track the strong 2012 cohort in 2014, wich is the highest value of the series. The trend on the LPUE (figure 7.4) shows an increase for the others commercial LPUE as for ORHAGO. Regarding this, the WG agreed to retain the ORHAGO abundance indices in the assessment.

7.2.4 Commercial catch- effort data

The French La Rochelle and Les Sables trawler series of commercial fishing effort data and LPUE indices were completely revised in 2005. A selection of fishing days (or trips before 1999) was made by a double threshold (sole landings > 10% and *nephrops* landings <= 10%) for a group of vessels. The process is described in the Stock Annex.

The risk that the sole 10 % threshold may lead to an underestimate of the decrease in stock abundance was pointed out by RG in 2010. This general point is acknowledged by this working group. However in this particular case using the knowledge about the fishery this threshold was set to avoid the effect of changing target species, which may also affect the trend in LPUE. Indeed, the choice of target species may affect effort repartition between sole major habitat and peripheral areas where sole abundance is lower. Because 10% is a minimum for sole percentage in catch when carrying out mixed species trawling on sole grounds, according to fishermen, this percentage was retained to ensure that sole LPUE are not driven by a fishing strategy evolution (the targeting of cephalopods more particularly).

The La Rochelle LPUE series (FR-ROCHELLE) shows a decreasing trend from 1990 to 2001. Later on, the series does not exhibit any trend but some up and down variations (Table 7.5.a and Figure 7.4). The Les Sables d'Olonne LPUE series (FR-SABLES) shows also a declining trend up to 2003. Thereafter, it shows a short increase in 2004-2005 but the trend is flat from 2005 onwards.

Two new series of tuning were added to the assessment according to the WKFLAT 2011: the Bay of Biscay offshore trawler fleet (14 – 18 m) in the second quarter (FR-BB-OFF-Q2) and the Bay of Biscay inshore trawler fleet (10 – 12 m) in the fourth quarter (FR-BB-IN-Q4) for 2000 to the last year. A selection of fishing days was made by a double threshold (sole landings > 6% and *nephrops* landings <= 10%) The process is described in the Stock Annex.

Unfortunately, the fishing effort for the FR-BB-OFF-Q2 is not available for 2013 and 2014. This is due to the use of the electronic logbooks, for which the fishing effort is not a required value. This data is not well exported in the official database, and the majority of the fishing effort is equal to 1. Therefore, the commercial LPUE could not be calculated for this fleet and year.

However, LPUE for the FR-BB-IN-Q4 fleet is provided using paper logbooks which are still used by this fleet. Its LPUE trend shows an increase from 2013 to 2014 (Figure 7.4).

The Belgian LPUE series was relatively constant from 1990 to 1996, declining severely until 2002 but increased in 2003 to return to the 1997-2000 level. Later on, its trend was flat until 2009, but it changed to an increasing one in 2010. The last value is higher than 2013 but still close to the 2004 value.

For the ORHAGO survey, the trend of the CPUE are similar to those of the commercial tuning fleets available in recent years and, more particularly, it is close to the trend of the Belgian beam trawler fleet and it also shows an increase from 2013 to 2014.

Consequently, all the LPUE and CPUE series available show an increase in the last year of the series.

7.3 Assessment

7.3.1 Input data

See stock annex

7.3.2 Model

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

The age range in the assessment is 2-8+, as last year assessment.

The year range used is 1984-2014.

Catch-at-age analysis and Data screening

The results of exploratory XSA runs, which are not included in this report, are available in ICES files.

A separable VPA was run to screen the catch-at-age data. The same settings as last year were used: terminal F of 0.6 on age 4 and terminal S of 0.9. There were no anomalous residuals apparent in recent years.

Four commercial LPUE series are used in the assessment: La Rochelle offshore trawlers (FR-ROCHELLE) and Les Sables d'Olonne offshore trawlers (FR-SABLES) 1991 to 2009, the Bay of Biscay offshore trawlers in the second quarter (FR-BB-OFF-Q2) 2000 to 2012 and the Bay of Biscay inshore trawlers in the last quarter (FR-BB-IN-Q4) 2000 to last year. The data for these four tuning series are in table 7.6.

The table below summarizes the available information on the commercial tuning fleets and the survey.

FLEET TYPE	ACRONYM	PERIOD	AGE RANGE	LANDING CONTRIBUTION
Offshore otter trawlers	FR-SABLES	1991 – 2009	1 – 8	<1 %
Offshore otter trawlers	FR-ROCHELLE	1991 – 2009	1 – 8	<1 %
Inshore otter trawlers	FR-BB-IN-Q4	2000 – 2014	1 – 8	<1 %
Offshore otter trawlers	FR-BB-OFF-Q2	2000 – 2012	1 – 8	<1 %
Beam trawler survey	FR-ORHAGO	2007 – 2014	0 – 8	0 %

XSA tuning runs (low shrinkage s.e. = 2.5, no taper, other settings as in last year tuning) were carried out on data from each fleet individually. The results show no trend and small residuals for all fleets (Figure 7.5 a & b) except for the FR-BB-OFF-Q2 for age 2 in 2009, 2010 and 2011 and for FR-ORHAGO at age 5 in 2007 and at age 6 in 2008, 2010 and in 2014.

Result of XSA runs

The final XSA was run using the same settings than in last year assessment.

The Figure 7.2 b shows a distribution of catches at age, between age 2 and 6. The strong age 4 and 5 last year are now found in the age 5 and 6 this year. This figure shows too a strong age 2 which is the most important of this year’s series.

As in last year’s assessment, the weight of the ORHAGO survey age estimate is major, far above the weight of other fleets from age 2 to 6 (Table 7.7), 97.5 % for age 2, 78.2 % for age 3, and 72 % for age 4 for example.

			2014 XSA			2015 XSA
Catch data range			84-13			84-14
Catch age range			2-8+			2-8+
Fleets	FR – SABLES	91-09	2-7	FR – SABLES	91-09	2-7
	FR – ROCHELLE	91-09	2-7	FR – ROCHELLE	91-09	2-7
	FR-BB-IN-Q4	00-13	3-7	FR-BB-IN-Q4	00-14	3-7
	FR-BB-OFF-Q2	00-12	2-6	FR-BB-OFF-Q2	00-12	2-6
	FR-ORHAGO	07-13	2-8	FR-ORHAGO	07-14	2-8
Taper			No			No
Ages catch dep. Stock size			No			No
Q plateau			6			6
F shrinkage se			1.5			1.5
Year range			5			5
age range			3			3
Fleet se threshold			0.2			0.2
F bar range			3-6			3-6

The results are given in Table 7.7. The log-catchability residuals are shown in Figure 7.5 a & b and retrospective results in Figure 7.6. The retrospective pattern shows a very small F overestimation and a small SSB overestimation in 2013. The SSB overestimation is linked to the F overestimation at age 5 and 6.

Because of the lack of the FR-BB-OFF-Q2 2014 abundance indices in the tuning data, the estimated survivors at age 2 are only based on the ORHAGO survey.

At age 3, the only one commercial fleet estimated survivors to have a significant weight is the FR-BB-INQ4 (around 20%) and it increases by 42% at age 7. The FR-BB-OFF-Q2 has less weight than the others fleets, the maximum is at age 6 at around 15%. The two discontinuied commercial fleets FR-SABLES and FR-ROCHELLE have minor weight and only at age 7 (less than 0.1%). At age 6, the fleets FR-BB-IN-Q4 and FR-ORHAGO have more or less the same estimated survivors around 40%.

Fishing mortalities and stock numbers at age are given in Tables 7.8 and 7.9 respectively. The results are summarised in Table 7.10. Trends in yield, F, SSB and recruitments are plotted in Figure 7.7. Fishing mortality in 2014 is estimated by XSA to have been at 0.48. Fishing mortality was 0.45 in 2012, and 0.47 in 2013. The fishing mortalities in 2011 and 2012 are a slightly higher than the value calculated at the last year's working group.

7.3.2.1 Estimating year class abundance

In this year's assessment the retrospective analyses shows that the 2012 and 2013 recruitments were well estimated and that the recruitments are confirmed to be at a low level. The group therefore considers that, with the inclusion of the ORHAGO survey, the estimate of the recruitment for last year (2014 in this year's assessment) has improved compared to previous assessment and decided to keep the value estimated by the assessment model.

The WG agreed to keep this calculation of the GM (1993 to n-2) to be homogeneous with the previous assessment.

Recruitment at age 2

Year class	Thousands	Basis	Survey	Commercial	Shrinkage
2012	25 770	XSA	97.5 %	0 %	2.5 %
2013 & subsequent	21 825	GM(93-12)			

Historic trends in biomass, fishing mortality and recruitment

A full summary of the time series of XSA results are given in Table 7.10 and illustrated in Figure 7.7.

Since 1984, fishing mortality gradually increased, peaked in 2002 and decreased substantially the following two years. It increased in 2005 and, later on stabilised at around 0.44 (Fpa=0.42) until 2012, this year it is estimated to be the highest value since 2009 (0.48).

The SSB trend in earlier years increases from 12 300 t in 1984 to 16 400 t in 1993, afterwards it shows a continuous decrease to 9600 t in 2003. After an increase between 2003 and 2006, the SSB remains close to 11 300 t from 2007 to 2009. Since 2010, the SSB although above Bpa (13 000 t) has been decreasing since 2012. The SSB value for 2013 has been reassess from 13 700 t to 13 200 t. The 2014 SSB is estimated to 10 576 t, lower (17%) than the estimated value from WGBIE 2014.

The recruitment values are lower since 1993. Between 2004 and 2008 the series is stable around 17 or 18 million and the 2007 year class is the highest value since 1984. The 2010 and 2011 values are closed to the $GM_{93\text{-}12}$ (21.8 million). However, the 2012 and 2013 values are the lowest of the series (11.3 million and 12.2 million respectively).

7.3.3 Catch options and prognosis

Although there is a slight increase in F for the last three years, the WG did not consider that there was a trend (Figure 7.7). Thus, the exploitation pattern is the mean over the period 2012-2014 (for age 2 and above). This *status quo* F is estimated at 0.46 for the run.

The recruits at age 2 from 2015 to 2017 are assumed equal to $GM_{93\text{-}12}$. Stock numbers at age 3 and above in 2015 are the XSA survivors estimates.

Weights at age in the landings are the 2012-2014 means using the new fresh/gutted transformation coefficient of French landing which was changed from 1.11 to 1.04 in 2007. Weights at age in the stock are the 2012-2014 means using the old fresh/gutted transformation coefficient of French landing (1.11). The predicted spawning biomass is consequently still comparable to the biomass reference point of the management plan.

7.3.3.1 Short term predictions

Input values for the catch forecast are given in Table 7.11.

The landings forecasts (Table 7.12) is 3939 t in 2015 (TAC is set at 3800 t), more or less the same than the 2014 landings (3934 t).

Assuming recruitment at $GM_{93\text{-}12}$, the SSB is predicted to increase to 12 000 t in 2015 and increase to 12 807 t in 2016, fishing at *status quo* F in 2015. It will continue to grow at *status quo* F, to reach 13 390 t in 2017 (Tables 7.12 and 7.13).

The proportional contributions of recent year classes to the landings in 2016 and to the SSB in 2017 are given in Table 7.14. Year classes for which $GM_{93\text{-}12}$ recruitment has been assumed (2013 to 2015) contribute 48.6 % of the 2016 landings and 57.7 % of the 2017 SSB.

7.3.3.2 Yield and Biomass Per Recruit

Results for yield and SSB per recruit conditional on *status quo* F, are given in Table 7.15 a & b, and in Figure 7.8. The F_{sq} (0.46) is 2 % below F_{max} (0.45) and 58 % higher than

$F_{0.1}$ (0.2). Long-term equilibrium landings and SSB (at F *status quo* and assuming GM recruitment) are estimated to be 4533 t and 14 311 t respectively (Table 7.15a & b).

7.3.4 Biological reference points

WGHMM 2010 proposals for MSY approach reference points are given below with technical basis with the value adopted for the precautionary approach reference points:

	Type	Value	Technical basis
MSY	MSY Btrigger	13000 t	Bpa
Approach	FMSY	0.26	Fmax (as estimated by WGHMM 2010) because no stock-recruitment relationship, limited variations of recruitment, Fishing mortality pattern known with a low uncertainty
	Blim	Not defined	
Precautionary	Bpa	13 000t	The probability of reduced recruitment increases when SSB is below 13 000 t, based on the historical development of the stock.
Approach	Flim	0.58	Based on the historical response of the stock.
	Fpa	0.42	Flim * 0.72

The basis for setting Flim was kept (historical response of the stock) and its value remains coherent with the historical SSB trend. Consequently, Fpa is unchanged.

The fishing mortality pattern is known with a low uncertainty because of the limited discards and the satisfactory sampling level of the catches.

The WKFLAT 2011 decided that Fmax remains unchanged as well as FMSY which is set to Fmax. This year the F_{max} is as the same level than the WG 2014 after an increase in 2011, 2012 and 2013 estimates. The working group carried out a new examination of the MSY reference point. Following recommendations from WKMSYREF3, it was decided to use the software PlotMSY and Eqsim.

EqSim

EqSim (stochastic equilibrium reference point software) provides MSY reference points based on the equilibrium distribution of stochastic projections. Productivity parameters (i.e. year vectors for natural mortality, weights-at-age, maturities, and selectivity) are re-sampled at random from the last 3-5 years of the assessment (although there may be no variability in these values). Recruitments are resampled from their predictive distribution. The software also allows the incorporation of assessment/advice error. Uncertainty in the stock-recruitment model is taken into account by applying model averaging using smooth AIC weights (Buckland et al. 1997). The method is described in more detail in Annex 8 of ICES WGMG (2013).

The main inputs for this software are B_{pa} and B_{lim}. For B_{lim} which is currently not defined for sole, the WG decided to use a value close to B_{loss} = 9600 t.

PlotMSY

This software (equilibrium approach with variance) is intended to provide robust estimation of deterministic (i.e. no future process error) MSY estimates that could be applied easily and widely. It fits three stock-recruit functions, namely the Ricker, Beverton-Holt, and a smooth Hockey-stick (Mesnil and Rochet, 2010), to estimate MSY quantities. Uncertainty in MSY estimates is characterised by MCMC sampling of the stock-recruit parameters and sampling from the distributions of other productivity parameters (i.e. natural mortality, weights-at-age, maturities, and selectivity).

Stock-recruit model uncertainty is taken into account by model averaging of the three functions. ICES WGMG (2013), Annex 7 provides a more detailed description of the method.

The main inputs for this software are F_{pa}, Fl_{im}, B_{pa} and B_{lim}. The number of MCMC fits calculated and used for confidence interval was set to 1000.

Results of analysis

For the two software results, the stock-recruitment values obtained from the assessment do not show any clear stock-recruitment signal to allow a clear estimation of a stock-recruitment curve (figure 7.9 et 7.10). There are no data sufficiently close to the origin to allow an understanding of what may happen at lower stock biomasses.

Combinig all SRR, the specified weight are different for Eqsim and plotMsy (table 7.16 and 7.17). PlotMsy result gives the maximum weight for Beverton-Holt and Eqsim for Segreg model.

For the EqSim SRRplot (figure 7.9) the breakpoint of the smooth Hockey-Stick model is estimated at a SSB around 14 500 tonnes and for the plotMsy SRRplot (figure 7.10) it is estimated around 12 500 t.

The equilibrium yield and SSB based on the three stock and recruitment models estimates are presented in Figures 7.11 to 7.13 for the plotMsy results, together with box plots of F_{MSY} and F_{crash}, and proxies for F_{MSY} based on the yield per recruit (F_{max}, $F_{0.1}$), and based on SSB per recruit ($F_{30\%}$ and $F_{35\%}$ SPR). Values of F_{MSY} reference points estimated for the 3 stock recruitment relationships are presented in Table 7.18 for plotMsy and table 7.19 for Eqsim. The plotMsy table shows that the F_{MSY} calculated for each S/R relationship are quite different: 0.38 for Ricker model, 0.47 for Hockey stick and 0.24 for Beverton-Holt model close to current F_{MSY}. For Eqsim this mean Fmsy value is estimated at 0.26 (=current Fmsy).

The figure 7.14 shows the probability of SSB being below B_{lim} at different values of F using the weighted combination of stock-recruit models (plotMsy). The fishing mortalities associated with a 5% probability for SSB to fall below B_{lim} was estimated at 0.41, (close to Fpa) and this value is higher (0.48) for EqSim (figure 7.15 and 7.16)

The F_{MSY} estimated with the combination of the three S/R relationships is equal to 0.36 for PlotMsy and equal to 0.32 for EqSim (Table 7.19 and 7.20, figure 7.16).

It must be noted also that the current F_{max} is estimated at 0.46 by xsa, which is above the fishing mortalities associated with a 5% probability for SSB to fall below B_{lim}. Fishing at F_{max} would thus be in conflict with precautionary considerations.

In 2010 the F_{MSY} value (=0.26) was estimated as a proxy of F_{max} based on the relative stability of this value in previous years. This F_{max} has increased since 2012 (0.31) until this year (0.46). The WG considers now that the current F_{MSY} proxy may no longer be appropriate. However, as there is no clear stock recruitment relationship for this stock and as the two methods used during the WG are providing different results, the WG considers that further work is needed in order to make proposals for a revision of F_{MSY} for the Bay of Biscay sole.

7.3.5 Comments on the assessment

Sampling

The sampling level (table 1.3, section 1) for this stock is considered to be satisfactory.

The ORHAGO survey provides information on several year classes at age 2. This series is now used in the assessment. At other ages, it is particularly useful to have a survey in the tuning file because the new use of electronic logbooks has caused some obvious wrong recordings of effort which limit available commercial tuning data in 2012 and 2013 and the lack of FR-BB-OFF-Q2 2013 and 2014 abundance indices.

Stopping the use of fleets of La Rochelle and Les Sables tuning series led to a paucity of information at age 2 in 2013, which were only provided by the Offshore Q2 tuning fleet (when the data was available). That is no more the case with incorporation of the ORHAGO survey in the assessment.

The same age reading method is now adopted by France and Belgium, however a discrepancy still exist between French and Belgian weights at age which has to be investigated.

Discarding

Available data on discards have shown that discards may be important at age 1. Discard at age 2 were assumed to be low in the past because the high commercial value of the sole catches but there are some reports of high-grading practices due to the landing limits adopted by some producers' organisations. The data available for discards do not seem representative to use them in the assessment, but the WKFLAT 2011 and the 2012 review group recommended that further work should include investigation on the monitoring of the inshore trawlers discards.

Consistency

Since the 2013 assessment, the ORHAGO survey has been included in the tuning fleets. This survey is the only one tuning fleet which provides a recruit index series up to 2013 because no LPUE data are available in 2013 and 2014 for the only one commercial tuning fleet which can also provide a recruitment index. The incorporation of a survey in the assessment is considered to have improved the XSA recruit estimates in the assessment terminal year.

A few more years of survey data may improve our ability to confirm the quality of these estimates. The 2012 and 2013 low recruitment appears to be estimated fairly well by the available tuning series (ORHAGO weight 97.5 %).

The GM is used only for the 2015 recruitment; this GM estimate has now a lower contribution in predicted landings and SSB. Furthermore, it is worth noting that variability of the recruit series has increased since 2001 and that, in recent period (until 2011), the use of GM estimate has led several times to forecast an increase in SSB which was superior to the one observed in following years.

The retrospective pattern in F shows a very small underestimation in 2013 (Figure 7.6) no more than 1 %. The definition of reference groups of vessels and the use of thresholds on species percentage to build the French series of commercial fishing effort data and LPUE indices is considered to provide representative LPUE of change in stock abundance by limiting the effect of long term change in fishing power (technological creep) and of change in fishing practices in the sole fishery.

The figure 7.17 shows the difference between the assessments in 2014 and in 2015. SSB in 2013 is revised slightly lower and F in 2013 revised very slightly higher.

Misreporting

Misreporting is likely to be limited for this stock but it may have occurred for fish of the smallest market size category in some years. There are some reports of high-grading practices due to the landing limits adopted by some producers' organisations.

Industry input

The traditional meeting with representatives of the fishing industry was organized in France prior to the WG to present the data used by the 2015 WGBIE to assess the state of the Bay of Biscay sole stock. They have made comments for the F_{MSY}, they emphasised that the F_{MSY} needs to be reevaluated. Anecdotial information from industry have highlighted that the abundance of sole in some parts of the Bay of Biscay have increased to levels close to that seen 20 years ago. In order not to use all their yearly quota in the beginning of this year, they had to reduce their fishing effort.

Management considerations

The assessment indicates that SSB has decreased continuously to 9700 t in 2003, since a peak in 1993 (16 500 t), has increased to 12 400 t in 2006 but it remains close to 11 700 t thereafter and since 2010 is above 13 000 t. It is estimated to be 12 012 t (below B_{pa} = 13 000 t) in 2015 assuming XSA recruitment value for 2014, but an increase is predicted by the short term prediction, and SSB is assumed to be close to B_{pa} in 2016 and above in 2017.

The (EC) 388/2006 management plan is agreed for the Bay of Biscay sole but a long-term F target has not yet been set. This plan has not been evaluated by ICES.

The WG considers that the current F_{MSY} proxy may no longer be appropriate. It was not possible to update the value during the working group and the group considers that further work is needed.

Table 7.1 a: Bay of Biscay sole (Division VIIIa,b). Internationals landings and catches used by the Working Group (in tonnes).

	Official landings						WG	Discards [2]	WG
Years	Belgium	France	Nether.	Spain	Others	Total	landings		catches
1979	0	2376		62*		2443	2619	-	-
1980	33*	2549		107*		2689	2986	-	-
1981	4*	2581*	13*	96*		2694	2936	-	-
1982	19*	1618*	52*	57*		1746	3813	-	-
1983	9*	2590	32*	38*		2669	3628	-	-
1984	na	2968	175*	40*		3183	4038	99	4137
1985	25*	3424	169*	308*		3925	4251	64	4315
1986	52*	4228	213*	75*		4567	4805	27	4832
1987	124*	4009	145*	101*		4379	5086	198	5284
1988	135*	4308		0		4443	5382	254	5636
1989	311*	5471		0		5782	5845	356	6201
1990	301*	5231		0		5532	5916	303	6219
1991	389*	4315		3		4707	5569	198	5767
1992	440*	5928		0		6359	6550	123	6673
1993	400*	6096		13		6496	6420	104	6524
1994	466*	6627		2***		7095	7229	184	7413
1995	546*	5326		0		5872	6205	130	6335
1996	460*	3842		0		4302	5854	142	5996
1997	435*	4526		0		4961	6259	118	6377
1998	469*	3821	44	0		4334	6027	127	6154
1999	504	3280		0		3784	5249	110	5359
2000	451	5293		5***		5749	5760	51	5811
2001	361	4350	201	0		4912	4836	39	4875
2002	303	3680		2***		3985	5486	21	5507
2003	296	3805		4***		4105	4108	20	4128
2004	324	3739		9***		4072	4002	-	-
2005	358	4003		10		4371	4539	-	-
2006	393	4030		9		4432	4793	-	-
2007	401	3707		9		4117	4363	-	-
2008	305	3018		11	2*	3336	4299	-	-
2009	364	4391				4755	3650	-	-
2010	451	4248				4699	3966	-	-
2011	386	4259				4645	4632	-	-
2012	385	3819				4204	4321	-	-
2013	312	4181				4492	4235	-	-
2014	307	3793		10		4110	3934**	-	-

[1] including reported in VIII or VIIIc,d [2] Discards = Partial estimates for the French offshore trawlers fleet

* reported in VIII ** Preliminary *** reported as *Solea* spp (*Solea lascaris* and *solea solea*) in VIII

Table **7.1 b** : Bay of Biscay sole (Division VIIIa,b). Contribution (in %) to the total landings by differents fleets.

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Shrimp trawlers	7	7	8	11	6	5	4	3	3	2	2	2	1	1	1
Inshore trawlers	29	28	27	25	31	29	30	25	27	25	17	13	13	12	13
Offshore otter trawlers	61	62	60	60	59	60	45	45	47	46	41	41	39	31	28
Offshore beam trawlers	0	1	0	0	0	0	1	1	2	3	5	5	7	7	6
Fixed nets	3	3	5	4	4	6	20	26	20	24	35	39	40	49	52

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Shrimp trawlers	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inshore trawlers	11	13	12	11	10	5	8	9	7	8	9	7	8	9	6
Offshore otter trawlers	29	26	26	30	30	24	21	24	18	24	23	21	19	21	19
Offshore beam trawlers	6	9	8	7	8	10	8	8	6	7	8	8	9	9	7
Fixed nets	52	53	54	52	52	61	63	59	70	60	60	63	64	61	69

Year	2009	2010	2011	2012	2013	2014
Shrimp trawlers	0	0	0	0	0	0
Inshore trawlers	6	8	7	8	7	8
Offshore otter trawlers	21	19	17	17	18	18
Offshore beam trawlers	10	11	8	9	7	8
Fixed nets	63	61	67	66	68	65

Table 7.2 : Bay of Biscay Sole - 2014

French and Belgian relative length distribution of landings

Length(cm)	France	Belgium
21	0.01	
22	0.20	
23	2.31	0.16
24	5.37	4.73
25	7.26	7.94
26	8.84	8.12
27	8.28	11.22
28	10.23	12.88
29	12.39	11.55
30	10.99	12.09
31	9.54	8.54
32	6.55	6.67
33	4.61	4.62
34	3.51	3.16
35	2.47	2.68
36	1.80	1.87
37	1.49	1.34
38	0.94	0.91
39	0.87	0.63
40	0.64	0.39
41	0.51	0.21
42	0.37	0.18
43	0.29	0.07
44	0.21	0.02
45	0.10	0.01
46	0.09	
47	0.05	
48	0.03	
49	0.03	
50	0.01	
51	0.01	
52	0.00	
53	0.01	
Total	100	100

MLS= 24 cm

Table 7.3: Bay of Biscay Sole, Catch number at age (in thousands)

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Age											
2	5901	8493	6126	3794	4962	4918	7122	4562	4640	1897	2603
3	3164	4606	4208	5634	5928	6551	6312	6302	7279	7816	5502
4	2786	2479	2673	3578	4191	3802	4423	4512	4920	6879	8803
5	2034	1962	2301	2005	2293	3147	2833	2083	2991	3661	5040
6	1164	906	1512	1482	1388	2046	972	1113	2236	1625	1968
7	880	708	1044	690	874	967	1018	1063	1124	566	970
+gp	1181	729	1235	714	766	499	870	981	951	708	696
TOTALNUM	17110	19883	19099	17897	20402	21930	23550	20616	24141	23152	25582
TONSLAND	4038	4251	4805	5086	5382	5845	5916	5569	6550	6420	7229
SOPCOF %	107	103	102	102	101	101	100	102	100	100	100

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
2	3249	3027	3801	4096	2851	5677	3180	5198	4274	3411	3976
3	5663	5180	9079	5550	5113	7015	6528	4777	6309	5415	3464
4	6356	5409	5380	6351	4870	5143	4948	4932	2236	3291	3738
5	3644	2343	3063	2306	2764	2542	1776	3095	1220	917	2309
6	1795	1697	1578	1237	1314	955	899	1269	729	661	991
7	843	1366	692	785	902	421	513	615	377	272	461
+gp	986	1319	877	1188	977	444	486	432	250	333	508
TOTALNUM	22536	20341	24470	21513	18791	22197	18330	20318	15395	14300	15447
TONSLAND	6205	5854	6259	6027	5249	5760	4836	5486	4108	4002	4539
SOPCOF %	100	100	100	101	100	101	101	101	101	101	102

Year	2006	2007	2008	2009	2010	2011	2012	2013	2014
2	3535	3885	3173	2860	2084	1516	1302	2312	3609
3	4436	5181	4794	3986	7707	5222	4680	2939	2952
4	2747	2615	2886	2233	3758	8347	4264	3777	1628
5	2012	1419	1353	1501	1272	1019	3787	3205	2230
6	1030	1262	938	946	484	570	1008	1450	1662
7	530	686	892	541	269	275	225	286	725
+gp	1537	946	1193	960	284	516	517	635	456
TOTALNUM	15827	15994	15229	13027	15858	17465	15783	14604	13262
TONSLAND	4793	4363	4299	3650	3966	4632	4321	4235	3934
SOPCOF %	101	100	100	102	100	100	100	101	110

Table 7.4: Bay of Biscay Sole, Catch weight at age (in kg)

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
Age											
2	0.121	0.106	0.102	0.141	0.134	0.136	0.131	0.143	0.146	0.145	0.147
3	0.168	0.174	0.173	0.201	0.19	0.188	0.179	0.192	0.196	0.197	0.195
4	0.213	0.252	0.245	0.285	0.272	0.258	0.241	0.26	0.262	0.267	0.251
5	0.269	0.313	0.328	0.376	0.357	0.354	0.348	0.325	0.341	0.341	0.324
6	0.329	0.39	0.409	0.467	0.495	0.437	0.436	0.437	0.404	0.439	0.421
7	0.368	0.457	0.498	0.497	0.503	0.543	0.601	0.535	0.49	0.569	0.569
+gp	0.573	0.698	0.657	0.682	0.604	0.799	0.854	0.715	0.715	0.677	0.774
SOPCOFAC	1.0712	1.0302	1.0197	1.0248	1.008	1.0055	1.0039	1.0183	1.0004	1.0008	1.0016

Year	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Age											
2	0.16	0.159	0.142	0.161	0.177	0.171	0.152	0.171	0.18	0.19	0.189
3	0.206	0.204	0.193	0.212	0.219	0.207	0.22	0.208	0.226	0.227	0.226
4	0.252	0.268	0.256	0.257	0.246	0.276	0.265	0.263	0.307	0.29	0.298
5	0.308	0.319	0.319	0.335	0.305	0.343	0.341	0.32	0.361	0.391	0.367
6	0.403	0.399	0.406	0.41	0.404	0.452	0.428	0.466	0.487	0.493	0.43
7	0.484	0.453	0.502	0.501	0.533	0.573	0.519	0.592	0.657	0.643	0.468
+gp	0.658	0.625	0.678	0.7	0.582	0.755	0.619	0.681	0.642	0.81	0.656
SOPCOFAC	1.0023	0.9998	1.0048	1.0091	1.0006	1.0066	1.01	1.0122	1.0056	1.0104	1.0153

Year	2006	2007*	2008*	2009*	2010*	2011*	2012*	2013*	2014*
Age									
2	0.195	0.176	0.174	0.17	0.179	0.193	0.182	0.208	0.179
3	0.242	0.225	0.229	0.215	0.206	0.223	0.224	0.24	0.243
4	0.282	0.298	0.287	0.275	0.272	0.253	0.257	0.272	0.282
5	0.347	0.326	0.352	0.317	0.337	0.342	0.307	0.304	0.297
6	0.42	0.388	0.392	0.361	0.414	0.432	0.369	0.368	0.344
7	0.455	0.419	0.401	0.447	0.477	0.489	0.414	0.518	0.39
+gp	0.533	0.511	0.519	0.601	0.768	0.606	0.585	0.521	0.548
SOPCOFAC	1.0136	1.0026	1	1.0158	1.0019	1.0046	1.0023	1.0082	1.0961

(*) for 2007 to 2013, French catch weight at age computed using the new fresh/gutted transformation coefficient (1.04)
Before 2007, the French fresh/gutted transformation coefficient is 1.11
The Belgian fresh/gutted transformation coefficient is 1.04 in 2014

Table **7.5 a** : Bay of Biscay sole LPUE and indices of fishing effort for French offshore trawlers.

Year	CPUE Inshore (10-12 m) trawlers of French sole fishery Q4	CPUE Offshore (14-18m) trawlers of French sole fishery Q2	Orhago Survey beam trawler kg/10km	LPUE La Rochelle offshore trawlers of French sole fishery (kg/h)	LPUE Les Sables offshore trawlers of French sole fishery (kg/h)
1984	-	-		6.0	6.9
1985	-	-		5.6	6.5
1986	-	-		7.2	7.2
1987	-	-		6.6	5.9
1988	-	-		6.4	6.7
1989	-	-		5.5	6.1
1990	-	-		7.1	6.3
1991	-	-		6.5	6.5
1992	-	-		5.4	5.6
1993	-	-		4.6	6.4
1994	-	-		5.0	6.6
1995	-	-		4.6	5.4
1996	-	-		4.9	6.0
1997	-	-		4.1	5.3
1998	-	-		4.2	5.3
1999	-	-		3.7	5.9
2000	5.7	3.5		4.0	5.7
2001	5.8	3.4		3.4	4.0
2002	4.8	4.1		4.4	5.0
2003	5.8	3.9		4.1	3.9
2004	5.4	3.6		4.0	4.1
2005	5.2	3.4		3.9	5.2
2006	5.8	2.2		3.4	5.4
2007	4.8	3.7	6.6	3.5	5.3
2008	3.9	3.2	4.4	4.1	5.6
2009	4.4	2.1	6.4	3.3	5.2
2010	4.6	3.5	7.4	3.6	5.7
2011	4.7	3.5	6.1	na	na
2012	6.0	3.6	7.0	na	na
2013	4.1		6.6	na	na
2014	5.2		7.7	na	na

* French offshore trawlers in other harbours than in La Rochelle and Les Sables
na : non available

Table **7.5 b** : Bay of Biscay sole fishing effort and LPUE for Belgian beam trawlers.

Year	Landing (t)	Effort (1000 h)	LPUE (kg/h)
1976	26.3	1.7	15.5
1977	64.4	3.4	18.7
1978	29.8	1.7	17.7
1979			
1980	33.1	1.9	17.9
1981	4.1	0.3	16.4
1982	20.5	1.1	18.6
1983	10.2	0.6	17.3
1984			
1985	26.7	1.6	17.2
1986	52.0	2.8	18.4
1987	124.0	7.7	16.1
1988	134.7	5.6	24.1
1989	311.0	16.7	18.6
1990	309.4	9.0	34.3
1991	400.5	9.8	41.0
1992	452.9	14.8	30.6
1993	399.7	10.7	37.5
1994	467.6	13.5	34.6
1995	446.7	13.5	33.0
1996	459.8	13.6	33.9
1997	435.4	16.2	26.9
1998	463.1	17.8	26.1
1999	498.7	20.8	24.0
2000	459.2	19.2	23.9
2001	368.2	17.5	21.1
2002	310.6	16.5	18.8
2003	295.8	12.5	23.6
2004	318.7	12.2	26.2
2005	365.1	15.0	24.3
2006	392.9	16.7	23.5
2007	404.2	16.3	24.8
2008	305.1	12.9	23.6
2009	363.3	16.2	22.5
2010	451.3	13.1	34.3
2011	386.4	12.7	30.4
2012	385.2	9.7	39.5
2013	311.9	11.8	26.3
2014	307.4	11.1	27.8

Table 7.6: Sole 8ab, available tuning data (landings); SOLE VIIIa,b commercial landings (N in 10-3) and survey catch - Fishing effort in hours; Series, year and range used in tuning are shown in bold type**

FR - SABLES									
Year	Fishing effort	1	**2**	**3**	**4**	**5**	**6**	**7**	8
1991	33763	30.5	**242.1**	**332.8**	**194.7**	**73.8**	**32.4**	**23.6**	19.5
1992	30445	3.7	**236.8**	**285.8**	**130.2**	**59.5**	**32.1**	**15.0**	11.9
1993	34273	3.7	**152.0**	**441.3**	**224.0**	**75.7**	**27.0**	**8.0**	10.9
1994	20997	1.2	**94.1**	**157.4**	**184.3**	**77.3**	**24.2**	**13.4**	10.8
1995	31759	7.3	**173.4**	**228.1**	**177.1**	**69.1**	**34.1**	**15.9**	19.5
1996	31518	13.0	**193.0**	**222.6**	**169.8**	**55.6**	**37.8**	**29.4**	23.2
1997	27040	5.0	**140.9**	**290.9**	**114.2**	**49.0**	**26.7**	**10.6**	11.4
1998	16260	0.8	**86.9**	**112.1**	**113.6**	**31.4**	**13.8**	**8.1**	7.7
1999	12528	0.0	**64.9**	**53.2**	**39.7**	**26.8**	**15.0**	**15.2**	17.6
2000	11271	3.4	**81.3**	**121.3**	**45.0**	**15.7**	**8.4**	**4.7**	4.7
2001	9459	2.3	**32.9**	**64.5**	**35.2**	**9.5**	**5.5**	**3.1**	2.2
2002	10344	7.2	**76.9**	**60.3**	**37.5**	**19.3**	**8.4**	**3.9**	1.7
2003	7354	1.5	**38.9**	**49.1**	**14.3**	**7.8**	**4.0**	**1.7**	0.6
2004	6909	2.7	**38.4**	**36.5**	**22.7**	**5.7**	**3.8**	**1.7**	1.8
2005	6571	6.6	**46.4**	**26.6**	**25.2**	**15.3**	**6.4**	**3.3**	3.2
2006	6223	7.7	**63.1**	**29.7**	**11.9**	**6.6**	**3.7**	**2.4**	6.3
2007	5954	1.0	**32.6**	**28.4**	**18.0**	**12.4**	**10.6**	**6.6**	8.2
2008	4321	0.0	**22.8**	**22.8**	**16.4**	**8.1**	**5.2**	**4.9**	7.8
2009	3577	0.7	**23.0**	**22.2**	**9.8**	**7.1**	**4.2**	**2.4**	5.7
FR - ROCHEL									
Year	Fishing effort	1	**2**	**3**	**4**	**5**	**6**	**7**	8
1991	15250	14.7	**134.8**	**157.4**	**88.9**	**30.3**	**11.6**	**6.7**	5.5
1992	12491	0.8	**99.4**	**130.1**	**58.7**	**21.2**	**9.1**	**4.5**	2.8
1993	12146	0.6	**53.3**	**126.5**	**51.8**	**17.2**	**6.4**	**2.1**	2.0
1994	8745	0.7	**42.4**	**56.5**	**52.9**	**19.4**	**6.4**	**2.7**	1.5
1995	4260	1.9	**25.9**	**31.3**	**20.7**	**7.2**	**2.4**	**1.1**	1.1
1996	10124	10.6	**113.1**	**74.6**	**34.3**	**8.8**	**5.0**	**3.1**	2.8
1997	12491	3.8	**74.1**	**117.6**	**35.8**	**12.6**	**7.3**	**2.6**	2.6
1998	10841	1.6	**77.7**	**65.4**	**57.9**	**11.3**	**4.7**	**2.9**	2.8
1999	8311	0.0	**53.7**	**31.6**	**19.0**	**10.1**	**6.4**	**4.3**	2.1
2000	8334	4.8	**64.0**	**44.4**	**19.2**	**6.7**	**2.8**	**1.5**	2.5
2001	7074	2.3	**24.7**	**39.9**	**23.7**	**5.5**	**3.3**	**1.9**	1.8
2002	6957	9.0	**89.2**	**36.3**	**11.8**	**5.4**	**2.3**	**1.3**	0.4
2003	5028	2.2	**37.8**	**40.0**	**9.1**	**3.7**	**1.7**	**0.5**	0.2
2004	1899	1.0	**12.1**	**11.8**	**4.4**	**1.0**	**0.7**	**0.3**	0.4
2005	3292	2.4	**17.3**	**10.5**	**8.8**	**5.2**	**2.4**	**1.1**	1.3
2006	2304	1.5	**11.0**	**8.3**	**3.9**	**2.4**	**1.3**	**0.6**	1.9
2007	2553	0.2	**12.3**	**21.5**	**4.5**	**1.8**	**1.6**	**0.7**	1.0
2008	1887	0.2	**11.3**	**14.6**	**5.4**	**2.1**	**1.1**	**1.1**	1.5
2009	1176	0.1	**4.8**	**7.1**	**2.3**	**1.3**	**0.7**	**0.4**	0.6
FR-BB-IN-Q4									
Year	Fishing effort	1	2	3	4	5	6	7	8
2000	1432	4.06	20.99	**11.21**	**3.34**	**1.00**	**0.34**	**0.23**	**0.09**
2001	1803	18.04	37.14	**6.56**	**2.03**	**0.77**	**0.66**	**0.32**	**0.52**
2002	2276	15.06	23.83	**11.09**	**1.62**	**1.00**	**0.99**	**0.64**	**0.51**
2003	2913	1.65	29.53	**32.18**	**4.54**	**0.87**	**0.53**	**0.38**	**0.50**
2004	3081	4.25	24.42	**24.00**	**8.76**	**3.48**	**2.96**	**0.56**	**1.38**
2005	5000	9.89	47.26	**16.31**	**13.09**	**5.31**	**2.12**	**1.11**	**2.71**
2006	7174	23.80	84.80	**27.60**	**6.86**	**4.71**	**3.97**	**2.66**	**6.18**
2007	4026	2.73	34.48	**16.10**	**7.27**	**3.72**	**3.09**	**0.68**	**2.20**
2008	3681	0.58	13.91	**15.86**	**8.59**	**2.98**	**1.67**	**1.23**	**1.24**
2009	3615	2.66	47.84	**14.71**	**3.36**	**1.81**	**1.53**	**0.64**	**1.37**
2010	4279	1.48	21.80	**33.47**	**9.45**	**3.01**	**0.93**	**0.44**	**1.06**
2011	4696	3.21	38.40	**21.35**	**12.89**	**3.40**	**1.69**	**0.75**	**1.53**
2012	2813	1.08	9.21	**20.38**	**13.65**	**7.17**	**1.42**	**0.93**	**1.11**
2013	2657	2.94	10.39	**7.22**	**6.87**	**2.81**	**2.49**	**0.91**	**1.72**
2014	4284	14.21	79.62	**13.95**	**4.32**	**3.23**	**2.51**	**0.84**	**1.03**

Table 7.6: cont'd

FR-BB-OFF-Q2

Year	Fishing effort	1	2	3	4	5	6	7	8
2000	5567	0.00	**22.92**	**28.32**	**23.17**	**9.54**	**2.72**	0.90	1.66
2001	5039	0.01	**14.87**	**30.25**	**20.82**	**5.69**	**3.64**	1.42	1.08
2002	5604	0.01	**36.79**	**33.91**	**17.16**	**9.07**	**4.09**	2.12	0.53
2003	3324	0.02	**22.88**	**27.61**	**6.99**	**1.85**	**0.81**	0.08	0.03
2004	4809	0.00	**13.97**	**43.91**	**14.51**	**1.37**	**0.70**	0.26	0.40
2005	4535	3.67	**13.13**	**19.61**	**16.22**	**5.78**	**0.56**	0.43	0.57
2006	2235	0.00	**3.50**	**9.56**	**2.91**	**1.50**	**0.97**	0.33	0.31
2007	4013	0.00	**13.41**	**46.11**	**6.41**	**1.18**	**1.69**	0.24	0.54
2008	3211	0.00	**16.58**	**23.51**	**7.36**	**2.33**	**0.40**	0.83	0.49
2009	968	0.00	**0.70**	**5.05**	**1.69**	**0.53**	**0.16**	0.10	0.22
2010	2279	0.00	**1.55**	**27.23**	**7.96**	**2.16**	**0.12**	0.03	0.07
2011	2882	0.00	**0.97**	**12.40**	**23.98**	**1.61**	**0.82**	0.39	1.11
2012	2047	0.00	**4.33**	**14.92**	**7.59**	**4.66**	**0.42**	0.32	0.37

FR-ORHAGO

Year	Fishing effort	1	2	3	4	5	6	7	8
2007	100	69	**164.2**	**68.9**	**28.0**	**15.5**	**9.5**	**0.8**	**2.2**
2008	100	343	**128.3**	**70.8**	**22.7**	**4.2**	**2.5**	**3.0**	**1.3**
2009	100	87	**490.1**	**101.2**	**20.5**	**4.9**	**1.9**	**0.4**	**2.2**
2010	100	170	**193.3**	**161.9**	**21.1**	**2.9**	**0.1**	**0.9**	**0.7**
2011	100	103	**208.9**	**76.8**	**30.5**	**3.0**	**1.7**	**2.1**	**3.2**
2012	100	64	**89.5**	**102.5**	**55.3**	**22.9**	**5.5**	**3.3**	**5.7**
2013	100	169	**84.5**	**50.6**	**61.8**	**24.3**	**16.1**	**4.7**	**3.5**
2014	100	169	**222.0**	**50.3**	**27.6**	**23.0**	**18.6**	**7.4**	**6.4**

Table 7.7: XSA tuning diagnostic

```
Lowestoft VPA Version 3.1

   30/04/2015  16:50

 Extended Survivors Analysis

 SOLE VIIIa,b

 CPUE data from file tunfilt.dat

 Catch data for  31 years. 1984 to 2014. Ages  2 to   8.

      Fleet,            First, Last, First, Last, Alpha,  Beta
                    ,    year, year,  age ,  age
 FR-SABLES           ,   1991, 2014,   2,     7,   .000,  1.000
 FR-ROCHELLE         ,   1991, 2014,   2,     7,   .000,  1.000
 FR-BB-IN-Q4         ,   2000, 2014,   3,     7,   .750,  1.000
 FR-BB-OFF-Q2        ,   2000, 2014,   2,     6,   .250,   .500
 FR-ORHAGO           ,   2007, 2014,   2,     7,   .830,   .960

Time series weights :

      Tapered time weighting not applied

 Catchability analysis :

      Catchability independent of stock size for all ages

      Catchability independent of age for ages >=    6

 Terminal population estimation :

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

      S.E. of the mean to which the estimates  are shrunk =   1.500

      Minimum standard error for population
      estimates derived from each fleet =    .200

      Prior weighting not applied

 Tuning converged after   75 iterations

 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,  2005,  2006,  2007,  2008,  2009,  2010,  2011,  2012,  2013,
2014

      2,  .258,  .219,  .258,  .196,  .091,  .098,  .077,  .128,  .222,
.159
      3,  .353,  .451,  .506,  .513,  .357,  .333,  .336,  .321,  .417,
.431
      4,  .432,  .464,  .464,  .520,  .423,  .594,  .639,  .447,  .412,
.381
```

```
     5,  .537,  .388,  .412,  .412,  .498,  .402,  .278,  .596,  .632,
.404
     6,  .522,  .431,  .398,  .465,  .501,  .262,  .281,  .432,  .423,
.702
     7,  .426,  .519,  .505,  .482,  .474,  .229,  .208,  .153,  .186,
.343
```

Table 7.7: cont'd

XSA population numbers (Thousands)

YEAR	AGE 2	3	4	5	6	7
2005	1.84E+04	1.22E+04	1.12E+04	5.85E+03	2.56E+03	1.40E+03
2006	1.89E+04	1.28E+04	7.77E+03	6.58E+03	3.09E+03	1.38E+03
2007	1.80E+04	1.37E+04	7.40E+03	4.42E+03	4.04E+03	1.82E+03
2008	1.87E+04	1.26E+04	7.48E+03	4.21E+03	2.65E+03	2.45E+03
2009	3.47E+04	1.39E+04	6.81E+03	4.02E+03	2.52E+03	1.51E+03
2010	2.34E+04	2.86E+04	8.82E+03	4.04E+03	2.21E+03	1.38E+03
2011	2.14E+04	1.92E+04	1.86E+04	4.41E+03	2.44E+03	1.54E+03
2012	1.14E+04	1.79E+04	1.24E+04	8.87E+03	3.02E+03	1.67E+03
2013	1.22E+04	9.06E+03	1.18E+04	7.20E+03	4.42E+03	1.77E+03
2014	2.58E+04	8.86E+03	5.40E+03	7.05E+03	3.46E+03	2.62E+03

Estimated population abundance at 1st Jan 2015

0.00E+00	1.99E+04	5.21E+03	3.34E+03	4.26E+03	1.55E+03

Taper weighted geometric mean of the VPA populations:

2.34E+04	1.74E+04	1.08E+04	6.01E+03	3.24E+03	1.78E+03

Standard error of the weighted Log(VPA populations) :

.2721	.2870	.2921	.2730	.2858	.3864

Log catchability residuals.

Fleet : FR-SABLES

Age	1991	1992	1993	1994
2	-.23	-.13	-.38	-.40
3	.11	-.18	.16	-.10
4	.13	-.27	-.09	.37
5	.08	-.16	-.11	.23
6	-.19	.17	-.39	.03
7	-.06	-.15	-.27	.18

Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
2	-.08	-.21	-.12	-.03	-.18	.20	-.16	.22	-.12	.30
3	-.17	-.03	.21	-.01	-.42	.39	.07	.26	.01	-.29
4	.14	.02	.01	.44	-.22	.14	-.05	.14	-.29	-.19
5	.00	-.12	-.24	.15	.28	-.08	-.27	.35	-.17	-.49
6	-.24	.24	-.02	-.40	.42	-.04	-.22	.36	.05	-.33
7	.07	.48	-.01	.11	.54	.08	-.22	.09	.10	-.12

Age	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
2	.48	.79	.24	.14	-.33	99.99	99.99	99.99	99.99	99.99
3	-.18	-.02	-.06	.13	.12	99.99	99.99	99.99	99.99	99.99
4	-.15	-.47	.04	.28	.00	99.99	99.99	99.99	99.99	99.99
5	.23	-.74	.34	.28	.43	99.99	99.99	99.99	99.99	99.99
6	.17	-.55	.26	.32	.36	99.99	99.99	99.99	99.99	99.99
7	.07	-.14	.64	.35	.31	99.99	99.99	99.99	99.99	99.99

Table 7.7: cont'd

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

Age	2	3	4	5	6	7
Mean Log q	-15.0749	-14.5221	-14.4802	-14.6645	-14.6582	-14.6582
S.E(Log q)	.3102	.1988	.2338	.3085	.2984	.2787

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	4.92	-3.163	34.66	.04	19	1.25	-15.07
3	1.00	.009	14.51	.63	19	.20	-14.52
4	.82	1.202	13.56	.73	19	.19	-14.48
5	1.10	-.347	15.28	.41	19	.35	-14.66
6	1.39	-1.040	17.29	.29	19	.42	-14.66
7	.74	2.262	12.64	.81	19	.17	-14.55

Fleet : FR-ROCHELLE

Age	1991	1992	1993	1994
2	-.08	-.18	-.45	-.39
3	.20	-.04	-.01	-.21
4	.45	.13	-.21	.30
5	.46	.18	-.08	.20
6	.12	.34	-.26	.11
7	.01	.08	-.03	-.01

Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
2	-.04	.33	-.05	.20	-.02	.20	-.23	.70	.16	.37
3	-.11	.06	.11	-.10	-.48	-.27	-.08	.19	.23	-.09
4	.31	-.14	-.07	.48	-.24	-.11	.14	-.32	-.06	-.23

```
     5 ,   .22,  -.35,  -.35,   .01,   .19,  -.16,  -.05,  -.06,  -.06,  -
.46
     6 ,  -.35,  -.11,  -.01,  -.53,   .52,  -.30,   .10,   .00,   .11,  -
.20
     7 ,  -.06,  -.10,  -.10,   .02,   .23,  -.22,   .12,  -.07,  -.21,  -
.03

  Age  ,  2005,  2006,  2007,  2008,  2009,  2010,  2011,  2012,  2013,
2014
     2 ,   .12,  -.03,   .05,   .20,  -.85, 99.99, 99.99, 99.99, 99.99,
99.99
     3 ,  -.38,  -.26,   .55,   .55,   .13, 99.99, 99.99, 99.99, 99.99,
99.99
     4 ,  -.21,  -.29,  -.20,   .30,  -.03, 99.99, 99.99, 99.99, 99.99,
99.99
     5 ,   .32,  -.29,  -.27,   .24,   .32, 99.99, 99.99, 99.99, 99.99,
99.99
     6 ,   .42,  -.07,  -.24,   .13,   .22, 99.99, 99.99, 99.99, 99.99,
99.99
     7 ,   .20,   .01,  -.22,   .22,   .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 ,         2,          3,          4,          5,          6,          7
 Mean Log q,  -15.0092,  -14.5634,  -14.7831,  -15.1387,  -15.1956,  -
15.1956,
 S.E(Log q),     .3390,     .2755,     .2591,     .2660,     .2734,
.1420,
```

Table 7.7: cont'd

Regression statistics :

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
2,	2.00,	-1.541,	19.96,	.12,	19,	.65,	-15.01,
3,	1.19,	-.622,	15.46,	.40,	19,	.33,	-14.56,
4,	.80,	1.298,	13.66,	.70,	19,	.20,	-14.78,
5,	.88,	.614,	14.34,	.60,	19,	.24,	-15.14,
6,	1.59,	-1.541,	19.44,	.29,	19,	.42,	-15.20,
7,	.85,	1.900,	14.03,	.91,	19,	.11,	-15.20,

Fleet : FR-BB-IN-Q4

Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
2	No data for this fleet at this age									
3	99.99,	99.99,	99.99,	99.99,	99.99,	.25,	-.37,	.27,	.68,	.22
4	99.99,	99.99,	99.99,	99.99,	99.99,	.38,	-.52,	-.69,	.13,	.30
5	99.99,	99.99,	99.99,	99.99,	99.99,	.10,	-.31,	-.10,	-.69,	.52
6	99.99,	99.99,	99.99,	99.99,	99.99,	-.50,	.01,	.61,	-.33,	.84
7	99.99,	99.99,	99.99,	99.99,	99.99,	-.22,	-.15,	.59,	.31,	.21

Age	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
2	No data for this fleet at this age									
3	-.28,	-.08,	-.06,	.11,	-.18,	-.27,	-.41,	.11,	-.10,	.11
4	.10,	-.51,	.17,	.47,	-.45,	.31,	-.18,	.63,	.02,	-.17
5	.24,	-.49,	.27,	.19,	-.17,	.08,	-.09,	.75,	.11,	-.41
6	.02,	.02,	.05,	.00,	.01,	-.73,	-.31,	-.05,	.18,	.20
7	-.11,	.50,	-.58,	-.21,	-.37,	-1.04,	-.72,	-.13,	-.12,	-.93

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

Age ,	3,	4,	5,	6,	7
Mean Log q,	-14.4628,	-14.9051,	-15.2038,	-15.0882,	-15.0882,
S.E(Log q),	.2932,	.4025,	.3828,	.3916,	.5233,

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,     1.07,     -.255,      14.81,      .49,      15,      .33,  -14.46,
  4,      .89,      .354,      14.25,      .43,      15,      .37,  -14.91,
  5,      .77,      .785,      13.66,      .47,      15,      .30,  -15.20,
  6,      .79,      .626,      13.59,      .41,      15,      .32,  -15.09,
  7,     4.60,    -2.393,      44.15,      .03,      15,     1.92,  -15.29,
1
```

Table 7.7: cont'd

```
 Fleet : FR-BB-OFF-Q2

  Age  ,  1995,  1996,  1997,  1998,  1999,  2000,  2001,  2002,  2003,
2004
     2 , 99.99, 99.99, 99.99, 99.99, 99.99,   .42,   .46,   .88,   .93,
.43
     3 , 99.99, 99.99, 99.99, 99.99, 99.99,  -.42,  -.12,   .23,   .16,
.19
     4 , 99.99, 99.99, 99.99, 99.99, 99.99,   .37,   .25,   .16,   .00,  -
.06
     5 , 99.99, 99.99, 99.99, 99.99, 99.99,   .76,   .49,   .82,  -.15,  -
.88
     6 , 99.99, 99.99, 99.99, 99.99, 99.99,   .73,  1.19,  1.42,   .43,  -
.46
     7 , No data for this fleet at this age

  Age  ,  2005,  2006,  2007,  2008,  2009,  2010,  2011,  2012,  2013,
2014
     2 ,   .37,  -.29,   .53,   .90, -1.72, -1.39, -2.00,   .48, 99.99,
99.99
     3 ,  -.17,  -.20,   .75,   .39,  -.11,  -.01,  -.64,  -.04, 99.99,
99.99
     4 ,  -.01,  -.64,  -.39,  -.02,  -.23,   .26,   .40,  -.07, 99.99,
99.99
     5 ,   .28,  -.54,  -.96,  -.01,  -.21,   .30,  -.36,   .46, 99.99,
99.99
     6 ,  -.70,   .33,   .02,  -.75,  -.40, -1.50,   .09,  -.39, 99.99,
99.99
     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,  -15.8963,  -14.5142,  -14.7468,  -15.3765,  -15.9129,
 S.E(Log q),    1.0261,     .3542,     .3011,     .5822,     .8225,


 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,   -1.69,   -1.518,      -.17,      .03,     13,    1.65,  -15.90,
  3,    1.87,   -1.145,     18.70,      .14,     13,     .65,  -14.51,
  4,     .63,    2.295,     12.65,      .77,     13,     .16,  -14.75,
  5,     .57,    1.118,     12.43,      .38,     13,     .33,  -15.38,
  6,    2.88,    -.563,     31.14,      .01,     13,    2.44,  -15.91,


 Fleet : FR-ORHAGO

  Age  ,  2005,  2006,  2007,  2008,  2009,  2010,  2011,  2012,  2013,
2014
     2 , 99.99, 99.99,   .14,  -.20,   .43,  -.11,   .05,  -.13,  -.17,  -
.01
```

```
     3 , 99.99, 99.99,   .00,   .12,   .24,  -.03,  -.38,  -.03,   .03,
.06
     4 , 99.99, 99.99,   .10,  -.07,  -.17,  -.24,  -.58,   .25,   .38,
.33
     5 , 99.99, 99.99,   .71,  -.55,  -.27,  -.89, -1.05,   .57,   .87,
.63
     6 , 99.99, 99.99,   .75,  -.11,  -.30, -3.33,  -.58,   .52,  1.20,
1.84
     7 , 99.99, 99.99,  -.83,   .17, -1.37,  -.69,   .03,   .35,   .67,
.88

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


    Age ,         2,         3,         4,         5,         6,         7
 Mean Log q,   -9.1206,   -9.3585,   -9.7779,  -10.5070,  -10.9578,  -
10.9578,
 S.E(Log q),     .2078,     .1780,     .3271,     .7778,    1.5670,
.7952,
```

Table 7.7: cont'd

Regression statistics :

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
2,	.72,	2.330,	9.33,	.92,	8,	.12,	-9.12,
3,	1.24,	-1.146,	9.31,	.79,	8,	.22,	-9.36,
4,	1.48,	-1.051,	10.09,	.45,	8,	.48,	-9.78,
5,	.36,	2.523,	9.27,	.72,	8,	.21,	-10.51,
6,	.17,	3.098,	8.51,	.70,	8,	.18,	-10.96,
7,	.33,	1.835,	8.66,	.55,	8,	.22,	-11.06,

Fleet disaggregated estimates of survivors :

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

Year class = 2012

FR-SABLES

Age,	2,
Survivors,	0.,
Raw Weights,	.000,

FR-ROCHELLE

Age,	2,
Survivors,	0.,
Raw Weights,	.000,

FR-BB-IN-Q4

Age,	2,
Survivors,	0.,
Raw Weights,	.000,

FR-BB-OFF-Q2

Age,	2,
Survivors,	0.,
Raw Weights,	.000,

FR-ORHAGO

Age,	2,
Survivors,	19748.,
Raw Weights,	17.559,

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FR-SABLES ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FR-ROCHELLE ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FR-BB-IN-Q4 ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FR-BB-OFF-Q2 ,	1.,	.000,	.000,	.00,	0,	.000,	.000
FR-ORHAGO ,	19748.,	.220,	.000,	.00,	1,	.975,	.160

```
  F shrinkage mean  ,      26135.,   1.50,,,,                        .025,
.123

 Weighted prediction :

 Survivors,         Int,       Ext,    N,    Var,     F
 at end of year,   s.e,       s.e,     ,   Ratio,
     19885.,       .22,       .04,    2,    .202,   .159
```

Table 7.7: cont'd

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

 Year class = 2011

 FR-SABLES
         Age,         3,          2,
   Survivors,        0.,         0.,
 Raw Weights,      .000,       .000,

 FR-ROCHELLE
         Age,         3,          2,
   Survivors,        0.,         0.,
 Raw Weights,      .000,       .000,

 FR-BB-IN-Q4
         Age,         3,          2,
   Survivors,     5817.,         0.,
 Raw Weights,     7.085,       .000,

 FR-BB-OFF-Q2
         Age,         3,          2,
   Survivors,        0.,         0.,
 Raw Weights,      .000,       .000,

 FR-ORHAGO
         Age,         3,          2,
   Survivors,     5516.,      4389.,
 Raw Weights,    16.241,     10.715,

        Fleet,              Estimated,    Int,       Ext,    Var,    N,   Scaled,
Estimated
            ,               Survivors,    s.e,       s.e,   Ratio,    ,   Weights,
F
 FR-SABLES          ,          1.,   .000,       .000,    .00,   0,  .000,
.000
 FR-ROCHELLE        ,          1.,   .000,       .000,    .00,   0,  .000,
.000
 FR-BB-IN-Q4        ,       5817.,   .303,       .000,    .00,   1,  .205,
.394
 FR-BB-OFF-Q2       ,          1.,   .000,       .000,    .00,   0,  .000,
.000
 FR-ORHAGO          ,       5037.,   .149,       .112,    .75,   2,  .782,
.443

   F shrinkage mean  ,      6613.,   1.50,,,,                        .013,
.354

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      5206.,       .13,      .07,    4,    .510,   .431

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

 Year class = 2010

 FR-SABLES
         Age,         4,          3,          2,
   Survivors,        0.,         0.,         0.,
```

```
Raw Weights,      .000,        .000,        .000,

FR-ROCHELLE
        Age,         4,           3,           2,
  Survivors,        0.,          0.,          0.,
Raw Weights,      .000,        .000,        .000,
```

Table 7.7: cont'd

```
 FR-BB-IN-Q4
         Age,        4,          3,          2,
   Survivors,     2821.,      3005.,         0.,
 Raw Weights,     3.953,      4.907,       .000,

 FR-BB-OFF-Q2
         Age,        4,          3,          2,
   Survivors,       0.,         0.,      5412.,
 Raw Weights,      .000,       .000,       .349,

 FR-ORHAGO
         Age,        4,          3,          2,
   Survivors,     4628.,      3434.,      2942.,
 Raw Weights,     5.674,     11.248,      8.150,

       Fleet,              Estimated,    Int,       Ext,    Var,    N,   Scaled,
Estimated
            ,              Survivors,    s.e,       s.e,   Ratio,    ,   Weights,
F
 FR-SABLES          ,          1.,   .000,       .000,     .00,   0,  .000,
.000
 FR-ROCHELLE        ,          1.,   .000,       .000,     .00,   0,  .000,
.000
 FR-BB-IN-Q4        ,       2922.,   .250,       .031,     .13,   2,  .255,
.425
 FR-BB-OFF-Q2       ,       5412.,  1.065,       .000,     .00,   1,  .010,
.252
 FR-ORHAGO          ,       3494.,   .139,       .117,     .84,   3,  .722,
.367

   F shrinkage mean  ,      2359.,   1.50,,,,                           .013,
.505

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      3336.,       .12,      .07,    7,    .586,   .381

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

 Year class = 2009

 FR-SABLES
         Age,        5,          4,          3,          2,
   Survivors,       0.,         0.,         0.,         0.,
 Raw Weights,      .000,       .000,       .000,       .000,

 FR-ROCHELLE
         Age,        5,          4,          3,          2,
   Survivors,       0.,         0.,         0.,         0.,
 Raw Weights,      .000,       .000,       .000,       .000,

 FR-BB-IN-Q4
         Age,        5,          4,          3,          2,
   Survivors,     2835.,      4352.,      4751.,         0.,
 Raw Weights,     4.271,      2.559,      3.498,       .000,

 FR-BB-OFF-Q2
         Age,        5,          4,          3,          2,
```

```
  Survivors,         0.,          0.,       4077.,        573.,
Raw Weights,       .000,        .000,       2.373,        .262,
```

Table 7.7: cont'd

```
 FR-ORHAGO
         Age,        5,          4,          3,          2,
   Survivors,    7976.,      6238.,      4116.,      4454.,
 Raw Weights,     .981,      3.673,      8.018,      6.112,

       Fleet,              Estimated,    Int,       Ext,    Var,    N,   Scaled,
Estimated
           ,               Survivors,    s.e,       s.e,   Ratio,    ,   Weights,
F
 FR-SABLES          ,          1.,   .000,       .000,    .00,   0,  .000,
.000
 FR-ROCHELLE        ,          1.,   .000,       .000,    .00,   0,  .000,
.000
 FR-BB-IN-Q4        ,      3755.,   .219,       .168,    .77,   3,  .321,
.448
 FR-BB-OFF-Q2       ,      3355.,   .348,       .587,   1.69,   2,  .082,
.490
 FR-ORHAGO          ,      4742.,   .137,       .114,    .83,   4,  .583,
.370

   F shrinkage mean  ,      3417.,   1.50,,,,                          .014,
.483

 Weighted prediction :

 Survivors,        Int,       Ext,    N,    Var,     F
 at end of year,   s.e,       s.e,     ,   Ratio,
      4258.,       .11,       .10,   10,    .872,   .404

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

 Year class = 2008

 FR-SABLES
         Age,        6,          5,          4,          3,          2,
   Survivors,       0.,         0.,         0.,         0.,         0.,
 Raw Weights,     .000,       .000,       .000,       .000,       .000,

 FR-ROCHELLE
         Age,        6,          5,          4,          3,          2,
   Survivors,       0.,         0.,         0.,         0.,         0.,
 Raw Weights,     .000,       .000,       .000,       .000,       .000,

 FR-BB-IN-Q4
         Age,        6,          5,          4,          3,          2,
   Survivors,    1889.,      1731.,      2903.,      1026.,         0.,
 Raw Weights,    3.028,      1.686,       .975,      1.313,       .000,

 FR-BB-OFF-Q2
         Age,        6,          5,          4,          3,          2,
   Survivors,       0.,         0.,      1441.,       822.,       388.,
 Raw Weights,     .000,       .000,      1.725,       .891,       .096,

 FR-ORHAGO
         Age,        6,          5,          4,          3,          2,
   Survivors,    9809.,      3687.,      1986.,      1062.,      1396.,
 Raw Weights,     .179,       .387,      1.399,      3.009,      2.247,

       Fleet,              Estimated,    Int,       Ext,    Var,    N,   Scaled,
Estimated
```

```
          ,              Survivors,    s.e,       s.e,   Ratio,    ,   Weights,
F
 FR-SABLES          ,          1.,   .000,       .000,    .00,   0,  .000,
.000
 FR-ROCHELLE        ,          1.,   .000,       .000,    .00,   0,  .000,
.000
 FR-BB-IN-Q4        ,       1751.,   .215,       .175,    .81,   4,  .403,
.643
 FR-BB-OFF-Q2       ,       1144.,   .236,       .236,   1.00,   3,  .156,
.868
 FR-ORHAGO          ,       1475.,   .141,       .222,   1.58,   5,  .416,
.729

   F shrinkage mean  ,       3411.,   1.50,,,,                        .026,
.381

 Weighted prediction :

 Survivors,         Int,       Ext,    N,    Var,     F
 at end of year,   s.e,       s.e,     ,   Ratio,
      1552.,       .12,       .12,   13,   1.027,   .702

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

 Year class = 2007

 FR-SABLES
        Age,         7,           6,           5,           4,           3,
2,
   Survivors,       0.,          0.,          0.,          0.,          0.,
1209.,
 Raw Weights,     .000,        .000,        .000,        .000,        .000,
.874,

 FR-ROCHELLE
        Age,         7,           6,           5,           4,           3,
2,
   Survivors,       0.,          0.,          0.,          0.,          0.,
719.,
 Raw Weights,     .000,        .000,        .000,        .000,        .000,
.732,

 FR-BB-IN-Q4
        Age,         7,           6,           5,           4,           3,
2,
   Survivors,     662.,       2010.,       3560.,       1410.,       1282.,
0.,
 Raw Weights,    2.429,       2.841,       1.640,        .782,       1.057,
.000,

 FR-BB-OFF-Q2
        Age,         7,           6,           5,           4,           3,
2,
   Survivors,       0.,          0.,       2668.,       2521.,       1661.,
302.,
 Raw Weights,     .000,        .000,        .702,       1.384,        .717,
.078,

 FR-ORHAGO
```

```
        Age,          7,           6,           5,           4,           3,
2,
   Survivors,     4054.,       5614.,       2962.,        945.,       1626.,
2582.,
 Raw Weights,      .997,        .168,        .376,       1.123,       2.423,
1.823,

        Fleet,                Estimated,    Int,       Ext,    Var,    N,   Scaled,
Estimated
             ,                Survivors,    s.e,       s.e,   Ratio,    ,   Weights,
F
 FR-SABLES          ,       1209.,   .318,       .000,    .00,   1,  .042,
.451
 FR-ROCHELLE        ,        719.,   .348,       .000,    .00,   1,  .036,
.673
 FR-BB-IN-Q4        ,       1508.,   .219,       .299,   1.36,   5,  .425,
.377
 FR-BB-OFF-Q2       ,       2175.,   .231,       .219,    .95,   4,  .140,
.275
 FR-ORHAGO          ,       2043.,   .173,       .214,   1.24,   6,  .336,
.291

   F shrinkage mean  ,      1069.,   1.50,,,,                          .022,
.498

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
      1684.,       .12,      .14,   18,   1.124,   .343
```

Table 7.8: Bay of Biscay Sole, Fishing mortality (F) at age

	YEAR	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	AGE											
	2	0.2967	0.3601	0.2578	0.1744	0.217	0.2028	0.2655	0.1441	0.1485	0.0835	0.1102
	3	0.2431	0.3538	0.271	0.3551	0.3991	0.4363	0.384	0.353	0.3192	0.3539	0.3272
	4	0.3358	0.2722	0.3178	0.346	0.4315	0.4272	0.5245	0.4618	0.4545	0.4988	0.7518
	5	0.3479	0.3719	0.387	0.3713	0.3464	0.5938	0.5778	0.4445	0.5622	0.6409	0.7415
	6	0.3196	0.2292	0.484	0.4101	0.4216	0.5247	0.324	0.4149	1.0909	0.6034	0.7627
	7	0.3353	0.2918	0.3975	0.3769	0.4011	0.5171	0.4771	0.6209	0.853	0.8054	0.7907
	+gp	0.3353	0.2918	0.3975	0.3769	0.4011	0.5171	0.4771	0.6209	0.853	0.8054	0.7907
0	FBAR 3- 6	0.3116	0.3068	0.365	0.3706	0.3997	0.4955	0.4526	0.4186	0.6067	0.5242	0.6458

	YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
	AGE											
	2	0.1563	0.1144	0.1847	0.2117	0.131	0.2733	0.2206	0.2476	0.2029	0.2352	0.2581
	3	0.3286	0.3539	0.514	0.3966	0.3934	0.4792	0.5099	0.5271	0.4731	0.3784	0.3533
	4	0.6816	0.5288	0.6681	0.733	0.6387	0.7676	0.6525	0.8106	0.4448	0.4289	0.4321
	5	0.7189	0.5075	0.5729	0.5983	0.7341	0.7252	0.581	1.0111	0.4178	0.2929	0.5366
	6	0.5668	0.7799	0.6775	0.4234	0.7252	0.534	0.5384	0.9732	0.6073	0.3719	0.5216
	7	0.78	1.0254	0.7601	0.7609	0.553	0.4735	0.543	0.7748	0.7777	0.4224	0.4265
	+gp	0.78	1.0254	0.7601	0.7609	0.553	0.4735	0.543	0.7748	0.7777	0.4224	0.4265
0	FBAR 3- 6	0.574	0.5425	0.6081	0.5378	0.6229	0.6265	0.5704	0.8305	0.4858	0.368	0.4609

	YEAR	2006	2007	2008	2009	2010	2011	2012	2013	2014	FBAR **-**
	AGE										
	2	0.2193	0.2578	0.196	0.0908	0.0981	0.0774	0.1282	0.2218	0.1593	0.1697
	3	0.451	0.5062	0.5125	0.3575	0.3326	0.3361	0.321	0.4173	0.4314	0.3899
	4	0.4643	0.4641	0.5204	0.4226	0.5937	0.6393	0.447	0.4119	0.3813	0.4134
	5	0.3879	0.4115	0.4121	0.4982	0.402	0.2783	0.5958	0.6316	0.4043	0.5439
	6	0.431	0.3983	0.4651	0.5009	0.2616	0.2811	0.4321	0.4226	0.7025	0.5191
	7	0.5187	0.5051	0.4816	0.474	0.2286	0.2079	0.1527	0.1857	0.3434	0.2273
	+gp	0.5187	0.5051	0.4816	0.474	0.2286	0.2079	0.1527	0.1857	0.3434	
0	FBAR 3- 6	0.4336	0.445	0.4775	0.4448	0.3975	0.3837	0.449	0.4708	0.4799	

Table 7.9: Bay of Biscay Sole, Stock number at age (start of year) **Numbers*10**-3**

	YEAR	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	AGE											
	2	24160	29525	28341	24918	26743	28167	32106	35745	35348	24902	26228
	3	15413	16248	18637	19817	18938	19478	20808	22276	28004	27570	20727
	4	10268	10936	10320	12860	12572	11497	11393	12824	14161	18415	17512
	5	7278	6641	7537	6796	8233	7389	6786	6102	7312	8134	10119
	6	4474	4650	4142	4631	4242	5268	3692	3446	3540	3771	3877
	7	3247	2941	3346	2310	2781	2518	2821	2416	2059	1076	1866
	+gp	4344	3019	3943	2382	2428	1293	2400	2217	1729	1336	1330
0	TOTAL	69184	73960	76267	73714	75937	75610	80006	85025	92152	85203	81659

	YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
	AGE											
	2	23610	29427	23691	22570	24404	24955	16890	24910	24464	17106	18377
	3	21256	18272	23748	17821	16526	19370	17180	12257	17595	18070	12234
	4	13521	13847	11606	12852	10846	10089	10854	9335	6547	9920	11200
	5	7472	6189	7384	5384	5587	5181	4237	5114	3755	3797	5845
	6	4362	3294	3371	3767	2678	2426	2270	2144	1684	2238	2563
	7	1636	2239	1366	1549	2232	1173	1287	1199	733	830	1396
	+gp	1901	2143	1720	2329	2406	1232	1213	837	483	1012	1532
0	TOTAL	73757	75411	72887	66272	64679	64427	53931	55798	55261	52973	53147

	YEAR	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	GMST 84-**	AMST 84-**
	AGE												
	2	18870	17974	18744	34651	23446	21397	11377	12219	25770	0	23886	24588
	3	12846	13711	12568	13942	28633	19233	17919	9056	8857	19885	18170	18658
	4	7775	7404	7478	6812	8824	18577	12435	11762	5398	5206	11076	11472
	5	6578	4422	4212	4021	4039	4409	8869	7196	7050	3336	5944	6166
	6	3093	4038	2651	2524	2211	2445	3020	4423	3462	4258	3200	3328
	7	1377	1819	2453	1507	1384	1540	1670	1774	2623	1552	1758	1889
	+gp	3974	2496	3267	2662	1458	2884	3831	3931	1644	2739		
0	TOTAL	54511	51864	51373	66118	69994	70484	59121	50360	54804	36976		

Table 7.10: Bay of Biscay Sole, Summary (without SOP correction)

	RECRUITS Age 2	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR3-6
1984	24160	14813	12320	4038	0.3278	0.3116
1985	29525	16056	13365	4251	0.3181	0.3068
1986	28341	17067	14477	4805	0.3319	0.365
1987	24918	18652	15476	5086	0.3286	0.3706
1988	26743	18506	15354	5382	0.3505	0.3997
1989	28167	17777	14461	5845	0.4042	0.4955
1990	32106	18393	14817	5916	0.3993	0.4526
1991	35745	19090	14787	5569	0.3766	0.4186
1992	35348	20528	15975	6550	0.41	0.6067
1993	24902	19904	16378	6420	0.392	0.5242
1994	26228	19295	15854	7229	0.456	0.6458
1995	23610	17665	14250	6205	0.4354	0.574
1996	29427	17760	13833	5854	0.4232	0.5425
1997	23691	16495	13339	6259	0.4692	0.6081
1998	22570	16469	13257	6027	0.4546	0.5378
1999	24404	15983	12350	5249	0.425	0.6229
2000	24955	15538	11871	5760	0.4852	0.6265
2001	16890	13059	10584	4836	0.4569	0.5704
2002	24910	13180	9776	5486	0.5612	0.8305
2003	24464	13357	9627	4108	0.4267	0.4858
2004	17106	14170	11176	4002	0.3581	0.368
2005	18377	14481	11549	4539	0.393	0.4609
2006	18870	15307	12210	4793	0.3925	0.4336
2007	17974	14324	11423	4363	0.3819	0.445
2008	18744	14318	11387	4299	0.3775	0.4775
2009	34651	16150	11288	3650	0.3234	0.4448
2010	23446	17530	13363	3966	0.2968	0.3975
2011	21397	19314	15389	4632	0.301	0.3837
2012	11377	17020	14690	4321	0.2942	0.449
2013	12219	15586	13255	4235	0.3195	0.4708
2014	25770	14362	10576	3934	0.372	0.4799
Arith. Mean	24227	16521	13176	5084	0.3885	0.4873
0 Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		
GM 93-2012 :	21825					

Table 7.11: Multifleet prediction input data

Sole in Bay of Biscay
Multi fleet input data

MFDP version 1a
Run: 2015
Time and date: 08:52 01/05/2015
Fbar age range (Total) : 3-6
Fbar age range Fleet 1 : 3-6

Input Fs are 2012-2014 means at age 2 to 8
Catch and stock wts are 2012-2014 means
Recruits are 1993-2012 GM
unscaled F

2015

Age	N	M	Mat	PF	PM	Stock Wt	F Landings	Landing WT
2	21825	0.1	0.32	0	0	0.202	0.1698	0.190
3	19885	0.1	0.83	0	0	0.251	0.3899	0.236
4	5206	0.1	0.97	0	0	0.287	0.4134	0.270
5	3336	0.1	1	0	0	0.322	0.5439	0.303
6	4258	0.1	1	0	0	0.381	0.5191	0.360
7	1552	0.1	1	0	0	0.464	0.2273	0.441
8	2739	0.1	1	0	0	0.581	0.2273	0.551

2016

Age	N	M	Mat	PF	PM	Stock Wt	F Landings	Landing WT
2	21825	0.1	0.32	0	0	0.202	0.1698	0.190
3		0.1	0.83	0	0	0.251	0.3899	0.236
4		0.1	0.97	0	0	0.287	0.4134	0.270
5		0.1	1	0	0	0.322	0.5439	0.303
6		0.1	1	0	0	0.381	0.5191	0.360
7		0.1	1	0	0	0.464	0.2273	0.441
8		0.1	1	0	0	0.581	0.2273	0.551

2017

Age	N	M	Mat	PF	PM	Stock Wt	F Landings	Landing WT
2	21825	0.1	0.32	0	0	0.202	0.1698	0.190
3		0.1	0.83	0	0	0.251	0.3899	0.236
4		0.1	0.97	0	0	0.287	0.4134	0.270
5		0.1	1	0	0	0.322	0.5439	0.303
6		0.1	1	0	0	0.381	0.5191	0.360
7		0.1	1	0	0	0.464	0.2273	0.441
8		0.1	1	0	0	0.581	0.2273	0.551

Input units are thousands and kg - output in tonnes

Table 7.12: Bay of Biscay Sole Multifleet prediction, management option table

MFDP version 1a	**Basis**
Run: 2015	
Time and date: 08:52 01/05/2015	**F(2015) = mean F(12-14) unscaled (age :**
Fbar age range (Total) : 3-6	**R15 = GM (1993 to n-2) = 21.8 million**
Fbar age range Fleet 1 : 3-6	

2015

Biomass	SSB	Landings FMult	Landings FBar	Yield
15904	12012	1.0000	0.4666	3939

2016

Biomass	SSB	Landings FMult	Landings FBar	Landing Yield	2017 Biomass	SSB
16621	12807	0.0000	0.0000	0	21883	17913
.	12807	0.1000	0.0467	472	21333	17382
.	12807	0.2000	0.0933	928	20803	16870
.	12807	0.3000	0.1400	1367	20291	16377
.	12807	0.4000	0.1866	1791	19798	15902
.	12807	0.5000	0.2333	2200	19323	15444
.	12807	0.6000	0.2799	2594	18864	15003
.	12807	0.7000	0.3266	2975	18422	14577
.	12807	0.8000	0.3733	3343	17995	14167
.	12807	0.9000	0.4199	3698	17584	13771
.	12807	1.0000	0.4666	4040	17186	13390
.	12807	1.1000	0.5132	4371	16803	13022
.	12807	1.2000	0.5599	4691	16433	12666
.	12807	1.3000	0.6065	4999	16076	12324
.	12807	1.4000	0.6532	5298	15731	11993
.	12807	1.5000	0.6999	5586	15398	11674
.	12807	1.6000	0.7465	5864	15076	11367
.	12807	1.7000	0.7932	6134	14765	11069
.	12807	1.8000	0.8398	6394	14465	10782
.	12807	1.9000	0.8865	6645	14175	10505
.	12807	2.0000	0.9331	6888	13895	10238

Bpa = 13000 t
Fpa = 0.42

Input units are thousands and kg - output in tonnes

Table 7.13: Bay of Biscay sole - Detailed predictions

MFDP version 1a
Run: 2015
Time and date: 08:52 01/05/2015
Fbar age range (Total) : 3-6
Fbar age range Fleet 1 : 3-6

Year: 2015 F multiplier: 1 Fleet1 HCFba 0.4666

Age	Landings F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
2	0.1698	3247	616	21825	4409	6984	1411	6984	1411
3	0.3899	6130	1445	19885	4991	16505	4143	16505	4143
4	0.4134	1683	455	5206	1494	5050	1449	5050	1449
5	0.5439	1338	405	3336	1073	3336	1073	3336	1073
6	0.5191	1648	594	4258	1624	4258	1624	4258	1624
7	0.2273	301	133	1552	721	1552	721	1552	721
8	0.2273	531	293	2739	1592	2739	1592	2739	1592
Total		14878	3939	58801	15904	40423	12012	40423	12012

Year: 2016 F multiplier: 1 Fleet1 HCFba 0.4666

Age	Landings F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
2	0.1698	3247	616	21825	4409	6984	1411	6984	1411
3	0.3899	5137	1211	16665	4183	13832	3472	13832	3472
4	0.4134	3939	1065	12183	3497	11818	3392	11818	3392
5	0.5439	1249	378	3116	1002	3116	1002	3116	1002
6	0.5191	678	244	1752	668	1752	668	1752	668
7	0.2273	444	196	2293	1065	2293	1065	2293	1065
8	0.2273	600	331	3093	1798	3093	1798	3093	1798
Total		15295	4040	60927	16621	42887	12807	42887	12807

Year: 2017 F multiplier: 1 Fleet1 HCFba 0.4666

Age	Landings F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
2	0.1698	3247	616	21825	4409	6984	1411	6984	1411
3	0.3899	5137	1211	16665	4183	13832	3472	13832	3472
4	0.4134	3301	892	10210	2930	9904	2842	9904	2842
5	0.5439	2924	885	7291	2345	7291	2345	7291	2345
6	0.5191	633	228	1636	624	1636	624	1636	624
7	0.2273	183	81	943	438	943	438	943	438
8	0.2273	753	415	3883	2257	3883	2257	3883	2257
Total		16178	4328	62454	17186	44473	13390	44473	13390

Input units are thousands and kg - output in tonnes

Table 7.14: 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	2010	2011	2012	2013	2014	2015
Stock No. (thousands) of 2 year-olds	11377	12219	25770	21825	21825	21825
Source	XSA	XSA	XSA	GM93-2012	GM93-2012	GM93-2012
Status Quo F:						
% in 2015 landings	26.0	14.3	14.6	17.5	-	-
% in 2016	11.8	9.3	12.2	32.2	16.4	-
% in 2015 SSB	8.9	12.1	34.5	11.7	-	-
% in 2016 SSB	5.2	7.8	26.5	27.1	11.0	-
% in 2017 SSB	3.3	4.7	17.5	21.2	25.9	10.5

GM : geometric mean recruitment

Sole in VIIIa,b : Year-class % contribution to

a) 2016 landings **b) 2017 SSB**

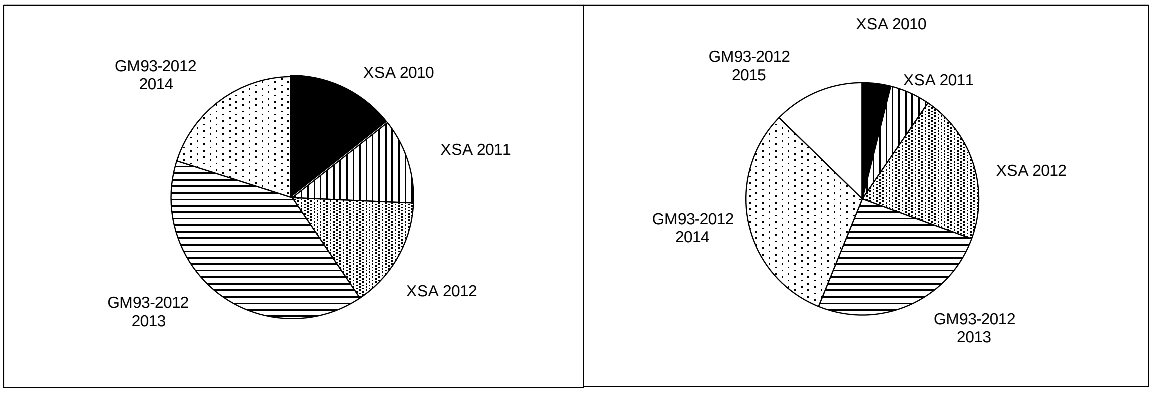


Table 7.15a: Bay of Biscay Sole Multifleet Yield per recruit

MFYPR version 2a
Run: wg2015
Time and date: 08:58 01/05/2015
Yield per results

Landings FMult	Landings Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0.0000	0.0000	0.0000	0.0000	10.5083	4.7922	9.6499	4.6092	9.6499	4.6092
0.1000	0.0467	0.2315	0.0883	8.1960	3.5160	7.3416	3.3340	7.3416	3.3340
0.2000	0.0933	0.3821	0.1382	6.6932	2.7027	5.8426	2.5217	5.8426	2.5217
0.3000	0.1400	0.4859	0.1675	5.6578	2.1547	4.8109	1.9747	4.8109	1.9747
0.4000	0.1866	0.5607	0.1849	4.9130	1.7700	4.0697	1.5909	4.0697	1.5909
0.5000	0.2333	0.6164	0.1953	4.3587	1.4911	3.5189	1.3130	3.5189	1.3130
0.6000	0.2799	0.6592	0.2014	3.9347	1.2837	3.0982	1.1064	3.0982	1.1064
0.7000	0.3266	0.6927	0.2049	3.6025	1.1259	2.7693	0.9494	2.7693	0.9494
0.8000	0.3733	0.7195	0.2068	3.3369	1.0035	2.5069	0.8279	2.5069	0.8279
0.9000	0.4199	0.7414	0.2075	3.1208	0.9070	2.2939	0.7323	2.2939	0.7323
1.0000	0.4666	0.7596	0.2077	2.9421	0.8297	2.1183	0.6557	2.1183	0.6557
1.1000	0.5132	0.7749	0.2074	2.7922	0.7669	1.9713	0.5937	1.9713	0.5937
1.2000	0.5599	0.7879	0.2069	2.6647	0.7151	1.8467	0.5427	1.8467	0.5427
1.3000	0.6065	0.7991	0.2063	2.5552	0.6720	1.7399	0.5002	1.7399	0.5002
1.4000	0.6532	0.8089	0.2056	2.4599	0.6355	1.6474	0.4645	1.6474	0.4645
1.5000	0.6999	0.8175	0.2049	2.3763	0.6045	1.5664	0.4341	1.5664	0.4341
1.6000	0.7465	0.8251	0.2042	2.3022	0.5777	1.4950	0.4080	1.4950	0.4080
1.7000	0.7932	0.8320	0.2035	2.2361	0.5544	1.4314	0.3854	1.4314	0.3854
1.8000	0.8398	0.8381	0.2029	2.1767	0.5339	1.3744	0.3656	1.3744	0.3656
1.9000	0.8865	0.8437	0.2023	2.1230	0.5158	1.3231	0.3481	1.3231	0.3481
2.0000	0.9331	0.8488	0.2017	2.0740	0.4997	1.2764	0.3325	1.2764	0.3325

Reference point	F multiplier	Absolute F
Fleet1 Landings Fbar(3-6)	1.0000	0.4666
FMax	0.9778	0.4562
F0.1	0.4242	0.1979
F35%SPR	0.3932	0.1834

Weights in kilograms

Table 7.15b: Bay of Biscay Sole Multifleet Yield per recruit (Long term equilibrium)

Long-term equilibrium at F status quo

landings	SSB
Yield * GM	SSBSpwn * GM
4533	14311

GM (93-12) for recruits (age 2)
21825

Table 7.16: EqSim results: values of reference points estimated for the 3 stock recruitment relationships (data range: 1984 to 2014)

	a	b	cv	model	n	prop
1	2.766	3.37E-05	0.260	Ricker	140	0.14
2	1.805	14460.617	0.262	Segreg	552	0.552
3	3.159	5.95E-05	0.260	Bevholt	308	0.308

Table 7.17: PlotMSY results: weights of each stock recruitment relationship (data range: 1984 to 2014)

Combining all SRRs
Automatically specified weights

Ricker	Beverton-Holt	Smooth hockeystick
0.113	0.707	0.180

Table 7.18: PlotMsy individual models results (data range: 1984 to 2014)

	Ricker	Beverton-Holt	Smooth hockeystick
	Fmsy	Fmsy	Fmsy
Deterministic	0.367	0.228	0.474
Mean	0.384	0.240	0.472
5%ile	0.233	0.152	0.336
25%ile	0.296	0.184	0.401
50%ile	0.362	0.221	0.460
75%ile	0.453	0.278	0.528
95%ile	0.598	0.383	0.663
CV	0.311	0.329	0.212
N	1000	1000	1000

Table 7.19: cont'd EqSim results: values of reference points estimated for the 3 stock recruitment relationships (data range: 1984 to 2014)

	F05	F10	F50	medianMSY	meanMSY	FCrash05	FCrash50
catF	0.484	0.501	0.571	0.316	0.263	0.579	0.684
lanF				0.316	0.263		
catch	5314	5100	3555	6014	5999	3332	48
landings				6014	5999		
catB	16157	15086	9441	27280	32710	8707	105
lanB				27280	32710		

Table 7.20: PlotMSY results: aggregated percentiles (models equally weighted)

Percentage	Fmsy	Fcrash	MSY	Bmsy	Fmsy_w	Fcrash_w	MSY_w	Bmsy_w
5%	0.169	0.434	4578	11686	0.154	0.446	4675	13186
25%	0.252	0.553	5002	15158	0.192	0.596	5290	19906
50%	0.358	0.707	5461	20155	0.244	0.786	6282	38962
75%	0.460	1.079	6764	39783	0.365	1.258	8642	68188
95%	0.604	2.336	16670	143300	0.529	2.778	26417	244764

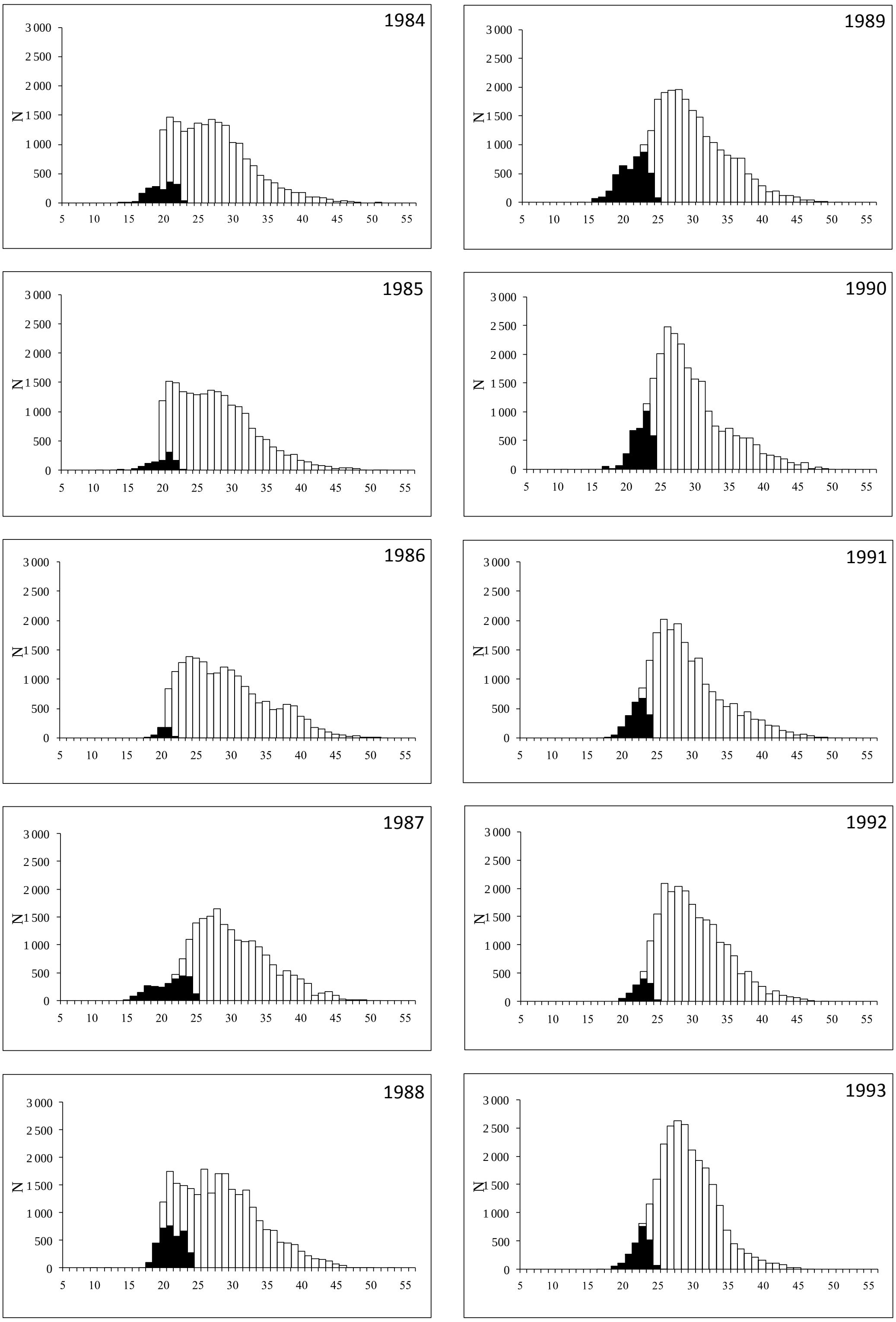


Figure 7.1 a: **Bay of Biscay sole French length distribution from 1984 to 1993**

Total French landings

Discard estimates of the French offshore trawlers fleet

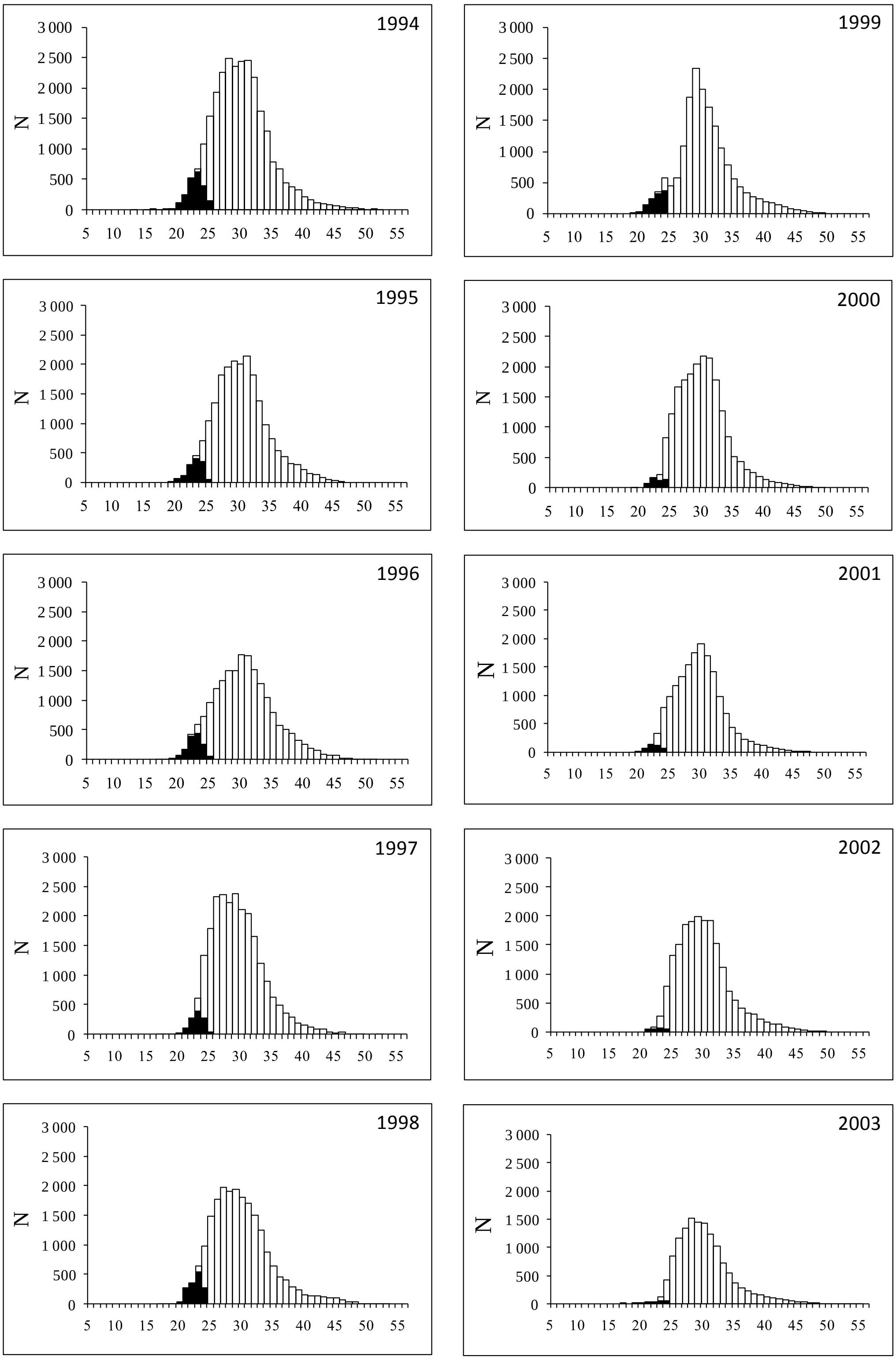


Figure 7.1 b: **Bay of Biscay sole French length distribution from 1994 to 2003**

Total French landings

Discard estimates of the French offshore trawler fleet (1994 to 2003)

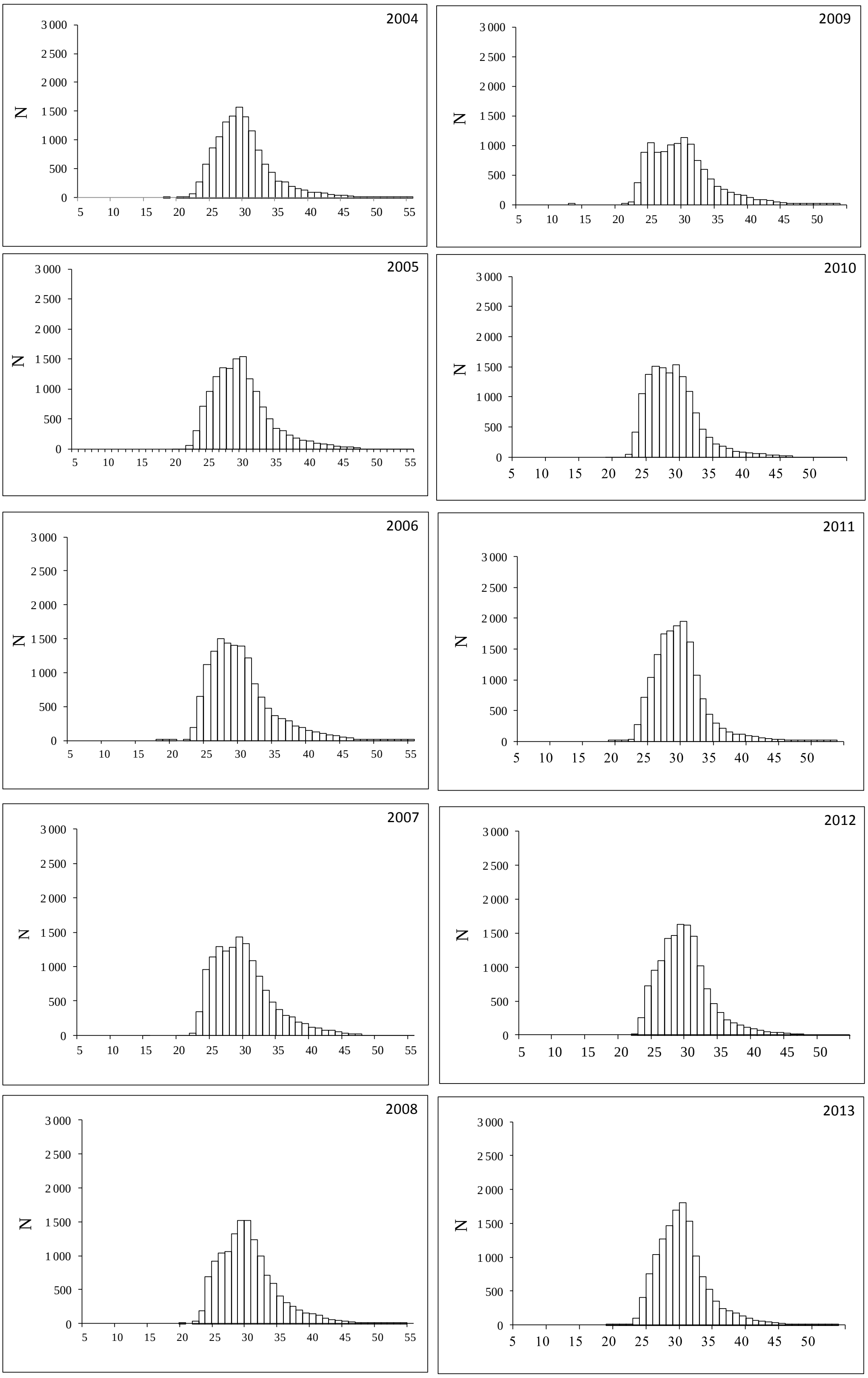


Figure 7.1 c: Bay of Biscay sole French length distribution from 2004 to 2013

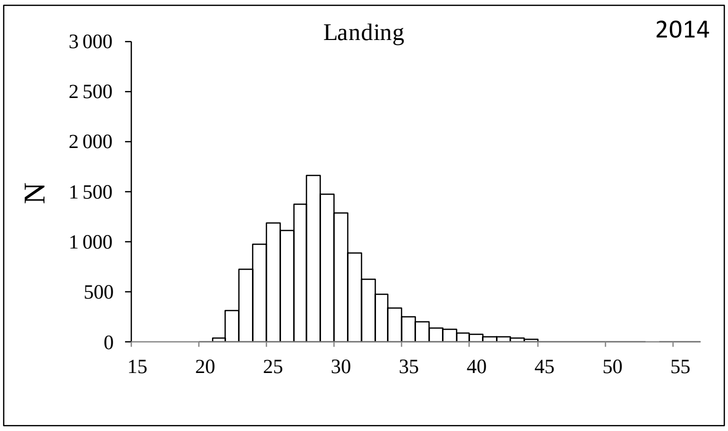
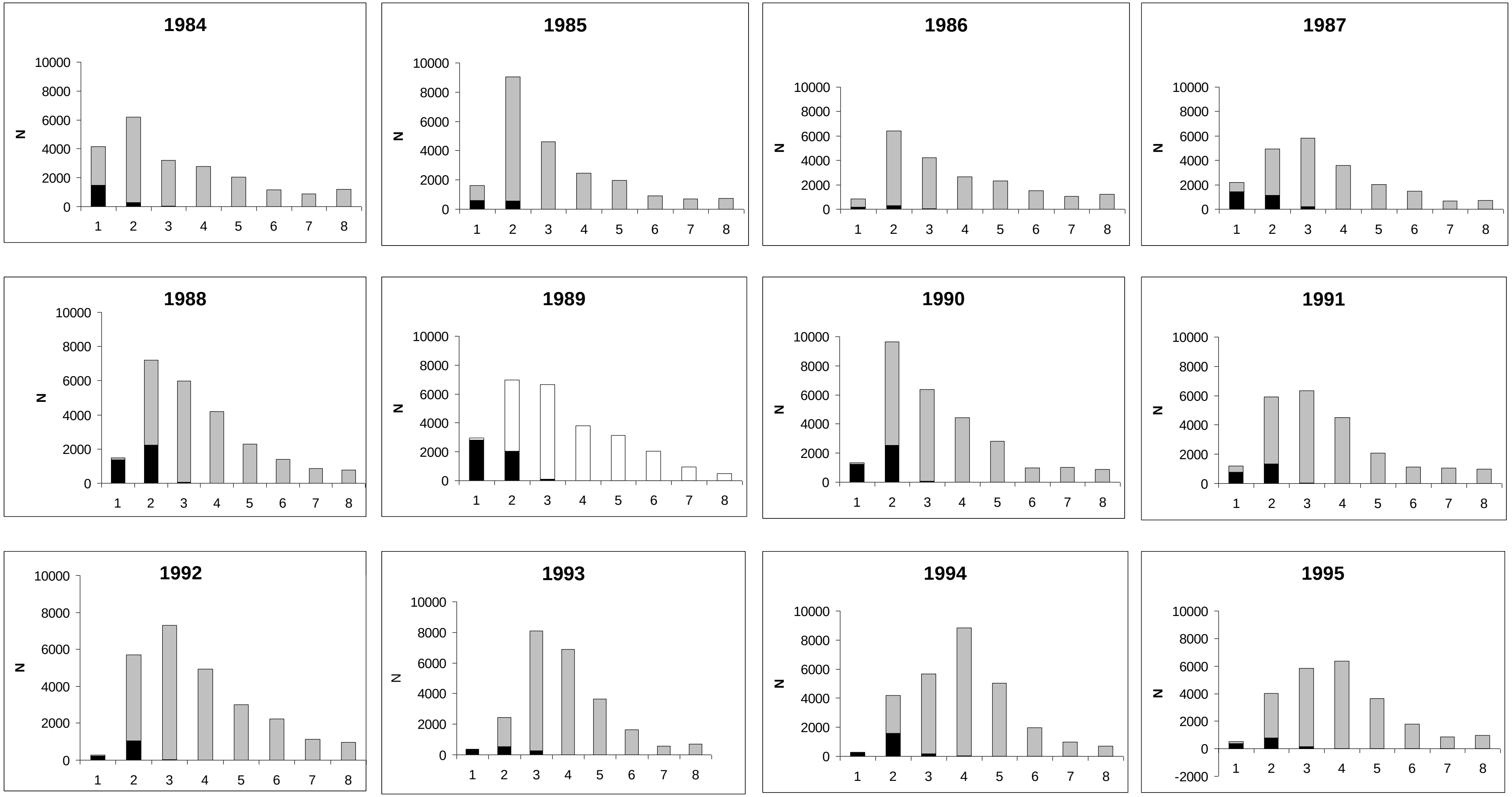


Figure 7.1 d: Bay of Biscay sole French 2014 length distribution


1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
N
10000
8000
6000
4000
2000
0
-2000
1
2
3
4
5
6
7
8

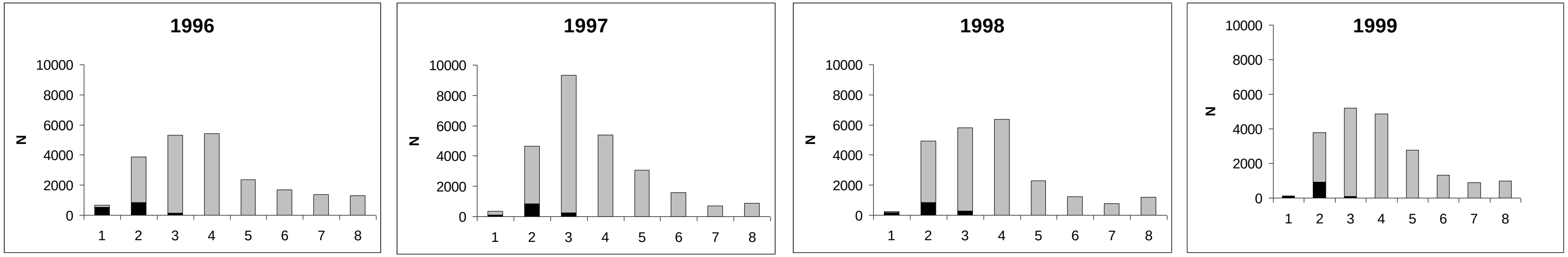
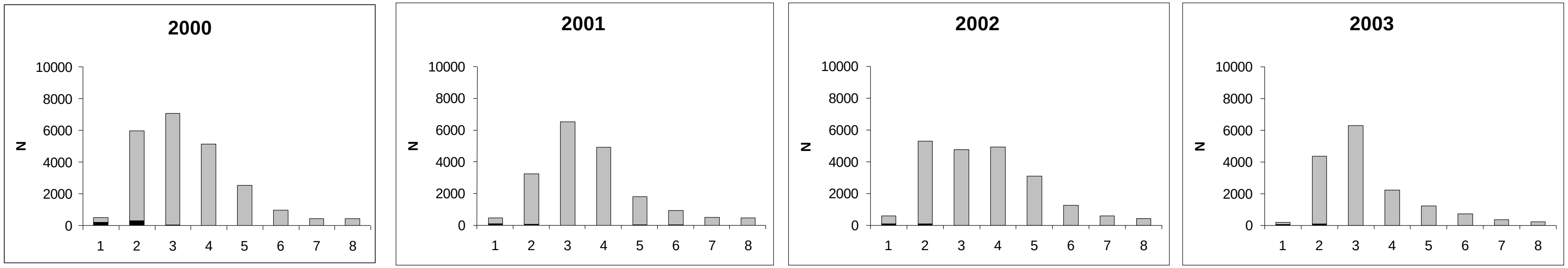


Figure 7.2 a: Bay of Biscay sole landings and discards age distributions from 1984 to 1999 (numbers in thousands)

Total landings
Discard estimates of the French offshore trawlers fleet



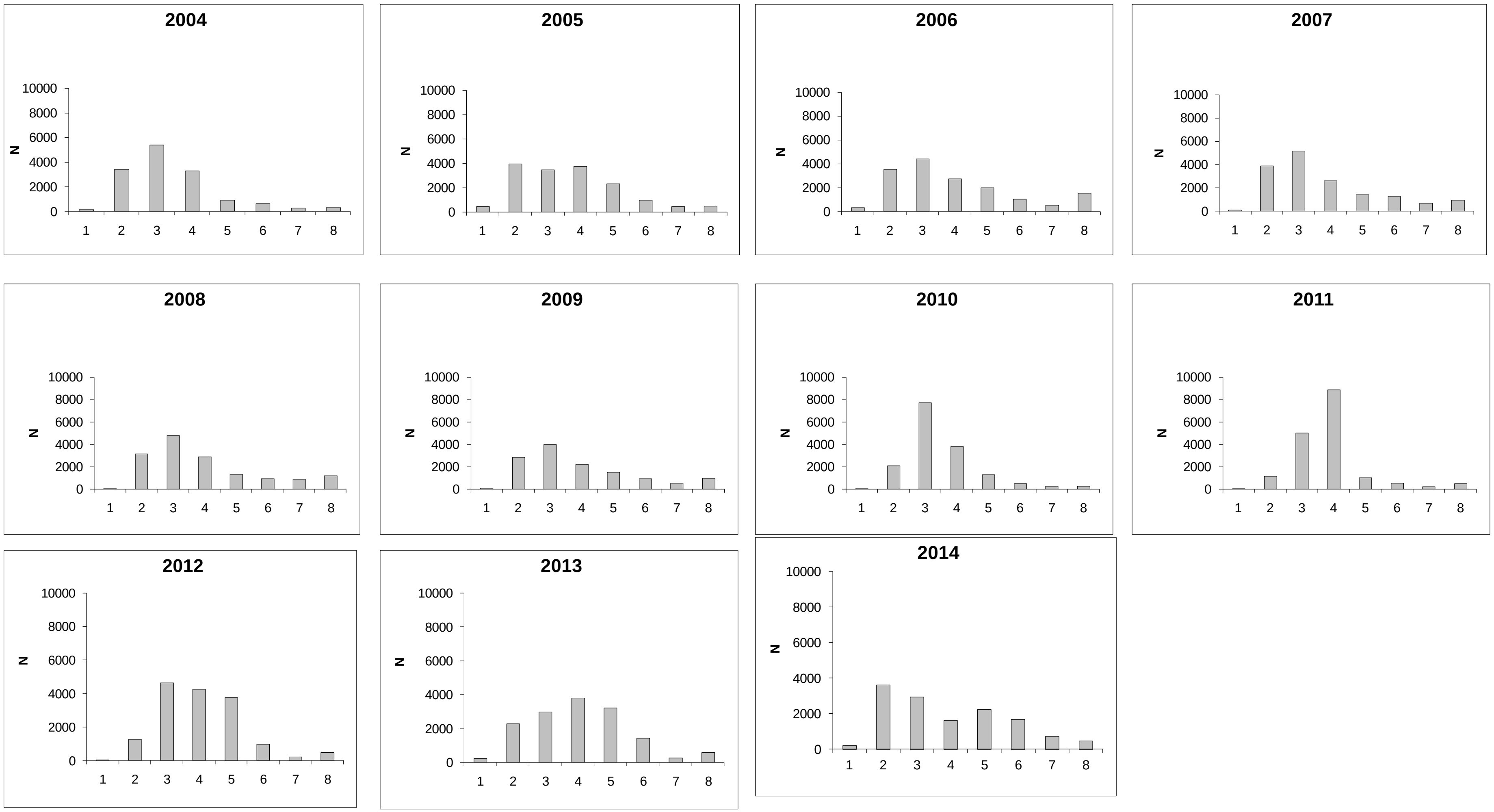

2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
N
10000
8000
6000
4000
2000
0
1
2
3
4
5
6
7
8

Figure 7.2 b: Bay of Biscay sole landings and discards age distributions from 2000 to 2014; landings age distribution since 2004 (numbers in thousands)

Total landings

Discard estimates of the French offshore trawlers fleet

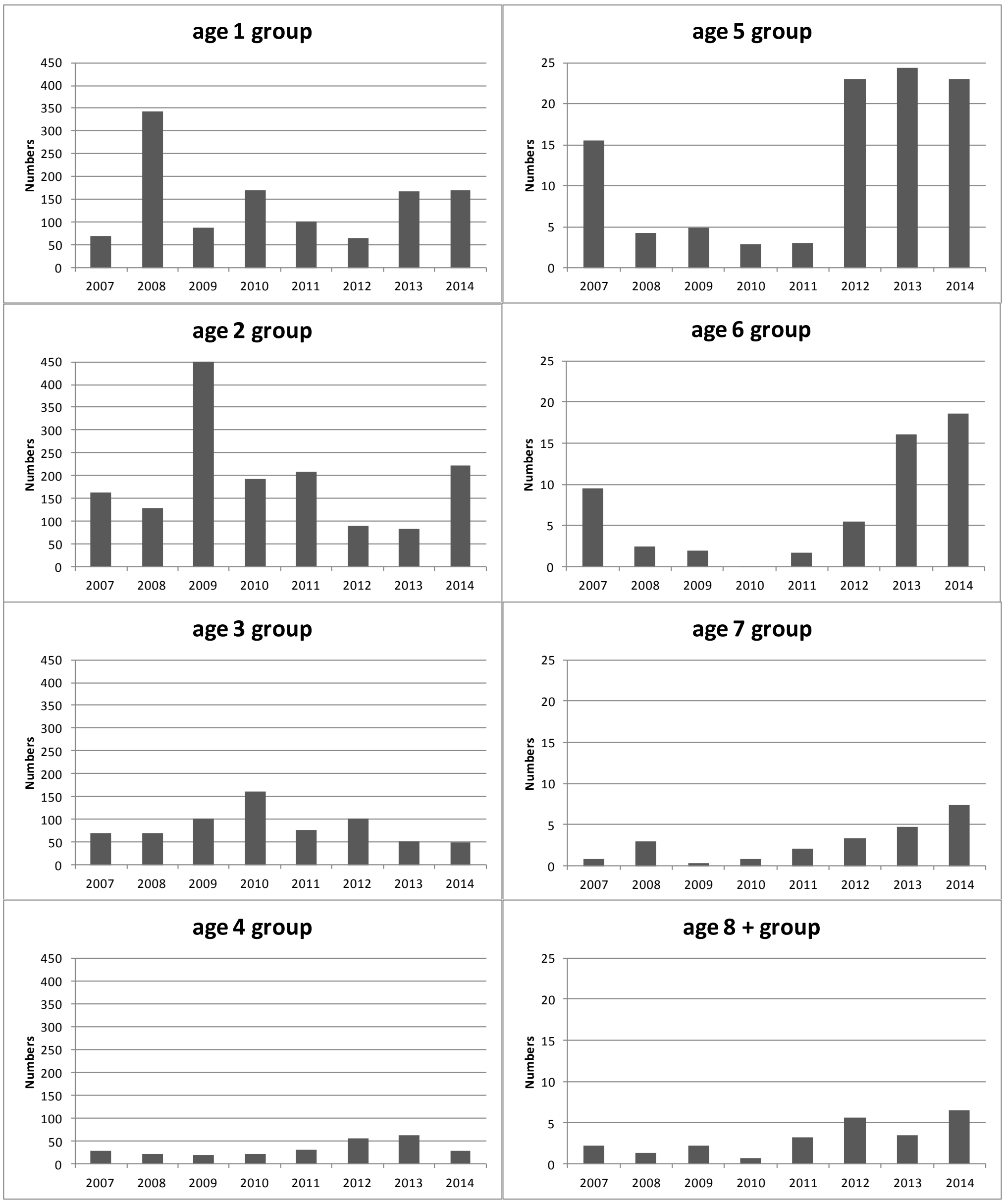


Figure 7.3: Orhago survey time series

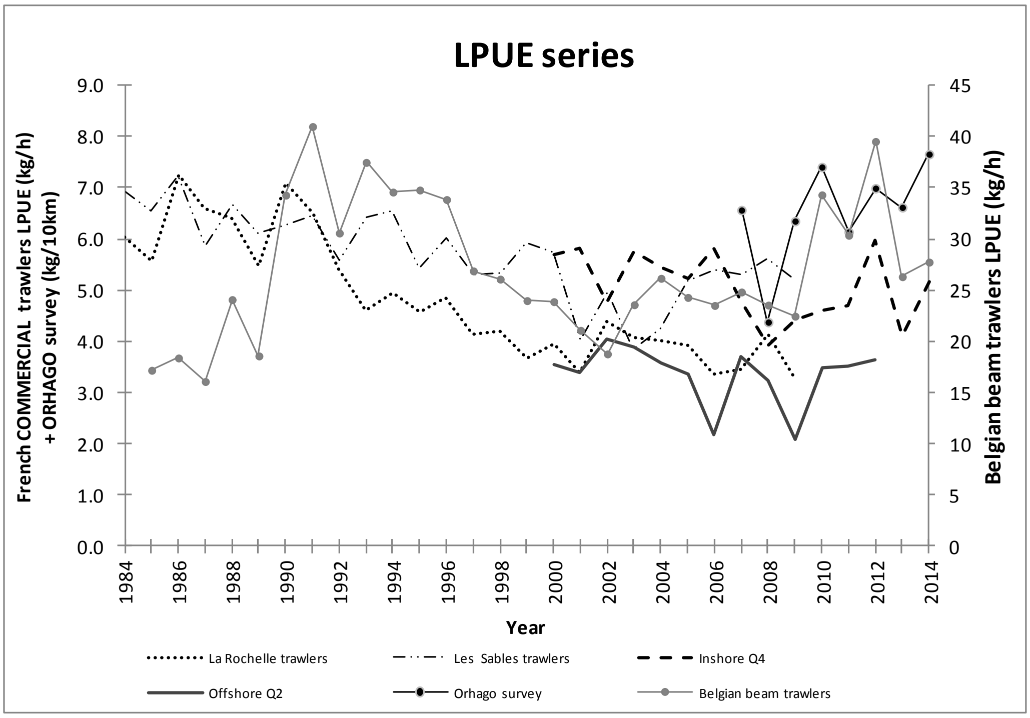
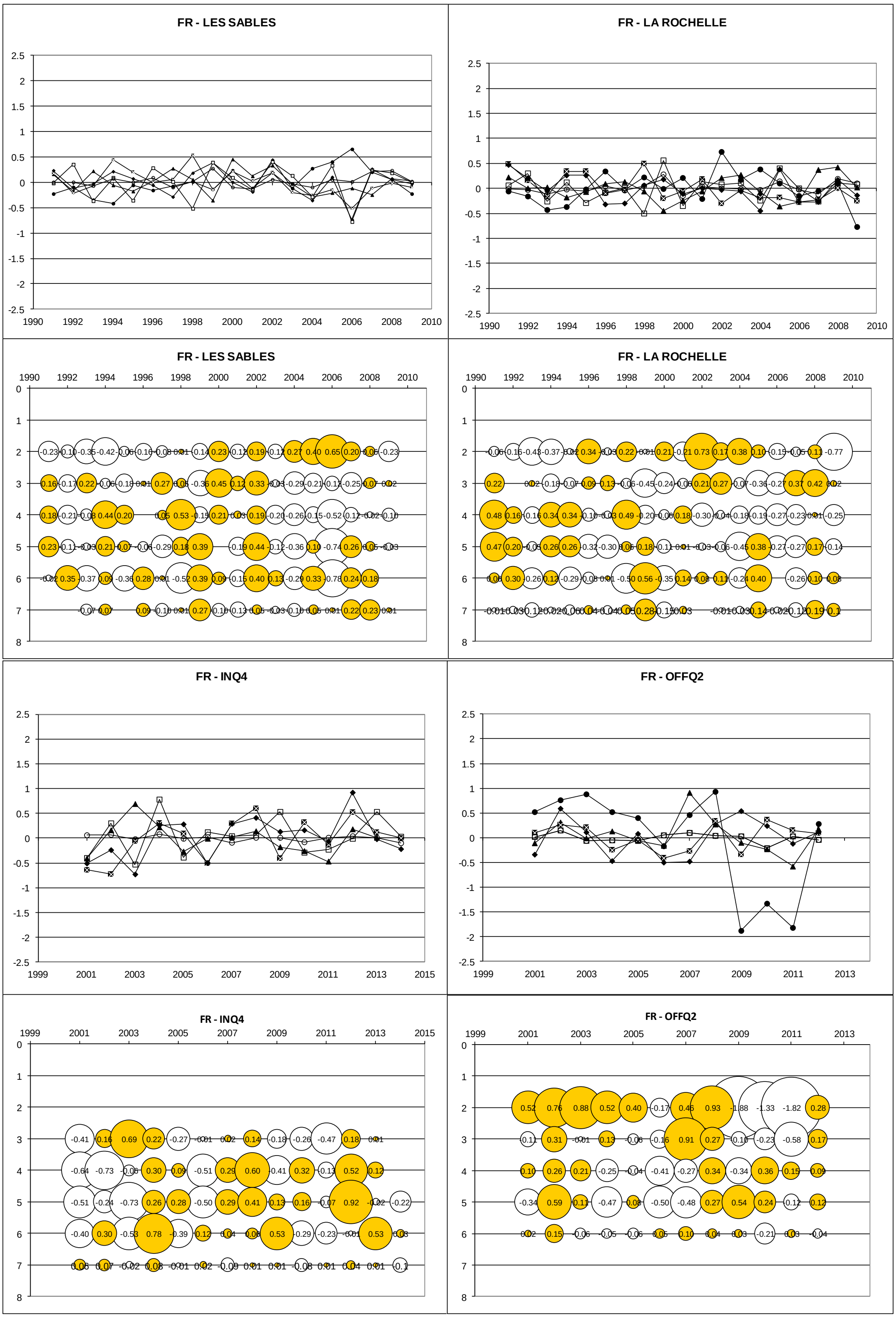


Figure 7.4: Bay of Biscay sole (Division VIIIa,b). LPUE trends of the 5 available commercial tuning fleets and CPUE of the ORHAGO survey (for sole greater than the minimum landing size, i.e. 24 cm)

LOG CATCHABILITY RESIDUAL PLOTS (XSA)



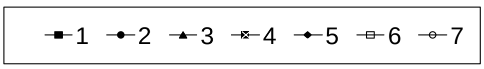


Figure 7.5a: Bay of Biscay sole (Division VIIIa,b)

XSA (No Taper, mean q, s.e. shrink = 2.5, s.e. min = .2)

LOG CATCHABILITY RESIDUAL PLOTS (XSA)

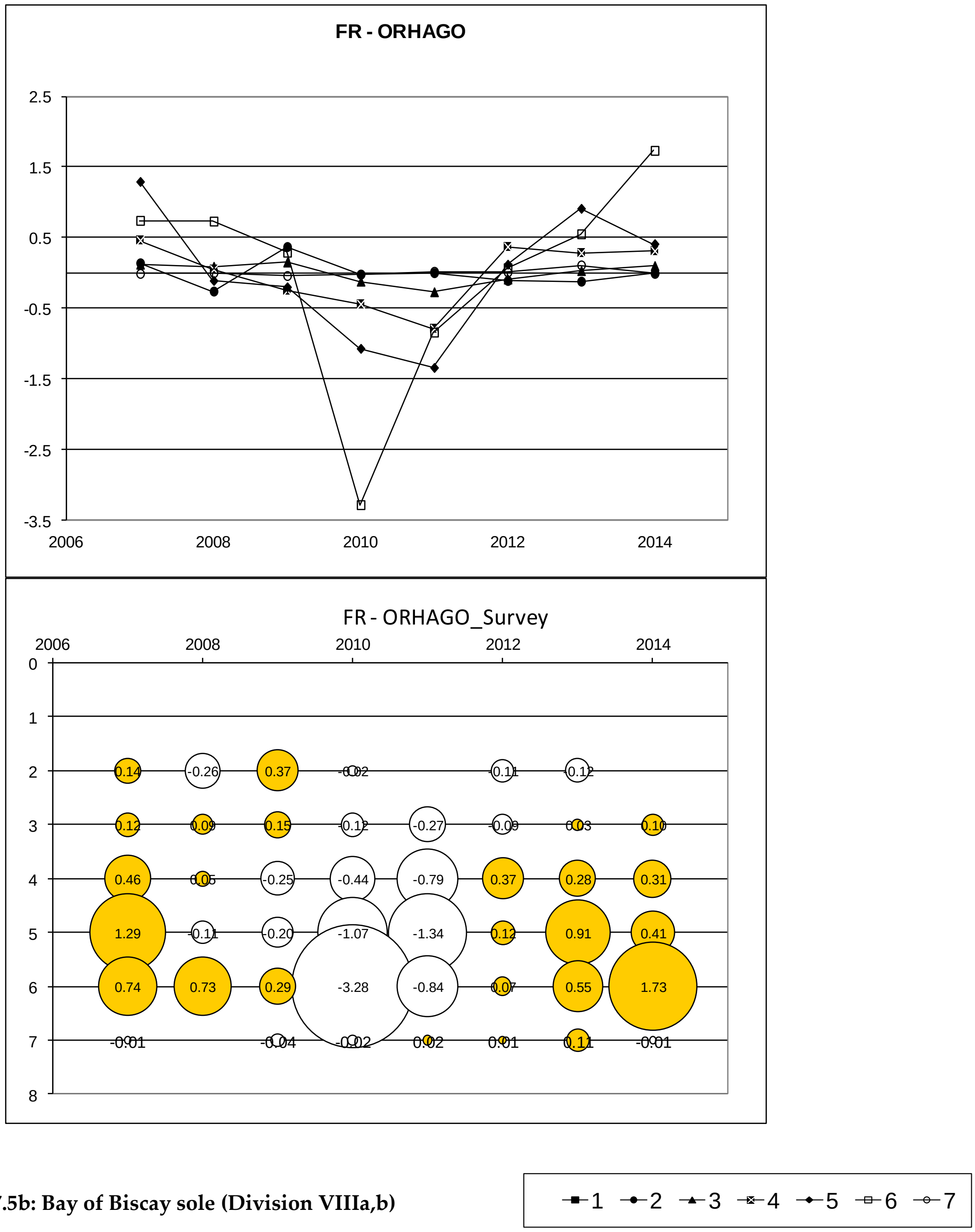


Figure 7.5b: Bay of Biscay sole (Division VIIIa,b)

XSA (No Taper, mean q, s.e. shrink = 2.5, s.e. min = .2)

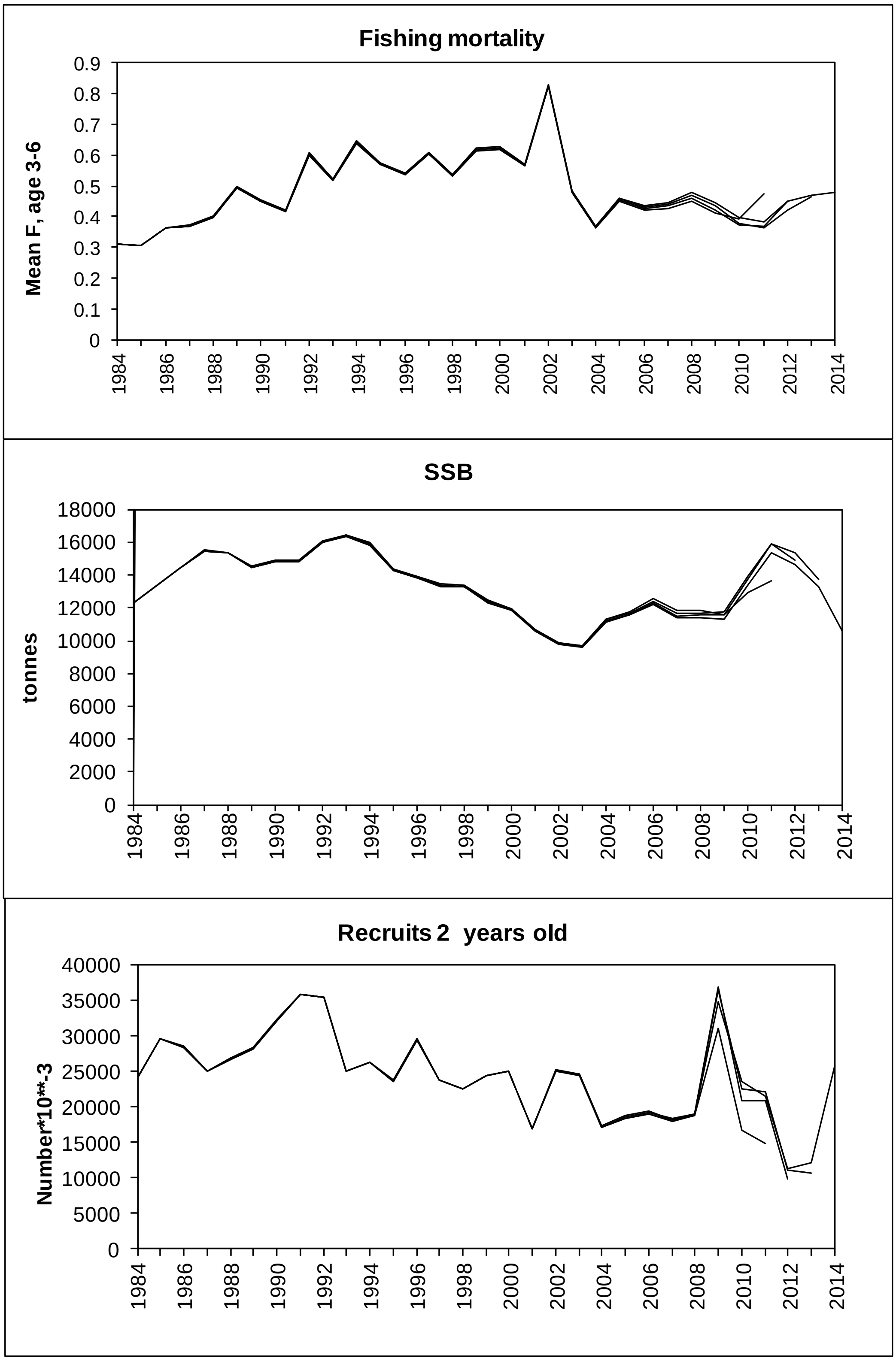


Figure 7.6: Bay of Biscay sole (Division VIIIa,b) - Retrospective results

(No taper, q indep. stock size all ages, q indep. of age>=6, shr.=1.5)

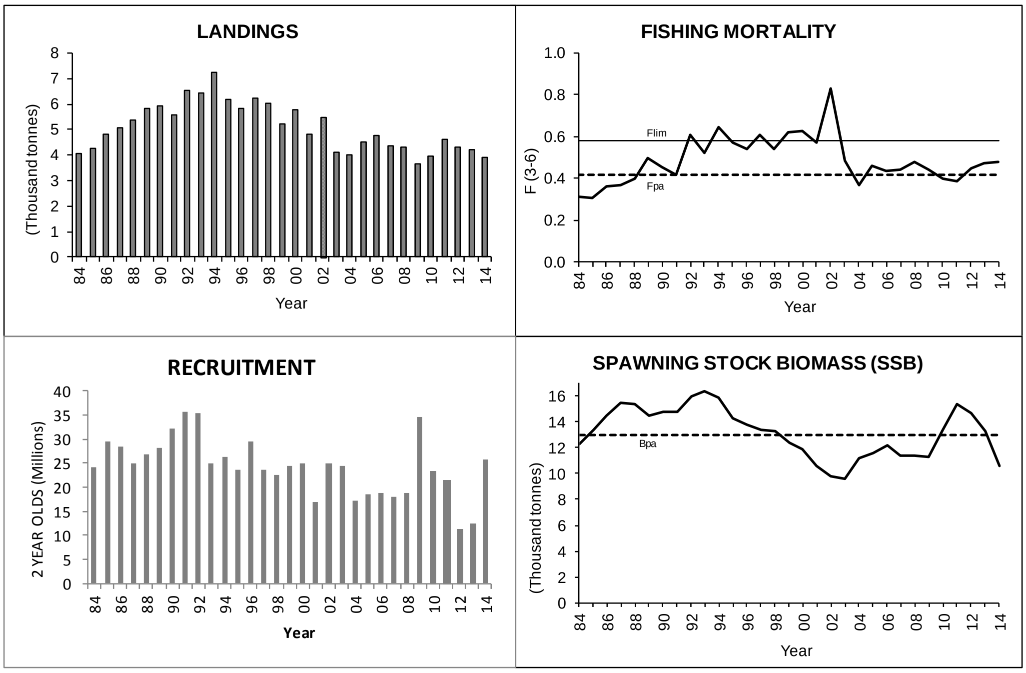
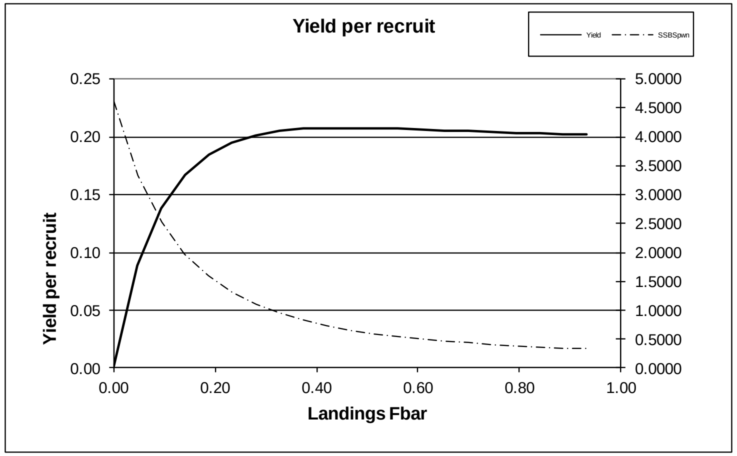
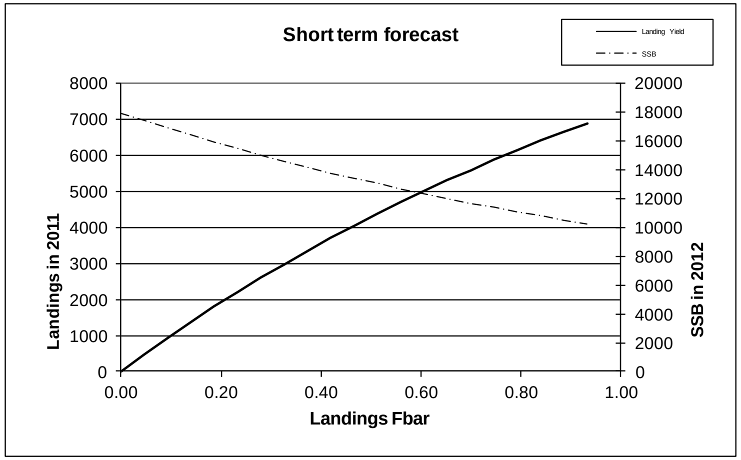


Figure 7.7: Sole in Division VIIIa,b (Bay of Biscay) – Trends for Landings, F, R, SSB





MFYPR version 2a
Run: wg2015
Time and date: 08:58 01/05/2015

Reference point	F multiplier	Absolute F
Fleet1 Landings Fbar(3-6)	1.0000	0.4666
FMax	0.9778	0.4562
F0.1	0.4242	0.1979
F35%SPR	0.3932	0.1834

Weights in kilograms

MFDP version 1a
Run: 2015
Time and date: 08:52 01/05/2015
Fbar age range (Total) : 3-6
Fbar age range Fleet 1 : 3-6

Input units are thousands and kg - output in tonnes

Figure 7.8: Sole in Division VIIIa,b (Bay of Biscay)

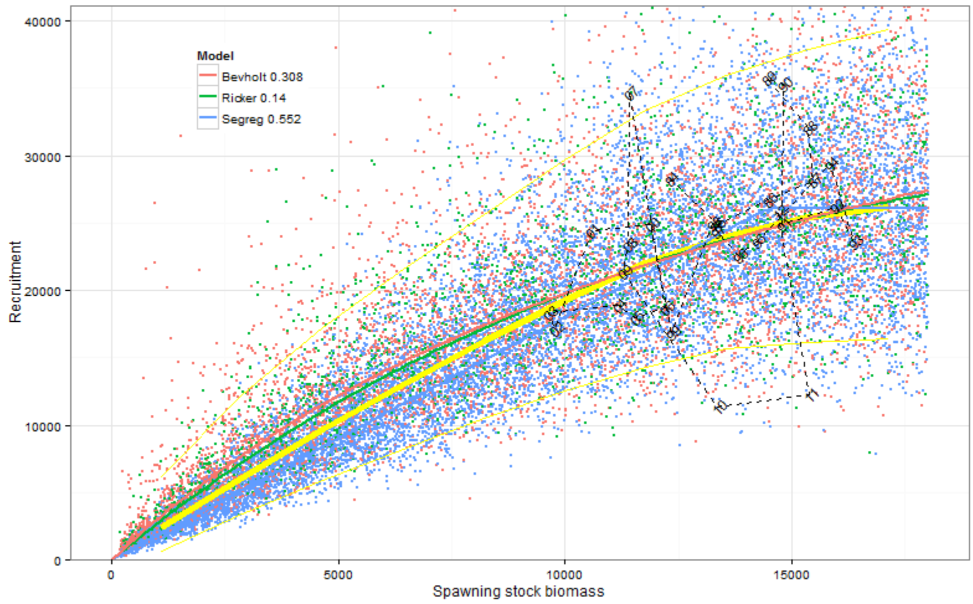


Figure 7.9: Sole in Division VIIIa,b (Bay of Biscay). The SRRplot from Eqsim

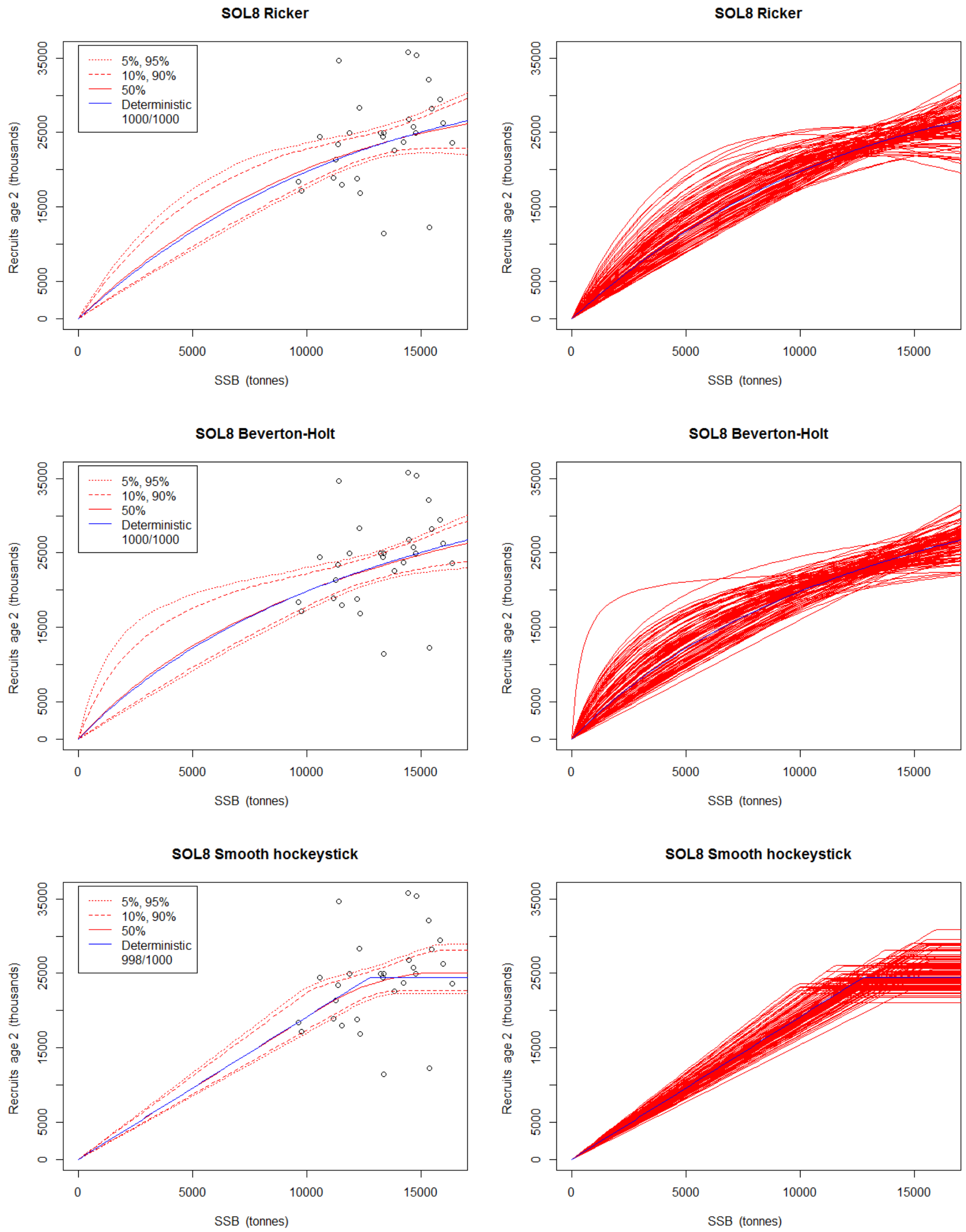


Figure 7.10: Bay of Biscay sole stock–recruit fits for Ricker (top), Beverton–Holt (middle) and smooth Hockey-stick (bottom). The left hand figures illustrate the 95th, 90th, median, 10th, and 5th percentiles from the successful MCMC samples, plotted with the assessment data points; the right hand figures provide 100 illustrative resamples. The estimates derived from MCMC sampling are illustrated in red; the deterministic estimates in blue. The bottom row in the legends indicates the number of successful resamples (i.e. with feasible stock–recruit parameters).

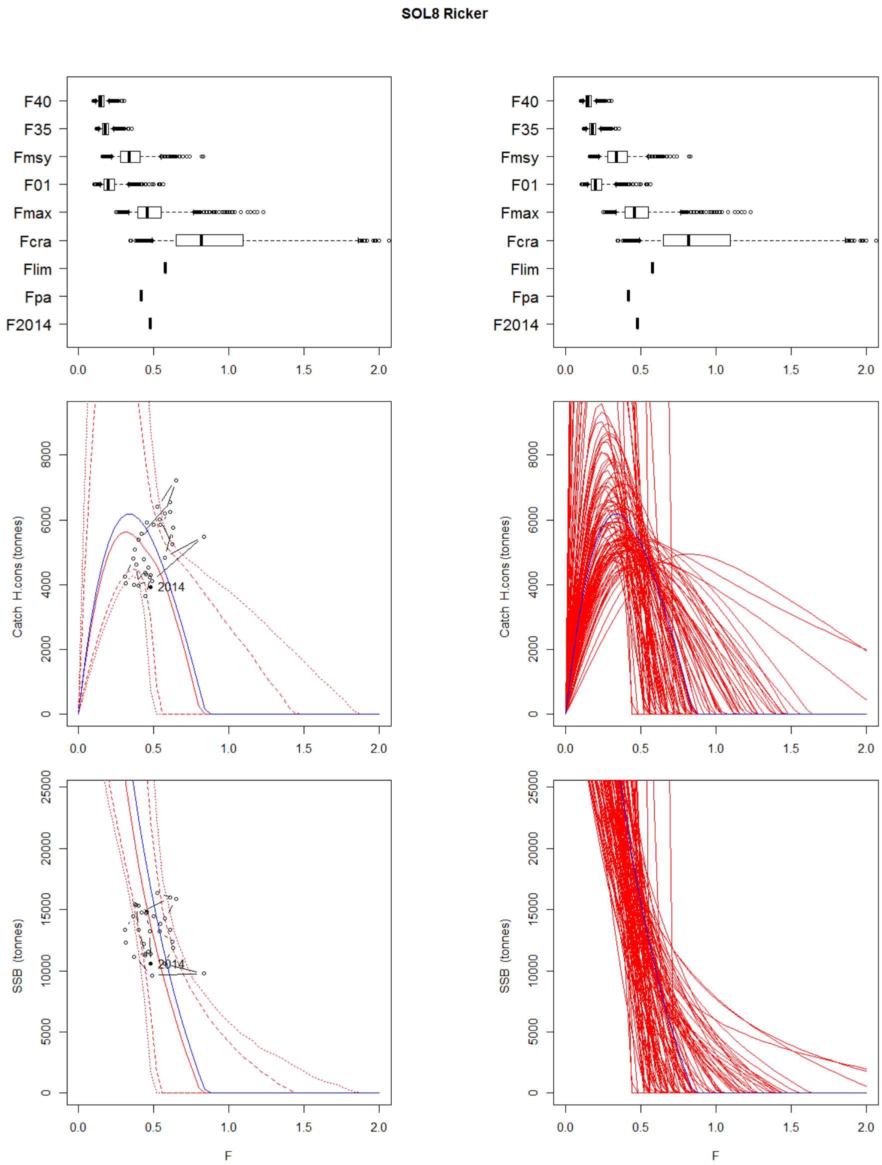


Figure 7.11: Bay of Biscay sole yield and SSB based on the Ricker stock and recruitment model estimates. Top: box plots of Fmsy and Fcrash with proxies for Fmsy based on the yield-per-recruit: Fmax, F0.1, F35% and F40% SPR also Flim, Fpa and F in the final year; middle: equilibrium landings vs. fishing mortality; bottom: equilibrium SSB vs. fishing mortality. The left hand figures illustrate the 95th, 90th, median, 10th, and 5th percentiles from the successful MCMC samples, plotted with the assessment data points; the right hand figures provide 100 illustrative resamples. The estimates derived from MCMC sampling are illustrated in red; the deterministic estimates in blue

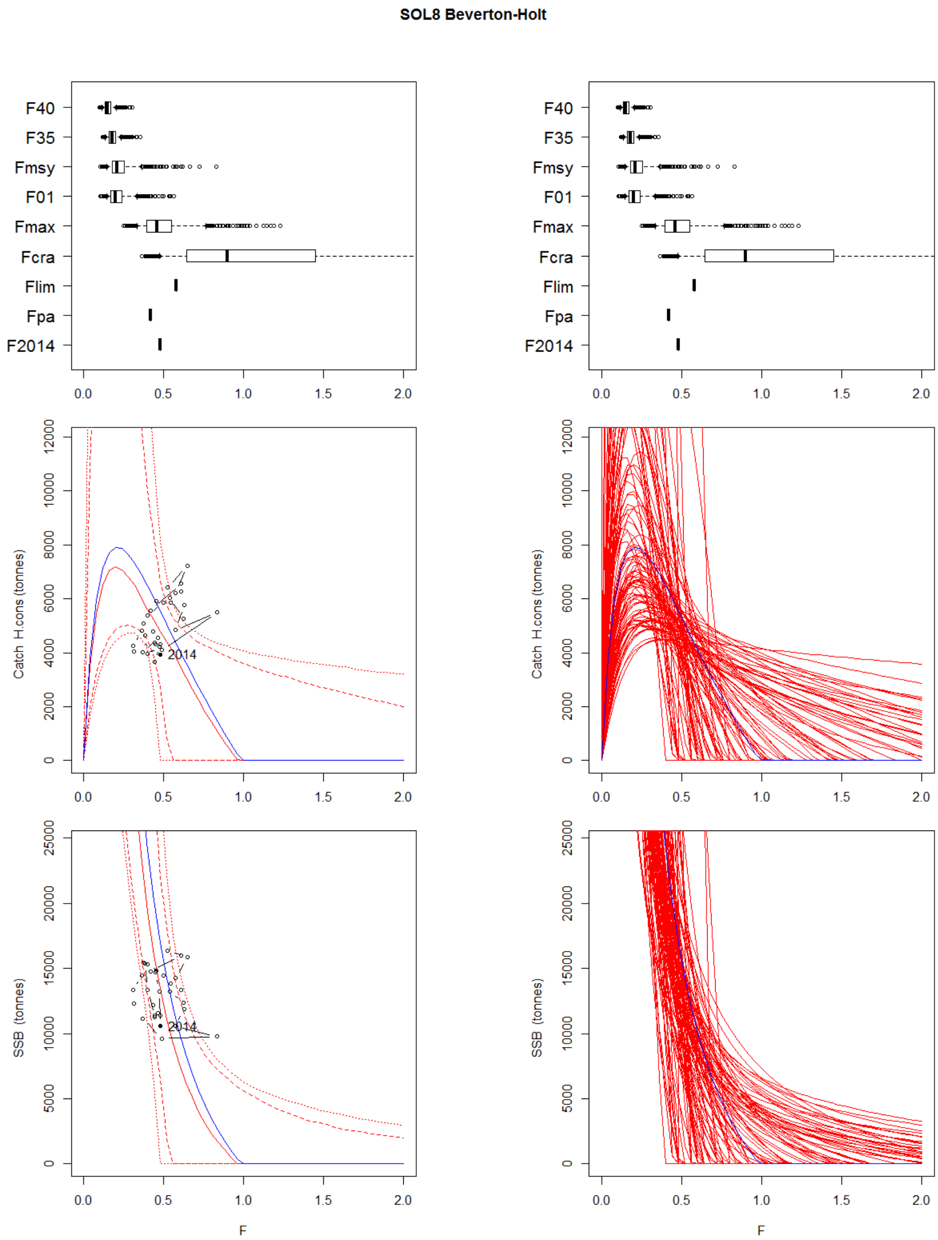


Figure 7.12: Bay of Biscay sole yield and SSB based on the Beverton–Holt stock and recruitment model estimates. Top: box plots of Fmsy and Fcrash with proxies for Fmsy based on the yield-per-recruit: Fmax, F0.1, F35% and F40% SPR also Flim, Fpa and F in the final year; middle: equilibrium landings vs. fishing mortality; bottom: equilibrium SSB vs. fishing mortality. The left hand figures illustrate the 95th, 90th, median, 10th, and 5th percentiles from the successful MCMC samples, plotted with the assessment data points; the right hand figures provide 100 illustrative resamples. The estimates derived from MCMC sampling are illustrated in red; the deterministic estimates in blue

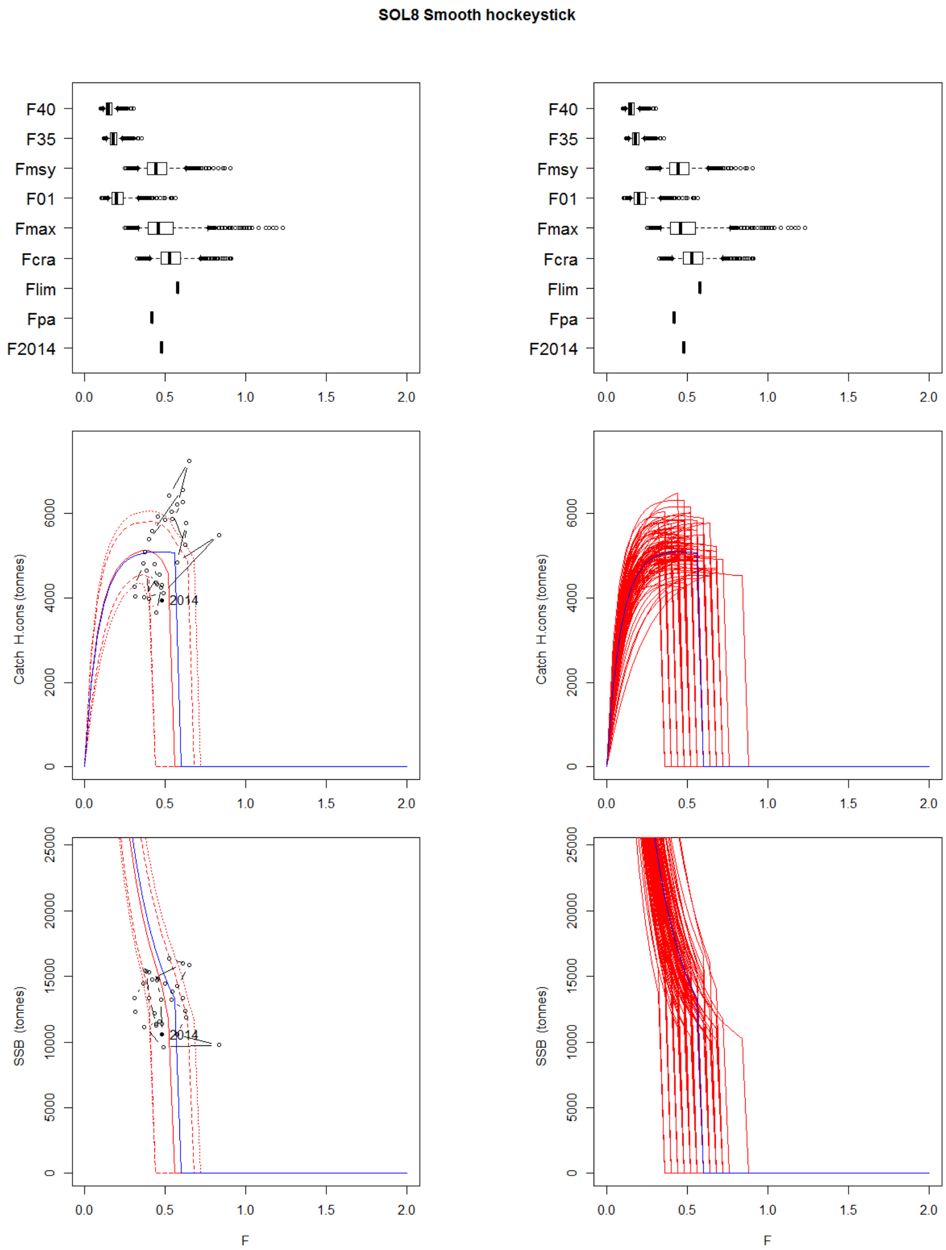


Figure 7.13: Bay of Biscay sole yield and SSB based on the Hockey-stick stock and recruitment model estimates. Top: box plots of Fmsy and Fcrash with proxies for Fmsy based on the yield-per-recruit: Fmax, F0.1, F35% and F40% SPR also Flim, Fpa and F in the final year; middle: equilibrium landings vs. fishing mortality; bottom: equilibrium SSB vs. fishing mortality. The left hand figures illustrate the 95th, 90th, median, 10th, and 5th percentiles from the successful MCMC samples, plotted with the assessment data points; the right hand figures provide 100 illustrative resamples. The estimates derived from MCMC sampling are illustrated in red; the deterministic estimates in blue.

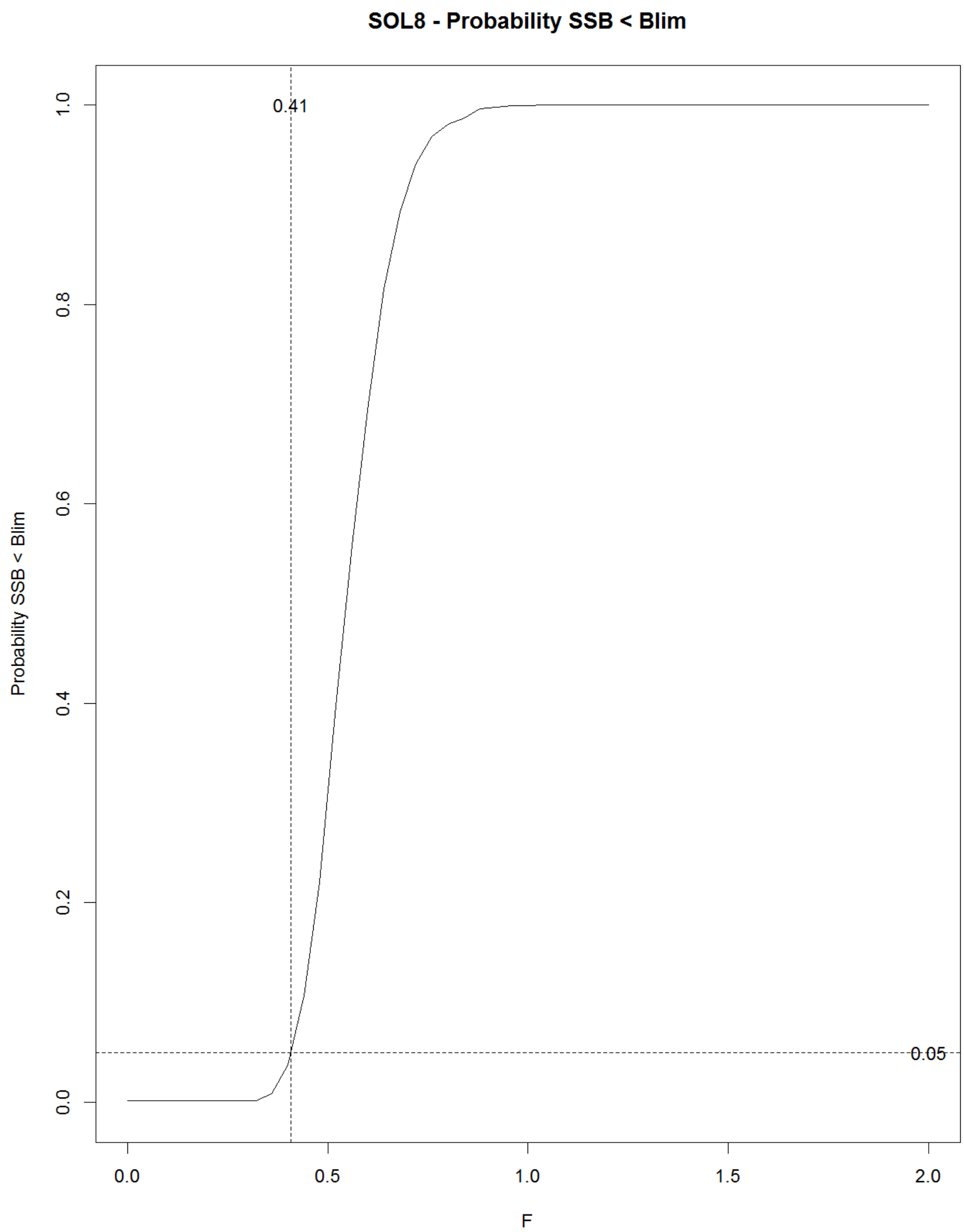


Figure 7.14: Bay of Biscay sole probability of SSB < Blim for the combined analysis weighted by model likelihood, indicating the F value coinciding with a 5% probability.

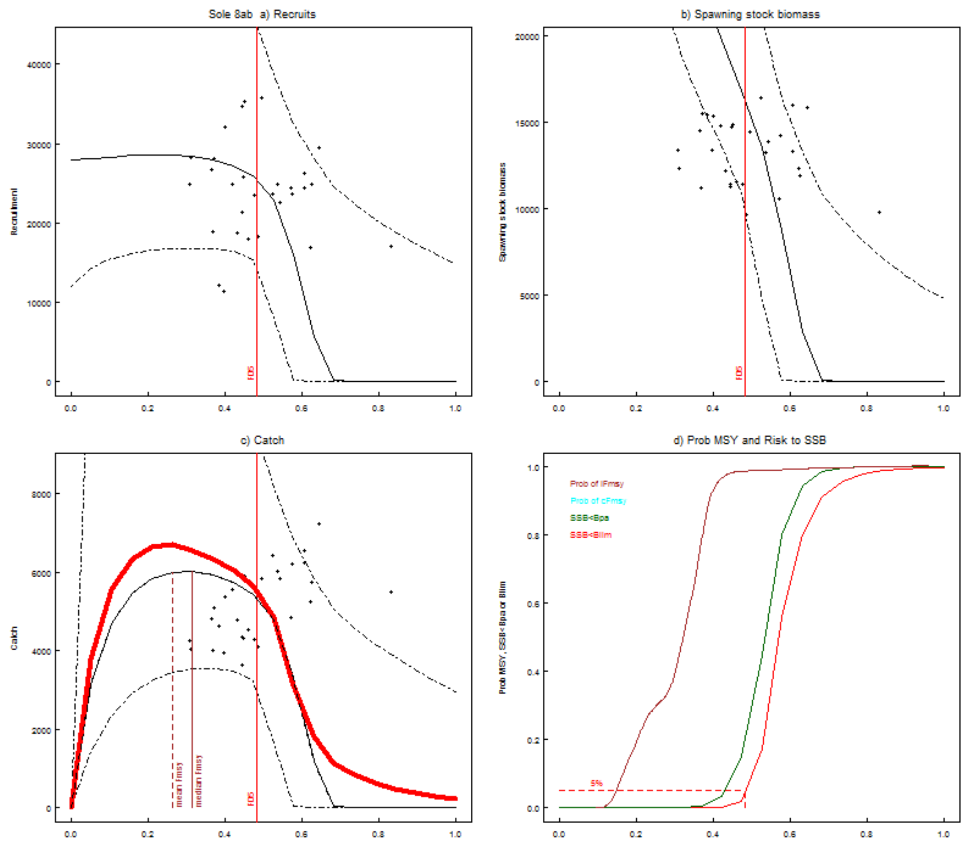


Figure 7.15: Bay of Biscay sole Eqsim summary plots

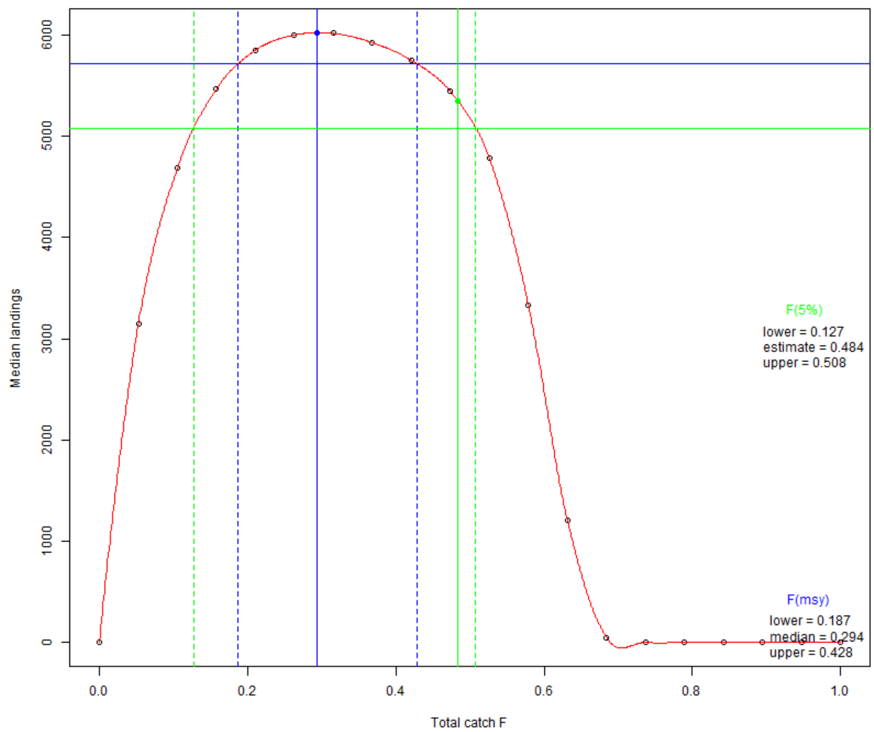


Figure 7.16: Sole in Division VIIIa,b (Bay of Biscay); The MSY range from Eqsim

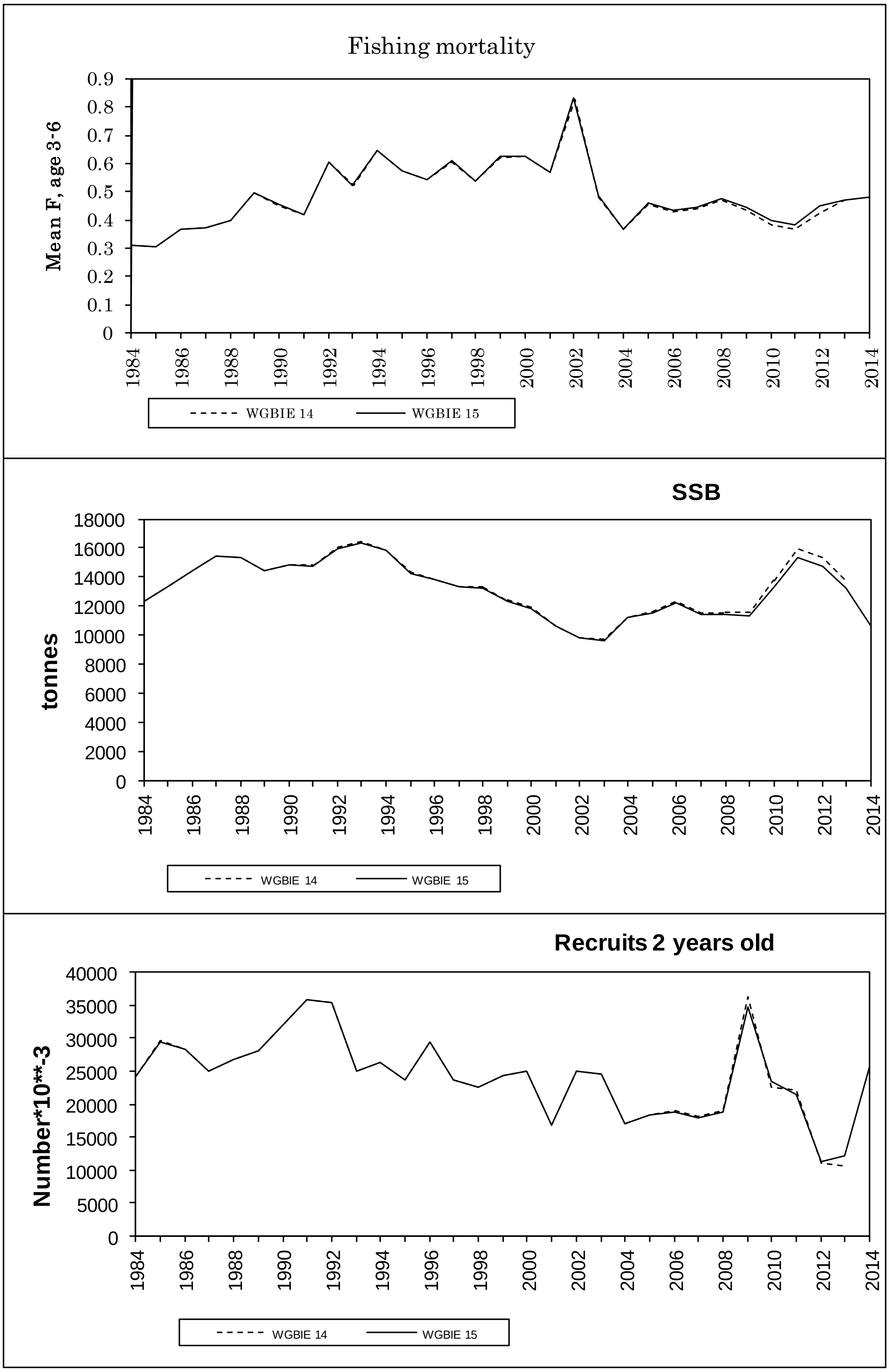


Figure 7.17: Bay of Biscay sole (Division VIIIa,b) - WG14 / WG15 comparison

8 Sole in subdivision VIIIc and IXa

8.1 General biology

Common sole (*Solea solea*) spawning takes place in winter/early spring and varies with latitude starting earlier in the south (Vinagre, 2007) . Larvae migrate to estuaries where juveniles concentrate until they reach approximately 2 years of age and move to deeper waters. In Portuguese waters, sole length of first maturity is estimated as 25cm for males and 27 cm for females (Jardim, et al, 2011). Sole is a nocturnal predator and therefore more susceptible to be captured by fisheries at night than in daytime. It feeds on polychaetes, molluscs and amphipods. *S. solea* is abundant in the Tagus estuary and uses this habitat as nursery ground. (Cabral and Costa, 1999)

Recent growth studies based on *S. solea* otolith readings in the Portuguese coast indicate L_{inf} 52.1cm (females) and 45.7cm (males) while the growth coefficient (k) estimate of females (K=0.23) was slightly higher than for males (k=0.21) and to -0.11 and 1.57 for females and males respectively, (Teixeira and Cabral, 2010). Maximum length observed between 2004 and 2011 from the landings sampling program (PNAB-DCF) attained 60cm. According to Vinagre (2007) *S. solea* off the Portuguese coast presents higher growth rates in comparison with the northern European coasts.

8.2 Stock identity and possible assessment areas;

There is no clear information to support the definition of the common sole stock for ICES subdivision VIIIc and IXa.

8.3 Management regulations (TAC's, minimum landing size)

The minimum landing size of sole is 24 cm. There are other regulations regarding the mesh size for trammel and trawl nets, fishing grounds and vessel's size. A precautionary TAC was set for *Solea spp*. in ICES divisions VIIIc- e, subareas IX and X.

8.4 Fisheries data

Table 8.11 presents all soles species official landings by country, for Division VIIIc and IXa. Table 8.12 indicates only common sole (*Solea solea*) official landings by Division and country. Figure 8.11 illustrates *Solea* species (*Solea solea, Solea senegalensis and Pegusa lascaris*) landings for Divisions VIIIc and IXa.

There is evidence of market *solea* species misclassification which means *solea solea* Portuguese official landings might not correspond only to this species but mixed with *Solea senegalensis* and *Pegusa lascaris.* Based on harbour length sampling data it is possible to separate the soles complex using scientifically identified proportions of each species: *Solea solea*, *S. senegalensis* and *Pegusa lascaris* , and this was estimated for the landings in Portugal (Division IXa) (Borges, *et al.*, 2014)

Landings length compositions for *Solea solea* are presented for the Portuguese area (Figure 8.12) (Borges, *et al*, 2014).

Based on the DCF discard sampling in Portugal discards for Sole (*Solea solea*) only occur in negligible small amounts due to the minimum landing size or damaged specimens.

8.5 Survey data, recruit series

Solea solea is rarely caught in the existing Portuguese bottom trawl research surveys (Jardim *et al*, 2011). This species may be found along the Portuguese coast mainly from very shallow waters and estuaries up to 100 m depth. To monitor sole species a dedicated independent research survey is necessary.

8.6 Biological sampling

In Div IXa, existing biological sampling is based on fishery data from commercial vessels landings.

8.7 Population biology parameters and a summary of other research

Solea solea maturity ogives by sex, length-weight relationship, sex-ratio by length based on harbour DCF sampling were presented in 2012 for IXa division (Jardim, *et al*, 2011).

8.8 General problems

In Portugal *Solea solea* (SOL) is caught together with and other similar species *Solea senegalensis* (OAL) and *Pegusa lascaris* (SOS) and there are evidences of misreporting sole (*Solea solea*) with the other two species. Figure 8.13 indicates the proportion of landings attributed to each species based on harbour DCF-IPMA sampling. It is apparent that the most abundant species in the area is Solea *senegalensis* (OAL) as reflected by the estimated higher catches, than *Solea solea* and *Pegusa lascaris*, based on the scientifically separated species sampling.

References

Borges, M.F., Moreira, A., Alcoforado, B., 2014. Sole (*Solea solea*) in Portuguese waters (Div. IXa). Working Document to WGNEW 2014.

Cabral, H. and Costa, M.J. 1999. Differential use of nursery areas within the Tagus estuary by sympatric soles, *Solea solea* and *Solea senegalensis*. *Environmental Biology of Fishes* 56: 389_397,1999

Jardim, E., Alpoim, R., Silva, C., Fernandes, A.C, Chaves, C., Dias, M., Prista, N., Costa, A.M., 2011. Portuguese data of sole, plaice, whiting and pollock provided to WGHMM in 2011. Working document to WGNEW 2012.

Teixeira, C M., and Cabral, H.N., 2010. Comparative analysis of the diet, growth and reproduction of the soles, *Solea, solea* and *Solea senegalensis*, occurring in sympatry along the Portuguese coast. *Journal of the Marine Biological Association of the United Kingdom*, 2010,90(5), 995_1003.

Vinagre C.M.B. 2007. Ecology of the juveniles of the soles, *Solea solea* (Linnaeus, 1758) and *Solea senegalensis* Kaup, 1858, in the Tagus estuary. Tese de Doutoramento em Biologia, especialidade Biologia Marinha e Aquacultura. 214 p.

Table 8.11. Sole in Divisions VIIIc and IXa. Official landings of solea spp: Solea solea, Pegusa Lascaris and solea senegalensis, by country and division (in tonnes.

solea spp	Div VIIIc				Division IX			Total
year	Spain	Portugal	France	Total	Spain	Portugal	Total	solea spp
1977						976	976	976
1978					310	606	916	916
1979					152	581	733	733
1980					166	628	794	794
1981					155	800	955	955
1982					275	789	1064	1064
1983					140	635	775	775
1984					242	626	868	868
1985			1	1	370	600	972	973
1986				0	444	1081	1525	1525
1987		3	1	1	609	1173	1787	1788
1988		7	1	8	479	1277	1772	1780
1989	22	8		30	194	1435	1689	1719
1990	22	5		27	192	1223	1469	1496
1991	10	3		13	290	1076	1392	1405
1992	19	1	1	21	171	1115	1328	1349
1993	15	3	1	19	75	1327	1440	1459
1994	15	2		17	35	1212	1281	1298
1995	6	3		9	33	1232	1283	1292
1996	13	4		17	61	938	1033	1050
1997	23	4		27	155	800	1009	1036
1998	40	4		44	188	726	1002	1046
1999	40	2		42	206	639	929	971
2000	89	2	7	98	184	735	1115	1213
2001	224	1		225	-	759	1209	1434
2002	25	1	1	27	115	579	748	775
2003	8	3	4	15	234	635	899	914
2004	45	12		57	120	783	1017	1074
2005	80	10		90	194	821	1195	1285
2006	81	10	1	92	73	594	851	943
2007	31	11	1	43	80	381	461	504
2008	36	11	1	48	97	467	564	612
2009	48	6	2	56	91	552	643	699
2010	49	7	2	58	152	616	884	942
2011	84	-		84	119	698	817	901
2012	75	-		75	139	515	654	729
2013	72	-		72	110	618	728	800
2014	73	-		73	158	598	756	829

Table 8.12 Official landings for Sole (*Solea solea*) in subdivision VIIIc and IXa

year	Spain	France	Portugal	totals
2004	165	0	164	164
2005	274	0	276	267
2006	154	1	286	177
2007	111	1	269	381
2008	133_	1	321	455
2009	139	2	360	501
2010	201	2	390	596
2011	203	-	432	635
2012	214	-	373	587
2013	182	--	432	614
201	231	-	450	681*

*** provisional**

- not available

Table 8.13. Portugal. Landings (ton) of *S. solea* (SOL), *P. lascaris* (SOS) and mixed soles species (SOX) by fleet/métier since 2003 (Division IXa. Source DGRM (official landings).

	SOS				SOL				SOX				All spp
Year	Dtrawl	Polyvalent	Pseine	Total	Dtrawl	Polyvalent	Pseine	Total	Dtrawl	Polyvalent	Pseine	Total	total
2003	3.5	94.2	0.0	97.7	1.4	109.9	0.0	111.3	26.5	385.0	2.2	413.7	622.7
2004	3.6	112.8	0.2	116.7	1.8	141.9	0.1	143.9	19.4	442.0	2.2	463.6	724.2
2005	5.4	143.2	0.1	148.7	5.5	269.9	0.7	276.2	11.3	387.9	3.0	402.2	827.1
2006	1.1	84.7	0.5	86.3	8.8	272.5	5.0	286.3	3.9	156.1	2.6	162.6	535.3
2007	1.7	52.4	0.1	54.1	16.7	247.1	2.8	266.5	1.6	56.5	0.1	58.2	378.8
2008	1.0	74.9	0.0	76.0	18.4	277.1	1.2	296.7	0.7	67.6	0.0	68.4	441.1
2009	1.2	132.3	0.1	133.6	16.9	315.3	1.8	334.1	0.2	55.2	0.0	55.4	523.1
2010	1.0	153.8	0.5	155.3	17.2	361.9	3.6	382.7	0.1	76.5	0.0	76.5	614.5
2011	1.7	171.2	0.1	173.0	27.9	402.2	2.3	432.4	0.1	86.3	0.0	86.4	691.8
2012	0.8	102.7	0.1	103.6	20.2	351.1	2.0	373.3	0.0	39.0	0.0	39.0	515.6
2013	0.9	150.0	0.7	151.6	19.0	411.6	1.1	431.7	0.0	34.3	0.0	34.3	617.6
2014	1.4	104.5	0.9	106.8	26.4	423.8	0.2	450.4	0.2	41.0	0.0	41.2	598

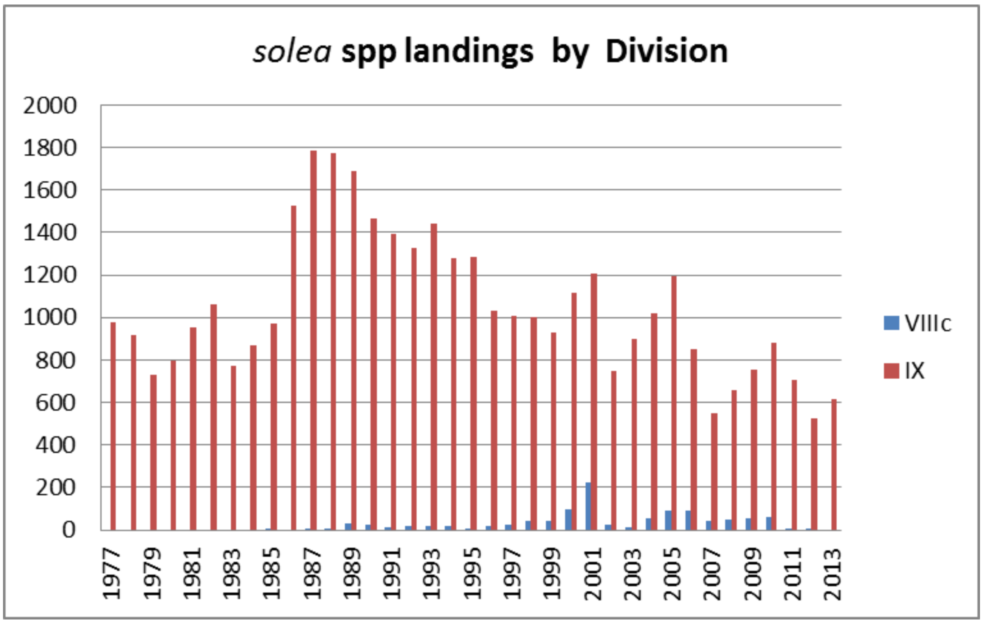


Figure 8.11 Sole in Divisions VIIIc and IXa. Official landings of solea spp*: Solea solea, Pegusa Lascaris and solea senegalensis*, by country and division (in tonnes).

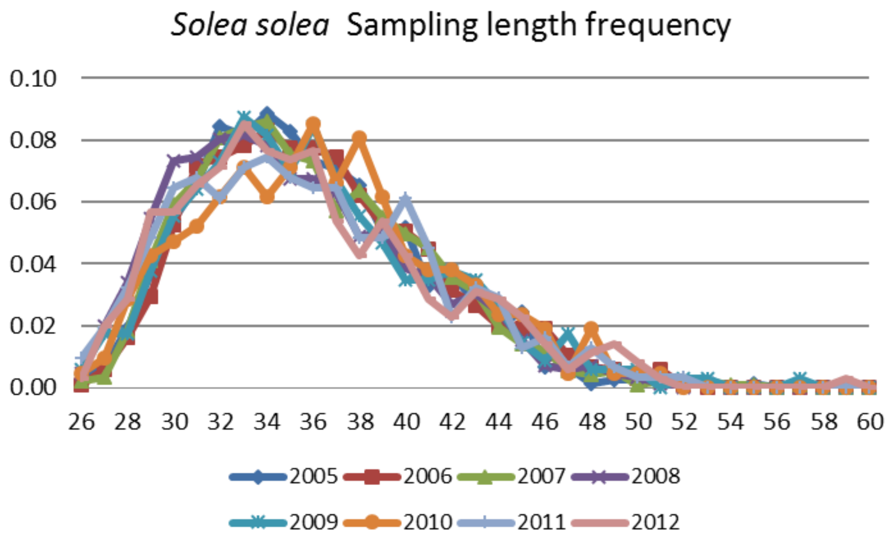


Figure 8.12- Division IXa (Portugal. *Solea solea* sampling length frequency from all métiers harbour sampling DCF-IPMA.

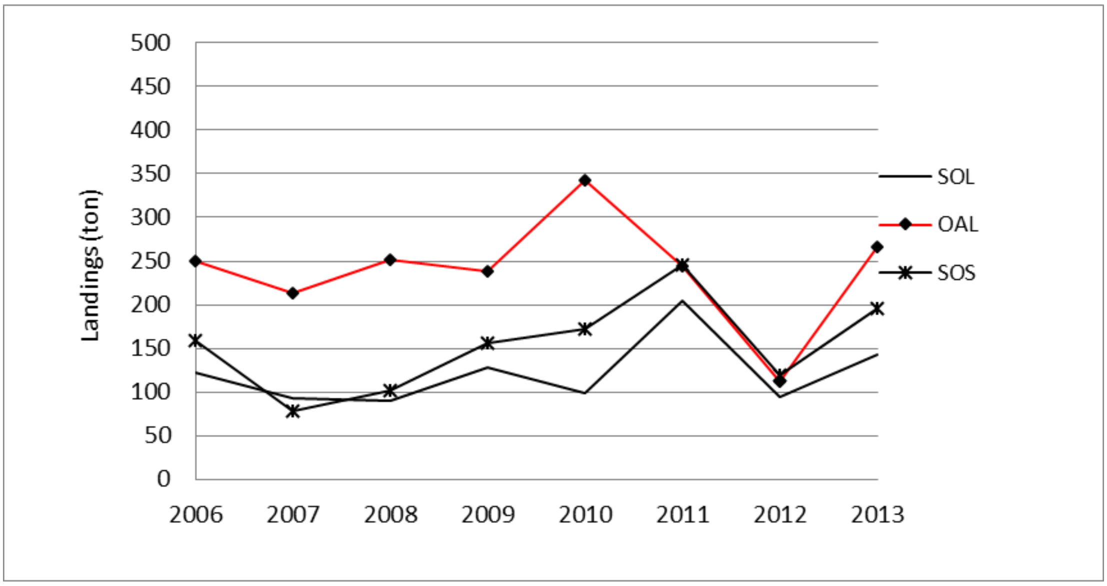


Figure 8.13. Estimated landings of Solea solea (SOL), Solea senegalensis (OAL) and Pegusa lascaris (SOS) for Div. IXa (Portugal)

9 Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock)

Type of assessment: update (stock benchmarked in 2014), stock on observation list. **Data revisions**: Spanish Porcupine Ground Fish Survey (SpPGFS-WIBTS-Q4) from 2001 to 2013 was revised. **Review Group issues: None.**

9.1 General

9.1.1 Stock definition and ecosystem aspects

This section is described in the Stock Annex.

9.1.2 Fishery description

The general description of the fishery is now presented in the Stock Annex.

9.1.3 Summary of ICES advice for 2016 and management for 2014 and 2015

ICES advice for 2015

The stock was considered to be above any potential MSY Btrigger. Following the ICES MSY framework implied fishing mortality to be reduced to 0.27, resulting in landings of 78 457 t tones in 2016.

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

TAC (t)	2009	2010	2011	2012	2013	2014	2015
IIIa, IIIb,c,d (EC Zone)	1552	1661	1661	1661	2093	2466	2738
IIa (EC Zone), IV	1808	1935	1935	1935	2438	2874	3190
Vb (EC Zone), VI, VII, XII, XIV	28879	30900	30900	30900	38938	45896	50944
VIIIa,b,d,e	19261	20609	20609	20609	25970	30610	33977
Total Northern Stock [IIa-VIIIabd]	51500	55105	55105	55105	69 440	81846	90849

Management for 2014 and 2015

The minimum legal sizes for fish caught in Sub areas IV-VI-VII and VIII is set at 27 cm total length (30cm in Division IIIa) since 1998 (Council Reg. no 850/98).

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

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

According to ICES advice for 2012, due to the new perspective of historical stock trends, resulting from the new assessment, the previously defined precautionary reference points are no longer appropriate. In particular, the absolute levels of spawning biomass, fishing mortality, and recruitment have shifted to different scales. As a consequence, the TAC corresponding to the current recovery plan (EC Reg. No. 811/2004) should not be considered, because the plan uses target values based on precautionary reference points that are no longer appropriate.

The initial TAC for 2015 (78 457 t) was revised upwards (90 849 t) by the EC after 2014 assessment working group.

9.2 Data

9.2.1 Commercial catches and discards

Total landings from the Northern stock of hake by area for the period 1961-2014 as used by the WG are given in Table 9.1. They include landings from Division IIIa, Subareas IV, VI and VII, and Divisions VIIIa,b,d, as reported to ICES. Unallocated landings are also included in the table; they are high over the first decade (1961-1970), when the uncertainties in the fisheries statistics were high. In the years 2011, 2012 and 2013, they have increased again due to differences between official statistics and scientific estimations. In 2014, the differences between scientific and official landings decreased greatly which produced a big decrease in unallocated landings. The scientific landings for 2011, 2012 and 2013 were revised before the assessment working group and resulted in an increase of 7910, 10 444 and 981 tonnes in landings respectively. The group decided to use scientific revised estimates to carry out the assessment. The unallocated landings were divided by metier using scientific information provided by the research institutes. Table 1 of the Stock Annex provides a historical perspective of the level of aggregation at which landings have been available to the WG.

Except for 1995, landings decreased steadily from 66 500 t in 1989 to 35 000 t in 1998. Up to 2003, landings fluctuated around 40 000 t. Since then, with the exception of 2006, landings have been increasing up to 91 525t in 2014, the highest value since 1961. The landings in 2014 were well above the 2014 TAC (81 846t).

The discard data sampling and data availability are presented in the Stock Annex. Table 9.2 presents discard data available to the group from 1999 to 2015. The discards increased significantly in since 2008 to 2013; the total amount of observed discards in 2013 was double of those observed in 2008. The increase was general to all the fleets. However in 2014 the discards decreased in general for all the fleets. It is remarkable the case of gillnetters which did not discard until 2011 and after they have high level of discards only for two years, around 1000 tonnes.

9.2.2 Biological sampling

The sampling level is given in Table 1.3.

Length compositions of the 2014 landings by Fishery Unit and quarter were provided by Ireland, France, Scotland, Spain, UK(E&W) and Denmark.

Length compositions samples are not available for all FUs of each country in which landings are observed (see Stock Annex). Only the main FUs are sampled (Table 9.3).

9.2.3 Abundance indices from surveys

Four surveys provide relative indices of hake abundance over time. The French RESSGASC survey was conducted in the Bay of Biscay from 1978 to 2002, the EVHOE-WIBTS-Q4 survey conducted in the Bay of Biscay and in Celtic Sea with a new design since 1997, the SpPGFS-WIBTS-Q4 survey conducted on the Porcupine Bank since 2001, and the Irish Groundfish Survey (IGFS-WIBTS-Q4) beginning in 2003 in the west of Ireland and the Celtic Sea. A brief description of each survey is given in the Stock Annex. Figure 9.1 present the abundances indices obtained for these surveys.

From 1985 until the end of the survey in 2002, the index from RESSGASC followed a slightly decreasing trend. The index from 2002 is not considered reliable and is not presented on the figure.

Throughout the available time series, the abundance index provided by EVHOE-WIBTS-Q4 showed four peaks in 2002, 2004, 2008 and 2012. The index obtained in 2012 reached the highest value of the series, 193% higher than previous year. Since then the index shows a decreasing trend and accumulates a decrease of 78%.

The abundance index provided by IGFS-WIBTS-Q4 is consistent with EVHOE WIBTS-Q4 survey over recent years. It showed a peak in 2008 and the abundance index obtained in 2012 achieves the higher value of the series, 268% higher than previous year index. The accumulate decrease since 2012 in this case is equal to 86%.

SpPGFS-WIBTS-Q4 survey is conducted on Porcupine's Bank since 2001. The abundance index follows an increasing trend since 2003, reaching its highest value in 2009 and slightly decreases in 2010 and 2011. The abundance index has an increasing trend since 2012 and it accumulates an increase of 218%. The peaks detected by EVHOE-WIBTS-Q4 and IGFS-WIBTS-Q4 are detected in this survey one year after. This is consistent with the fact that this survey catches bigger individuals.

The spatial distribution of the EVHOE-WIBTS-Q4 index for hakes from 0 to 20cm is given in Figure 9.4 for the most recent years. It is apparent from this figure that inter-annual variations in abundance are different between areas (VII and VIII). In 2012, both areas display large abundance, even higher than in 2008, another year with high abundance index over recent years. Since 2012 the recruitment abundance shows a decreasing trend especially in the Celtic sea.

9.2.4 Commercial catch-effort data

A description of the commercial LPUE indices available to the group is given in the Stock Annex. They are not used in the assessment model.

Effort and LPUE data for the period 1982-2012 are given in Table 9.4 and Figure 9.2.

Since the start of the time series the effort of A Coruña and Vigo trawler fleets operating in Subarea VII show a decreasing trend. The LPUE of A Coruña trawlers has fluctuated, with an increasing trend reaching its maximum value in 2011 and after a sharp decreased in 2012 and 2013 it slightly increased in 2014. Over the same period, LPUE from Vigo trawlers operating in Subarea VII followed a slightly decreasing trend, becoming less variable during the last 15 years. It must be taken into account that while A Coruña trawl fleet is targeting hake, the Vigo trawl fleet is directed to megrim, taking hake only as bycatch.

LPUE from Ondarroa pair trawlers operating in Divisions VIIIa,b, shows an increasing trend until 2009. The increase in LPUE in 2008 and 2009 was very high, especially in 2009. Until 2012 the LPUE decreased, although not to the low levels of the beginning of the time series. In 2013 it increased slightly again followed by a decrease in 2014. Since 1999 the effort has a decreasing trend.

Assessment

This is an update assessment.

9.2.5 Input data

See Stock Annex (under "*Input data for SS3*").

9.2.6 Model

The Stock Synthesis 3 (SS3) assessment model (Methot and Wetzel 2013) was selected for use in this assessment. Model description and settings are presented in the Stock Annex (under "*Current assessment*" for model description and "*SS3 settings (input data and control files)*" for model settings).

9.2.7 Assessment results

Residuals of the fits to the surveys log(abundance indices) are presented in Figure 9.6. The greater part of the upward trend, until 2012, in relative abundance observed in all three contemporary trawl surveys (EVHOE-WIBTS-Q4, SpPGFS-WIBTS-Q4 and IGFS-WIBTS-Q4) has been captured by the model but there is still some residual trend apparent in the graphs. Pearson residuals of their length frequency distributions show a "fairly random" behaviour with no particular trend or lack of fit (Figure 9.6, where blue and red circles denote positive and negative residuals, respectively). Residuals of the length frequency distributions of the commercial fleets landings and discards (not presented in this report but available on the Share-point) show some patterns, as mentioned in the benchmark report (ICES, 2014a).

The assessment model includes estimation of size-based selectivity functions (selection pattern at length) for commercial fleets and for population abundance indices (surveys). For commercial fleets total catch is subsequently partitioned into discarded and retained portions. Figure 9.7 presents selectivity (for the total catch; solid lines) and retention functions by fleet (dashed lines) estimated by the model. The selection curve is assumed constant over the whole period for all the fleets except for that operating outside areas VII and VIII (the *others* fleet). For the Spanish trawl fleets in VII, three retention functions are estimated, one for years 1978-1997 (black), a second one for 1998-2009 (red) and a third one for 2010-present (green). For the Spanish trawl fleets in VIII, two retention functions are estimated one for years 1978-1997 and a second one for 1998-present The change in retention in 1998 for both trawl fleets was clearly noticed when examining the length frequency distributions of the landings and might be due to a stricter enforcement of the minimum landing size. The most recent change in retention of Spanish trawl fleet in VII was motivated by the observed change in the mean size of discards from 23.6 cm before 2010 to 28.8 cm after that year. For the French trawlers targeting *Nephrops* in VIII, the same retention function is assumed throughout the entire assessment period (1978-present). For the other fleet both selection and retention curves are considered constant until 2002 and are allowed to vary from year to year since then. The variation is modelled using a random walk as described in the stock annex. The assessment currently assumes that the other commercial fleets do not discard fish, although this assumption should be revised as more information on discards becomes available. It is noteworthy the high amount of discards (> 1000 tonnes) of gillnetter fleet in VII and VIII in the last two years. Before 2012 the discards of this fleet were considered negligible..

The retrospective analysis (Figure 9.8) shows that for F and SSB the model results are sensitive to the exclusion of recent data. The inclusion of 2012 data provoked a revision upwards of the SSB and downwards of the fishing mortality. The trends of the series were almost identical but the absolute levels were slightly different. Afterwards the inclusion of further years of data did not lead to the same patterns only the last years is revised with a tendency to underestimate SSB and over-estimate F over the most recent years. The revision upwards of the SSB and downward of F is especially marked with the inclusion of 2013 year data. In recent assessments a marked retrospective pattern was observed for recruitment in 2008 with sharp increase in recruitment as more years were added to the assessment. This year, the inclusion of 2014 data has not produced the same patterns and the estimate of the recruitment in 2008 has slightly increased compared to last year estimate.

F2014 (average of F-at-length over lengths 15-80 cm) was estimated at 0.34 and SSB at 203 296 t.

Summary results from SS3 are given in Table 9.5 and Figure 9.9.

9.2.8 Historic trends in biomass, fishing mortality and recruitment

For recruitment, fluctuations appear to be without substantial trend over the whole series. The recruitment in 2008 was the highest in the whole series 700 millions of individuals and in 2014 decreased below mean level (240 million).

From high levels at the start of the series (100 000 t in 1980), the SSB has decreased steadily to a low level at the end of the 90s (25 000 t in 1998). Since that year, SSB has increased to the highest value of the series in 2012 (218 000 t) and decreased slightly in 2013.

The fishing mortality is calculated as the average annual F for sizes 15–80 cm. This measure of F is nearly identical to the average F for ages 1–5. Values of F increased from values around 0.5-0.6 in the late 70s and early 80s to values around 1.0 during the 90s. They declined sharply afterwards to 0.31 in 2012 and increased up to 0.34 in 2013.

9.3 Catch options and prognosis

9.3.1 Short – Term projection

For the current projection, unscaled F is used, corresponding to F(15-80cm) = 0.33.

The recruitment used for projections in this WG is the GM calculated from 1978 to the final assessment year minus 2.

Landings in 2016 and SSB in 2017 predicted for various levels of fishing mortality in 2016 are given in Table 9.6 and Figure 9.10. Maintaining status quo F in 2016 is expected to result in an increase in landings with respect to 2015 and a decrease in SSB in 2017 with respect to 2016.

9.3.2 Yield and biomass per recruit analysis

Options for long term projection are indicated in the Stock Annex.

Results of equilibrium yield and SSB per recruit are presented in Table 9.7 and Figure 9.11. The F-multiplier in Table 9.7 is with respect to status quo F (average F in the final 3 assessment years, 2012-2014). Considering the yield and SSB per recruit curves, F_{max}, $F_{0.1}$, $F_{35\%}$ and $F_{30\%}$ are respectively estimated to be 84%, 57%, 62% and 72% of status quo F. The maximum equilibrium yield per recruit is around 1% above the equilibrium yield at $F_{sq.}$

9.4 Biological reference points

Biological reference points for the stock of Northern Hake were calculated in 2014 (ICES 2014c) assessment working group and they are still considered valid.

	Type	Value	Technical basis
MSY	MSY Btrigger	46 200	Bpa
Approach	FMSY	0.27	Fmsy in the combined stock recruitment relationship (ICES 2014c)
	Blim	33 000	SSB2006 Low level of SSB followed by a sharp increase, lower level of SSB would led to lower recruitment level.
Precautionary	Bpa	46 200	1.4Blim
Approach	Flim	Not defined	
	Fpa	Not defined	

9.5 Comments on the assessment

The retrospective pattern in 2008 recruitment was somewhat corrected in last benchmark (ICES, 2014a) but it worsen again in the following assessment working group when 2013 data was included (ICES, 2014). However, the inclusion of 2014 data has had very slight impact in the revision upwards of 2008 year recruitment and the increase in the SSB in the final part of the assessment was smaller than in previous years. During the last benchmark assessment the retrospective pattern was related with the length frequency distributions of the fleets and the way they are modelled. The model tried to explain the length frequency distributions observed through an increase in the recruitment. This was partially solved giving more flexibility to the selectivity and retention curves over time. As this pattern has not disappeared, in the future, more work will be needed to understand what is driving such a retrospective pattern. The discards of non-Spanish trawlers in VII and VIII have increased significantly in the last year. Their length frequency distribution has been made available in intercatch in the last two years, so it could be advisable to include them in the model. This year, the inclusion in the assessment of annual Scottish discard length frequency distribution of in *others* fleet has been tested. The impact in the results of the assessment was limited. However the fit to the length frequency distribution was not very good and the working group decided not to include this data in the assessment. However, the working group notes that in the current assessment the fit to the discard data of *others* fleet is done without any length frequency distribution data since 2008. As the Scottish data is considered representative of this discard of this fleet the working group will investigate in the future assessment the inclusion of this data into the assessment.

2014 length frequency distribution data of some fleets showed a very strange pattern. A preliminary analysis seems to indicate that this could be related to the way intercatch does the allocations and the raising. Due to lack of time it was not possible to carry out an exhaustive analysis of the problem but it is considered crucial to identify the problem before next year assessment.

9.6 Management considerations

After several years of increasing trend in SSB, it decreased in 2013 and maintained almost constant in 2014. The fishing mortality increased slightly in 2014. The decrease in SSB is the consequence of high fishing mortality and low recruitments in 2009-2011. However, 2012 year class was the stronger in the series and will contribute to the SSB in the short term. It must be noted that the fast growth rate estimated by the model combined with the assumed high natural mortality rate (M=0.4 since the 2010 benchmark) generates a rapid turn-over of the hake stock dynamic. This means that short term predictions in SSB and landings are strongly related to variations in recruitment. The short-term forecasts of SSB and yield obtained this year are influenced by the high recruitments estimated for 2012-2013.

9.7 References.

Methot, R. D. and C. R. Wetzel (2013). "Stock synthesis: A biological and statistical framework for fish stock assessment and fishery management." Fisheries Research 142: 86-99.

ICESa (2014). Report of the Bechmark Wrokshop on Southern megrim and hake (WKSOUTH). 3–7 February 2014, Copenhagen, Denmark. ICES CM 2014/ACOM:40. Copenhaguen, Denmark.

ICESb (2014). Report of the Workshop to consider reference points for all stocks (WKMSYREF2. 8-10 January 2014, Copenhagen, Denmark. ICES CM 2014/ACOM:47. Copenhaguen, Denmark.

ICESc (2014). Report of the Working Group for the Bay of Biscay and the Iberian waters Ecoregion (WGBIE). 7-13 May 2014, Lisbon, Portugal. ICES CM 2014/ACOM:11. Copenhaguen, Denmark.

Table 9.1. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock. Estimates of landings ('000 t) by area for 1961-2011.

	Landings (1)					Discards (2)	Catches (3)
Year	IVa+VI	VII	VIIIa,b	Unallocated	Total	Total	Total
1961	-	-	-	95.6	95.6	-	95.6
1962	-	-	-	86.3	86.3	-	86.3
1963	-	-	-	86.2	86.2	-	86.2
1964	-	-	-	76.8	76.8	-	76.8
1965	-	-	-	64.7	64.7	-	64.7
1966	-	-	-	60.9	60.9	-	60.9
1967	-	-	-	62.1	62.1	-	62.1
1968	-	-	-	62.0	62.0	-	62.0
1969	-	-	-	54.9	54.9	-	54.9
1970	-	-	-	64.9	64.9	-	64.9
1971	8.5	19.4	23.4	0	51.3	-	51.3
1972	9.4	14.9	41.2	0	65.5	-	65.5
1973	9.5	31.2	37.6	0	78.3	-	78.3
1974	9.7	28.9	34.5	0	73.1	-	73.1
1975	11.0	29.2	32.5	0	72.7	-	72.7
1976	12.9	26.7	28.5	0	68.1	-	68.1
1977	8.5	21.0	24.7	0	54.2	-	54.2
1978	8.0	20.3	24.5	-2.2	50.6	-	50.6
1979	8.7	17.6	27.2	-2.4	51.1	-	51.1
1980	9.7	22.0	28.4	-2.8	57.3	-	57.3
1981	8.8	25.6	22.3	-2.8	53.9	-	53.9
1982	5.9	25.2	26.2	-2.3	55.0	-	55.0
1983	6.2	26.3	27.1	-2.1	57.5	-	57.5
1984	9.5	33.0	22.9	-2.1	63.3	-	63.3
1985	9.2	27.5	21.0	-1.6	56.1	-	56.1
1986	7.3	27.4	23.9	-1.5	57.1	-	57.1
1987	7.8	32.9	24.7	-2.0	63.4	-	63.4
1988	8.8	30.9	26.6	-1.5	64.8	-	64.8
1989	7.4	26.9	32.0	0.2	66.5	-	66.5
1990	6.7	23.0	34.4	-4.2	60.0	-	60.0
1991	8.3	21.5	31.6	-3.4	58.1	-	58.1
1992	8.6	22.5	23.5	2.1	56.6	-	56.6
1993	8.5	20.5	19.8	3.3	52.1	-	52.1
1994	5.4	21.1	24.7	0.0	51.3	*	51.3
1995	5.3	24.1	28.1	0.1	57.6	-	57.6
1996	4.4	24.7	18.0	0.0	47.2	-	47.2
1997	3.3	18.9	20.3	-0.1	42.5	-	42.5
1998	3.2	18.7	13.1	0.0	35.1	-	35.1
1999	4.3	24.0	11.6	0.0	39.8	*	39.8
2000	4.0	26.0	12.0	0.0	42.0	*	42.0
2001	4.4	23.1	9.2	0.0	36.7	-	36.7
2002	2.9	21.2	15.9	0.0	40.1	-	40.1
2003*	3.3	25.4	14.4	0.0	43.2	1.4	44.6
2004*	4.4	27.5	14.5	0.0	46.4	2.6	49.0
2005*	5.5	26.6	14.5	0.0	46.6	4.6	51.1
2006*	6.1	24.7	10.6	0.0	41.5	1.2	42.7
2007*	7.0	27.5	10.6	0.0	45.1	2.2	47.3
2008*	10.7	22.8	14.3	0.0	47.8	3.4	51.2
2009*	13.1	25.3	20.4	0.0	58.8	11.0	69.8
2010*	14.2	33.5	25.1	0.0	72.8	12.1	84.9
2011*	19.4	19.1	17.1	32.0 (4)	87.5	13.9	101.4
2012*	24.2	23.9	18.1	19.3 (4)	85.6	14.9	100.5
2013*	17.6	31.0	21.6	13.1 (4)	83.3	15.8	99.1
2014*	23.8	39.6	23.7	2.7	89.8	9.1	98.9

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

(2) Discard estimates from observer programmes. In years marked with *, partial discard estimates are available and used in the assessment. For remaining years for which no values are presented, some estimates are available but not considered valid and thus not used in the assessment In the years with data only Spanish discards and discards from French Nephrops trawlers are included.

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

(4) Unallocated landings for years 2011-2014 were revised in 2015.

Table 9.2. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Summary of discards data available (weight (t) in bold, numbers ('000) in italic)). The discards of Fleet 2 and Fleet 3 (in red) are not included in the assessment,

SS3 Fleets	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
FLEET 1	**1034**	**1530**	na	**537**	**1712**	**2010**	**5674**	**5077**	**5054**	**3495**	**1464**
	10666	*17393*	na	*4526*	*21437*	*17542*	*27619*	*27954*	*26452*	*38293*	*8335*
FLEET 2	**32**	**94**	**na**	**na**	**na**	**1025**	**1192**	**130**	**1142**	**2934**	**2510**
	282	*629*	*na*	*na*	*na*	*6814*	*3831*	*1037*	*5101*	*16863*	*7483*
FLEET 3	**1359**	**1597**	**532**	**767**	**858**	**4283**	**726**	**871**	**624**	**1475**	**392**
	39550	*37740*	*18031*	*24277*	*18245*	*68524*	*14709*	21208	*25228*	*32535*	*4099*
FLEET 4	**30**	**489**	**206**	**471**	**352**	**580**	**101**	**292**	**364**	**379**	**184**
	451	*8475*	*3397*	*10002*	*7153*	*7925*	*1719*	*5036*	*5329*	*5552*	*2718*
FLEET 5	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**na**	**1503**	**1256**	**42**
	na	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*4061*	*3283*	*53*
FLEET 7	**159**	**873**	**484**	**390**	**446**	**3135**	**4425**	**7533**	**6183**	**6287**	**4343**
	na	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*na*	*16855*	*4866*
Total Weight (t)	**2614**	**4583**	**1222**	**2165**	**3368**	**11033**	**12118**	**13903**	**14870**	**15826**	**8935**
Total Number ('000)	*51724*	*64237*	*21428*	*39654*	*47488*	*101349*	*48325*	*58210*	*66171*	*113381*	*27554*

Table 9.3. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Landings (L) and Length Frequency Distribution (LFD) provided in 2011.

Country		France	Ireland	Spain	UK(E+W)	Scotland	Denmark	Others
Unit	Quarter							
	1	L		L+LFD	L	L		
1 + 2	2	L		L+LFD	L	L		
	3	L		L+LFD	L	L		
	4	L		L+LFD	L	L		
	1	L	L+LFD	L	L+LFD	L		
3	2	L	L+LFD	L	L+LFD	L		
	3	L+LFD	L+LFD	L	L+LFD	L		
	4	L	L+LFD	L	L+LFD	L		
	1	L+LFD	L+LFD	L+LFD	L+LFD	L		
4 + 5 + 6	2	L+LFD	L+LFD	L+LFD	L+LFD	L		
	3	L+LFD	L+LFD	L+LFD	L+LFD	L		
	4	L+LFD	L+LFD	L+LFD	L+LFD	L		
	1	L+LFD			L+LFD	L		L
8	2	L+LFD			L+LFD	L		L
	3	L+LFD			L+LFD	L		L
	4	LFD			L+LFD	L		L
	1	L+LFD						
9	2	L+LFD						
	3	L+LFD						
	4	L+LFD						
	1	L+LFD		L+LFD				
10 + 14	2	L+LFD		L+LFD				L
	3	L+LFD		L+LFD				
	4	L		L+LFD				
	1	L+LFD		L+LFD				
12	2	L+LFD		L+LFD				
	3	L		L+LFD				
	4	L+LFD		L+LFD				
	1	L		L+LFD				
13	2	L		L+LFD				
	3	L+LFD		L+LFD				
	4	L+LFD		L+LFD				
	1	L+LFD	L+LFD		L+LFD	L		L
15	2	L+LFD	L+LFD		L+LFD	L		L
	3	L+LFD	L+LFD		L+LFD	L		L
	4	L+LFD	L+LFD		L	L		L
	1	L+LFD			L+LFD	L+LFD	L+LFD	L+LFD
16	2	L+LFD			L+LFD	L+LFD	L+LFD	L+LFD
	3	L+LFD			L+LFD	L+LFD	L+LFD	L+LFD
	4	L+LFD			L+LFD	L+LFD	L+LFD	L

Table 9.4. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Effort and LPUE values of commercial fleets.

Sub-area VII

	A Coruña trawl in VII			Vigo trawl in VII		
Year	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort**	LPUE**
1982				2051	75194	27
1983				3284	75233	44
1984				3062	76448	40
1985	5612	14268	393	1813	71241	25
1986	4253	11604	366	2311	68747	34
1987	8191	12444	658	2485	66616	37
1988	6279	12852	489	3640	65466	56
1989	6104	12420	491	1374	75853	18
1990	4362	11328	385	2062	80207	26
1991	3332	9852	338	2007	78218	26
1992	3662	6828	536	1813	63398	29
1993	2670	5748	464	1338	59879	22
1994	3258	5736	568	1858	56549	33
1995	4069	4812	846	1461	50696	29
1996	2770	4116	673	1401	54162	26
1997	1858	4044	459	1099	50576	22
1998	2476	3924	631	1201	53596	22
1999	2880	3732	772	1652	50842	32
2000	3628	2868	1265	1487	55185	27
2001	2585	2640	979	1071	56776	19
2002	1534	2556	600	1152	50410	23
2003	3286	3084	1065	1486	54369	27
2004	2802	2820	994	1595	53472	30
2005	2681	2748	976	1323	52455	25
2006	2498	2688	929	1422	53677	26
2007	2529	2772	912	1459	58123	25
2008	2042	1872	1091	1159	54324	21
2009	2418	1884	1284	1493	51551	29
2010	4934	2484	1986	1326	48432	27
2011	5108	2232	2288	1321	43533	30
2012	2819	1452	1942	1122	32760	34
2013	1474	903	1632	725	26834	27
2014	996	496	2008	482	15297	32

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

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

Sub-area VIII

	Ondarroa pair trawl in VIIIabd			Pasajes pair trawl in VIIIa,b,d		
Year	Landings(t)*	Effort(days)	LPUE(Kg/day)	Landings(t)*	Effort(days)	LPUE(Kg/day)
1993	64	68	930	na	na	na
1994	815	362	2250	540	423	1276
1995	3094	959	3226	2089	746	2802
1996	2384	1332	1790	2519	1367	1843
1997	2538	1290	1966	3045	1752	1738
1998	2043	1482	1378	2371	1462	1622
1999	2135	1787	1195	2265	1180	1920
2000	2004	1214	1651	2244	1233	1820
2001	1899	1153	1648	941	587	1603
2002	4314	1281	3368	2570	720	3571
2003	3832	1436	2669	2187	754	2902
2004	3197	1288	2482	1859	733	2535
2005	3350	1107	3026	658	252	2611
2006	4173	1236	3377	516	182	2837
2007	3815	1034	3691	278	105	2644
2008	5473	791	6916	0	0	na
2009	6716	633	10610	0	0	na
2010	8056	844	9545	0	0	na
2011	6357	893	7115	0	0	na
2012	4769	799	5969	0	0	na
2013	4562	518	8801	0	0	na
2014	3467	545	6356	0	0	na

Table 9.5. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Summary of landings and assessment results.

Year	Recruit Age 0	Total Biomass	Total SSB	Landings	Discards[(1)]	Catch	Yield/SSB	F (15-80 cm)
1978	278207	117030	78348	50551	NA	50551	0.65	0.5
1979	260879	125618	98288	51096	NA	51096	0.52	0.53
1980	291624	123178	100026	57265	NA	57265	0.57	0.64
1981	560384	106289	85396	53918	NA	53918	0.63	0.66
1982	395575	97942	69192	54994	NA	54994	0.79	0.69
1983	140176	105345	67545	57507	NA	57507	0.85	0.62
1984	274256	112562	81486	63286	NA	63286	0.78	0.65
1985	641019	97925	78178	56099	NA	56099	0.72	0.79
1986	388654	83133	59039	57092	NA	57092	0.97	0.92
1987	455759	81600	45471	63369	NA	63369	1.39	0.99
1988	499560	81600	48394	64823	2.2	64825.2	1.34	1.01
1989	477088	80824	46630	66473	72.8	66545.8	1.43	1.09
1990	518776	73448	43215	59954	NA	59954	1.39	1.02
1991	306863	71812	42817	58129	NA	58129	1.36	0.96
1992	313837	73682	42780	56617	NA	56617	1.32	1.02
1993	569747	64388	41317	52144	NA	52144	1.26	1.08
1994	310500	57835	32095	51259	356.2	51615.2	1.6	1.11
1995	158246	63473	31143	57621	NA	57621	1.85	1.13
1996	376608	57658	36259	47210	NA	47210	1.3	1
1997	254237	48906	30892	42465	NA	42465	1.37	1.08
1998	412616	46455	25087	35060	NA	35060	1.4	0.99
1999	209695	50305	28356	39814	348.6	40162.6	1.4	0.98
2000	180639	55696	31192	42026	82.6	42108.6	1.35	0.91
2001	313920	55013	36645	36675	NA	36675	1	0.76
2002	248984	56951	37233	40107	NA	40107	1.08	0.82
2003	148106	60331	36863	43162	2109.804	45271.804	1.17	0.81
2004	300555	61999	41090	46417	2552.443	48969.443	1.13	0.83
2005	210359	57476	39033	46550	4675.8487	51225.8487	1.19	0.97
2006	284384	54285	31772	41467	1816.1534	43283.1534	1.31	0.86
2007	449482	61662	38250	45028	2191.4212	47219.4212	1.18	0.73
2008	703128	79558	46257	47739	3247.73	50986.73	1.03	0.58
2009	222405	128197	72260	58818	9870.773	68688.773	0.81	0.46
2010	211925	206535	133658	72799	9414.6677	82213.6677	0.54	0.35
2011	231134	259188	211670	87540	13774.978	101314.978	0.41	0.33
2012	594886	253212	218747	85677	12225.2225	97902.2225	0.39	0.31
2013	616422	245348	202374	77753	11637.1017	89390.1017	0.38	0.33
2014	240888	274935	203296	91525	6547.5083	98072.5083	0.45	0.34
Arith.Mean	352744	100848	70062	55676	4760	57864		
	Units	Thousands	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes	

[(1)] Discards used in the assessment. In years with (-) discards are not available or considerent unreliable.

Table 9.6. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Catch option table.

SSB(2015)	Rec proj	F(15-80cm)	Catch(2015)	Land(2015)	SSB(2016)
249017	319133	0.33	121714	105877	287177

Fmult	Fcatch(15-80cm)	Catch(2016)	Land(2016)	Disc(2016)	SSB(2017)
0	0.00	0	0	0	398305
0.1	0.03	14993	13583	1410	383396
0.2	0.07	29404	26625	2779	369067
0.3	0.10	43255	39147	4108	355292
0.4	0.13	56568	51169	5399	342051
0.5	0.17	69365	62713	6653	329322
0.6	0.20	81667	73796	7870	317085
0.7	0.23	93491	84438	9053	305320
0.8	0.26	104859	94656	10202	294008
0.9	0.30	115786	104468	11319	283133
1	0.33	126291	113888	12403	272675
1.1	0.36	136391	122934	13457	262620
1.2	0.40	146100	131619	14481	252950
1.3	0.43	155435	139959	15476	243651
1.4	0.46	164410	147967	16443	234708
1.5	0.49	173039	155656	17383	226108
1.6	0.53	181336	163039	18297	217836
1.7	0.56	189313	170128	19185	209879
1.8	0.59	196984	176935	20049	202226
1.9	0.63	204360	183472	20888	194864
2	0.66	211452	189748	21704	187782

Table 9.7. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Yield per recruit summary table.

SPR level	Fmult	F(15-80cm)	YPR(catch)	YPR(landings)	SSB PR
1	0	0	0	0	3.2
0.82	0.1	0.03	0.10	0.09	2.63
0.67	0.2	0.07	0.16	0.15	2.19
0.56	0.3	0.1	0.21	0.20	1.84
0.47	0.4	0.13	0.24	0.22	1.56
0.40	0.5	0.16	0.26	0.24	1.33
0.34	0.6	0.2	0.28	0.25	1.15
0.30	0.7	0.23	0.29	0.26	0.99
0.26	0.8	0.26	0.29	0.26	0.87
0.23	0.9	0.3	0.30	0.26	0.76
0.20	1	0.33	0.30	0.26	0.68
0.18	1.1	0.36	0.29	0.26	0.60
0.16	1.2	0.4	0.29	0.25	0.54
0.14	1.3	0.43	0.29	0.25	0.48
0.13	1.4	0.46	0.28	0.24	0.44
0.11	1.5	0.49	0.28	0.24	0.40
0.10	1.6	0.53	0.27	0.23	0.36
0.10	1.7	0.56	0.27	0.22	0.33
0.09	1.8	0.59	0.26	0.22	0.30
0.08	1.9	0.63	0.26	0.21	0.28
0.07	2	0.66	0.25	0.21	0.26

	SPR level	Fmult	F(15-80cm)	YPR(catch)	YPR(landings)	SSB PR
Fmax	0.26	0.84	0.28	0.29	0.26	0.82
F0.1	0.38	0.57	0.19	0.27	0.25	1.21
F35%	0.35	0.62	0.2	0.28	0.25	1.12
F30%	0.3	0.72	0.24	0.29	0.26	0.96

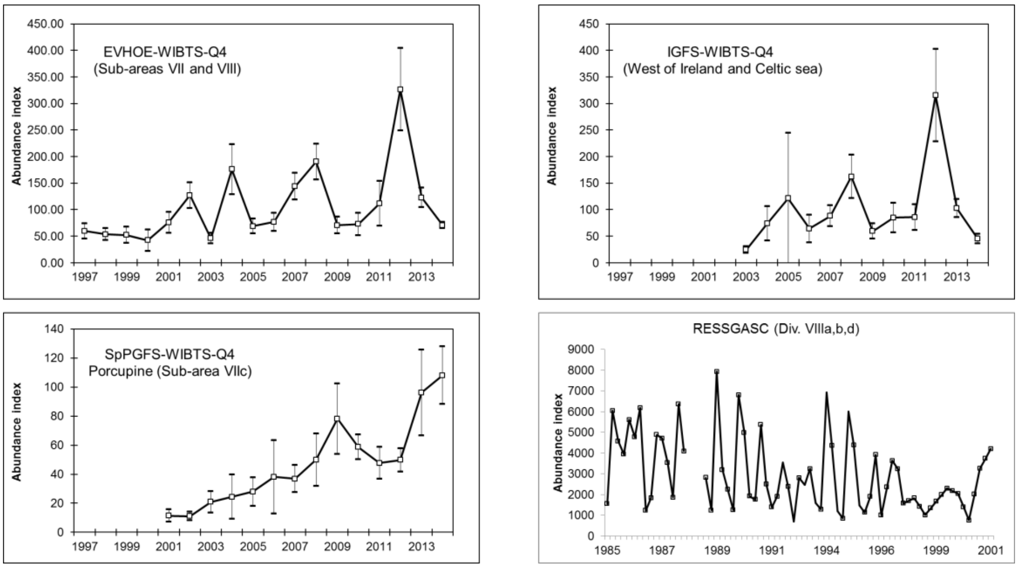


Figure 9.1. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Abundance indices from surveys.

Figure 9.2. Northern Hake. Effective effort indices and LPUE values of commercial fleets estimated by National laboratories.

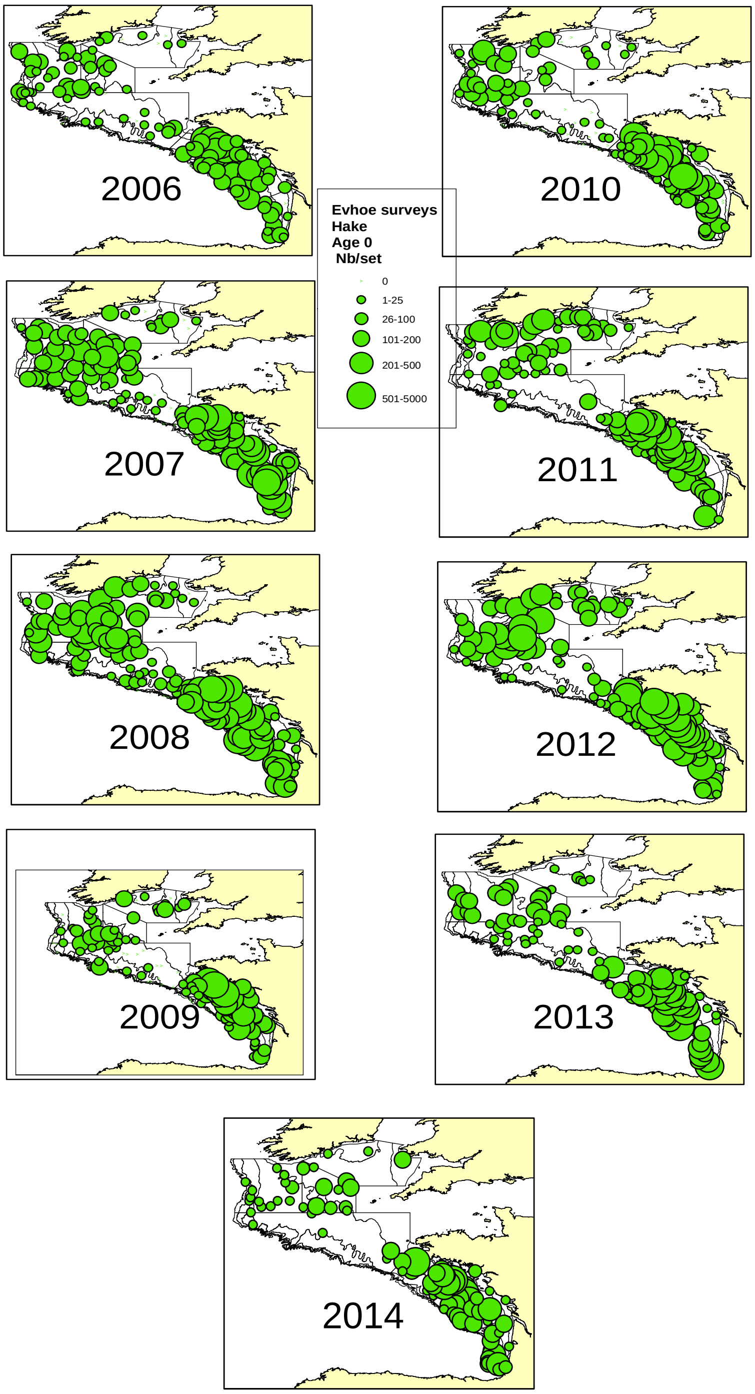


Figure 9.3. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Spatial distribution of hake (0-20 cm) indices from EVHOE-WIBTS-Q4 survey from 2006 to 2011.

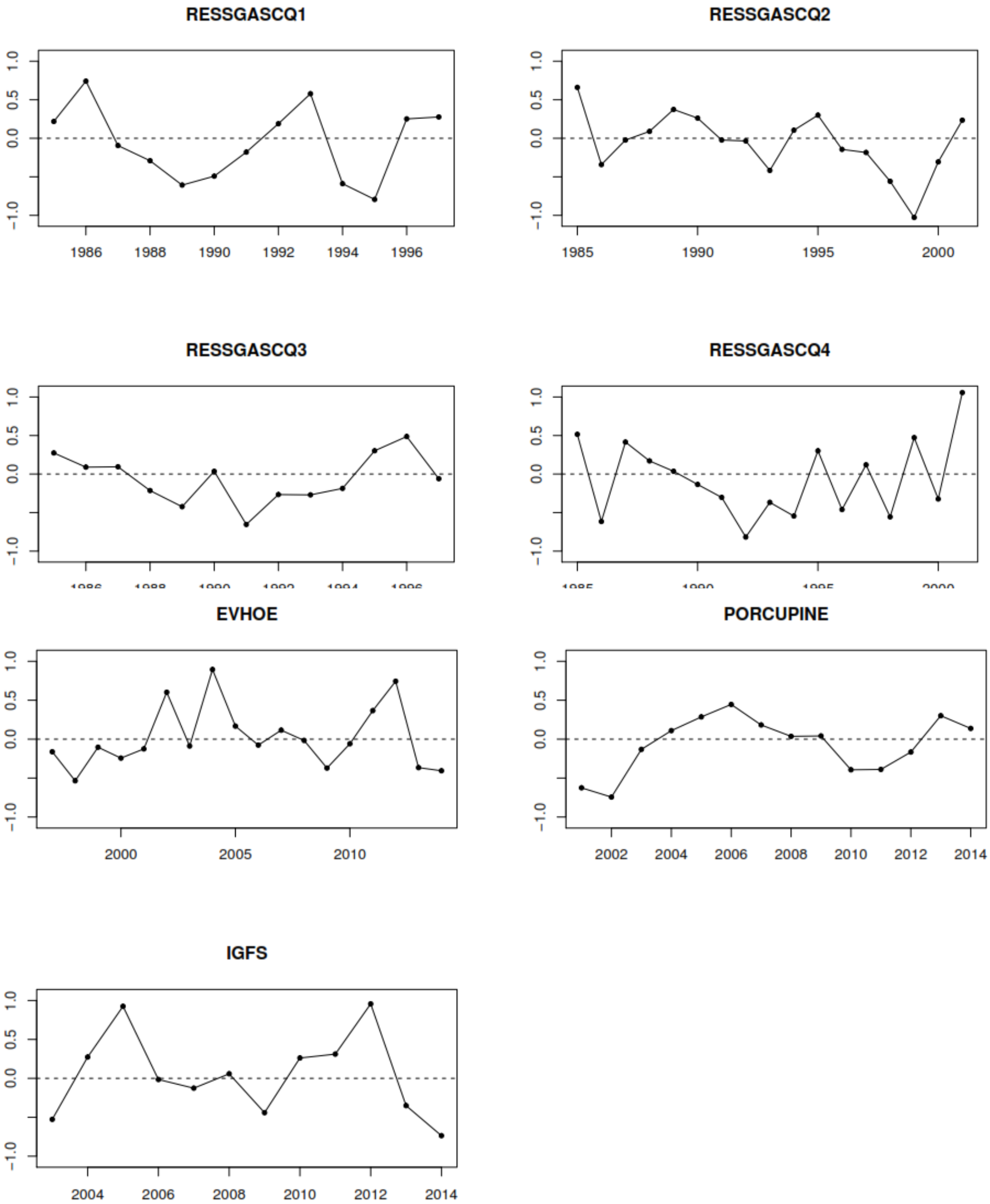


Figure 9.4. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Residuals of the fits to the surveys log(abundance indices). For RESSGASC, EVHOE, PORCUPINE and IGFS, fits are by quarter.

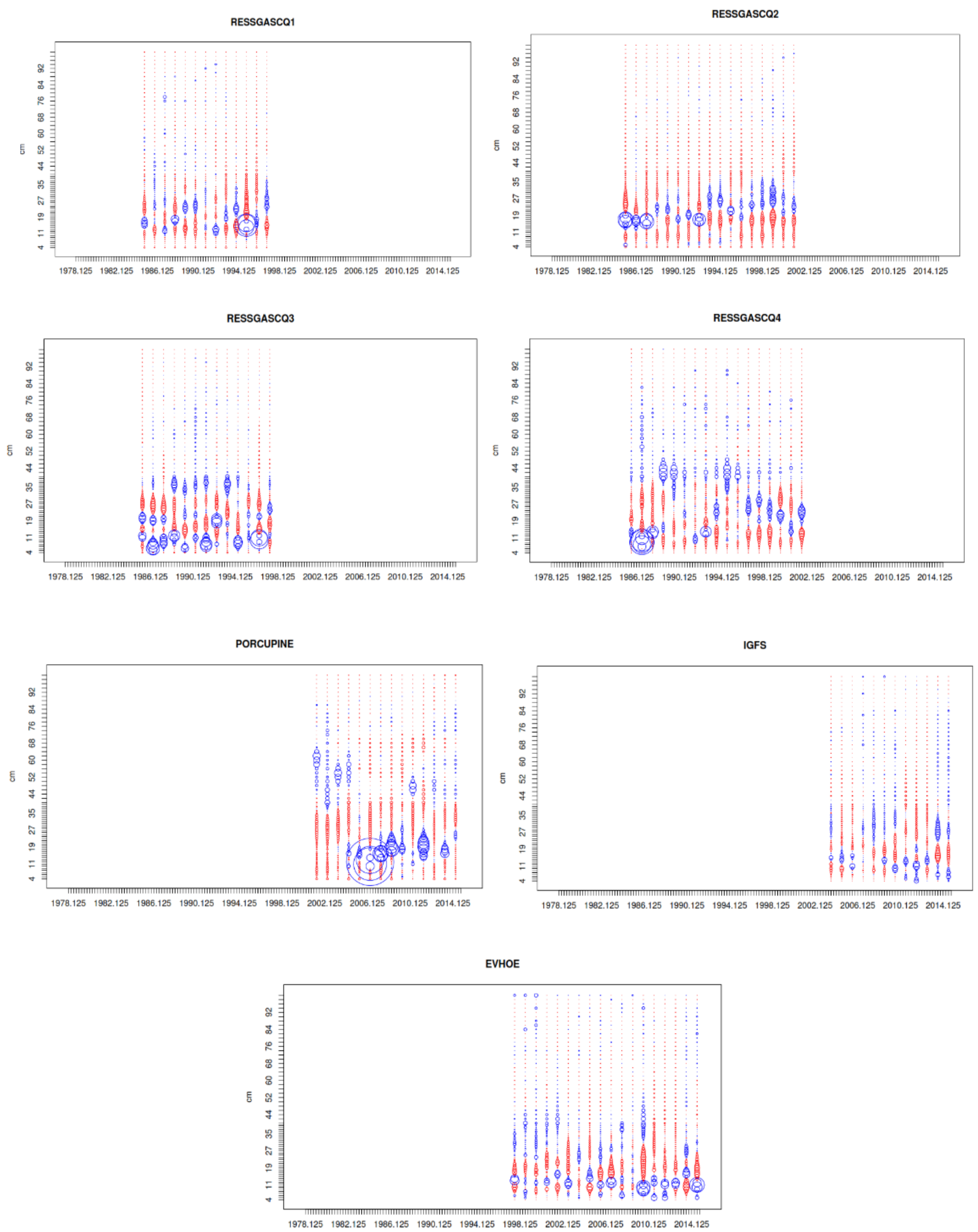


Figure 9.5. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Pearson residuals of the fit to the length distributions of the surveys abundance indices. For RESSGASC, fits are by quarter. Blue and red denote positive and negative residuals, respectively.

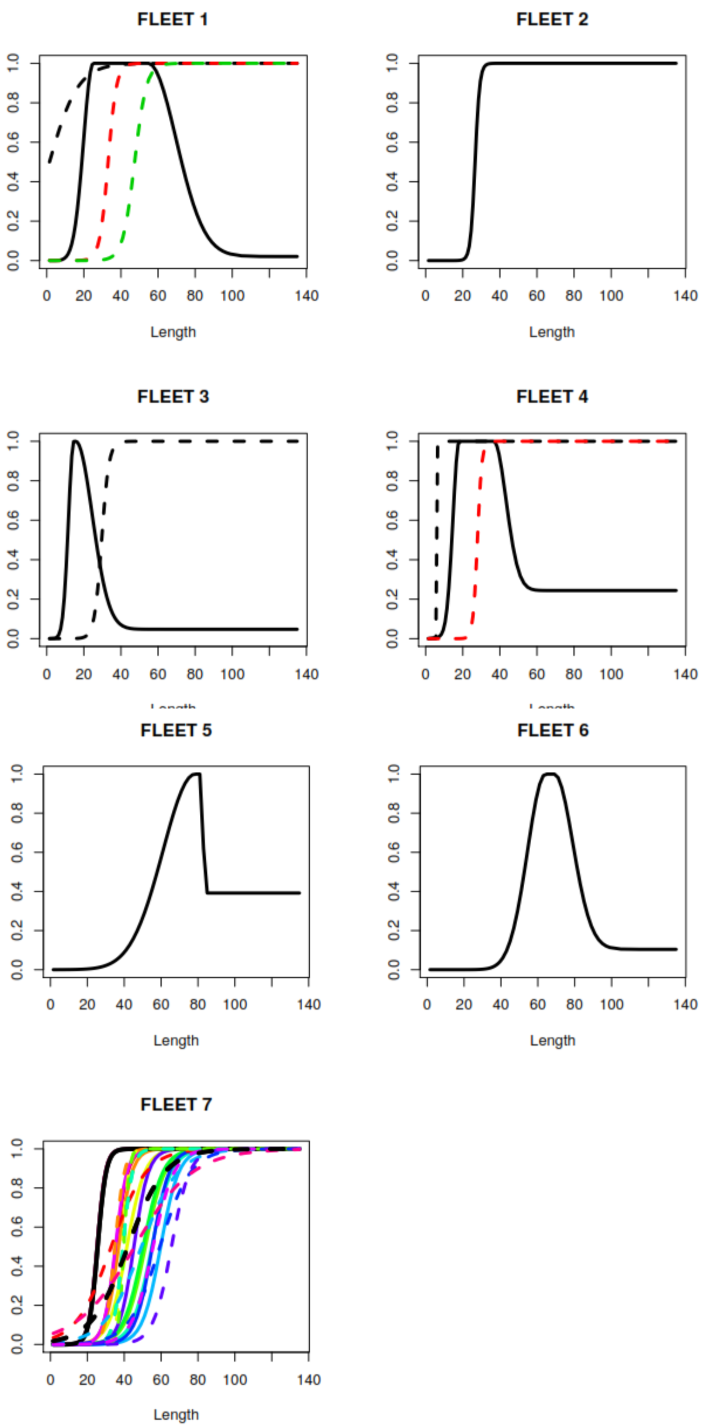


Figure 9.6. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Selection patterns (solid lines) and retention functions (dashed lines) at length by commercial fleet estimated by SS3. For FLEET1, retention functions for 1978-1997, 1998-2009 and 2010-2013 are in black, red and green respectively. For FLEET4, retention functions for 1978-1997 and 1998-2013 are in black and red respectively. For FLEET7, black lines correspond with the selection and retention functions from 1978 to 2002, the colours for the rest of the years are, 2003 (red), 2004 (orange), 2005 (yellow), 2006 (light green), 2007 (green), 2008 (light blue), 2009 (blue), 2010 (dark blue), 2011 (violet), 2013 (purple) and 2014 (pink).

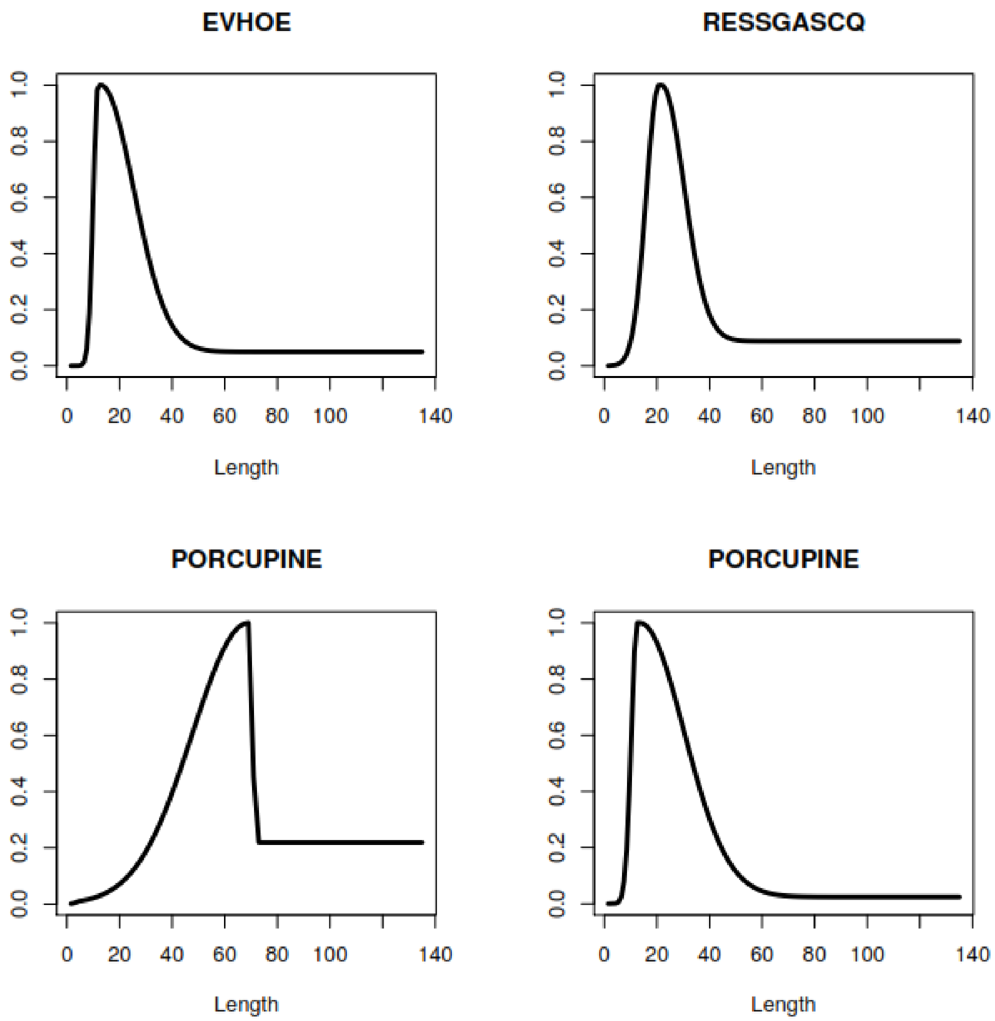


Figure 9.6 (continued). Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Selection patterns at length for surveys estimated by SS3.

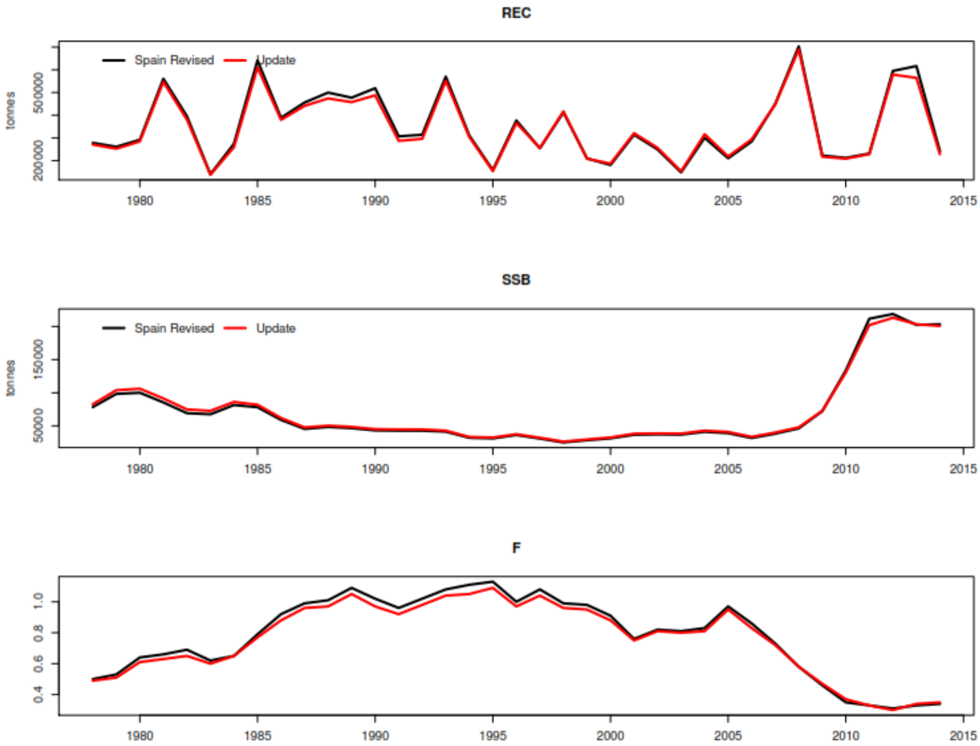


Figure 9.7. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Comparison of assessment results using updated data from 2014 assessment and revised Spanish data for years 2011 to 2013.

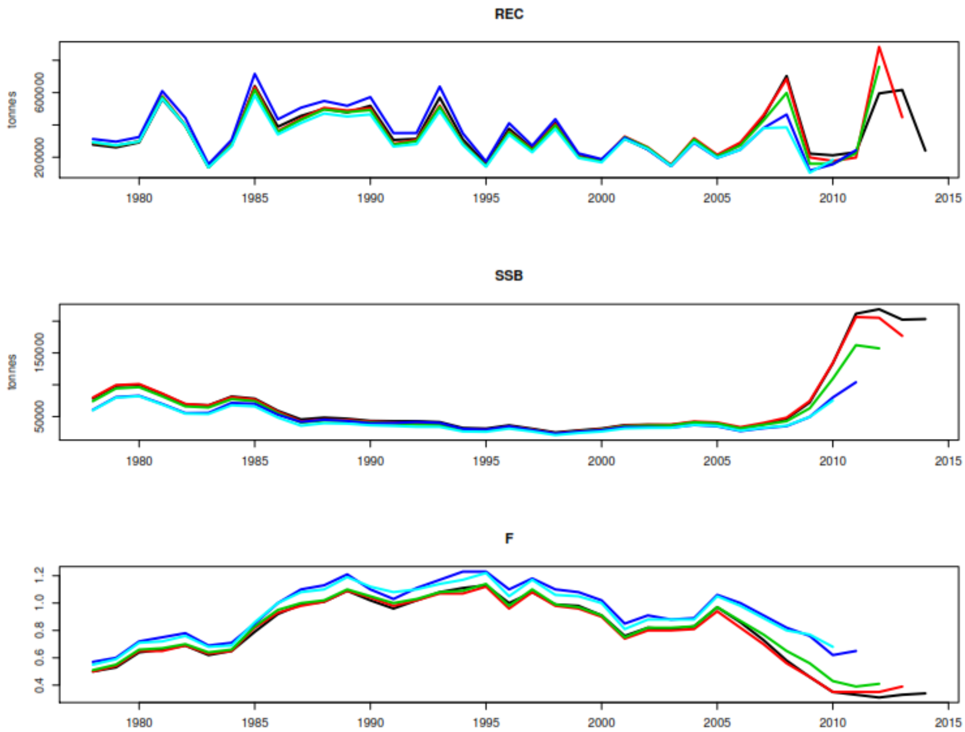


Figure 9.8. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Retrospective plot from SS3.

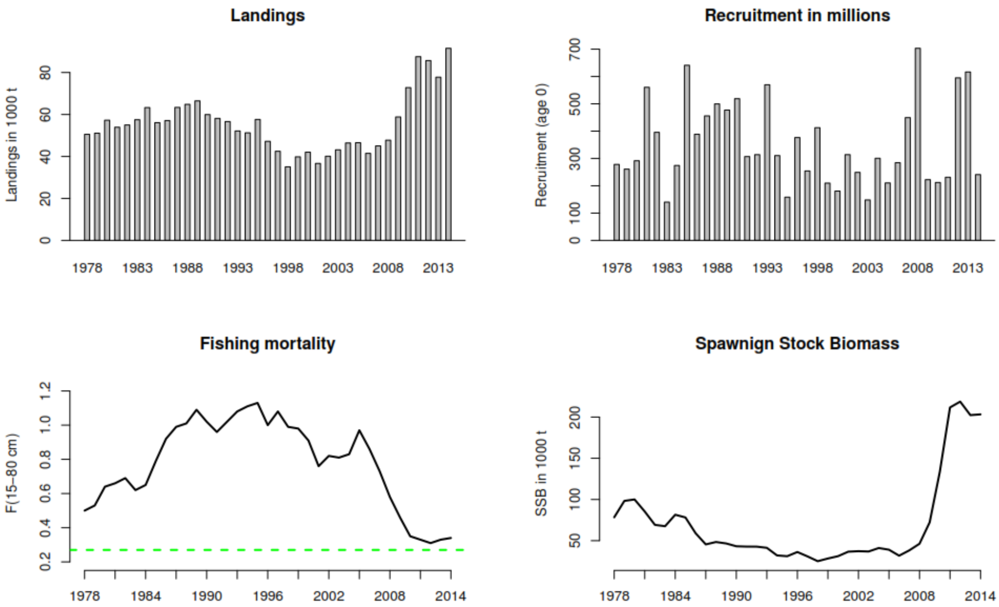


Figure 9.9. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Summary plot of stock trends.

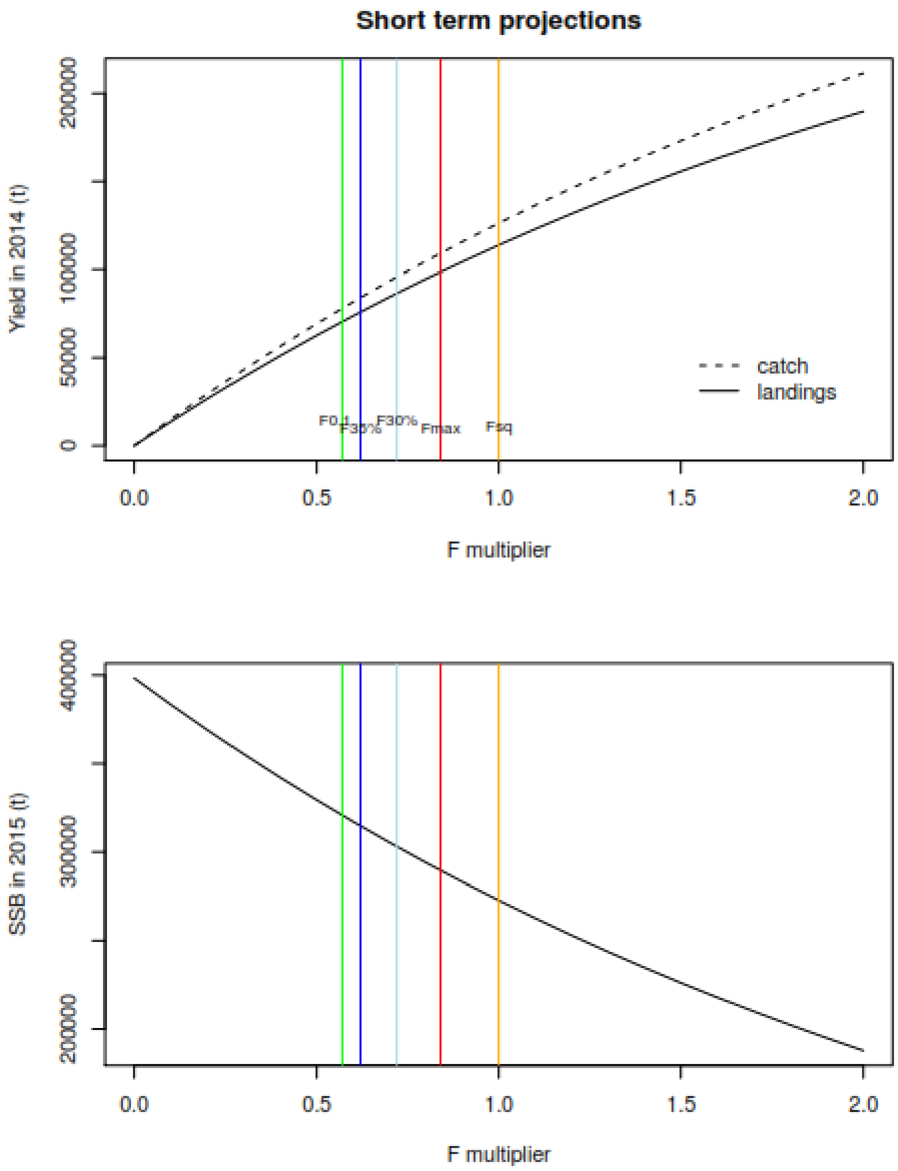


Figure 9.10. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Short term projections

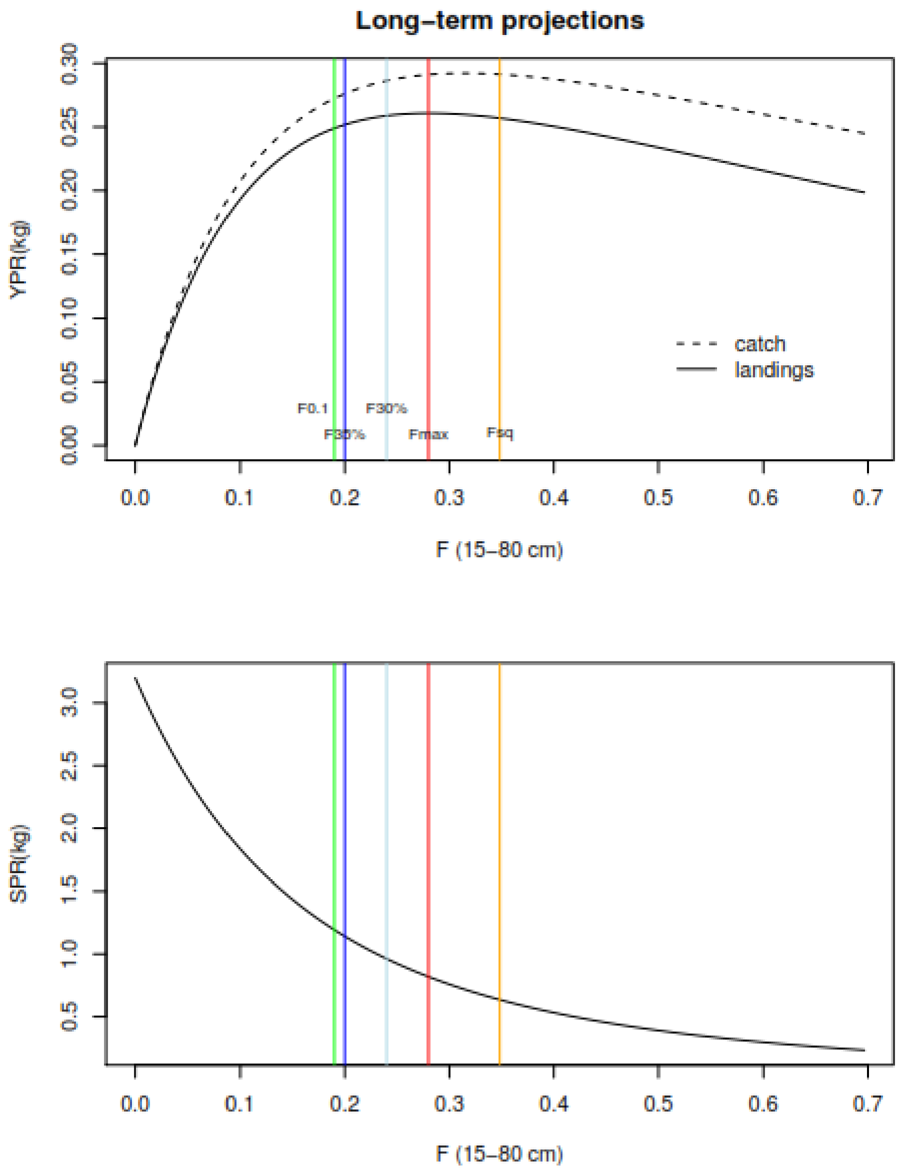


Figure 9.11. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Equilibrium yield and SSB per recruit.

10 Southern Stock of Hake

10.1 General

The type of assessment is "update" based on a previous benchmark assessment (WKSOUTH, 2014).

Data revisions:

Unallocated landings for 2013

Portuguese discard for 2012 and 2013.

10.1.1 Fishery description

Fishery description is available in the Stock Annex.

10.1.2 ICES advice for 2015 and Management applicable to 2014 and 2015.

ICES Advice for 2015

ICES advises on the basis of the MSY approach that catches should be no more than 8417 tonnes in 2015. If discard rates do not change from the average of the years 2011–2013, this implies landings of no more than 7302 tonnes.

Management Applicable for 2014 and 2015

Hake is managed by TAC, effort control and technical measures. The agreed TAC for Southern Hake in 2014 was 16 266 t and in 2015 is 13 826 t.

A Recovery Plan for southern hake was enacted in 2006 (CE 2166/2005). This plan aims to rebuild the stock to within safe biological limits by decreasing fishing mortality a maximum of 10% at year with a TAC constrain of 15%. SSB target (35 000 t) is no longer considered suitable under the new assessment model. This regulation includes effort management limiting days at sea that is updated every year Reg. EU Council 104/2015 (annex II-b). The effort from fishing trips which retain <8% hake are excluded from the regulation.

Technical measures applied to this stock include: (i) minimum landing size of 27 cm, (ii) protected areas, and (iii) minimum mesh size. These measures are set depending on areas and gears by several national regulations.

According to the Spanish Regulations AAA/1307/2013 the Spanish quota is shared by individual vessels The Portuguese regulations also established a closure for trawling off the southwest coast of Portugal between December and February.

10.2 Data

10.2.1 Commercial Catch: landings and discards

Catches: landings and discards

Southern Hake catches by country and gear for the period 1972-last year, as estimated by the WG, are given in Table 10.1. Since 2011, estimates of unallocated landings have been included in the assessment. The method to estimate these landings has changed in 2013. A review of 2011 and 2012 estimates was performed to check the consistency of the new method and to correct these figures if necessary. Although the new method provided reasonable figures for most species, this is not the case for Southern hake with landings well below those previously estimated (WD-3). The new figures were considered unrealistic and were rejected. This also raises the concern about the possible underestimation of landings for 2013 and 2014. It was not possible to suggest a reasonable correction since other factors partially explain the decrease of landings in 2013 and 2014. These factors are the increase of Spanish discards in 2013 and 2014 (see table 10.1) and also the decrease of survey abundance (SpGFS-WIBTS-Q4) in 2013 and 2014 (see Table 10.4). The group finally accepted 2013 and 2014 landing estimates because they are considered the best available information at the moment. WGBIE would welcome any further research to confirm the validity of these landing estimates.

In 2014, Portuguese landings were 2 347 t, slightly below those from 2013 (2 744 t). Spanish official landings were 7 154 t in 2013 and 7 256 t in 2014. Unallocated landings were 1 455 t in 2013 and 2 246 t in 2014. Total landings in 2013 were 11 661 t and 12 011 t in 2014 well below TACs that were 14 144 t in 2013 and 16 266 t in 2014 Total discards in 2013 were 2 553 t and 2 602 in 2014. Total catches were 14 214 and 14 614 in 2013 and 2014.

Length distribution for 2014 landings and discards are presented in Tab 10.2. A slight change in mean size can be observed for landings (from 35.5 cm in 2013 to 33.8 in 2014) and discards (from 20.6 to 21.9) and catch from 27 to 27.9 cm.

Growth, Length–weight relationship and M

An international length-weight relationship for the whole period (a=0.00659; b=3.01721) has been used since 1999. The assessment model follows a constant von Bertalanffy model with fixed Linf = 130 cm, t_0=0 and estimating k parameter. Natural mortality was assumed to be 0.4 year^{-1} for all ages and years.

Maturity ogive

The stock is assessed with annual maturity ogives for males and females together. The maturity proportion in this assessment year is shown in Figure 10.2. L50 have oscillated from 31.5 cm in 2012 to 36.5 cm in 2013 and 31.7 cm in 2014. Mean historical figures were around 36 cm.

10.2.2 Abundance indices from surveys

Biomass, abundance and recruitment indices for the Portuguese and Spanish surveys respectively are presented in Table 10.3 and Table10.4 and Figure 10.3. The Spanish (SpGFS-WIBTS-Q4 and SPGFS-caut-WIBTS-Q4) and the Portuguese (PtGFS-WIBTS-Q4) surveys are used to tune the model, by fitting the model estimates to the observed length proportions and survey trends.

The Portuguese Autumn survey (PtGFS-WIBTS-Q4) showed variable abundance indices with a minimum in 1993 and maximum in 2010. The survey was not performed in 2012. There were very high values in recent years. However the last figure is around the historical mean. The Spanish groundfish survey (SpGFS-WIBTS-Q4) shows low values for biomass and abundance in the early 2000s. These values increased from 2004 peaking to a historical maximum in 2009, after which they remained relatively stable until 2012. In 2013 and 2014 there was a further decrease to below the historical mean.

The recruitment indices of the SpGFS-WIBTS-Q4, SPGFS-caut-WIBTS-Q4 and PtGFS-WIBTS-Q4 (Figure 10.3) were highly variable in the past, showing good recruitments in recent years. In 2013, PtGFS-WIBTS-Q4 and SPGFS-caut-WIBTS-Q4 were both at the respective maxima, while SpGFS-WIBTS-Q4 was slightly below the mean. In 2014 the 3 surveys decreased below historical means.

Commercial catch–effort data

Effort and respective landings series are collected from Portuguese log-books maintained in DGRM and compiled by IPMA. For the Portuguese fleets, until 2011 most log-books were filled in paper but have thereafter been progressively replaced by e-logbooks. In 2014 more than 90% of the log-books are being completed in the electronic version. The standardized CPUE from the Portuguese bottom-trawl fleet targeting roundfish is calculated by fitting a GLM to log-book data on landings and effort (modulated by additional fleet and catch characteristics), following the methods described in the stock annex and accepted by WKROUND (2010). The latest series (WD-5) is based on a renewed extraction of the complete logbook dataset housed in the DGRM (Portuguese administration) databases, which now includes both paper and e-logbooks. Following the application of the method, which now includes a greater number of vessels, the series was compared to the previously calculated series, showing similar trends (WD-5) although a different magnitude in numbers. The late availability of the 2014 data however meant that the new series was not yet incorporated in the assessment model.

Spanish sales notes and Owners Associations data were compiled by IEO to estimate fleet effort until 2012 and are presented in figure 10.4 and table 10.5. Spanish LPUE (SP-CORUTR) estimates for 2013 and 2014 were estimated with a different methodology (for both landings and effort) and were not used in the model. WD-4 provided a review of LPUE in recent years with the new methodology. Effort increases between 10 and 20% and the landings up to 37%. The length distribution provided only included 4 years of data. As soon as a more complete time series is available the data will be considered again to calibrate the model as a new time series.

The assessment model does not incorporate any additional LPUE as compared to 2013. The two fleets included in the assessment model are SP-CORUTR (from 1985 to 2012) and P-TR (from 1989 to 2010).

10.3 Assessment

The assessment carried out used the gadget model (length-age based) as decided by WKSOUTH (ICES, 2014) and described on the stock annex.

10.3.1 Model diagnostics

Likelihood profiles for each parameter estimated by the model are presented in Figure 10.5. This analysis is carried out in each parameter individually and it does not guarantee that the model finds an absolute minimum. It allows checking that the minimization algorithm found a minimum. The values on the horizontal axes of the plots represent multiplicative factors with respect to the estimated parameter value. To check for convergence the minimum likelihood value must correspond to the estimated parameter value (i.e. the multiplier 1). The change in likelihood may be very large if the model gives “understocking”, i.e. if it is not able to produce enough fish to subtract the observed catches from the modelled population. Due to the distinct impact each parameter has on the likelihood value, the plots are presented scaled and unscaled. In Figure 10.5, all parameter estimates correspond to the minimum of the likelihood.

Residuals for surveys and abundance indices (SpGFS-WIBTS-Q4 and PtGFS-WIBTS-Q4) and commercial fleets (SP-CORUTR and P-TR) are presented in Fig 10.6a-b, grouped in 15 cm classes (from 4 to 49 cm in surveys and 25 to 70 cm in commercial fleets). Most residuals are within the range of -1 to 1 (±1 s.d.). Surveys' residuals show a random distribution with the exception of PtGFS-WIBTS-Q4 for lengths 4-19 cm, that shows figures above the model estimates in the last 5 years.

Regarding commercial fleets, P-TR was not available from 2011 to 2014 and SP-CORUTR for the last two years (2013-14). P-TR (25-40 cm) shows negative residuals with a downwards trend from 2005 to 2010. The difficulty of these indices to follow the abundance generated by the recent increase in recruitment may be due to the fact that discards are not included in the computation. Apart from this, the fits for these 3 length groups are quite consistent. The SP-CORUTR shows also quite consistent random residuals with the exception of the length group 55-70 cm, which shows positive residuals for the last 6 years (2007-2012).

Figures 10.6 (c-i) present bubble plots of residuals for proportions at length. These proportions are grouped in 2 cm classes for all "fleets" used in the model calibration (see Stock Annex for descriptions). The model fits these proportions at length assuming a constant selection pattern for every "fleet" in the years and quarters in which length distributions are observed. The quality of the fit is different for different data sets, but not all of them contribute equally to the overall model fit. Projections are based on the selection patterns estimated only for landings (10.6-d) and discards (10.6-f). The residual analysis shows that there is an underestimation (positive residuals) in the most exploited lengths and overestimation on the larger sizes (negative residuals). Such patterns are not of major concern since the residuals' values are quite small (maximum ~0.3). The model takes into account the data precision when weighting the individual likelihood components (defined in the Stock Annex), so data sets with larger model residuals will have less impact on the overall model fit.

10.3.2 Assessment results

Estimated parameters

The model estimates selection parameters for each "fleet" for which length proportions are fitted. Furthermore it estimates the von Bertalanffy growth parameter k. Results are presented in Figure 10.7. The selection patterns of different "fleets" of catches (catches in 1982-93; landings in 1994-latest; discards 1992-latest and Cadiz landings (1982-2004) are presented in the upper plot. The pattern corresponding to catches during 1982-93 shows higher relative efficiency for smaller fish (when compared with catches from 1994 onwards), which is in agreement with our assumption that before 1992 (when the minimum landing size was implemented) the importance of discards was relatively lower. The discards (1992-latest) and landings (1994-latest) selection patterns are used for projections.

Survey selection patterns are presented in the lower selection pattern panel. The Portuguese survey PtGFS-WIBTS-Q4 catches relatively larger fish than the Spanish surveys (SpGFS-WIBTS-Q4 and SPGFS-caut-WIBTS-Q4). Both Spanish surveys show a similar pattern. They are both performed with the same vessel and gear in every year, but since 2013 a new vessel has been used (without a significant impact in hake abundance estimates).

The von Bertalanffy k parameter was estimated to be 0.164, the same as in the previous assessment.

Historic trends in biomass, fishing mortality, yield and recruitment

Model estimates of abundance at length in the beginning of the 4^{th} quarter are presented in Figure 10.8. The figure shows a general increase of small fish in 2005-09, that contributes to an increase of large fish in more recent years.

Table 10.6 and Figure 10.9 present summary results with estimated annual values for fishing mortality (averaged over ages 1-3), recruitment (age 0) and SSB, as well as observed landings and discards.

Recruitment (age 0) is highly variable and presents three different periods: one from 1982 to 2003 with mean figures around 70 million (ranging from 40 to 120 mill); another between 2005 and 2009 with mean figures of 121 mill; and a latter period around the historic mean (80 mill). In 2014 it was 61.68 mill. Fishing mortality increased from the beginning of the time series (F=0.36 in 1982) peaking in 1995-97 around 1.18; declining to 0.78 in 1999 and remaining relatively stable until 2009 (F=1.01). F then progressively decreased to reach 0.68 in 2014. The SSB was very high at the beginning of the time series with values around 40 000 t, then decreased to a minimum of 5 810t in 1998. Since then biomass has continuously increased, reaching 18 840 in 2014.

Retrospective pattern for SSB, fishing mortality, yield and recruitment

Figure 10.10 presents the results of the assessments performed using the retrospective data series from 2014-2009. There is a clear trend in the retrospective pattern for recruitment, F and SSB. Recruitment shows high variability, whereas both recruitment and SSB show a tendency to be overestimated, in contrast to F which shows a tendency to be underestimated. The correction in 2014 is stronger than in previous years.

10.4 Catch options and prognosis

10.4.1 Short-term projections

The methodology used this year was developed during the latest benchmark (WKSOUTH, 2014) and described in the Stock Annex. Short term projections are presented in Fig. 10.11 and Table 10.7. Note that mortality in GADGET is length based. This may cause some small changes in F (ages 1-3) if the relative contributions of different length on these ages change from year to year. That is because F (1-3) in 2014 is 0.68 and F (1-3) in 2015 is 0.67. Furthermore, F multipliers do not apply linearly , e.g. if Fmult is 1, F is 0.67 however if Fmult=0.5 F is 0.32 (see table 10.7).

In 2015 the expected SSB is 18 856 t. Fsq for the intermediate year (2015) is estimated as the average of the last 3 assessment years scaled to last year (0.67). Recruitment for 2014 was accepted. Recruitment used for projections in years 2015-16 was the geometric mean of 1989-2013 (80 205 thousand). During the intermediate year, 2015, the expected yield (landings) is 12 980 t and the SSB at the end of the year is expected to be 17 684 t.

Different F multipliers applied in 2016 provide management alternatives according to different scenarios. Under Fsq (Fmult=1), F would be 0.67, the expected yield would be 12 416 t and SSB in 2017 would be 17 683 t. Decreasing F by 10% (F mult=0.9), F would be 0.60, the yield and SSB, 11 502 t and 19 354 t, respectively. This is outside the -15% TAC constraint of the recovery plan, which would result in a yield of 11 752 t and a SSB of 18 895 t. With the MSY approach (F=0.24), Fmult would be 0.38, the yield 5 566 t and SSB 30 438 t.

10.4.2 Yield and biomass per recruit analysis

The F that produces maximum landings per recruit was estimated following the Stock Annex. This results in Fmax = 0.24 and F0.1=0.17 (Figure 10.12).

The following table shows the expected figures for different reference Fs:

	F (1–3)	Yield/R	SSB/R
Fsq	0.67	0.17	0.24
Fmax	0.24	0.24	0.97
F0.1	0.17	0.23	1.30
F35%SPR	0.2	0.23	1.13

10.5 Biological reference points

Fmax (F=0.24) is the Southern hake Fmsy proxy.

Blim= 9 000 t based on Bloss. The stock recruitment plot does not show any clear sign of reduced recruitment at low SSB (Fig 10.13). However we opted for a conservative approach rejecting the 4 lowest SSB values (see Fig. 13) which results in a Bloss figure around 9 000 t.

All reference points, including MSY ranges, will be reconsidered by ICES next October.

Reference points

	Type	Value	Technical basis
MSY	MSY Btrigger	Not defined.	
approach	FMSY	0.24	Fmax (WGHMM, 2010).
	Blim	9 000 t	Bloss (WGBIE, 2014)
Precautionary	Bpa	Not defined.	
approach	Flim	Not defined.	
	Fpa	Not defined.	

10.6 Comments on the assessment

Landings in the last two years are uncertain and could be underestimated.

Updates of two indices (SP-CORUTR and P-TR) could not be included in the model. These 2 indices are important calibration information for large fish.

Given the lack of abundance indices for large fish at the beginning of the time series, the SSB estimates for this period may be considered with caution.

Recruitment was quite high in 2005-09, afterward which it returned to a value around the historic mean. Surveys indicate that the latest recruitment abundance (<20 cm) is below the historical mean. .

The retrospective pattern shows a trend to overestimate SSB and underestimate F. This pattern has been stronger in 2014.

10.7 Management considerations

Landings have historically been well above the TACs since 2004. However, for the latest two years (2013 and 2014), landings have been well bellow the advised TAC.

The objective of the recovery plan was to rebuild the stock within safe biological limits, meaning to reach an SSB of 35 000 t by 2015. Since the enforcement of the plan the stock historical perception has changed caused by a wrong perception of growth and the subsequent implementation of a length based model. The SSB of the recovery plan is therefore no longer valid. A B_{lim} = 9 000 t was proposed in 2014 (ICES, 2014) based on B_{loss}. SSB in years 2014 and 2015 are around 19 000 t, suggesting that the stock is inside safe biological limits

F in 2014 continues to be above Fmax. The stock is therefore being overexploited.

The retrospective pattern shows overestimation of SSB and underestimation of F. This could result in an overestimation of SSB predictions. The impact on the advised TAC is relatively low since both processes balance each other.

Table 10.1 HAKE SOUTHERN STOCK. Catch estimates (´000 t) by country and gear.

	SPAIN									PORTUGAL				FRANCE		TOTAL		
YEAR	ART	GILLNET	LONGLINE	Cd-Trw	Pr-Bk TRW	Pa-Trw	Ba-Trw	DISC	LAND	ART	TRAWL	DISC	LAND	TOTAL	UNALLOCATED	DISC	LAND	CATCH
1972	7.10	-	-	-	10.20				17.3	4.70	4.10	-	8.8			-	26.1	26.1
1973	8.50	-	-	-	12.30				20.8	6.50	7.30	-	13.8	0.20		-	34.8	34.8
1974	1.00	2.60	2.20	-	8.30				14.1	5.10	3.50	-	8.6	0.10		-	22.8	22.8
1975	1.30	3.50	3.00	-	11.20				19.0	6.10	4.30	-	10.4	0.10		-	29.5	29.5
1976	1.20	3.10	2.60	-	10.00				16.9	6.00	3.10	-	9.1	0.10		-	26.1	26.1
1977	0.60	1.50	1.30	-	5.80				9.2	4.50	1.60	-	6.1	0.20		-	15.5	15.5
1978	0.10	1.40	2.10	-	4.90				8.5	3.40	1.40	-	4.8	0.10		-	13.4	13.4
1979	0.20	1.70	2.10	-	7.20				11.2	3.90	1.90	-	5.8	-		-	17.0	17.0
1980	0.20	2.20	5.00	-	5.30				12.7	4.50	2.30	-	6.8	-		-	19.5	19.5
1981	0.30	1.50	4.60	-	4.10				10.5	4.10	1.90	-	6.0	-		-	16.5	16.5
1982	0.27	1.25	4.18	0.49	3.92				10.1	5.01	2.49	-	7.5	-		-	17.6	17.6
1983	0.37	2.10	6.57	0.57	5.29				14.9	5.19	2.86	-	8.0	-		-	22.9	22.9
1984	0.33	2.27	7.52	0.69	5.84				16.7	4.30	1.22	-	5.5	-		-	22.2	22.2
1985	0.77	1.81	4.42	0.79	5.33				13.1	3.77	2.05	-	5.8	-		-	18.9	18.9
1986	0.83	2.07	3.46	0.98	4.86				12.2	3.16	1.79	-	4.9	0.01		-	17.2	17.2
1987	0.53	1.97	4.41	0.95	3.50				11.4	3.47	1.33	-	4.8	0.03		-	16.2	16.2
1988	0.70	1.99	2.97	0.99	3.98				10.6	4.30	1.71	-	6.0	0.02		-	16.7	16.7
1989	0.56	1.86	1.95	0.90	3.92				9.2	2.74	1.85	-	4.6	0.02		-	13.8	13.8
1990	0.59	1.72	2.13	1.20	4.13				9.8	2.26	1.14	-	3.4	0.03		-	13.2	13.2
1991	0.42	1.41	2.20	1.21	3.63				8.9	2.71	1.25	-	4.0	0.01		-	12.8	12.8
1992	0.40	1.48	2.05	0.98	3.79			0.14	8.7	3.77	1.33	0.33	5.1	-		0.5	13.8	14.3
1993	0.37	1.26	2.74	0.54	2.67			0.24	7.6	3.04	0.87	0.44	3.9	-		0.7	11.5	12.2
1994	0.37	1.90	1.47	0.32		0.82	1.90	0.29	6.8	2.30	0.79	0.71	3.1	-		1.0	9.9	10.9
1995	0.37	1.59	0.96	0.46		2.34	2.94	0.93	8.6	2.56	1.03	1.18	3.6	-		2.1	12.2	14.3
1996	0.23	1.15	0.98	0.98		1.46	2.17	0.91	7.0	2.01	0.76	0.99	2.8	-		1.9	9.7	11.6
1997	0.30	1.04	0.76	0.88		1.32	1.78	1.07	6.1	1.52	0.90	1.20	2.4	-		2.3	8.5	10.8
1998	0.32	0.75	0.62	0.53		0.88	1.95	0.57	5.0	1.67	0.97	1.11	2.6	-		1.7	7.7	9.4
1999	0.33	0.60	0.00	0.57		0.87	1.59	0.35	4.0	2.12	1.09	1.17	3.2	-		1.5	7.2	8.7
2000	0.26	0.85	0.15	0.58		0.83	1.98	0.62	4.7	2.09	1.16	1.21	3.3	-		1.83	7.90	9.7
2001	0.32	0.55	0.11	1.20		1.06	1.12	0.37	4.4	2.02	1.20	1.29	3.2	-		1.66	7.58	9.2
2002	0.22	0.58	0.12	0.88		1.37	0.75	0.38	3.9	1.81	0.97	1.11	2.8	-		1.49	6.70	8.2
2003	0.37	0.43	0.17	1.25		1.36	1.07	0.41	4.7	1.13	0.96	1.05	2.1	-		1.46	6.74	8.2
2004	0.48	0.42	0.13	1.06		1.66	1.13	0.22	4.9	1.27	0.80	0.69	2.1	-		0.91	6.94	7.9
2005	0.72	0.63	0.09	0.88		2.77	1.14	0.38	6.2	1.10	0.96	1.60	2.1	-		1.98	8.30	10.3
2006	0.48	0.71	0.35	0.63		4.70	1.81	2.65	8.7	1.22	0.91	0.61	2.1	-		3.26	10.80	14.1
2007	0.83	1.80	0.89	0.50		6.71	2.07	1.19	12.8	1.41	0.72	1.31	2.1	-		2.50	14.93	17.4
2008	1.12	2.64	1.51	0.53		6.32	2.44	1.45	14.6	1.27	0.94	0.86	2.2	-		2.31	16.77	19.1
2009	1.41	2.92	2.10	0.55		7.37	2.54	0.98	16.9	1.39	0.96	1.96	2.4	-		2.93	19.24	22.2
2010	0.72	1.71	1.88	0.68		6.33	1.71	1.00	13.0	1.61	0.73	0.58	2.3	0.36		1.58	15.74	17.3
2011	0.42	1.09	0.76	0.53		2.18	1.48	1.21	6.5	1.72	0.49	0.74	2.2		8.40	1.95	17.07	19.0
2012	0.34	0.85	1.08	0.50		1.64	1.42	1.35	5.8	1.79	0.81	0.47	2.6		6.14	1.82	14.57	16.4
2013	0.64	1.75	1.11	0.62		1.86	1.16	2.22	7.2	1.93	0.81	0.33	2.7	0.31	1.46	2.55	11.66	14.2
2014	0.75	1.46	1.60	0.54		1.72	1.18	2.02	7.3	1.71	0.66	0.58	2.4	0.14	2.25	2.60	12.01	14.6

Table 10.2 HAKE SOUTHERN STOCK - length compositions (thousands)

Length (cm) (4 to 100+ each 2)	Land	Disc	Catch
4	0	7	7
6	0	7	7
8	3	50	52
10	201	235	436
12	525	935	1460
14	811	1738	2549
16	987	2539	3526
18	811	3950	4761
20	909	4967	5876
22	1281	6297	7577
24	1387	5170	6557
26	2069	3102	5171
28	3457	866	4324
30	3213	364	3577
32	2556	161	2717
34	2216	28	2244
36	1803	5	1807
38	1622	6	1629
40	1220	0	1220
42	740	0	740
44	635	0	635
46	596	0	596
48	576	0	576
50	592	0	592
52	570	26	596
54	503	0	503
56	425	0	425
58	363	0	363
60	248	0	248
62	187	0	187
64	136	0	136
66	108	0	108
68	82	0	82
70	67	0	67
72	45	0	45
74	44	0	44
76	23	0	23
78	17	0	17
80	14	0	14
82	6	0	6
84	8	0	8
86	7	0	7
88	5	0	5
90	2	0	2
92	1	0	1
94	1	0	1
96	1	0	1
98	1	0	1
TOTAL	31074	30453	61526
Nominal Weight (tons)	11.88	2.60	14.48
SOP	11.92	2.48	14.40
SOP / NW	1.00	1.05	1.01
Mean length (cm)	33.8	21.9	27.9

*** without France landings**

Table 10.3 HAKE SOUTHERN STOCK - Portuguese groundfish surveys; biomass, abundance and recruitment indices

Year	Winter (ptGFS-WIBTS-Q1)					Summer					Autumn (ptGFS-WIBTS-Q4)					
	Biomass (kg/h)		Abundance (N/h)			Biomass (kg/h)		Abundance (N/h)			Biomass (kg/h)		Abundance (N/h)			
	Mean	s.e.	Mean	s.e.	hauls	Mean	s.e.	Mean	s.e.	hauls	Mean	s.e.	Mean	s.e.	n/hour < 20 cm (1)	hauls
1979 *						11.7		80.4		55	9.5		na			55
1980 * (**)	11.3		178.1		36	15.4		153.0		63	12.5		108.7			62
1981 (Autumn **)	10.7	0.7	122.4	15.5	67	9.9	1.3	87.8	15.5	69	24.4	0.5	734.8	29.3		111
1982	18.1	2.5	265.6	37.5	69	11.0	2.7	93.0	32.8	70	10.6	1.8	119.5	34.7		190
1983 (Autumn **)	27.0	6.0	530.5	151.0	69	15.1	2.3	120.5	20.8	98	13.4	0.5	121.8	4.8		117
1984																
1985						14.3	0.8	170.7	15.6	101	11.0	0.7	128.7	8.4	86.7	150
1986						27.4	1.8	249.4	15.1	118	17.7	1.2	165.6	28.4	90.2	117
1987											8.6	0.9	37.4	3.7	7.3	81
1988											15.3	1.7	177.8	30.8	111.7	98
1989						11.9	0.9	80.8	8.6	114	8.4	0.5	59.6	4.6	19.8	130
1990						9.8	1.0	95.6	13.5	98	11.8	1.0	157.2	26.3	97.2	107
1991						14.2	1.2	104.2	11.3	119	20.9	4.3	195.3	41.5	92.3	80
1992	14.5	1.2	176.4	32.3	88	10.9	1.1	74.1	11.4	81	11.7	1.7	65.2	11.1	18.8	51
1993	9.0	0.7	78.7	16.8	75	11.3	1.7	105.0	34.7	66	5.5	0.8	54.4	12.9	28.4	58
1994											9.9	1.0	98.9	12.1	52.9	77
1995						15.0	1.4	129.3	16.3	81	14.8	1.7	85.8	10.7	7.9	80
1996***											9.2	1.1	109.9	17.8	18.2	63
1997						19.0	1.4	206.5	16.9	86	24.6	9.3	208.0	92.5	62.1	51
1998						10.5	0.8	71.6	8.6	87	15.6	2.0	140.6	21.7	75.9	64
1999***						11.8	0.7	116.2	10.1	65	11.6	1.5	118.3	17.1	14.4	71
2000						16.4	1.6	123.0	15.2	88	11.8	1.8	102.7	19.9	49.2	66
2001						16.6	1.7	132.5	14.2	83	15.6	2.8	164.2	38.5	89.9	58
2002											13.0	2.1	117.6	26.9	60.6	66
2003 ***											9.8	1.0	94.2	8.0	11.9	71
2004 ***											18.4	3.3	402.3	85.2	78.2	79
2005	17.7	2.6	384.0	53.8	68						19.0	1.9	214.2	23.5	131.7	87
2006	16.0	2.0	377.5	55.4	66						16.5	1.8	126.2	11.0	54.7	88
2007	22.4	3.4	609.1	114.1	63						25.8	2.8	370.2	46.7	240.0	96
2008	31.1	4.8	700.6	170.8	67						34.6	4.3	293.6	33.9	87.7	87
2009											37.5	4.4	476.4	75.9	318.6	93
2010											38.2	4.3	418.0	49.8	249.8	87
2011											18.7	1.5	272.9	25.2	179.4	86
2013											35.2	3.4	473.1	62.1	289.0	93
2014											17.1	1.5	195.7	23.9	93.9	81

NO surveys in 2012

all data concerns 20 mm cod end mesh size except data marked with * which concerns 40 mm

(1) n/hour <20 cm converted to Noruega and NCT

(**) all area not covered

*** R/V Capricornio, other years R/V Noruega

Strata depth:

from 1979 to 1988 covers 20-500 m depth

from 1989 to 2004 covers 20-750 m depth

since 2005 covers 20-500 m depth

since 2002 tow duration is 30 min for autumn survey

Table 10.4 HAKE SOUTHERN STOCK - Spanish groundfish surveys; abundances and recruitment indices for total area (Mino - Bidasoa). Biomass for Cadiz surveys.

	Spanish Survey (SpGFS-WIBTS-Q4) (/30 min)						Cadiz Survey (SPGFS-caut-WIBTS-Q4) (/hour)				Cadiz Survey (SPGFS-cspr-WIBTS-Q4) (/hour)			
	Biomass index (Kg)			Abundance Index (nº)		Recruits (<20cm)	Biomass index (Kg)			Rec (<20cm)	Biomass index (Kg)			Rec (<20cm)
Year	Mean	s.e.	Hauls	Mean	s.e.	Mean	Mean	s.e.	hauls	Mean	Mean	s.e.	hauls	mean
1983	7.04	0.65	107	192.4	25.0	177								
1984	6.33	0.60	94	410.4	53.5	398								
1985	3.83	0.39	97	108.5	14.0	98								
1986	4.16	0.50	92	247.8	46.5	239								
1987														
1988	5.59	0.69	101	390.0	67.4	382								
1989	7.14	0.75	91	487.9	73.1	477								
1990	3.34	0.32	120	85.9	9.1	78								
1991	3.37	0.39	107	166.8	15.8	161								
1992	2.14	0.19	116	59.3	5.4	52								
1993	2.49	0.21	109	80.0	8.0	73					3.04	0.53	30	
1994	3.98	0.33	118	245.0	24.9	240					2.68	0.33	30	
1995	4.58	0.44	116	80.9	8.4	68					4.66	1.28	30	71.5
1996	6.54	0.59	114	345.2	40.5	335					7.66	1.14	31	72.7
1997	7.27	0.78	119	421.4	56.5	410	5.28	2.77	27	26.7	3.34	0.52	30	72.5
1998	3.36	0.28	114	75.9	8.7	65	2.66	0.42	34	6.6	2.93	0.67	31	18.6
1999	3.35	0.25	116	95.3	10.6	89	2.71	0.44	38	23.9	3.03	0.37	38	44.6
2000	3.01	0.43	113	66.9	7.4	59	2.03	0.61	30	18.6	3.02	0.47	41	39.7
2001	1.73	0.29	113	42.0	7.6	37	2.57	0.45	39	22.7	6.01	0.79	40	72.4
2002	1.91	0.23	110	57.1	8.8	53	3.39	0.78	39	118.6	2.74	0.25	41	22.4
2003	2.61	0.27	112	92.8	11.6	86	1.61	0.28	41	17.5				
2004	3.94	0.40	114	177.0	23.5	170	2.72	0.69	40	85.8	3.65	0.47	40	92.7
2005	6.46	0.53	116	344.8	32.2	335	6.68	1.29	42	100.6	10.77	5.65	40	184.3
2006	5.50	0.39	115	224.5	21.9	211	4.99	2.00	41	212.3	2.15	0.40	41	3.7
2007	4.97	0.43	117	158.2	15.0	150	6.92	1.43	37	200.3	3.22	0.68	41	51.1
2008	4.93	0.46	115	99.3	11.5	81	4.33	0.60	41	64.4	3.48	0.67	41	50.5
2009	9.32	0.94	117	559.7	93.9	789	7.35	0.97	43	95.0	4.24	0.06	40	65.6
2010	8.36	0.65	114	201.0	14.9	175	5.82	0.83	44	46.0	6.91	1.09	36	202.5
2011	8.98	0.68	111	241.5	21.0	216	2.97	0.38	40	48.2	3.75	0.50	42	32.2
2012	8.44	0.75	115	297.3	39.5	280	5.38	0.90	37	44.0	3.49	0.65	33	62.9
2013	5.59	0.78	114	136.9	13.6	118	12.52	2.04	43	285.6	5.50	0.56	40	76.5
2014	3.72	0.44	116	78.0	9.6	68	9.33	1.38	45	63.0	6.01	0.65	40	60.4

Since 1997 new depth stratification: 70-120m, 121-200m and 201-500 m
Before 1997: 30-100m, 101-200m and 201-500 m

Table 10.5 HAKE SOUTHERN STOCK. Landings (tonnes), Catch per unit effort and effort for trawl fleets

	A Coruña Trawl			Portugal trawl		
YEAR	**Landings**	**lpue (Kg/day x100 HP)**	**Effort**	**Landings**	**lpue (Kg/hour std)**	**Effort**
1985	945	21	45920			
1986	842	21	39810			
1987	695	20	34680			
1988	698	17	42180			
1989	715	16	44440	1847	38.6	47810
1990	749	17	44430	1138	33.4	34106
1991	501	12	40440	1245	37.7	33035
1992	589	15	38910	1325	33.8	39257
1993	514	12	44504	871	31.0	28053
1994	473	12	39589	789	31.1	25341
1995	831	20	41452	1026	38.4	26690
1996	722	20	35728	894	34.2	26121
1997	732	21	35211	906	38.1	23781
1998	895	27	32563	913	35.0	26053
1999	691	23	30232	1092	40.4	27019
2000	590	20	30102	1162	32.0	36312
2001	597	20	29923	1210	36.6	33048
2002	232	11	21823	970	36.0	26975
2003	274	15	18493	962	35.8	26855
2004	259	12	21112	800	35.0	22849
2005	330	16	20663	965	37.1	25997
2006	518	27	19264	908	35.8	25369
2007	621	29	21201	724	35.4	20447
2008	762	38	20212	936	41.9	22353
2009	640	40	16162	964	42.2	22836
2010	553	40	13744	727	43.1	16855
2011	538	47	11532			
2012	498	42	11887			
2013*	542	37	14736			
2014*	493	27	18060			

Spanish LPUEs are scientific estimations from a selection of ships that may change from year to year.

* **Spanish sampling method changed for effort and landings**

Table 10.6. Southern Hake Stock Assessment summary

Year	Mort (1-3)	R (million)	SSB ('000 tn)	Land ('000 tn)	Disc ('000 tn)	Catch ('000 tn)
1982	0.36	98.40	41.10	17.59		17.59
1983	0.44	81.48	45.80	22.95		22.95
1984	0.45	69.48	43.05	22.18		22.18
1985	0.42	44.09	43.15	18.94		18.94
1986	0.45	40.97	40.03	17.16		17.16
1987	0.51	50.13	36.77	16.18		16.18
1988	0.65	71.23	27.03	16.65		16.65
1989	0.65	78.08	19.90	13.79		13.79
1990	0.69	82.32	16.29	13.19		13.19
1991	0.69	69.86	16.46	12.83		12.83
1992	0.84	52.41	15.53	13.80	0.47	14.27
1993	0.91	61.08	12.77	11.48	0.68	12.17
1994	0.89	119.55	8.91	9.86	0.99	10.86
1995	1.18	51.26	7.10	12.24	2.10	14.34
1996	1.15	101.03	8.55	9.71	1.91	11.62
1997	1.17	80.48	6.56	8.50	2.27	10.77
1998	0.93	57.59	5.81	7.68	1.68	9.36
1999	0.78	66.66	7.55	7.17	1.52	8.69
2000	0.88	70.38	8.82	7.90	1.83	9.74
2001	0.86	48.25	8.97	7.58	1.66	9.24
2002	0.82	70.67	9.38	6.69	1.49	8.18
2003	0.84	60.08	9.07	6.74	1.46	8.21
2004	0.74	80.51	8.96	6.94	0.91	7.86
2005	0.77	126.16	9.29	8.33	1.98	10.31
2006	0.89	97.77	10.80	10.82	3.26	14.08
2007	0.94	159.00	12.79	14.93	2.50	17.44
2008	0.93	116.22	12.70	16.80	2.31	19.11
2009	1.01	108.01	13.83	19.24	2.93	22.17
2010	0.79	71.76	12.94	15.37	1.58	16.95
2011	0.89	95.94	15.23	17.06	1.95	19.01
2012	0.85	95.01	14.76	14.57	1.82	16.40
2013	0.67	78.34	14.04	11.35	2.55	13.91
2014*	0.68	61.68	18.84	11.88	2.60	14.48

Landings do not include France data presented in table 7.1

Table 10.7. Short term projections

	SSB 2015	BIO 2015	F 2015	Yield 2015	Catch 2015	SSB 2016	BIO 2016
number	18856	23030	0.67	12980	14768	17684	22303

Fmult	F 2016	Yield 2016	Catch 2016	SSB 2017	
0	0.00	0	0	41158	
0.1	0.06	1604	1830	38057	
0.20	0.13	3120	3564	35122	
0.30	0.19	4550	5203	32376	
0.38	**0.24**	**5566**	**6371**	**30438**	***Fmsy***
0.40	0.26	5897	6752	29809	
0.50	0.32	7165	8213	27412	
0.60	0.39	8357	9590	25176	
0.70	0.46	9475	10887	23093	
0.80	0.53	10522	12105	21155	
0.85	0.57	11020	12685	20238	
0.90	0.60	11502	13247	19354	
0.93	**0.62**	**11752**	**13541**	**18895**	***Rec Plan (TAC 2015 * 0.85)***
1.00	0.67	12416	14318	17683	
1.10	0.75	13267	15320	16134	
1.20	0.82	14059	16255	14701	
1.45	1.03	15900	18448	11388	

There is a EC Recovery Plan (-10% annual F redution; +-15% TAC constrain)
Fmsy proxi = Fmax (0.24)
TAC 2015 = 13 826 (-+15% [15 900, 11 752])
Recruitment = 80 mill (geo mean 1989-13)

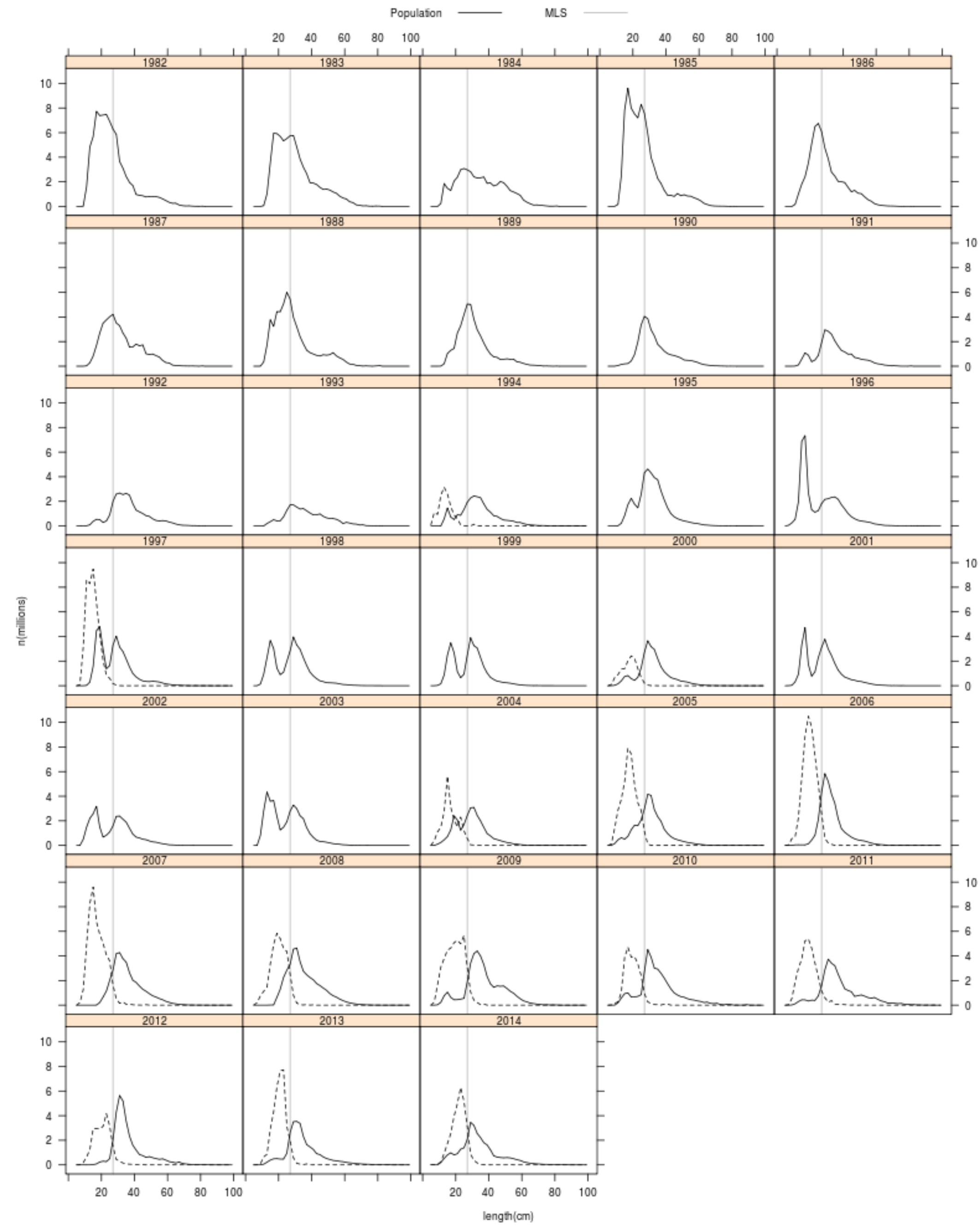


Figure 10.1. Length distribution of catches used in the assessment. Landings and discards. Minimum landing size (MLS) since 1992 at 27 cm.

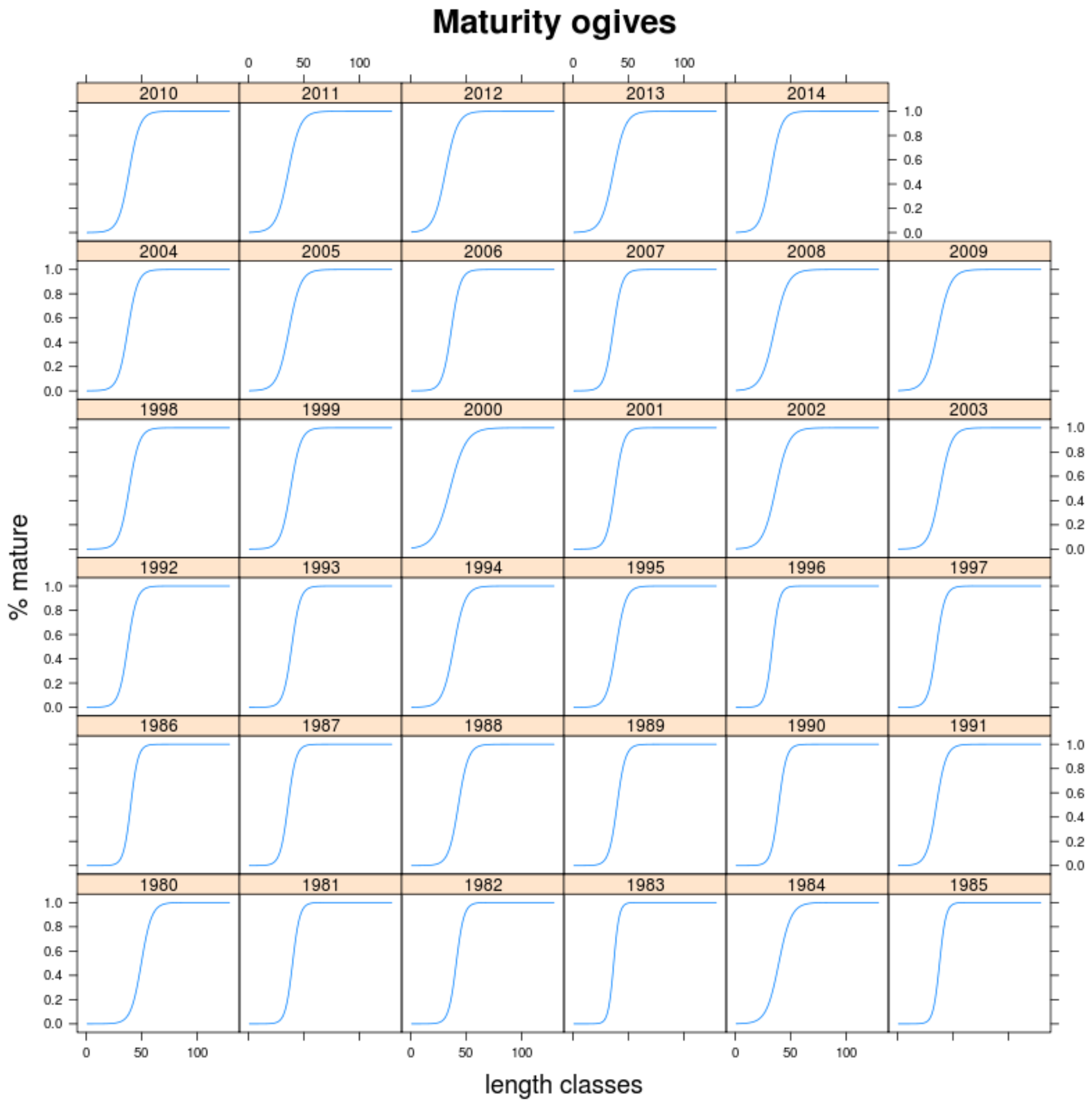
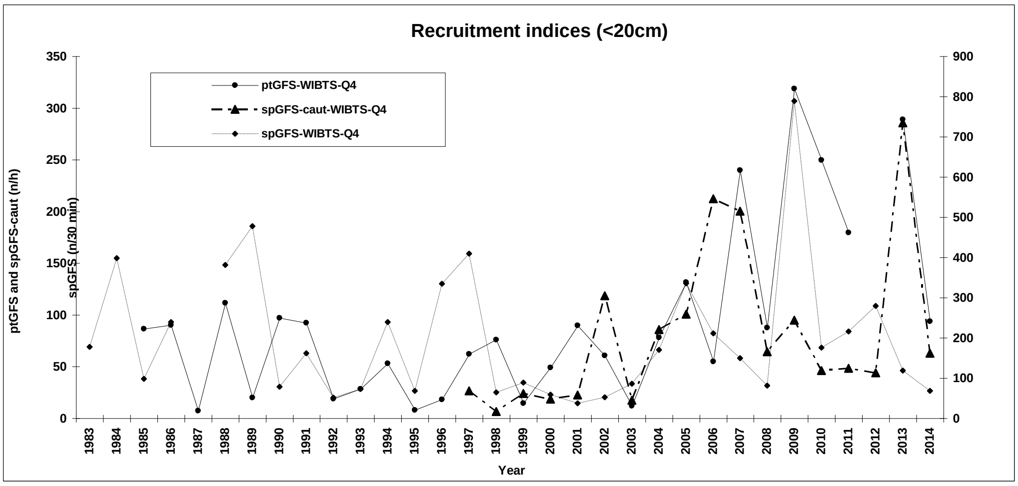


Figure 10.2 Maturity ogives from 1908 to end



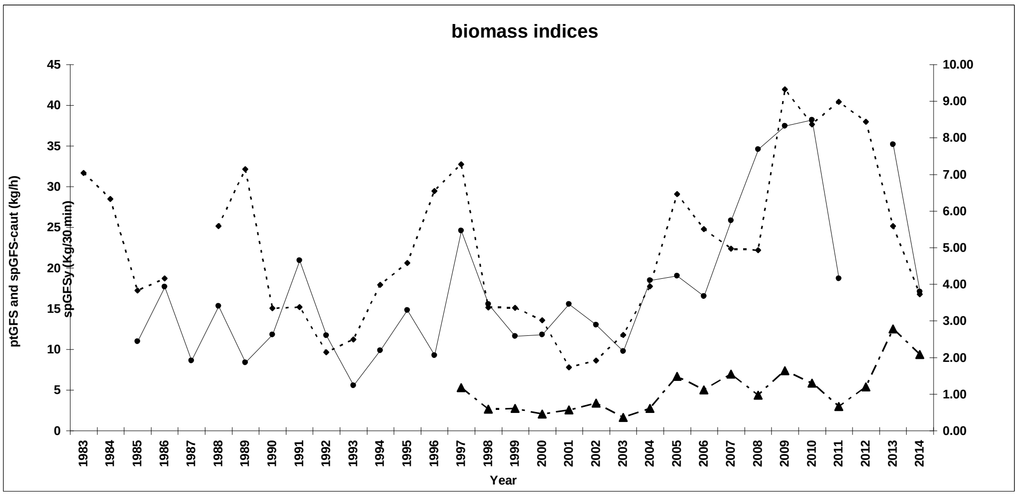


Figure 10.3 HAKE SOUTHERN STOCK - Recruitment and biomass Indices from groundfish surveys

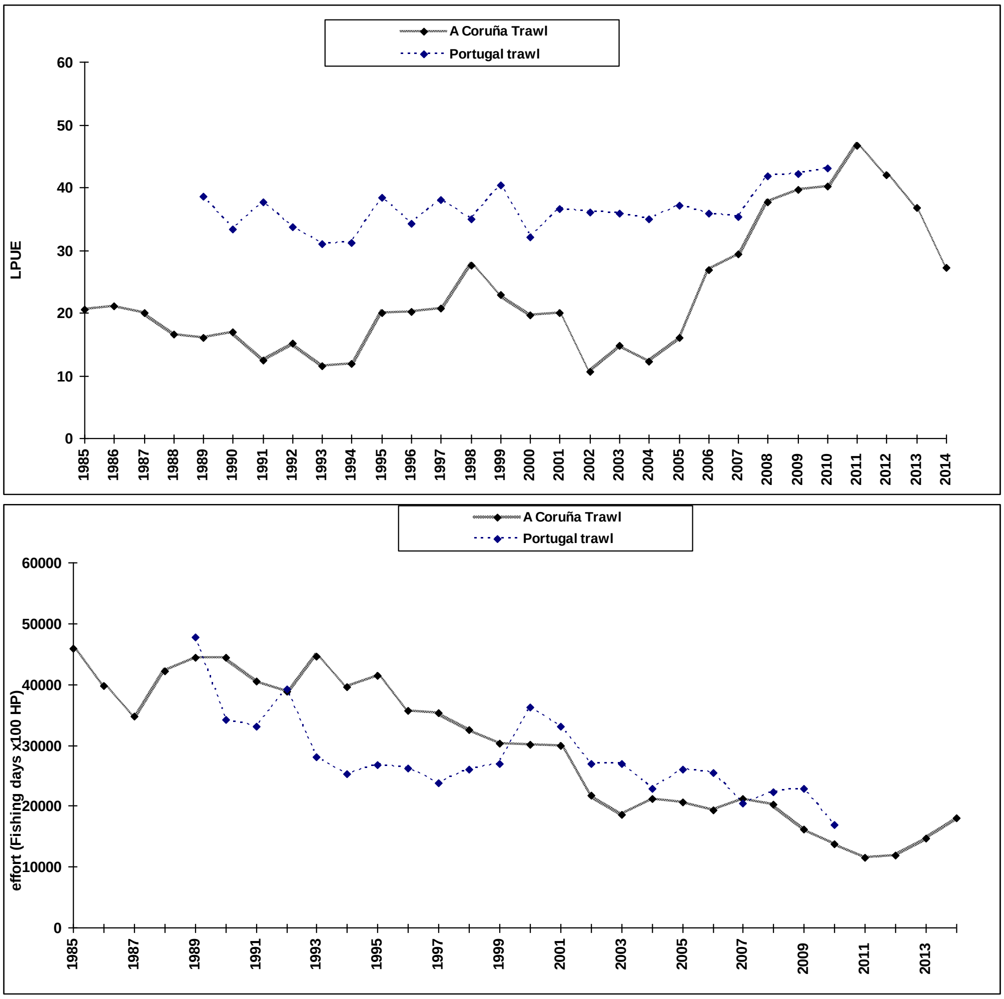


Figure 10.4 HAKE SOUTHERN STOCK- LPUE and fishing effort trends for trawl fleets

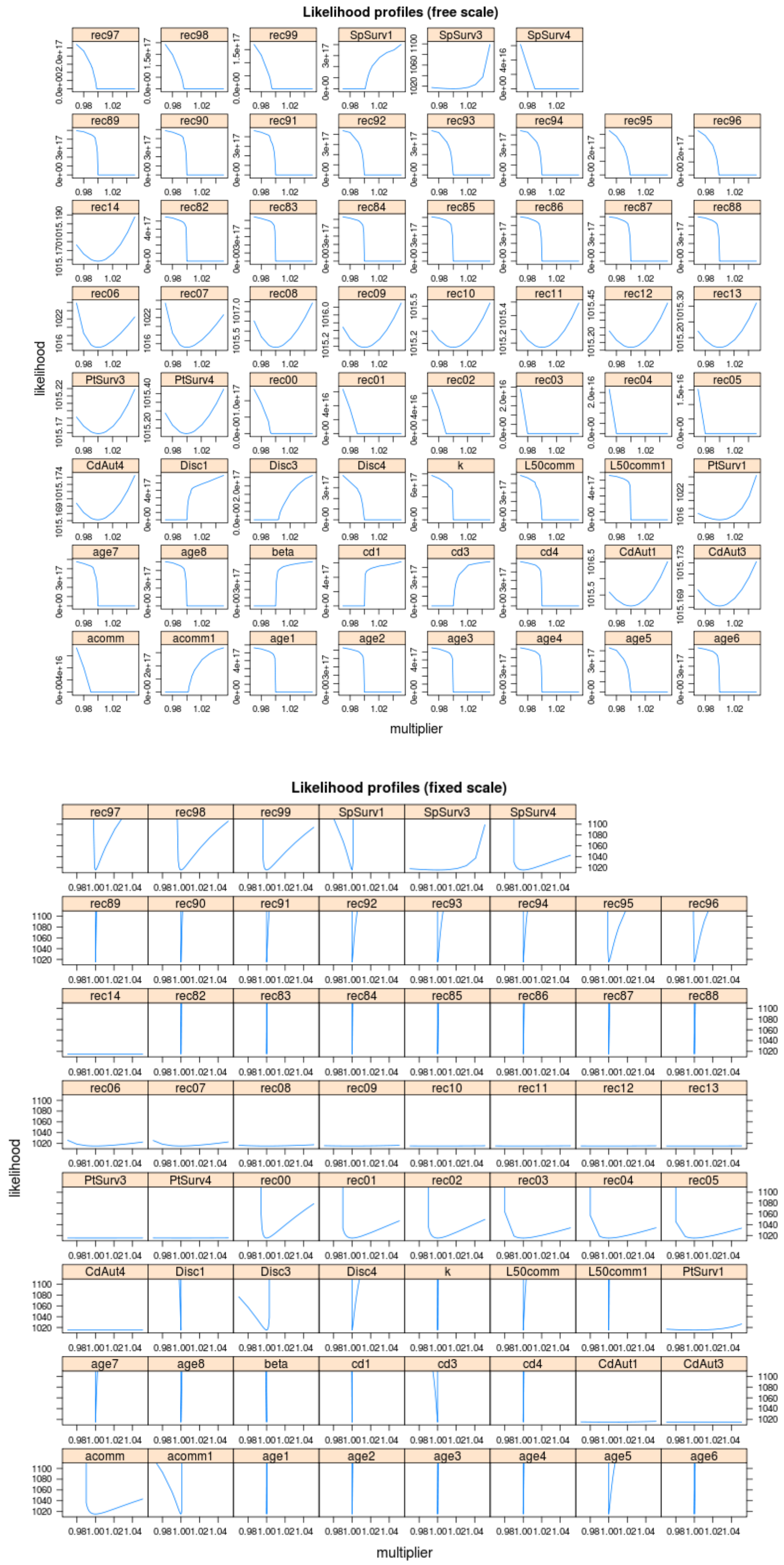
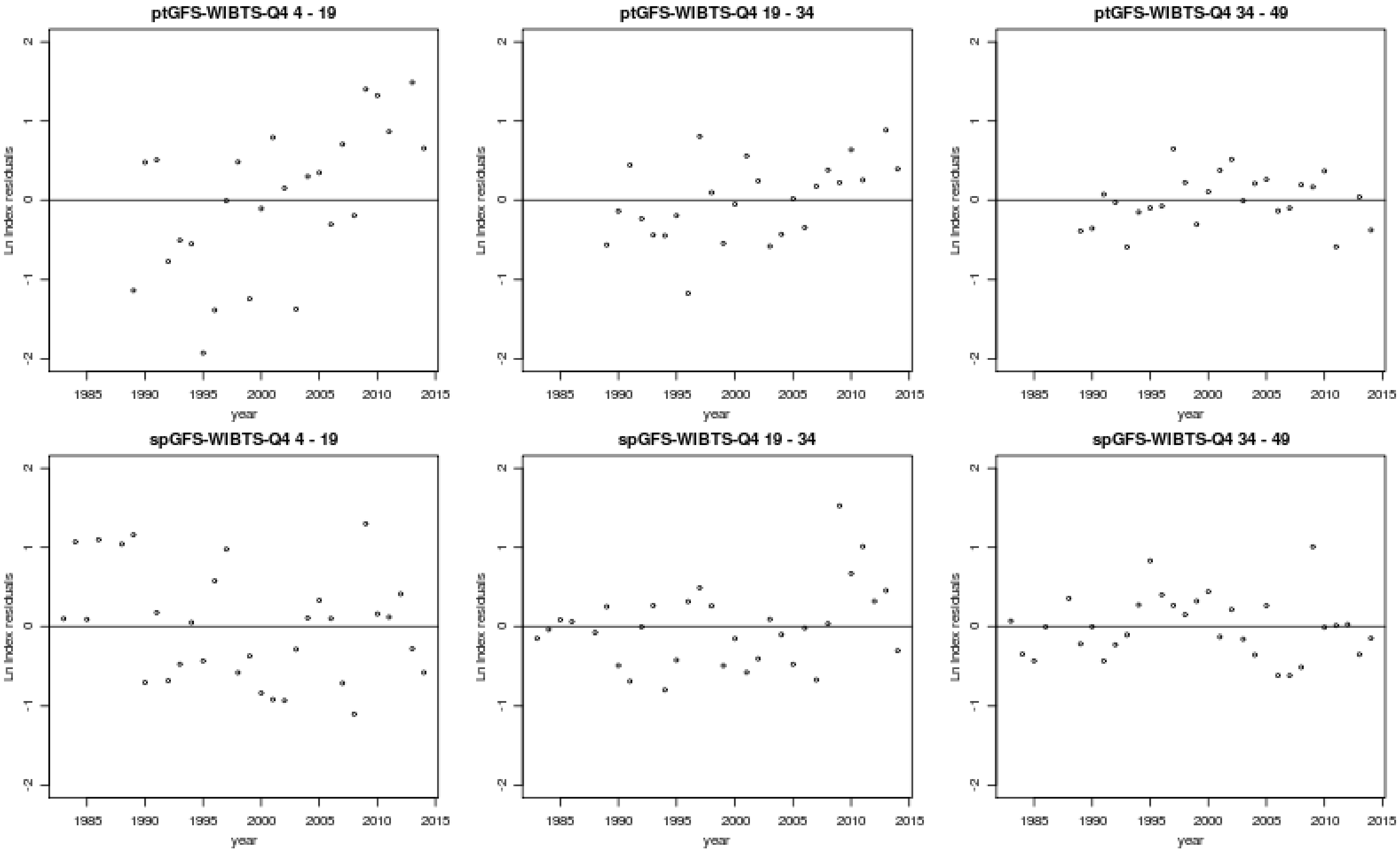
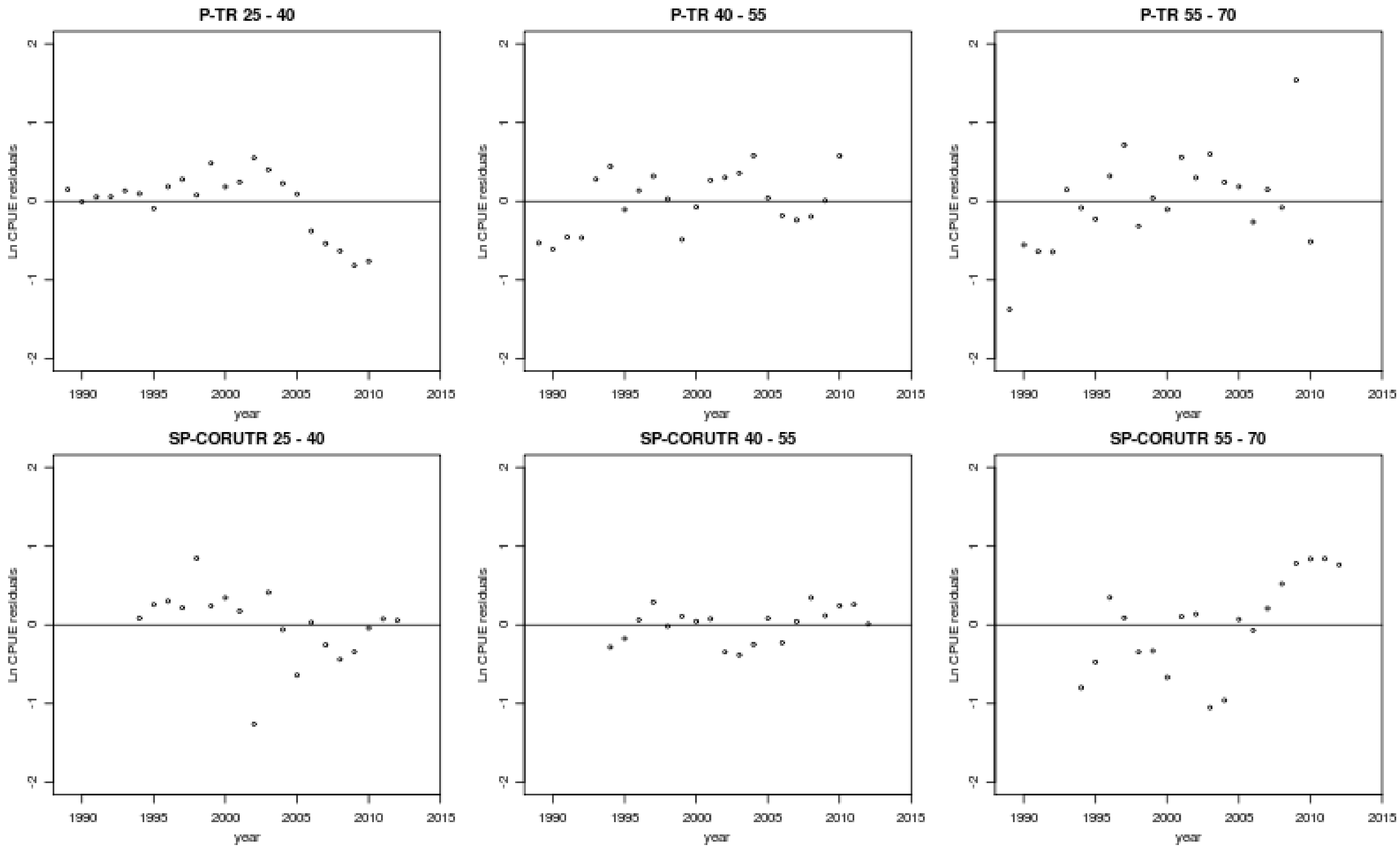


Figure 10.5. Gadget convergence with likelihood profiles. Free scaled (upper panel) and fixed scaled (lower panel)

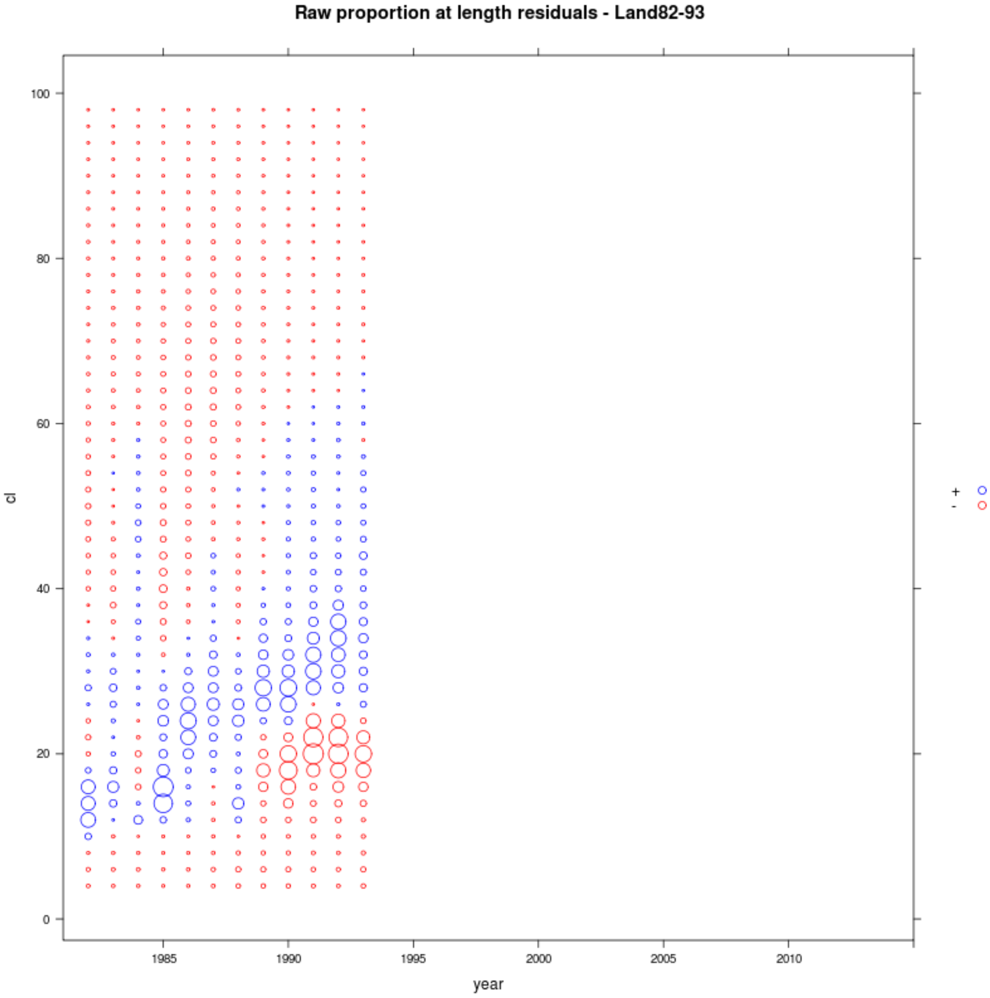
Figure 10.6 Diagnostics Residuals (10.6 a and b). Observed vs. expected length proportions (10.6 c-i))



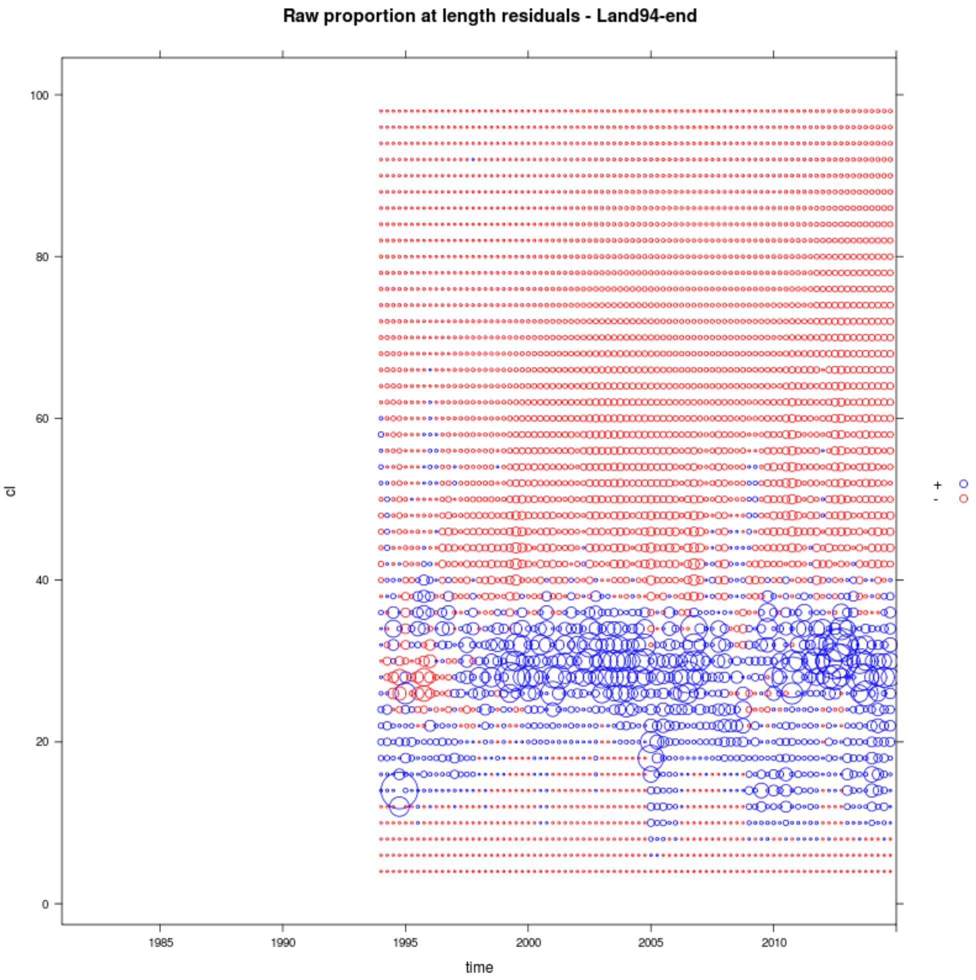
(10.6 a) Survey residuals by 15 cm groups (4-19, 19-34, 34-49 cm)



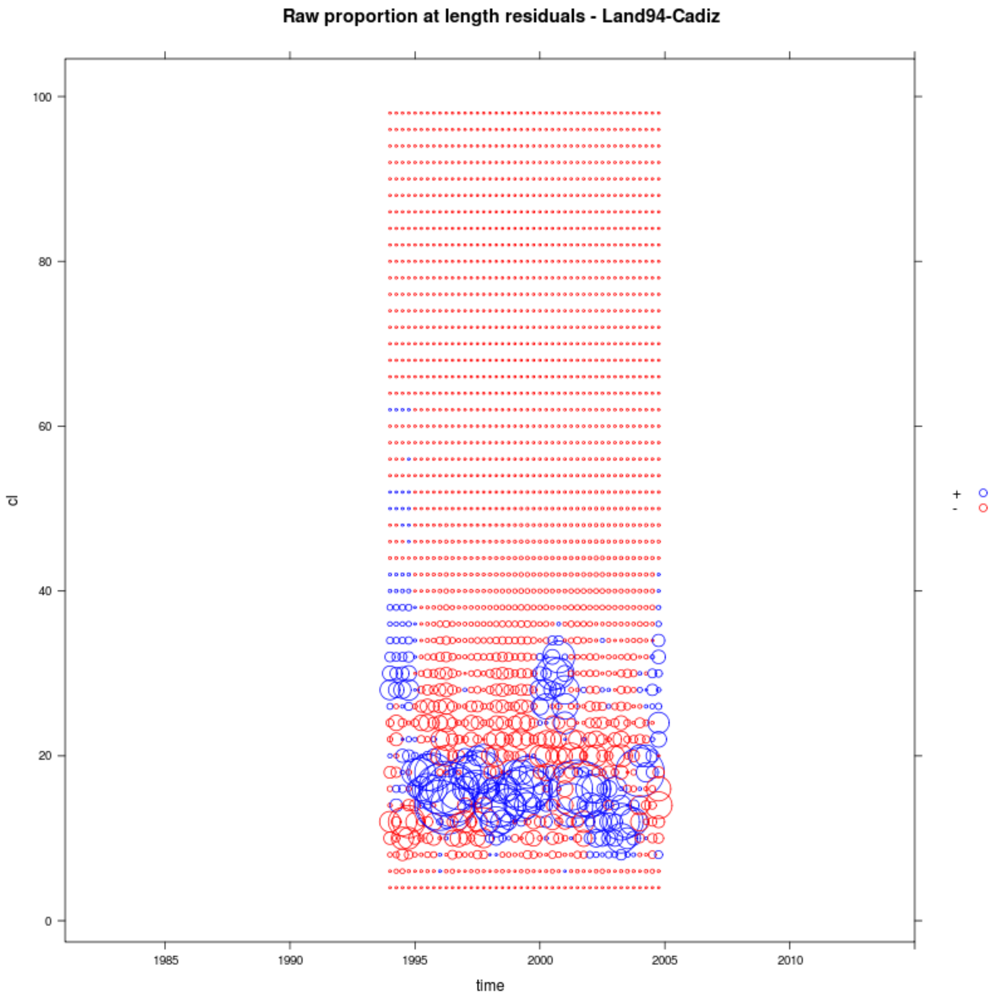
(10.6 b) LPUE residuals by 15 cm groups (25-40, 40-55, 55-70 cm)



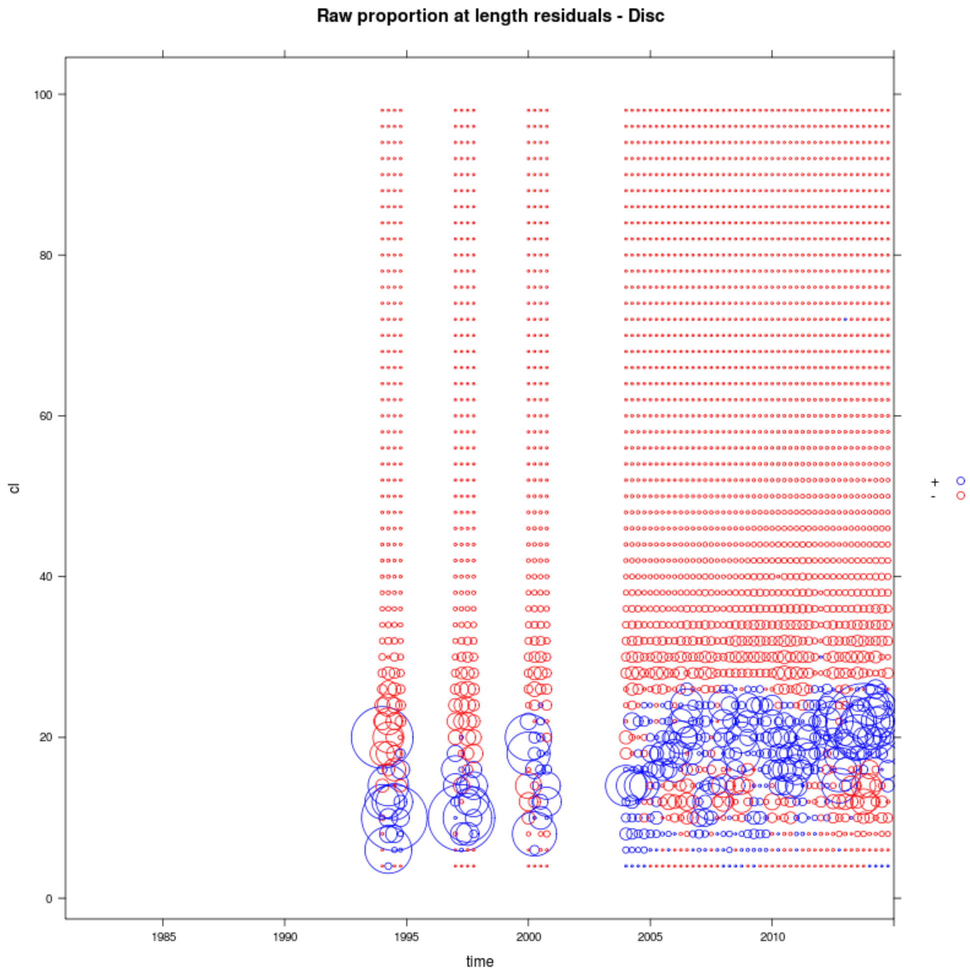
(10.6 c). Bubble plot for landings length distribution from 1982 to 1993.



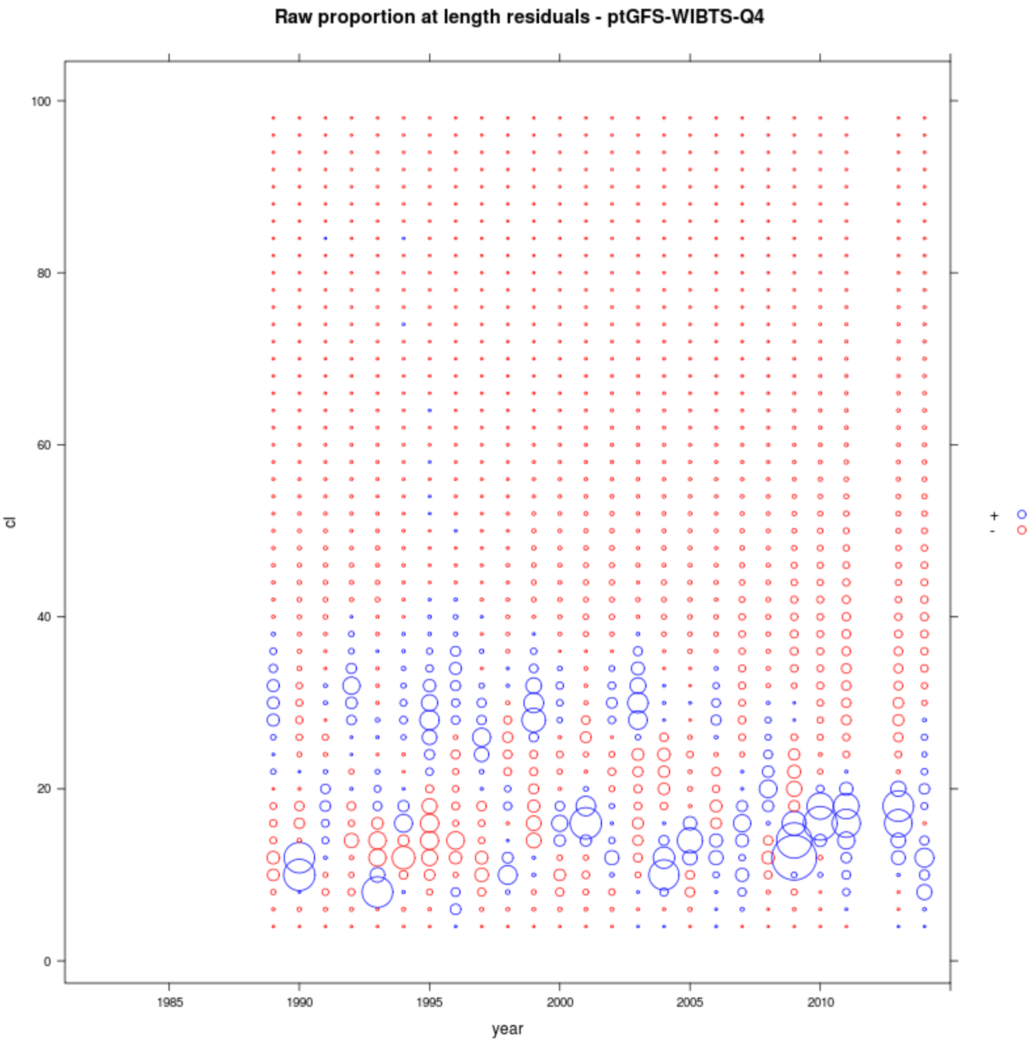
(10.6 d). Bubble plot for landings length distribution from 1994 to last year.



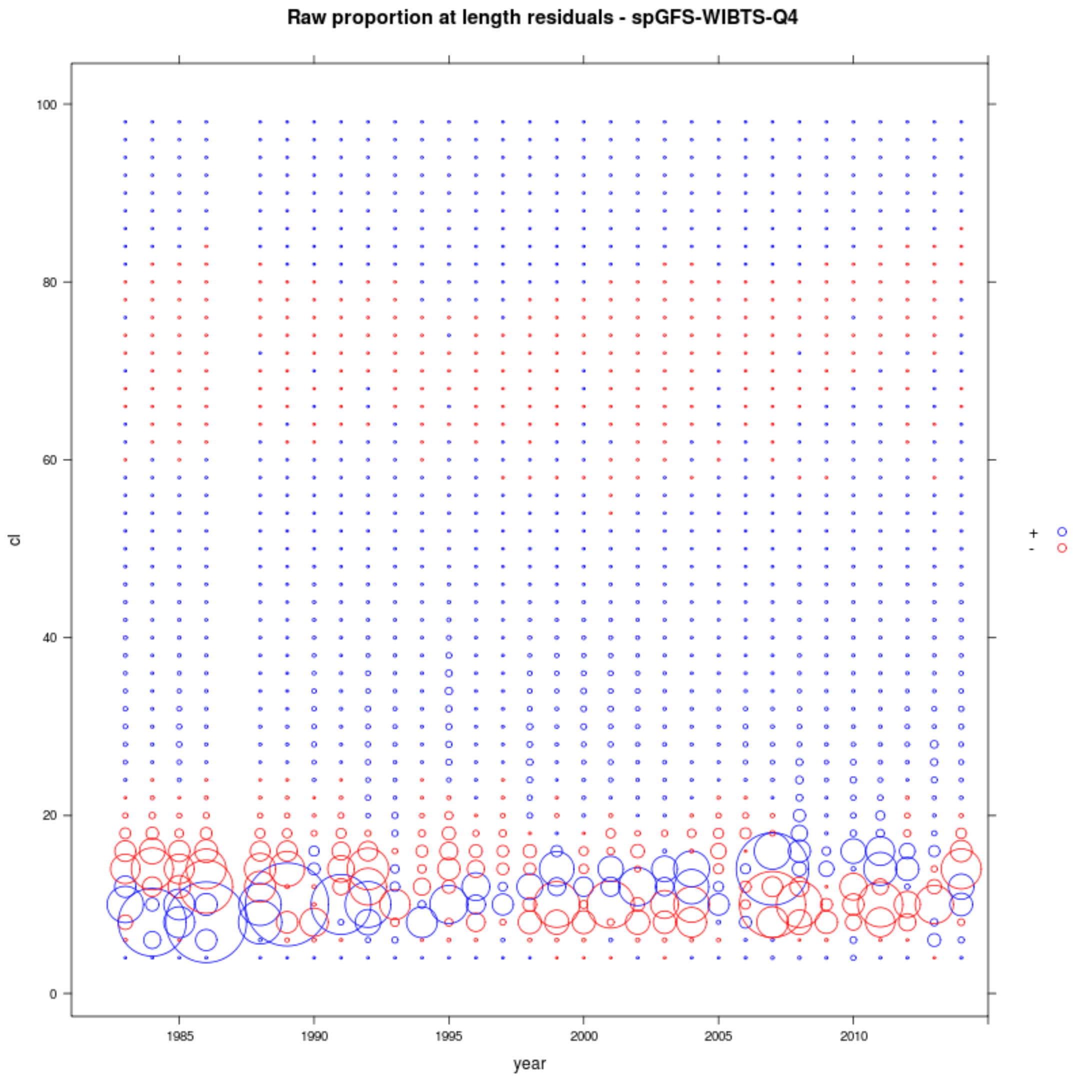
(10.6 e). Bubble plot for Cadiz landings length distribution from 1982 to 2004.



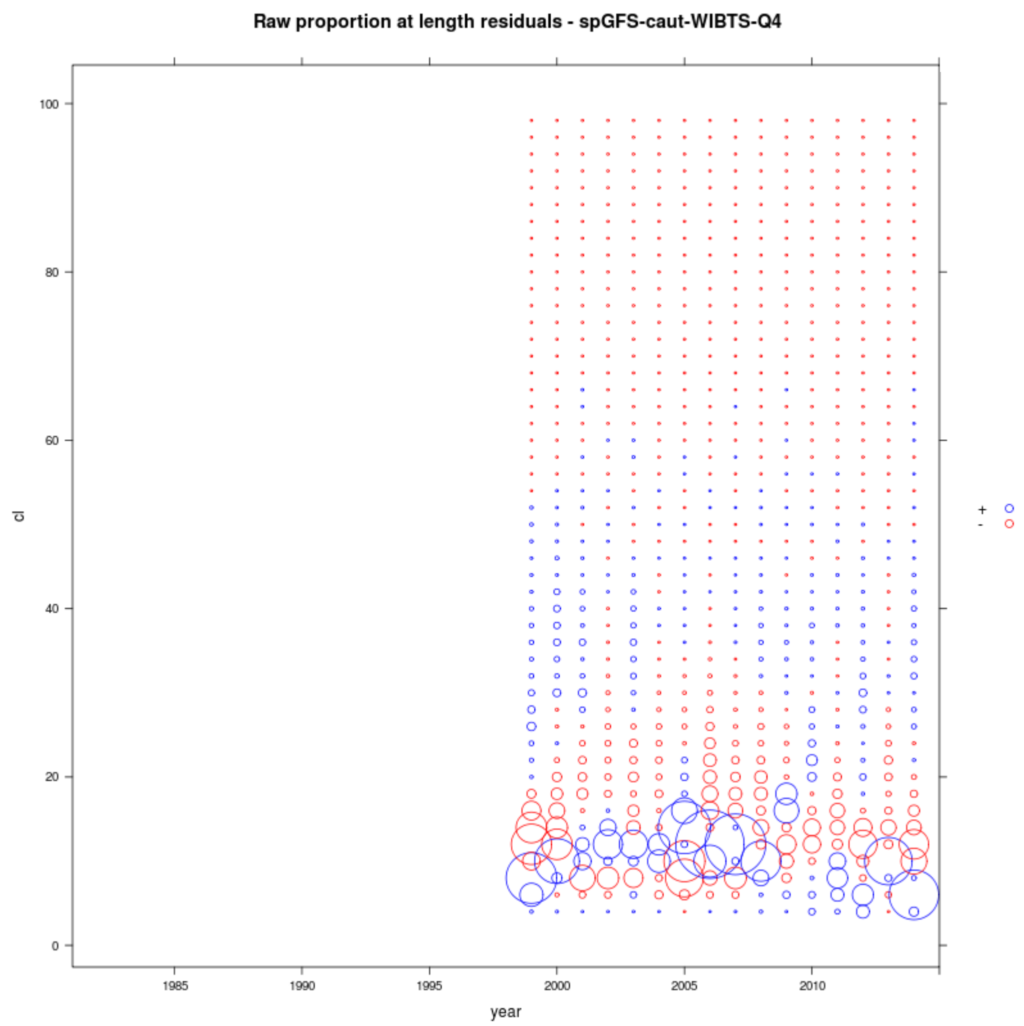
(10.6 f). Bubble plot for Discards length distribution for years 1993,97,99, 2004-end



(10.6 g) Bubble plot for Portuguese demersal survey (ptGFS-WIBTS-Q4)



(10.6 h) Bubble plot for North Spain demersal survey (spGFS-WIBTS-Q4)



(10.6 i) Bubble plot for South Spain (Cadiz) demersal survey (spGFS-caut-WIBTS-Q4)

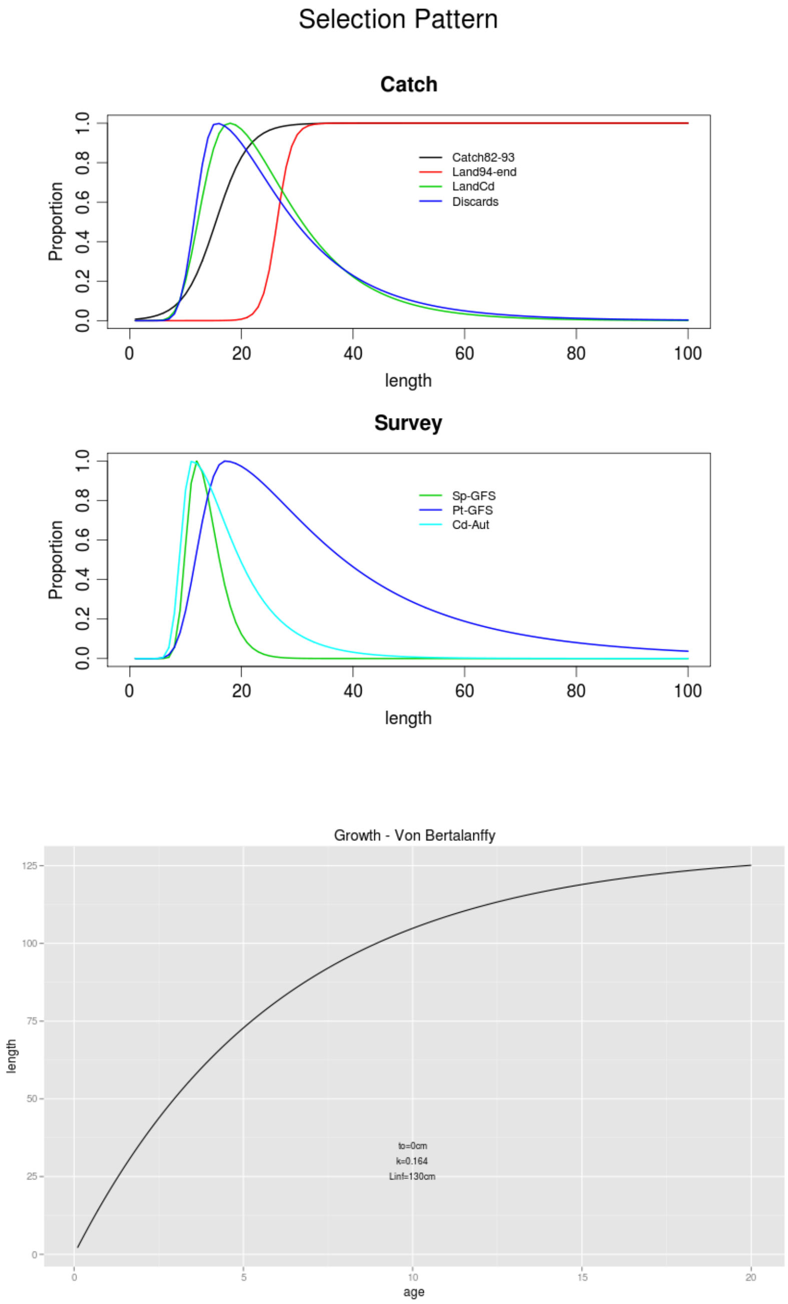


Figure 10.7. Selection pattern (upper panel) and and von Bertalanffy growth with k parameter estimated by the model (lower panel)

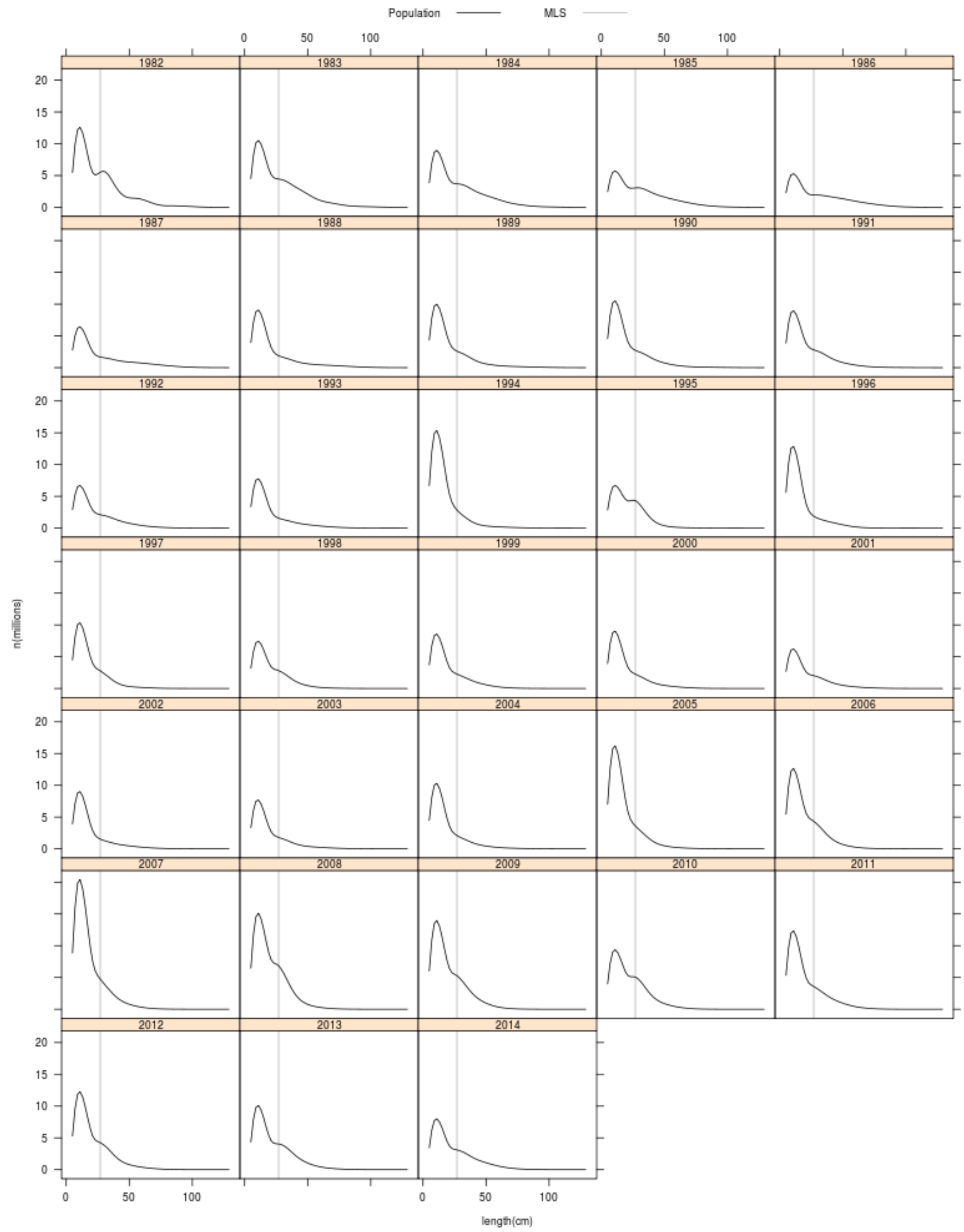


Figure 10.8. Population length distribution (4rd quarter)

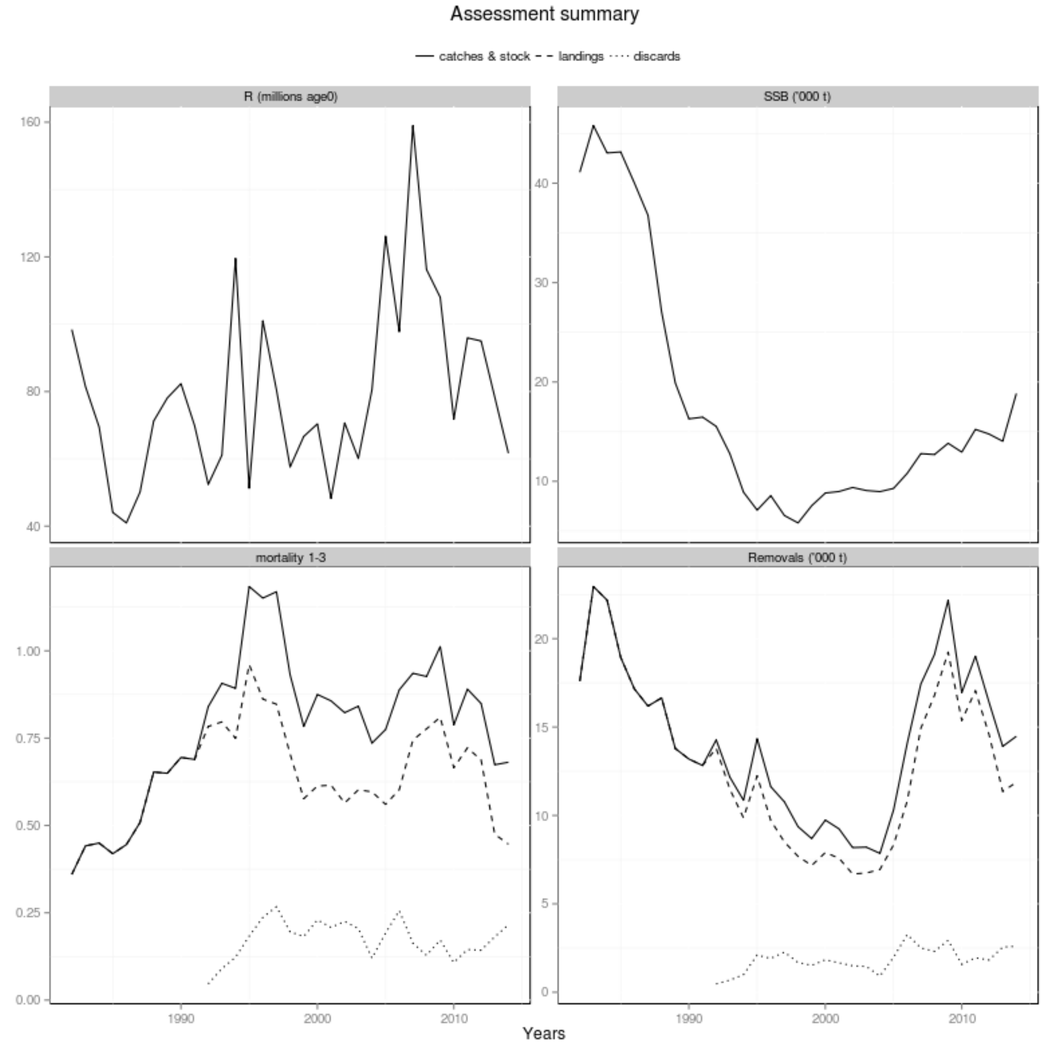


Figure 10.9. Summary plot. SSB and removals (catch, landings and discards)

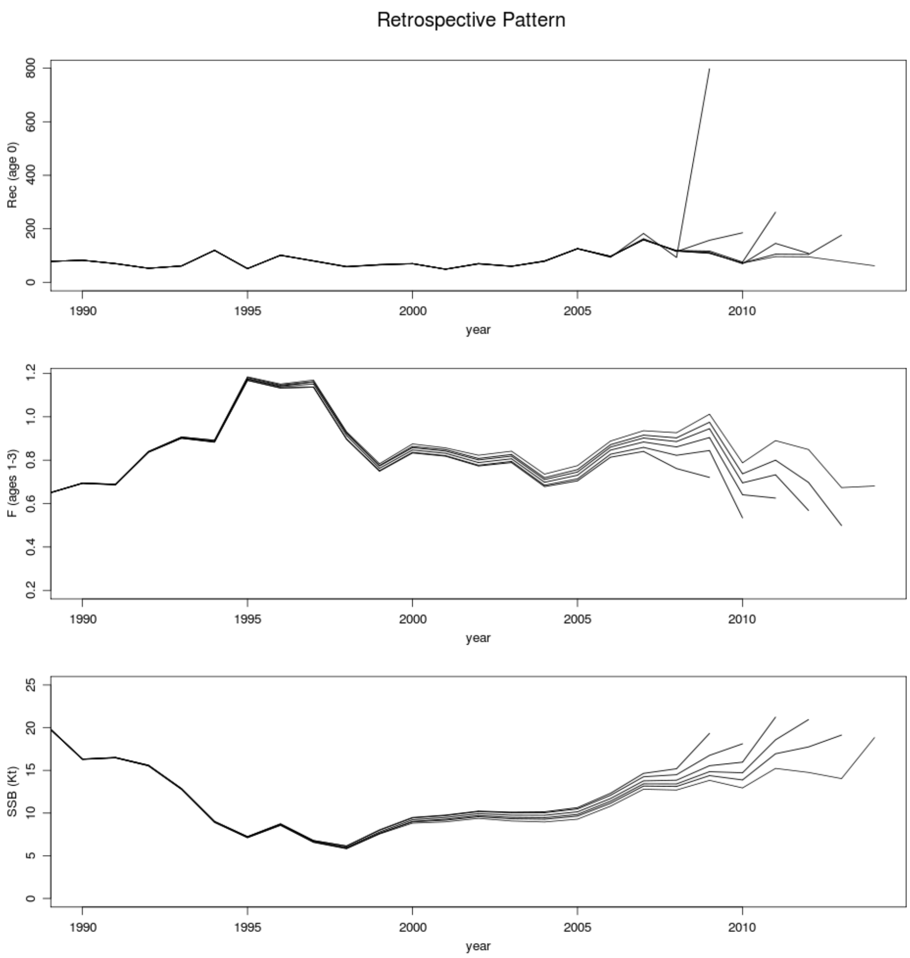


Figure 10.10. Retrospective plot

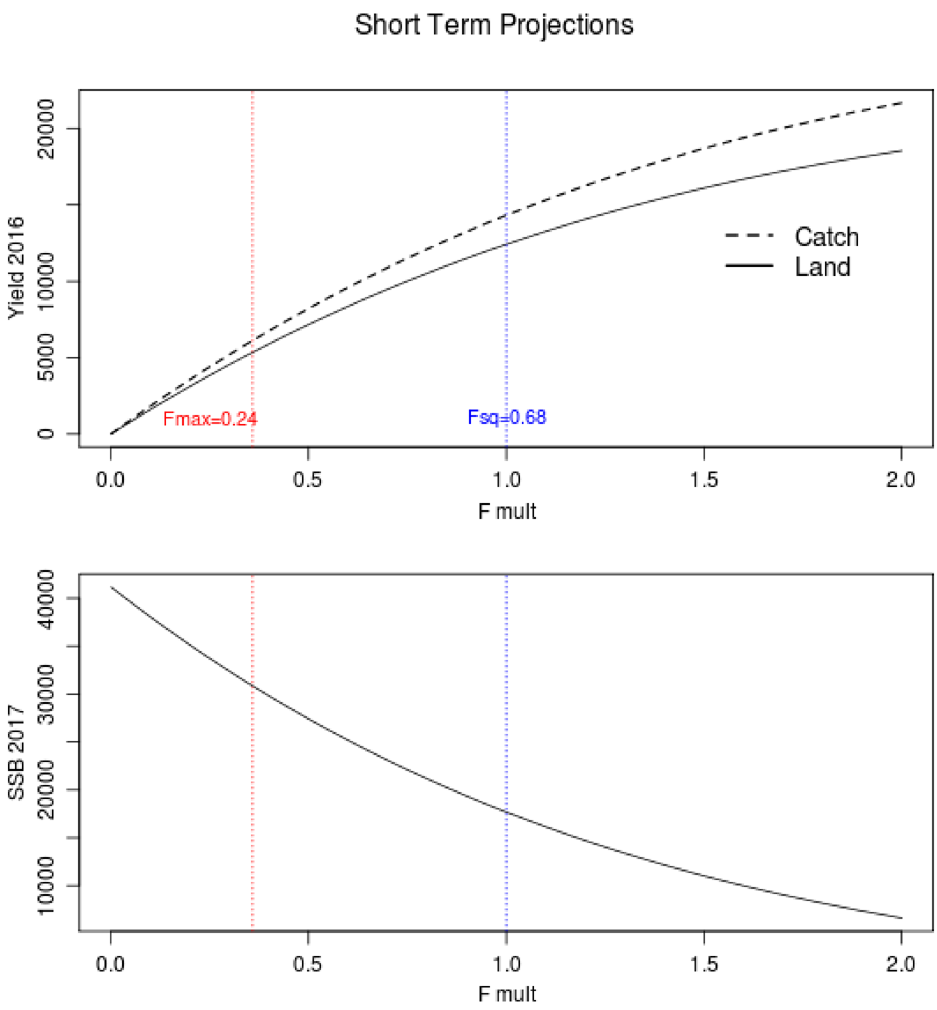


Figure 10.11. Short term projections

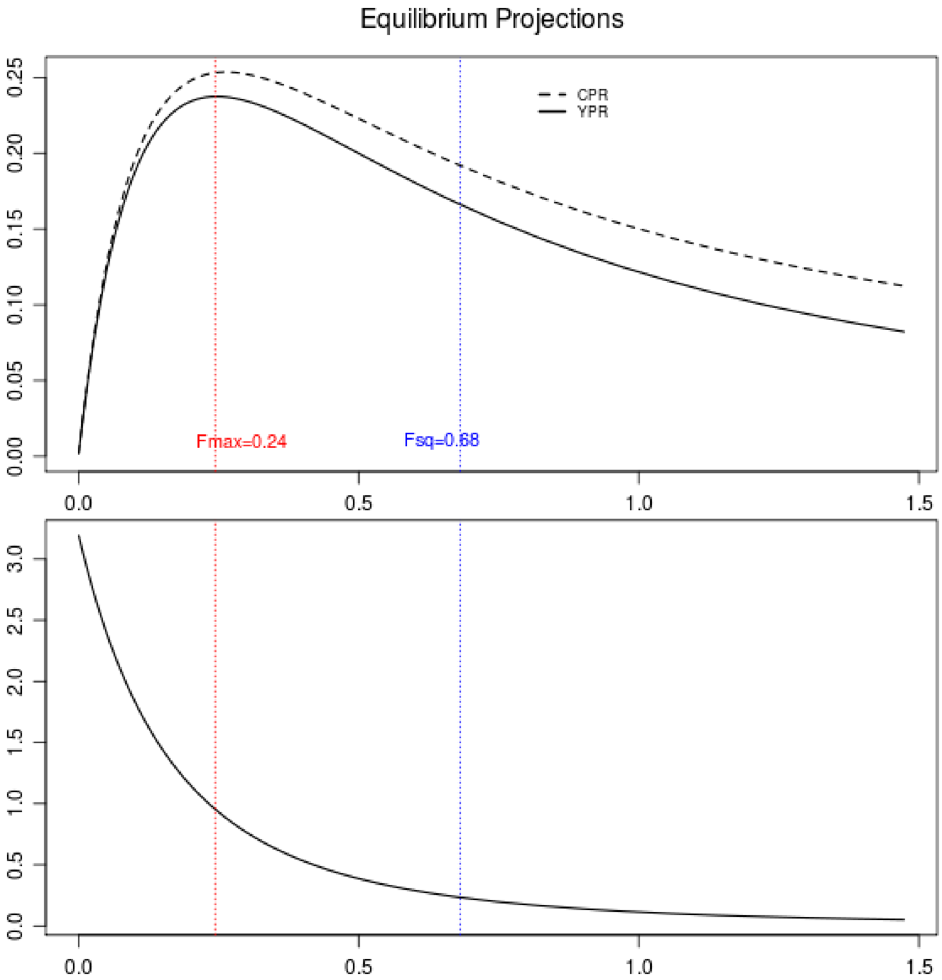


Figure 10.12. Long term yield and SSB per recruit

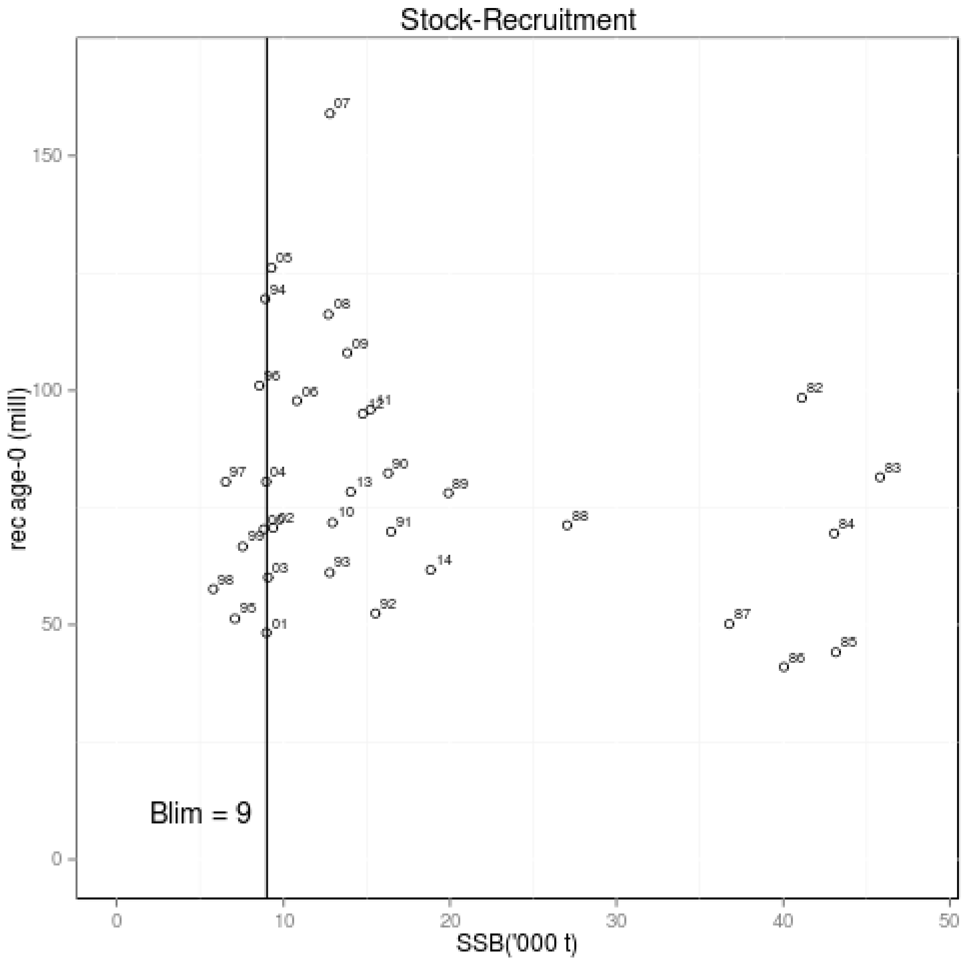


Figure 10.13 Stock-Recruitment plot.

11 Nephrops (Divisions VIII ab, FU 23-24)

Type of assessment: biennal assessment

Main changes from the last assessment (WGBIE2014):

No relevant.

Previously, some changes have occurred since the IBP Nephrops 2012:

- *Methodology for discard derivation (probabilistic approach replaced the proportional one).*
- *Scientific time series provided by the survey LANGOLF included in the tuning data (although the survey was stopped in 2014).*

ICES description	VIIIa,b
Functional Units	Bay of Biscay North, VIII a (FU 23)
	Bay of Biscay South, VIII b (FU 24)

11.1 General

11.1.1 Ecosystem aspects

This section is detailed in Stock Annex.

11.1.2 Fishery description

The general features of the fishery are given in Stock Annex.

11.1.3 ICES Advice for 2015

For 2015 *ICES based on approach for data-limited stocks, advised that landings should increase by no more than 14%* (*i.e.* 3214 t).

11.1.4 Management applicable for 2014 and 2015

Species:	Norway lobster *Nephrops norvegicus*	**Zone:**	VIIIa, VIIIb, VIIId and VIIIe (NEP/8ABDE.)
Spain	234		
France	3 665		
Union	3 899		
TAC	3 899		Analytical TAC

The *Nephrops* fishery is managed by TAC [articles 3, 4, 5(2) of Regulation (EC) No 847/96] along with technical measures. The agreed TAC for 2015 was 3 899 t (the same as for 2013 and 2014) whereas the ICES recommendation was to reduce catch. In 2014, total nominal landings reached 2 807 t.

For a long-time, a minimum landing size of 26 mm CL (8.5 cm total length) was adopted by the French producers' organisations (larger than the EU MLS set at 20 mm CL *i.e.* 7 cm total length). Since December 2005, a new French MLS regulation (9 cm total length) has been established. This change has already significantly impacted on the data used by the WG (see report WGHMM 2007).

A mesh change was implemented in 2000 and the minimum codend mesh size in the Bay of Biscay was 70 mm instead of the former 55 mm for *Nephrops*, which had replaced 50 mm mesh size in 1990-91. 100 mm mesh size is required in the *Hake* box. For 2006 and 2007, *Nephrops* trawlers were allowed to fish in the hake box with mesh size smaller than 100 mm once they have adopted a square mesh panel of 100 mm. This derogation was maintained onwards.

As annotated in the Official Journal of the European Union (p.4, art. 27): "*In order to ensure sustainable exploitation of the hake and Norway lobster stock and to reduce discards, the use of the latest developments as regards selective gears should be permitted in ICES zones VIIIa, VIIIb and VIIId.*"

In agreement with this, the National French Committee of Fisheries (deliberations 39/2007, 1/2008) fixed the rules of trawling activities targeting *Nephrops* in the areas VIIIa, VIIIb applicable from the 1st April 2008. All vessels catching more than 50 kg of *Nephrops* per day must use a selective device from at least one of the following: (1) a ventral panel of 60 mm square mesh; (2) a flexible grid or (3) a 80 mm codend mesh size. The majority of *Nephrops* directed vessels (Districts of South Brittany) chose the increase of the codend mesh size whereas the ventral squared panel was adopted by multi-purpose trawlers (mainly in harbours outside Brittany).

A licence system was adopted in 2004 and, since then, there has been a cap on the number of *Nephrops* trawlers operating in the Bay of Biscay of 250 (less than 200 in 2014). In the beginning of 2006, the French producers' organisations adopted new additional regulations such as monthly quotas which had some effects on fishing effort limitation.

11.2 Data

11.2.1 Commercial catches and discards

Total catches, landings and discards, of *Nephrops* in division VIIIa,b for the period 1960-2014 are given in Table 11.1.

Throughout the mid-60's, the French landings gradually increased to a peak value of 7 000 t in 1973-1974, then fluctuated between 4 500 and 6 000 t during the 80's and the mid-90's. An increase has been noticeable during the early 2000's. Landings remained stable between 2008 and 2009 (3 030 t and 2 987 t) whereas they had decreased compared with previous years (3 176 in 2007, 3 447 t in 2006 and 3 991 t in 2005). In 2010 and 2011, total landings increased (3 398 t and 3 559 t respectively). In 2012 and 2013, a strong reduction of the landings occurred (2 520 t and 2 380 t respectively). In 2014, landings increased significantly (2 807 t: +18%). Landings since 2008 have been reached under the new selectivity regulations.

Males usually predominate in the landings (sex ratio, defined as number of females divided by total, fluctuates between 0.31 and 0.46 for the overall period 1987-2014) and in a lesser degree in the removals (sexio ratio in the range 0.35-0.49). Females are less accessible in winter because of burrowing and, also, they have a lower growth rate. The female proportion in landings slightly increased up to the late 1990’s/early 2000's, but this trend was not confirmed in recent years probably because of the MLS increase (December 2005) and, moreover, because of the new selectivity regulations (April 2008).

Discards represent most of the catches of the smallest individuals as indicated by the available data (Figure 11.1). The average weight of discards per year in the period up to early 2000's (not routinely sampled) is about 1 550 t whereas discard estimates of the recent sampled years (2003-2014) reached a higher level of 1 993 t. This change in the amount of discards could be due to the restriction of individual quotas (notably applied since 2006), the strength of some recruitments in the middle of 2000's and the change in the MLS (which tends to increase the discards), although the change in the selectivity should tend to reduce the discards. The relative contribution of each of these three factors remains unknown. In 2014, 118 million individuals were estimated to have been discarded (1 326 t).

11.2.2 Biological sampling

Discard data by sampling on board are available for 1987, 1991, 1998 and from 2003. For the intermediate years up to 2002, since the former WGNEPH, numbers discarded at length were derived by the "proportional method" calculating discards by sex for years with no sampling onboard by applying identical quarterly LFDs of the preceding sampled year raised to the quarterly landings *i.e.* for years 1992-1997 derivation used quarterly LFDs from 1991. This method was suspected to induce inter-dependence throughout the time series, therefore, lack of contrast for annual recruitment. IBP *Nephrops* 2012 even not finally conclusive investigated the probabilistic (logistic) approach developed for the WGHMM since 2007 (Table 11.2; see Stock Annex) and compared with the previous discard derivation. The probabilistic calculation provides wider variations on number of removals for age group 1 and 2 after conversion of the size composition to an age one (under assumptions involving in individual growth by sex according to Von Bertalanffy's function as used by previous WGs). Since the WGHMM 2012, the probabilistic method has been chosen: the derivation is performed by sex and quarter using logistic function describing the s-shaped hand-sorting onboard and assuming symmetrical densities of probability for yearly LFDs as tested on years with sampling onboard before MLS change (up to 2005).

Since 2003, discards have been estimated from sampling catch programmes on board *Nephrops* trawlers (488 trips and 1 402 hauls have been sampled over 12 years). In spite of improvements in agreement between logbook declarations and auction hall sales since the middle of 2000's, the quality of crossed information fluctuates between years. *e.g.* for years 2007-2014 the percentage of cross-validation item by item between logbooks and sales was comprised in a wide range of 69 to 90% (85% for 2014). Therefore, the total number of trips is usually not well known and needs to be estimated under assumptions. This can be done using the number of auction hall sales, when boats conduct daily trips, which is the case in the northern part of the fishery, but not in the southern one. Discard sampling from the southern part of the fishery was carried out only once in the past (2005), but the sampling plan has been routinely applied since 2010.

The length distribution of landings, discards, catches and removals are presented in Tables 11.3.a-h and in Figure 11.1. Removals at length are obtained by adding the landings and "dead discards" and applying a discard mean survival rate of 30% (Charuau et *al.*, 1982). Combined sex mean lengths are presented for catches, landings and discards in Figure 11.2.

11.2.3 Abundance indices from surveys

For many years, abundance indices were not available for this stock. A survey specifically designed to evaluate abundance indices of *Nephrops* commenced in 2006 (with the most appropriate season: 2nd quarter, hours of trawling: around dawn and dusk and fishing gear: twin trawl). This survey (called LANGOLF; see Stock Annex) occurred once a year in May and its sampling design was stratified using sedimentary strata. Therefore, as regards the investigations carried out during the IBP *Nephrops* 2012, its results for abundance indices were included in the assessment (WGHMM 2012, 2013; WGBIE 2014). The time series provided by this survey was interrupted for financial reasons (the survey has not been conducted since May 2014). Otherwise, a new experimental survey combining UWTV burrows counting and trawling indices as routinely operated for many *Nephrops* stocks on areas VI and VII was initiated in September 2014. Trawling was operated by two commercial vessels applying the same sampling plan (stratified random) and using the same twin trawls (20 mm codend mesh size) as those of the former LANGOLF survey. The burrows counting was undertaken by the Irish scientific vessel "Celtic Voyager" on the basis of a systematic sampling plan with no stratification. Some preliminary geostatistical investigations were carried out (see WDs 7 and 8; WGBIE 2015). This survey should also be conducted in July 2015 which is a more adequate period accordingly to the female availability. The choice of survey dates is constrained by the schedule time for UWTV Irish equipment and staff.

11.2.4 Commercial catch-effort data.

Commercial fleets used in the assessment to tune the model

Up to 1998, the majority of the vessels were not obliged to keep logbooks because of their size and fishing forms were established by inquiries. Since 1999, logbooks became compulsory for all vessels longer than 10 m. The available log-book data cannot be currently considered as representative for the fishing effort of the whole fishery during the overall time series. Hence, since 2004, it was attempted to define a better effort index.

Effort data indices, landings and LPUE for the "Le Guilvinec District" *Nephrops* trawlers in the 2nd quarter (noted GV-Q2) are available for the overall time series (Table 11.4; Figure 11.3). Effort increased from 1987 to 1992, but there has been a decreasing trend since then. In 2012-2014, the lowest fishing effort for the whole period was observed. The downwards trend in effort can be explained by the decrease in the number of fishing vessels following the decommissioning schemes implemented by the EU. The LPUEs of the GV-Q2 fleet were reasonably stable for a long period, fluctuating around a long-term average of 13.1 kg/hour (Figure 11.3), with three pics values occurring in 1988, 2001 and 2010. LPUE increased steeply between 2009 and 2010 (+35%: from 13.8 kg/h to 18.6 kg/h maximum of the historical series), then strongly decreased in 2011 (-19%: 15.1 kg/h), remained stable in 2012 (15.2 kg/h) and steeply declined in 2013 (-15%: 12.8 kg/h). In spite of the steep increase of the yearly landings between 2013 and 2014, the GV-Q2 LPUE index remained stable in 2014 (12.7 kg/h).

Changes in fishing gear efficiency and individual catch capacities of vessels, imply that the time spent at sea may not be a good indicator of effective effort and hence LPUE trends are possibly biased. Since the early 90's, the number of boats using twin-trawls increased (10% in 1991, more than 90% in recent years, almost 100% in the northern part of the fishery) and also the number of vessels using rock-hopper gear on the rough sea bottom of the extreme NW part of the central mud bank of the Bay of Biscay. Moreover, an increase in onboard computer technology has occurred. The effects of these changes are difficult to quantify as twin-trawling is not always recorded explicitly in the fisheries statistics and improvement due to computing technology is not continuous for the overall time series.

11.3 Assessment

No analytical assessment was carried out in 2015. Updated data do not change the perception of the stock status from last year assessment.

11.4 Catch options and prognosis

No short-term projections and yield per recruit analysis were carried out.

11.5 Biological reference points

In previous analytical assessments, F_{max} was proposed as a satisfactory F_{MSY} proxy for the stock although the rejection of the XSA assessment for this stock suggests to define new biological reference points based on the new survey combining UWTV and trawling (benchmark workshop proposed for the end of 2016).

11.6 Comments on the assessment

The continuation of the French *Nephrops* trawlers onboard sampling programme will avoid the use of "derived" data for missing years (13 years on 28). Since 2009, there has been a improvement of the sampling design as many trips were sampled in the Southern part of the fishery. Derivation based on probabilistic approach should improve diagnostic in further analytical investigations when new alternative assessment methods will be applied.

11.7 Information from the fishing industry

Many exchanges occurred between scientists and the fishing industry prior to the WG in the case of the partnership for the new UWTV/trawl combined survey (scientific methodological and financial supporting project). The industry underlined the heterogeneous feature of the whole area of the stock and commented on the application of only one tuning series involved in the northern part of the fishery and its extrapolation to the southern one. They emphasized the necessity of applying additional tuning commercial information on the southern part of fishery. They have been aware of the downwards trend for the stock between the late 2000's and the early 2010's, moreover they considered the unfavourable context induced by the interruption of the LANGOLF series and the necessity to routinely replace it by an UWTV one. For 2014, industry commented the contradictory result between the steep increase of the yearly landings and the stability of the LPUE seasonal indices from the commercial tuning fleet. They pointed out that the 2014's fishing profile does not correspond to the typically seasonal one for *Nephrops* because global indices were stronger in the 3rd quarter of the year than in the 2nd one.

11.8 Management considerations

Even with no quantitative analytical investigations the stability of the commercial LPUEs combined with the relative reduction of the discards suggest to not change the perception for the stock.

Table 11.1. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Estimates of catches (t) by FU for 1960-2014

	Landings (1)					Total Discards		Catches
Year	FU 23-24 (2)	FU 23	FU 24	Unallocated (MA N)(3)	Total VIIIa,b	FU 23-24		Total
	VIIIa,b	VIIIa	VIIIb		used by WG	VIIIa,b		VIIIa,b
1960	3524	-	-	-	3524	-		3524
1961	3607	-	-	-	3607	-		3607
1962	3042	-	-	-	3042	-		3042
1963	4040	-	-	-	4040	-		4040
1964	4596	-	-	-	4596	-		4596
1965	3441	-	-	-	3441	-		3441
1966	3857	-	-	-	3857	-		3857
1967	3245	-	-	-	3245	-		3245
1968	3859	-	-	-	3859	-		3859
1969	4810	-	-	-	4810	-		4810
1970	5454	-	-	-	5454	-		5454
1971	3990	-	-	-	3990	-		3990
1972	5525	-	-	-	5525	-		5525
1973	7040	-	-	-	7040	-		7040
1974	7100	-	-	-	7100	-		7100
1975	-	6460	322	-	6782	-		6782
1976	-	6012	300	-	6312	-		6312
1977	-	5069	222	-	5291	-		5291
1978	-	4554	162	-	4716	-		4716
1979	-	4758	36	-	4794	-		4794
1980	-	6036	71	-	6107	-		6107
1981	-	5908	182	-	6090	-		6090
1982	-	4392	298	-	4690	-		4690
1983	-	5566	342	-	5908	-		5908
1984	-	4485	198	-	4683	-		4683
1985	-	4281	312	-	4593	-		4593
1986	-	3968	367	99	4335	-		4335
1987	-	4937	460	64	5397	1767	*	7164
1988	-	5281	594	69	5875	4138		10013
1989	-	4253	582	77	4835	3007		7842
1990	1	4613	359	87	4972	644		5616
1991	1	4353	401	55	4754	1213	*	5967
1992	0	5123	558	47	5681	1217		6897
1993	0	4577	532	49	5109	974		6084
1994	0	3721	371	27	4092	717		4809
1995	0	4073	380	14	4452	687		5139
1996	0	4034	84	15	4118	487		4606
1997	2	3450	147	41	3610	914		4523
1998	2	3565	300	40	3865	1453	*	5318
1999	2	2873	337	26	3209	1092		4301
2000	0	2848	221	36	3069	1337		4406
2001	1	3421	309	22	3730	2628		6358
2002	2	3323	356	36	3679	2535		6214
2003	1	3564	322	49	3886	1977	*	5863
2004	na	3223	348	5	3571	1932	*	5503
2005	na	3619	372	na	3991	2698	*	6689
2006	na	3026	420	na	3447	4544	*	7990
2007	na	2881	292	na	3176	2411	*	5587
2008	na	2774	256	na	3030	2123	*	5154
2009	na	2816	212	na	2987	1833	*	4820
2010	na	3153	245	na	3398	1275	*	4673
2011	na	3240	319	na	3559	1263	*	4822
2012	na	2290	230	na	2520	1013	*	3533
2013	na	2195	185	na	2380	1521	*	3900
2014	na	2699	108	na	2807	1326	*	4133

(1) WG estimates
(2) landings from VIIIa and VIIIb aggregated until 1974
(3) outside FU 23-24

Table 11.2. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Derivation and estimations of discards

1987	sampled
1988	from 1987's logistic function of sorting by quarter+density of probability
1989	from 1987's logistic function of sorting by quarter+density of probability
1990	from 1987's logistic function of sorting by quarter+density of probability
1991	sampled
1992	from 1991's logistic function of sorting by quarter+density of probability
1993	from 1991's logistic function of sorting by quarter+density of probability
1994	from 1991's logistic function of sorting by quarter+density of probability
1995	from 1991's logistic function of sorting by quarter+density of probability
1996	from 1991's logistic function of sorting by quarter+density of probability
1997	from 1991's logistic function of sorting by quarter+density of probability
1998	sampled
1999	from 1998's logistic function of sorting by quarter+density of probability
2000	from 1998's logistic function of sorting by quarter+density of probability
2001	from 1998's logistic function of sorting by quarter+density of probability
2002	from 1998's logistic function of sorting by quarter+density of probability
2003	sampled
2004	sampled
2005	sampled
2006	sampled
2007	sampled
2008	sampled
2009	sampled
2010	sampled
2011	sampled
2012	sampled
2013	sampled
2014	sampled

Table 11.3.a Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) landings length distributions in 1987-2000

Landings														
CL mm/Y	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
10	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
12	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
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	14	0	0	0
16	0	158	59	0	0	0	0	0	0	0	14	0	0	0
17	149	230	77	12	35	62	0	0	0	0	0	0	0	0
18	331	553	131	64	30	0	0	31	20	0	0	0	0	14
19	1296	1886	901	48	79	138	0	72	61	0	0	0	0	11
20	3129	4227	2791	529	474	450	464	206	341	48	448	25	72	116
21	6476	8882	7039	1947	1572	1595	1285	482	1573	414	1313	288	219	433
22	13501	16050	12971	5913	4733	3948	3878	2824	2395	1311	2799	985	849	1015
23	21337	25374	18073	10910	7854	9701	7398	5366	5523	2799	4638	3171	1888	2531
24	24339	33950	21960	13293	15521	20948	11949	9650	8731	6071	10005	6484	4032	5462
25	32476	36294	25650	16440	19747	27876	21011	15079	14348	13239	19837	13980	10717	11357
26	29670	29808	22747	18205	22106	26617	23732	18312	19769	16779	19380	13535	10590	10212
27	28086	28380	22091	16109	21900	28410	26044	21181	25126	18384	22823	16602	12724	11528
28	24925	26017	19087	19595	21214	32091	27580	20488	20914	15744	19466	14432	12058	12639
29	18703	20920	14227	16250	17138	24760	20627	16527	15909	16332	20878	11832	9448	11473
30	18407	17862	13688	12055	14762	19828	21414	15903	19164	20214	21487	16335	16187	13888
31	11419	13156	9037	11088	12408	14281	13452	11207	13333	14009	9791	8539	9209	9828
32	10185	12822	8410	8540	8635	12786	12711	11490	13667	14392	9622	9237	9745	8936
33	8528	8848	7127	10649	7273	9297	11369	7022	7117	8576	6334	5947	6000	6333
34	5926	7812	6967	10543	7987	7318	7355	6684	7584	6524	4816	6619	5910	5225
35	5763	5935	6214	7637	5425	5928	6307	5646	4677	6578	4737	6700	5267	4895
36	4033	5064	4532	6274	4979	4998	4608	4337	3709	4133	2568	5308	4291	3242
37	4024	3754	3545	4841	4541	4195	4089	3752	3496	4226	2135	4722	3230	2946
38	3131	3106	3193	4966	2993	3933	2991	2771	2879	2788	1142	3527	2588	2687
39	2151	2778	2154	3339	2869	2987	2290	1841	1746	1596	927	2169	2186	2027
40	2425	2159	2175	2766	2414	2574	2206	1738	2015	1956	982	3084	2353	1862
41	1375	1753	1461	1951	2076	1546	1452	1150	1123	1250	520	1558	1362	1020
42	1350	1542	1130	1668	1662	1599	1111	1118	1558	1142	508	1490	1124	797
43	1150	1209	1087	1908	1495	1348	1069	687	1039	610	370	1049	761	534
44	965	704	1192	1401	1089	1050	745	500	915	414	219	748	708	413
45	641	581	1194	955	1058	766	684	550	700	464	253	902	429	421
46	645	689	669	713	666	734	584	353	460	374	135	525	424	248
47	509	391	641	715	431	567	417	407	437	397	140	327	276	213
48	343	333	526	863	636	588	456	270	494	264	92	382	104	205
49	290	254	378	470	377	263	145	178	254	205	57	132	151	177
50	319	216	351	230	263	256	238	273	255	179	76	154	159	154
51	135	241	240	181	210	107	126	156	214	123	38	191	58	109
52	192	48	180	335	180	159	202	107	175	77	30	115	93	85
53	137	70	150	121	124	111	55	136	91	84	26	156	23	133
54	111	112	218	99	189	94	120	77	55	75	11	93	11	63
55	76	85	187	53	63	61	128	66	91	53	9	114	16	75
56	111	41	123	26	28	66	50	49	47	62	12	7	5	18
57	74	39	116	43	34	61	72	36	77	48	8	31	14	20
58	39	65	70	2	11	68	58	47	88	48	9	14	5	16
59	32	60	36	13	17	28	13	31	36	30	8	10	2	7
60	21	7	30	5	24	7	54	26	32	9	5	8	4	2
61	21	15	15	4	11	0	25	12	4	4	0	0	3	8
62	0	0	21	10	0	44	3	8	0	9	1	10	0	1
63	19	13	10	0	3	28	0	5	20	4	5	4	0	0
64	0	7	0	0	0	14	7	10	0	0	0	0	0	4
65	8	0	4	0	0	0	30	16	4	0	0	4	2	1
66	0	0	0	0	0	0	7	0	20	2	4	0	0	0
67	0	0	0	0	0	0	18	3	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	3	0
69	0	0	0	0	0	0	7	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	8	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	4	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	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
Total	**288974**	**324498**	**244875**	**213779**	**217338**	**274286**	**240638**	**188879**	**202294**	**182041**	**188694**	**161549**	**135304**	**133383**
Weights	**5397**	**5875**	**4835**	**4972**	**4754**	**5681**	**5109**	**4092**	**4452**	**4118**	**3610**	**3865**	**3209**	**3069**

Table 11.3.b Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) landings length distributions in 2001-2014

Landings CL mm/Y	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
10	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
12	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
14	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
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	20	7	0	0	0	0	0	0	0	0	0	0
18	13	0	14	0	25	5	4	12	0	0	0	0	0	0
19	38	0	0	14	27	0	0	0	0	0	1	0	5	0
20	284	107	87	47	82	5	4	77	37	14	22	35	31	1
21	643	925	280	249	270	70	14	191	73	75	6	25	151	74
22	2116	1122	661	899	771	131	18	208	288	252	11	235	682	180
23	6261	5513	1614	2194	2588	227	48	322	473	386	111	334	1002	764
24	8915	10061	3966	5664	6511	822	188	721	1929	1238	515	1399	3162	1836
25	17106	12951	8164	10930	13678	2844	1201	2742	3670	3940	1803	3843	7873	4419
26	13745	21403	13297	13998	17811	6376	5684	6319	8258	8499	4773	7875	13242	7910
27	17098	19433	17614	16094	22006	12010	9439	10891	12759	14173	7520	11079	14926	12869
28	15835	22074	18572	15350	21879	14647	13248	12640	15732	15390	8991	11920	13260	13788
29	13779	16559	16843	14808	18027	14591	12516	12890	13524	15340	9602	11120	13397	14560
30	16168	18105	17264	14143	15570	13690	12219	10726	13271	15736	8821	9636	10296	12662
31	11316	9989	13345	12353	12634	11814	10698	9772	10859	12749	8253	8393	9137	11051
32	11335	10284	11276	10322	9907	9694	9274	8845	9310	11366	6954	7414	7116	10354
33	8250	7813	8253	8020	7800	8421	7859	7436	7086	8851	6175	6069	5558	6509
34	6185	5308	6195	6298	6537	7112	6539	6425	5985	7140	5467	4505	4123	6657
35	5213	4309	4653	4673	5100	5135	6529	5366	4568	5852	4541	3507	2783	4961
36	4037	3157	3818	3308	3369	4104	4735	3867	3697	3626	4260	2649	1978	3264
37	2901	2049	3075	2875	2597	3196	3839	3121	2565	3024	3648	1976	1472	2682
38	2369	2224	2660	2098	2380	2662	2639	2398	1871	2247	3911	1563	998	1783
39	2297	1559	2174	1683	1650	1956	2245	2043	1491	1630	3472	1314	936	1844
40	1908	1398	1936	1555	1628	1599	1711	1633	1190	1280	3296	1103	518	843
41	941	764	1423	1188	1154	1171	1227	1190	878	966	2740	878	438	669
42	863	632	1403	889	953	990	1111	1015	742	742	2497	635	351	412
43	530	640	1054	774	842	741	710	805	540	560	2157	558	320	343
44	383	432	810	707	640	633	746	706	473	509	1762	536	249	234
45	523	416	808	613	605	595	518	536	396	442	1177	478	177	206
46	294	328	535	485	415	479	373	405	307	305	1024	441	181	159
47	368	241	456	388	353	440	311	361	262	290	858	378	88	151
48	188	188	339	313	339	382	257	294	245	237	656	381	98	87
49	183	79	206	318	288	319	237	262	196	204	557	212	74	72
50	160	115	253	306	276	287	190	228	156	160	501	160	46	63
51	135	73	170	214	176	246	163	201	115	135	383	132	37	58
52	102	46	150	152	184	201	138	116	110	120	296	128	32	24
53	82	51	120	111	142	137	140	121	98	97	198	96	24	42
54	40	20	80	90	104	156	115	95	63	95	271	93	17	18
55	53	30	57	47	109	137	79	73	75	79	152	58	15	11
56	24	13	23	86	69	117	60	67	54	75	132	46	8	5
57	46	6	47	49	58	134	70	41	31	67	98	48	22	10
58	29	6	22	27	43	134	45	40	48	47	105	52	3	8
59	26	3	10	32	41	85	33	19	23	48	79	33	12	3
60	21	11	8	10	19	115	33	23	14	42	48	22	3	2
61	7	0	5	5	28	40	23	7	8	30	39	15	8	1
62	2	0	4	3	16	21	9	9	9	16	55	18	1	1
63	5	1	1	5	9	19	9	7	10	7	23	11	2	1
64	0	0	0	8	8	18	10	6	3	16	12	8	0	0
65	0	1	0	1	14	11	9	1	3	9	11	7	0	0
66	0	0	1	1	6	10	1	0	2	3	11	3	0	0
67	0	0	0	1	5	8	1	0	2	3	6	1	0	0
68	0	0	0	2	4	7	3	0	0	4	7	0	0	0
69	0	0	1	0	1	6	2	0	1	1	2	2	0	0
70	0	0	0	0	2	4	0	0	0	1	2	0	0	0
71	0	0	1	0	1	5	0	0	0	1	1	0	0	0
72	0	0	0	0	1	5	0	0	0	0	0	0	0	0
73	0	0	0	0	0	2	1	0	0	0	0	0	0	0
74	0	0	0	0	0	4	0	0	0	0	1	0	0	1
75	0	0	0	0	1	4	0	0	0	0	0	1	0	0
Total	**172819**	**180442**	**163771**	**154405**	**179758**	**128777**	**117273**	**115274**	**123504**	**138120**	**108011**	**101424**	**114853**	**121594**
Weights	**3730**	**3679**	**3886**	**3571**	**3991**	**3447**	**3176**	**3030**	**2987**	**3398**	**3559**	**2520**	**2380**	**2807**

Table 11.3.c Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) discards length distributions in 1987-2000.

Total Discards

CL mm/Y	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
10	0	1318	75	0	0	546	199	134	185	82	1325	0	93	186
11	0	2152	152	0	114	807	313	208	279	125	1611	85	150	291
12	0	3508	308	0	0	1190	491	323	419	191	1952	128	240	455
13	0	5695	624	1	93	1749	768	501	627	291	2354	162	384	710
14	78	9194	1261	2	258	2556	1198	774	936	441	2823	660	613	1104
15	2074	14706	2539	7	1249	3708	1858	1189	1388	666	3364	1741	977	1710
16	3974	23183	5074	22	2240	5320	2854	1811	2040	999	3980	1861	1548	2631
17	13577	35760	9995	71	4638	7521	4326	2727	2961	1484	4671	3527	2433	4008
18	29288	53448	19148	235	10619	10421	6429	4034	4221	2171	5432	5003	3776	6016
19	28370	76547	34910	766	12852	14070	9295	5825	5877	3114	6254	5991	5753	8843
20	60253	230038	153497	2426	22797	18408	12961	8143	7938	4347	7125	12091	8534	12628
21	45446	129602	100993	31048	18043	23225	17283	10932	10337	5862	8028	9973	12205	17372
22	51268	61144	47652	26066	24289	17350	17709	13186	9925	7591	14964	23278	16667	25140
23	23074	25627	17991	11687	15611	20991	15746	11862	12053	6558	10661	21641	17635	22623
24	7213	10004	6496	3836	13741	20860	12123	10225	9074	6765	10758	19750	15698	21146
25	2686	3535	2479	1516	14722	13478	10054	7645	7037	6720	10252	20487	18666	20177
26	672	1008	694	570	7131	6137	5513	4390	4741	4030	4720	10676	8465	8496
27	270	335	240	181	1711	3200	2863	2452	2817	2088	2639	7502	4774	4780
28	0	117	70	78	999	1759	1449	1143	1117	874	1096	3019	2202	2630
29	0	32	20	25	138	654	517	434	415	431	584	1357	813	1245
30	0	10	7	7	291	256	268	208	249	263	287	686	695	679
31	0	3	2	2	97	94	84	69	84	89	64	129	208	273
32	0	1	1	1	0	39	40	34	42	45	30	481	115	112
33	0	0	0	0	0	14	18	11	11	13	10	231	38	40
34	0	0	0	0	0	6	6	5	6	5	4	151	20	17
35	0	0	0	0	0	2	2	2	2	2	2	88	10	8
36	0	0	0	0	0	1	1	1	1	1	0	48	5	3
37	0	0	0	0	0	0	0	0	0	0	0	74	2	2
38	0	0	0	0	0	0	0	0	0	0	0	44	1	1
39	0	0	0	0	0	0	0	0	0	0	0	36	0	0
40	0	0	0	0	0	0	0	0	0	0	0	57	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	6	0	0
44	0	0	0	0	0	0	0	0	0	0	0	30	0	0
45	0	0	0	0	0	0	0	0	0	0	0	2	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	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
Total	**268244**	**686969**	**404228**	**78546**	**151634**	**174362**	**124368**	**88267**	**84780**	**55250**	**104994**	**150995**	**122720**	**163330**
Weights	**1767**	**4123**	**2634**	**627**	**1213**	**1354**	**1007**	**741**	**706**	**495**	**805**	**1453**	**1148**	**1455**

Table 11.3.d Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) discards length distributions in 2001-2014.

Total Discards														
CL mm/Y	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**
10	950	1268	28	0	0	0	22	0	82	0	0	0	0	0
11	1341	1817	0	0	94	0	171	38	135	2	0	0	0	0
12	1890	2597	70	363	413	70	202	98	79	0	237	0	0	0
13	2654	3696	294	1722	1085	234	122	235	177	97	596	532	0	28
14	3713	5233	636	3152	3190	1138	900	389	291	83	834	665	229	101
15	5164	7354	1198	5548	7287	3102	1288	189	1157	155	941	1425	870	281
16	7126	10227	3386	6784	13528	7810	2959	1027	2315	822	1230	4544	1313	1300
17	9732	14027	5927	8836	15094	11655	3636	1832	3059	1333	2430	4737	4179	1647
18	13110	18895	8078	10161	19795	16139	4590	2626	4843	2309	3630	8066	3372	2808
19	17354	24883	11506	17361	19522	25891	5244	6473	6485	3532	4546	8024	8730	3822
20	22483	31890	12142	19250	22265	39742	8735	11444	12766	5692	7227	10125	9682	6457
21	28397	39629	18597	25898	32409	54220	11585	15630	16772	7699	10393	12145	15281	9195
22	49505	24662	21416	25210	35523	69870	17930	24730	18701	11689	15161	14034	20618	11284
23	54819	48438	28429	26756	40041	70094	24086	27560	21693	13672	13837	12904	26287	15130
24	34491	39179	26501	21343	36279	55408	30615	29638	24105	16963	15551	14889	21750	14000
25	30416	22841	23211	20085	30222	52660	32917	28007	20736	14670	16545	10873	17823	18051
26	11137	17386	17357	12006	19003	38812	27376	23127	14205	11852	10047	7747	10188	11947
27	6340	8069	9680	6436	8498	20124	20567	10129	9188	8558	8127	4304	5439	8155
28	2658	4129	6187	3487	4603	10263	10365	5893	5927	5986	3201	919	2824	5026
29	1183	1494	2537	2115	1201	4188	4464	3225	3163	3360	2086	588	2146	2316
30	665	876	1605	1901	1600	2578	2868	1923	3261	1876	2011	680	945	1672
31	226	214	1326	1115	1417	1109	1316	925	1824	1274	1246	125	922	1263
32	114	119	574	735	526	592	737	454	839	716	492	200	684	1482
33	47	44	313	503	296	544	484	421	671	350	265	13	365	384
34	20	21	261	385	553	411	537	1025	830	274	272	145	494	433
35	7	7	176	424	260	230	265	206	332	242	174	24	233	125
36	4	4	113	108	46	73	336	78	197	55	59	3	260	391
37	1	1	83	74	246	25	299	153	188	162	149	146	130	45
38	1	1	93	31	116	99	40	93	269	16	97	68	81	71
39	1	0	15	139	147	0	3	369	55	33	24	0	33	230
40	0	0	37	73	37	169	47	0	66	38	25	3	0	122
41	0	0	34	60	20	0	40	0	8	4	0	0	0	7
42	0	0	4	12	31	0	20	53	0	4	157	0	0	0
43	0	0	14	13	0	0	11	0	38	0	4	4	0	152
44	0	0	0	13	0	0	0	0	14	6	0	0	0	0
45	0	0	13	0	0	36	0	0	0	0	5	0	0	0
46	0	0	0	0	0	0	0	0	0	6	0	0	0	0
47	0	0	0	0	0	0	0	0	0	0	6	0	0	7
48	0	0	0	0	0	0	0	0	8	0	0	0	36	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	11	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	39	0	0	0	0	0	0
59	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
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	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
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	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
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	**305547**	**329002**	**201841**	**222102**	**315346**	**487288**	**214788**	**198031**	**174480**	**113530**	**121603**	**117935**	**154914**	**117930**
Weights	**2537**	**2620**	**1977**	**1932**	**2698**	**4544**	**2411**	**2123**	**1833**	**1275**	**1263**	**1012**	**1521**	**1326**

Table 11.3.e Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) catches length distributions in 1987-2000.

Total catches

CL mm/Y	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
10	0	1318	75	0	0	546	199	134	185	82	1325	0	93	186
11	0	2152	152	0	114	807	313	208	279	125	1611	85	150	291
12	0	3508	308	0	0	1190	491	323	419	191	1952	128	240	455
13	0	5695	624	1	93	1749	768	501	627	291	2354	162	384	710
14	78	9194	1261	2	258	2556	1198	774	936	441	2823	660	613	1104
15	2074	14706	2539	7	1249	3708	1858	1189	1388	666	3378	1741	977	1710
16	3974	23341	5134	22	2240	5320	2854	1811	2040	999	3994	1861	1548	2631
17	13727	35990	10072	83	4673	7583	4326	2727	2961	1484	4671	3527	2433	4008
18	29620	54001	19279	299	10649	10421	6429	4065	4241	2171	5432	5003	3776	6031
19	29666	78433	35810	814	12931	14209	9295	5897	5938	3114	6254	5991	5753	8854
20	63382	234265	156289	2955	23271	18858	13425	8348	8279	4394	7573	12116	8605	12744
21	51922	138484	108031	32996	19615	24820	18569	11413	11910	6276	9341	10260	12424	17805
22	64770	77194	60622	31979	29023	21298	21587	16010	12320	8902	17764	24263	17516	26155
23	44411	51001	36064	22597	23464	30692	23143	17227	17576	9357	15299	24812	19523	25155
24	31551	43954	28456	17129	29262	41808	24072	19876	17805	12836	20763	26235	19730	26608
25	35162	39829	28130	17956	34469	41355	31065	22724	21385	19960	30089	34467	29383	31534
26	30342	30817	23441	18775	29237	32754	29245	22702	24510	20810	24100	24211	19056	18708
27	28357	28715	22331	16290	23611	31610	28907	23633	27943	20472	25462	24104	17498	16307
28	24925	26134	19157	19672	22213	33851	29028	21631	22031	16618	20563	17450	14261	15269
29	18703	20952	14247	16275	17276	25413	21145	16961	16324	16763	21463	13189	10261	12718
30	18407	17871	13696	12061	15053	20084	21682	16111	19413	20478	21774	17021	16882	14567
31	11419	13159	9038	11090	12505	14375	13535	11276	13418	14098	9856	8668	9417	10102
32	10185	12823	8410	8541	8635	12825	12751	11524	13710	14436	9652	9718	9860	9048
33	8528	8848	7128	10650	7273	9311	11387	7033	7128	8589	6344	6178	6038	6373
34	5926	7812	6967	10543	7987	7324	7361	6688	7590	6529	4820	6770	5930	5242
35	5763	5935	6214	7637	5425	5931	6309	5648	4678	6580	4739	6787	5277	4903
36	4033	5064	4532	6274	4979	4999	4609	4338	3709	4134	2568	5356	4295	3245
37	4024	3754	3545	4841	4541	4195	4089	3753	3496	4227	2135	4796	3232	2947
38	3131	3106	3193	4966	2993	3933	2991	2771	2879	2788	1142	3571	2589	2688
39	2151	2778	2154	3339	2869	2987	2290	1841	1746	1596	927	2205	2186	2027
40	2425	2159	2175	2766	2414	2574	2206	1738	2015	1956	982	3140	2353	1862
41	1375	1753	1461	1951	2076	1546	1452	1150	1123	1250	520	1558	1363	1020
42	1350	1542	1130	1668	1662	1599	1111	1118	1558	1142	508	1490	1124	797
43	1150	1209	1087	1908	1495	1348	1069	687	1039	610	370	1055	762	534
44	965	704	1192	1401	1089	1050	745	500	915	414	219	778	708	413
45	641	581	1194	955	1058	766	684	550	700	464	253	904	429	421
46	645	689	669	713	666	734	584	353	460	374	135	525	424	248
47	509	391	641	715	431	567	417	407	437	397	140	327	276	213
48	343	333	526	863	636	588	456	270	494	264	92	382	104	205
49	290	254	378	470	377	263	145	178	254	205	57	132	151	177
50	319	216	351	230	263	256	238	273	255	179	76	154	159	154
51	135	241	240	181	210	107	126	156	214	123	38	191	58	109
52	192	48	180	335	180	159	202	107	175	77	30	115	93	85
53	137	70	150	121	124	111	55	136	91	84	26	156	23	133
54	111	112	218	99	189	94	120	77	55	75	11	93	11	63
55	76	85	187	53	63	61	128	66	91	53	9	114	16	75
56	111	41	123	26	28	66	50	49	47	62	12	7	5	18
57	74	39	116	43	34	61	72	36	77	48	8	31	14	20
58	39	65	70	2	11	68	58	47	88	48	9	14	5	16
59	32	60	36	13	17	28	13	31	36	30	8	10	2	7
60	21	7	30	5	24	7	54	26	32	9	5	8	4	2
61	21	15	15	4	11	0	25	12	4	4	0	0	3	8
62	0	0	21	10	0	44	3	8	0	9	1	10	0	1
63	19	13	10	0	3	28	0	5	20	4	5	4	0	0
64	0	7	0	0	0	14	7	10	0	0	0	0	0	4
65	8	0	4	0	0	0	30	16	4	0	0	4	2	1
66	0	0	0	0	0	0	7	0	20	2	4	0	0	0
67	0	0	0	0	0	0	18	3	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	3	0
69	0	0	0	0	0	0	7	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	8	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	4	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	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
Total	**557218**	**1011467**	**649102**	**292325**	**368972**	**448648**	**365006**	**277146**	**287074**	**237291**	**293688**	**312544**	**258025**	**296713**
Weights	**7164**	**9997**	**7470**	**5599**	**5967**	**7034**	**6116**	**4833**	**5159**	**4614**	**4415**	**5318**	**4357**	**4523**

Table 11.3.f Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) catches length distributions in 2001-2014.

Total catches

CL mm/Y	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
10	950	1268	28	0	0	0	22	0	82	0	0	0	0	0
11	1341	1817	0	0	94	0	171	38	135	2	0	0	0	0
12	1890	2597	70	363	413	70	202	98	79	0	237	0	0	0
13	2654	3696	294	1722	1085	234	122	235	177	97	596	532	0	28
14	3713	5233	636	3152	3190	1138	900	389	291	83	834	665	229	101
15	5164	7354	1198	5548	7287	3102	1289	189	1157	155	941	1425	870	281
16	7126	10227	3386	6784	13528	7810	2959	1027	2315	822	1230	4544	1313	1300
17	9732	14027	5947	8843	15094	11655	3636	1832	3059	1333	2430	4737	4179	1647
18	13122	18895	8092	10161	19820	16144	4593	2638	4843	2309	3630	8066	3372	2808
19	17392	24883	11506	17376	19549	25891	5244	6473	6485	3532	4546	8024	8735	3822
20	22767	31997	12229	19297	22348	39747	8738	11521	12803	5706	7249	10160	9713	6458
21	29040	40555	18877	26146	32679	54289	11598	15820	16845	7775	10398	12170	15433	9269
22	51621	25784	22077	26109	36293	70001	17948	24938	18989	11941	15171	14269	21300	11464
23	61081	53951	30042	28950	42629	70322	24134	27882	22167	14058	13948	13238	27289	15894
24	43406	49240	30467	27006	42790	56230	30803	30359	26034	18202	16065	16288	24913	15836
25	47522	35792	31376	31015	43900	55504	34119	30750	24406	18610	18348	14716	25696	22470
26	24882	38790	30654	26004	36814	45189	33060	29446	22463	20352	14820	15622	23430	19857
27	23438	27502	27294	22530	30504	32134	30006	21020	21948	22730	15647	15383	20365	21024
28	18493	26203	24759	18837	26482	24909	23613	18533	21659	21375	12191	12838	16084	18814
29	14962	18053	19381	16923	19228	18779	16980	16115	16687	18700	11687	11708	15543	16876
30	16833	18981	18868	16044	17170	16268	15087	12649	16531	17612	10832	10315	11241	14334
31	11542	10203	14672	13469	14051	12923	12014	10697	12682	14024	9500	8518	10059	12314
32	11448	10403	11849	11057	10433	10286	10011	9299	10150	12082	7447	7614	7801	11836
33	8297	7857	8566	8523	8095	8965	8343	7857	7757	9201	6440	6082	5923	6892
34	6204	5329	6456	6684	7090	7524	7076	7449	6815	7414	5739	4649	4617	7091
35	5220	4316	4829	5097	5361	5366	6793	5573	4900	6094	4715	3531	3016	5087
36	4041	3161	3931	3416	3415	4177	5071	3945	3894	3681	4319	2652	2237	3654
37	2903	2050	3158	2949	2844	3221	4138	3273	2753	3186	3797	2122	1602	2727
38	2370	2225	2752	2129	2496	2760	2679	2491	2139	2263	4007	1632	1079	1854
39	2298	1560	2189	1822	1797	1956	2247	2412	1546	1662	3496	1314	968	2075
40	1908	1399	1973	1628	1665	1768	1758	1633	1257	1318	3321	1107	518	965
41	941	764	1457	1248	1174	1171	1267	1190	886	971	2740	878	438	676
42	863	632	1407	901	984	990	1130	1069	742	746	2654	635	351	412
43	530	641	1068	787	842	741	722	805	578	560	2161	563	320	495
44	383	432	810	719	640	633	746	706	487	515	1762	536	249	234
45	523	416	821	613	605	631	518	536	396	442	1182	478	177	206
46	294	328	535	485	415	479	373	405	307	312	1024	441	181	159
47	368	241	456	388	353	440	311	361	262	290	865	378	88	158
48	188	188	339	313	339	382	257	294	254	237	656	381	134	87
49	183	79	206	318	288	319	237	262	196	204	557	212	74	72
50	160	115	253	306	276	287	201	228	156	160	501	160	46	63
51	135	73	170	214	176	246	163	201	115	135	383	132	37	58
52	102	46	150	152	184	201	138	116	110	120	296	128	32	24
53	82	51	120	111	142	137	140	121	98	97	198	96	24	42
54	40	20	80	90	104	156	115	95	63	95	271	93	17	18
55	53	30	57	47	109	137	79	73	75	79	152	58	15	11
56	24	13	23	86	69	117	60	67	54	75	132	46	8	5
57	46	6	47	49	58	134	70	41	31	67	98	48	22	10
58	29	6	22	27	43	134	45	80	48	47	105	52	3	8
59	26	3	10	32	41	85	33	19	23	48	79	33	12	3
60	21	11	8	10	19	115	33	23	14	42	48	22	3	2
61	7	0	5	5	28	40	23	7	8	30	39	15	8	1
62	2	0	4	3	16	21	9	9	9	16	55	18	1	1
63	5	1	1	5	9	19	9	7	10	7	23	11	2	1
64	0	0	0	8	8	18	10	6	3	16	12	8	0	0
65	0	1	0	1	14	11	9	1	3	9	11	7	0	0
66	0	0	1	1	6	10	1	0	2	3	11	3	0	0
67	0	0	0	1	5	8	1	0	2	3	6	1	0	0
68	0	0	0	2	4	7	3	0	0	4	7	0	0	0
69	0	0	1	0	1	6	2	0	1	1	2	2	0	0
70	0	0	0	0	2	4	0	0	0	1	2	0	0	0
71	0	0	1	0	1	5	0	0	0	1	1	0	0	0
72	0	0	0	0	1	5	0	0	0	0	0	0	0	0
73	0	0	0	0	0	2	1	0	0	0	0	0	0	0
74	0	0	0	0	0	4	0	0	0	0	1	0	0	1
75	0	0	0	0	1	4	0	0	0	0	0	1	0	0
Total	**478366**	**509443**	**365612**	**376507**	**495103**	**616065**	**332060**	**313305**	**297984**	**251649**	**229614**	**219358**	**269767**	**239523**
Weights	**6267**	**6299**	**5863**	**5503**	**6689**	**7990**	**5587**	**5154**	**4820**	**4673**	**4822**	**3532**	**3900**	**4133**

Table 11.3.g Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) removals length distributions in 1987-2000.

Removals=Landings+dead catches (discard survival rate : 30%)

CL mm/Y	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
10	0	922	52	0	0	382	139	94	130	57	928	0	65	130
11	0	1507	106	0	80	565	219	146	195	88	1128	60	105	204
12	0	2455	216	0	0	833	344	226	293	134	1366	89	168	319
13	0	3987	437	0	65	1224	538	351	439	203	1648	114	269	497
14	55	6436	883	1	181	1789	839	542	655	309	1976	462	429	773
15	1452	10294	1777	5	875	2595	1301	832	972	466	2369	1219	684	1197
16	2782	16386	3611	15	1568	3724	1998	1268	1428	699	2800	1302	1084	1842
17	9654	25262	7074	62	3282	5326	3028	1909	2072	1039	3270	2469	1703	2806
18	20833	37967	13534	229	7464	7294	4500	2855	2974	1520	3802	3502	2643	4226
19	21155	55469	25338	584	9075	9987	6507	4150	4175	2180	4378	4194	4027	6201
20	45306	165254	110239	2228	16432	13336	9537	5906	5898	3090	5436	8489	6045	8956
21	38288	99604	77733	23681	14202	17852	13384	8134	8809	4518	6933	7269	8763	12593
22	49389	58851	46327	24159	21736	16093	16274	12054	9343	6624	13274	17280	12516	18613
23	37489	43313	30667	19090	18781	24395	18420	13669	13960	7390	12101	18320	14232	18368
24	29387	40953	26507	15979	25139	35550	20435	16808	15083	10807	17535	20310	15021	20264
25	34356	38768	27386	17501	30052	37311	28048	20431	19274	17944	27014	28321	23783	25481
26	30141	30514	23233	18604	27098	30913	27591	21385	23088	19601	22684	21008	16516	16159
27	28276	28615	22259	16236	23098	30650	28048	22897	27098	19846	24670	21853	16066	14873
28	24925	26099	19136	19649	21914	33323	28594	21288	21696	16356	20234	16545	13600	14480
29	18703	20942	14241	16268	17235	25217	20989	16831	16199	16633	21287	12782	10017	12345
30	18407	17868	13693	12059	14965	20008	21602	16049	19338	20399	21688	16815	16674	14363
31	11419	13158	9038	11089	12476	14347	13510	11255	13392	14072	9836	8629	9354	10020
32	10185	12823	8410	8541	8635	12813	12739	11514	13697	14423	9643	9574	9826	9014
33	8528	8848	7128	10649	7273	9306	11382	7030	7124	8585	6341	6109	6027	6361
34	5926	7812	6967	10543	7987	7322	7360	6687	7588	6527	4819	6725	5924	5237
35	5763	5935	6214	7637	5425	5930	6309	5647	4678	6580	4738	6761	5274	4901
36	4033	5064	4532	6274	4979	4999	4609	4338	3709	4133	2568	5341	4294	3244
37	4024	3754	3545	4841	4541	4195	4089	3753	3496	4226	2135	4774	3231	2947
38	3131	3106	3193	4966	2993	3933	2991	2771	2879	2788	1142	3558	2589	2688
39	2151	2778	2154	3339	2869	2987	2290	1841	1746	1596	927	2195	2186	2027
40	2425	2159	2175	2766	2414	2574	2206	1738	2015	1956	982	3123	2353	1862
41	1375	1753	1461	1951	2076	1546	1452	1150	1123	1250	520	1558	1363	1020
42	1350	1542	1130	1668	1662	1599	1111	1118	1558	1142	508	1490	1124	797
43	1150	1209	1087	1908	1495	1348	1069	687	1039	610	370	1053	761	534
44	965	704	1192	1401	1089	1050	745	500	915	414	219	769	708	413
45	641	581	1194	955	1058	766	684	550	700	464	253	904	429	421
46	645	689	669	713	666	734	584	353	460	374	135	525	424	248
47	509	391	641	715	431	567	417	407	437	397	140	327	276	213
48	343	333	526	863	636	588	456	270	494	264	92	382	104	205
49	290	254	378	470	377	263	145	178	254	205	57	132	151	177
50	319	216	351	230	263	256	238	273	255	179	76	154	159	154
51	135	241	240	181	210	107	126	156	214	123	38	191	58	109
52	192	48	180	335	180	159	202	107	175	77	30	115	93	85
53	137	70	150	121	124	111	55	136	91	84	26	156	23	133
54	111	112	218	99	189	94	120	77	55	75	11	93	11	63
55	76	85	187	53	63	61	128	66	91	53	9	114	16	75
56	111	41	123	26	28	66	50	49	47	62	12	7	5	18
57	74	39	116	43	34	61	72	36	77	48	8	31	14	20
58	39	65	70	2	11	68	58	47	88	48	9	14	5	16
59	32	60	36	13	17	28	13	31	36	30	8	10	2	7
60	21	7	30	5	24	7	54	26	32	9	5	8	4	2
61	21	15	15	4	11	0	25	12	4	4	0	0	3	8
62	0	0	21	10	0	44	3	8	0	9	1	10	0	1
63	19	13	10	0	3	28	0	5	20	4	5	4	0	0
64	0	7	0	0	0	14	7	10	0	0	0	0	0	4
65	8	0	4	0	0	0	30	16	4	0	0	4	2	1
66	0	0	0	0	0	0	7	0	20	2	4	0	0	0
67	0	0	0	0	0	0	18	3	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	3	0
69	0	0	0	0	0	0	7	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	8	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	4	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	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
Total	**476745**	**805376**	**527834**	**268762**	**323482**	**396340**	**327696**	**250666**	**261640**	**220716**	**262190**	**267245**	**221208**	**247714**
Weights	**6634**	**8760**	**6679**	**5411**	**5603**	**6628**	**5814**	**4610**	**4947**	**4465**	**4173**	**4882**	**4013**	**4087**

Table 11.3.h Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) removals length distributions in 2001-2014.

Removals=Landings+dead catches (discard survival rate : 30%)

CL mm/Y	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
10	665	888	19	0	0	0	16	0	58	0	0	0	0	0
11	939	1272	0	0	66	0	119	27	94	1	0	0	0	0
12	1323	1818	49	254	289	49	142	69	56	0	166	0	0	0
13	1858	2587	206	1205	760	164	85	164	124	68	417	372	0	20
14	2599	3663	445	2206	2233	797	630	272	204	58	584	466	160	71
15	3615	5148	839	3883	5101	2171	902	132	810	108	658	998	609	196
16	4988	7159	2370	4749	9469	5467	2072	719	1621	575	861	3181	919	910
17	6812	9819	4169	6193	10565	8158	2545	1282	2141	933	1701	3316	2925	1153
18	9190	13226	5669	7112	13882	11302	3216	1851	3390	1616	2541	5646	2360	1966
19	12186	17418	8055	12167	13692	18124	3671	4531	4540	2472	3183	5617	6116	2676
20	16022	22430	8586	13522	15668	27825	6118	8087	8973	3998	5081	7122	6809	4521
21	20521	28666	13298	18377	22957	38024	8123	11131	11813	5465	7281	8527	10848	6510
22	36769	18385	15653	18546	25636	49040	12569	17519	13379	8434	10623	10058	15114	8079
23	44635	39420	21514	20924	30617	49293	16909	19614	15659	9957	9797	9367	19403	11355
24	33059	37486	22517	20604	31906	39608	21619	21468	18803	13113	11400	11821	18387	11636
25	38397	28940	24412	24990	34834	39706	24243	22348	18185	14209	13385	11454	20349	17054
26	21541	33574	25447	22402	31113	33545	24847	22508	18202	16796	11806	13298	20373	16273
27	21536	25081	24390	20599	27955	26097	23835	17982	19191	20163	13209	14092	18733	18578
28	17695	24964	22903	17791	25101	21831	20503	16765	19881	19579	11231	12563	15237	17306
29	14607	17605	18619	16289	18868	17523	15641	15148	15738	17692	11061	11531	14899	16181
30	16633	18718	18387	15474	16690	15495	14227	12072	15553	17049	10229	10111	10957	13832
31	11475	10138	14274	13134	13626	12590	11619	10419	12135	13641	9126	8480	9783	11935
32	11414	10367	11677	10836	10276	10108	9790	9163	9898	11867	7299	7554	7595	11391
33	8283	7844	8472	8372	8007	8802	8197	7731	7556	9096	6361	6078	5814	6777
34	6198	5323	6377	6568	6924	7400	6915	7142	6566	7332	5657	4606	4469	6961
35	5218	4314	4776	4970	5282	5297	6714	5511	4801	6021	4663	3524	2946	5049
36	4040	3160	3897	3384	3401	4155	4971	3921	3835	3665	4301	2651	2159	3537
37	2902	2050	3133	2927	2770	3214	4048	3228	2696	3138	3753	2078	1563	2713
38	2370	2225	2725	2120	2461	2731	2667	2463	2059	2258	3978	1611	1055	1833
39	2298	1560	2184	1780	1753	1956	2246	2301	1529	1652	3489	1314	959	2006
40	1908	1399	1962	1606	1654	1717	1744	1633	1237	1306	3313	1106	518	929
41	941	764	1447	1230	1168	1171	1255	1190	884	969	2740	878	438	674
42	863	632	1406	897	975	990	1125	1053	742	745	2607	635	351	412
43	530	641	1064	783	842	741	718	805	567	560	2160	561	320	449
44	383	432	810	715	640	633	746	706	483	514	1762	536	249	234
45	523	416	817	613	605	620	518	536	396	442	1181	478	177	206
46	294	328	535	485	415	479	373	405	307	310	1024	441	181	159
47	368	241	456	388	353	440	311	361	262	290	863	378	88	156
48	188	188	339	313	339	382	257	294	251	237	656	381	124	87
49	183	79	206	318	288	319	237	262	196	204	557	212	74	72
50	160	115	253	306	276	287	198	228	156	160	501	160	46	63
51	135	73	170	214	176	246	163	201	115	135	383	132	37	58
52	102	46	150	152	184	201	138	116	110	120	296	128	32	24
53	82	51	120	111	142	137	140	121	98	97	198	96	24	42
54	40	20	80	90	104	156	115	95	63	95	271	93	17	18
55	53	30	57	47	109	137	79	73	75	79	152	58	15	11
56	24	13	23	86	69	117	60	67	54	75	132	46	8	5
57	46	6	47	49	58	134	70	41	31	67	98	48	22	10
58	29	6	22	27	43	134	45	68	48	47	105	52	3	8
59	26	3	10	32	41	85	33	19	23	48	79	33	12	3
60	21	11	8	10	19	115	33	23	14	42	48	22	3	2
61	7	0	5	5	28	40	23	7	8	30	39	15	8	1
62	2	0	4	3	16	21	9	9	9	16	55	18	1	1
63	5	1	1	5	9	19	9	7	10	7	23	11	2	1
64	0	0	0	8	8	18	10	6	3	16	12	8	0	0
65	0	1	0	1	14	11	9	1	3	9	11	7	0	0
66	0	0	1	1	6	10	1	0	2	3	11	3	0	0
67	0	0	0	1	5	8	1	0	2	3	6	1	0	0
68	0	0	0	2	4	7	3	0	0	4	7	0	0	0
69	0	0	1	0	1	6	2	0	1	1	2	2	0	0
70	0	0	0	0	2	4	0	0	0	1	2	0	0	0
71	0	0	1	0	1	5	0	0	0	1	1	0	0	0
72	0	0	0	0	1	5	0	0	0	0	0	0	0	0
73	0	0	0	0	0	2	1	0	0	0	0	0	0	0
74	0	0	0	0	0	4	0	0	0	0	1	0	0	1
75	0	0	0	0	1	4	0	0	0	0	0	1	0	0
Total	**386702**	**410743**	**305060**	**309877**	**400500**	**469879**	**267624**	**253896**	**245640**	**217590**	**193133**	**183978**	**223293**	**204145**
Weights	**5506**	**5513**	**5270**	**4923**	**5880**	**6627**	**4864**	**4517**	**4270**	**4290**	**4443**	**3229**	**3444**	**3735**

Table 11.4. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b). Effort and LPUE values of commercial fleets.

Sub-area VIII a,b

	Le Guilvinec District Quarter 2		
Year	Landings(t)	Effort(100h)	LPUE(Kg/h)
1987	603	437	13.8
1988	777	471	16.5
1989	862	664	13.0
1990	801	708	11.3
1991	717	728	9.8
1992	841	757	11.1
1993	805	735	11.0
1994	690	671	10.3
1995	609	627	9.7
1996	715	598	12.0
1997	638	539	11.8
1998	622	489	12.7
1999	505	423	11.9
2000	438	405	10.8
2001	697	417	16.7
2002	527	371	14.2
2003	487	355	13.7
2004	410	321	12.7
2005	455	335	13.6
2006	414	306	13.5
2007	401	291	13.8
2008	410	271	15.1
2009	384	279	13.8
2010	471	253	18.6
2011	422	279	15.1
2012	348	229	15.2
2013	288	224	12.8
2014	252	198	12.7

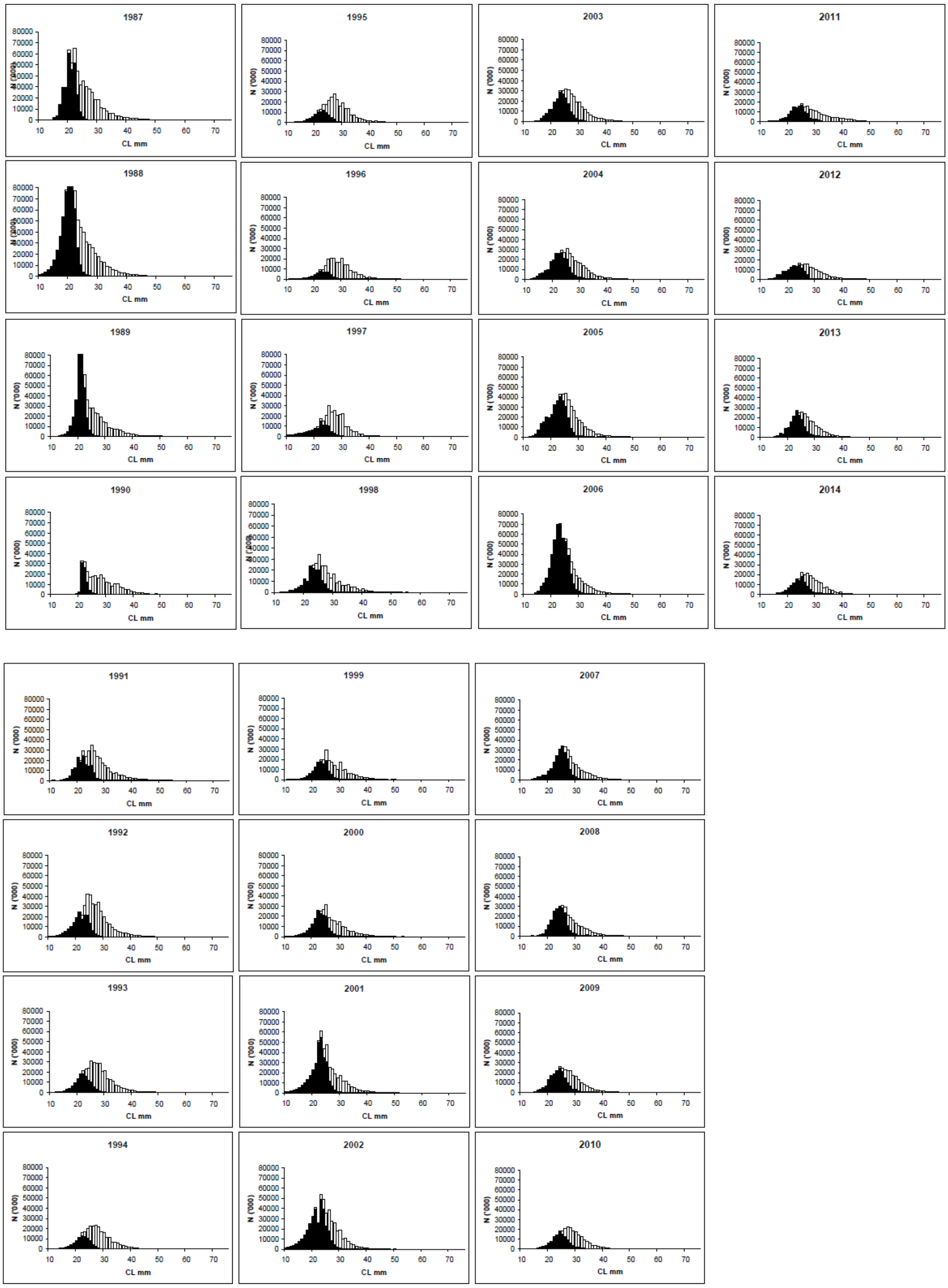


Figure 11.1. Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) catches (landings in white and discards in black) length distributions in 1987-2014.

Figure 11.2. Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) - mean length of landings, discards and catches

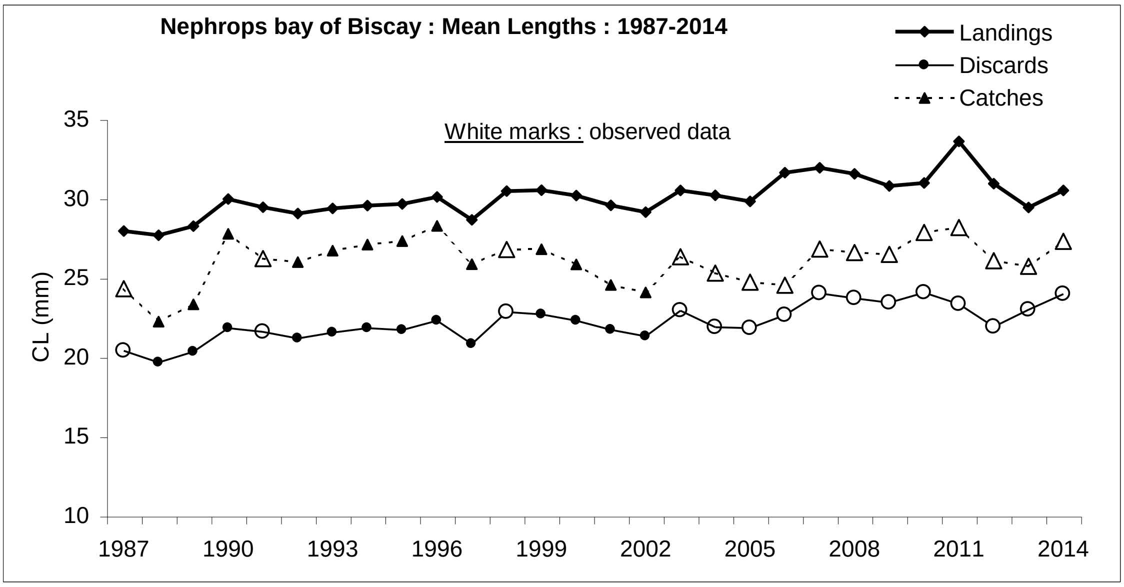
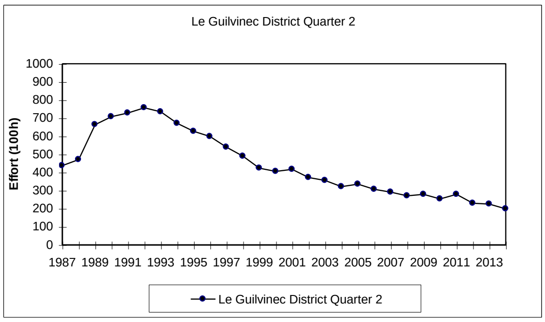
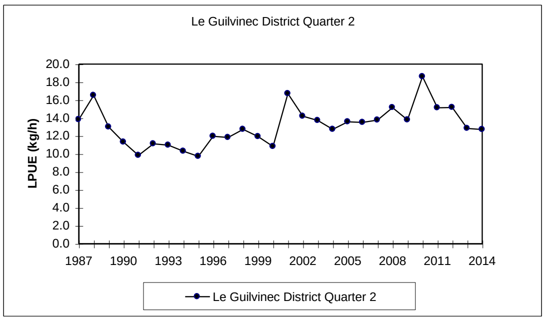


Figure 11.3. Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) - Effort and LPUE values of commercial fleets used in the assessment to tune the model.

I. Effort



II. LPUE



12 *Nephrops* in Division VIIIc

The ICES Division VIIIc includes two *Nephrops* Functional Units: FU 25, North Galicia and FU 31, Cantabrian Sea.

12.1 *Nephrops* FU 25 (North Galicia)

12.1.1 General

12.1.1.1 Ecosystem aspects

See Annex K

12.1.1.2 Fishery description

See Annex K

12.1.1.3 Summary of ICES Advice for 2015 and management applicable to 2015 and 2016

ICES advice for 2015

The advice for these *Nephrops* stocks is biennial and valid for 2015 and 2016.

ICES advises on the basis of the precautionary considerations that there should be directed fishery and bycatch should be minimized.

To protect the stock in this Functional Unit, ICES advices that management area should be consistent with the assess area. Therefore, management should be implemented at the Functional Unit level.

Management applicable to 2014 and 2015

A recovery plan for southern hake and Iberian *Nephrops* stocks has been in force since the end of January 2006. The aim of the recovery plan is to rebuild the stocks within 10 years, with a reduction of 10% in F relatively to the previous year and the TAC set accordingly (Council Regulation (EC) No. 2166/2005). TACs of 67 t and 60 t were set for the whole of Division VIIIc for 2014 and 2015, respectively.

12.1.2 Data

12.1.2.1 Commercial catches and discards

Up to 2010, in previous years landings have been estimated by the WG based on IEO scientific estimations. The information was compiled by IEO from sale sheets and Owners Associations where the *Nephrops* landings allocation was carried out based on landing port criteria. Since 2011, the Spanish Authority for Fisheries (Secretaría General de Pesca, SGP) who is also the National Authority for the Data Collection Framework established a new policy and general approach in the provision of official data on catches and fishing effort. So, since 2011 *Nephrops* landings are official landings.

Unlike the IEO scientific estimates, official landings are derived from logbooks. This source of information allows the landings disaggregation by ICES statistical rectangles. In WGHMM 2013 was noticed that some *Nephrops* catches were recorded into statistical rectangles outside of the FU 31 definition. In 2012 and 2013 *Nephrops* catches recorded into statistical rectangles outside of this FU were considered as part of the landings in FU 25. In 2014 Spanish landings of *Nephrops* have been uploaded to InterCatch broken down by ICES statistical rectangle for first time according to the 2014 ICES Data Call requirements. However, only were uploaded to Intercatch 83.7% of 2014 landings which were recorded inside ICES statistical rectangles defined as FU 31 (WD Nº 3, Castro). As the outer rectangles were not defined in InterCatch, the remaining landings couldn't be upload this year but this will be for next year WG.

Landings were reported only by Spain. Since the early 90s landings declined from about 400 t to less than 100 t in 2003. In the period 2004-2014, landings show a continuous decreasing trend up to 9 t in the last year (Table 12.1.1). The time series of the commercial landings (Figure 12.1.1) shows a clear declining trend, with present values representing approximately less than 1% of the landings in the 70s. Information on discards was sent to the WG through InterCatch. There are no discards in this functional unit.

12.1.2.2 Biological sampling

Length frequencies by sex of the *Nephrops* landings are collected as a rule on a monthly basis. The sampling levels are showed in Table 1.3.

Annual length compositions for males and females combined, mean size and mean weight in the landings are given in Table 12.1.2 for the period 1981-2014 (see also Figures 12.1.2a and 12.1.2b).

Mean sizes in the landings shows an increasing trend in the time series in both sexes. The maximum value was recorder in 2009, reaching 48.5 and 45.1 mm CL for males and females, respectively. However, decreasing trend was observed from 2010 to 2014 (Figure 12.1.1). In 2014, the mean size in females was 39.2 mm of carapace length while 40.2 mm for males.

12.1.2.3 Commercial catch-effort data

Fishing effort and LPUE data were available for the A Coruña trawl fleet (SP-CORUTR8c) from 1986 (Table 12.1.3 and Figure 12.1.1). The method to estimate the effort has changed since 2009. Before this date the effort series (SP-CORUTR8c) was estimated using a different fleet segmentation. Since implementation of the current DCF sampling program (EC, 2008), the Northwester Spanish OTB fleet was split into two different *metiers*: OTB_DEF_>55_0_0 (trips targeting demersal fish that include *Nephrops*) and OTB_MPD_>55_0_0 (trips targeting pelagic fish accompanied by demersal fish). In this WG are presented a revision of the 2009-2014 effort and LPUE series in FU 25 using only the demersal *métier* OTB_DEF_>55_0_0 and they have been renamed this year as SP-LCGOTBDEF (WD Nº 4, Castro & Morlan). As a consequence it must be noted that the method uses to calculate the LPUE of SP-LCGOTBDEF is not consistent across the period as shown in Figure 12.1.1.

The available time series of effort (Figure 12.1.1) shows a continuous decreasing trend. The lowest effort was observed in 2011, representing approximately 15% of fishing effort in the 70's. In 2012-2014 period, effort increased slightly but it remains at very low level. Effort of the bottom trawl in this fishery is directed primarily at a set of demersal and bottom species, with *Nephrops* making only a small contribution to the whole landings.

The overall trend of LPUE is declining too (Figure 12.1.1). After a period quite variable at the beginning of the time series, LPUE remained relatively stable at around 40 kg/trip between 1993 and 1997. Since then, LPUE has fluctuated at low levels but shows a decreasing trend up to 2014, the lowest value recorded in the time series (4.5 Kg/trip).

12.1.3 Assessment

As the perception of the stock did not change from previous year, no update of the assessment was performed.

12.1.4 Biological reference points

There are not reference points defined for this stock.

12.1.5 Management Considerations

Nephrops is taken as by catch in the mixed bottom fishery. The overall trend in landings of *Nephrops* from the North Galicia (FU25) is strongly declining. Landings have dramatically decreased since the beginning of the series (1975-2014), representing less 1% of the landings.

A recovery plan for southern hake and Atlantic Iberian *Nephrops* stocks was approved in December 2005 (Council Regulation (EC) No 2166/2005) and implemented since January 2006. The management objective is to rebuild the stock to safe biological limits within a period of 10 years. This recovery plan includes a procedure for setting the TACs for *Nephrops* stocks, complemented by a system of fishing effort limitation (a reduction of 10% in the fishing mortality rate in the year of its application as compared with the fishing mortality rate estimated for the preceding year, within the limits of ±15% of the preceding year TAC).

Table 12.1.1. ***Nephrops*** **FU25, North Galicia. Landings in tonnes.**

Year	Trawl	Unallocated	Total FU
1975	731		731
1976	559		559
1977	667		667
1978	690		690
1979	475		475
1980	412		412
1981	318		318
1982	431		431
1983	433		433
1984	515		515
1985	477		477
1986	364		364
1987	412		412
1988	445		445
1989	376		376
1990	285		285
1991	453		453
1992	428		428
1993	274		274
1994	245		245
1995	273		273
1996	209		209
1997	219		219
1998	103		103
1999	124		124
2000	81		81
2001	147		147
2002	143		143
2003	89		89
2004	75		75
2005	63		63
2006	62		62
2007	67		67
2008	39		39
2009	21		21
2010	34		34
2011	44		44
2012	10	11	21
2013	10		10
2014	9		9

Table 12.1.2. ***Nephrops*** **FU25, North Galicia. Length compositions of landings of landings, mean weight (Kg) and mean length (CL, mm) for the period 1982-2014.**

Size, CL/Year	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
15																																6	
16																																	
17																																	
18																																	
19	1	8			6							5																0	0				
20	1	17		16	1				2			34			1			0								0		0	0			0	
21	7	31	9							1		49	1	0	2				0		1	0		0		0		0	0			0	0
22	10	99	20	8	50	0						32	1	7	5	5		0					1	1	0	1		0	0			8	0
23	41	143	18	68	68	6	4		5	15		15	10	6	6	7	1	1	0	10	2	0	1	1	1	1		0	0				
24	53	350	138	198	136	38	1		8	20	13	80	10	19	29	16	2	5	2		2	1	2	2	1	1	0	0	0				
25	105	496	150	300	192	191	16		30	71	19	57	60	64	38	18	6	15	7	10	2	0	7	5	2	1	1	0	0			8	1
26	142	511	342	326	279	185	42	1	30	203	26	70	118	77	56	53	12	26	9	19	5	2	7	8	3	5	1		0			8	0
27	275	748	519	575	299	467	17	2	59	359	102	71	179	108	91	49	16	21	5	20	14	3	12	13	9	4	3	0	2	0		0	1
28	303	731	686	799	495	302	208	23	186	1038	331	105	281	213	179	186	47	67	32	79	30	2	26	25	15	8	4		2	1	2	9	1
29	382	761	1004	943	500	365	175	21	174	850	280	134	262	189	225	178	38	91	24	125	43	5	28	25	18	11	6	0	2	2	1	2	1
30	648	1068	1307	1253	470	505	535	84	278	1426	563	176	335	424	266	441	92	194	85	112	105	14	46	43	25	19	10	1	9	2	2	12	3
31	611	1004	1108	1215	602	446	504	95	329	1047	584	152	330	370	342	303	65	136	60	129	102	26	45	56	39	36	10	1	9	3	3	2	2
32	782	1009	1581	1045	779	618	613	248	535	1319	883	308	410	444	404	492	99	197	127	288	198	36	60	66	55	44	15	1	18	3	3	3	2
33	874	956	1323	817	812	526	906	369	547	946	831	472	471	433	454	387	69	100	95	319	181	51	71	87	69	69	13	3	20	5	3	5	5
34	906	782	1193	975	886	741	719	406	448	981	1114	533	507	480	520	695	152	300	219	302	272	66	70	83	62	75	16	4	27	13	2	5	7
35	927	777	1032	797	764	820	745	625	555	883	976	670	564	707	396	543	193	258	218	265	308	85	91	98	85	90	25	5	34	25	4	18	12
36	991	756	972	823	682	945	820	414	563	709	809	549	547	480	360	500	139	241	158	243	259	110	98	102	88	101	31	6	30	21	4	8	16
37	728	610	643	637	694	845	989	618	447	738	923	563	462	462	341	323	192	208	144	285	236	123	101	88	87	105	37	9	34	23	5	9	13
38	582	667	456	484	600	453	799	757	429	641	656	546	454	459	329	407	178	211	113	238	185	147	98	92	80	101	35	10	26	63	3	6	13
39	553	513	360	593	341	491	438	433	315	404	528	362	330	315	257	299	123	138	82	192	129	130	81	69	67	86	37	10	23	45	1	15	11
40	480	438	442	494	416	478	582	477	348	449	517	336	301	507	233	326	203	202	134	212	186	129	96	81	64	90	47	12	20	78	8	11	13
41	368	348	323	307	329	283	461	507	304	279	365	230	178	239	166	141	101	110	64	115	99	81	78	61	59	73	44	12	23	61	4	7	9
42	347	286	412	230	251	226	673	375	235	295	386	243	222	300	145	166	106	106	73	150	117	79	63	52	49	63	38	11	23	50	3	6	8
43	250	194	187	301	283	312	314	417	244	230	296	175	113	219	122	98	81	58	30	103	67	65	57	47	44	59	35	12	24	52	1	15	8
44	193	124	202	239	108	286	236	280	181	146	214	173	99	116	82	57	65	61	48	98	109	52	39	36	32	46	29	14	22	34	3	7	7
45	238	125	205	104	102	125	219	236	157	170	138	158	99	142	74	84	82	72	40	68	78	46	44	34	30	42	23	13	21	24	3	7	4
46	111	87	97	223	64	302	123	209	93	109	138	124	52	74	55	31	35	42	20	35	65	57	35	26	26	37	22	11	22	17	1	7	5
47	100	56	79	65	80	136	104	156	78	97	104	43	38	56	55	37	41	23	10	22	34	42	26	20	18	30	20	14	22	13	1	2	4
48	81	44	181	85	31	108	106	163	71	79	34	69	25	30	37	26	31	26	17	24	35	37	23	14	17	22	16	9	17	15	0	4	2
49	48	23	89	52	42	93	44	90	36	32	45	23	29	12	21	16	16	16	11	18	23	27	16	13	11	16	14	8	14	17	2	3	2
50	48	17	56	48	25	41	30	71	26	34	31	25	18	16	21	28	28	41	13	18	24	27	19	11	14	18	10	8	13	12	0	2	2
51	32	16	64	41	17	9	23	49	22	10	16	17	8	8	12	3	5	6	8	16	34	20	13	7	9	11	11	6	11	7	1	2	1
52	16	6	3	4	20	19	20	41	24	9	33	26	11	6	6	5	9	9	8	10	18	16	12	8	8	8	9	6	8	7	0	2	1
53	12	9	6	34	8	21	5	41	18	13	14	20	10	6	11	4	4	4	2	15	13	11	9	6	7	7	8	7	9	4	1	2	2
54	9	6	25	33	8	1	7	26	8	4	5	2	7	4	7	3	3	5	5	4	4	9	7	5	4	4	6	5	7	7	0	2	1
55	8	6	25	7	4	3	5	13	9	1	12	10	7	3	5	5	3	7	7	7	9	6	6	5	4	3	6	6	7	6	1	1	1
56	3	3	25	5	0	10	3	9	2	3	2	2	4	2	3	0	2	4	2	5	6	5	5	3	9	3	4	4	4	5	0	1	1
57	4	1		6	0	7	4	8	5	3	0		5	1	2	1	0	2	3	0	5	7	4	3	4	2	5	3	5	4	0	0	0
58	1	3	1	0	11	8		5	1	3	0	0	2	1	5	0	1	2	4	1	9	4	4	3	2	2	4	3	3	4	0	1	1
59	3	2		2	1		10	2	2	1	0	0	1	1	5	0	1	0	0	1	4	5	3	2	1	1	3	3	2	1	0	1	0
60	2	2	1	1	0	3	2	8	1	0	1		0	1	3	1	1	0	2	1	2	2	2	2	1	1	2	3	3	3	0	0	0
61	0	2		1	0			4	2				1	1	2	0	0		2		1	1	3	1	1	1	2	1	1	3	1		0
62	3	2		1	0			2		1	1		0	1	3	0	0	0	0	0	3	3	2	1	7	1	1	2	1	6	0	1	0
63	1	1		1		1		1	0	0	0		1	1	1	2	0		0	0	10	0	2	1	1	1	1	2	1	1	0		0
64	2	0		3	0	1	2	3	1				0	1	1	0	0		0	0	0	1	2	1	6	0	1	1	0	2	0	0	0
65	1	0		0	0	1	12	1	0	2	1		0	0	4				0	0	4	1	2	1	1	0	1	1	1	1	0		0
66	0	1		1	0			1	1					0	1	1	0		0	0	1	2	1	1	0	0	1	1	1	1	0	0	0
67	1	2		0					1	1			0	0	0	1	0		0		2	1	1	1	1	0	1	1	0	2	0		0
68	0	1		1			2	0	1				0	0	1	0	0		0		0	1	1	1	0	0	1	1	1	2	0		0
69	1	0		1			2	1	1				0		1		0		0		0	2	1	1	0	0	1	1	0	0	0	0	0
70	0	1		1				0	0	0					1	0	1		1		2	1	1	1	0	0	0	1	0	0	0		0
71	1	1		0			2		1	0						0	0		0		0	1	2	0	6	0	0	1	0		0		0
72	1	0				1		0				0			0	0	0		0	0	0	1	1	0	6	0	0	1	0	0	0		0
73	0	1		1					1				0		0						0	1	1	1	0	0	0	1	0	0	0		0
74	0	1		0	0			1		0			0	0	1	1	0		0	0	1	0	1	0	0	0		0	0	0	0		
75	0	1		1					0	0			1		1		0		0	0	0	1	0	0	0	0		0			0		0
76	1	1		0									0		1	0	0				0	0	0	0	0	0	0	0			0		
77	0	0		0		1			0				1	0	0		0			0		0	0	0	0			0			0		
78	0	2		1				1		0			0	0	0		0			0	0	0	0		0	0		0	0		0		0
79	0	0		0									0		0								0	0				0	0		0		
80	1	0		0				0								0	0		0		0		0	0	0		0	0			0		
Total number (thousand)	11285	13842	15281	14164	10457	10417	10521	7294	6814	13623	10992	6661	6564	7002	5384	5938	2242	3004	1887	3561	3041	1540	1421	1314	1147	1298	612	235	528	650	66	206	163
Total weight (tonnes)	431	432	515	477	363	411	444	376	281	452	427	274	246	273	209	219	103	124	81	147	143	89	75	63	62	67	39	21	34	44	10	10	9
Mean weight (kg)	0.038	0.031	0.034	0.034	0.035	0.039	0.042	0.052	0.041	0.033	0.039	0.041	0.037	0.039	0.039	0.037	0.046	0.041	0.043	0.041	0.047	0.058	0.052	0.048	0.054	0.051	0.064	0.091	0.065	0.068	0.152	0.048	0.056
CL Mean length (mm)	35.5	33.0	34.0	33.9	34.4	35.8	36.8	39.4	36.6	33.9	35.9	36.4	35.3	35.8	35.5	35.3	37.8	36.5	36.9	36.5	37.8	40.6	39.0	37.9	39.6	40	42.2	46.9	42.2	42.6	40.0	41.0	39.9

Table 12.1.3. *Nephrops* FU 25: North Galicia. Fishing effort and LPUE.

		Effort (trips)		LPUE (kg/trip)	
Year	Landings (t)	SP-CORUTR8c	SP-LCOTBDEF	SP-CORUTR8c	SP-LCOTBDEF
1986	302	5017		60.1	
1987	356	4266		83.5	
1988	371	5246		70.7	
1989	297	5753		51.7	
1990	199	5710		34.9	
1991	334	5135		65.1	
1992	351	5127		68.5	
1993	229	5829		39.2	
1994	207	5216		39.6	
1995	233	5538		42.0	
1996	182	4911		37.0	
1997	187	4850		38.5	
1998	67	4560		14.7	
1999	121	4023		30.1	
2000	77	3547		21.7	
2001	145	3239		44.8	
2002	115	2333		49.5	
2003	65	1804		35.9	
2004	40	2091		18.9	
2005	32	2063		15.5	
2006	33	1699		19.4	
2007	37	2075		17.8	
2008	21	2128		9.9	
2009	11		1355		8.3
2010	22		1164		18.6
2011	35		906		38.4
2012	10		1460		6.8
2013	8		1582		5.3
2014	8		1869		4.5

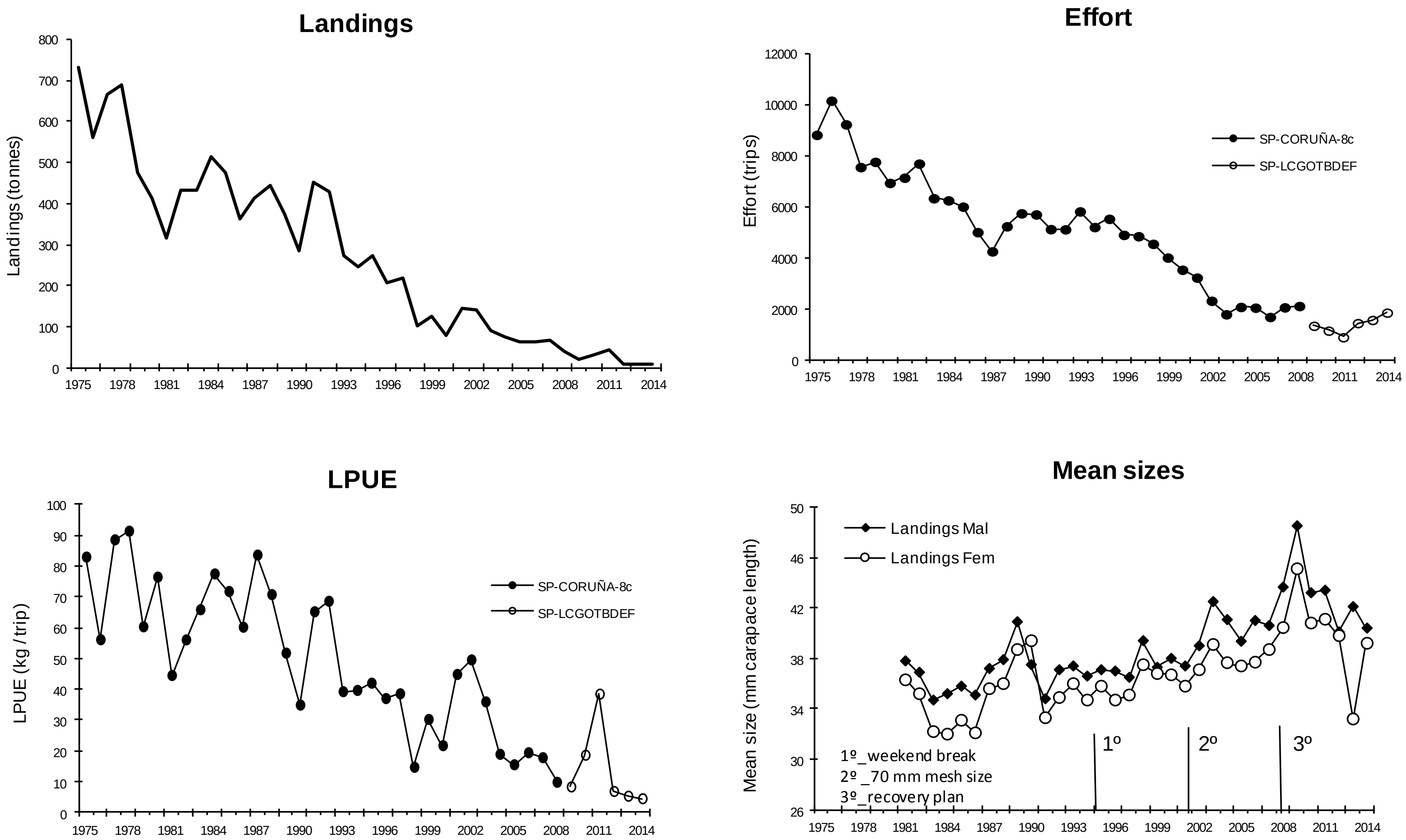


Figure 12.1.1. ***Nephrops*** **FU25, North Galicia. Long-term trends in landings, effort, LPUE and mean sizes.**

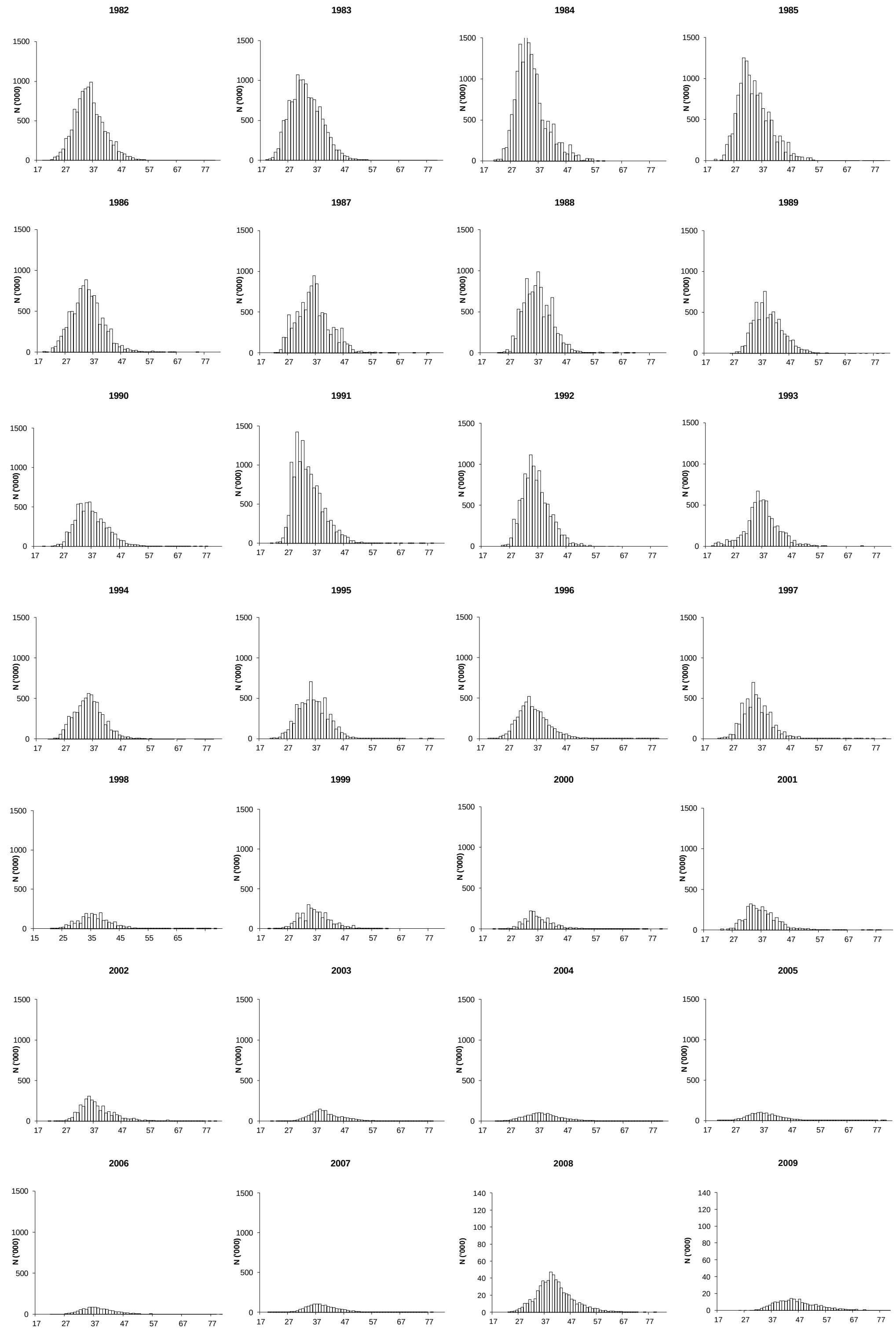


Figure 12.1.2a. ***Nephrops*** **FU25, North Galicia. Length distributions in landings for 1982-2009 period. Y-axe scale has been change from 2008 for a better analysis.**

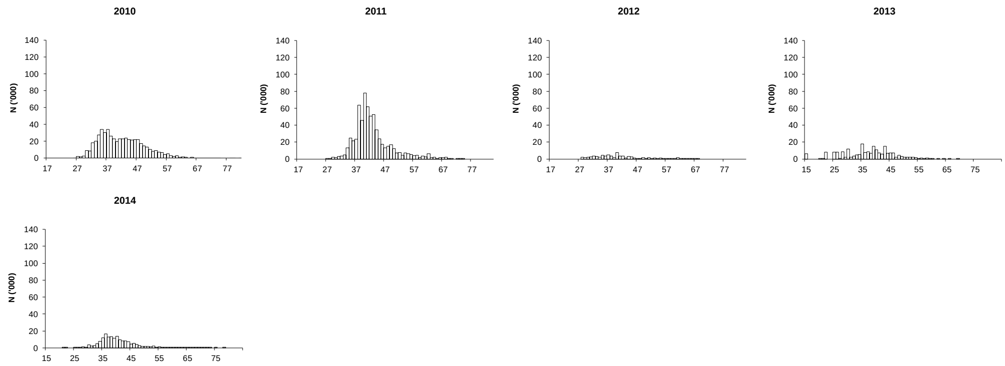


Figure 12.1.2b. ***Nephrops*** **FU25, North Galicia. Length distributions in landings for the period 2010-2014.**

12.2 *Nephrops* FU 31 (Cantabrian Sea)

12.2.1 General

12.2.1.1 Ecosystem aspects

See Annex K

12.2.1.2 Fishery description

See Annex K

12.2.1.3 Summary of ICES Advice for 2015 and management applicable to 2015 and 2016

ICES advice for 2015

The advice for these *Nephrops* stocks is biennial and valid for 2015 and 2016.

ICES advises on the basis of the precautionary considerations that there should be directed fishery and bycatch should be minimized.

To protect the stock in this Functional Unit, ICES advices that management area should be consistent with the assess area. Therefore, management should be implemented at the Functional Unit level.

Management applicable to 2014 and 2015

TACs of 67 and 60 t were set for the whole of Division VIIIc for 2014 and 2015, respectively. A fishing effort limitation is also applicable in accordance with the southern hake and *Nephrops* recovery plan.

12.2.2 Data

12.2.2.1 Commercial catches and discards

Up to 2010, landings have been estimated by the WG based on IEO scientific estimations. The information was compiled by IEO from sale sheets and Owners Associations where the *Nephrops* landings allocation was carried out based on landing port criteria. Since 2011, the Spanish Authority for Fisheries (Secretaría General de Pesca, SGP) who is also the National Authority for the Data Collection Framework established a new policy and general approach in the provision of official data on catches and fishing effort. So, since 2011 *Nephrops* landings are official landings.

Unlike the IEO scientific estimates, official landings are derived from logbooks. This source of information allows the landings disaggregation by ICES statistical rectangles. In WGHMM 2013 was noticed that some *Nephrops* catches were recorded into statistical rectangles outside of the FU 31 definition. In 2012 and 2013*Nephrops* catches recorded into statistical rectangles outside of this FU were considered as part of the landings in FU 31. In 2014 Spanish landings of *Nephrops* have been uploaded to InterCatch broken down by ICES statistical rectangle for first time according to the 2014 ICES Data Call requirements. However, only were uploaded to InterCatch 77.4% of 2014 landings which were recorded inside ICES statistical rectangles defined as FU 31 (WD Nº 3 Castro). As the outer rectangles were not defined in InterCatch, the remaining landings couldn't be upload this year but this will be for next year WG.

Nephrops landings from FU 31 are reported by Spain (the only participant in the fishery) (Table 12.2.1 and Figure 12.2.1) and are available for the period 1983-2014. The highest landings were recorded in 1989 and 1990, with 177 t and 174 t, respectively. Since 1996 landings have declined sharply from 129 t to less than 4 t in 2014.

12.2.2.2 Biological sampling

Length frequencies by sex of *Nephrops* landings were collected by the biological sampling programme. The sampling levels are shown in Table 1.3.

Mean size of males and females in the landings fluctuated during 1988-2014 (Figure 12.2.1). Data show a general increasing trend for both sexes to 2009 (Figure 12.2.1), where it was recorded the highest values (males with 55.8 mm and females with 45.9 mm CL). In 2011 the mean carapace length decreased slightly in relation to the previous year, and it has fluctuated onwards although with an increasing trend. Mean size in 2014 was around 52.0 and 46.8 mm of carapace length in males and females, respectively.

12.2.2.3 Commercial catch-effort data

The fishing effort and LPUE data series includes three bottom trawl fleets operating in the Cantabrian Sea with home harbors in Avilés, Santander and Gijón. In last years, the information of the different fleets is intermittent, although Santander data series is the largest (up to 2013). A new effort series including the Santander, Avilés and Gijón effort together from 2009 to 2014 are presented in this WG. In order to standardize the effort units in Division VIIIc, the new effort series is expressed in trips. The series of effort for Santander, Avilés and Gijón will be combined for the years prior to 2009 for the next WG.

The available old time series of effort shows a period of relative stability from the early 1980s to the beginning of the 1990s. Since 1992, effort shows a marked downward trend (Figure 12.2.1) with the lowest value recorded in 2005 (364 fishing days corresponding to Santander fleet). The increase in the use of other gears (HVO and pair trawl) resulted in the reduction in effort by the baca trawl fleet, the only gear fishing for *Nephrops*. After a slight increase in 2006 and 2007, fishing effort declined again and it has remained at low levels in the last five years. The new effort series (Santander+Avilés+Gijón) from 2009 to 2014 (expressed in trips) shows an increasing trend since 2010, ranging between 850 trips to 1083 trips (Figure 11.2.1). The Santander LPUE series shows fluctuations around the general downward trend (Figure 12.2.1). The LPUE reached the lowest value of the time series in 2013 (2.3 Kg/fishing days), last available data. The new LPUE series (Santander+Avilés+Gijón) shows a decreasing trend in the time series suggesting a very low *Nephrops* abundance in FU 31.

12.2.3 Assessment

As the perception of the stock did not change from previous year, no update of the assessment was performed.

12.2.4 Management considerations

Nephrops is taken as by catch in the mixed bottom fishery. The overall trend in landings of *Nephrops* from the Cantabrian Sea strongly declining. Landings have dramatically decreased since the beginning of the series (1982-2014), representing less 1% of the landings.

A recovery plan for southern hake and Atlantic Iberian *Nephrops* stocks including a fishing effort reduction was implemented and enforced in 2006.

Table 12.2.1. ***Nephrops*** **FU31, Cantabrian Sea. Landings in tonnes.**

Year	Trawl	Creel	Total
1983	63		63
1984	100		100
1985	128		128
1986	127		127
1987	118		118
1988	151		151
1989	177		177
1990	174		174
1991	105	4	109
1992	92	2	94
1993	95	6	101
1994	146	2	148
1995	90	4	94
1996	120	9	129
1997	97	1	98
1998	69	3	72
1999	46	2	48
2000	33	1	34
2001	26	1	27
2002	25	1	26
2003	21	1	22
2004	17	0	17
2005	14	0	14
2006	15	0	15
2007	19	0	19
2008	19	0	19
2009	6	0	6
2010	8	0	9
2011	7	0	7
2012	10	0	10
2013	10	0	10
2014	4	0	4

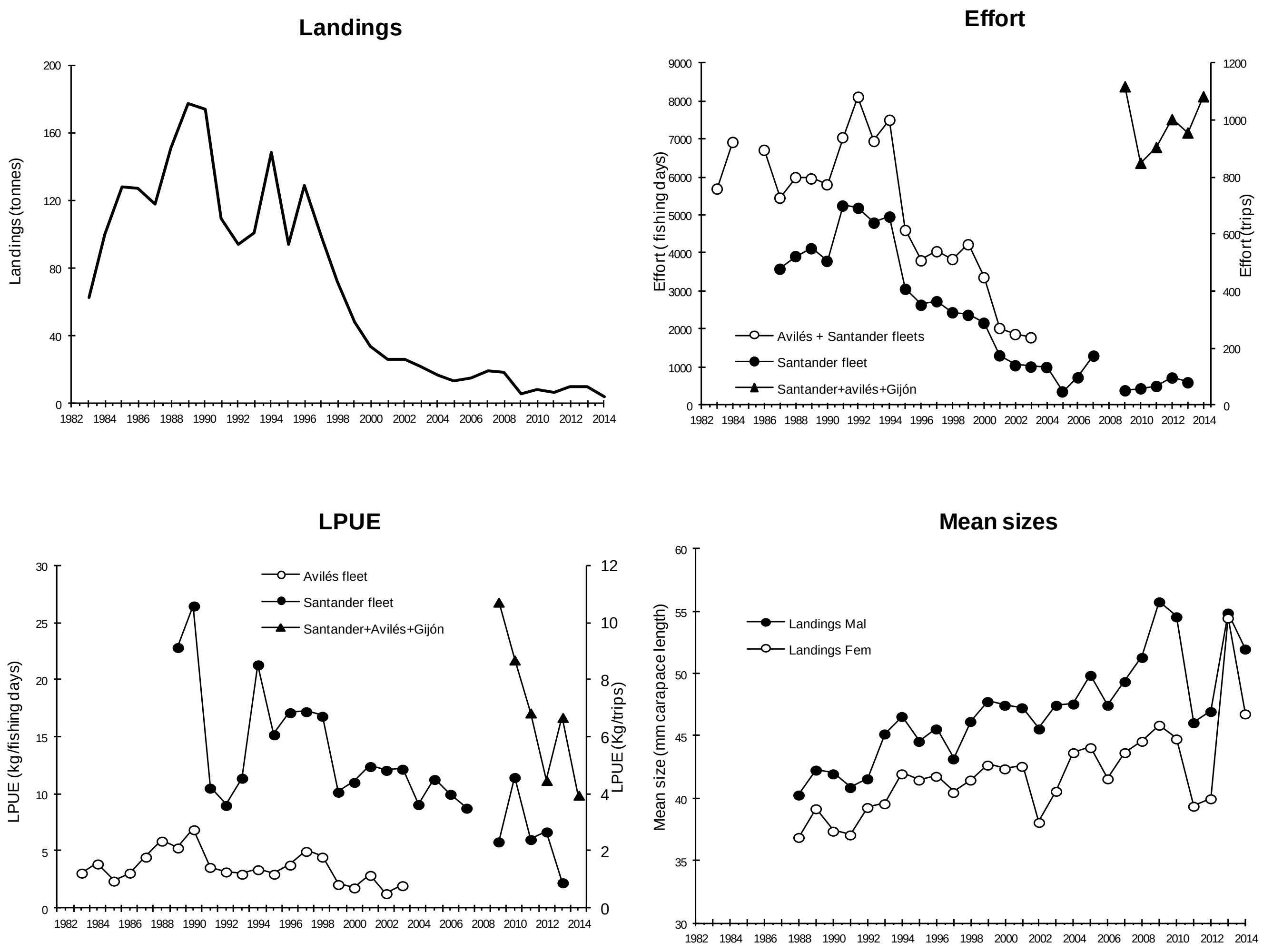


Figure 12.2.2. ***Nephrops*** **FU31, Cantabrian Sea. Long-term trends in landings, effort, LPUE and mean sizes.**

12.3 Summary for Division VIIIc

Nephrops in Division VIIIc includes two FUs (North Galicia, FU 25 and Cantabrian Sea, FU 31). Table 12.3.1 shows the landings in Division VIIIc. Landings from both FUs have declined dramatically. Landings in Division VIIIc were below the TAC in recent years, and therefore the TAC has not been restrictive.

The very low levels of landings from FU 25 and FU 31 and the decreasing LPUE trends to 2014 indicate that both stocks are in very poor condition.

A recovery plan for southern hake and Atlantic Iberian *Nephrops* stocks was approved in December 2005 (Council Regulation (EC) No 2166/2005) and implemented since January 2006. This recovery plan includes a procedure for setting the TACs for *Nephrops* stocks, complemented by a system of fishing effort limitation (a reduction of 10% in the fishing mortality rate in the year of its application as compared with the fishing mortality rate estimated for the preceding year, within the limits of ±15% of the preceding year TAC). ICES has not evaluated the recovery plan.

Table 12.3.1. *Nephrops* in Division VIIIc. Landings by FU (tonnes).

Year	FU 25	FU 31	Unallocated	DIVISION VIIIc
1975	731			731
1976	559			559
1977	667			667
1978	690			690
1979	475			475
1980	412			412
1981	318			318
1982	431			431
1983	433	63		496
1984	515	100		615
1985	477	128		605
1986	364	127		491
1987	412	118		530
1988	445	151		596
1989	376	177		553
1990	285	174		459
1991	453	109		562
1992	428	94		522
1993	274	101		375
1994	245	148		393
1995	273	94		367
1996	209	129		338
1997	219	98		317
1998	103	72		175
1999	124	48		172
2000	81	34		115
2001	147	27		174
2002	143	26		169
2003	89	22		111
2004	75	17		92
2005	63	14		77
2006	62	15		77
2007	67	19		86
2008	39	19		58
2009	21	6		27
2010	34	8		42
2011	44	7		51
2012	10	10	11	31
2013	10	10		20
2014	9	4		13

13 *Nephrops* in Division IXa

The ICES Division IXa has five *Nephrops* Functional Units: FU 26, West Galicia; FU 27 North Portugal; FU 28, Alentejo, Southwest Portugal; FU 29, Algarve, South Portugal and FU 30, Gulf of Cádiz.

13.1 *Nephrops* FU 26–27, West Galicia and North Portugal (Division IXa)

13.1.1 General

13.1.1.1 Ecosystem aspects

See Annex L

13.1.1.2 Fishery description

See Annex L

13.1.2 Summary of ICES Advice for 2015 and management applicable to 2015 and 2016

ICES advice for 2015

The advice for these *Nephrops* stocks is biennial and valid for 2015 and 2016.

ICES advises on the basis of the precautionary considerations that there should be no directed fishery and bycatch should be minimized.

To protect the stock in this Functional Unit, ICES advices that management area should be consistent with the assess area. Therefore, management should be implemented at the Functional Unit level.

Management applicable to 2014 and 2015

A recovery plan for southern hake and Iberian *Nephrops* stocks has been in force since the end of January 2006. The aim of the recovery plan is to rebuild the stocks within 10 years, with a reduction of 10% in F relative to the previous year and the TAC set accordingly (Council Regulation (EC) No. 2166/2005).

In order to reduce F on *Nephrops* stocks in this Division even further, a seasonal ban was introduced in the trawl and creel fishery for two boxes, located in FU 26 and 28, in the peak of the *Nephrops* fishing season. These boxes are closed for *Nephrops* fishing in June–August and in May–August, respectively.

ICES has not evaluated the current recovery plan for *Nephrops* in relation to the precautionary approach.

The TAC set for the whole Division IXa was 221 t for 2014 and 254 t for 2015, respectively, of which no more than 6 % may be taken in FUs 26 and 27. The maximum number of fishing days per vessel was fixed at 127 and 114 days for Spanish vessels and at 126 and 113 days for Portuguese vessels for these two years (Annex IIb of Council Regulations nos. 43/2014 and 104/2015). The number of fishing days included in these regulations is not applicable to the Gulf of Cadiz (FU 30), which has a different regime.

13.1.3 Data

13.1.3.1 Commercial catches and discards

Up to 2010, landings have been estimated by the WG based on IEO scientific estimations. The information was compiled by IEO from sale sheets and Owners Associations where the *Nephrops* landings allocation was carried out based on landing port criteria. Since 2011, the Spanish Authority for Fisheries (Secretaría General de Pesca, SGP) who is also the National Authority for the Data Collection Framework established a new policy and general approach in the provision of official data on catches and fishing effort. So, since 2011 *Nephrops* landings are the official landings.

Unlike the IEO scientific estimates, official landings are derived from logbooks. This source of information allows the landings disaggregation by ICES statistical rectangles. In WGHMM 2013 it was noticed that some *Nephrops* catches were recorded into statistical rectangles outside of the FU 26-27 definition. In 2012 and 2013 *Nephrops* catches from statistical rectangles outside of this FU were considered as part of the landings in FU 26-27. In 2014 Spanish landings of *Nephrops* have been uploaded to Intercatch broken down by ICES statistical rectangle for the first time according to the 2014 ICES Data Call requirements. However, only the landings recorded inside ICES statistical rectangles defined as FU 26-27 were uploaded to InterCatch, which correspond to 96.3% of 2014 landings (WD Nº 3, Castro). As the outer rectangles were not defined in Intercatch, the remaining landings couldn't be upload this year but this should be done for next year WG.

Landings in these FUs are reported by Spain and minor quantities by Portugal. The catches are taken by the Spanish fleets fishing on the West Galicia (FU 26) and North Portugal (FU 27) fishing grounds, and by the Portuguese fleet fishing on FU 27. *Nephrops* represents a minor percentage in the composition of total trawl landings and can be considered as by-catch although it is a very valuable species.

Along the time series, landings by the Spanish fleets are mostly from FU 26, together with smaller quantities taken from FU 27. However, since 2011 landings are very low in both FUs. Prior to 1996, no distinction was made between the two FUs, and therefore they are considered together.

Two periods can be distinguished in the time series of landings available 1975-2014 (Figure 13.1.1). During 1975-1989, the mean landing was 680 t, fluctuating between 575 and 800 t approximately. Since 1990 onwards there has been a marked downward trend in landings, being below 50 t from 2005 to 2011..In the last three years, landings were minimal (less than 10). In 2014, landings were 4 t. Information on discards was sent to the WG through Intercatch although no discards are recorded in these FUs.

Total Portuguese landings from FU 27 have decreased from almost 100 t in 1988 to just 1 t in 2012, 2013 and 2014.

13.1.3.2 Biological sampling

Length frequencies by sex of the *Nephrops* landings are collected monthly. The sampling levels are shown in Table 1.3.

Mean size for both sexes shows an increasing trend from 2001 to 2010 with the highest value recorded in 2010 (52.0 mm CL in males and 43.7 mm CL in females) (Figure 13.1.1). In contrast, mean carapace length declined in both sexes in 2011-2013 period. The mean size in 2014 was 42.4 mm and 35.6 mm of carapace length in males and females, respectively. Annual length compositions for males and females combined, mean size and mean weight in landings for the period 1988-2014 are given in Table 13.1.2 and Figure 13.1.2.

13.1.3.3 Commercial catch-effort data

Fishing effort and LPUE estimates are available for Marin trawl fleet (SP-MATR) for the period 1990-2014 (Table 13.1.3). The overall trend for the LPUE of SP-MATR is decreasing, with some stability in the 2007-2009 periods although at very low level (~17.5 Kg/trip). From 2010 to 2014, LPUE downfall again to the lowest recorded in the time series (0.8 Kg/trip) indicating that the *Nephrops* abundance is at very low level.

Time series of fishing effort and LPUE of the bottom trawl fleets with the Spanish home ports of Muros (1984-2003), Riveira, (1984-2004), and Vigo, (1995-2008 and 2010) are also available. These data are plotted in Figure 12.1.1 for complementary information.

13.1.4 Assessment

As the perception of the stock did not change from previous year, no update of the assessment was performed.

13.1.5 Biological reference points

There are not reference points defined for this stock.

13.1.6 Management Considerations

Nephrops is taken as by catch in a mixed bottom trawl fishery. Landings of *Nephrops* have substantially declined since 1995. Recent landings represent less than 1% of the average landings in the early period of the time series (1975-1992). Fishing effort in FU 26-27 has decreased throughout the time series.

A recovery plan for southern hake and Iberian *Nephrops* stocks was approved in December 2005 (CE 2166/2005) and implemented since January 2006.

The recovery plan includes a reduction of 10% in the hake F relative to the previous year and TAC set accordingly, within the limits of ±15% of the previous year TAC (Council Regulation (EC) No 2166/2005). Although no clear targets were defined for Norway lobster stocks in the plan, the same 10% reduction has been applied to these stocks effort and TAC. The number of allowed fishing days is set in each year regulations (Council Regulations (EC) Nos. 51/2006, 41/2007, 40/2008, 43/2009, 53/2010, 57/2011, 43/2012, 39/2013, 43/2014 and 104/2015). The recovery plan target and rules have not been changed since it was implemented. This plan also includes a seasonal closure (June-August) for *Nephrops* in an area of the West Galicia (FU 26) fishing grounds, which was amended to the Council Regulation (EC) No 850/98.

Tabla 13.1.1. ***Nephrops*** **FU26-27, West Galicia and North Portugal. Landings in tonnes by Functional Units and country.**

	Spain		Portugal	Unallocated	Total
Year	FU 26**	FU 27	FU 27	FU27	FU 26-27
1975	622				622
1976	603				603
1977	620				620
1978	575				575
1979	580				580
1980	599				599
1981	823				823
1982	736				736
1983	786				786
1984	604		14		618
1985	750		15		765
1986	657		37		694
1987	671		71		742
1988	631		96		727
1989	620		88		708
1990	401		48		449
1991	549		54		603
1992	584		52		636
1993	472		50		522
1994	426		22		448
1995	501		10		511
1996	264	50	17		331
1997	359	68	6		433
1998	295	42	8		345
1999	194	48	6		248
2000	102	21	9		132
2001	105	21	6		132
2002	59	24	4		87
2003	39	26	8		73
2004	38	24	9		71
2005	16	16	11		43
2006	15	17	12		44
2007	20	17	10		47
2008	17	12	13		42
2009	16	5	10		31
2010	3	14	4		21
2011	8	8	4	7	27
2012	3	4	1		8
2013	1	<1	1		3
2014	1	<1	1		4

**Prior 1996, landings of Spain recorded in FU 26 include catches in FU 27

Table 13.1.2. ***Nephrops*** **FU26-27, West Galicia and North Portugal. Length compositions, mean weight (Kg) and mean size (CL, mm) in landings for the 1988-2014 period.**

Size, CL/Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
12	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
13	0	71	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
14	0	69	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15	0	451	110	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16	0	191	289	13	0	0	0	0	0	0	0	0	3	17	0	0	0	0	0	0	0	0	0	0	0	0	
17	0	128	518	17	0	0	7	0	0	0	0	0	3	11	0	0	0	0	0	0	0	0	0	0	0	0	
18	0	683	898	25	0	0	2	1	0	0	0	0	16	19	0	4	0	0	0	0	0	0	0	0	0	0	
19	0	679	1502	38	0	0	0	0	0	0	0	0	38	52	0	4	0	0	0	0	0	0	0	0	0	0	
20	27	1057	2044	97	6	5	10	7	25	3	0	0	86	151	3	29	0	0	0	0	0	0	0	0	0	0	
21	27	1260	2489	199	12	24	19	8	78	0	0	0	119	236	3	27	0	0	1	0	0	0	0	0	0	0	
22	39	1657	2642	398	48	99	84	47	202	12	1	0	129	348	11	11	1	0	1	0	0	0	0	0	0	1	
23	109	1901	3063	568	103	99	77	151	373	26	6	0	127	518	16	31	0	0	0	0	1	0	0	0	0	0	
24	198	1626	2736	1216	284	222	169	338	550	46	7	3	93	466	22	17	1	2	1	0	2	0	0	0	0	0	1
25	290	2212	1802	1477	541	381	199	672	906	113	45	15	134	441	35	28	1	2	1	0	3	1	0	0	0	0	2
26	574	1675	1451	1516	829	542	289	709	960	184	40	43	145	365	56	22	7	2	2	1	2	1	0	0	0	0	1
27	854	1878	1333	1351	926	904	409	933	746	306	80	68	129	419	106	40	18	8	5	2	3	1	0	0	0	0	1
28	1272	1560	1319	1940	1079	1017	524	1298	842	402	138	109	123	274	74	46	23	12	8	6	9	4	0	0	0	0	2
29	1487	1716	913	1797	1023	987	613	1223	706	489	191	134	143	266	86	60	20	15	13	7	7	9	0	0	0	0	2
30	1615	1510	845	1501	1069	1140	767	1371	792	681	295	195	172	252	118	90	31	25	20	12	13	11	0	1	1	1	4
31	1960	1106	632	1450	1180	890	802	1378	609	719	359	239	182	209	105	102	27	21	21	13	16	9	1	1	0	1	1
32	1951	1472	772	1484	1197	912	847	1491	601	888	411	292	285	220	160	95	49	29	35	23	27	11	2	3	2	1	1
33	2288	1313	601	1126	1378	878	898	1444	517	780	525	377	176	201	167	84	56	26	40	47	23	11	2	2	2	1	0
34	1581	1299	572	1160	1001	849	853	1255	542	745	551	376	192	156	131	83	56	31	51	43	37	22	5	3	2	1	5
35	1487	952	518	1044	915	855	745	963	506	637	569	432	200	148	96	91	53	26	48	46	25	18	4	5	2	1	5
36	1161	634	407	879	776	901	611	744	433	527	484	360	176	120	110	85	56	21	42	36	22	15	4	5	1	1	2
37	838	545	284	651	627	736	546	580	348	484	417	321	175	143	106	111	70	31	51	49	31	17	7	5	2	1	3
38	1196	608	294	616	545	682	621	542	346	534	425	308	128	110	76	72	86	35	61	38	28	20	6	9	2	1	1
39	837	451	226	600	505	510	475	425	285	406	292	240	128	85	95	79	65	27	43	36	21	14	6	12	3	1	2
40	501	325	199	450	666	573	412	455	284	466	393	218	115	65	76	60	90	24	55	39	32	21	7	19	4	1	4
41	428	288	165	375	431	385	321	321	213	399	312	182	112	58	88	48	60	21	40	32	23	16	8	13	4	1	1
42	367	287	144	220	362	375	314	214	182	360	249	210	66	57	81	54	101	22	47	43	26	14	6	12	6	1	1
43	433	296	156	203	425	307	293	188	165	325	292	219	64	36	76	47	73	25	38	49	25	13	9	12	4	1	1
44	164	277	87	136	301	251	200	152	127	290	207	193	61	44	52	33	62	20	32	38	36	13	10	11	4	0	3
45	165	286	58	110	303	219	178	125	118	218	196	162	58	42	44	34	56	17	18	29	17	12	8	11	5	0	3
46	96	135	23	90	350	153	129	116	94	191	178	152	40	28	49	26	29	20	18	24	18	8	10	10	3	0	1
47	94	117	45	82	228	104	92	84	56	123	120	84	38	47	42	31	38	26	18	28	17	8	8	9	4	0	1
48	71	100	25	49	222	58	96	55	70	117	147	96	23	18	22	13	28	18	12	15	16	7	7	4	3	1	1
49	73	76	29	42	148	84	71	46	23	60	105	64	21	16	15	16	18	13	11	14	9	5	7	8	3	0	1
50	83	127	14	46	63	81	69	29	31	81	95	54	17	12	12	15	16	15	13	14	9	9	10	9	3	0	2
51	15	48	9	14	71	27	59	13	21	43	59	21	17	6	7	15	7	15	7	7	9	6	4	3	3	0	0
52	20	75	14	33	71	21	59	18	22	43	55	30	18	6	7	10	12	10	8	10	9	6	5	4	3	0	0
53	23	34	13	26	34	20	28	6	13	30	37	33	5	5	6	10	5	7	6	8	4	6	5	3	2	0	0
54	14	10	11	23	23	14	12	6	15	42	28	27	8	3	2	8	4	11	10	6	7	4	5	3	3	0	1
55	6	27	1	6	13	17	12	1	9	25	26	12	6	7	3	4	5	8	3	6	6	5	7	3	1	0	1
56	6	9	1	5	5	10	5	1	9	14	14	14	7	4	3	5	3	4	2	3	6	6	4	2	1	0	0
57	10	5	1	2	6	5	10	0	4	8	12	6	5	3	3	2	2	3	2	4	5	5	3	1	0	0	0
58	11	5	1	4	6	5	14	0	3	6	11	5	4	5	4	3	3	4	4	4	5	5	4	2	0	0	1
59	7	0	4	0	7	2	7	0	0	2	1	5	3	3	0	1	4	3	1	3	2	2	1	1	1	0	0
60	2	0	2	0	4	3	3	0	0	1	2	3	2	2	2	2	7	4	2	1	3	3	4	2	1	0	1
61	4	0	1	0	3	2	12	0	0	0	2	0	3	2	0	2	1	14	1	2	1	1	3	1	1	0	0
62	2	0	1	0	1	0	7	0	0	0	0	0	1	5	0	2	2	4	2	1	3	2	1	1	1	0	0
63	1	0	1	0	3	0	5	0	0	1	0	0	3	3	0	2	1	2	1	1	1	1	2	1	0	0	0
64	2	0	1	0	3	1	4	0	0	0	1	0	2	2	0	2	1	1	1	1	2	3	2	1	0	0	0
65	2	0	1	0	1	0	2	0	0	0	0	0	1	1	1	1	2	2	1	1	1	2	2	1	0	0	0
66	3	0	1	0	1	0	2	0	0	0	1	0	2	2	0	1	0	1	1	1	1	1	1	0	1	0	0
67	2	4	1	0	1	1	1	0	0	0	1	0	3	1	0	2	1	2	1	1	1	1	1	0	0	0	0
68	2	11	1	0	2	2	6	0	0	0	0	0	2	1	0	2	1	1	2	2	2	1	2	1	0	0	0
69	1	4	1	0	1	1	0	0	0	0	0	0	2	1	0	1	1	1	2	1	1	1	1	0	1	0	0
70	12	25	1	2	12	6	8	0	1	0	3	0	11	1	1	5	4	8	1	1	4	1	1	1	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	1	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
76	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
81	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
82	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
83	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total number (thousand)	22409	31275	29319	23087	17811	15360	12003	17411	11828	10827	7383	5302	3822	5712	2169	1666	1257	638	800	752	569	355	191	201	81	20	60
Total weight (t)	727	708	450	603	636	522	448	511	331	432	344	246	132	132	87	72	70	42	44	46	36	25	19	16	7	2	4
Mean weight (kg)	0.032	0.023	0.015	0.026	0.036	0.034	0.037	0.029	0.028	0.040	0.047	0.046	0.035	0.023	0.040	0.043	0.056	0.066	0.057	0.061	0.063	0.071	0.099	0.080	0.086	0.081	0.06
CL Mean length (mm)	34.0	29.1	25.9	31.4	34.5	34.3	35.2	32.9	31.9	36.2	38.1	38.1	33.5	29.5	36.0	36.2	40.2	42.0	40.0	41.3	41.5	42.6	48.4	46.5	46.1	35.8	39.4

Table 13.1.2. ***Nephrops*** **FU26-27, West Galicia and North Portugal. Fishing effort and LPUE for SP-MATR fleet.**

		SP-MATR	
Year	Landings (t)	trips	LPUE (kg/trip)
1994	234	2692	113.9
1995	267	2859	93.3
1996	158	3191	49.5
1997	245	3702	66.3
1998	188	2857	66.0
1999	134	2714	49.5
2000	72	2479	28.9
2001	80	2374	33.6
2002	52	1671	31.2
2003	59	1597	24.0
2004	31	1980	19.3
2005	17	1629	10.3
2006	18	1547	11.9
2007	22	1196	18.0
2008	17	980	17.3
2009	15	854	17.4
2010	8	539	15.4
2011	4	543	6.4
2012	1	492	2.2
2013	<1	419	1.0
2014	<1	494	0.8

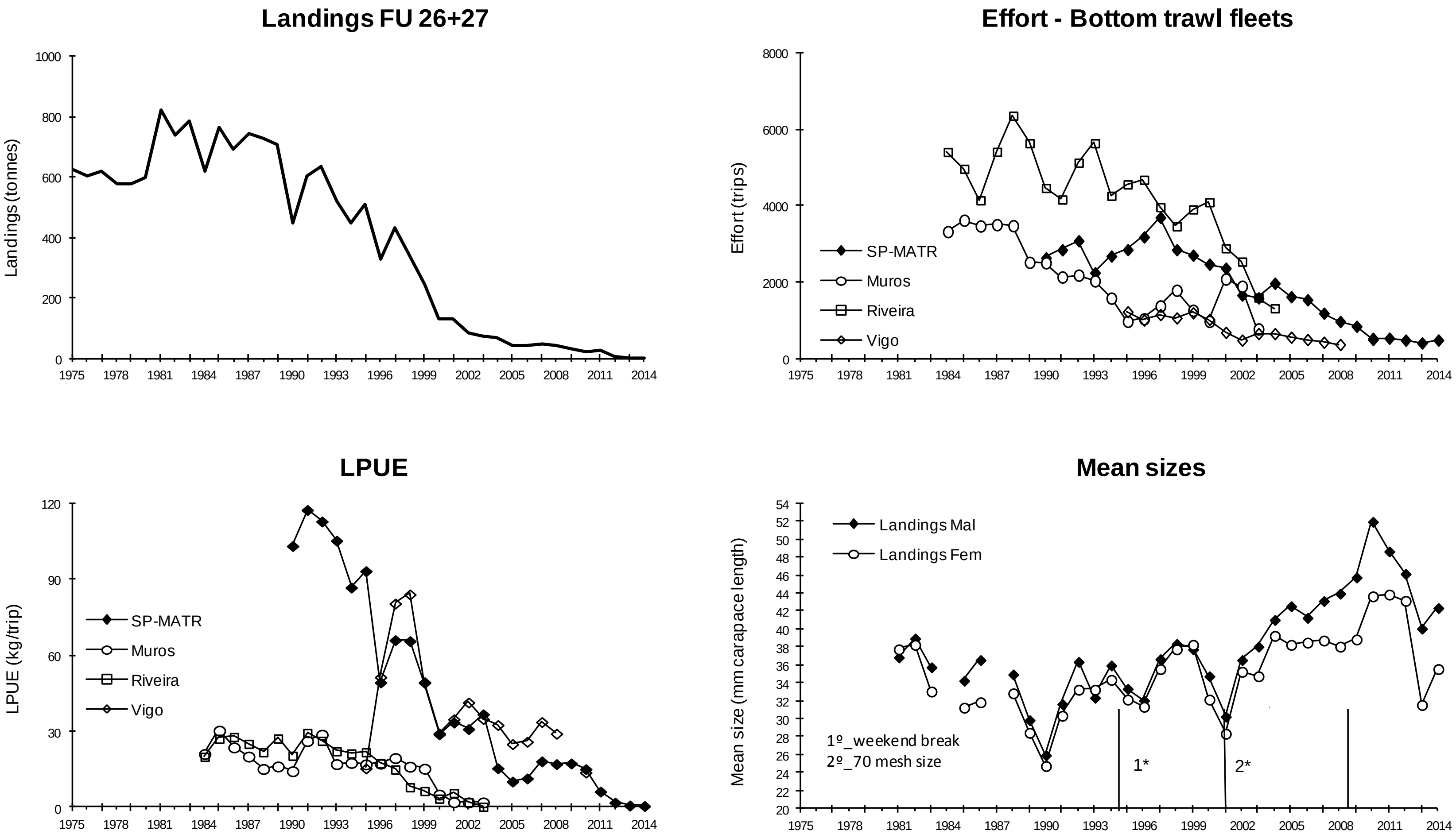


Figure 13.1.1. ***Nephrops*** **FU26-27, West Galicia and North Portugal. Long-term trends in landings, effort and mean sizes.** 1*-weekend break in West Galicia, 2*- 70 mm mesh size, 3*-recovery plan

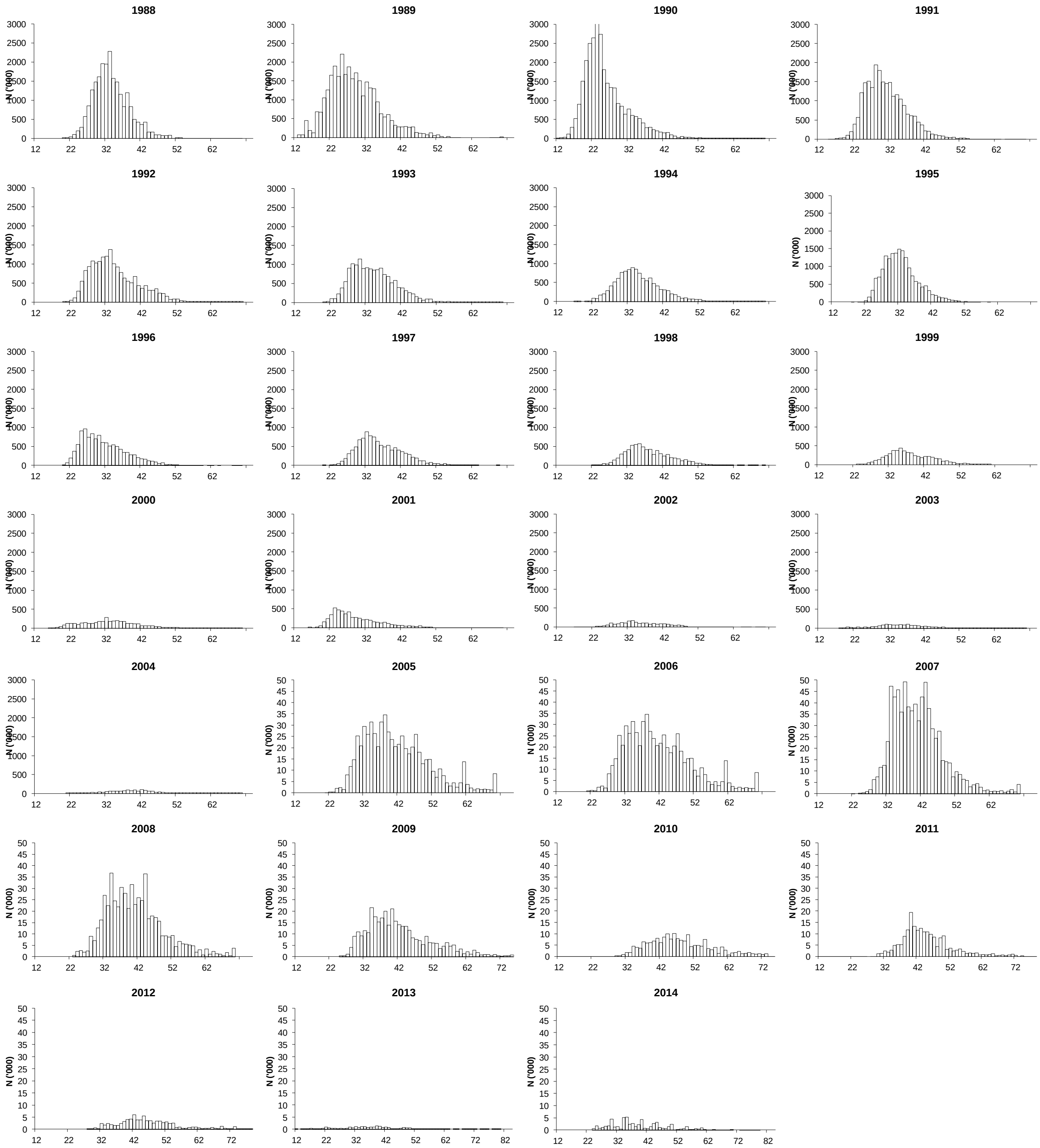


Figure 13.1.2. ***Nephrops*** **FU26-27. West Galicia and North Portugal. Length distributions in landings for the 1988-2014 period. Y-axis scale has been changed since 2005 in order to do a better analysis.**

13.2 FU 28 - 29 (SW and S Portugal)

13.2.1 General

13.2.1.1 Ecosystem aspects

See the Stock Annex (in Annex L of WG report)

13.2.1.2 Fishery description

See the Stock Annex (in Annex L of WG report)

13.2.1.3 ICES Advice and Management applicable for 2015 and 2016

ICES Advice for 2015 and 2016

The advice for these stocks is biennial and valid for 2015 and 2016. Based on the ICES approach for data-limited stocks, ICES advises that catches in 2015 for FUs 28 and 29 should be no more than 226 tonnes.

To protect the stock in this Functional Unit, ICES advices that management area should be consistent with the assess area. Therefore, management should be implemented at the Functional Unit level.

Management applicable for 2015 and 2016

A recovery plan for southern hake and Iberian *Nephrops* stocks has been in force since the end of January 2006. The aim of the recovery plan is to rebuild the stocks within 10 years, with a reduction of 10% in F relative to the previous year and the TAC set accordingly (Council Regulation (EC) No. 2166/2005).

In order to reduce F on *Nephrops* stocks in Division IXa even further, a seasonal ban was introduced in the trawl and creel fishery for two boxes (geographic areas) located in FU 26 and in FU 28, in the peak of the *Nephrops* fishing season. These boxes are closed for *Nephrops* fishing in June–August and in May–August, respectively.

ICES has not evaluated the current recovery plan for *Nephrops* in relation to the precautionary approach.

The TAC set for the whole Division IXa was 221 and 254 t for 2014 and 2015, respectively, of which no more than 6 % may be taken in FUs 26 and 27. The maximum number of fishing days per vessel was fixed at 127 and 114 days for Spanish vessels and at 126 and 113 days for Portuguese vessels for these two years (Annex IIb of Council Regulations 43/2014 and 104/2015). The number of fishing days included in these regulations is not applicable to the Gulf of Cadiz (FU 30), which has a different effort management regime.

13.2.2 Data

13.2.2.1 Commercial catches and discards

Table 13.2.1 and Figure 13.2.1 show the landings data series for these Functional Units (FUs). For the time period 1984 to 1992, the recorded landings from FUs 28 and 29 have fluctuated between 420 and 530 t, with a long-term average of about 480 t, falling drastically in the period 1990–1996, down to 132 t. From 1997 to 2005 landings have increased to levels observed during the early 1990s but decreased again in recent years.

The value landings in 2009-2011 was approximately at the same level (≈ 150 t), increasing to an average value of 220 t in the years 2012-2013. The landings in 2013 and 2014 decreased due to TAC limitations. In 2013 the fishery was closed in the last quarter whereas in 2014 it was closed in the period August to mid-November.

Since 2011, landings include the Spanish official landings. Spanish vessels are licensed for crustaceans in these FUs under a bilateral agreement since 2004. No data from these vessels' operation is available prior to 2011.

Spanish official landings are derived from logbooks. This source of information allows landings disaggregation by ICES statistical rectangles. In 2012 and 2013, *Nephrops* catches recorded in statistical rectangles outside the FUs in Division IXa were allocated to the closest rectangles in each FU. In 2014, 100% of the caches were into FU 28-29 definition (WD 03).

Males are the dominant component in all landings with exception for 1995 and 1996 when total female landings exceeded male landings (ICES, 2006). For the period 2002-2011 male to female sex-ratio has been close to 1.5:1. The years 2012 and 2013 present a ratio of 2.3:1. The sex-ratio in 2014 was close to 1:1.

Information on discards and on the sampling program was sent to the WG through ICES Accessions. The frequency of *Nephrops* occurrence in discards samples is very low. Discards are negligible in this fishery and mostly due to quality and not related to MLS (20 mm of carapace length). Only in 2013, the occurrence of *Nephrops* in discards samples was greater than 30% and a total amount of 3 t was estimated, with a high coefficient of variation (CV = 58%).

13.2.2.2 Biological sampling

Length distributions for both males and females for the Portuguese trawl landings are obtained from samples taken weekly at the main auction port, Vila Real de Sto. António. Sampling frequency in 2014 was at the same level as in previous years, in the months in which fishing was open. The sampling data are raised to the total landings by market category, vessel and month.

The length compositions of the landings are presented in Tables 13.2.2a-b and Figures 13.2.2a-b. The number of samples and measured individuals are presented in Table 1.3.

13.2.2.3 Biomass indices from surveys

Since 1997, several groundfish (PtGFS-WIBTS-Q4) and crustacean trawl surveys (PT-CTS UWTV FU 28-29) were carried out in FUs 28 and 29. Table 13.2.4 and Figure 13.2.1 shows the average *Nephrops* CPUEs (kg/h trawling) from the crustacean trawl surveys, which can be used as an overall biomass index. As the surveys were performed with a smaller mesh size than the commercial fishery, this information provides a better estimation of the abundance for the smaller lengths of *Nephrops*. There was an increase in the overall biomass index in the period 2003-2005, and also of small individuals in a particular juvenile concentration area in 2005, which could be an indication of higher recruitment.

The R/V "NORUEGA" had some technical problems in 2010 and could not trawl in areas deeper than 600 m. The survey plan had to be adapted accordingly. The CPUE value obtained for 2010, the highest from the series, was probably affected by this change. In 2011, due to engine failure, the survey did not cover the whole area of

Nephrops distribution. No CPUE index was presented for this year. Budgetary constraints of national scope turned unfeasible to repair the R/V NORUEGA and the chartering of another research vessel and therefore no survey was conducted in 2012.

The biomass index estimated from the 2013 survey is only comparable to the value of 2009, which covered the same area. Comparing the fraction of the area covered in 2011 and the same area in 2013, the biomass of *Nephrops* increased in the area of Alentejo (FU 28). The survey in 2011 did not cover the main area of concentration in Algarve (FU29). In recent years, there is a large uncertainty associated with the survey indices due to technical problems of the research vessel and partial coverage of the area of distribution.

The survey area was adapted in 2014 taking into account the information from the fishing grounds obtained from VMS data. The 2014 survey was carried out later than in previous years, after the peak of the fishing season and the biomass index was lower (Figure 13.2.1 and 13.2.3).

As shown in ICES (2012a), the distribution of survey indices is in very good agreement with the fishery CPUE spatial distribution. The correlation between the average annual CPUE from the fishery and the biomass index from the Crustacean survey until 2009 is also high. The values from recent years were not taken into account due to the R/V operation problems already referred.

In 2005 and 2007, some experiments to collect UWTV images from the *Nephrops* fishing grounds were made with a camera hanged from the trawl headline. In 2008, the images collected from 9 stations in FU 28 with the same procedure looked very promising. In 2009 survey, a two-beam laser pointer was attached to the camera and UWTV images were recorded from 58 of the 65 stations. The trawling speed and the turbidity were the main problems affecting the clarity of the image and the high variation of the height of the camera to the ground resulted in a variable field of view. In 2010 and 2011, no images were collected due to technical problems of the research vessel. It is not guaranteed that this method can be used for abundance estimation (information presented to SGNEPS 2012 – Study Group of *Nephrops* Surveys (ICES, 2012b).

13.2.2.4 Mean sizes

Mean carapace length (CL) data for males and females in the landings and surveys are presented for the period 1994-2014 (Table 13.2.5). Figure 13.2.1 shows the mean CL trends since 1984. The mean sizes of males and females have fluctuated along the period with no apparent trend.

13.2.2.5 Commercial catch-effort data

A standardization of the CPUE series was presented to WGHMM in 2008 (ICES, 2008, Silva, C. – WD 25) applying the generalized linear models (GLMs). The data used for this standardization were the crustacean logbooks for the period 1988-2007. The factors retained for the final model (year, month and vessel category) were those which contribute more than 1% to the overall variance. The model explains 17% to 19% of the variability, when using the CPUE in kg/day or kg/haul respectively.

Until 2010, this model was updated each year with the addition of new data.

The issue of effort estimation using standardized CPUE from GLMs or other methods taking into account the flexibility of the fleet in relation to target species was further developed in the WGHMM 2010 (ICES, 2010a) and during WKSHAKE2 (ICES, 2010b). Crustacean vessels are targeting two main species, rose shrimp and Norway lobster, which have different market value. Depending on their abundance/availability, the effort is directed at one species or the other. In 2006, the landings of rose shrimp start to increase showing a change in the objectives of the fishery (Figure 13.2.3).

The effort is estimated using the CPUE of the fleet. If the CPUE of *Nephrops* decreased due to a change in target species (and consequently, fishing grounds), the effort might be overestimated.

The model of CPUE standardization used until 2010 never explained more than 20% of the variability (ICES, 2010a). The explanatory variables used were *year*, *month* and *vessel-category*. Considering the behaviour of the fleet in periods of high abundance of rose shrimp, new variables related to the catches of this species and the proportion of *Nephrops* in the total catch were incorporated. As the distributions of rose shrimp and *Nephrops* are fishing ground and depth dependent, the availability and use of VMS data could improve the standardization model, as suggested in Silva and Afonso-Dias, 2011 (WD to WKCPUEFFORT).

Taking all this into account, new variables as the fishing depth, the catches of rose shrimp and the proportion of *Nephrops* in the total crustacean catches were incorporated in the new model for CPUE standardization and presented to IBP *Nephrops* 2012 (Inter-Benchmark Protocol for *Nephrops* 2012, ICES, 2012c).

The IBP *Nephrops* did not come to a conclusion about the stock assessment method but the WG has agreed to use this new CPUE standardization for the trends based assessment and standardized effort estimation.

However, as VMS data are only available since 1998, the use of this method has shortened the length of the time series. In the models presented before, the CPUE was expressed in kg/day and the time series started in 1988. The CPUE in the new model is expressed in kg/hour, the time series starts 10 years later but the estimation of CPUE is based on more reliable effort data.

The overall analysis of the geo-referenced catches confirms the general preference of rose shrimp and *Nephrops* for grounds shallower and deeper than 400 m, respectively. These data also confirm that, in years of higher abundance of rose shrimp, a greater effort is allocated to depths shallower than 400 m. In what concerns the distribution of the fishing effort between the two Functional Units, FU29 represents in average 83% of the total effort. However, the fishing areas (FUs) were found not significantly different and therefore removed from the model.

The factors and levels retained in the final model and updated to include more recent data were:

- year: 1998 – 2014
- month: 1 – 12
- depth interval: [100, 400[, [400, 800[, [800, 1500]
- log catch of rose shrimp: [0, 2[, [2, 5]
- proportion of *Nephrops* in the total catch of crustaceans: [0, 0.25[, [0.25, 1]
- and vessel category: A (standard), B and C. These two categories correspond to vessels less or more productive than the standard type.

The choice of the final model was based on the highest value of explained variance and the smallest AIC. In 2014 assessment, with the data from 1998-2013, the model explained 47% of the total variability, with the proportion of *Nephrops* in the crustacean catches as the most important factor (Table 13.2.6). This year, the same model was updated with one more year of data, but the explained deviance has reduced to 33.5%. One possible explanation is that in the last two years, fishing does not cover the whole year, due to the reduced quota.

Figure 13.2.4 shows the annual observed CPUE and the estimates from the model, considering the depth interval class [400, 800[, log catch of rose shrimp class [0, 2[, the category of proportion of *Nephrops* [0.25, 1] and vessel category A as the reference factors for *Nephrops* target CPUE.

The correlation found between the CPUE series derived from the model presented here and the biomass indices from the Crustacean surveys (not considering the estimates after 2009, for the reasons explained before) is high and gives confidence that CPUE is reflecting the abundance of *Nephrops* in FU 28 and 29.

The effort in 2003-2004 corresponds to only eleven months of fleet operation for each year as the crustacean fishery was experimentally closed in January 2003 and 30 days for *Nephrops* in September – October 2004.

A Portuguese national regulation (Portaria no. 1142, 13th September 2004) closed the crustacean fishery in January-February 2005 and enforced a ban in *Nephrops* fishing for 30 days in September – October 2005. As a result, the effort in 2005 corresponds to nine months.

The recovery plan for southern hake and Iberian *Nephrops* stocks was approved in December 2005 and initiated at the end of January 2006. This recovery plan includes a reduction of 10% in F relative to the previous year (Council Regulation (EC) No 2166/2005). As a result, the number of fishing days per vessel was progressively reduced. Additional days were allocated in 2010 to Spanish and Portuguese vessels on the basis of permanent cessation of vessels from each country (Commission Decisions nos. 2010/370/EU and 2010/415/EU).

Besides this effort reduction, the Council Regulation (EC) No 850/98 was amended with the introduction of two boxes in Division IXa, one of them located in FU 28. In the period of higher catches (May-August), this box is closed for *Nephrops* fishing (Council Regulation (EC) No 2166/2005). By way of derogation, fishing with bottom trawls in these areas and periods are authorised provided that the by-catch of Norway lobster does not exceed 2 % of the total weight of the catch. The same applies to creels that do not catch *Nephrops*.

The effort reduction measures were combined with a national regulation closing the crustacean fishery every year in January (Portaria no. 43, 12th January 2006). As a result of these measures, the nominal effort in 2006 to 2011 corresponds to 11 months each year.

In the period 1999-2001, standardized fishing effort increased substantially, remaining high until 2004-2005 (Table 13.2.3 and Figure 13.2.1), with an exceptional drop in 2003. After 2005, the effort presents a decreasing trend until 2009. The effort decline may be related to the effort management measures but also to effort shift to rose shrimp, which presented a large increase in abundance and landings in the period 2007-2011 (Figure 13.2.4).

The standardized effort increased in 2012 due to a higher catch from Portuguese fleet and to the provision of Spanish catches in this year. As stated in section 13.2.2.1, Spanish vessels are licensed for crustaceans in these FUs under a bilateral agreement since

2004, but no official data were available prior to 2011. In 2013, due to the lower availability of rose shrimp and the increase in abundance of Norway lobster, the Portuguese quota was fished until September and the Portuguese crustacean fleet had to stop the operation or to target other crustacean species, resulting in effort reduction. The same happened in 2014, but the industry decided to stop earlier the fishery and save part of the quota to be fished in November-December In regard to the Spanish fleet, the number of fishing days has reduced, due to sanctions imposed by EC related to the catches over quota in 2012, affecting also the operation of this fleet in the Portuguese fishing grounds.

13.2.3 Assessment

As the perception of the stock did not change from previous year, no update of the assessment was performed.

13.2.4 Short-term Projections

No projections were performed.

13.2.5 Biological reference points

No biological reference points are defined for these stocks.

Biological reference points estimated on the basis of the Yield per Recruit curve were presented in ICES (2011).

13.2.6 Management considerations

Nephrops is taken by a multi-species and mixed bottom trawl fishery.

A recovery plan for southern hake and Iberian *Nephrops* stocks was approved in December 2005 and in action since the end of January 2006. This recovery plan includes a reduction of 10% in the hake F relative to the previous year and TAC set accordingly, within the limits of ±15% of the previous year TAC (Council Regulation (EC) No 2166/2005). Although no clear targets were defined for Norway lobster stocks in the plan, the same 10% reduction has been applied to these stocks effort and TAC. The number of allowed fishing days is set in each year regulations (Council Regulations (EC) Nos. 51/2006, 41/2007, 40/2008, 43/2009, 53/2010, 57/2011, 43/2012, 39/2013, 43/2014 and 104/2015). The recovery plan target and rules have not been changed since it was implemented.

Besides the recovery plan, the Council Regulation (EC) No 850/98 was amended with the introduction of two boxes in Division IXa, one of them located in FU 28. In the period of higher catches (May-August), these boxes are closed for *Nephrops* fishing (Council Regulation (EC) No 2166/2005). By derogation, fishing with bottom trawls in these areas and periods are authorised provided that the by-catch of Norway lobster does not exceed 2 % of the total weight of the catch. The same applies to creels that do not catch *Nephrops*.

With the aim of reducing effort on crustacean stocks, a Portuguese national regulation (Portaria no. 1142, 13th September 2004) closed the crustacean fishery in January-February 2005 and enforced a ban in *Nephrops* fishing for 30 days in September – October 2005, in FUs 28-29. This regulation was revoked in January 2006, after the entry in force of the recovery plan and the amendment to the Council Regulation (EC) No 850/98, keeping only one month of closure of the crustacean fishery in January (Portaria no. 43/2006, 12th January 2006).

Portugal and Spain have bilateral agreements for fishing in each other waters. The agreement for the period 2004-2013 was reviewed and extended for 2014 and 2015. Under this agreement a number of Spanish trawlers are licensed to fish crustaceans in Portuguese waters. No information from landings of these vessels is available for the years prior to 2011.

Table 13.2.1. ***Nephrops* in South-West and South Portugal (FU 28-29). Total landings per country (tonnes).**

Year	FU 28+29 SW+S Portugal					
	28***	29	28+29			Total
	Spain	Spain	Portugal			
	Trawl	Trawl	Artisanal	Trawl	Total	
1987			11	498	509	509
1988			15	405	420	420
1989			6	463	469	469
1990			4	520	524	524
1991			5	473	478	478
1992			1	469	470	470
1993			1	376	377	377
1994				237	237	237
1995			1	272	273	273
1996			4	128	132	132
1997			2	134	136	136
1998			2	159	161	161
1999			5	206	211	211
2000			4	197	201	201
2001			2	269	271	271
2002			1	358	359	359
2003			35	335	370	370
2004			31	345	375	375
2005			31	360	391	391
2006			17	274	291	291
2007			18	274	291	291
2008			35	188	223	223
2009			17	133	151	151
2010			16	131	147	147
2011		17	16	117	133	150
2012	<1	14	3	211	214	229
2013		10	1	198	199	209
2014**		8	3	183	186	193

Table 13.2.3. - SW and S Portugal (FUs 28-29): Effort and CPUE of Portuguese trawlers, 1994-2014 (standardized).

Year	No. of trawlers	CPUE (t/boat)	Estimated hours	CPUE** (kg/hour)
1994	31	7.6		
1995	30	9.1		
1996	25	5.3		
1997	25	5.4		
1998	25	6.4	38,077	4.2
1999	29	7.3	35,668	5.9
2000	33	6.1	46,720	4.3
2001	33	8.2	74,280	3.7
2002	34	10.5	57,751	6.2
2003	35	9.6	44,911	8.2
2004	33	10.4	51,666	7.3
2005	32	11.9	42,778	9.1
2006	30	9.1	34,826	8.3
2007	30	9.1	37,227	7.8
2008	30	6.3	29,622	7.5
2009	30	4.4	27,226	5.5
2010	26	5.0	25,111	5.9
2011	26	4.5	28,338	5.3
2012	21	10.2	31,044	7.4
2013	24	8.2	28,083	7.5
2014*	24	5.6	24,310	7.6

* provisional; ** standardized CPUE

Table 13.2.4. - SW and S Portugal (FUs 28-29): *Nephrops* CPUEs (kg/hour) in research trawl surveys, 1994-2012.

Year	Demersal surveys			Crustacean surveys	
	CPUE (kg/hour)			Month and year of survey	CPUE (kg/hour)
	Summer	Autumn	Winter		
1994	ns	0.40	ns	May-94	2.3
1995	1.3	0.26	ns	No surveys 1995-96	
1996	ns	0.03	ns		
1997	0.7	0.06	ns	Jun-97	2.6
1998	0.7	0.02	ns	Jun-98	1.2
1999	0.3	0.02	ns	Jun-99	2.5
2000	1.0	0.92	ns	Jun-00	1.6
2001	0.6	0.35	ns	Jun-01	0.8
2002	ns	0.02	ns	Jun-02	2.4
2003	ns	0.19	ns	Jun-03	2.6
2004	ns	0.51	ns	Jun-04	nr
2005	ns	0.09	0.16	Jun-05	4.7
2006	ns	0.19	0.06	Jun-06	2.4
2007	ns	0.04	0.73	Jun-07	2.8
2008	ns	0.13	0.25	Jun-08	4.0
2009	ns	0.13	ns	Jun-09	2.0
2010	ns	0.34	ns	Jun-10	6.8
2011	ns	0.11	ns	Jun-11	nc
2012	ns	ns	ns	ns	ns
2013	ns	0.64	ns	Jun-13	2.2
2014	ns	0.06	ns	Jul-14	1.0

ns = no survey nr = not reliable nc = whole area not covered

Table 12.3.5. - SW and S Portugal (FUs 28-29): Mean sizes (mm CL) of male and female Nephrops in Portuguese landings and surveys, 1994-2012.

Year	Landings		Demersal surveys						Crustacean surveys	
			Summer		Autumn		Winter			
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
1994	37.4	33.6	ns	ns	39.0	33.6	ns	ns	ns	ns
1995	39.3	37.0	42.1	35.6	42.0	34.9	ns	ns	ns	ns
1996	36.9	36.6	ns	ns	38.6	32.2	ns	ns	ns	ns
1997	35.9	32.8	40.4	36.9	39.1	31.7	ns	ns	43.7	41.9
1998	36.8	34.5	36.0	33.9	40.6	35.9	ns	ns	39.5	36.7
1999	38.7	34.6	45.1	40.4	43.8	32.8	ns	ns	39.7	37.5
2000	38.9	35.2	40.8	37.1	39.0	35.1	ns	ns	41.7	40.2
2001	41.6	36.1	40.5	34.5	47.2	41.6	ns	ns	44.5	39.9
2002	40.7	36.2	na	na	35.0	39.0	ns	ns	44.8	40.7
2003	39.1	36.4	ns	ns	37.5	32.3	ns	ns	39.7	36.7
2004	37.3	33.8	ns	ns	36.7	31.3	ns	ns	39.0	37.0
2005	35.6	33.0	ns	ns	40.6	39.1	40.6	40.9	37.3	35.7
2006	37.2	34.1	ns	ns	36.1	32.8	31.7	35.0	37.7	35.2
2007	36.5	32.8	ns	ns	42.0	38.5	39.0	36.2	38.3	35.0
2008	40.1	35.5	ns	ns	43.2	41.4	46.7	40.6	40.1	36.7
2009	37.4	34.2	ns	ns	45.3	39.8	ns	ns	41.4	36.6
2010	40.1	36.5	ns	ns	39.7	33.7	ns	ns	37.7	36.6
2011	45.0	39.2	ns	ns	43.1	40.0	ns	ns	nc	nc
2012	36.9	34.4	ns	ns	ns	ns	ns	ns	ns	ns
2013	39.7	35.3	ns	ns	42.6	37.3	ns	ns	39.1	39.5
2014	41.3	36.7	ns	ns	46.5	39.2	ns	ns	37.8	35.2

ns = no survey nr = not reliable nc = whole area not covered

Table 13.2.6 Analysis of deviance for the Gamma-based GLM model fitted to the positive *Nephrops* CPUE in the catches.

Source of variation	Df	Deviance	Resid. Df	Resid. Dev	Pr(>F)	% explained
NULL			75860	87419		
year	16	9349.5	75844	78069	< 2.2e-16	10.7%
month	11	2605.7	75833	75464	< 2.2e-16	3.0%
depth.class2	2	2004.3	75831	73459	< 2.2e-16	2.3%
catdps	1	3397.4	75830	70062	< 2.2e-16	3.9%
cat_pnep	1	9361	75829	60701	< 2.2e-16	10.7%
catPRT2	2	2555.1	75827	58146	< 2.2e-16	2.9%
Total	**33**	**29273**				**33.5%**

AIC: 289606

Table 13.2.2.a. FU 28-29 - Length Composition of Nephrops Males (1984-2014)

Landings (thousands)

Age/Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
17															
18															
19					4	21					0				
20			0	16	4			6	4						
21		17	9			84		16	37	9					
22	7	5	14	15		97	9	29	96	38	9				2
23	24	7	7	8		143	5	19	55	34			8	4	
24	14	40	121	209	51	272	27	53	202	42	18		17	9	8
25	109	83	115	81	97	229	116	69	181	149	34	3	23	6	16
26	250	170	137	446	128	205	182	111	263	72	68	0	36	43	32
27	282	326	170	718	208	269	149	94	185	95	77	0	54	95	81
28	374	500	289	871	399	280	337	139	506	272	157	0	56	78	65
29	439	559	341	727	456	283	415	159	462	382	95	28	38	88	65
30	412	742	328	584	442	317	695	239	725	548	187	11	68	104	160
31	277	670	389	742	457	230	813	325	755	548	231	24	92	172	129
32	373	784	680	806	446	367	866	260	670	674	383	108	151	283	289
33	339	531	213	236	428	265	702	133	345	365	149	83	70	90	95
34	389	635	609	721	656	328	785	239	451	655	270	215	159	251	269
35	478	525	590	245	664	291	755	171	296	475	224	169	147	169	118
36	378	463	519	342	572	295	449	138	399	639	221	147	78	154	166
37	528	346	322	406	424	356	465	77	351	391	107	262	172	149	167
38	496	383	606	355	571	302	479	120	378	344	179	134	113	58	85
39	353	309	361	240	326	332	611	126	348	306	95	151	62	46	47
40	447	337	323	156	366	316	829	200	248	174	144	232	83	82	83
41	247	230	316	335	164	314	797	141	243	158	93	247	78	37	53
42	371	246	507	264	215	360	628	174	246	170	168	293	85	33	167
43	199	156	198	62	102	364	335	121	242	107	127	65	31	21	43
44	194	233	422	215	128	481	553	125	371	179	150	88	42	28	69
45	165	144	233	206	93	339	324	90	220	150	87	27	22	21	34
46	148	178	189	170	72	231	228	128	167	55	79	58	21	33	38
47	129	161	140	74	76	191	202	122	191	96	68	31	38	20	34
48	176	212	149	79	85	193	121	62	178	102	78	25	15	9	24
49	89	138	104	58	43	73	92	78	111	47	47	16	20	4	13
50	91	142	50	34	53	94	58	67	69	30	50	12	9	3	33
51	66	120	63	27	34	114	59	44	50	38	29	4	6	7	14
52	64	135	66	44	38	77	33	40	35	15	46	11	16	7	31
53	45	99	32	37	23	40	19	16	29	18	22	5	6	6	11
54	73	101	35	45	22	35	27	29	50	23	18	5	8	16	19
55	20	67	25	31	22	37	30	26	29	19	9	3	4	10	8
56	20	35	14	20	16	20	30	19	5	5	11	2	4	3	6
57	10	33	5	15	12	22	7	10	6	5	11	3	7	16	8
58	13	14	8	14	11	17	14		11	4	6		5	3	5
59	7	10	3	9	4	16	5	2	9	3	10	0	5	2	3
60	3	6	3	4	3	13	2		10	8	1	1	1	4	1
61	3	1	4	4	1	5		1	3	2	1	0	1	9	1
62	3	1	2	1	2	3		1	7	5	1		2	7	1
63	1	1		1	1	4		5	0	1	0		2	3	0
64		2	0	2	1			1	3	1	2		0	4	0
65	0	0		2	2				3	1	1		0	4	
66	0			0	1					1			0	4	0
67	0			0	0	0			6	5				6	0
68					0	2				0	1			0	0
69				0										0	0
70	0			1		0				2				0	0
71										0					0
72				0		0				1					0
73														0	
74	0									1					
75															
76															
77															
78		0			0										
79															
80									0						
81															
82															
83															
Total	**8106**	**9897**	**8709**	**9679**	**7925**	**8329**	**12255**	**4023**	**9249**	**7463**	**3766**	**2466**	**1854**	**2200**	**2491**
Landings (t)	**292**	**353**	**315**	**277**	**249**	**318**	**351**	**345**	**304**	**232**	**139**	**98**	**65**	**74**	**88**

Table 13.2.2.a. FU 28-29 - Length Composition of Nephrops Males (1984-2014)

Landings

Age/Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
17																
18																
19					0				2	0						
20	4				0		4		3	1	0	0				
21	3	3	0	2	0	0	33		5	0	0	0				0
22	0	16	1	2	13	4	51	10	20	8	2		0	3		1
23	5	8	3	1	3	15	32	22	31	10	4		1	0	3	1
24	9	20	5	2	11	20	107	53	53	26	29	8	0	8		1
25	39	13	6	3	40	45	120	46	65	28	30	10	1	27	8	6
26	33	58	8	11	56	126	153	75	121	32	38	8	3	37	6	7
27	49	85	24	24	87	187	206	94	111	52	63	22	6	47	27	15
28	68	44	24	48	62	205	286	144	141	60	89	14	4	37	25	12
29	109	148	53	60	147	246	330	220	189	62	83	33	5	143	55	35
30	133	87	74	139	248	300	533	290	297	60	129	44	5	158	84	36
31	272	111	92	123	188	277	573	270	256	93	116	75	22	248	82	49
32	88	161	274	233	325	475	757	378	295	129	135	116	32	573	217	120
33	182	92	139	281	248	352	437	247	246	108	80	78	21	329	109	47
34	152	160	224	257	264	352	574	311	327	150	94	104	52	436	276	119
35	175	100	173	274	275	347	333	194	252	121	76	83	31	356	155	144
36	143	158	163	265	195	224	263	168	256	83	59	77	34	248	191	119
37	128	162	167	247	234	167	293	172	224	109	57	78	64	211	145	108
38	75	106	99	254	197	147	226	164	265	73	58	125	69	206	216	144
39	180	81	109	229	174	93	175	100	173	75	61	71	39	126	95	129
40	83	96	159	254	215	165	152	100	188	77	63	84	44	112	162	160
41	184	102	130	163	163	108	129	125	163	102	53	55	49	114	113	90
42	58	91	195	163	168	177	152	190	198	128	105	75	68	140	171	129
43	102	47	181	167	172	113	118	95	82	76	38	51	45	79	64	58
44	63	86	173	122	121	122	176	144	90	61	51	65	43	87	89	104
45	111	61	140	113	103	131	140	96	83	60	25	39	19	52	42	59
46	67	85	144	106	76	103	117	118	71	38	25	26	15	46	81	59
47	59	88	120	111	75	97	113	61	60	48	25	43	18	47	89	83
48	40	55	80	104	83	90	66	54	65	48	23	35	12	30	67	26
49	50	37	79	86	59	58	52	41	38	34	24	23	12	32	53	36
50	32	65	93	103	94	82	69	28	42	36	20	25	11	19	59	25
51	32	34	71	72	65	41	40	30	37	27	17	20	15	17	37	32
52	8	53	88	94	73	65	45	37	48	29	32	30	24	33	47	64
53	13	18	41	69	58	31	22	22	21	24	13	16	9	22	18	25
54	15	31	54	53	57	50	24	33	27	23	19	21	24	32	36	44
55	9	19	34	28	46	26	12	15	10	20	12	14	15	15	16	24
56	13	19	29	43	29	57	14	11	8	15	13	8	25	24	20	20
57	8	19	37	37	25	16	9	6	6	17	11	9	25	20	15	20
58	4	13	23	26	21	12	9	7	7	20	7	11	45	7	12	10
59	4	10	15	16	13	15	8	9	5	11	4	6	19	7	8	9
60	1	8	15	25	16	24	12	6	3	9	7	5	13	4	10	7
61	2	14	9	11	8	11	8	8	4	8	4	5	7	9	7	4
62	3	6	10	11	15	16	8	8	3	15	8	6	22	3	1	12
63	2	1	4	11	11	7	7	7	1	8	4	6	7	2	4	3
64	1	1	9	11	8	10	10	7	1	10	6	5	17	2	3	8
65	0	4	6	5	4	3	10	7	1	9	2	3	9	1	1	2
66		1	5	8	3	7	3	4	2	11	1	3	5	3	2	3
67			4	3	5	2	2	6	1	6	1	3	3	3	1	2
68			1	6	6	2	3	4	0	8	0	4	3	3	1	1
69		0	3	3	2	2	2	4	1	4	1	0	2	1		1
70		0	6	2	4	3	4	5	0	4	1	0	1	3	1	1
71			2	2	4	1	1	3	1	2	0	0	0	1		1
72			2	2	4	1	3	4	0	3	1	0	1	3	0	1
73		0	0	1	1	1	2	2		1	0	0	1	1		1
74			0	1	1	1	3	1		1	1	0	1	1		1
75			0	1	0	0	1	1		1	1	2	0	1		0
76			0	0	0	0	0	1		1	0		0	0		
77				0	0	0	0	1		1	0	0	0	0		
78						0	1			0			0			
79				0		0	1	0		0	0			0		
80							0			0			0			
81								0		0	0					
82				0				0		0	0					
83										0						
Total	**2811**	**2680**	**3602**	**4486**	**4575**	**5233**	**7036**	**4259**	**4598**	**2280**	**1822**	**1649**	**1018**	**4170**	**2928**	**2217**
Landings (t)	**116**	**117**	**190**	**222**	**205**	**205**	**231**	**162**	**159**	**114**	**73**	**79**	**72**	**149**	**132**	**114**

Table 13.2.2.b. FU 28-29 - Length Composition of Nephrops Females (1984-2014)

Landings (thousands)															
Age/Year	**1984**	**1985**	**1986**	**1987**	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**
17															
18					4										
19		0				35					0				
20	3	1	7		8	21				18					
21	1	1	22	3	21	102		21	9	49					
22	8	21	30	78		88	19	11	102	63			0	13	2
23	66	21	7	31	28	135	15	69	38	21	2		0	0	4
24	79	102	118	270	153	258	38	173	164	41	22	2	11	20	15
25	228	205	104	357	163	197	138	198	203	191	73		13	20	25
26	272	284	186	684	220	282	140	436	361	111	92	1	35	102	74
27	345	491	359	902	429	326	247	418	448	235	134	0	37	77	91
28	431	523	322	1421	471	231	345	598	597	413	170	6	36	152	148
29	443	672	419	1253	516	285	491	590	514	523	269	31	45	178	114
30	422	588	381	928	499	317	575	771	599	775	326	104	50	199	199
31	487	593	418	948	482	501	639	414	736	752	427	182	95	394	168
32	485	653	700	946	766	306	859	807	617	824	558	322	198	502	376
33	613	415	406	227	527	314	596	375	430	449	283	251	53	163	116
34	618	467	654	774	813	511	734	310	369	359	353	641	209	278	298
35	562	563	447	447	460	435	519	284	287	194	246	674	184	150	112
36	469	329	316	386	489	274	243	130	267	203	237	811	142	135	166
37	505	353	400	223	206	318	189	108	333	154	147	692	267	129	171
38	383	284	330	269	265	285	207	135	251	100	128	348	151	39	48
39	274	142	211	146	288	148	216	74	176	150	66	194	67	35	59
40	171	119	80	119	132	131	230	131	147	110	114	344	120	21	89
41	58	106	55	65	128	149	73	39	68	108	77	361	63	31	64
42	50	36	133	54	43	127	210	62	69	95	73	165	111	18	84
43	30	27	21	40	28	109	58	82	26	43	23	64	29	2	34
44	17	13	47	147	27	91	77	6	46	42	43	88	90	18	71
45	14	11	27	84	19	27	41	21	40	34	13	54	36	8	22
46	7	6	5	40	14	38	31	45	25	37	11	13	15	4	28
47	5	3	3	26	9	24	16	7	12	29	7	18	23	3	23
48	4	1		71	11	29	7	15	18	15	4	15	8	2	6
49	1	0	3	17	4	9	1	17	17	23	4	1	6	7	6
50	1	0		2	6	3	1	2	32	8	17	1	2	1	6
51	0	0	3	4	3	7	2	4	4	5	0			1	2
52	1			5	5	8	1		5	6	1	1	0	1	1
53	2			2	3	1			9	6	0			0	0
54				4	1	1			1	1			1	0	1
55				0	1	1			6	2					
56				3	0	2		5	14	5					0
57				0	0	1			4	1			0		0
58				0		0			4	1					
59				1	0	0									
60					0				1	0					
61						1									
62															
63									4	1					
64															
65															
66															
67															
68									4	1					
69															
70															
71															
72															
73															
74															
75															
76															
77															
78															
79															
80															
81															
82															
83															
Total	**7052**	**7032**	**6218**	**10978**	**7243**	**6126**	**6962**	**6358**	**7059**	**6198**	**3920**	**5385**	**2095**	**2702**	**2621**
Landings (t)	**169**	**156**	**150**	**232**	**171**	**151**	**174**	**134**	**165**	**145**	**97**	**174**	**67**	**62**	**72**

Table 13.2.2.b. FU 28-29 - Length Composition of Nephrops Females (1984-2014)

Landings

Age/Year	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
17					0											
18						0				0						
19					1				2	0						
20			0		0	0	8		4	1						
21		3	1	0	3	12	48	3	15	2	1			7		
22	5	18	0		3	10	88	14	26	12	1	0			3	1
23	4	6	7	0	9	43	54	37	34	11	4	1	1		7	1
24	25	49	7	10	19	62	135	44	53	25	22	10	1	5	7	3
25	27	24	15	11	36	101	129	55	130	23	23	11	1	8	18	10
26	94	81	24	15	67	211	272	113	227	38	80	12	3	17	7	10
27	76	139	34	34	67	266	294	152	298	73	138	20	7	40	36	17
28	100	64	44	107	98	336	242	179	355	81	170	26	7	51	33	23
29	121	171	90	127	173	395	420	392	458	123	149	51	4	130	59	60
30	236	152	131	237	241	406	654	321	365	145	205	67	7	164	119	80
31	263	131	167	195	152	334	565	305	317	129	132	99	26	330	129	99
32	485	283	316	296	360	530	857	510	409	252	209	145	45	397	290	203
33	187	153	184	467	270	433	448	272	253	182	110	91	51	195	194	105
34	346	235	252	429	314	400	462	341	386	177	122	140	96	297	278	202
35	287	193	158	470	255	324	254	249	351	187	103	120	56	165	232	188
36	317	225	174	351	194	222	203	162	213	103	83	144	60	138	166	153
37	201	213	144	302	203	178	182	142	240	121	90	119	73	98	199	151
38	184	85	108	300	206	151	178	152	247	134	83	106	151	76	206	148
39	151	92	112	213	160	113	89	173	138	123	86	95	113	46	61	121
40	111	79	133	186	284	136	84	114	109	125	62	80	68	46	67	145
41	81	66	79	110	170	82	73	129	73	95	83	65	65	37	41	66
42	73	67	91	80	192	122	116	112	56	75	94	52	80	35	65	90
43	38	41	55	87	132	70	70	44	16	30	25	28	80	33	9	27
44	34	49	56	57	75	66	61	46	21	24	43	40	41	27	13	40
45	18	23	29	51	68	66	50	35	18	28	17	25	21	10	9	17
46	18	38	33	40	37	51	39	54	19	14	22	19	11	10	11	17
47	7	52	26	25	25	44	35	23	9	26	16	18	15	11	13	18
48	9	25	12	24	28	37	18	11	8	20	7	12	9	5	7	5
49	4	21	15	19	18	24	24	7	7	13	6	7	7	6	5	7
50	5	10	15	26	24	20	23	7	3	13	8	7	2	6	5	4
51	2	10	9	22	14	13	17	11	5	11	3	6	5	6	1	3
52	3	16	6	19	21	13	17	7	3	7	3	4	4	9	5	4
53		6	6	10	13	8	10	2	1	8	3	2	3	5	1	3
54		5	2	2	14	7	6	9	1	8	1	2	5	5	3	8
55		1	2	3	10	4	5	1	1	3	4	0	5	2	1	3
56		3	1	3	7	6	2	1	0	3	0	0	2	1	1	6
57		1	0	2	4	2	3	1		1	0	0	1	3	2	2
58			1	1	1	2	0	1	0	1	1	0	4	2	0	
59		0	1	0	0	1	1	1			0	0	2	0	1	1
60			0		0		2			1		0	2	0		2
61		3	1		0	1					0	0	1	0		
62				0	0	0	1	0				0	0	0	0	0
63			0	0			0				0	0	2	0		
64						1	0		0	0	0			0		
65						0	0						0			
66		0	0				0									
67													0			
68																
69																
70						0					0					
71																
72																
73																
74																
75																
76																
77																
78																
79																
80																
81																
82																
83																
Total	3509	2829	2540	4332	3969	5304	6240	4229	4871	2449	2211	1628	1138	2424	2306	2044
Landings (t)	95	84	79	135	130	140	151	112	114	74	60	52	45	65	66	66

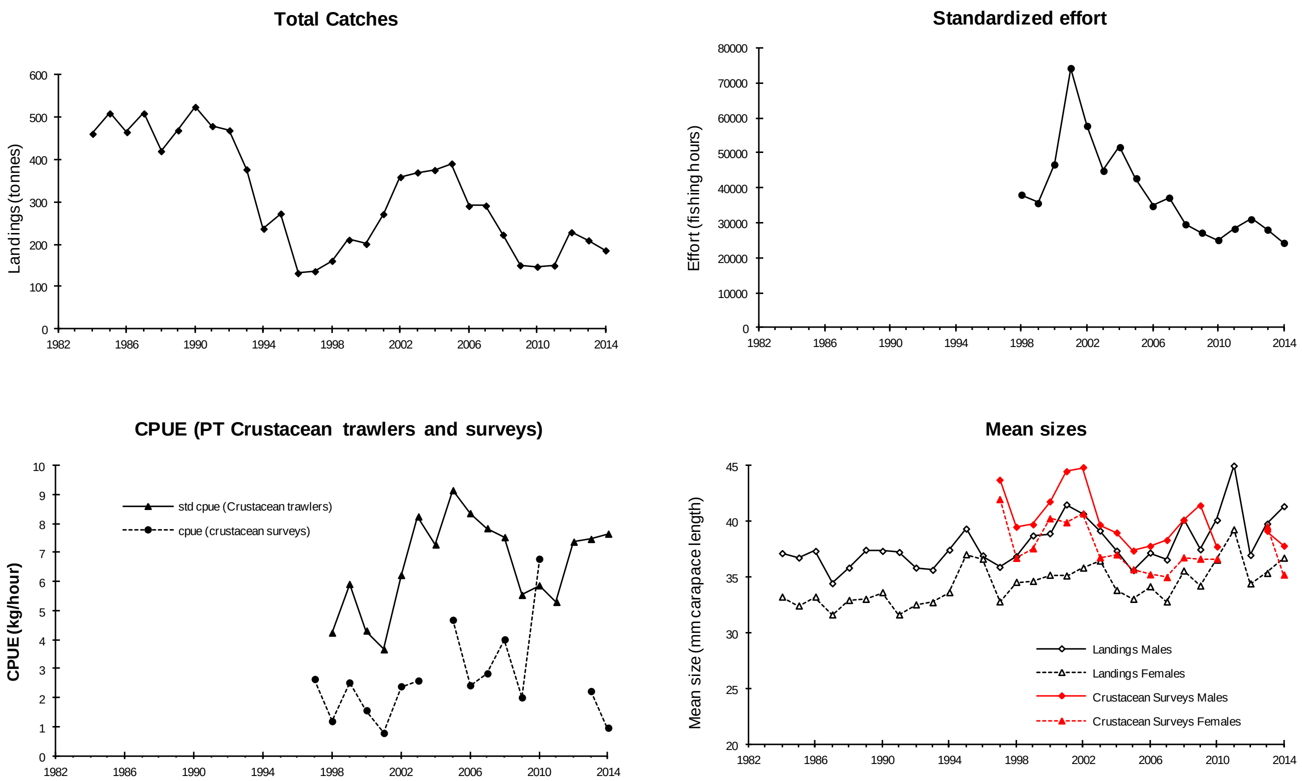


Figure 13.2.1. SW and S Portugal (FU 28+29): landings, effort, biomass indices and mean sizes of *Nephrops* in Portuguese landings and surveys. Note: Values of CPUEs and effort updated with the new CPUE standardization.

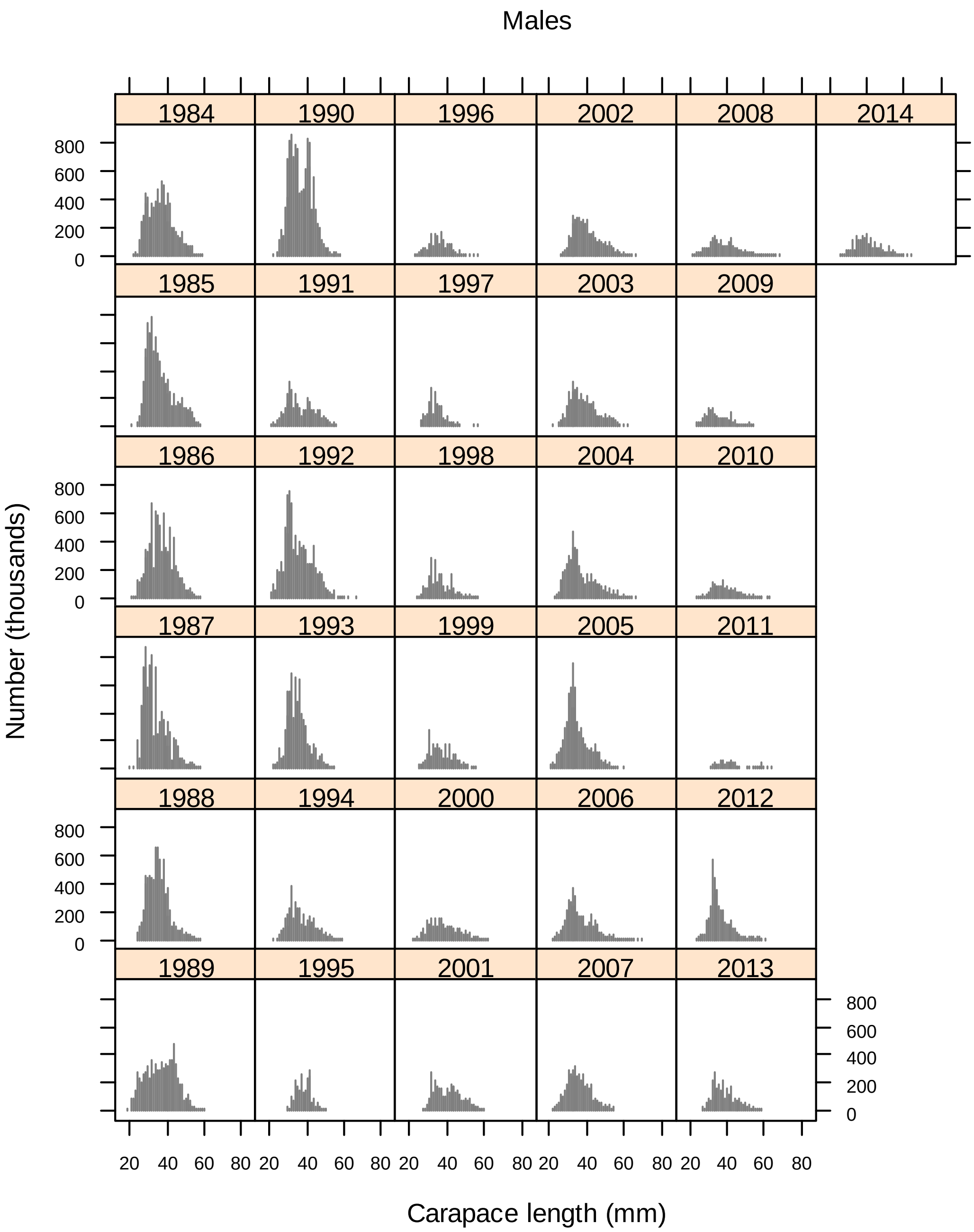


Figure 13.2.2.a. SW and S Portugal (FU 28-29) male length distributions for the period 1984-2014.

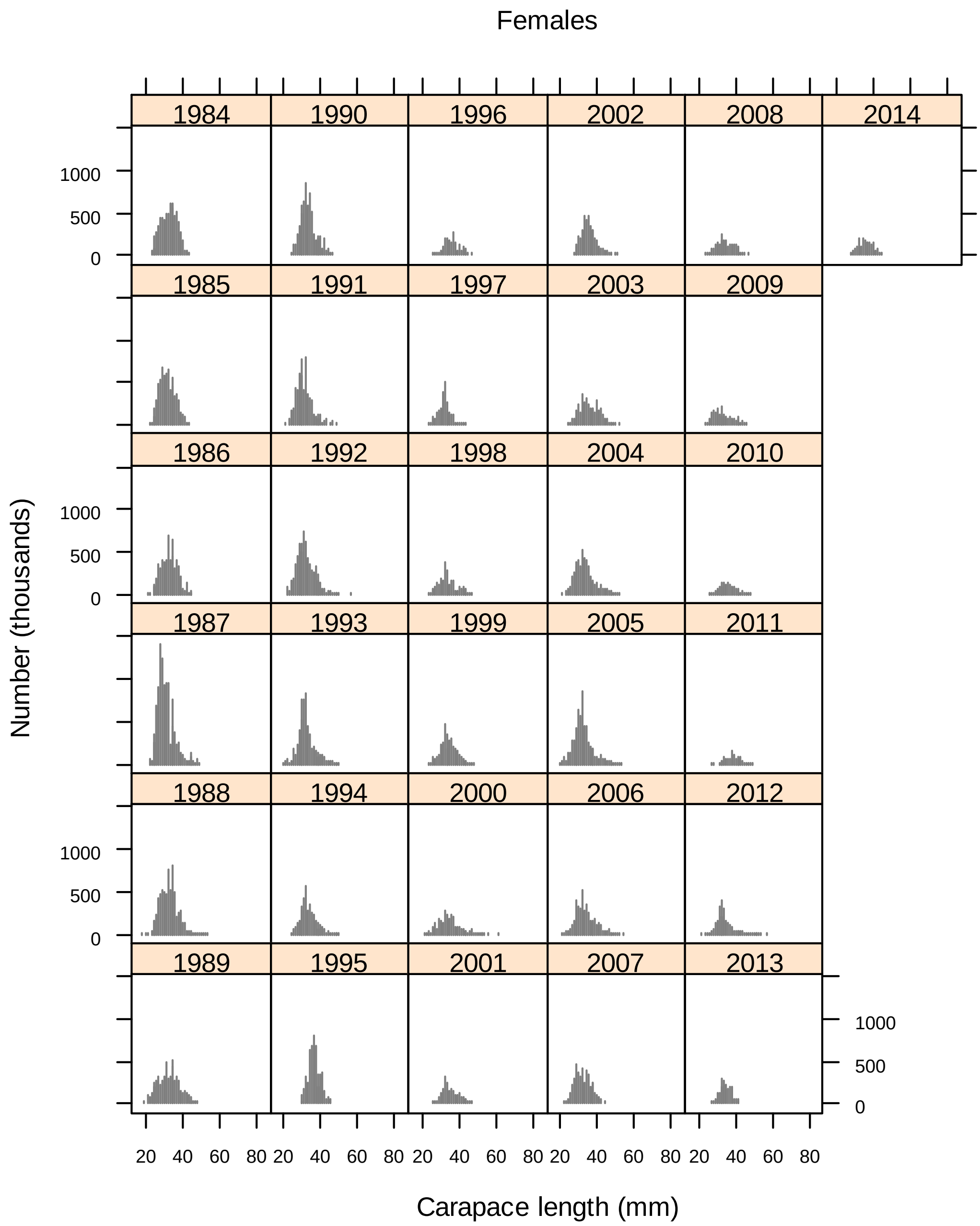


Figure 13.2.2.b. SW and S Portugal (FU 28-29) female length distributions for the period 1984-2013.

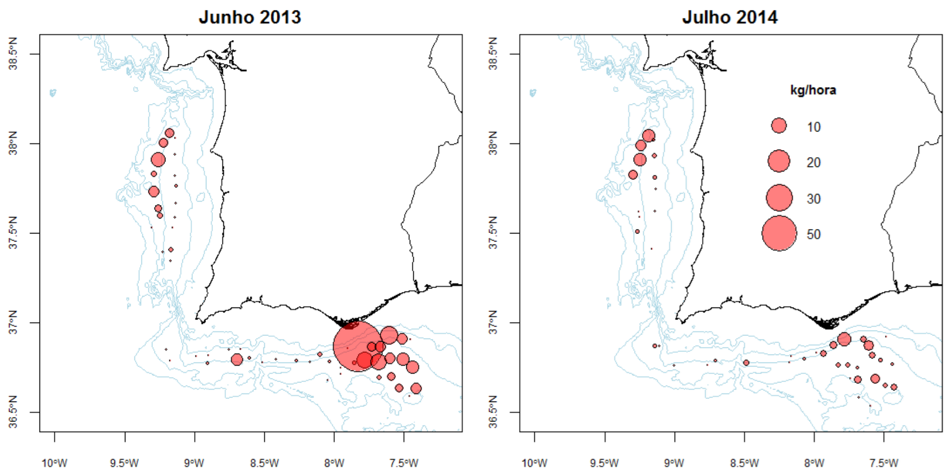


Figure 13.2.3. Spatial distribution of *Nephrops* biomass survey index in the years 2013 and 2014.

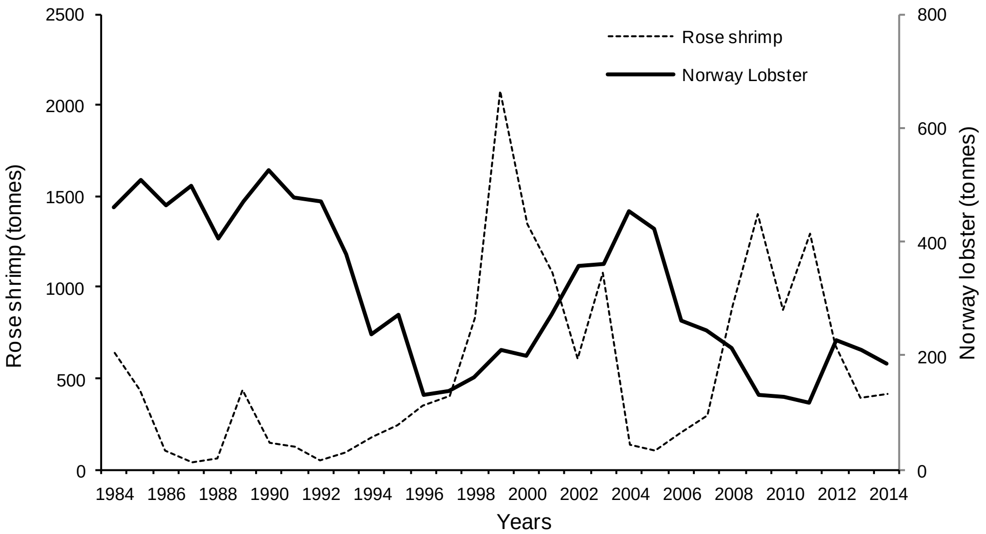


Figure 13.2.4 FUs 28-29: Landings of the two main target species of the Crustacean Fishery in the period 1984-2014.

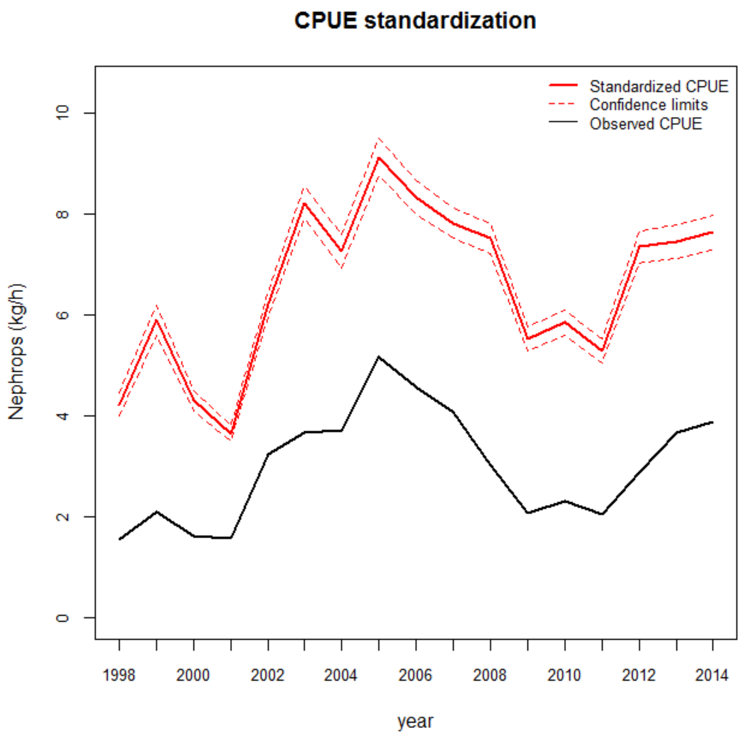


Figure 13.2.5. Comparison of standardized and observed *Nephrops* CPUE.

13.3 *Nephrops* in FU 30 (Gulf of Cadiz)

13.3.1 General

13.3.1.1 Ecosystem aspects

See Annex L

13.3.1.2 Fishery description

See Annex L

13.3.1.3 ICES Advice for 2015 and Management applicable for 2015 and 2016

ICES Advice for 2015

The advice for these *Nephrops* stocks is biennial and valid for 2015 and 2016.

Based on the ICES approach for data-limited stocks, ICES advises that catches should be no more than 95 tonnes. All catches are assumed to be landed.

To protect the stock in this Functional Unit, ICES advices that management area should be consistent with the assess area. Therefore, management should be implemented at the Functional Unit level.

Management applicable for 2014 and 2015

A recovery plan for southern hake and Iberian *Nephrops* stocks has been in force since the end of January 2006. The aim of the recovery plan is to rebuild the stocks within 10 years, with a reduction of 10% in F relative to the previous year and the TAC set accordingly (Council Regulation (EC) No. 2166/2005).

An increase of mesh size to 55 mm was established since September of 2009 (Orden ARM/2515/2009) for the bottom trawl fleet.

The TAC set for the whole Division IXa was 221 t for 2014 and 254 t for 2015, respectively, of which no more than 6 % may be taken in FUs 26 and 27. The maximum number of fishing days per vessel was fixed at 127 and 114 days for Spanish vessels and at 126 and 113 days for Portuguese vessels for these two years (Annex IIb of Council Regulations nos. 43/2014 and 104/2015). The number of fishing days included in these regulations is not applicable to the Gulf of Cadiz (FU 30), which has a different regime.

13.3.2 Data

13.3.2.1 Commercial catch and discard

Up to 2010, landings have been estimated by the WG based on IEO scientific estimations. The information was compiled by IEO from sale sheets and Owners Associations and the *Nephrops* landings allocation was carried out based on landing port criteria. Since 2011, the Spanish Authority for Fisheries (Secretaría General de Pesca, SGP) who is also the National Authority for the Data Collection Framework established a new policy and general approach in the provision of official data on catches and fishing effort. So, since 2011 *Nephrops* landings are official landings.

Unlike the IEO scientific estimates, official landings are derived from logbooks. This source of information allows the landings disaggregation by ICES statistical rectangles.

In WGHMM 2013 it was noticed that some *Nephrops* catches were recorded into statistical rectangles outside of the FU 30 definition. In 2012 and 2013, *Nephrops* catches recorded into statistical rectangles outside of this FU were considered as part of the landings in FU 30. In 2014 Spanish landings of *Nephrops* have been uploaded to InterCatch broken down by ICES statistical rectangle for the first time according to the 2014 ICES Data Call requirements. However, only the landings recorded inside ICES statistical rectangles defined as FU 30 were uploaded to InterCatch, which correspond to 83.8% of 2014 landings (WD Nº 3 Castro). As the outer rectangles were not defined in InterCatch, the remaining landings couldn't be upload this year but this will be for next year WG.

Landings in this FU are reported by Spain and also minor quantities by Portugal. Since WGHMM in 2010, *Nephrops* landings in Ayamonte port were incorporated in the Gulf of Cadiz time series of landings, as well as directed effort and LPUE from 2002 (Tables 13.3.1 and 13.3.4). *Nephrops* total landings in FU 30 decreased from 108 t in 1994 to 49 t in 1996. After that, there has been an increasing trend, reaching 307 t in 2003, dropping to 246 t in 2005-2006 (with the exception for the year 2004 when a decrease of more than 50% was observed). In the 2008-2012 periods, landings remained relatively stable around 100 t but decreased to 26 t in 2013 and 15 t in 2014. The reason for this drop is that the quota in 2012 was exceeded and the European Commission applied a sanction to be paid in 3 years. So, the *Nephrops* fishery was closed in 2013 and 2014 and vessels could only go fishing *Nephrops* a few days in summer and winter. In addition, a modification of the regulation implemented for the Spanish Administration for the Gulf of Cadiz grounds in 2014 (Orden AAA/1710/2014) establishes the assignment of *Nephrops* quotas by vessel. These facts may have caused unreported *Nephrops* landings and as consequence a decrease of landings in 2014.

Information on discards was sent to the WG through InterCatch. The discarding rate of *Nephrops* in this fishery fluctuates annually but is always low and the discards are considered negligible (Table 13.3.2). No *Nephrops* discards were recorded in 2011-2014 period with the exception for the year 2013 which represented 3.7%. Figure 13.3.2 shows the estimated length frequency distributions of the discarded and retained *Nephrops* by trip for the annual discarding program.

13.3.2.2 Biological sampling

The sampling level for the species is given in Table 1.3.

Figure 13.3.3a and 13.3.3b shows the annual landings length distribution for males, females and both sexes combined during the period 2001-2014. The length composition of landings is biased for the period 2001 to 2005 since the sampling of landings was not stratified by commercial categories (Silva et al., 2006). A new sampling scheme was applied from 2006 to 2008 and the information was more reliable. The mean sizes for both sexes remained relatively stable after the sampling scheme was changed, around 29 mm CL for sexes combined.

Since 2009, onboard concurrent sampling is carried out, as required by the DCF (Reg. EC 1343/2007). Outside of the *Nephrops* fishing season, a higher proportion of observer trips are likely to not cover *Nephrops* catches whereas when the directed *Nephrops* sampling were carried out in harbours in the past, the length distribution of landings were covered in all months. This fact could reduce the consistency of the length distribution of the catches in 2011 and 2012. The number of monthly sampling in 2013 and 2014 was probably influenced by the closure of *Nephrops* fishery.

Mean size of males and females in *Nephrops* landings in the period 2001-2014 are shown in Figure 13.3.1. The mean sizes show a slight increasing trend from 2006 to 2012. In 2013 and 2014, a decline of the mean size was observed.

13.3.2.3 Abundance indices from surveys

The biomass and the abundance indices of *Nephrops* by depth strata, estimated from the Spanish bottom trawl spring surveys (SPGF-cspr-WIBTS-Q1) carried out from 1993 to 2014 are shown in Table 13.3.3.

Two different periods can be observed in the time series. From 1993 to 1998 the overall abundance index trend was decreasing, while from 1998 to 2009 the index has remained stable although fluctuating widely in some years, except in 2004, which value was the lowest value in the time series. In 2010 the deeper strata (500-700 m) were not sampled due to a reduction in number of the survey the days, as a consequence of adverse weather conditions. Therefore, only the abundance index for the strata 200-500 m is available for 2010 (Table 13.3.3) and its value is similar to the corresponding strata in previous year. The abundance index was lower in 2011 and 2012 but it increased strongly in 2013 and 2014, reaching the highest value of the time series in the last year (Table 13.3.3). This survey is not specifically directed to *Nephrops* and is not carried out during the main *Nephrops* fishing season but it shows a similar trend to the commercial LPUE.

The length distributions of *Nephrops* obtained in the Spanish bottom trawl spring surveys (SPGF-cspr-WIBTS-Q1) during the period 2001-2014 are presented in Figure 13.3.6. The time series of *Nephrops* mean sizes for males, females and combined sexes obtained in these surveys are shown in Figure 13.3.6. No apparent trends are observed. The mean size ranged in 2014 was 37.3 mm carapace length for males and 30.1 for females.

13.3.2.4 Commercial catch– Effort data

Figure 13.3.1 and Table 13.3.4 show directed *Nephrops* effort estimates and LPUE series modified after the incorporation of data from Ayamonte port since 2002.

The directed fishing effort trend is clearly increasing from 1994 to 2005, where the highest value of the time series was recorded (4336 fishing days). After that, the effort declined to 2008 (73%) remaining relatively stable during the 2008-2012 period. The closure of the *Nephrops* fishery resulted in a decrease of the fishing effort in 2013 (262 fishing days) and 2014 (293 fishing days) in relation to the previous years (Figure 13.3.1)

LPUE obtained from the directed effort shows a gradual decrease from 1994 to 1998. After 1998, the trend slightly increases until 2003. In 2004, the LPUE decreases to the lowest value recorded (44.3 Kg/fishing day). LPUE then increased until 2008 around 60%. Since 2008 LPUE have declined to 50 Kg/fishing day in 2009 and 45.5 Kg/fishing day in 2010 (about 30% less with respect to 2008). Since 2010, LPUE shows an increasing trend with a high rise in 2013 but drop in 2014 (Figure 13.3.1). LPUE in 2013 and 2014 must be taken with caution as it does not cover the whole year due of the closure of the *Nephrops* fishery the most part of the year which increases the uncertainty associated with the LPUE index. Moreover, the assignment of *Nephrops* quotas by vessel implemented in 2014 might have caused unreported landings and to contribute to the increases the uncertainty of the commercial index.

The overall LPUE trend is quite similar to the abundance survey index in the stratum of 200-700 m from 1996 to 2013 (no survey was carried out in 2003) despite the survey index have fluctuated in some years (Figure 13.3.4). The lowest values were detected in 2004 in both series. In 2008, the abundance survey index was well above the commercial LPUE, however, the abundance index drop in 2009 agrees with the commercial LPUE. This fact may be explained by the increase of the rose shrimp abundance in 2008. The increased abundance of rose shrimp is believed to have led to a change in the objectives of the fishery, as rose shrimp achieves a higher market value and its fishing grounds, shallower (90-380 m) and closer to the coast. In 2011 and 2012, an increase of the directed commercial LPUE was observed but differently, the abundance index of spring survey decreased. In contrast, a strong increase of the survey abundance index was observed in 2013 and 2014. The value of the survey index in 2014 was the highest recorded in the whole time series indicating an increase of the *Nephrops* abundance in FU 30 (Figure 13.3.5).

13.3.3 Assessment

The update of the LPUE series and abundance survey index shows two conflicting signals. The LPUE decreasing while the survey index is increasing however, WG express concerns over the ability of those two indexes to reflect variations in the abundance in 2013 and 2014. The WG considers that no new information is available to change the perception of the status of the stock.

13.3.4 Biological reference points

No reference points are defined for this stock.

13.3.5 Management considerations

Nephrops fishery is taken in mixed bottom trawl fisheries; therefore HCRs applied to other species will affect this stock.

In 2013 and 2014, *Nephrops* fishery was closed the most part of the year because the quota in 2012 was exceeded and a sanction for the European Commission to be paid in 3 years was applied.

A Recovery Plan for the Iberian stocks of hake and *Nephrops* was approved in December 2005 (CE 2166/2005). This recovery plan includes a reduction of 10% in F relative to the previous year and TAC set accordingly, within the limits of ± 15% of the previous year TAC. By derogation, a different method of effort management method is applied to the Gulf of Cadiz.

Different Fishing Plans for the Gulf of Cadiz have been established by the Spanish Administration since 2004 in order to reduce the fishing effort of the bottom trawl fleet (ORDENES APA/3423/2004, APA/2858/2005, APA/2883/2006, APA/2801/2007, ARM/2515/2009, ARM/58/2010, ARM/2457/2010; AAA/627/2013). Last plan continue establishing a closed fishing season to 45 days, between September and November, plus 5 additional days to be selected by the ship owner during the duration of this Plan. The potential effect of the closed seasons on the *Nephrops* population has not been evaluated. Additionally, an increase of mesh size to 55 mm or more was implemented at the end of 2009 in order to reduce discards of individuals below the minimum landing size. In 2014, a modification of last Fishing Plan for the Gulf of Cadiz was established (AAA/1710/2014). This new regulation establishes an assignation of the *Nephrops* quotas by vessel.

Regulations were established by the Regional Administration with the aim of distributing the fishing effort throughout the year (Resolutions: 13th February 2008, BOJA nº

40; 16th February 2009, BOJA nº 36; 23th November 2009, BOJA nº 235; 15th October 2010, BOJA nº 209). These regional regulations control the days and time when the Gulf of Cadiz bottom trawl fleet can enter or leave fishing ports. Although the regulations vary among them, they generally allow a large flexibility during late spring and summer months (*e.g.* the 2010 Regulation established a continuous period from Monday 3 am to Thursday 9 pm during May-August, that was implemented in 2011), which is the main *Nephrops* fishing season, with more restricted time period in other months. This flexibility in summer months might have induced fleets from the ports closer to *Nephrops* grounds, such as Ayamonte or Isla Cristina, to direct their fishing effort to this species.

Table 13.3.1. ***Nephrops*** **FU30, Gulf of Cadiz: Landings in tonnes.**

Year	Spain**	Portugal	Total
1994	108		108
1995	131		131
1996	49		49
1997	97		97
1998	85		85
1999	120		120
2000	129		129
2001	178		178
2002	262		262
2003	303	4	307
2004	143	4	147
2005	243	3	246
2006	242	4	246
2007	211	4	215
2008	117	3	120
2009	117	2	119
2010	106	1	107
2011	93	3	96
2012	115	1	116
2013	26	<1	27
2014	14	<1	15

** Ayamonte landings are included since 2002

Table 13.3.2. ***Nephrops*** **FU30, Gulf of Cadiz: Mean carapace length of the discarded and retained fraction of** ***Nephrops*****, and percentage of discarded (2005-2014) for the annual discarding program.**

	MEAN CARAPACE LENGTH (mm)		% DISCARDED	
	Discarded fraction	Retained fraction	Weight	Number
2005	23.4	33.5	5.2	15.2
2006	20.5	29.4	4.6	11.8
2007	23.2	33.7	0.5	1.4
2008	20.8	35.2	2.5	7.7
2009	21.2	30.2	2.7	4.0
2010	21.9	31.7	1.3	4.5
2011	-	32.7	0.0	0.0
2012	-	32.6	0.0	0.0
2013	23.9	32.7	3.7	10.9
2014	-	34.5	0.0	0.0

Table 13.3.3. ***Nephrops*** **FU30, Gulf of Cadiz. Abundance index from Spanish bottom trawl spring surveys (SPGFS-cspr-WIBTS-Q1).**

	Spanish bottom trawl spring surveys					
	200-500 meters		500-700 meters		200-700 meters	
Year	Kg/60'	Nb/60'	Kg/60'	Nb/60'	Kg/60'	Nb/60'
1993	0.77	19	1.16	34	0.95	26
1994	1.23	31	0.60	8	0.94	21
1995	0.55	8	**	**	na	na
1996	0.56	10	1.33	29	0.93	19
1997	0.08	2	0.70	23	0.38	12
1998	0.40	16	0.23	7	0.30	11
1999	0.50	15	0.28	7	0.41	12
2000	0.22	7	0.57	15	0.37	10
2001	0.32	8	0.61	14	0.44	11
2002	0.49	17	0.45	11	0.47	14
2003	ns	ns	ns	ns	ns	ns
2004	0.15	5	0.15	4	0.15	5
2005	0.54	18	0.76	25	0.64	21
2006	0.24	6	0.66	20	0.42	12
2007	0.44	16	0.23	9	0.35	13
2008	0.88	26	0.81	14	0.85	20
2009	0.64	18	0.30	4	0.37	9
2010	0.63	20	**	**	na	na
2011	0.35	11	0.08	2	0.23	7
2012	0.15	4	0.22	4	0.18	4
2013	0.36	13	1.39	51	0.79	29
2014	2.97	84	0.50	9	1.92	52

ns = no survey

**= no sampled

Table 13.3.4. ***Nephrops*** **FU30, Gulf of Cádiz. Total landings and landings, LPUE and effort at the bottom trawl fleet making fishing trips with at least 10%** ***Nephrops*** **catches.**

Year	**Total landings (t)	*Landings (t)	*LPUE (kg/day)	*Effort (Fishing days)
1994	108	90	98.6	915
1995	131	107	99.4	1079
1996	49	40	88.2	458
1997	97	75	79.2	943
1998	85	51	62.3	811
1999	120	83	66.2	1259
2000	129	90	60.6	1484
2001	178	130	67.7	1924
2002	262	196	69.4	2827
2003	307	214	75.4	2840
2004	147	98	44.3	2206
2005	246	228	52.7	4336
2006	246	227	64.0	3555
2007	215	198	63.7	3105
2008	120	84	72.9	1150
2009	119	83	50.0	1653
2010	107	73	45.5	1603
2011	97	62	54.6	1135
2012	116	80	58.0	1380
2013	27	24	92.1	262
2014	15	12	40.1	293

*Landings, LPUE and fishing effort from fishing trips with at least 10% *Nephrops* .

** Ayamonte landings are included since 2002

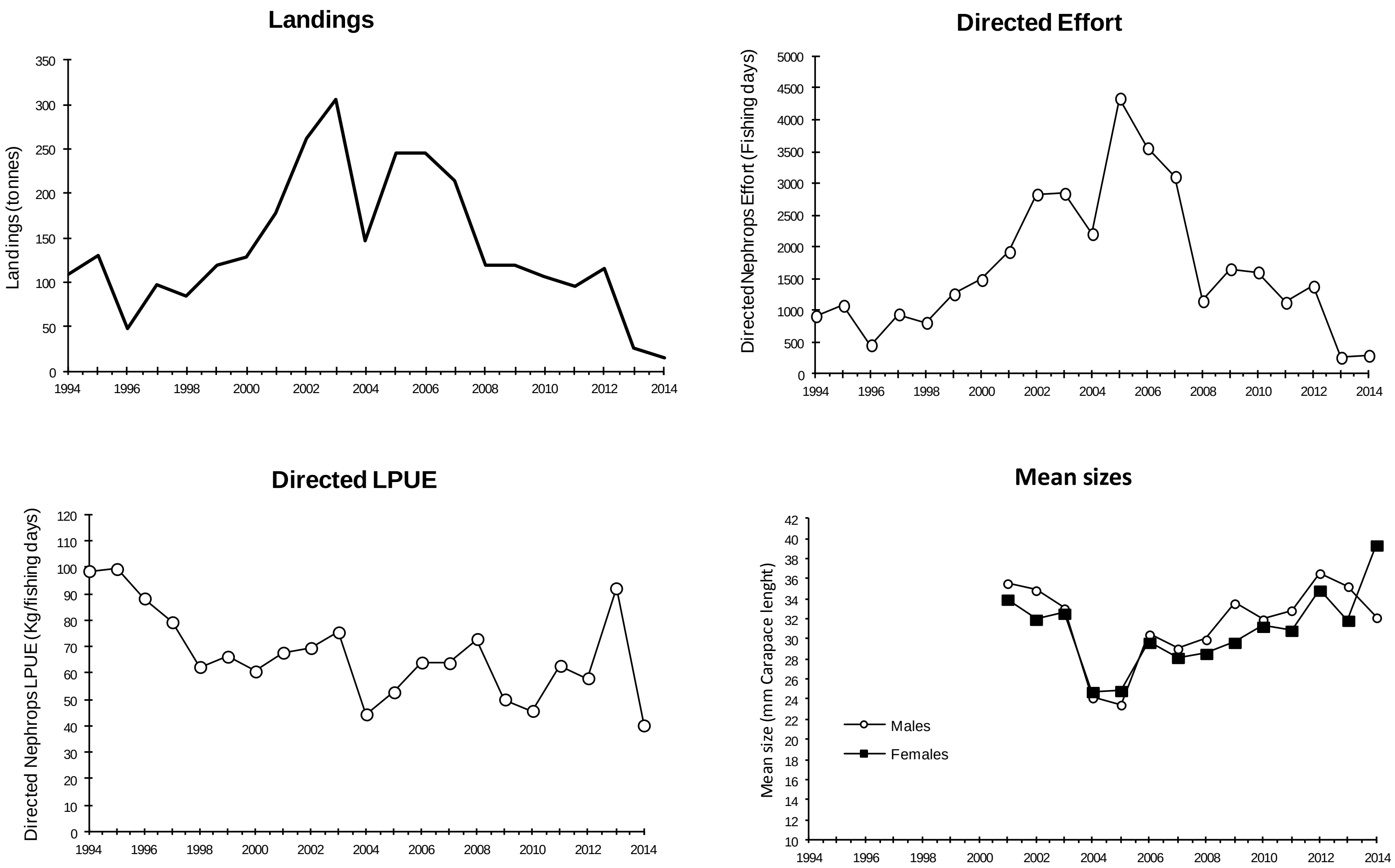


Figure 13.3.1. ***Nephrops*** **FU 30, Gulf of Cádiz. Long term trends in landings,** ***Nephrops*** **directed effort and LPUE and mean sizes.**

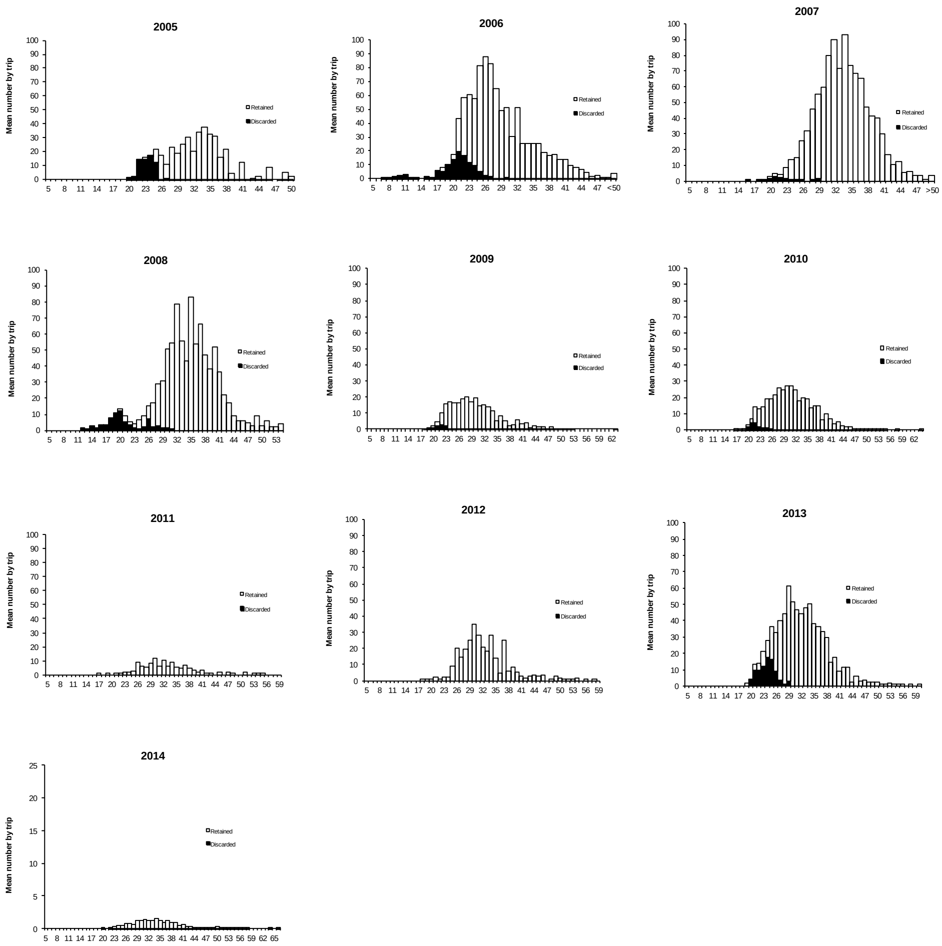


Figure 13.3.2. ***Nephrops*** **FU 30, Gulf of Cadiz. Length distribution of retained and discarded fractions** ***Nephrops*** **from discards program (2005-2014 period).**

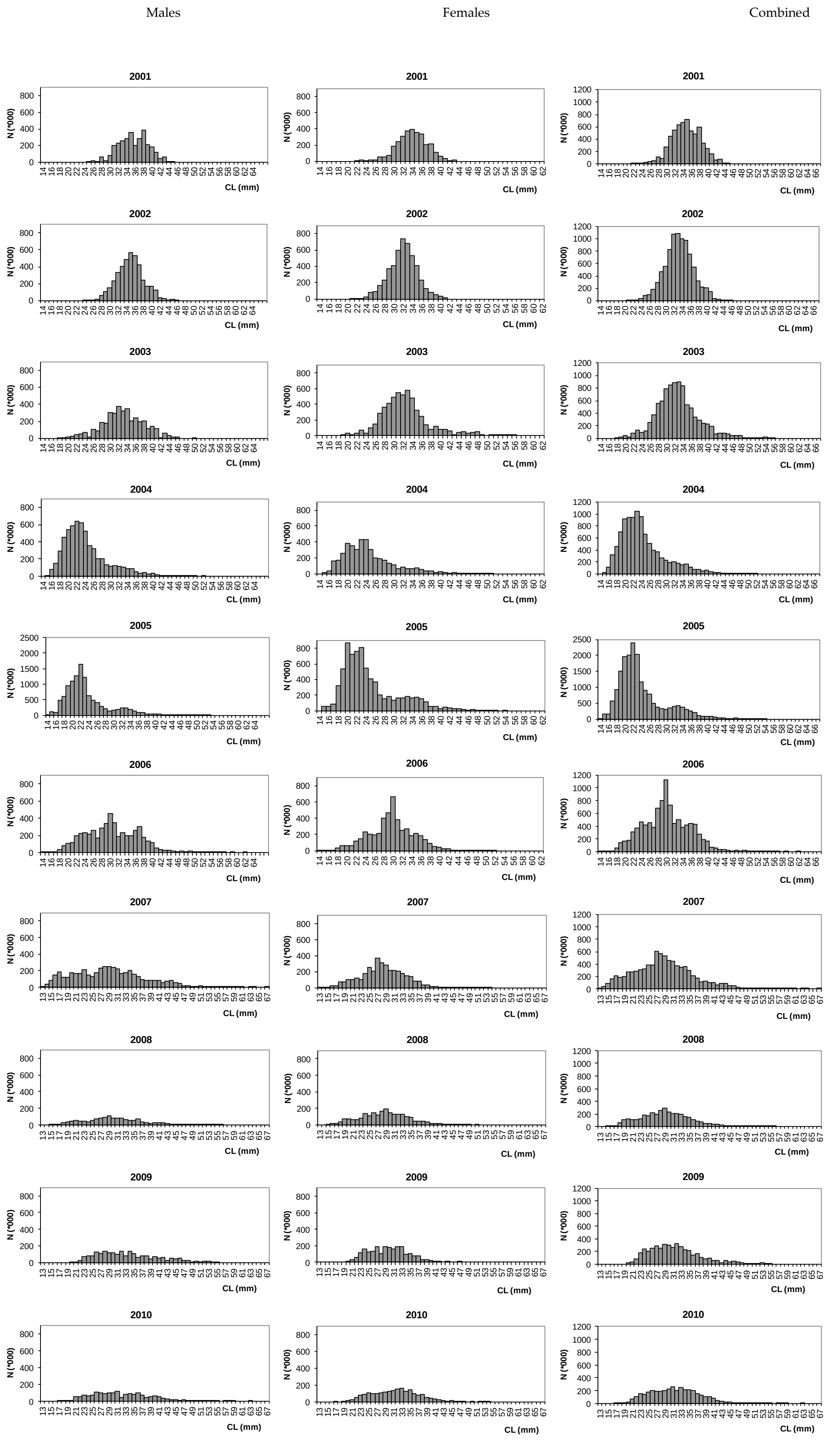


Figure 13.3.3a. ***Nephrops*** **FU30, Gulf of Cádiz. Length distributions of landings for the period 2001-2010.**

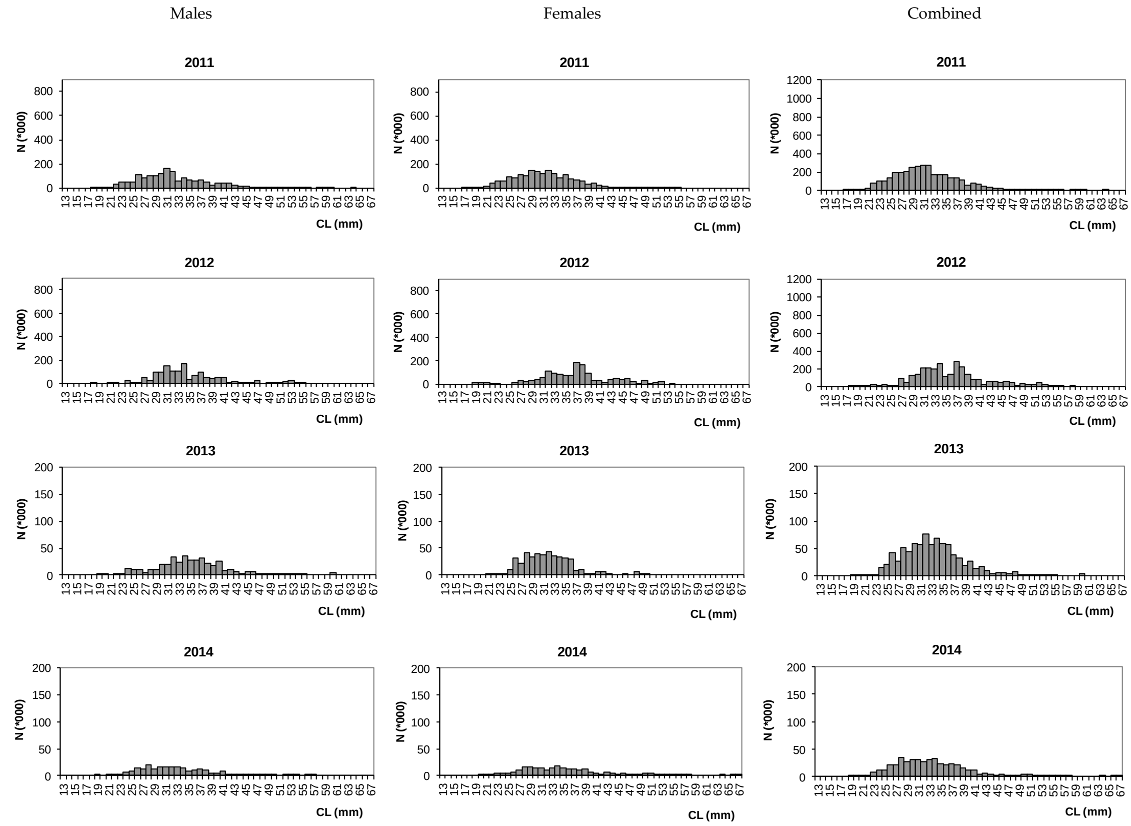
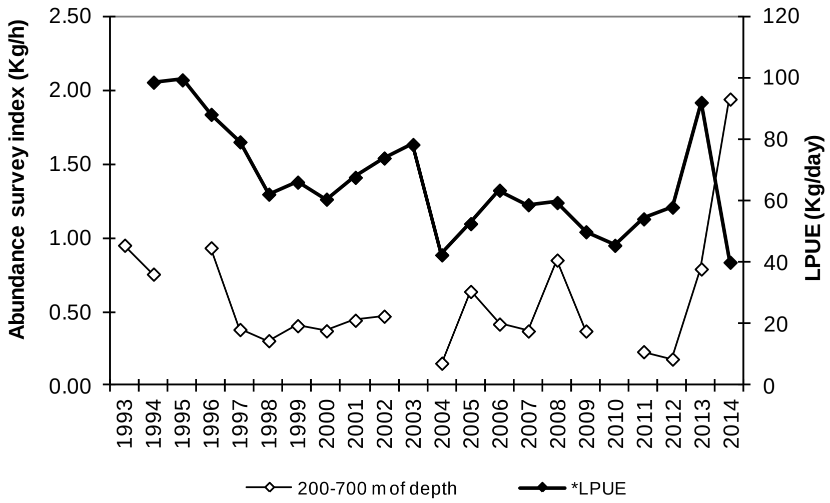


Figure 13.3.3b. *Nephrops* FU30, Gulf of Cadiz. Length distributions of landings for the period 2011-2014. Y-axis scale has been changed in 2013.



* 1995 and 2010: strata 500-700 m no sampled

** 2003: no survey

Figure 13.3.4. ***Nephrops*** **FU30, Gulf of Cádiz, Abundance index from Spanish bottom trawl spring surveys (SPGFS-cspr-WIBT-Q1) and commercial directed** ***Nephrops*** **LPUE from the bottom trawl fleet.**

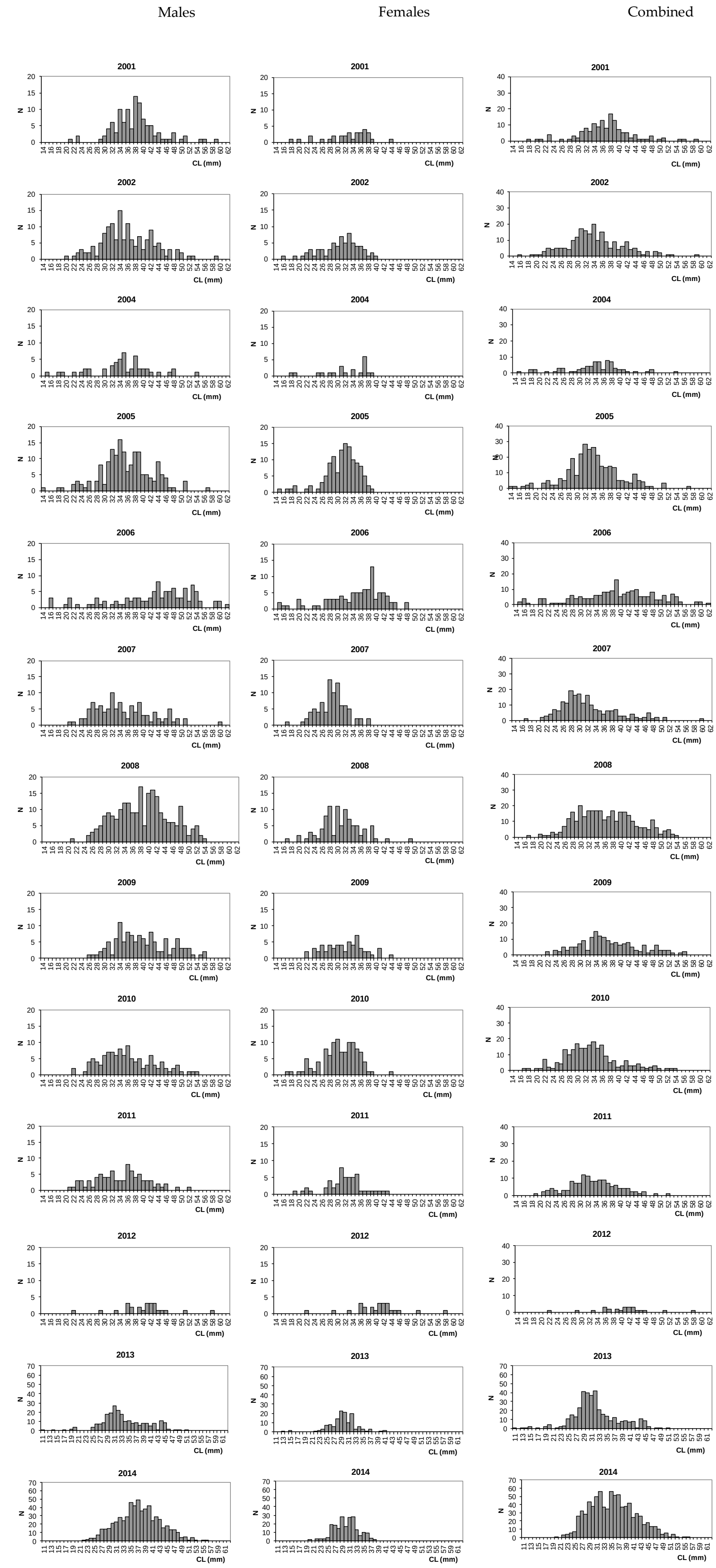


Figure 13.3.5. ***Nephrops*** **FU30, Gulf of Cádiz. Length distributions from Spanish bottom trawl surveys (SPGFS-cspr-WIBTS-Q1) for 2001-2014 period. Y-axis scale has been changed in 2013.**

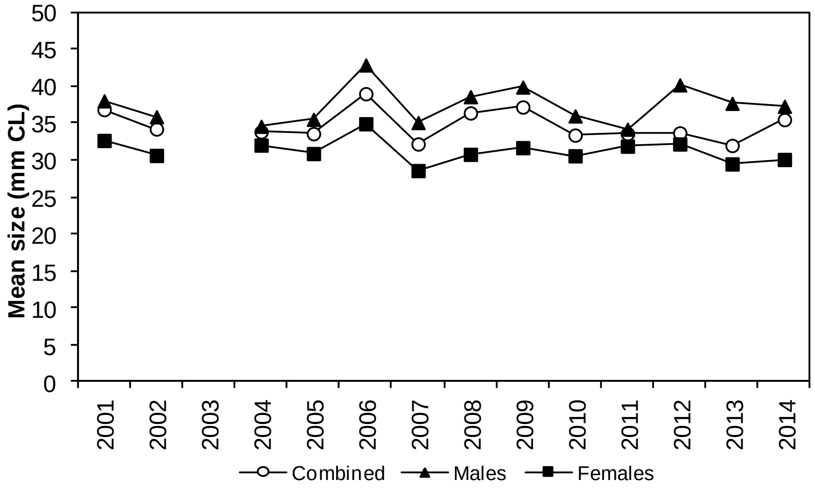


Figure 13.3.6. ***Nephrops*** **FU30, Gulf of Cádiz. Mean size in spring bottom trawl surveys (SPGFS-cspr-WIBTS-Q1) for the period 2001-2014.**

14 European Seabass in Division VIIIa,b

14.1 ICES advice applicable to 2014 (June 2014)

"There are no new data available that change the perception of the stock; therefore, the advice for this fishery in 2015 is the same as the advice for 2014. The advice for 2014 was (see ICES, 2013): Based on the ICES approach to data-limited stocks, ICES advises that commercial catches should be no more than 1890 tonnes. Discards are considered as negligible, therefore, all catches are assumed to be landed […]".

14.2 General

14.2.1 Stock ID and sub-stock structure

Bass Dicentrarchus labrax is a widely distributed species in northeast Atlantic shelf waters with a range from southern Norway, through the North Sea, the Irish Sea, the Bay of Biscay, the Mediterranean and the Black Sea to North-west Africa. The species is at the northern limits of its range around the British Isles and southern Scandinavia. Stock identity of European seabass was reviewed by WGNEW 2012 and further considered at ICES IBP-NEW 2012. The other stock units defined for sea bass are: west of Scotland and Ireland (VIa and VIIb,j); IVbc + VIIa,d-h; VIIIab and the more southerly population in VIIIc IXa (Figure 14-1). The IBP New 2012 reports that it is clear that further studies are needed on sea bass stock identity, using conventional and electronic tagging, genetics and other individual and population markers (e.g. otolith microchemistry and shape), together with data on spawning distribution, larval transport and VMS data for vessels tracking migrating sea bass shoals, to con-firm and quantify the exchange rate of sea bass between sea areas that could form management units for this stock.

In the absence of new information the pragmatic view of WGBIE2015 is to continue to assume the presence of discrete sea bass stocks off southern Ireland and in the Bay of Biscay (VIIIab) and iberian waters (VIIIc, IXa).

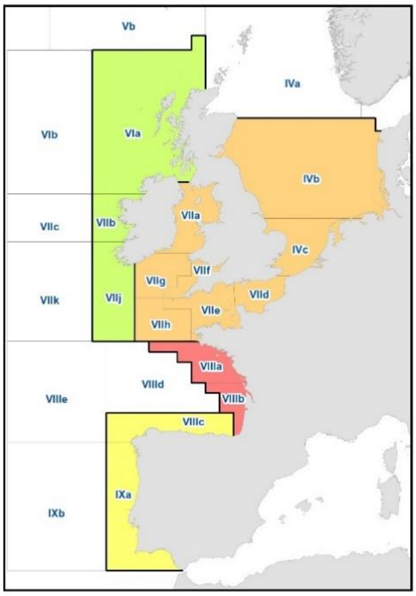


Figure 14-1 : stock seabass units defined at ICES (IBP new 2012)

14.2.2 Management applicable to 2014

Sea bass are not subject to EU TACs and quotas. Under EU regulation, the minimum landing size (MLS) of bass in the Northeast Atlantic is 36 cm total length, A variety of national restrictions on commercial bass fishing are also in place. These include:

- A landings limit of 5 t/boat/week for French and UK trawlers landing bass (which is not based on a biological point of reference). In France from 2012, following the implementation of a national licensing system for commercial gears targeting sea bass, the landings limits have slightly changed (depending on season and gear)[1].
- A licensing system from 2012 in France for commercial gears targeting sea bass in order to fix the level of the French commercial fishery.
- A MLS of 42 cm for the French recreational fisheries has been implemented in 2013.
- Voluntary closed season from February to mid-March for longline and handline bass fisheries in Brittany, France;

14.2.3 Management applicable to 2015

No new management plan is known at present in the Bay of Biscay. For information in IVbc and VIIa,d–h (North Sea, Channel, Celtic Sea and Irish Sea) the European Council has adopted measures to help sea bass recover (Recent scientific analyses have reinforced previous concerns about the state of the stock and advised urgently to reduce fishing by 80%. Effective emergency measures in January 2015 placed a ban on targeting the fish stock by pair-trawling while it is reproducing, during the spawning season, which runs until the end of April 2015. For recreational fishing the decision will mean the introduction of a limit of three fish per day per angler. This will be complemented by further measures to ensure that all those who fish sea bass make a balanced and fair contribution to saving the stock. In order to help the stock of sea bass recover, more action is needed to address the impact of all other commercial and recreational fishing activities.

14.3 Fisheries data

14.3.1 Commercial landings data

Seabass in the Bay of Biscay, are targeted by France (more than 90% of international landings) by line fisheries which take place mainly from July to October, by nets, pelagic trawlers, and in a mixed bottom trawl fisheries from November to April on pre spawning and spawning grounds when seabass is aggregated. In 2014 nets represent 39% of the landings of the area, lines (handlines+longlines) 27%, bottom trawl 16%, and pelagic trawl 7% (but It has to be note that pelagic trawlers were used from 2000 to 2008 to catch around 25% of the landings of the area decreasing to 9 (the pelagic fishery take place at present essentially in the Channel before 2015).

[1] http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000026844700&dateTexte=&categorieLien=id

A high increase in the french landings of nets is observed from 2011. An average of 585 tons during the period 2000-2012 is landed. In 2013, 834 tons have been landed, and 1131 tons in 2014. The main reason is the decrease of sole quotas from 2011 and an effort report on seabass which become more targeted, combined with good weather condition in 2014 and an increase in fishing technicality. French landings by metier are presented in Figure 14-2

Spain is responsible for 3% of the catches of the area (VIIIb essentially) in 2014, mainly with bottom trawlers. Spanish bass landings from Division VIIIa,b,d have increased to around 20 tons in the 90's to around 150 tons in the middle of the 2000's, then a peak to 317 tons in 2011. 91 tons have been landed in 2014

UK landings from this area are very low, usually inferior to 5 tons per year.

Recreational fisheries are an important part of the total removals but these are not accurately quantified. Figure 14-2 presents official and ices landings.

14.3.2 Length compositions : commercial landings

Table 14-2 gives fleet-raised length compositions for all French gears

14.3.3 Commercial discards

14.3.3.1 France

Discarding of sea bass by commercial fisheries can occur where fishing takes place in areas with bass smaller than the minimum landing size (36cm in most European countries), and where mesh sizes <100mm are in use. For 2009 it's estimated to be 44 tons, for 2010 44 tons, for 2011 20 tons, for 2012 37 tons and for 2013 68 tons

Discarding is thought to be low because of the high value of the fish. In 2014, very low number of sebass have been sampled (160 fish have been measured at sea in 2014, 65% for bottom trawlers, 28% for nets and 7% longlines and handlines). This cannot allowed to raise raw data to the whole fishery (DCRcvIndicator=0.97). Neverless this may indicate discarding is low in the area.

14.3.3.2 Spain

Observer data from Spanish vessels fishing in Areas VIII, have shown there was no seabass discard from 2003. No information in 2013 and 2014 were available on discards for WGBIE.

14.3.4 Recreational catches

Recreational marine fishery surveys in Europe are still at an early stage in development (ICES WGRFS 2012). A french study targeting sea bass was conducted between 2009 and 2011 in VIIIa, VIIIb, VIIe, VIIh, VIId, Ivc. Estimates of sea bass catches were obtained from a panel of 121 recreational fishermen recruited during a random digit dialling screening survey of 15 000 households in the targeted districts (Atlantic and Chanel). The estimated recreational catch of bass in the Bay of Biscay and in the Channel was 3,170t of which 2,350t was kept and 830t released. The precision of the the combined Biscay & Channel estimate is relatively low (CV =-26%; note that the figure of 51% given in IBP-NEW 2012 was incorrect). This makes the confidence interval at 95% of the average (3170t) to [1554t;4786t].

A new survey was conducted from July 2011 to December 2012, based on a similar methodology to the previous study (not only on sea bass this time, but also on other marine species including crustaceans and cephalopods). A random digit dialling screening survey of 16 130 households led to the recruitment of a panel of 183 fishermen to keep logbooks. In parallel, 151 fishermen were recruited on site by the Promopeche association, and 30 more via the sea bass fishermen panel set up in 2009. This resulted in 364 panel members keeping logbooks describing their catches (species, weight, size, etc.) The focus of the survey on sea bass shows that in Atlantic (Bay of Biscay and Channel), the estimated recreational catch of bass in 2012 was 3922 t of which 3146 t was kept and 776 t released. At this time results have to be considered as provisional, (results split between Bay and Biscay and Channel are not available yet with relative standard error).

14.3.5 Abundance Indices

No pre and post-recruit surveys are available for the area. In 2015 a study "French Logbook data analysis 2000-2013: possible contribution to the discussion of the sea bass stock(s) structure/annual abundance indices. Alain Laurec, M.Drogou"has been conducted and presented in a Working Document (reference : WD_12).

14.4 Assessment

WGBIE 2015 propose to upgrade stock VIIIab from category 5 to category 3.2.

The working document (A.Laurec;M.Drogou 2015) has been presented to WGBIE 2015. Annual indices of abundance have been assessed by the group. The assessment is also based on the analysis of lpues and total catches. For data-limited stocks for which a biomass index is available, ICES uses a harvest control rule based on an index-adjusted status quo catch. The advice is based on a comparison of the 3 most recent biomass index values with the 4 preceding values, combined with recent catch or landings data.

Any visual check of apparent abundance time series reveals the combination of a strong seasonal effect, a multiannual trend and apparent added noise. The strongest seasonal effect corresponds to what will be interpreted as spawning migrations and concentrations which take place in late autumn and winter. This is why it has been decided not to use the usual calendar year from January to December, but 12 months period from July to the following June month, the apparent abundance being for most squares low in June-July, without major changes between June and the following July month. The analysis has also been carried out using the basic calendar year on a data series from 2000 to 2013. It led to the same seasonal patterns which are simply more difficult to follow between december and january, when the main part of the landings are taken which corresponds to the spawning season in the Bay of Biscay).

The Working Group decided to retain the seasonal LPUE index as each yearly index fully covers the spawning season (December to March) when the main fishery occurs.

Table 14.3 and Figure 14.3 present Abundance Index used for assesment.

For calculating catch option, mean of landings from 2007 to 2013 has been calculated. A large period has been retained because of the seabass long life duration (up to 28 years)

For Seabass the biomass is estimated to have increased by more than 30% between the periods 2008–2011 (average of the 4 years) and 2012–2013 (average of the 3 years). This implies an increase in landings of at most 20%. When the uncertainty cap in relation to the average landings of the last 7 years (2007-2013) is applied, this corresponds to landings in 2016 of no more than 3 037t. Considering that landings in the net fisheries has increased significantly (the bulk of the net fishery historically targets sole and to a lesser extent seabass but reports effort on seabass increasing after the decrease of the sole quota from 2012), an additional precautionary action is needed. This would lead to landings of no more than 2437t.

Discards are known to take place but are not fully quantified. Anecdotal information suggests that discards may be very low in the area.

14.5 Future Research and data requirements

There are several important limitations to knowledge of sea bass populations, and deficiencies in data, that should be addressed in order to improve the assessments and advice for sea bass in the NE Atlantic. WGBIE 2015 makes the following recommendations:

The establishment of dedicated surveys on nurseries and tagging data on small fish could provide valuable information on trends in abundance and population structure of bass

Recruitment indices are needed for a wider geographic range including the Celtic/Irish Sea and Biscay areas.

Further research is needed to better understand the spatial dynamics of sea bass (mixing between ICES areas; effects of site fidelity on fishery impacts; spawning site – recruitment ground linkages; environmental influences)

Studies are needed to investigate the accuracy/bias in ageing, and errors due to age sampling schemes historically

Continued estimation of recreational catches is needed across the stock range, and information to evaluate historical trends in recreational effort and catches would be beneficial for interpreting changes in age-length compositions over time.

14.6 Management plans

No management plan is known at present for the VIIIab stock.

14.7 Management consideration

Sea bass are characterised by slow growth, late maturity and low natural mortality on adults, which imply the need for comparatively low rates of fishing mortality to avoid depletion of spawning potential in each year class. In the IVbc, VIIa,d-h stock, dynamic of the stock is closely dependant to some year of good or very poor recruitment. It could be also the case in the Bay of Biscay.

The importance of sea bass to recreational fisheries, artisanal and other inshore commercial fisheries and large-scale offshore fisheries in different regions means that resource sharing is an important management consideration

The effects of targeting of offshore spawning aggregations of sea bass are poorly understood, particularly how the fishing effort is distributed in relation to mixing of fish from different nursery grounds or summer feeding grounds, given the strong site fidelity of sea bass.

As bass is, at present, a non-TAC species, there is potential for displacement of fishing effort from other species with limiting quotas as observed with nets in Bay of Biscay.

With no effective control on the fishery to limit the increase of the landings as observed in 2014, risks are taken unless strong year classes are produced.

14.8 Recommendations for next benchmark assessment

WGBIE proposes a benchmark for 2017 to :

-Develop assessment methods, possibly in conjunction with the other stocks of seabass

-Carry out a quality check of all seabass data for the Bay of Biscay.

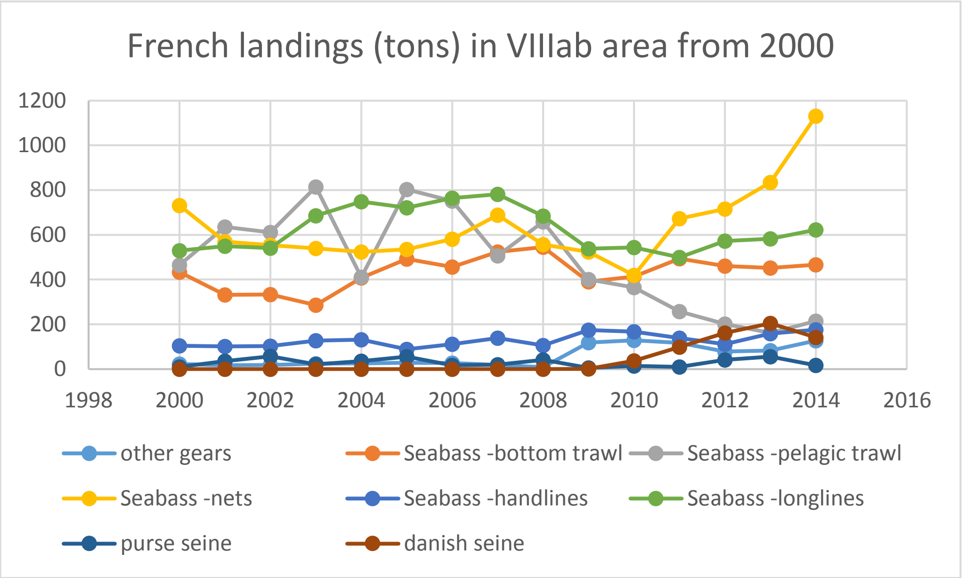


Figure 14-2 : French landings in tons in Bay of Biscay (VIIIa, VIIIb) by gears.

Table 14-1 Sea bass in the VIIIab area. ICES and official landings (tons).

VIIIab	Belgium	France	France	Netherlands	Spain	Spain	UK(Eng+Wales+N.Irl+Scotland)
Source	official stats	official stats	Ices stats	official stats	official stats	Ices stats	official stats
1978	0	1146	1146	0	0		0
1979	0	1132	1132	0	0		0
1980	0	1086	1086	0	0		0
1981	0			0	0		0
1982	0			0	0		0
1983	0	1363	1363	0	0		0
1984	0	2886	2886	0	0		0
1985	0	2477	2477	0	0		0
1986	0	2606	2606	0	0		0
1987	0	2474	2474	0	0		5
1988	0	2274	2274	0	0		15
1989	0	2201	2201	0	0		0
1990	0	1678	1678	0	0		0
1991	0	1774	1774	0	17		0
1992	0	1752	1752	0	14		0
1993	0	1595	1595	0	14		0
1994	0	1708	1708	0	17		0
1995	0	1549	1549	0	0		0
1996	0	1459	1459	0	0		0
1997	0	1415	1415	0	0		0
1998	0	1261	1261	0	27		0
1999	0	0	2080	0	11		0
2000	0	2080	2295	0	67		0
2001	0	2020	2238	3	68		0
2002	0	1937	2216	0	176		0
2003	0	2812	2497	0	119		0
2004	0	2561	2284	0	96		0
2005	0	3184	2722	0	74		0
2006	0	3318	2707	0	168		2
2007	1	2984	2677	0	74	90	1
2008	0	1508	2600	0	145		0
2009	1	2339	2152	0	194	126	0
2010	0	2322	2089	0	165	140	2
2011	1	2295	2297	0	311	278	0
2012	0	2325	2348	0		201	
2013	0		2532	0		153	0
2014*	0	2900	2900	0	91	91	0

***Provisional**

Table 14-2 French Number at length by gear, 2014

2014, France, 8ab	bottomtrawl	danish seine	others	handlines	longlines	nets	pelagic trawl
31	183	0	0	0	0	0	0
32	183	0	0	0	0	0	0
33	959	369	0	0	0	84	0
34	183	0	0	0	0	0	0
35	7761	737	0	72	520	135	0
36	11962	496	0	1213	3950	1370	0
37	31828	10952	0	1142	10587	5179	0
38	31501	128	0	1003	9194	5352	0
39	35070	369	0	2375	14287	21400	191
40	29069	1707	0	3780	14908	31573	574
41	35990	1437	0	2804	18493	134050	794
42	28415	1883	0	6250	29189	95182	2607
43	21056	12720	0	4182	25842	112621	2345
44	23868	2604	0	4955	23309	90634	766
45	16625	13962	0	7000	20198	175239	3153
46	12772	2917	0	8194	18665	152877	4736
47	14309	1379	0	3456	12505	117676	3583
48	9166	1198	0	4559	10958	34222	5932
49	10136	1331	0	3633	24339	42289	8562
50	7009	10974	0	3956	13902	38892	5736
51	7153	964	0	3297	10709	29587	6918
52	4973	418	0	2648	12433	25256	5044
53	5955	914	142	2145	15717	11972	1387
54	4741	312	0	360	11019	10182	2181
55	4109	812	0	2372	11770	16066	2811
56	2450	523	142	1224	15167	10883	892
57	2743	1050	0	571	14553	12787	617
58	1367	628	0	931	10074	12646	1545
59	2030	234	0	0	5171	11038	2764
60	2498	628	0	643	7369	11527	1470
61	1840	785	71	571	8756	11901	1083
62	870	262	0	360	8002	8617	1686
63	1321	234	0	931	7597	7950	1903
64	1367	0	0	571	6257	10388	1614
65	688	262	71	360	10460	11484	1662
66	2535	156	0	0	7919	7951	1205
67	183	206	71	0	10483	5301	1662
68	451	213	0	0	6912	7321	672
69	909	78	0	1142	3549	6159	2073
70	0	0	71	0	7396	4088	578
71	458	156	71	0	6079	2252	481
72	0	0	0	1142	6014	3191	0
73	412	396	0	0	3278	1080	1638
74	229	0	71	0	1650	1589	289
75	232	0	0	0	3417	868	0
76	458	0	0	72	1808	672	191
77	451	78	0	0	1634	1265	191
78	183	0	0	0	1805	77	425
79	0	78	0	0	333	84	0

2014, France, 8ab	bottomtrawl	danish seine	others	handlines	longlines	nets	pelagic trawl
80	0	105	0	0	667	102	603
81	0	0	0	0	302	48	191
82	0	0	0	0	635	1640	0
83	0	0	71	0	635	1559	0
84	0	0	0	0	1652	0	0
85	0	0	0	0	302	84	0
86	0	0	0	0	0	0	0
87	0	0	0	0	302	0	0

Table 14-3 Abundance Index from French log book used for assessment

YEAR	apparent LPUE (Kg/day)
2000	1,66
2001	1,84
2002	1,27
2003	1,37
2004	1,55
2005	0,86
2006	0,85
2007	1,18
2008	0,93
2009	1,2
2010	1,19
2011	1,2
2012	1,3
2013	1,52
2014	1,61

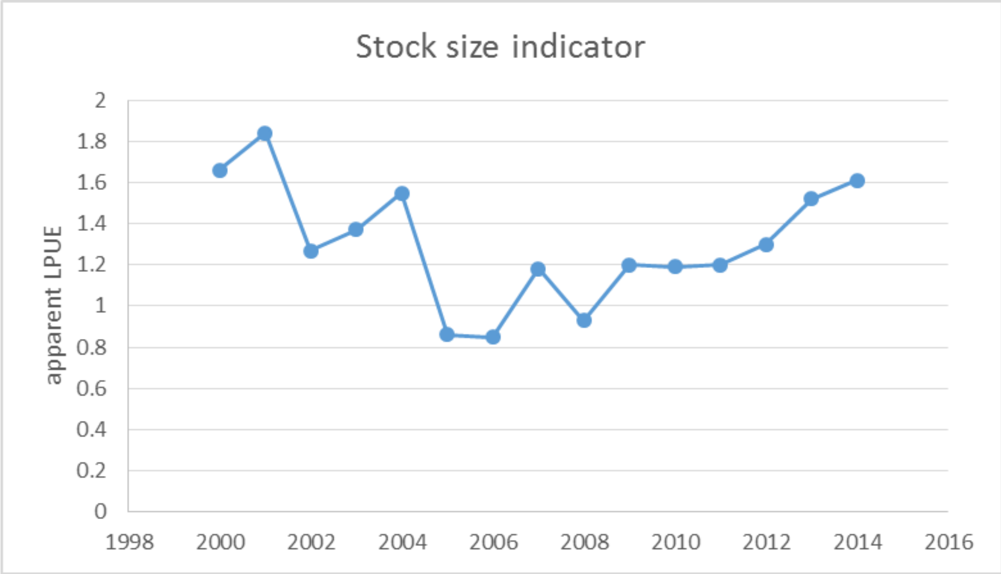


Figure 14-3 Abundance Index from French logbook used for assessment

15 European Seabass in Division VIIIc, IXa

15.1 ICES advice applicable to 2014 (June 2014)

"There are no new data available that change the perception of the stock. Therefore, the advice for this fishery in 2015 is the same as the advice for 2014 (see ICES, 2013): Based on ICES approach to data-limited stocks, ICES advises that commercial catches should be no more than 598 t. All commercial catches are assumed to be landed. Recreational catches cannot be quantified; therefore, total catches cannot be calculated"

15.2 General

15.2.1 Stock ID and sub-stock structure

Bass Dicentrarchus labrax is a widely distributed species in northeast Atlantic shelf waters with a range from southern Norway, through the North Sea, the Irish Sea, the Bay of Biscay, the Mediterranean and the Black Sea to North-west Africa. The species is at the northern limits of its range around the British Isles and southern Scandinavia. Stock identity of European seabass was reviewed by WGNEW 2012 and further considered at ICES IBP-NEW 2012. The other stock units defined for sea bass are: west of Scotland and Ireland (VIa and VIIb,j); IVbc + VIIa,d-h; VIIIab and the more southerly population in VIIIc IXa (Figure 15-1). The IBP New 2012 reports that it is clear that further studies are needed on sea bass stock identity, using conventional and electronic tagging, genetics and other individual and population markers (e.g. otolith microchemistry and shape), together with data on spawning distribution, larval transport and VMS data for vessels tracking migrating sea bass shoals, to con-firm and quantify the exchange rate of sea bass between sea areas that could form management units for this stock.

In the absence of new information the pragmatic view of WGBIE2015 is to continue to assume the presence of discrete sea bass stocks off southern Ireland and in the Bay of Biscay (VIIIab) and iberian waters (VIIIc, IXa).

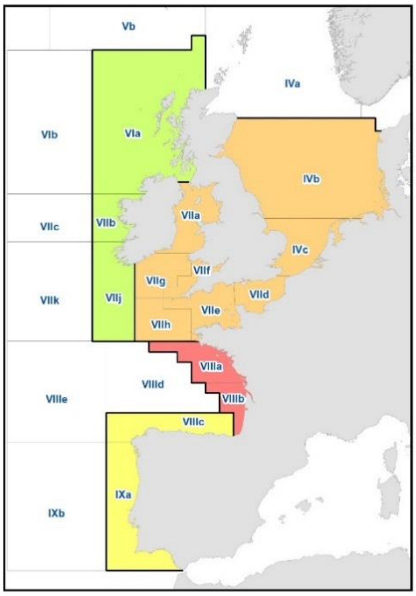


Figure 15-1: stock seabass units defined at ICES (IBP new 2012)

15.2.2 Management applicable to 2014

Sea bass are not subject to EU TACs and quotas. Under EU regulation, the minimum landing size (MLS) of bass in the Northeast Atlantic is 36 cm total length, A variety of national restrictions on commercial bass fishing are also in place. These include:

Seabass are not subject to EU TACs and quotas. Under EU regulation, the MLS of sea bass in the Northeast Atlantic is 36 cm total length (EC regulation 850/98). A variety of national restrictions on commercial fishing for each metier also apply to sea bass. The measures affecting recreational fisheries in Portugal include gear restrictions, a minimum landing size equal to the commercial fishery MLS (36 cm), the total catch of fish and cephalopods by each fisher must be less than 10 kg per day, and prohibition on the sale of catch.

15.2.3 Management applicable to 2015

No new management plan is known at present in the Bay of Biscay. For information in IVbc and VIIa,d–h (North Sea, Channel, Celtic Sea and Irish Sea) the European Council has adopted measures to help sea bass recover (Recent scientific analyses have reinforced previous concerns about the state of the stock and advised urgently to reduce fishing by 80%. Effective emergency measures in January 2015 placed a ban on targeting the fish stock by pair-trawling while it is reproducing, during the spawning season, which runs until the end of April 2015. For recreational fishing the decision will mean the introduction of a limit of three fish per day per angler. This will be complemented by further measures to ensure that all those who fish sea bass make a balanced and fair contribution to saving the stock. In order to help the stock of sea bass recover, more action is needed to address the impact of all other commercial and recreational fishing activities.

15.3 Fisheries data

15.3.1 Commercial landings data

Landings series are given in Table 15-1 and are derived from :

i) Official statistics recorded in the Fishstat database since around the mid-1970s.

ii) Spanish landings for 2007-2011 from sale notes

iii) Portuguese estimated landings from 1986 to 2011 including distinction between Dicentrarchus labrax and punctatus.

Spanish and Portuguese vessels represent almost of the total annual landings in the area IXa and VIIIc. Commercial landings represent 917 tons in 2014. A peak of landings is observed in the early 90's and in 2013, reaching more than 1000 tons, and lowest landings (637 tons) have been observed in 2004. Artisanal fisheries are mainly observed in this area. In 2014, in the all area, landings were equivalent between Spain and Portugal. However Landings from Portugal are only from the IXa area, while the Spanish landings are distributed between the two zones IXa and VIIIc (respectively (130 tons and 247 tons).

15.3.2 Commercial discards

Portugal: Sea bass discards are recorded by the DCF on-board sampling programme. The Portuguese on-board sampling is not covering the Sea Bass fishing area.No discards are observed.

Spain: No bass discards were observed for any metier in the 2003-2014 periods.

15.3.3 Recreational catches

Recreational marine fishery surveys in Europe are still at an early stage in development (ICES WGRFS 2012).

15.4 Management plans

No management plan is known at present for the VIIIc, IXa stock.

Table 15-1: Sea bass in the IX and VIIIc areas. ICES and official landings (tons).

Country	France official landings	Portugal official landings	Spain official landings	Total official landings	Total ICES estimates***
1978	0	576	0	576	576
1979	0	550	0	550	550
1980	0	460	0	460	460
1981	0	370	0	370	370
1982	0	556	135	691	691
1983	0	408	114	522	522
1984	0	431	250	681	681
1985	0	311	164	475	475
1986	0	219	182	401	580
1987	0	216	194	410	542
1988	14	115	93	222	586
1989	0	105	417	522	1029
1990	1	90	541	632	1042
1991	2	77	411	490	867
1992	0	53	348	401	743
1993	0	57	351	408	694
1994	0	57	440	497	863
1995	0	42	446	488	798
1996	0	48	534	582	956
1997	0	39	474	513	742
1998	0	38	373	411	683
1999	0	37	355	392	720
2000	2	49	329	380	775
2001	0	42	235	277	635
2002	8	43	121	172	518
2003	1	47	113	161	466
2004	39	67	256	362	676
2005	57	177	219	453	753
2006	2	461	268	731	905
2007	1	545	342	888	910
2008	0	403	252	655	614
2009	8	414	212	634	652
2010	2	489	286	777	814
2011	5	441	313	759	777
2012	2	271		273	701
2013	4	529	513	1046	1046
2014	3	536	378	917	917

*** Preliminary**

***-Official landings have been extracted from the Ices Official Catch Statistics Web page (04May 2015) for "BSS" and area VIIIc, IXa and IX (IX has been retained for Portuguese statistics because reported as IXa prior 2007).**

*****Difference between Ices Statistics and official Statistics are mainly due prior 2006 to Portugal statistics : before 2006 most of the sea bass catches were registered under the code BSE, i.e. (Dicentrarchus sp.). After the DCF implementation there was a progressive increase in the correct identification of species in the official statistics (BSS increase, BSE decrease) who consider Dicentrarchus sp landings minus 2.3% of Dicentrarchus punctatus based on DCF market and on-board sampling between 2008 and 2012)**

16 Plaice in Subarea VIII and Division IXa

Plaice (*Pleuronectes platessa*) are caught as a bycatch by various fleets and gear types covering small-scale artisanal and trawl fisheries. Portugal and France are the main participants in this fishery with Spain playing a minor role. Present fishery statistics are considered to be preliminary as there are concerns about the reliability of the French data from 2008-09. Landings may also contain misidentified flounder (*Platichthys flesus*) as they are often confounded at sales auctions in Portugal. The quantity of discarding is uncertain. For these reasons, the landings are unlikely to be a good indicator of total removals and ICES considers that it is not possible to quantify the catches.

This stock from is currently ranked as a Data Limited Stock in category 5.2 as only landings data are available (Table 16.1); however, all the stocks covered by the current DCF sampling programme have been proposed to be upgraded to category 4, because of the availability of biological information. For the first time this year national laboratories were requested via ICES Data call to provide information on quantity and length composition of commercial landings and discards. However, no length information was submitted. Quantity of landings and discards were provided by Spain, France, Portugal and Belgium (Table 16.2).

Plaice were not present in sufficient numbers to provide survey abundance indices and no commercial indices were available. Other approaches should be considered in order to obtain fishery independent information.

Biological information needs to be compiled. However, issues concerning the quality of landings statistics in addition to the lack of survey or commercial abundance indices need to be resolved before a new assessment is developed. As this species is at the southern extent of its range in the Bay of Biscay and Iberian Peninsula (Figure 16.1) perhaps merging of the northern and southern stocks would provide the best opportunity to improve the assessment.

Table 16.1: Plaice in Subarea VIII and Division IXa: official landings by country in tonnes (* 2014 provisional)

Year	Belgium	France	Portugal	Spain	Total
1994		365	33	1	399
1995		319		12	331
1996		248		14	262
1997		255		3	258
1998		219		6	225
1999	1			3	4
2000	15	193		22	230
2001		201		22	223
2002	1	167		11	179
2003	1	217	1	4	223
2004		229	163	7	399
2005	4	186	1	33	224
2006	2	246	1	4	253
2007	5	214	41	4	264
2008	2	98	89	4	193
2009	2	134	101	9	246
2010	1	200	112	12	325
2011	2	208	64	8	282
2012	3	183	62	3	251
2013	0	147	44	5	196
2014*	1	163	51	5	220

Table 16.2: Plaice in Subarea VIII and Division IXa: ICES estimate of the 2014 landings by country in tonnes .

Country	VIIIa	VIIIb	VIIIc	VIIId	VIIIe	IXa	Total
Belgium	0	1	0	0	0	0	1
France	148	13	0	1	0	0	162
Portugal	0	0	0	0	0	47	47
Spain	1	0	3	0	0	1	6
Total	150	14	3	1	0	49	217

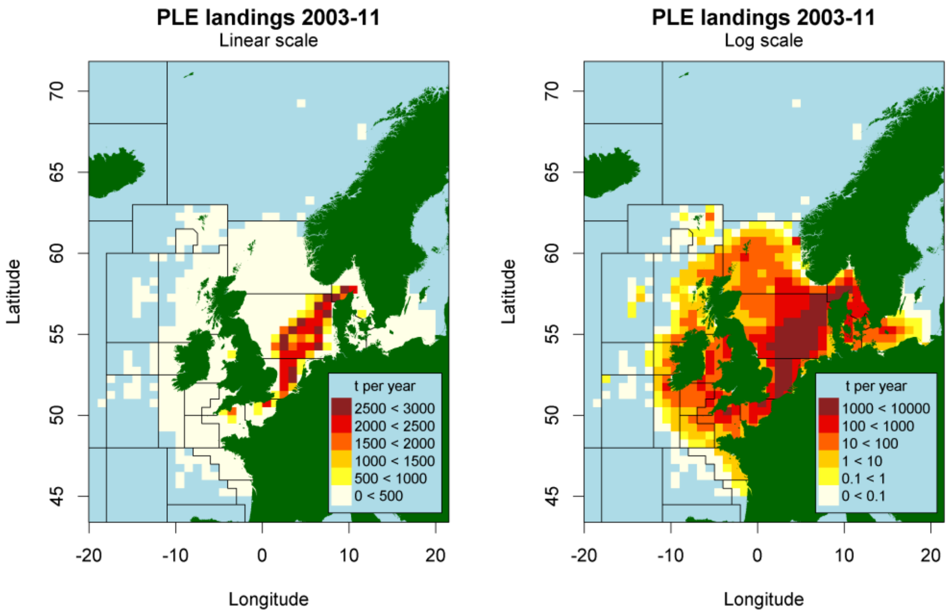


Figure 16.1: International landings of Plaice by statistical rectangle from 2003-2011

17 Pollack in Subarea VIII and Division IXa

The official landing statistics have been updated in table 17. 1 for 2014. In the 2014 advice ICES advises that catches should decrease by 20% in relation to the last three years' average landings (2011–2013), corresponding to landings of no more than 1316 tonnes. No additional data were provided in 2014 and landing statistics do not show any remarkable changes so the group considered there is no basis to change the advice basis.

However, since the landing data are now available, the working group considered that it is now appropriate to quantify the advice (for a 20% reduction compared to the last 3 years average official landings - 2010-2012).

There is a difference between the total landing statistics in the official data in this table and Table 17.2 with national landings (by country and gear type), for which not all data were available in 2013 and 2014.

Landings have been reported by the three countries with quota: France, Spain and Portugal. The respective time series, from 2001 to 2012, of national landings desegregated by gear are shown in Table 17.2.

This stock from is currently ranked as a Data Limited Stock in category 5.2; however, all the stocks covered by the current DCF sampling programme have been proposed to be upgrade to category 4, because of the availability of biological information. Therefore, survey abundance indices, length frequency distributions, and other biological information is required from the respective National laboratories.

Length frequency distributions (LFD) were provided by IEO (Spain) for years 2011 and 2012 by metier. However, as Pollack is scarce in landings, most of samples (83%) come from the gillnet fleet, due to it has a higher number of metiers than others fleets, as longline. Different mean sizes are obtained depending on the mesh size used (Figure XXX.2): 46.0 cm (GNS_DEF_60-79_0_0), 46.9 cm (GNS_DEF_80-99_0_0), and 48.8 cm (GNS_DEF_>=100_0_0).

Discards estimates of Pollack in Spanish trawlers were also provided by IEO (Spain) for year 1994, 1997, 1999, 2000, and the period 2003-2012. The low numbers of discards recorded makes it reasonable to assume that landings can be a proxy of catches.

Therefore, from the biological information compiled (scarce due to the low catches of this species in the area), just the LFD could be useful in order to improve the assessment of this stock in the future. However, the time series should be longer and more representative of the different metiers catching Pollack.

Table 17.1: Pollack in Subarea VIII and Division IXa: Official landings (tonnes) by country.

Area	Bay of Biscay (Subarea VIII)				Iberian (division IXa)		Total
Country	BE	ES	FR	UK	ES	PT	
1985	0	2304	2769	23	636	0	5732
1986	0	437	2127	5	237	0	2806
1987	0	584	2022	1	308	3	2918
1988	3	476	1761	6	329	7	2582
1989	13	214	1682	4	57	3	1973
1990	14	194	1662	2	27	1	1900
1991	1	221	1867	1	76	2	2168
1992	2	154	1735	0	65	2	1958
1993	3	135	1327	0	47	1	1513
1994	3	157	1764	0	28	3	1955
1995	6	153	1457	2	59	2	1679
1996	8	137	1164	0	43	2	1354
1997	2	152	1167	1	54	2	1378
1998	1	152	956	0	55	1	1165
1999	0	120	0	0	36	1	157
2000	0	121	1315	0	49	15	1500
2001	0	346	1142	0	81	41	1610
2002	0	170	1467	0	35	45	1717
2003	0	142	1245	1	39	31	1458
2004	0	211	1145	0	90	12	1458
2005	0	306	1311	0	132	6	1755
2006	0	251	1419	171	102	7	1950
2007	0	198	1238	62	103	5	1606
2008	0	265	814	64	128	31	1302
2009	0	218	1507	41	68	3	1837
2010	0	265	1269	44	91	2	1671
2011	0	321	1454	26	104	2	1907
2012	0	158	1095	0	139	2	1394
2013	0.2		1337	8		3	1348
2014	0	259	1622		101	1	1983

Table 17.2: Pollack in Subarea VIII and Division IXa: Annual landings (tonnes) from France, Spain and Portugal by country and gear.

	France				Spain			Portugal		Others	
YEAR	Nets	Trawl	Lines	Others	Longlines	Gillnets	Others	Polyvalent	Trawl	---	TOTAL
2001	325	136	75	8	31	53	169	-	-	0	766
2002	358	173	36	5	26	28	134	-	-	0	760
2003	570	202	65	3	31	35	146	-	-	1	1053
2004	542	151	57	4	47	36	222	16.5	0.1	-	1092
2005	378	205	95	6	90	36	161	7.8	0.6	0	988
2006	498	294	92	11	48	29	243	6.7	0.3	171	1400
2007	565	311	133	19	72	51	210	4.5	0.4	62	1433
2008	557	263	138	12	147	95	163	33.3	0	64	1506
2009	679	224	217	5	101	76	97	2.4	0.5	41	1446
2010	-	-	-	-	167	162	93	1.7	0.1	44	470
2011	-	-	-	-	207	199	20	1.2	0.3	26	455
2012	608	170	267	49	123	122	53	-	-	-	1392

19 Whiting in Subarea VIII and Division IXa

Whiting (*Merlangius merlangus*) are caught in mixed demersal fisheries primarily by France and Spain (Table 19.1). Present fishery statistics are considered to be preliminary as there are concerns about the reliability of the French data from 2008-09. Landings may also contain misidentified Pollack (*Pollachius pollachius*). Whiting has never been recorded in Spanish discards and is negligible in Portuguese discards. However there are indications that there is considerable discarding by the French fleet.

This stock from is currently ranked as a Data Limited Stock in category 5.2 as there is information on landings only; however, all the stocks covered by the current DCF sampling programme have been proposed to be upgrade to category 4, because of the availability of biological information. For the first time this year national laboratories were requested via ICES Data call to provide information on quantity and length composition of commercial landings and discards (Table 19.2). Data were submitted by Spain, France and Belgium however as this is the first year these data must be considered preliminary. No information was received from Portugal. According to the French DCF National Programme and Technical reports, whiting in VIII have been sampled for age since 2011. These data may be useful to provide additional information on this stock.

Whiting are present in the French EVHOE-WIBTS-Q4 survey from the Bay of Biscay. Adults were not sufficient in number to serve as an SSB indicator but it may provide an index of recruitment. Commercial abundance index is available from Spanish pair trawl fleet in VIIIabd although it has declined to negligible levels in recent years.

This species is at the southern extent of its range in the Bay of Biscay and Iberian Peninsula (Figure 13.8.1). It is not clear whether this is a separate stock from a biological point of view.

Table 19.1: Whiting in Subarea VIII and Division IXa: official landings by country in tonnes (*2014 provisional)

Year	Belgium	France	Portugal	Spain	Total
1994		3496	15	136	3647
1995		2645	2	1	2648
1996		1544	4	13	1561
1997		1895	3	47	1945
1998		1750	3	105	1858
1999			1	211	212
2000	2	1106	2	338	1448
2001	3	1989	1	288	2281
2002	3	1970		230	2203
2003	1	2275	4	171	2451
2004		1965	77	249	2291
2005	3	1662	2	416	2083
2006	2	1400	6	433	1841
2007	4	1605	107	296	2012
2008	1	772	98	187	1058
2009	2	1303	114	54	1473
2010	3	2234	114	101	2452
2011	1	2029	105	108	2243
2012	3	1791	90	110	1994
2013	1	1943	95	55	2094
2014*	1	1572	63	54	1690

Table 19.2 Whiting in Subarea VIII and Division IXa: estimated 2014 landings by country in tonnes

Country	VIIIa	VIIIb	VIIIc	VIIId	VIIIe	IXa	Total
Belgium	0	1	0	0		0	1
France	880	259	0	0		0	1139
Spain	8	46	0	0		0	54
Total	888	306	0	0		0	1194

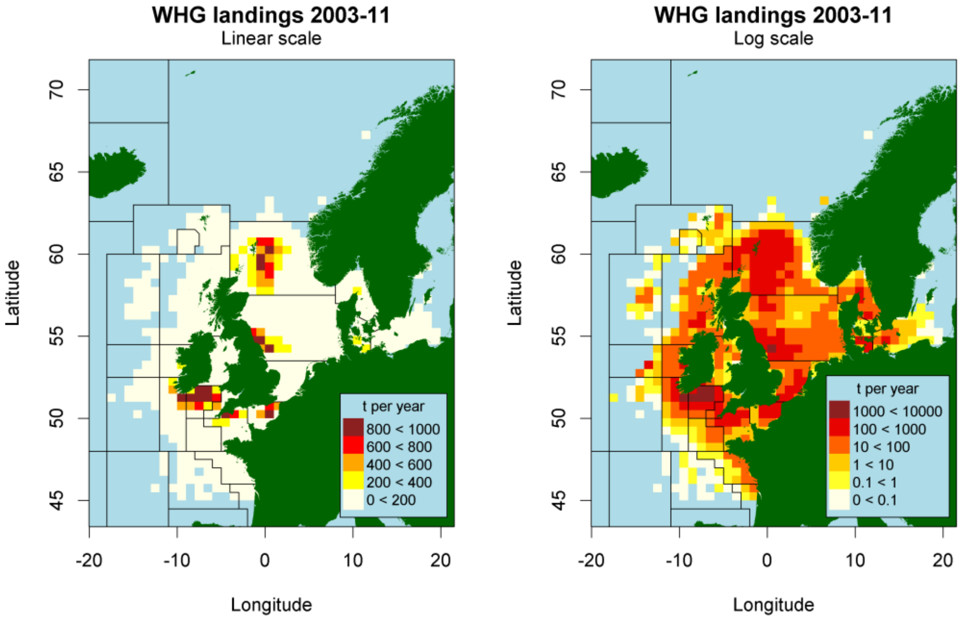


Figure 19.1: International landings of Whiting by statistical rectangle from 2003-2011

Annex 01 – List of participants

Working Group for the Bay of Biscay and the Iberic waters Ecoregion (WGBIE))

4 – 10 May 2015

List of Participants

Name	Address	Phone/Fax	Email
Esther Abad	Instituto Español de Oceanografía. Centro Oceanográfico de Vigo P.O. Box 1552 E-36200 Vigo (Pontevedra) Spain	Phone +34 986 492 111 Fax +34 986 498 626	esther.abad@vi.ieo.es
Ricardo Alpoim	IPMA Avenida de Brasilia PT-1449-006 Lisbon Portugal	Phone +351 21 302 7024 Fax +351 21 301 5948	ralpoim@ipma.pt
Michel Bertignac	IFREMER Brest Laboratoire LBH BP 70 F-29280 Plouzané France	Phone +33 298 224 525 Fax +33 298 224 653	Michel.Bertignac@ifremer.fr
Maria de Fatima Borges	IPMA- Instituto Português do Mar e da Atmosfera Av. Brasilia 1449-006 Lisboa, Portugal	Tel: +351 213027098 Fax +351 213015948	mfborges@ipma.pt
Santiago Cerviño	Instituto Español de Oceanografía Centro Oceanográfico de Vigo P.O. Box 1552 E-36200 Vigo (Pontevedra) Spain	Phone +34 986492111 Fax +34 986498626	santiago.cervino@vi.ieo.es
Anne Cooper	International Council for the Exploration of the Sea (ICES) H.C. Andersens Boulevard 1553 Copenhagen V. Denmark	Tel: +45 3338 6767	anne.cooper@ices.dk
Mickaël Drogou	IFREMER Brest Laboratoire LBH BP 70 F-29280 Plouzané France	Phone +33 298 224 374 Fax +33 298 224 653	Mickael.Drogou@ifremer.fr

Spyros Fifas	IFREMER Brest Laboratoire LBH BP 70 F-29280 Plouzané France	Phone +33 298 224 378 Fax +33 29008547	Spyros.Fifas@ifremer.fr
Joao Figueiredo Pereira	Portuguese Institute for the Sea and the Atmosphere (IPMA) Avenida de Brasilia 1449-006 Lisbon Portugal	Phone +351 213027044 Fax +351 213015948	jpereira@ipma.pt
Dorleta Garcia	AZTI-Tecnalia Sukarrieta Txatxarramendi ugartea z/g E-48395 Sukarrieta (Bizkaia) Spain	Phone +34 946 574 000 Fax +34 946 870 006	dgarcia@azti.es
Ane Iriondo	AZTI-Tecnalia Sukarrieta Txatxarramendi ugartea z/g E-48395 Sukarrieta (Bizkaia) Spain	Phone +34 94 602 94 00 Fax +3494 687 00 06	airiondo@azti.es
Muriel Lissardy	IFREMER LRHA UFR Côte Basque, 1 allée du Parc Montaury 64600 Anglet France	Phone +33 229 008 580 Fax +33 229 008 552	muriel.lissardy@ifremer.fr
Simon Northridge	Scottish Oceans Institute University of St Andrews United Kingdom		spn1@st-andrews.ac.uk
Iñaki Quincoces	AZTI-Tecnalia Sukarrieta Txatxarramendi ugartea z/g E-48395 Sukarrieta (Bizkaia) Spain	Phone +34 667174408 Fax +34 94 6572555	iquincoces@azti.es
Lisa Readdy	Centre for Environment, Fisheries and Aquaculture Science (Cefas) Pakefield Road Lowestoft NR33 0HT United Kingdom	Phone +44 1502 524319	lisa.readdy@cefas.co.uk

Camilo Saavedra	Instituto Español de Oceanografía Centro Oceanográfico de Vigo P.O. Box 1552 E-36200 Vigo (Pontevedra) Spain		camilo.saavedra@vi.ieo.es
Paz Sampedro	Instituto Español de Oceanografía Centro Oceanográfico de A Coruña P.O. Box 130 E-15001 A Coruña Spain	Phone +34 981 205 362	paz.sampedro@co.ieo.es
Cristina Silva	IPMA Avenida de Brasilia PT-1449-006 Lisbon Portugal	Phone +351 213 027096 Fax +351 213 025 948	csilva@ipma.pt
Audric Vigier	IFREMER Brest Laboratoire LBH BP 70 F-29280 Plouzané France		Audric.vigier@ifremer.fr
Yolanda Vila	Instituto Español de Oceanografía Centro Oceanografico de Cádiz Puerto Pesquero, Muelle de Levante s/n E-11071 Cádiz Spain	Phone +34 956 294189	yolanda.vila@cd.ieo.es

Annex 02 – Recommendations

Recommendation	For follow up by:
The EWG notes that hake otoliths are currently collected but not used in the assessment due to lack of a validated ageing method. The EWG considers that ageing data would be important to improve current hake assessment. The EWG also considers that it has no expertise on how this information could be best obtained and, as a consequence, cannot provide recommendation on the sampling level of hake otholiths. The EWG recommends that WGBIOP and WGDATA look at these issues.	ICES Secretariat / ACOM WGBIOP, WGDATA
The EWG notices that several of the new stocks assessed this year have negligible catches and that there are distributed mainly in more northerly areas. This includes the stocks of Plaice (Pleuronectes platessa) in Subarea VIII and Division IXa [ple-89a], whiting [whg-89a]and pollack [pol-89a]. The scientific effort required to provide coverage of these less abundant stocks in the southern area could be more useful if applied to current stocks in the EWG.	ACOM Leadership / WG on Stock Identification
A new index of abundance has been proposed and used for the advice of sea bass in areas VIIIab. A similar index has been estimated for the sea bass stock IVbc, VIIa,d-h. The EWG recommends that the methodology be reviewed and appropriateness for advice evaluated.	WGISDA
For the Iberian waters, several survey indices are used to provide advice for several stocks of WGBIE. The EWG recommends that the combination of those indices into one combined index be assessed.	WGISDA

Annex 03: Term of Reference for 2016

WGBIE– Working Group for the Bay of Biscay and Iberic waters Ecoregion

2016/2/ACOM?? The Working Working Group for the Bay of Biscay and Iberic waters Ecoregion [WGBIE], chaired by ... , will meet in ... , 18–24 May 2016 to:

a) Address generic ToRs for Regional and Species Working Groups (see table below);

b) Assess the progress on the benchmark preparation of [???];

The assessments will be carried out on the basis of the stock annex in National Laboratories, prior to the meeting. The data to perform the assessment should be available 4 weeks before the meeting. This will be coordinated as indicated in the table below.

WGBIE will report by [?? May] for the attention of ACOM. The group will report on the ACOM guidelines on reopening procedure of the advice before 14 October and will report on reopened advice before 29 October.

Annex 04: List of stock annexes

A list of stock annexes will be presented here (including direct hyperlinks) as soon as the work on the stock annexes is finalized.

Annex 05: Benchamark planning

Stock	BSS-8ab	
Stock coordinator	Mickael Drogou	Mickael.drogou@ifremer.fr
Stock assessor	To define	
Data contact	Mickael Drogou	Mickael.drogou@ifremer.fr

Issue	**Problem/Aim**	**Work needed / possible direction of solution**	**Data required. Are these available? Where should they come from?**
Landings data	Historical landings	Landings, fleet, area yearly required from 2000.	Landings from all the involved countries split by fleet, area
Tuning series	Commercial tuning data is available.	Finalise the appropriate commercial tuning series including 2015.	
Survey tuning series	No survey tuning survey		
Discards	Considered as negligible		
Length compositions	French length composition from 2000 are not yet available but should be in 2015-2016	Supply of length and age distributions for landings. This should include sampling intensities.	French length and age distribution per year from 2000 per Ices area

Issue	Problem/Aim	Work needed / possible direction of solution	Data required. Are these available? Where should they come from?
	Spain Length composition would probably not be available	Spanish Landings represents 3% of the total in 8ab. If not available maybe not an issue	
Biological Parameters	No Biological Parameters available in 2015, but some data are currently collected to have some (maturity, growth curve for nthe area)	Use some of the Biological data (Natural mortality) from the WGCSE assesment.	

Stock	Nephrops FU 23-24	
Stock coordinator	Name: Spyros Fifas	Email:Spyros.Fifas@ifremer.fr
Stock assessor	Name: Spyros Fifas	Email: Spyros.Fifas@ifremer.fr
Data contact	Name: Spyros Fifas, Michèle Salaun	Email: Spyros.Fifas@ifremer.fr, Michele.salaun@ifremer.fr

Issue	Problem/Aim	Work needed / possible direction of solution	Data needed to be able to do this: are these available / where should these come from?	External expertise needed at benchmark type of expertise / proposed names
(New) data to be Considered and/or quantified[1]	UWTV survey data for years 2014 and 2015 (planned for July 2015)	Spatially structure models	Data provided from LANGOLF survey (series 2006-2013)+DCF sampling onboard (since 2003)+UWTV survey data (2014-2015)	
Tuning series	Commercial tuning fleet (district of Le Guilvinec 2nd quarter, years 1987-2013)+twin trawl survey LANGOLF (years 1987-2013) not carried out from 2014 onwards	Investigation aiming to include another tuning series corresponding to the Southern part (outside Brittany) of the fishery	Data provided by fishing industry representative	
Discards	DCF sampling plan covering period since 2003+sparse years (1987,1991,1998). For validation of the discard derivation method applied on missing years see IBP Nephrops 2012	Additional investigations have to be undertaken on the actual impact of selectivity devices adopted since 1st April 2008 (not enough data for the moment)	DCF samples since 2003	

[1] Include all issues that you think may be relevant, even if you do not have the specific expertise at hand.If need be, the Secretariat will facilitate finding the necessary expertise to fill in the topic. There may be items in this list that result in 'action points for future work' rather than being implemented in the assessment in one benchmark.

Issue	Problem/Aim	Work needed / possible direction of solution	Data needed to be able to do this: are these available / where should these come from?	External expertise needed at benchmark type of expertise / proposed names
(New) data to be Considered and/or quantified[1]	UWTV survey data for years 2014 and 2015 (planned for July 2015)	Spatially structure models	Data provided from LANGOLF survey (series 2006-2013)+DCF sampling onboard (since 2003)+UWTV survey data (2014-2015)	
Biological Parameters	Validation of discard survival rate either as used by WGHMM (WGBIE) for the whole historical series or as updated by recent experiments (higher value of the survival rate)	Spatial variability of female maturity ogives (GLMs vs. compacity of the sediment, depth, etc.)	Maturity database as filled in since 2004-2005	
Assessment method	The IBP 2012 concluded the inadequancy of the CSA (Collie-Sissenwine analysis) because of unlikely variability of predicted SSB and recruitment indices. The XSA assessment was retained although it should be replaced by alternative approaches (length structured models?) or by UWTV survey (nevertheless, this method limits unibiased investigations only on the adult component of Nephrops stocks)			

Issue	Problem/Aim	Work needed / possible direction of solution	Data needed to be able to do this: are these available / where should these come from?	External expertise needed at benchmark type of expertise / proposed names
(New) data to be Considered and/or quantified[1]	UWTV survey data for years 2014 and 2015 (planned for July 2015)	Spatially structure models	Data provided from LANGOLF survey (series 2006-2013)+DCF sampling onboard (since 2003)+UWTV survey data (2014-2015)	
Biological Reference Points	N/A			

Stock	Nephrops FU 28-29	
Stock coordinator	Name: Cristina Silva	Email: csilva@ipma.pt
Stock assessor	Name: Cristina Silva	Email: csilva@ipma.pt
Data contact	Name: Cristina Silva	Email: csilva@ipma.pt

Issue	Problem/Aim	Work needed / possible direction of solution	Data needed to be able to do this: are these available / where should these come from?	External expertise needed at benchmark type of expertise / proposed names
(New) data to be Considered and/or quantified[2]	Additional M - predator relations			
	Prey relations			
	Ecosystem drivers			
	Other ecosystem parameters that may need to be explored?			
Total Catch	Only landings from Portuguese fleet are available in most of the years -> unaccounted mortality Possible separation by Functional Unit?	Review and estimate total catch and total effort	Historical data from Spanish Fleet in these FUs (landings, logbook data) Spatial data (VMS) Portuguese data available	

[2] Include all issues that you think may be relevant, even if you do not have the specific expertise at hand.If need be, the Secretariat will facilitate finding the necessary expertise to fill in the topic. There may be items in this list that result in 'action points for future work' rather than being implemented in the assessment in one benchmark.

Issue	Problem/Aim	Work needed / possible direction of solution	Data needed to be able to do this: are these available / where should these come from?	External expertise needed at benchmark type of expertise / proposed names
(New) data to be Considered and/or quantified[2]	Additional M - predator relations			
	Prey relations			
	Ecosystem drivers			
	Other ecosystem parameters that may need to be explored?			
Tuning series	Fishery targeting 2 main species of crustaceans, deepwater rose shrimp and Norway lobster, sharing only partly the same grounds. In periods of high abundance of rose shrimp the vessels spend less effort on *Nephrops*. Crustacean trawl survey	Standardized CPUE series for *Nephrops* related to area/depth, other species dependency Estimate abundance/biomass for fishing areas	All data available: Logbooks, VMS data Crustacean survey series	
Discards	Discarding is minimal in this fishery. Not an issue			
Biological Parameters	Growth parameters and natural mortality estimated by tagging in 1990. Attempts to include a joint tagging program for several *Nephrops* FUs in DCF not successful due to high costs.			

Issue	Problem/Aim	Work needed / possible direction of solution	Data needed to be able to do this: are these available / where should these come from?	External expertise needed at benchmark type of expertise / proposed names
(New) data to be Considered and/or quantified[2]	Additional M - predator relations			
	Prey relations			
	Ecosystem drivers			
	Other ecosystem parameters that may need to be explored?			
Assessment method	No analytical assessment approved. XSA, used until 2011, accepted only for trends. The use of standardized CPUE has reduced the residuals in catchability and the retrospective pattern but problems of internal consistency remain (IBP, 2012) ICES DLS approach used since 2013	Explore: Length based assessments with different methods (LCA, SS3, ...) Age based assessments using slicing (for comparison) A number of approaches, including trawl surveys, length composition information, and basic fishery data such as landings and effort.	Data available: Landings (partial – missing Spanish data) CPUE Survey indices Length distribution Maturity Weight-length relationship Spatial distribution	Helen Dobby/Richard Methot/Jim Ianelli

Issue	Problem/Aim	Work needed / possible direction of solution	Data needed to be able to do this: are these available / where should these come from?	External expertise needed at benchmark type of expertise / proposed names
(New) data to be Considered and/or quantified[2]	Additional M - predator relations			
	Prey relations			
	Ecosystem drivers			
	Other ecosystem parameters that may need to be explored?			
Biological Reference Points	No BRPs adopted	BRPs (Y/R) or proxies depending on the assessment approach		
Management issues	Crustacean fishery directed at rose shrimp and Norway lobster. Norway lobster is the 2nd target species, its importance increases in periods of low abundance of rose shrimp. Recovery Plan for Southern Hake and Iberian *Nephrops* stocks since 2006. No objectives defined for *Nephrops* in this plan. 10% reduction in F for Southern Hake resulted in 10% reductions in TAC and effort for *Nephrops* every year.	Understand the fisheries dynamics and the dependence from rose shrimp. Unlink *Nephrops* management from Southern Hake recovery. Set management objectives for *Nephrops*, taking into account the characteristics of the crustacean fishery.		

Issue	Problem/Aim	Work needed / possible direction of solution	Data needed to be able to do this: are these available / where should these come from?	External expertise needed at benchmark type of expertise / proposed names
(New) data to be Considered and/or quantified[2]	Additional M - predator relations			
	Prey relations			
	Ecosystem drivers			
	Other ecosystem parameters that may need to be explored?			

Stock	Nephrops FU 30	
Stock coordinator	Name: Yolanda Vila	Email: yolanda.vila@cd.ieo.es
Stock assessor	Name: Yolanda Vila	Email: yolanda.vila@cd.ieo.es
Data contact	Name: Yolanda Vila	Email: yolanda.vila@cd.ieo.es

Issue	Problem/Aim	Work needed / possible direction of solution	Data needed to be able to do this: are these available / where should these come from?	External expertise needed at benchmark type of expertise / proposed names
(New) data to be Considered and/or quantified[3]	Additional M - predator relations			
	Prey relations			
	Ecosystem drivers			
	Other ecosystem parameters that may need to be explored?			

[3] Include all issues that you think may be relevant, even if you do not have the specific expertise at hand. If need be, the Secretariat will facilitate finding the necessary expertise to fill in the topic. There may be items in this list that result in 'action points for future work' rather than being implemented in the assessment in one benchmark.

Issue	Problem/Aim	Work needed / possible direction of solution	Data needed to be able to do this: are these available / where should these come from?	External expertise needed at benchmark type of expertise / proposed names
(New) data to be Considered and/or quantified[3]	Additional M - predator relations			
	Prey relations			
	Ecosystem drivers			
	Other ecosystem parameters that may need to be explored?			
Tuning series	- *Metier* highly multiespecific. Directed effort estimated from trips with at least 10% *Nephrops* landings. - Trawl survey_ARSA_(SPGF-cspr-WIBTS-Q1) but it is directed to demersal species in general and not to *Nephrops*	- VMS and logbooks analysis.	VMS are available for 2011-2013 periods. For other year it should be supplied by the Spanish Administration (Secretaría General de Pesca, SGP). Logbooks available	
Discards	Discarding is negligible in this fishery. Not an issue			

Issue	Problem/Aim	Work needed / possible direction of solution	Data needed to be able to do this: are these available / where should these come from?	External expertise needed at benchmark type of expertise / proposed names
(New) data to be Considered and/or quantified[3]	Additional M - predator relations			
	Prey relations			
	Ecosystem drivers			
	Other ecosystem parameters that may need to be explored?			
Biological Parameters	There is no information about growth parameters and natural mortality in this FU. Maturity ogives are available from 2004, 2009, 2010 and 2011.		Biological parameters information of others FUs	

Issue	Problem/Aim	Work needed / possible direction of solution	Data needed to be able to do this: are these available / where should these come from?	External expertise needed at benchmark type of expertise / proposed names
(New) data to be Considered and/or quantified[3]	Additional M - predator relations			
	Prey relations			
	Ecosystem drivers			
	Other ecosystem parameters that may need to be explored?			
Assessment method	No analytical assessment	- UWTV survey approach. UWTV exploratory survey was carried out in 2014. However, improvements must be performed in next survey. Annual UWTV will be carried out from 2015.	*Nephrops* UWTV survey will be carried out in June2015 Data available: Landings LPUE Trawl Survey indices Length distributions Maturity Weight-length relationship	Colm Lordan/Jennifer Doyle/Helen Dobby
Biological Reference Points	N/A			

Issue	Problem/Aim	Work needed / possible direction of solution	Data needed to be able to do this: are these available / where should these come from?	External expertise needed at benchmark type of expertise / proposed names
(New) data to be Considered and/or quantified[3]	Additional M - predator relations			
	Prey relations			
	Ecosystem drivers			
	Other ecosystem parameters that may need to be explored?			
Data to be Considered	Identification of other burrowing species associated to the *Nephrops* ground	Analysis of the spatial distribution and abundance in Trawl survey_ARSA_(SPGF-cspr-WIBTS-Q1) -Trawls during UWTV survey	Trawl survey_ARSA__(SPGF-cspr-WIBTS-Q1)information available	

Stock	Ang-78ab	
Stock coordinator	Iñaki Quincoces (L.piscatorius) Lisa Readdy (L.budegassa)	iquincoces@azti.es lisa.readdy@cefas.co.uk
Stock assessor	Iñaki Quincoces (L.piscatorius) Lisa Readdy (L.budegassa)	iquincoces@azti.es lisa.readdy@cefas.co.uk
Data contact	Iñaki Quincoces	iquincoces@azti.es

Issue	Problem/Aim	Work needed / possible direction of solution	Data required. Are these available? Where should they come from?
Landings data	Historic landings	Landings by species, fleet, area, and quarter required prior to 1986.	Landings from all the involved countries split by species, fleet, area, quarter.
Tuning series	limited commercial tuning data is available.	Development of appropriate commercial tuning series for both species.	Raw data from logbooks and the length distributions for that fleet. Data should be available from member states
Survey tuning series	Limited appropriate tuning series for black anglers in 78ab	Development of appropriate tuning series. Review available survey tuning series available for both species.	EVHOE data is available, but there are other surveys that might be informative
Discards	Enforcement of laws about minimum landing weight (0.5 kg) changed the retention ogive and the landings length distribution.	Provision of discard data by species, fleet area and quarter for all years.	Raised discard estimates from all the involved countries by species fleet area quarter.

Issue	Problem/Aim	Work needed / possible direction of solution	Data required. Are these available? Where should they come from?
Length compositions	To model the retention and selectivity patterns of the catch, length compositions are required for both landings and discards for historic and missing years.	Supply of length distributions for discards and historic landings. This should include sampling intesities.	At the very least for discard length frequencies 2009 to present and 2001-2005 to take account of the change in selectivity/retention of the fish below 500g
	Length distribution quality	The length range of the species makes it too difficult to obtain good quality LDs specifically for the larger individuals that usually show a scattered pattern. Increase sampling intensities especially for the larger fish	
Biological Parameters	Split of the landings between species of anglerfish not known for some countries and there is a possibility that for some years this has not been done/sampled correctly due to differences between species proportion among different countries fishing the same grounds.	Have the historical detailed information on methods used by each country. Historically apply the split between species from the best identified method/country/fleet (i.e. the proportions in landings of countries splitting the species due to market reasons…).	Available directly from historic data or from Member States Data submitter to provide an overview on the sampling and raising methodoligy used to split the species PRIOR TO SEPTEMBER
	Sex ratio and maturity of anglerfish from an European project done in 1996-98 with a recent revision of the maturity ogive	Support in the collection of biological data. Development of a simple “on board sampling method” based on: identification of main metiers to be sampled, season of the year, simple visual protocol of maturity stages for identification by industry on board. If fish are processed, the possibility of collecting gonads on board will be assessed with the industry	Maturity data from all the DCF years is needed to assess/update the maturity ogive.

Issue	Problem/Aim	Work needed / possible direction of solution	Data required. Are these available? Where should they come from?
	Growth pattern unknown or poorly known	Research on anglerfishes growth pattern. Could come from tag/recapture experiments, aswell as analysis of length distributions from surveys.	In order to use length based models it's necessary to have a good knowledge of the ageing of the species and growth pattern

Stock	mgw-78	email
Stock coordinator	Ane Iriondo	airiondo@azti.es
Stock assessor	Ane Iriondo	airiondo@azti.es
Data contact	Ane Iriondo	airiondo@azti.es

Issue	**Problem/Aim**	**Work needed / possible direction of solution**	**Data required. Are these available? Where should they come from?**
Discards	Lack of discard data from the French fleets. since 1999.	Discard data from France since available data should be provided. Strengthening of the discards sampling is from 2009 onwards. Before 2009, there is data, but it needs to be quality evaluated before use.	Data seems to be available at IFREMER.
Tuning series	France: No update of LPUEs data series are provided to the group from 2008 onwards.	Provide LPUE data from France for different bottom trawl fleet from 2008 onwards.	IFREMER to provide FU LPUE data series reviewed.

Issue	Problem/Aim	Work needed / possible direction of solution	Data required. Are these available? Where should they come from?
Assessment method	If the new discard data are provided the Bayesian sthatistical catch at age model should be updated and fitted.	SCAA should be reviewed and updated to include new discard data. With the new data, model priors should be fitted. If it is approved by the benchmark, the absolute values could be used as the basis for ICES advice.	
Projections	SSB predicted by the projection program is not consistent with the historical series estimated by the model	A revision of the projection program should be made and its approval by the benchmark is needed to be used as the basis for ICES advice.	
Biological Reference Points	No defined	If new assessment success → they could be calculated using ICES EqSim program.	

Annex 06. List of Working Documents

WD 01 Irish Maturity Ogives 2004-2014

Hans Gerritsen

This document provides maturity-at-age estimates for stocks assessed by the WGCSE and WGBIE. All data are obtained on surveys and commercial sampling carried out by the Marine Institute.

WD-02 Information from the Irish and French IBTS surveys to inform the assessment of monkfish in 78ab

Hans Gerritsen

The French and Irish IBTS surveys appear to have good coverage of most of the distribution of *Lophius* spp. For *L. piscatorius* the first two age classes appear to be fully covered by the depth range of the surveys. It is not clear whether the full adult population is covered as considerably numbers may be present at depths greater than those covered by the surveys. It is possible to track cohorts in the length frequency distribution of both species, allowing growth parameters to be estimated. This, in turn, allows the length distribution to be split into age classes. The resulting numbers-at-age index shows good cohort tracking and internal consistency. If accurate catch or landings length-frequency data can be obtained, it may be possible to apply a similar length splits, using growth parameters estimated from the survey, which would allow an age-based assessment which can make use of the strong contrast between cohorts.

WD-03 IEO scientific estimation of WGBIE stocks landings

José Castro

The methodology used to estimate Spanish landings had to be updated when processing the 2013 fisheries data due to changes in the quality and availability of fisheries statistics. WGBIE discussed and accepted this new methodology but requested a review of data from the previous two years (2011-2012) in order to facilitate comparison between both approaches. The 2013 data submitted last year were obtained with a preliminary version of the new methodology and therefore new landings estimations for the period 2011-2013 have been uploaded this year to InterCatch for northern and southern stocks of hake, anglerfishes and megrims. This working document describes both methodologies and provides an interpretation of their respective results.

WD-04 Review of the Spanish commercial tuning indices used in the assessment of the southern stocks of hake and anglerfish, and FU25 of Norway lobster

J. Castro and R. Morlán

The largest Spanish commercial tuning indices in Atlantic Iberian waters are based on the bottom otter trawl fleet that operates from the port of A Coruña (Galicia, Spain). They are used by ICES in the assessment of a variety of Iberian demersal stocks, such as hake, anglerfish, megrims and Norway lobsters. However, the adaptation of scientific data bases to the recent update of raw fisheries statistics has caused irregularities in the submission of these tuning indices in the last five years. This paper provides the A Coruña commercial tuning indices for the southern stocks of hake, white anglerfish and black anglerfish, as well as Functional Unit 25 (West Galicia) of Norway lobster for 2009-2014.

WD-05 Improved time-series of Hake catches per unit of effort for the Portugueses OTB fishery

João Pereira and Bernardo Alcoforado

During the 2010 benchmark, a new approach to the definition of a standardised hake CPUE time-series was proposed by Cardador and Jardim for the Portuguese commercial trawl fleet (as part of a Working Document). This methodology was defended and eventually approved to become part of the stock annex for the assessment of the species. It involved the analysis of vessel activity logs relating to individual vessel catches in weight by species, made within particular ICES rectangles over a specific number of hauls of a set duration. To this the main characteristics of each vessel (power, gross registered tonnage, length overall and type of license) were added in order to better characterise the catchability of fleet segments. The approved methodology was followed to produce a time-series used in the 2010 assessment with data up to 2009.Thereafter, several constraints made it impossible to update the series, which was nonetheless kept in the model. One of the main constraints was the introduction of a different data recording methodology used by the Fisheries Directorate General in Portugal, which relates to the gradual replacement of paper-based by electronic logbooks.In 2014, after the near complete implementation of electronic logbooks, a whole new time-series was reconstructed, which was then processed following the bechmark agreed methodology in order to obtain a new cpue time-series.

WD-06 Langolf survey carried out from 2006 to 2014

Spyros Fifas et Michele Salaun

The WD (powerpoint presentation) summarise the results of the Langolf survey carried out in the Bay of Biscay from 2006 to 2014.

WD-07 UWTV survey trial carried out on the *Nephrops* stocks of the Bay of Biscay

Spyros Fifas et Michele Salaun

The WD (powerpoint presentation) presents an exploratory *Nephrops* UWTV survey carried out in 2014 in the Bay of Biscay.

WD-08 Estimation geostatistique de l'abondance de langoustine du Golfe de Gascogne par campagne de video sous-marine

Mathieu Woillez, Spyros Fifas et Michele Salaun

The WD (powerpoint presentation) presents a geostastistical analysis of the LANGOLF-TV carried out in the Bay od Biscay in 2014 to map and estimate the abundance of the Nephrops stock.

WD-09 Improving stock assessment and managing bycatch rates using a multispecies approach. A case of study of the European Hake, Common and Bottlenose dolphins in Atlantic waters of the Iberian Peninsula

Camilo Saavedra, Santiago Cerviño and Simon Nothridge

Single-species models have been widely used to assess fish stocks; however, multispecies models offer a number of advantages over single-species models as a better appreciation of the fishing on ecosystem structure and function, and of the need to consider the value of marine ecosystems for functions other than harvesting fish. The EU fishing policy demands that fisheries management moves toward an ecosystem approach, and ICES is seeking ways to ensure more integrated ways to present advice. In this working document a multispecies model is presented. Two species of cetaceans (Common and Bottlenose dolphins) were joined to the current Gadget model used for the assessment of the Southern European Hake. Dolphins act as predators of hake, since high consumption of hake and strong trophic interactions between these species were noted in previous studies. In this document we described the available data that were used to construct the model and the lack of good information to estimate some parameters were discussed. Special attention was placed on the estimation of the natural and bycatch mortality from strandings, trends in the abundance and proportions of prey consumed. Moreover, the possibility of assessing fisheries and marine mammals simultaneously was discussed. Cetacean bycatch mortality is fleet dependent and partial effort levels can be linked with a potential bycatch rate. Bycatch rates provided by observers on board are the best way to obtain accurate bycatch estimates of the fleet. However, since those are not currently available, our model might also provide a way to explore the feasibility of considering impacts of fishing on non-target species.

WD-10 Nephrops (FU 30) UWTV Exploratory Survey on the Gulf of Cadiz Grounds

Yolanda Vila, , Burgos, C., Sobrino, I., Soriano, M., Barragán, C., Rueda, J.L., Gallardo, M., Farias, C. , Canoura, J. and Gil, J.

The WD presents an exploratory Nephrops UWTV survey carried out in 2014 on the Gulf of Cadiz fishing grounds by the Spanish Oceanographic Institute (IEO) within the framework of a project supported by Fundación Biodiversidad (Agricultura, Alimentación y Medio Ambiente Ministry) and European Fisheries Funds (EFF). The survey was designed from a multidisciplinary approach and the main objectives of the survey were: To set up the equipment and the UWTV survey methodology in the Gulf of Cadiz, obtain estimates of Nephrops burrows densities from a randomized isometric grid of UWTV stations spacing 5 nautical miles, obtain density estimates of macro benthos species and the occurrence of trawl marks on the sea bed, to collect sediment samples using a meso Box-Corer, to collect oceanographic data using a sledge mounted CTD

WD-11 Stock definition of plaice and sole in 7hjk (WGCSE) and 89a (WGBIE)

Hans Gerritsen

Plaice and sole in 7hjk and 89a are generally caught on distinct patches of sandy ground. It is not known how much exchange of eggs/larvae/fish there is between these patches. With the exception of sol-89a the landings are minor and result from bycatches in a mixed fishery. For these species areas 7hjk and 89a are at the edge of their distribution and their abundance in these areas is very low compared to their main distribution area.

WD 12 French Logbook data analysis 2000-2013: possible contribution to the discussion of the sea bass stock(s) structure/annual abundance indices.

Alain Laurec and Mickael Drogou

Daily catch rates per vessel, grouped within months and ICES rectagles, have been analysed basically through a multiplicative two factors model in order to estimate fishing powers and apparent abundances time series of sea bass within ICES rectangles. The abundance times series could potentially be used as an index of abundance for the stock assessment of sea bass.