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

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Contents

Executive Summary

The ICES Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim (WGHMM) met in ICES Headquarters during May 5-11 2011. There are 19 stocks in its remit, distributed from ICES Division IIIa to IXa: 2 stocks of hake (Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d and Hake in Divisions VIIIc and IXa), 4 of anglerfish (*Lophius piscatorius* and *L. budegassa* in Divisions VIIb-k and VIIIa,b,d and *L. piscatorius* and *L. budegassa* in Divisions VIIIc and IXa), 3 of megrim (*Lepidorhombus whiffiagonis* in Divisions VIIb-k and VIIIa,b,d and *Lepidorhombus boscii* and *L. Whiffiagonis* in Divisions VIIIc and IXa), 1 of sole (Sole in Divisions VIIIa,b - Bay of Biscay), 2 functional units of *Nephrops* in Divisions VIIIa,b, 2 in Division VIIIc and 5 in Division IXa. There were 18 participants (of which 1 participated part-time and 1 by correspondence) from 5 countries (France, Ireland, Portugal, Spain and UK). The meeting was chaired by Carmen Fernández (Spain).

The meeting was tasked with carrying out stock assessments and providing catch forecasts and a first draft of ICES advice for 2012 for all stocks excepting the *Nephrops* FUs. For *Nephrops*, catch and abundance indices information was updated. Analytical assessments using age-structured models were conducted for the southern stocks of megrim and the Bay of Biscay sole, whereas the two hake stocks 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 southern stocks of anglerfish. No analytical assessments have been provided for the northern stocks of anglerfish or megrim after 2006. For anglerfish 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. For megrim, there have been severe deficiencies in the input data, of which several still remain. 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. This year, the northern megrim and anglerfish stocks were scheduled for the "Same Advice as Last Year".

All 4 anglerfish stocks and the northern megrim stock are scheduled for benchmark assessments at the start of 2012, whereas *Nephrops* FUs 23-24 and *Nephrops* FUs 28-29 are scheduled for Inter-benchmark protocols at the same time. The WGHMM meeting also spent considerable time planning these benchmarks.

Section 1 of the report presents a summary by stock and discusses general issues. Section 2 provides descriptions of relevant fishing fleets and surveys, whereas Sections 3 to 12 contain the single stock assessments. Section 13 groups references. Several annexes follow. Titles and abstracts of Working Documents presented to the meeting are in Annex B. Planning of preparatory work for future benchmarks is presented in Annex N. WGHMM recommendations are in Annex O and main data problems requiring action in Annex P. Additionally, the WG ToRs this year included collating data for 4 new species in the Bay of Biscay and Iberian waters (see Annex R) and generic ToRs concerning the Marine Strategy Framework Directive and Coastal and Marine Spatial Planning (Annex S). Annex T presents and discusses InterCatch use.

1 Introduction

1.1 Terms of Reference

2010/2/ACOM11 The **Working Group on Hake, Monk and Megrim** (WGHMM), chaired by Carmen Fernández, Spain, will meet at ICES Headquarters, 5–11 May 2011 to:

a) Address generic ToRs for Fish Stock Assessment Working Groups (see table below).

b) Assess the progress on the benchmark preparation of *Nephrops* FU 23–24, and FU28-29 anglerfish (*Lophius budegassa* and *L. piscatorius*) in Divisions VIIIc and IXa , anglerfish and megrim in VII and VIII,

c) Draft advice for stocks under "same advice as last year", whenever new MSY $B_{trigger}$ points turns last year advice innapropriate.

The assessments will be carried out on the basis of the stock annex in National Laboratories, prior to the meeting. This will be coordinated as indicated in the table below.

WGHMM will report by 18 May 2011 for the attention of ACOM.

Fish Stock	Stock Name	Stocks Coordinator	Assess. Coord. 1	Assess. Coord. 2	Perform assessment	Advice
ang-78ab	Anglerfish (*Lophius budegassa* and *L. piscatorius*) in Divisions VIIb-k and VIIIa,b	Spain/France	Spain/France	France/Spain	Y	SALY
anp-8c9a	Anglerfish (*Lophius. piscatorius*) in Divisions VIIIc and IXa	Spain/Portugal	Spain/Portugal	Portugal/Spain	Y	Advice
anb-8c9a	Anglerfish (*Lophius budegassa*) in Divisions VIIIc and IXa	Spain/Portugal	Spain/Portugal	Portugal/Spain	Y	Advice
hke-nrtn	Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock);	France	France	Spain	Y	Advice
hke-soth	Hake in Division VIIIc and IXa (Southern stock);	Spain	Spain	Portugal	Y	Advice

Fish Stock	Stock Name	Stocks Coordinator	Assess. Coord. 1	Assess. Coord. 2	Perform assessment	Advice
mgw-78	Megrim (*L. whiffiagonis*) in Subarea VII & Divisions VIIIa,b,d,e	Spain	Spain		Y	SALY
mgb-8c9a	Megrim (*Lepidorhombus boscii*) in Divisions VIIIc and IXa	Spain	Spain		Y	Advice
mgw-8c9a	Megrim (*Lepidorhombus whiffiagonis*) in Divisions VIIIc and IXa	Spain	Spain		Y	Advice
sol-bisc	Bay of Biscay sole	France	France		Y	Advice
nep-8ab	*Nephrops* in Divisions VIIIa,b (Bay of Biscay, FU 23, 24)	France	France		N	SALY
nep-8c	*Nephrops* in Division VIIIc (FU 25, 31)	Spain	Spain		N	SALY
nep-9a	*Nephrops* in Division IXa (FU 26-30)	Spain/Portugal	Spain/Portugal	Portugal/Spain	N	SALY
ple-89a	Plaice in the bay of Biscay and Iberian coast					Collate data
Pol-89a	Pollack in the Bay of Biscay and Iberian coast					Collate data
sol-8c9a	Sole in the Iberian coast					Collate data
whg-89a	Whiting in the Bay of Biscay and Iberian coast					Collate data

1.2 Summary by Stock

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

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. Spain accounts 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 73 100 t in 2010, which is well above the 2010 TAC (55 105 t). The biggest increases in landings took place in 2009 and 2010, each year representing an approximate 25% increase with respect to landings in the preceding year.

The Northern hake emergency plan (EC 1162/2001, EC 2602/2001 and EC 494/2002) was followed by a recovery plan in 2004 (EC 811/2004). The recovery plan aims at achieving a spawning stock biomass (SSB) of 140 000 t (B_{pa}). This is to be achieved by limiting fishing mortality to F=0.25 (F_{pa}) and by allowing a maximum change in TAC between consecutive years of 15%. ICES advised in 2008 that the northern hake stock had met the SSB target in the recovery plan for two consecutive years (2006 and 2007). The recovery plan indicates that, in such a situation, a long-term management plan should be implemented. Such a plan is currently under development by the EC.

This stock had a benchmark assessment in February 2010 (WKROUND, ICES 2010a), where main issues tackled were the fact that growth of this species is faster than previously assumed and that ages have been overestimated in the past. As no new ageing criterion has been developed, WKROUND replaced the previous age-based assessment model (XSA) with a new one (Stock Synthesis) which permits the use of only length data and has the capability to estimate fish growth together with population dynamics and exploitation levels. Discards have also been incorporated in the new assessment, with landings and discards data entered at "fleet" level and quarterly. The benchmark assessment started in 1990, the year up to which data at this finer level of disaggregation have been recovered. Only abundance indices from research surveys (*i.e.* no commercial CPUEs) have been used for tuning.

In 2010, WGHMM updated the northern hake assessment in the Autumn, due to the unavailability of 2009 French landings data before that time. The updated assessment indicated overall increasing and decreasing trends for SSB and F, respectively, since the late 1990s. However, the reduced length of the assessed period (from year 1990) and the fact that no large fish are present in the commercial catches or survey abundance indices during this period, made the assessment uncertain, particularly in the most recent years. The WG in 2010 was of the view that, whereas the overall trends estimated by the assessment were representative of stock development, the actual rates of increase and decrease of SSB and F in the most recent years were very uncertain. Short term projections using recent F values showed SSB increases that seemed unrealistic. As a consequence of these uncertainties, the WG in 2010 accepted the assessment only as indicative of stock trends and did not present short term projections.

For the 2011 WG it was possible to recover commercial data (landings and length frequency distributions) by fleet for years 1978-1989, albeit on an annual rather than a quarterly basis. This allowed extending the assessment period back to 1978, as was the case with the previous XSA assessment. The incorporation of these earlier years has improved the model's ability to determine the degree to which levels of fishing reduced hake abundance during the mid 80s and the 90s and, thus, provides a clearer perspective of the historical stock development. While recent rates of F decrease and SSB increase remain important, recent F and SSB estimates are consistent with values estimated at the end of the 70s. The sharp increase in SSB in recent years is the direct consequence of a series of good recruitments in 2006-2008 and the high growth rate estimated by the assessment model (consistent with estimates from tagging data). Estimated SSB trends are also consistent with increasing landings and increasing CPUEs from commercial fleets and current SSB estimates are in line with the short-term projections that were deemed to be unrealistic in 2010. The retrospective analysis shows that assessment results are not overly sensitive to the exclusion of recent data. As a consequence, the WG decided to accept the assessment this year as a full analytical assessment and used it as a basis to provide short-term projections and catch forecasts.

The WG considers that appropriate standardisation of a CPUE series from a fleet catching large individuals (*e.g.* a long-line fishery) would help to improve the assessment, reducing uncertainty in SSB estimates.

The previous biological reference points are not applicable in the context of the new assessment. In 2010, the WG proposed an F_{MSY} proxy based on the benchmark assessment and the same value was kept by the WG this year. If the present northern hake assessment becomes an established analytical assessment, further work on reference points should be conducted in the near future.

Details about the assessment of this stock are provided in Section 3 and Annex C.

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. Landings in 2010 were estimated to be 15 700 t, well above the TAC (9 300 t). Total stock catch, including discards, was estimated to be 17 300 t. It is worth mentioning that Spanish national legislation introduced in the second semester of 2010 strongly reduced Spanish landings during the second semester and similar legislation remains in place for the whole of 2011.

A Recovery Plan for southern hake and Iberian *Nephrops* was enacted in 2006 (EC 2166/2005). This plan aims to rebuild the stock to within safe biological limits, corresponding to 35 000 t of SSB (B_{pa}), driving fishing mortality to 0.27. A fishing mortality rate reduction of 10% should be applied every year, with a constraint of 15% maximum change in TAC between any two consecutive years. The regulation also includes effort management measures. The plan is in the process of being revised jointly by STECF/ICES and developing towards F_{MSY} targets, with the possible inclusion of anglerfish stocks. This is, however, work under development and no new plan has yet emerged.

The southern hake stock had a benchmark assessment in February 2010 (WKROUND, ICES 2010a). As for northern hake, growth and age reading were main issues and WKROUND replaced the previous age-based assessment model (Bayesian statistical catch-at-age) with a new one (GADGET) which permits the use of only length data and can estimate fish growth together with population dynamics and exploitation levels. Discards and the Gulf of Cádiz area were incorporated in the benchmark assessment.

For SSB, the current assessment indicates a strong decreasing trend from the mid 1980s until the late 1990s, when the historic minimum is reached. After that, SSB shows a general increasing trend, accelerating in recent years, and reaches 18 700 t in 2010. Recruitment has been increasing strongly after 2004 with the largest estimate corresponding to year 2010, but this value needs to be confirmed in future assessments (the WG this year replaced this estimate by the geometric mean of recruitment estimates over years 1989-2009). F shows relatively stable values for about one decade until 2009, with a sudden drop in 2010. This is suspected to be a consequence of the reduction in Spanish landings due to the national legislation mentioned above.

The previous biological reference points are not applicable in the context of the assessment conducted in the 2010 benchmark. In 2010, WGHMM proposed an F_{MSY} proxy based on the benchmark assessment and the same value was kept by the WG this year.

Details on the assessment of this stock are in Section 7 and Annex G.

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*. The 2010 TAC for both species combined is 41 400 t and estimated landings 29 700 t. However, the 2009 and 2010 French landings must be considered as preliminary and may well be revised. Spain and France together contribute about 80% of total stock landings.

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 between them the whole distribution area of the stocks and with little overlap between them.

For *L. piscatorius* the available data indicate that biomass has been increasing as a consequence of very high recruitments in 2001, 2002 and 2004 and has stabilised in recent years (although with some decrease according to the French survey in the last 2 years). There is evidence of good recruitments in 2008-2010.

For *L. budegassa* survey data indicate that biomass and abundance in numbers have been continuously increasing from the mid to late 2000s, due to a sequence of strong recruitments during 2004-2008. Recruitment in 2009 appears to be low but with an improvement in 2010.

Measures should be taken to ensure good survival of recent recruitments. For both anglerfish species, data from surveys tracking recent good recruitment give scope for growth studies that should be initiated as soon as possible.

More details on the anglerfish assessment can be found in Section 4 and Annex D. A benchmark assessment is scheduled for the start of 2012, with preparation details presented in Annex N.

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 2010 were 2 355 t, 57% above the TAC of 1 496 t, which is set for both species combined.

A benchmark assessment was carried out in 2007 for these stocks. Age determination problems prevent the application of an age-structured model. The two species are assessed separately, using a surplus-production model (software ASPIC), tuned with commercial LPUE series in both cases, although the series are different for the two species.

Biomass of *L. piscatorius* has decreased during the 1980s and early 1990s, and has since remained stable at low levels, well below B_{MSY}, although with a slightly increasing trend in the last 4 years. F has been above F_{MSY} during the whole time series, except in years 2001, 2002 and 2010. F has been decreasing for five consecutive years now and is estimated to be 15% below F_{MSY} in 2010. Fishing mortality equal to 0 from 2012 onwards is expected to bring the stock to B_{MSY} in 2015 and if fishing mortality continued at the 2010 level the stock would be expected to reach B_{MSY} approximately in 2020.

Fishing mortality of *L. budegassa* was around F_{MSY} in the early 1980s, subsequently increasing to much higher levels. F has been decreasing strongly since year 2000 and is below F_{MSY} in 2009 and 2010. Biomass was close to B_{MSY} until the mid-late 1980s, then decreasing strongly during the period of higher fishing mortality. In parallel with the reduction in F in recent years, biomass shows an upwards trend since 2003, being below but close to B_{MSY} in 2011. If F during 2011 remains the same as in 2010, the stock biomass is expected to be above B_{MSY} in 2012.

Although the stocks are assessed separately, they are managed together. The differences in their current status make it difficult to give common advice.

More details are provided in Section 8 and Annex H. A benchmark assessment is scheduled for the start of 2012, with preparation details presented in Annex N.

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 2010 TAC is 20 425 t. Landings in 2008 (11 282 t) corresponded to the minimum of the historical series but have increased to approximately average levels in 2010 (14 942 t landed in 2010). French landings data for 2009 and 2010 must be considered as preliminary and may well be revised. Discarding of smaller megrim is substantial and also includes individuals above the minimum landing size of 20 cm. The discards estimate for 2010, 4 297 t, is among the highest in the historical series

The stock was assessed with XSA until 2006, but severe deficiencies in the input data made it impossible to continue conducting an analytical assessment. There was some improvement of the data situation in 2009, although a number of important issues remained to be resolved (see Annex P, concerning stock data problems). The present assessment is based on examining commercial CPUE and survey series.

The surveys and commercial CPUE values available for 2010 generally indicate a biomass increase with respect to 2008, although the Irish survey shows substantial variability in abundance between years. None of the data examined appear to indicate the presence of a strong incoming recruitment. In view of the available data, the WG concluded that the stock appears to be stable at the present level of fishing. The group states strongly the importance of incorporating annual estimates of discards in the assessment, which requires receiving discards estimates corresponding to all major contributors to stock catches.

Details of the available data and analysis carried out during the WG are provided in Section 5 and Annex E. See also Annex P for details on stock data problems, of particular relevance for this stock. A benchmark assessment is scheduled for the start of 2012, with preparation details presented in Annex N.

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 2010 were 1 380 t (of which 94% correspond to *L. boscii*), above the TAC of 1 287 t, which is set for both species combined.

The species are assessed separately, using XSA for each of them. Update assessments were conducted this year. For *L. whiffiagonis*, a survey and two commercial LPUE series (one of which ended in 2003) are used for tuning the XSA. For *L. boscii*, the same survey and one of the commercial LPUE series (although stopped in 1999) are used for tuning.

For *L. whiffiagonis* the assessment indicates that SSB has been at lower levels since 1991, with a slow but gradually declining trend since 1997. The lowest SSB estimates correspond to years 2004-2010, although a substantial increase is estimated for the start of 2011. Recruitment (at age 1) has been continuously at low levels for about one decade, with the 2009 estimate being the lowest in the entire time series. However, the 2010 recruitment estimate is much higher, similar to the values estimated for the late 1990s. F has been variable over time, although with generally lower values after the mid 1990s. F in 2010 has decreased for the fourth consecutive year, reaching the lowest value in the entire series (0.08).

For *L. boscii* the assessment indicates that SSB decreased substantially between 1988 and 2001, with a slight increasing trend from that year until 2008 and a slight decrease in 2009. SSB is estimated to have again increased slightly in both 2010 and 2011. F has fluctuated through time, but values since the mid 1990s are lower than those estimated for earlier years. Both high and low recruitments are seen throughout the whole time series.

There are no biological reference points defined for these stocks. The WG proposed F_{MSY} values in 2010, which were maintained this year.

The differences in SSB, recruitment and F trends in the last years make it difficult to give combined advice for the two stocks. Mixed fishery considerations should be taken into account when providing management advice.

Details of the assessments are presented in Section 9 and Annex I.

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). Landings in 2010 were 3 966 t, whereas the TAC was 4 829 t.

In 2006 a multiannual plan for the sustainable exploitation of the stock of sole in the Bay of Biscay (EC regulation 388/2006) was established, which set the objective of bringing SSB above 13 000 t (B_{pa}) in 2008. This was to be attained by gradually reducing the fishing mortality rate (10 % annual reduction), while constraining the TAC change to a maximum of 15% between consecutive years. ICES advised in 2009 that the SSB target had been met in 2008. According to the plan, the Council should therefore decide on a long-term fishing mortality target and a rate of reduction to be applied in order to reach it. This has not yet happened although work is currently under development jointly by STECF and ICES.

A benchmark for this stock took place at the start of 2011, in the ICES workshop WKFLAT (ICES, 2011b). The assessment approved at the benchmark is based on XSA, as was the previous assessment. The benchmark decided to exclude the tuning series corresponding to the RESSGASC survey, as this survey was last conducted in 2002 and was no longer contributing to final population estimates. At the benchmark, two additional CPUE series from commercial fleets were incorporated for tuning. The main reason for this decision was that the two commercial series previously used for tuning (composed of appropriately chosen groups of trawlers from the ports of La Rochelle and Les Sables d'Olonne) were displaying less and less effort and it was clear that they might soon no longer be representative of stock abundance. This was considered to be the case already in this year's assessment. Hence, the assessment conducted by the WG this year is an update of the assessment approved at the benchmark, but without the inclusion of the 2010 tuning data from La Rochelle and Les Sables fleets. Discards are considered to be low for the ages included in the assessment, which starts at age 2. At present, no recruitment indices are available for tuning the assessment, although a survey which started in 2007 (ORHAGO) should be useful in the near future and the benchmark workshop recommended its inclusion as soon as possible.

The benchmark kept the previous reference points, so B_{pa} remains at 13 000 t. However, as a consequence of the changes introduced at the benchmark, the time series of SSB estimates was revised upwards during the 1980s and slightly downwards for recent years, with the consequence that SSB is now estimated to be a bit below B_{pa} during the 1999-2010 period, although just above it in 2011. F has been at lower levels since 2003, at around F_{pa} (0.42). It is estimated to be below F_{pa} in 2009 and 2010. The XSA recruitment estimate in the terminal year is very uncertain and was, as usual, overwritten by a short GM series from 1993 to the antepenultimate assessment year.

An F_{MSY} value was proposed for this stock by WGHMM in 2010 and kept this year.

Details on the assessment are in Section 6 and Annex F of the report.

Nephrops in ICES Division VIIIa,b

There are two Functional Units in ICES Division VIIIa,b: FU 23 (Bay of Biscay North) and FU 24 (Bay of Biscay South), 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. There has been a decline again in recent years, with landings in 2008 and 2009 corresponding to the lowest recorded values, at around 3 000 t. Landings in 2010 were 3 400 t whereas the TAC 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. Discards are estimated to have decreased every year after 2006. Considerable effort has been put in the development of a probabilistic method to fill in the many gaps in the series of discards estimates, and the Inter-benchmark protocol planned for this stock for the start of 2012 has the aim of incorporating this methodology in the assessment (see planning details in Annex N).

The stock was assessed in 2010 using XSA, although the results were considered only indicative of stock trends. ICES concluded that SSB and F have been relative stable over most of the assessment period and advised on the basis of a transition to an MSY approach to reduce landings in 2011 and 2012 with respect to recent levels. This year, no assessment has been carried out and only an update of data has been done.

Details can be found in Section 10 and Annex J.

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 is caught in the mixed bottom trawl fishery in the North and Northwest Iberian Atlantic. The fishery takes place throughout the year, with the highest landings in Spring and Summer. At present, the trawl fleet comprises three main components: baca bottom trawl, high vertical opening trawl (HVO) and bottom pair trawl, of which only the baca trawl catches *Nephrops*. Landings in 2010 from the two FUs combined were 43 t, well below the TAC of 101 t, which is set for the whole of Division VIIIc.

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 25 (North Galicia): Landings were reported only by Spain. Since the early 1990s landings declined from about 400 t to less than 50 t. Landings in 2008-2010 are the three lowest recorded values. The LPUE from the main commercial fleet shows an overall declining trend, with some fluctuations and reaching its three lowest values in 2008-2010.

FU 31 (Cantabrian Sea): Landings reported by Spain (the only participant in the fishery) are available for the period 1983-2010. The highest landings were recorded in 1989 and 1990. After 1996 landings have declined sharply from 129 t to less than 20 t in recent years, with only 6 and 8.5 t landed in 2009 and 2010, respectively. The LPUE data available show an increase in 2010, but this does not change the perception that the stock is at a very low abundance level.

Both FUs were assessed in 2010, with the conclusion that they were at very low abundance levels and ICES advised zero catch for 2011 and 2012. No assessments have been conducted this year.

Additional details are provided in Section 11 and Annex K of the report.

***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 2010 from the five FUs combined were 250 t, below the TAC of 337 t, set for the whole of Division IXa.

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. During 1975-1989 landings fluctuated between 600 and 800 t, with a strong downward trend starting from 1990. After 2004, landings have been below 50 t every year. Only 19 t were landed in 2010.

The stock was assessed in 2010, with the conclusion that it continued to be at a very low abundance level. No assessment has been conducted this year.

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.

Until 1992 landings fluctuated around 480 t, subsequently falling drastically until 132 t in 1996. After that, landings increased again substantially until 2004, at which point a new decreasing trend started. Landings were 124 t in 2010, the second lowest value in the series.

In 2010, an assessment was carried out, using XSA separately for males and females. The assessment was accepted for trends only. ICES concluded that the stock trend is stable and the exploitation status unknown. Hence, according to a transition to an MSY approach it advised to reduce catch from recent levels. No assessment has been conducted this year.

Considerable effort has been devoted to obtaining an appropriately standardised LPUE index from the crustacean trawl fleet, which takes into account the mixed nature of the fishery and the shifts between different target species. An Inter-benchmark protocol is planned for this stock for the start of 2012 with the aim of incorporating this methodology in the assessment (see planning details in Annex N).

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 fluctuated around 100 t until year 2000, subsequently increasing to much higher levels (over 200 t). They have been decreasing again since 2006, with a big drop in 2008. Landings in 2010 were only 107 t, the lowest value for over a decade. Estimated directed effort at *Nephrops* has decreased substantially since 2005. This could be a consequence of several effort regulation measures established in very recent years and other factors such as bad weather conditions and an industry strike in 2008. Landings of rose shrimp increased in 2008, indicating a possible change in the objectives of the fishery.

The stock was assessed in 2010 via examination of directed LPUE and survey trends. The LPUE series shows an overall declining trend and ICES advised on the basis of a transition to an MSY approach to reduce landings from recent levels at a rate greater than the rate of stock decrease. No assessment was conducted this year.

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. Fine scale management of catches and effort at a geographic scale corresponding to the actual stocks would be more appropriate.

Additional details can be found in Section 12 and Annex L.

1.3 Data available

As in previous years, data for 2011 were prepared in advance of the meeting and all revisions to data are referred to in the appropriate stock sections. Data deficiencies have compromised the assessments conducted for some stocks. The main data problems detected by the Working Group and for which action is required are described in the “Data Problems” table included in Annex P of the WG report. Annex P also includes a second table, indicating how PGCCDBS and the North Atlantic Regional Coordination Meeting answered to the issues raised in the “Data Problems” table filled by this WG last year and what (if any) subsequent action has followed.

In many cases, national statistics for recent years are either not currently available officially or are of a preliminary nature. As a consequence, the official landings (http://www.ices.dk/fish/statlant.asp) provided to ICES by statistical offices are of limited relevance for the assessments.

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 1.3.

1.4 Issues that arose during the WGHMM meeting

1.4.1 Fmsy and Btrigger reference points

In 2010, the WG was requested to establish reference points F_{MSY} and $B_{MSY\text{-trigger}}$, for application of the MSY-based approach to advice by ICES. This was done following the guidelines provided in the WKFRAME (ICES 2010b) report. Proposals for F_{MSY} were made by WGHMM last year for all stocks with analytical assessments. The WG considered the issue again this year, on a stock-by-stock basis, and saw no reason to change the F_{MSY} values that were proposed last year. The only exception to this were the southern anglerfish stocks, which are assessed using the production model ASPIC, which produces an F_{MSY} estimate in each new assessment. As F estimates from the ASPIC model are better interpreted relative to F_{MSY} instead of in an absolute sense, the WG considered appropriate to revise the F_{MSY} values for these stocks in accordance with this year's estimates from the ASPIC model. The WG highlights that F_{MSY} values for all stocks may well be revised as further work on their assessments and appropriate reference points is developed. This is particularly the case for the stocks that will have a benchmark in the near future.

No progress was made this year towards defining $B_{MSY\text{-}trigger}$ for any stock. There is only one stock in the WG (Bay of Biscay sole) for which B_{pa} is currently defined and $B_{MSY\text{-}trigger}$ is taken to be equal to B_{pa} for this stock. The WG discussed extensively the possibility of establishing $B_{MSY\text{-}trigger}$ values for the southern anglerfish stocks, currently assessed with ASPIC, but the problems detected in the current assessment fits combined with the fact that these stocks will be benchmarked at the start of 2012 made the WG decide against trying to establish $B_{MSY\text{-}trigger}$ values for them. The northern hake assessment was accepted as an analytical assessment by the WG this year, whereas it had only been taken as indicative of stock trends last year. If this year's assessment is also considered acceptable as an analytical assessment by the Review Group and, finally, by ACOM, it will make sense to develop further work on biological reference points for this stock, to be presented at WGHMM 2011.

Bayesian assessment models than can handle incomplete time series of discards are currently being developed for the assessment of the southern megrim stocks. When that work is completed (expected within 1 year), it will make sense to review the F_{MSY} values currently established for them and to consider $B_{MSY\text{-}trigger}$ possibilities. Because of the progress already shown with the new models (presented as WD6 in this year's meeting), this WG recommends that the southern megrim stocks be preliminarily scheduled for a benchmark in 2013.

1.4.2 Use of InterCatch by WGHMM

No progress has been made by the group with regards to the use of InterCatch after last year. As requested, the WG stock coordinators have filled a table indicating whether or not InterCatch has been used for their stocks and the reasons for not using it. This table is incorporated in Annex T of the report, which also includes relevant comments.

The WG agreed to define common "InterCatch fleets" (which essentially correspond to Level 5 DCF métiers) to facilitate the use of InterCatch in future years and to promote consistency between countries and stocks. The proposal for InterCatch fleets is presented in Section 2.1 of this report.

1.4.3 Stock annexes

This year the only stock annex that was still missing (southern megrims) has been prepared and is presented as Annex I of the WG report. Hence, all stocks assessed by this WG now have a stock annex.

1.4.4 Benchmarks

There are many benchmarks scheduled for WGHMM stocks for the start of 2012: the 4 anglerfish stocks assessed by this WG and the northern megrim stock. Two *Nephrops* stocks (FU 23-24 and 28-29) will have Inter-benchmark protocols (done by correspondence) at the same time. Having so many benchmarks in the same year is largely the consequence of having postponed several benchmarks that were originally scheduled to take place in earlier years, because the WG felt that not enough progress had been done to be able to have a successful benchmark. The WG reviewed the situation this year and decided to go ahead with all benchmarks proposed for the start of 2012. The ICES benchmark preparation tables by stock were revised during the WG meeting, identifying the tasks that should be conducted inter-sessionally (during the second half of 2011) as well as responsible persons for them and delivery dates. These updated tables and relevant comments regarding the 2012 benchmarks are included in Annex N ("Benchmark planning for 2012").

1.4.5 New survey acronyms used

ICES has asked this year that survey acronyms be used consistently across all ICES Expert Groups, providing a list that should be used in all cases. Accordingly, the new survey acronyms have been used throughout this report, including the stock annexes. To facilitate comparison with previous reports of this WG, Section 2.2 provides a list of surveys used or mentioned in this WG report, making the correspondence between the acronyms used last year and the new acronyms used this year.

1.4.6 Data Tables

As requested by ICES in recent years, this year the WG stock coordinators were again asked to fill Data Tables concerning data transmitted to the WG for assessment purposes. These tables have been filled during the WG meeting and are available on the WGHMM 2011 SharePoint site, under the "Data Tables" folder. It seems clear to WG members that these tables have been used recently by the European Commission to check whether collected data under the DCF were being transmitted to ICES assessment WGs.

The WG members would like to highlight that the categories provided in the drop down boxes to fill these tables are not appropriate for all situations. To try and avoid possible confusions, WG stock coordinators have made extensive use of the comments box to make the situation as clear as possible. Therefore, the WG urges any potential users of these tables to read those comments carefully and to take them into consideration.

1.4.7 New ToRs on new species and on MSFD and Marine Spatial Planning

The four species at the end of the table in Section 1.1, for which the requirement was to "collate data", were new to WGHMM this year and have been handled in Annex R. The new Generic ToRs given to all ICES Expert Groups on the Marine Strategy Framework Directive and Coastal and Marine Spatial Planning have been dealt with in Annex S.

Table 1.3 **Biological sampling levels by stock and country. Number of fish measured and aged from landings in 2010**

		Angler (*L.pisc*.)		Angler (*L.bude*.)		Megrim (*L.whiff*.)		Megrim (*L. boscii*)	Sole
		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
Belgium	No. lengths								14662
	No. ages								268
	No. samples**								6
E & W (UK)	No. lengths	9228		848		7099			
	No. ages	177		182		592			
	No. samples*	91		54		46			
France	No. lengths	23770		15190		28584			26431
	No. ages					1119			1861
	No. samples***	2673		2673		5158			183
Portugal	No. lengths		114		464		6	3901	
	No. ages***		0		0		0	0	
	No. samples*		24		54		5	57	
Republic of	No. lengths	6556		3847		8415			
Ireland	No. Ages*****	1667		585		428			
	No. samples*	116		116		173			
Spain	No. lengths	6723	5175	7528	3464	16337	4498	39322	
	No. Ages*****		0		0	2116	950	1090	
	No. samples	102	499	105	431	140	144	144	
Total	**No. lengths**	**46277**	**5289**	**27413**	**3928**	**60435**	**4504**	**43223**	**41093**
	No. ages	**1844**	**0**	**767**	**0**	**4255**	**950**	**1090**	**2129**
Total No. in international landings (thousands)		**8139**	**493**	**7063**	**292**	**64873**	**445**	**10853**	**15982**
No. Measured as % of annual number caught		**0.6**	**1.1**	**0.4**	**1.3**	**0.1**	**1.0**	**0.4**	**0.3**

* Vessels
** Categories
*** Ages, surveys
****Boxes/hauls (for sampling onboard)
*****Otoliths collected and prepared but not read

Table 1.3 (continued)

		Hake		Nephrops		
		IIIa, IV, VI, VII & VIIIa,b	VIIIc & IXa	VIIIab FU 23-24	VIIIc FU 25-31	IXa FU 26-30
Scotland (UK)	No. lengths	2346				
	No. ages					
	No. samples*	73				
E & W (UK)	No. lengths	8769				
	No. ages	454				
	No. samples*	99				
France	No. lengths	14833		31042		
	No. Ages*****	1860				
	No. samples***	246		468		
Portugal	No. lengths		22474			10489
	No. ages***		2331			
	No. samples*		349			39
Republic of Ireland	No. lengths	8508				
	No. ages*****					
	No. samples*	150				
Spain	No. lengths	73208	43441		3079	4752
	No. ages****	2272	0			
	No. samples*	235	431		46	42
Total	**No. lengths**	**107664**	**65915**	**31042**	**3079**	**15241**
	No. ages	**4586**	**2331**	**0**	**0**	**0**
Total No. in international landings (thousands)		**NA**	**35547**	**251649**	**594**	**6760**
No. Measured as % of annual number caught		**NA**	**0.2**	**0.01**	**0.52**	**0.2**

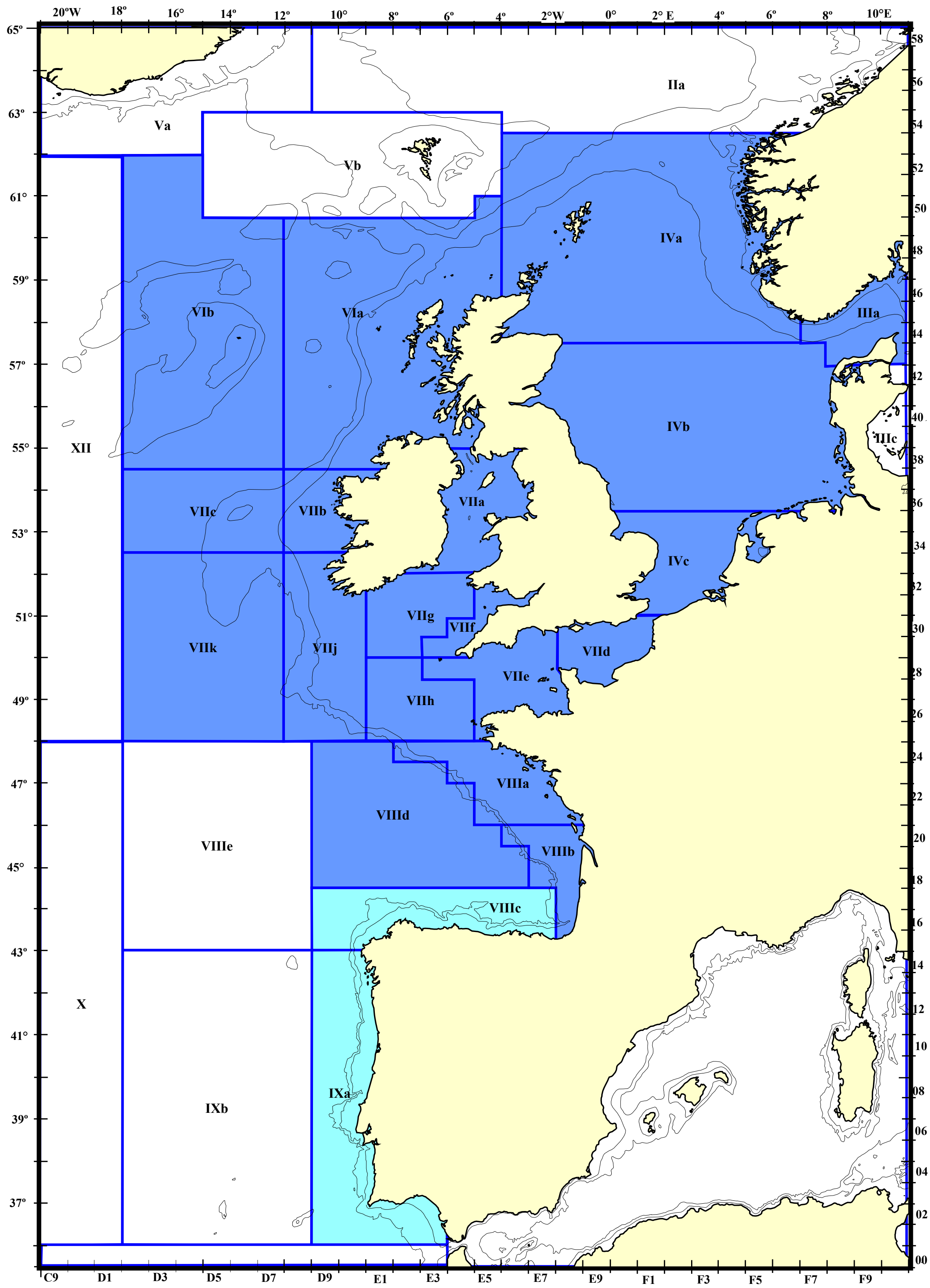

Figure 1.1. Map of ICES Divisions. Northern (IIIa, IV, VI, VII and VIIIabd) and Southern (VIIIc and IXa) Divisions with different shading.

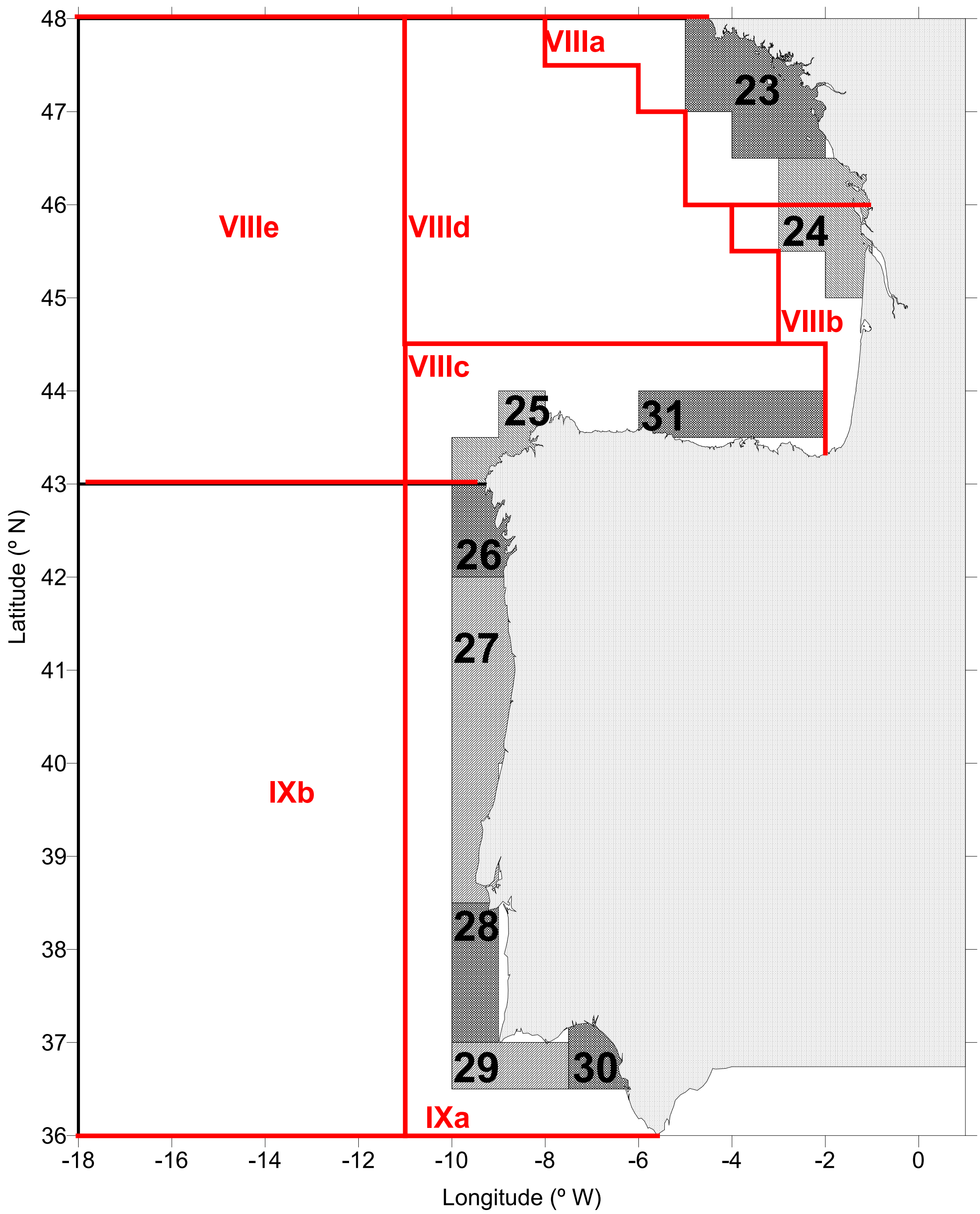

Figure 2.2. ICES Division VIII and IXa. *Nephrops* Functional Units. Division VIIIab (Management Area N): FUs 23-24. Division VIIIc (Management Area O): FUs 25 and 31. Division IXa (Management Area Q): FUs 26-30.

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 in future years, it presents the "fleets" that the WG proposes to use for data submission in InterCatch. WG members will check with the data teams and their institutions that this choice of fleets is indeed feasible for data submission. If problems are detected, these will be communicated to the WG chair by the end of July 2011 at the latest, so that the WG can make a final decision on fleets for data submission by mid September 2011.

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):

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	

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.

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			X	

FU	Fleet for InterCatch	DCF metier (Level 6)	Description	FR	IR	SP	UK
			mm)				
	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:

<table>
<tr><th>COUNTRY</th><th>FISHERY UNIT</th><th>DESCRIPTION</th></tr>
<tr><td rowspan="9">Spain</td><td>Small Gillnet</td><td>Gillnet fleet using "beta" gear (60 mm mesh size) for targeting hake in Divisions VIIIc and IXa North</td></tr>
<tr><td>Gillnet</td><td>Gillnet fleet using "volanta" gear (90 mm mesh size) for targeting hake in Division VIIIc</td></tr>
<tr><td></td><td>Gillnet fleet using "rasco"gear (280 mm mesh size) for targeting anglerfish in Division VIIIc</td></tr>
<tr><td>Long Line</td><td>Long line fleet targeting a variety of species (hake, great fork beard, conger) in Division VIIIc</td></tr>
<tr><td>Northern Artisanal</td><td>Miscellaneous fleet exploiting a variety of species in Divisions VIIIc and IXa North</td></tr>
<tr><td>Southern Artisanal</td><td>Miscellaneous fleet exploiting a variety of species in Division IXa South (Gulf of Cádiz)</td></tr>
<tr><td>Northern Trawl</td><td>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.</td></tr>
<tr><td>Southern Trawl</td><td>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).</td></tr>
<tr style="display:none"><td></td><td></td></tr>
<tr><td rowspan="2">Portugal</td><td>Artisanal</td><td>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</td></tr>
<tr><td>Trawl</td><td>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).</td></tr>
</table>

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
Spain	Gillnet	GNS_DEF	GNS_DEF_80-99_0_0	Set gillnet directed to demersal species (80-99 mm)	X	
			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	
	Southern artisanal	LLS_DWS	LLS_DWS_0_0_0	Set longline directed to deep-water species	X	
	Northern Trawl	PTB_DEF	PTB_DEF _>= 55_0_0	Pair bottom trawl directed to demersal fish (at least 55 mm)	X	
		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	
Portugal	Artisanal	GTR_DEF	GTR_DEF_>=100_0_0	Trammel net directed to demersal fish (at least 100 mm)		X
		GNS_DEF	GNS_DEF_80-99_0_0	Set gillnet directed to demersal fish (80-99 mm)		X
		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		-----
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 *Neph-*

rops 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, using twin trawl, with hours of trawling around dawn and dusk.

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

Type of assessment: update (stock benchmarked in 2010), stock on observation list.

Data revisions: no data revision, data series extended back to 1978

Review Group issues: no outstanding issue. Some editorial suggestions for the stock-annex have been addressed

3.1 General

3.1.1 Stock definition and ecosystem aspects

This section is described in the Stock Annex (Annex C).

3.1.2 Fishery description

The general description of the fishery is now presented in the Stock Annex.

3.1.3 Summary of ICES advice for 2011 and management for 2010 and 2011

ICES advice for 2011

No reliable assessment can be presented for this stock. The main cause is uncertainty in recent years' estimates of SSB and F. Therefore, fishing possibilities cannot be projected.

MSY approach

According to ICES MSY approach, catches should be maintained at recent levels, corresponding to landings of 50 600 t (average of 2007–2009). Despite uncertainty in the rate of abundance increase in recent years, the stock trend is increasing and the exploitation status is unknown.

PA approach

There is no sign of impaired recruitment throughout the assessed period. Therefore, according to the PA approach catches should not exceed recent levels, corresponding to landings of 50 600 t (average of 2007–2009).

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)	2005	2006	2007	2008	2009	2010	2011
IIIa, IIIb,c,d (EC Zone)	1284	1323	1588	1627	1552	1661	1661
IIa (EC Zone), IV	1496	1541	1850	1896	1808	1935	1935
Vb (EC Zone), VI, VII, XII, XIV	23888	24617	29541	30281	28879	30900	30900
VIIIa,b,d,e	15932	16412	19701	20196	19261	20609	20609
Total Northern Stock [IIa-VIIIabd]	42600	43893	52680	54000	51500	55105	55105

Management for 2010 and 2011

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 2011, the 2011 TAC corresponding to the recovery plan (EC Reg. No. 811/2004) could not be determined as the 2010 assessment was only considered as indicative of trends.

3.2 Data

3.2.1 Commercial catches and discards

Total landings from the Northern stock of hake by area for the period 1961-2010 as used by the WG are given in Table 3.1. 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, which are higher over the first decade (1961-1970), when the uncertainties in the fisheries statistics were high. 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 73 100 t in 2010, the highest value since 1974 and well above the 2010 TAC (55 100 t).

The discard data sampling and data availability are presented in the Stock Annex. Table 3.2 presents discard data available to the group from 1999 to 2010.

3.2.2 Biological sampling

The sampling level is given in Table 1.3.

Length compositions of the 2010 landings by Fishery Unit and quarter were provided by Ireland, Spain, France, Scotland, 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 3.3).

3.2.3 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 3.1 presents 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.

After two consecutive years of increases in 2001 and 2002, the abundance index provided by EVHOE-WIBTS-Q4 dropped in 2003, then showed a sharp increase in 2004 and dropped again in 2005 and 2006. The index increased again in 2007 and 2008, to reach the highest value of the series. It dropped again in 2009 and 2010 to a level close to the 2005 and 2006 levels.

The abundance index provided by IGFS-WIBTS-Q4 follows a similar trend to EVHOE-WIBTS-Q4 in recent years with a decrease from 2008 to 2009-2010.

For the SpPGFS-WIBTS-Q4 survey 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.

The spatial distribution of the EVHOE-WIBTS-Q4 index for hakes from 0 to 20cm is given in Figure 3.2 for the most recent years. It is apparent from this figure that inter-annual variations in abundance are different between areas (VII and VIII).

3.2.4 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 1982-2010 are given in Table 3.4ab and Figure 3.3ab.

Since 1985, the LPUE of A Coruña trawlers operating in Subarea VII has fluctuated, with an increasing trend reaching its maximum value in 2010. 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.

LPUE from Ondarroa and Pasajes pair trawlers operating in Divisions VIIIa,b,d have followed similar trends and have been quite variable. Two peak values have been observed in 1995 and 2002. For Ondarroa, very large increases in LPUE have been observed in 2008 and 2009, with the largest value observed in 2009. Its LPUE remained at this high level in 2010. In 2005 both fleets experienced a decrease in effort (expressed in number of days), which corresponds to a decrease in number of vessels. This decrease has continued further for the Pasajes pair trawlers which were at a very low level of effort in 2007 (105 days only) and stopped their operations in 2008.

For the Ondarroa "Baka" trawlers fishing in Subareas VI, VII and Div. VIIIa,b,d, the Pasajes "Bou" trawlers fishing in Subarea VIII and the trawlers from Santander in VIIIa,b,d there is no marked trend in the LPUE, except for Ondarroa "Baka" trawlers in Subarea VII targeting hake and megrim until 1996 and megrim and anglerfish with lower hake LPUE since then, and Ondarroa trawl in VI which shows a increasing trend after 2003. LPUEs from Ondarroa "Baka" trawlers fishing in Div. VIIIa,b,d have been increasing since 2006.

Due to important reductions in the availability of log-book information in recent years for both French fleets from Les Sables and Lesconil, LPUE values for the years 1996 onwards have low reliability. Effort and LPUE for the period 1987-2003 are given in Table 3.4b and presented in Figure 3.3b only for the period 1987-1995.

The LPUE series of the two most important Spanish longline fleets operating in VII (Celeiro and Burela) have been rather stable over time, but both experienced a marked increased in the last 2-3 years. This same trend in also present in A Coruña longliners fishing in VII, although it is not quite as strong. It is to be noted however that for gill-netters and long liners, LPUEs expressed in kg/day may not be the most appropriate.

3.3 Assessment

This is an update assessment.

3.3.1 Input data

See Stock Annex (under "*Input data for SS3*"). This year, the modelled time period has been extended back to 1978. Landing data (tonnage and length frequency distributions) are now available on a yearly basis from 1978 to 1989 and on a quarterly basis from 1990 onwards. The Stock Annex has been updated accordingly.

3.3.2 Model

The Stock Synthesis 3 (SS3) assessment model (Methot, 2009) 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).

3.3.3 Assessment results

Residuals of the fits to the surveys log (abundance indices) are presented in Figure 3.4. The greater part of the upward trend 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 3.5, 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, 2010a).

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 3.6 presents selectivity (for the total catch; black lines) and retention functions by fleet (red and green lines) estimated by the model. For the Spanish trawl fleets in VII and VIII, a retention function is estimated for years 1978-1997 and another one for 1998-present. This change in retention 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. For the French trawlers targeting *Nephrops* in VIII, the same retention function is assumed throughout the entire assessment period (1978-present). 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.

The assessment model also estimates the growth rate K from a von Bertalanffy growth model (with L infinite fixed at 130 cm, in accordance with the Stock Annex). This year K is estimated at 0.177, close to last year's estimate.

The retrospective analysis (Figure 3.7) shows that for F and SSB the model results are not very sensitive to the exclusion of recent data. For 2006 and 2007, the patterns observed indicate a tendency to underestimate SSB and over-estimate F over the last years, but for more recent years (2008 to 2010), the trends in F and SSB remain fairly stable over the whole series. Some retrospective pattern is observed for recruitment but here again, the decreasing trend after 2008 is relatively well defined.

F2010 (average of F-at-length over lengths 15-80 cm) was estimated at 0.39 and SSB at 131 075 t.

Summary results from SS3 are given in Table 3.5 and Figure 3.8.

3.3.4 Historic trends in biomass, fishing mortality and recruitment

For recruitment, fluctuations appear to be without substantial trend over the whole series. Over the last years however, after some increase up to 454 million in 2007 (estimated to be among the highest of the series), the recruitment has decreased sharply to 100 million in 2009 (one of the lowest values of the series).

From high levels at the start of the series (102 000 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 2010 (131 000 t).

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 0.39 in 2010.

3.4 Catch options and prognosis

3.4.1 Short - Term projection

Options for short term projection are indicated in the Stock Annex

For the current projection, unscaled F is used, corresponding to F(15-80cm)=0.42.

The recruitment used for projections in this WG is the GM calculated over the whole data series from 1978 to the final assessment year and not to the final assessment year minus 2 as indicated in the Stock Annex. The WG suggests that the Stock Annex be updated accordingly.

Landings in 2012 and SSB in 2013 predicted for various levels of fishing mortality in 2012 are given in Table 3.6 and Figure 3.9. Maintaining status quo F in 2012 is expected to result in a decrease in landings with respect to 2011 and a decrease in SSB in 2013 with respect to 2012.

3.4.2 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 3.7 and Figure 3.10. The F-multiplier in Table 3.7 is with respect to status quo F (average F in the final 3 assessment years, 2008-2010). Considering the yield and SSB per recruit curves, F_{max}, $F_{0.1}$, $F_{35\%}$ and $F_{30\%}$ are respectively estimated to be 68%, 46%, 48% and 57% of status quo F. The maximum equilibrium yield per recruit is less than 4% above the equilibrium yield at F_{sq}.

3.5 Biological reference points

The benchmark carried out in 2010 (ICES 2010a) led to a complete re-start relative to the previous assessment which was based on age data now demonstrated to be biased. Thus, the PA reference points are no longer appropriate.

F_{MSY} has been set to 0.24, the value proposed by WGHMM in 2010 based on F30% (the fishing rate that would reduce the spawning biomass per recruit to 30% of its unfished level). As can be seen in Table 3.7, F30% is still estimated equal to 0.24 in this year's assessment.

According to the guidelines provided by WKFRAME (ICES, 2010b; ICES, 2011), for stocks fished at a level well above F_{MSY} (as this is the case for northern hake), B_{PA} could be used as a preliminary operational trigger point which could be revised once we get better knowledge of the biomass distribution under the condition of fishing at F_{MSY}. As explained above, the B_{pa} value previously used for the northern hake stock is no longer appropriate and the WG is not proposing any MSY-$B_{trigger}$ this year.

	Type	Value	Technical basis
MSY Approach	MSY $B_{trigger}$	Not defined	
	F_{MSY}	0.24	$F_{30\%SPR}$ as estimated in WGHMM 2010
Precautionary Approach	B_{lim}	Not defined	
	B_{pa}	Not defined	
	F_{lim}	Not defined	
	F_{pa}	Not defined	

3.6 Comments on the assessment

The northern hake assessment has been completely revised during the WKROUND benchmark workshop (ICES, 2010a). The new assessment has shifted to a length-based approach using the Stock Synthesis assessment model. This approach allows direct use of length–composition data and explicit modelling of a retention process that partitions total catch into discarded and retained portions. No age data are used in the new assessment.

Last year, the assessment was found to be limited in its ability to precisely estimate current stock abundance and mortality mainly because the modelled time period, 1990–2009, did not exhibit strong contrasts in the available data and little information was available on large fish as a very small proportion of fish larger than 60 cm is observed in the data since 1990 (landings and surveys). All this led to large uncertainties associated with the main population parameters (SSB, F and recruitment), particularly regarding the rate of decrease in F and increase in SSB in the most recent years. WGHMM in 2010 accepted the assessment as only indicative of trends and decided not to carry out short term projections.

This year, the Working Group accepted the assessment and carried out short-term projections. The modelled time period has been extended back to 1978 (using quarterly length-frequency distributions starting from 1990, as done last year, and now incorporating annual length-frequency distributions before 1990). As expected, this has improved the model's ability to determine the degree to which levels of fishing reduced hake abundance during the mid 80s and the 90s and thus provides a clearer perspective of the historical development of the stock. While the rate of decrease in F and increase in SSB estimated by SS3 in recent years remains important, it leads to levels of F and SSB consistent with values estimated at the end of the 70s. The sharp increase in SSB in recent years is the direct consequence of a series of good recruitments in 2006-2008 [1]and a high growth rate estimated by SS3 (K=0.177, consistent with the growth rate estimated from tagging data (de Pontual et al., 2009). Furthermore, the trends are consistent with increasing landings (Table 3.1) and increasing LPUEs (Table 3.4). Finally, the retrospective analysis shows that for F and SSB the model results are not very sensitive to the exclusion of recent data and, for the recent years (2008 to 2010), the trends in F and SSB remain fairly stable over the whole series.

The assessment is now carried out with discards of several commercial fleets included. To account for the large uncertainties associated with the estimations of discards in weight, the discard data are entered in the assessment model assuming a CV of 50% (see Stock Annex). This leads, for some fleets, to low estimates of discards compared to the observations (not presented in this report but available on the WG Share-point) and, as a consequence, to projections of discards that are also very low when compared with recent observed values (as can be noticed by comparing Tables 3.6 and 3.2).

The assessment is consistent with the assessment conducted by WGHMM in 2010, and which was, in 2010, accepted as only indicative of stock trends (Figure 3.11)

3.7 Management considerations

In last year's assessment, the modeled time-period started in 1990, at the end of the sharp decrease in SSB estimated in previous assessments (which had been conducted using XSA) and the historical perspective of the stock was consequently modified. In this year's assessment, the modeled time-period has been extended back to 1978, which provides a clearer perspective of the historical development of the stock and gives indications of the degree to which historical levels of fishing reduced hake abundance in the past.

As in previous years, there are strong indications of an increase in SSB and decrease in fishing mortality. The increase in SSB is the consequence of several strong incoming recruitments, in particular, the 2006-2008 year classes. It must be noted however 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 low recruitments estimated for 2009 and 2010.[2]

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[1] RGBBI suggestion: combined with a relatively low fishing mortality

[2] RGBBI suggestion: The abundance indices from EVOE-WBTS-Q4 and IGFS-WIBTS-Q4 also show recruitment low values in 2009 and 2010.

Table 3.1. Northern hake estimated of landings ('000 t) by area for 1961-2010.

	Landings (1)				
Year	IVa+VI	VII	VIIIa,b	Unallocated	Total
1961	-	-	-	95.6	95.6
1962	-	-	-	86.3	86.3
1963	-	-	-	86.2	86.2
1964	-	-	-	76.8	76.8
1965	-	-	-	64.7	64.7
1966	-	-	-	60.9	60.9
1967	-	-	-	62.1	62.1
1968	-	-	-	62.0	62.0
1969	-	-	-	54.9	54.9
1970	-	-	-	64.9	64.9
1971	8.5	19.4	23.4	0	51.3
1972	9.4	14.9	41.2	0	65.5
1973	9.5	31.2	37.6	0	78.3
1974	9.7	28.9	34.5	0	73.1
1975	11.0	29.2	32.5	0	72.7
1976	12.9	26.7	28.5	0	68.1
1977	8.5	21.0	24.7	0	54.2
1978	8.0	20.3	24.5	-2.2	50.6
1979	8.7	17.6	27.2	-2.4	51.1
1980	9.7	22.0	28.4	-2.8	57.3
1981	8.8	25.6	22.3	-2.8	53.9
1982	5.9	25.2	26.2	-2.3	55.0
1983	6.2	26.3	27.1	-2.1	57.5
1984	9.5	33.0	22.9	-2.1	63.3
1985	9.2	27.5	21.0	-1.6	56.1
1986	7.3	27.4	23.9	-1.5	57.1
1987	7.8	32.9	24.7	-2.0	63.4
1988	8.8	30.9	26.6	-1.5	64.8
1989	7.4	26.9	32.0	0.2	66.5
1990	6.7	23.0	34.4	-4.2	60.0
1991	8.3	21.5	31.6	-3.4	58.1
1992	8.6	22.5	23.5	2.1	56.6
1993	8.5	20.5	19.8	3.3	52.1
1994	5.4	21.1	24.7	0.0	51.3
1995	5.3	24.1	28.1	0.1	57.6
1996	4.4	24.7	18.0	0.0	47.2
1997	3.3	18.9	20.3	-0.1	42.5
1998	3.2	18.7	13.1	0.0	35.1
1999	4.3	24.0	11.6	0.0	39.8
2000	4.0	26.0	12.0	0.0	42.0
2001	4.4	23.1	9.2	0.0	36.7
2002	2.9	21.2	15.9	0.0	40.1
2003*	3.3	25.4	14.4	0.0	43.2
2004*	4.4	27.5	14.5	0.0	46.4
2005*	5.5	26.6	14.5	0.0	46.6
2006*	6.1	24.7	10.6	0.0	41.5
2007*	7.0	27.5	10.6	0.0	45.1
2008*	10.7	22.8	14.3	0.0	47.8
2009*	13.1	25.5	20.4	0.0	59.0
2010*	14.2	33.9	25.1	0.0	73.1

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

There are some unallocated landings (moreover for the period 1961-1970).

Table 3.2. 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)).

Fleet/metier sampled	Corresponding Fishery Units	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Spanish Trawl in VII	FU 4	NA	**83**	NA	NA	NA	**1034**	**1530**	NA	**537**	**1712**	**2010**	**5674**
		NA	*759*	NA	NA	NA	*10666*	*17393*	NA	*4526*	*21437*	*17542*	*27619*
French Nephrops trawl in VIIIabd	FU9	**565**	**341**	**417**	**172**	**1035**	**1359**	**1597**	**532**	**767**	**858**	**4283**	**726**
		9139	*7421*	*6407*	*2992*	*23676*	*39550*	*37740*	*18031*	*24277*	*18245*	*68524*	*14709*
French trawl in VIIIabd	FU10	**211**	**169**	**100**	**142**	NA	NA	NA	NA	NA	NA	*	*
		3053	*3013*	*1439*	*2253*	NA	NA	NA	NA	NA	NA	*	*
Spanish trawl in VIIIabd	FU14	NA	NA	NA	NA	NA	**30**	**489**	**206**	**471**	**352**	**580**	**101**
		NA	NA	NA	NA	NA	*451*	*8475*	*3397*	*10002*	*7153*	*7925*	*1719*
Irish trawl and seine in VII	FU15	**190**	**650**	**194**	NA	NA	**32**	**94**	*	*	*	NA	NA
		1868	*892*	*1046*	NA	NA	282	*629*	*	*	*	*684*	*641*
UK (EW) trawl in IV and VII	FU16 + 4 + 5	NA	*	*	*	*	*	*	*	*	*	*	*
		NA	*	*	*	*	*	*	*	*	*	*	*
Spanish trawl in VI	FU16	NA	NA	NA	NA	NA	NA	NA	NA	NA	**6**	**31**	**120**
		NA	NA	NA	NA	NA	NA	NA	NA	NA	*11*	*36*	*146*
Danish trawl and seine	FU16	**42**	**21**	**142**	**354**	**242**	**206**	**814**	**610**	**255**	**190**	**213**	**95**
		29	*38*	*483*	*691*	*479*	*775*	NA	NA	*849*	*642*	*508*	*234*
Total Weight from sampled fleet (t)		**1008**	**1264**	**854**	**668**	**1277**	**2661**	**3710**	**738**	**1775**	**3119**	**7117**	**6501**
Total Number from sampled fleets ('000)		*14090*	*12123*	*9376*	*5935*	*24155*	*51724*	*64237*	*21428*	*38805*	*47488*	*95219*	*44687*

* sampled but not raised

Table 3.3. 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 2010.

Country		France	Ireland	Spain	UK(E+W)	Scotland	Denmark	Others
Unit	Quarter							
1	1			L+LFD				
	2			L+LFD				
	3			L+LFD				
	4			L+LFD				
2	1	L+LFD			L			
	2	L+LFD			L			
	3	L+LFD			L			
	4	L+LFD			L			
3	1	L+LFD	L	L+LFD	L+LFD			
	2	L+LFD	L	L+LFD	L+LFD			
	3	L+LFD	L	L+LFD	L+LFD			
	4	L+LFD	L	L+LFD	L+LFD			
4	1	L+LFD		L+LFD	L			
	2	L+LFD		L+LFD	L			
	3	L+LFD		L+LFD	L			
	4	L+LFD		L+LFD	L			
5	1	L+LFD	L		L+LFD			
	2	L+LFD	L		L+LFD			
	3	L+LFD	L		L+LFD			
	4	L+LFD	L		L+LFD			
6	1		L		L+LFD			
	2		L		L+LFD			
	3		L		L+LFD			
	4		L		L+LFD			
8	1	L+LFD	L					
	2	L+LFD	L					
	3	L+LFD	L					
	4	L+LFD	L					
9	1	L+LFD						
	2	L+LFD						
	3	L+LFD						
	4	L+LFD						
10	1	L+LFD						
	2	L+LFD						
	3	L+LFD						
	4	L+LFD						
12	1	L+LFD		L+LFD				
	2	L+LFD		L+LFD				
	3	L+LFD		L+LFD				
	4	L+LFD		L+LFD				
13	1	L+LFD		L+LFD				
	2	L+LFD		L+LFD				
	3	L+LFD		L+LFD				
	4	L+LFD		L+LFD				
14	1			L+LFD				
	2			L+LFD				
	3			L+LFD				
	4			L+LFD				
15	1		L+LFD					L
	2		L+LFD					L
	3		L+LFD					L
	4		L+LFD					L
16	1		L	L+LFD	L	L+LFD	L+LFD	L
	2		L	L+LFD	L	L+LFD	L+LFD	L
	3		L	L+LFD	L	L+LFD	L+LFD	L
	4		L	L+LFD	L	L+LFD	L+LFD	L
00	1	L						
	2	L						
	3	L						
	4	L						

Table 3.4.a 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	1527	59213	26
2008	2042	1872	1091	1370	58396	23
2009	2418	1884	1284	1651	58521	28
2010	4934	2484	1986	1650	56065	29

* Before 1988 landings and effort refer to Vigo trawl fleet only, from 1988 to 2002 to combined Vigo+Marín trawl
** Effort in days/100HP; LPUE in kg/(day/100HP)

Sub-area VIII

	Ondarroa pair trawl in VIIIa,b,d			Pasajes pair trawl in VIIIa,b,d		
Year	Landings(t)*	Effort(days)	LPUE(Kg/day)	Landings(t)*	Effort(days)	LPUE(Kg/day)
1982	--			--		
1983	--			--		
1984	--			--		
1985	--			--		
1986	--			--		
1987	--			--		
1988	--			--		
1989	--			--		
1990	--			--		
1991	--			--		
1992	--			--		
1993	64	68	930	--		
1994	815	362	2250	540	423	1276
1995	3094	959	3226	2089	746	2802
1996	2384	1332	1790	2519	1367	1843
1997	2538	1290	1966	3045	1752	1738
1998	2043	1482	1378	2371	1462	1622
1999	2135	1787	1195	2265	1180	1920
2000	2004	1214	1651	2244	1233	1820
2001	1899	1153	1648	941	587	1603
2002	4314	1281	3368	2570	720	3571
2003	3832	1436	2669	2187	754	2902
2004	3197	1288	2482	1859	733	2535
2005	3350	1107	3026	658	252	2611
2006	4173	1236	3377	516	182	2837
2007	3815	1034	3691	278	105	2644
2008	5473	791	6916			
2009	6716	633	10610			
2010	8056	844	9545			

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

Table 3.4.b. 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 VI

	Ondarroa trawl in VI		
Year	Landings(t)	Effort(days)	LPUE(Kg/day)
1994	164	635	259
1995	164	624	262
1996	259	695	372
1997	127	710	179
1998	89	750	118
1999	197	855	230
2000	243	763	318
2001	239	1123	213
2002	233	1234	189
2003	138	718	193
2004	306	411	743
2005	291	337	864
2006	304	368	827
2007	265	335	791
2008	451	349	1293
2009	383	380	1008

Sub-area VII

	A Coruña long line in VII			Celeiro long line in VII			Burela long line in VII			Ondarroa trawl in VII*		
Year	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort(days)	LPUE(Kg/day)
1985	3577	4788	747	n/a	n/a		n/a	n/a		n/a	n/a	
1986	3038	4128	736	n/a	n/a		n/a	n/a		n/a	n/a	
1987	2832	4467	634	n/a	n/a		n/a	n/a		n/a	n/a	
1988	3141	3766	834	n/a	n/a		n/a	n/a		n/a	n/a	
1989	2631	3503	751	n/a	n/a		n/a	n/a		n/a	n/a	
1990	2342	3682	636	n/a	n/a		n/a	n/a		n/a	n/a	
1991	2223	3217	691	n/a	n/a		n/a	n/a		n/a	n/a	
1992	2464	2627	938	n/a	n/a		n/a	n/a		n/a	n/a	
1993	2797	2568	1089	n/a	n/a		n/a	n/a		538	1094	492
1994	2319	2641	878	4062	6516	623	2278	3804	599	1084	980	1106
1995	2507	2161	1160	5209	6420	811	2905	3444	843	528	1214	435
1996	2111	1669	1265	5988	6720	891	3245	3636	892	291	1170	249
1997	830	900	922	4174	6144	679	2299	3540	649	109	540	202
1998	292	372	784	2817	4668	603	1639	3000	546	137	1196	115
1999	323	395	817	3447	4980	692	1982	2880	688	195	1384	141
2000	281	276	1018	3699	4440	833	2282	2928	779	249	1850	135
2001	229	276	830	3383	3756	901	3034	3672	826	164	1451	113
2002	214	300	712	2769	3984	695	2399	3732	643	195	949	206
2003	648	1188	545	3386	4404	769	2514	3636	691	112	1022	110
2004	280	312	899	3990	4596	868	3255	3852	845	111	910	122
2005	199	288	691	4177	3930	1063	3074	3507	876	76	544	140
2006	256	312	822	4372	4560	959	3639	5184	702	102	487	210
2007	271	520	520	5039	5712	882	4367	6300	693	66	476	138
2008	233	288	810	4302	5184	830	4058	4884	831	17	105	162
2009	214	192	1116	4959	4624	1072	5146	4536	1135			
2010	315	375	839	7630	5556	1373	9141	5736	1594			

* From 1996 hake no more targeted

	A Coruña gillnet in VII			Celeiro gillnet in VII			Ondarroa gillnet in VII			Burela gillnet in VII		
Year	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort(days)	LPUE(Kg/days	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort(days)	LPUE(Kg/day)
1998	192	324	593	818	1572	520	34	73	462	238	444	536
1999	206	252	817	805	1068	754	50	58	869	451	444	1016
2000	237	204	1162	994	1308	760	81	84	969	353	600	588
2001	188	168	1119	674	1008	669	118	117	1007	215	252	852
2002	217	156	1388	631	912	692	189	132	1429	223	276	807
2003	126	192	656	454	660	688				280	348	805
2004	135	144	937	513	756	679				260	264	983
2005	326	300	1087	624	857	728				228	230	992
2006	182	180	1011	497	924	537				56	144	388
2007	118	516	229	680	1524	446				99	348	284
2008	32	48	675	501	804	624				115	228	503
2009	12	15	823	779	948	822				15	36	413
2010	31	24	1292	498	660	754						

Sub-area VIII

	Ondarroa trawl in VIIIa,b,d*			Santander trawl in VIIIa,b,d			Avilés long line in VIIIa,b,d			Avilés gillnet in VIIIa,b,d		
Year	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort	LPUE(Kg/days	Landings(t)	Effort(days)	LPUE(Kg/day)	Landings(t)	Effort(days)	LPUE(Kg/day)
1993	2244	5590	401	n/a	n/a		n/a	n/a				
1994	2817	5619	501	175	640	273	1145	2340	489			
1995	2069	4474	463	131	620	211	1145	2184	524			
1996	944	4378	216	62	530	117	819	2184	375			
1997	2348	4286	548	65	805	81	700	1896	369			
1998	287	3002	96	95	1445	66	353	1044	338	218	780	279
1999	81	2337	34	89	1830	49	567	1392	407	213	564	378
2000	157	2227	70	79	1520	52	553	1344	411	219	492	445
2001	341	2118	161	94	1590	59	893	1974	453	482	780	618
2002	321	2107	152	252	1260	200	314	744	423	392	504	778
2003	230	2296	100	212	1405	151	513	828	620	n/a	n/a	n/a
2004	165	2159	76	200	995	201	592	n/a	n/a	885	n/a	n/a
2005	257	2263	114	120	596	202	n/a	n/a	n/a	n/a	n/a	n/a
2006	216	2398	90	83	636	131	310	1075	288	406	1054	385
2007	296	2098	141	105	1278	82	n/a	n/a	n/a	n/a	n/a	n/a
2008	543	2017	269	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2009	741	1807	410	120	1278	94	368	252	1461	1215	1116	1089
2010				69	774	89	520	n/a		1658	n/a	

* From 1998 hake no more targeted

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

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

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

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

Table 3.5. 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	Yield/SSB	F (15-80 cm)
1978	280631	116459	78177	50551	0.65	0.49
1979	258652	126414	99476	51096	0.51	0.53
1980	276005	124635	101917	57265	0.56	0.63
1981	538869	107689	87727	53918	0.61	0.64
1982	370360	98643	71402	54994	0.77	0.66
1983	128493	105040	68866	57507	0.84	0.6
1984	243448	111442	81881	63286	0.77	0.64
1985	550445	96291	78221	56099	0.72	0.79
1986	326490	78788	57999	57092	0.98	0.89
1987	387231	74529	42763	63369	1.48	0.95
1988	452547	75117	45644	64823	1.42	0.98
1989	433097	74731	43982	66473	1.51	1.06
1990	430813	69258	41029	59954	1.46	0.99
1991	238950	67117	40943	58129	1.42	0.93
1992	257803	66545	40131	56617	1.41	0.95
1993	467945	59108	39296	52144	1.33	1.01
1994	264551	52822	30737	51259	1.67	1.03
1995	136309	58978	30037	57621	1.92	1.07
1996	330345	54544	35188	47210	1.34	0.93
1997	229932	46728	30507	42465	1.39	1.03
1998	378378	44200	24603	35060	1.43	0.94
1999	194931	48612	28062	39814	1.42	0.93
2000	173072	54342	31083	42026	1.35	0.86
2001	317173	54478	36791	36675	1	0.72
2002	265151	57279	37888	40107	1.06	0.78
2003	145895	62443	38161	43162	1.13	0.78
2004	334983	65433	43609	46417	1.06	0.78
2005	224857	62059	42802	46550	1.09	0.87
2006	303304	61200	36530	41467	1.14	0.72
2007	454286	71402	45909	45098	0.98	0.61
2008	381687	92250	56968	47823	0.84	0.47
2009	99576	134346	85181	58975	0.69	0.4
2010	176248	174907	131075	73125	0.56	0.39
Arith. Mean	304620	80237	54078	52066		
Units	Thousands	Tonnes	Tonnes	Tonnes		

Table 3.6. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Catch option table.

SSB(2011)	Rec proj	F(15-80cm)	Catch(2011)	Land(2011)	SSB(2012)
153890	280869	0.42	79185	77390	130536

Fmult	F(15-80cm)	Catch(2012)	Land(2012)	Disc(2012)	SSB(2013)
0	0	0	0	0	178879
0.1	0.04	8035	7744	291	170904
0.2	0.08	15700	15126	574	163296
0.3	0.13	23013	22161	852	156037
0.4	0.17	29990	28867	1123	149112
0.5	0.21	36647	35259	1388	142505
0.6	0.25	42998	41352	1646	136201
0.7	0.3	49058	47160	1898	130185
0.8	0.34	54840	52695	2145	124443
0.9	0.38	60358	57971	2387	118964
1	0.42	65622	63000	2622	113735
1.1	0.46	70646	67794	2852	108744
1.2	0.51	75440	72362	3078	103979
1.3	0.55	80014	76717	3297	99431
1.4	0.59	84379	80867	3512	95090
1.5	0.63	88545	84823	3722	90944
1.6	0.68	92521	88593	3928	86987
1.7	0.72	96314	92186	4128	83207
1.8	0.76	99935	95610	4325	79599
1.9	0.8	103390	98873	4517	76153
2	0.85	106687	101983	4704	72862

Table 3.7. 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(15-80 cm)	YPR(catch)	YPR(landings)	SSB/R
1.00	0.0	0.00	0.00	0.00	3.20
0.78	0.1	0.04	0.11	0.11	2.51
0.62	0.2	0.08	0.18	0.18	1.99
0.50	0.3	0.13	0.23	0.22	1.61
0.41	0.4	0.17	0.25	0.25	1.31
0.34	0.5	0.21	0.27	0.26	1.08
0.28	0.6	0.25	0.27	0.27	0.91
0.24	0.7	0.30	0.28	0.27	0.76
0.20	0.8	0.34	0.28	0.27	0.65
0.17	0.9	0.38	0.27	0.26	0.56
0.15	1.0	0.42	0.27	0.26	0.48
0.13	1.1	0.46	0.26	0.25	0.42
0.12	1.2	0.51	0.25	0.24	0.37
0.10	1.3	0.55	0.25	0.23	0.33
0.09	1.4	0.59	0.24	0.23	0.29
0.08	1.5	0.63	0.23	0.22	0.26
0.07	1.6	0.68	0.23	0.21	0.23
0.07	1.7	0.72	0.22	0.20	0.21
0.06	1.8	0.76	0.21	0.20	0.19
0.05	1.9	0.80	0.20	0.19	0.17
0.05	2.0	0.85	0.20	0.18	0.15

	SPR level	Fmult	F(15-80cm)	YPR(catch)	YPR(landings)	SSB/R
Fmax	0.25	0.68	0.29	0.28	0.27	0.79
F0.1	0.37	0.46	0.19	0.26	0.26	1.18
F35%	0.35	0.48	0.20	0.26	0.26	1.12
F30%	0.30	0.57	0.24	0.27	0.27	0.96

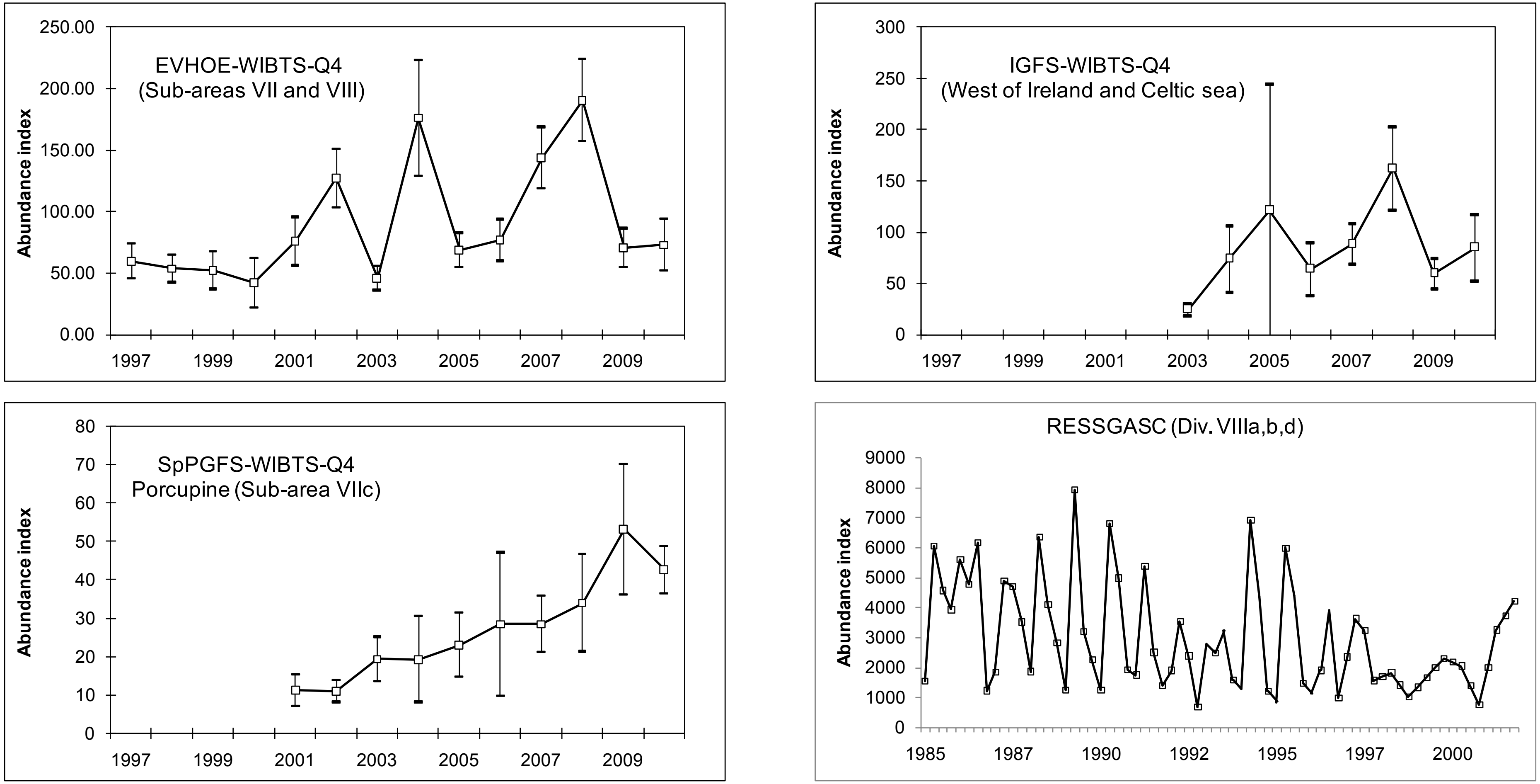


Figure 3.1 . Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Abundance indices from surveys.

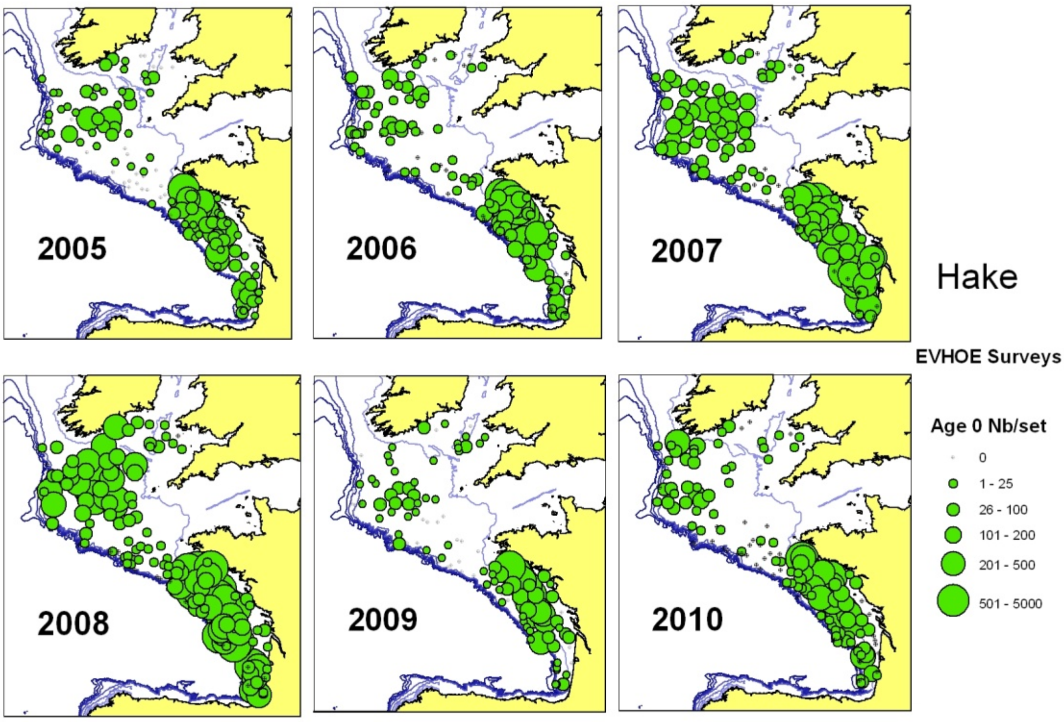


Figure 3.2. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Spatial distribution of hake (0-20 cm) indices from EVHOE-WIBTS-Q4 survey from 2005 to 2010.

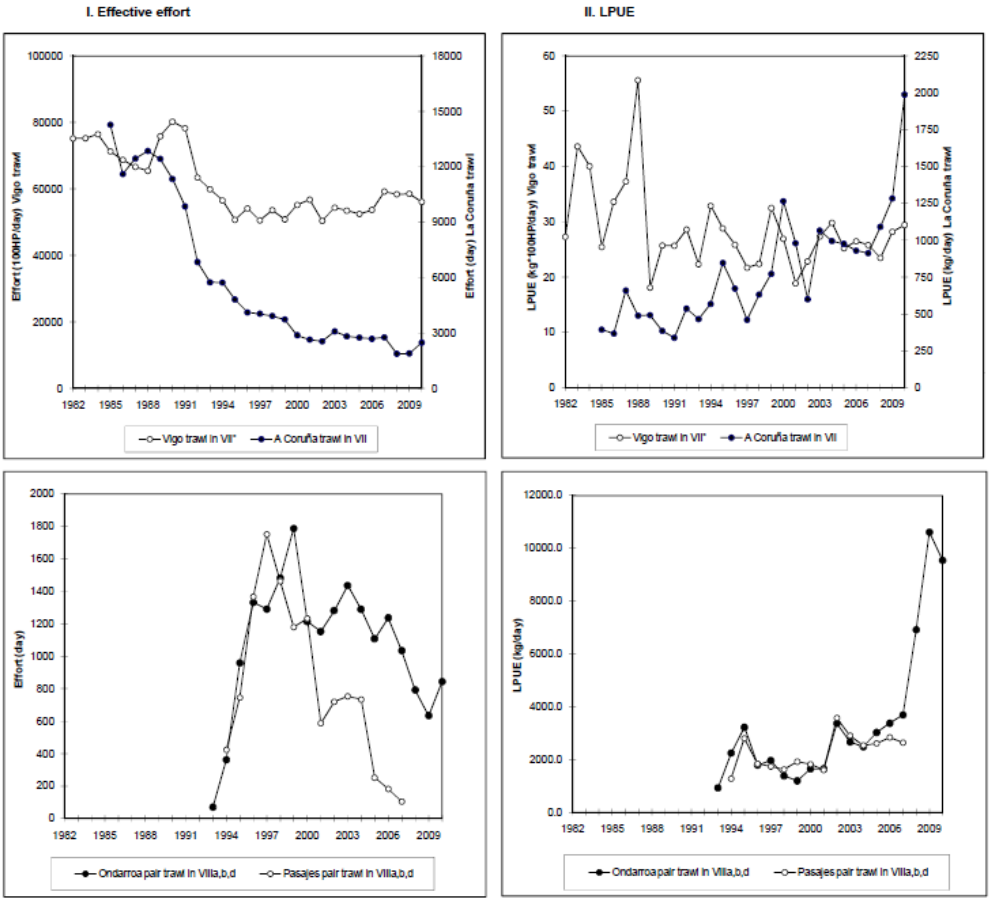


Figure 3.3a. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). LPUE and effort from commercial fleets

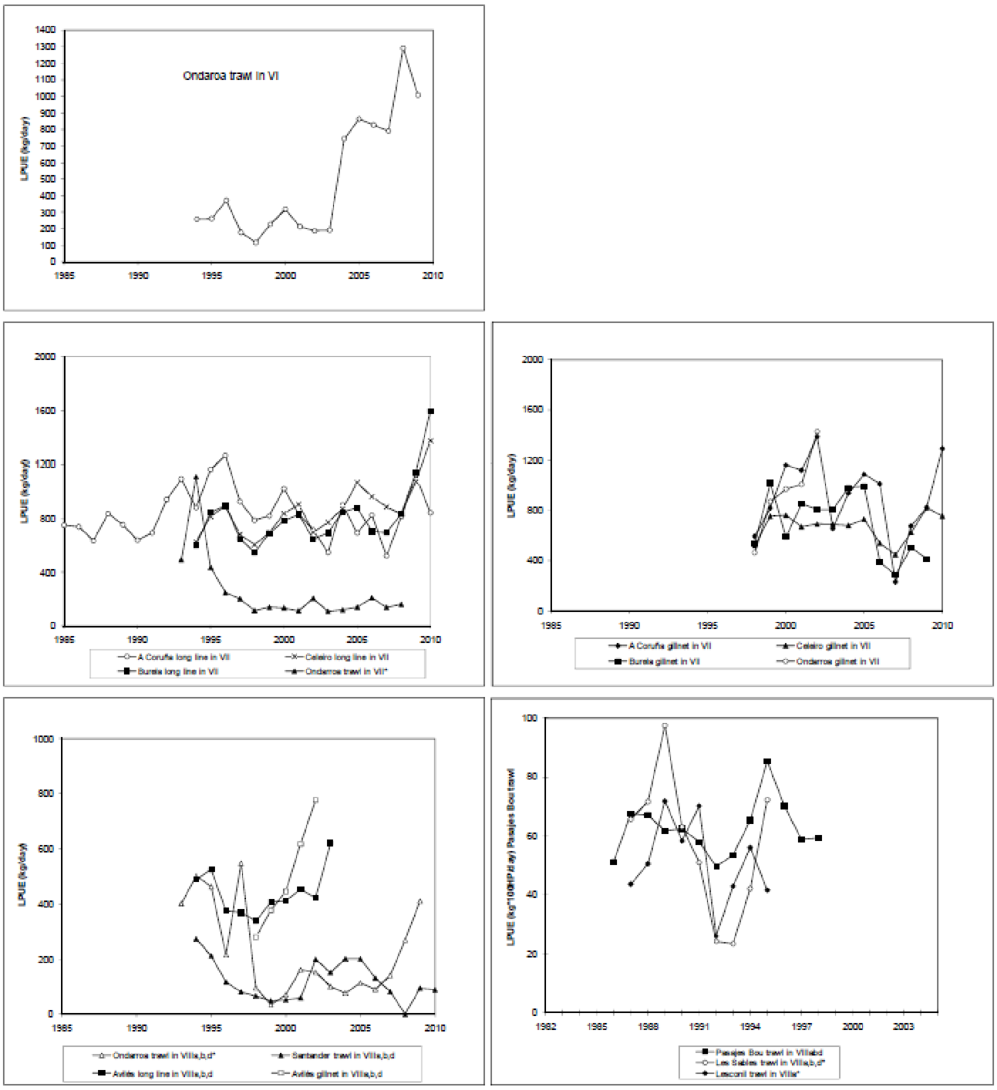


Figure 3.3b. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). LPUE and effort for commercial fleets.

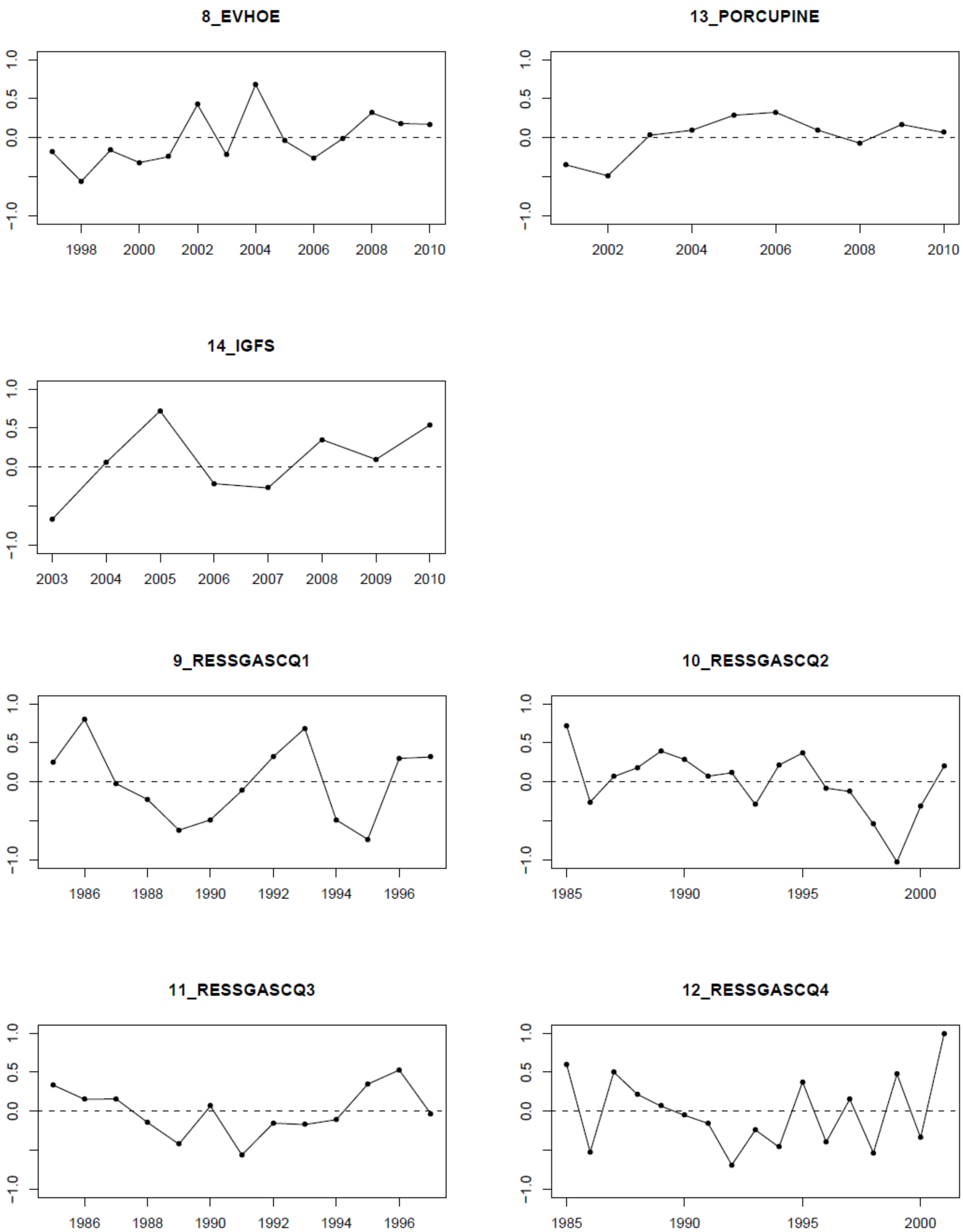


Figure 3.4. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Residuals of the fits to the surveys log(abundance indices). For RESSGASC, fits are by quarter.

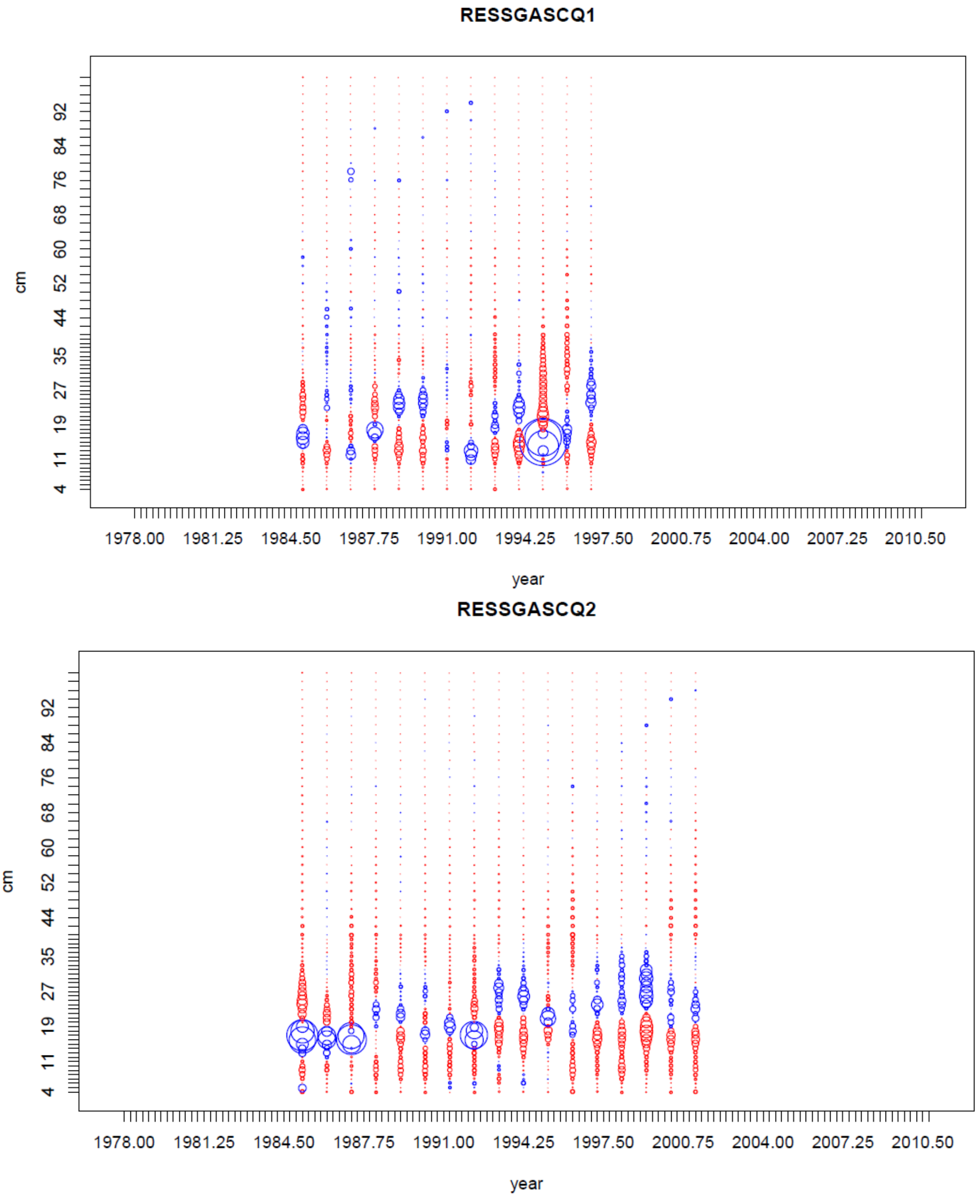


Figure 3.5. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Pearson residuals of the fit to the length distributions of the surveys abundance indices. For RESSGASC, fits are by quarter. Blue and red denote positive and negative residuals, respectively.

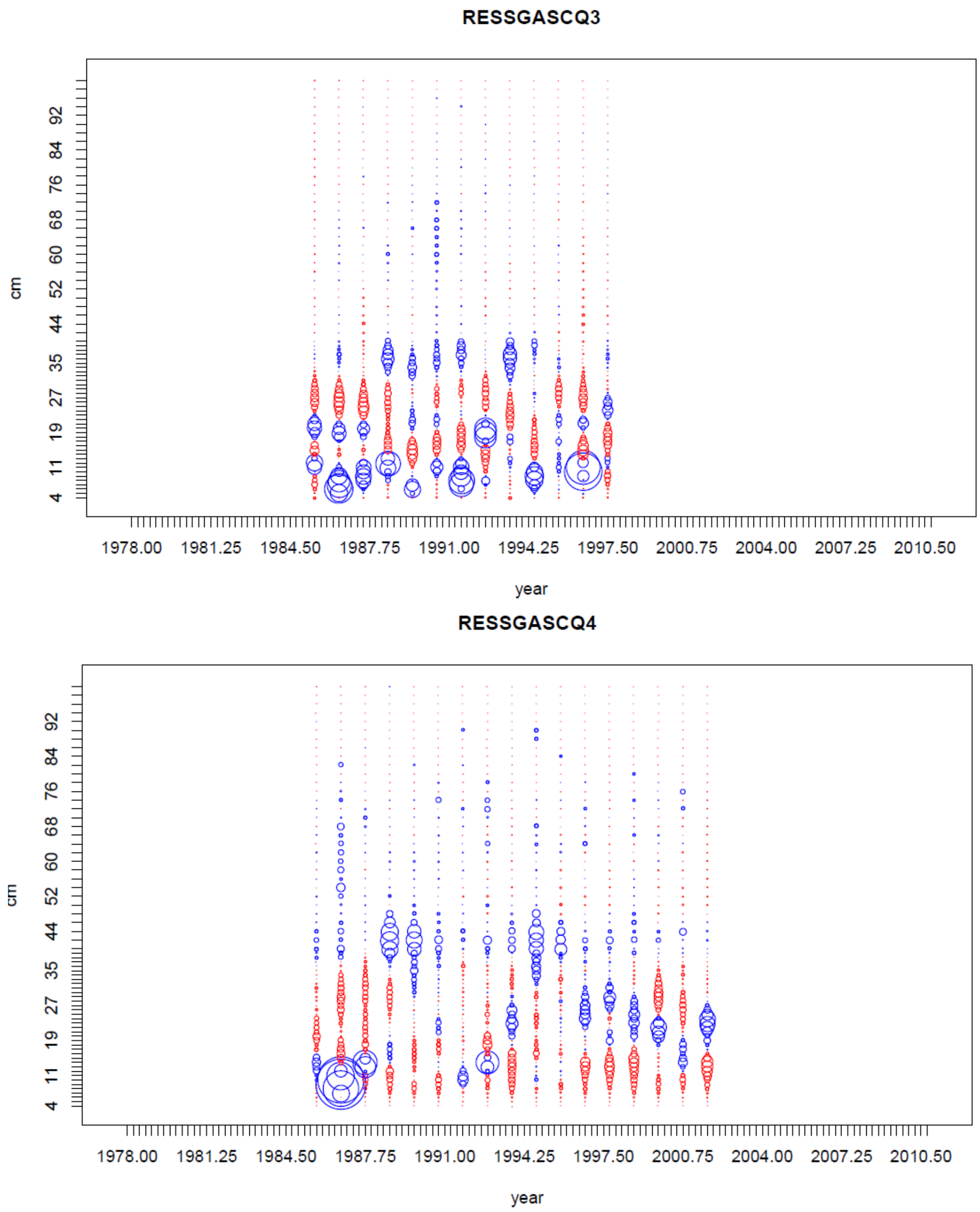


Figure 3.5 (continued). Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Pearson residuals of the fit to the length distributions of the surveys abundance indices. For RESSGASC, fits are by quarter. Blue and red denote positive and negative residuals, respectively.

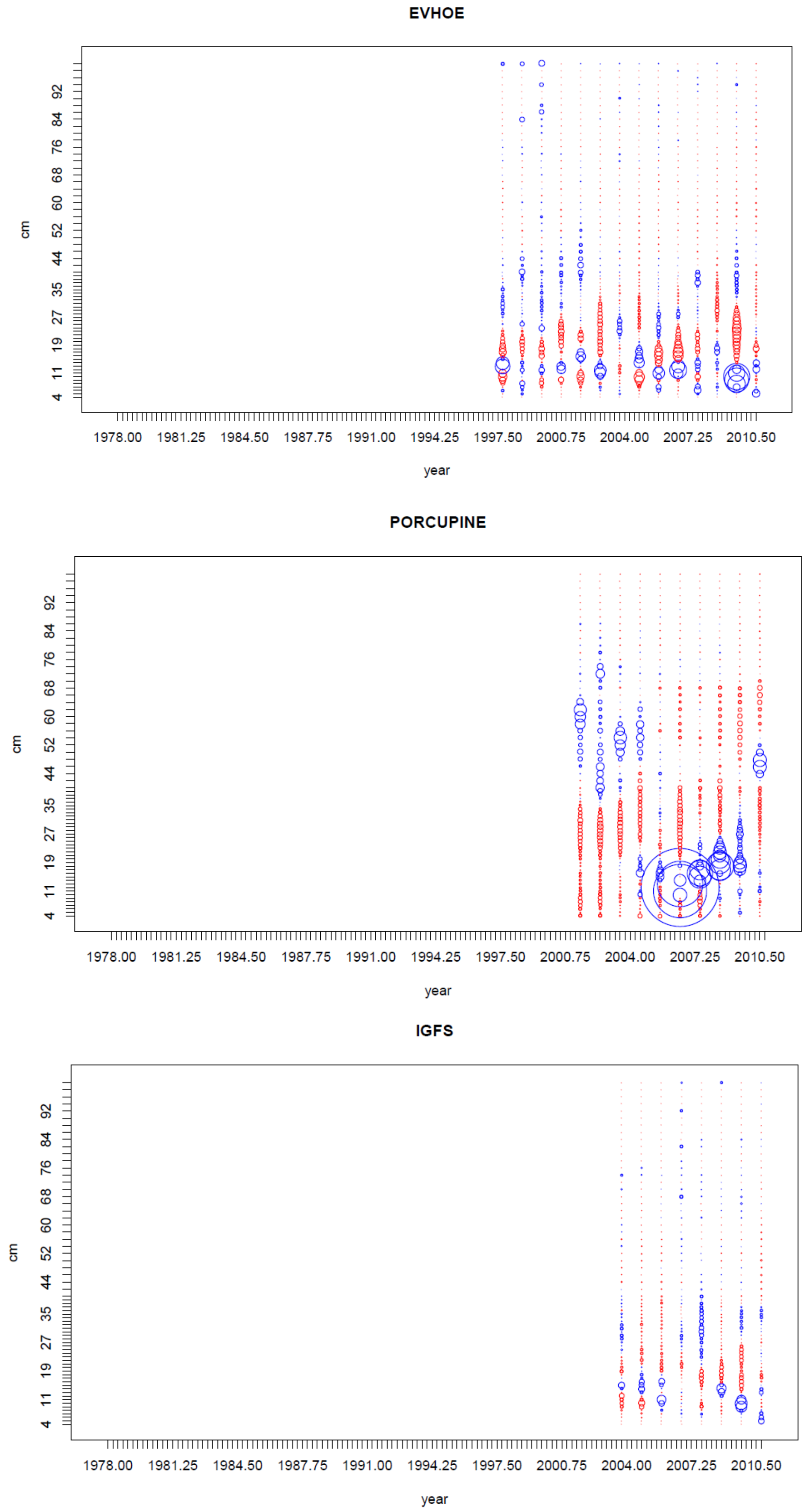


Figure 3.5. (continued) Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Pearson residuals of the fit to the length distributions of the surveys abundance indices. Blue and red denote positive and negative residuals, respectively.

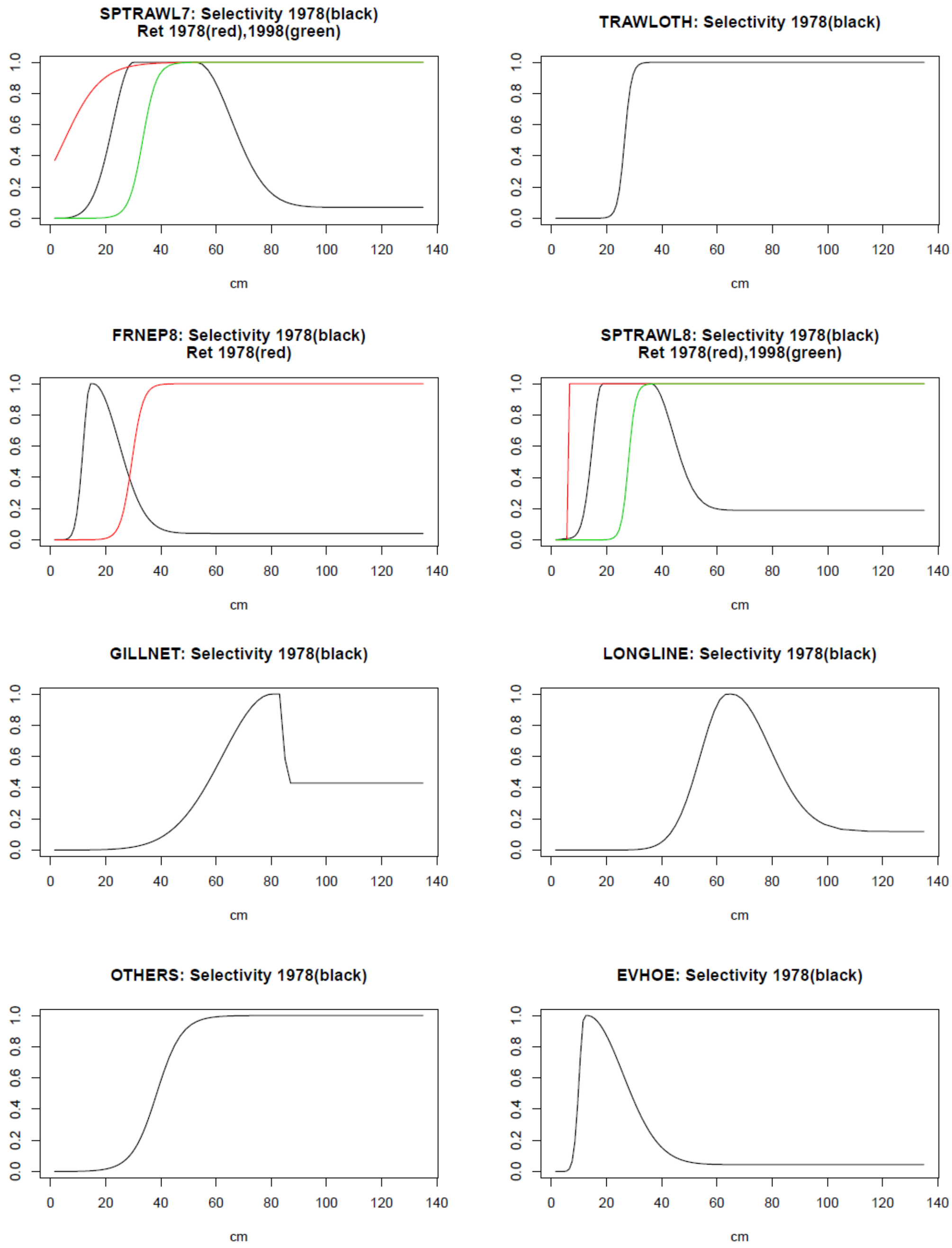


Figure 3.6. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Selection patterns and retention functions at length by fleet estimated by SS3.

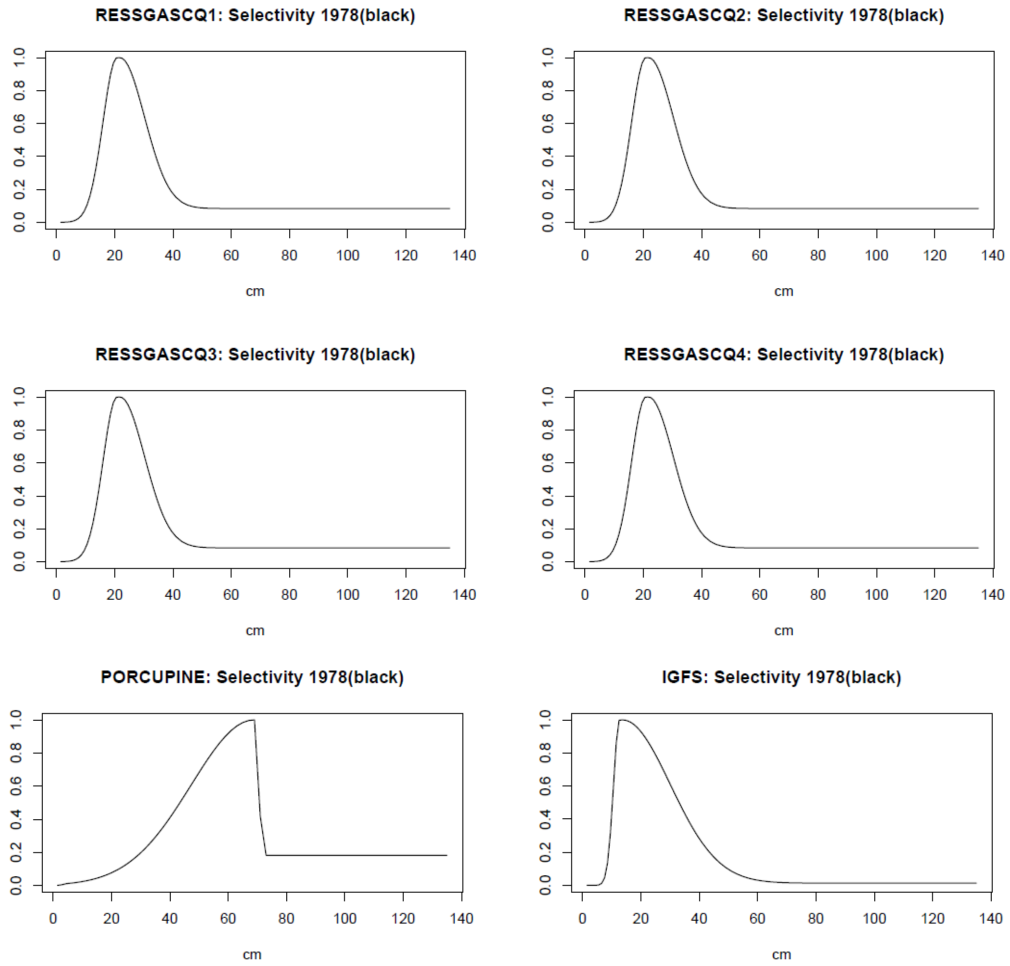


Figure 3.6 (continued). Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Selection patterns and retention functions at length estimated by SS3.

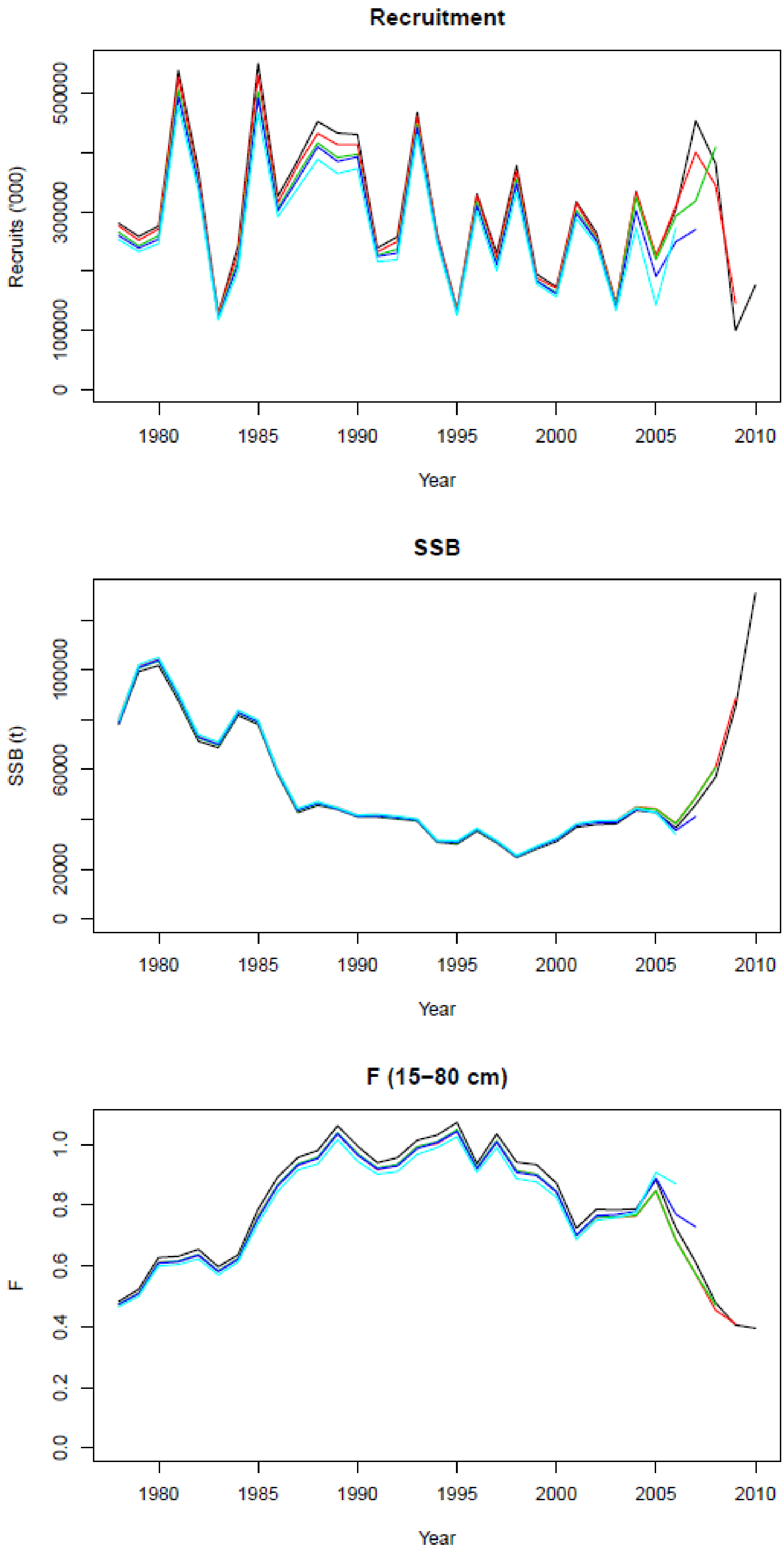


Figure 3.7. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Retrospective plot from SS3.

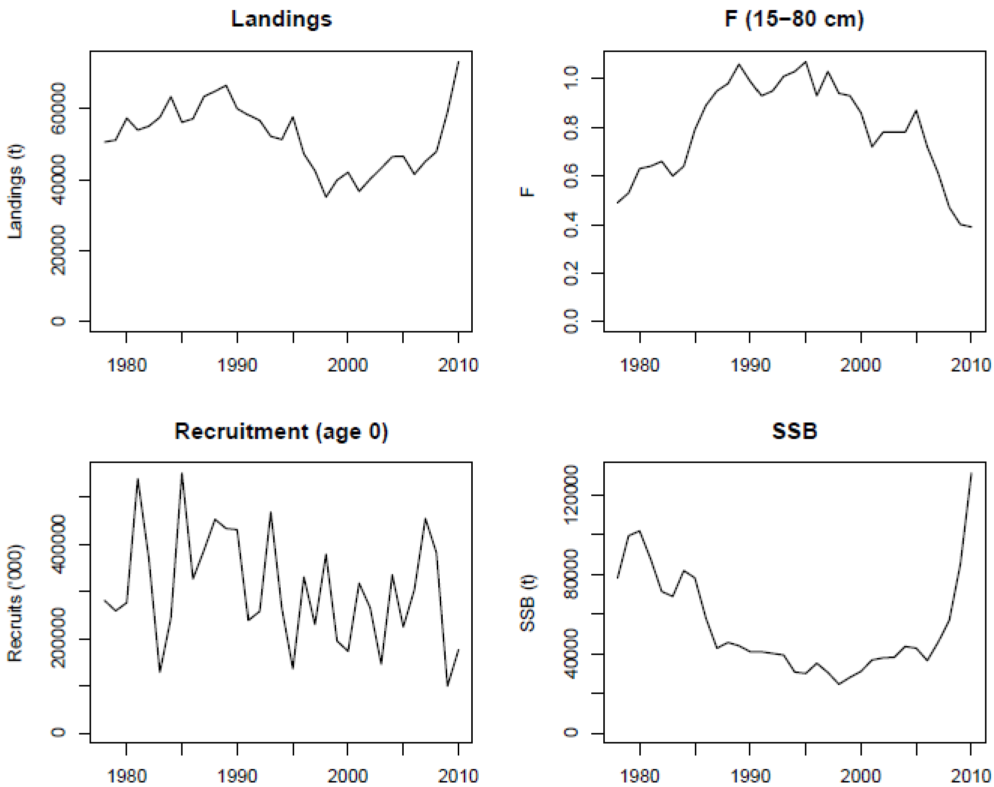


Figure 3.8. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Summary plot of stock trends.

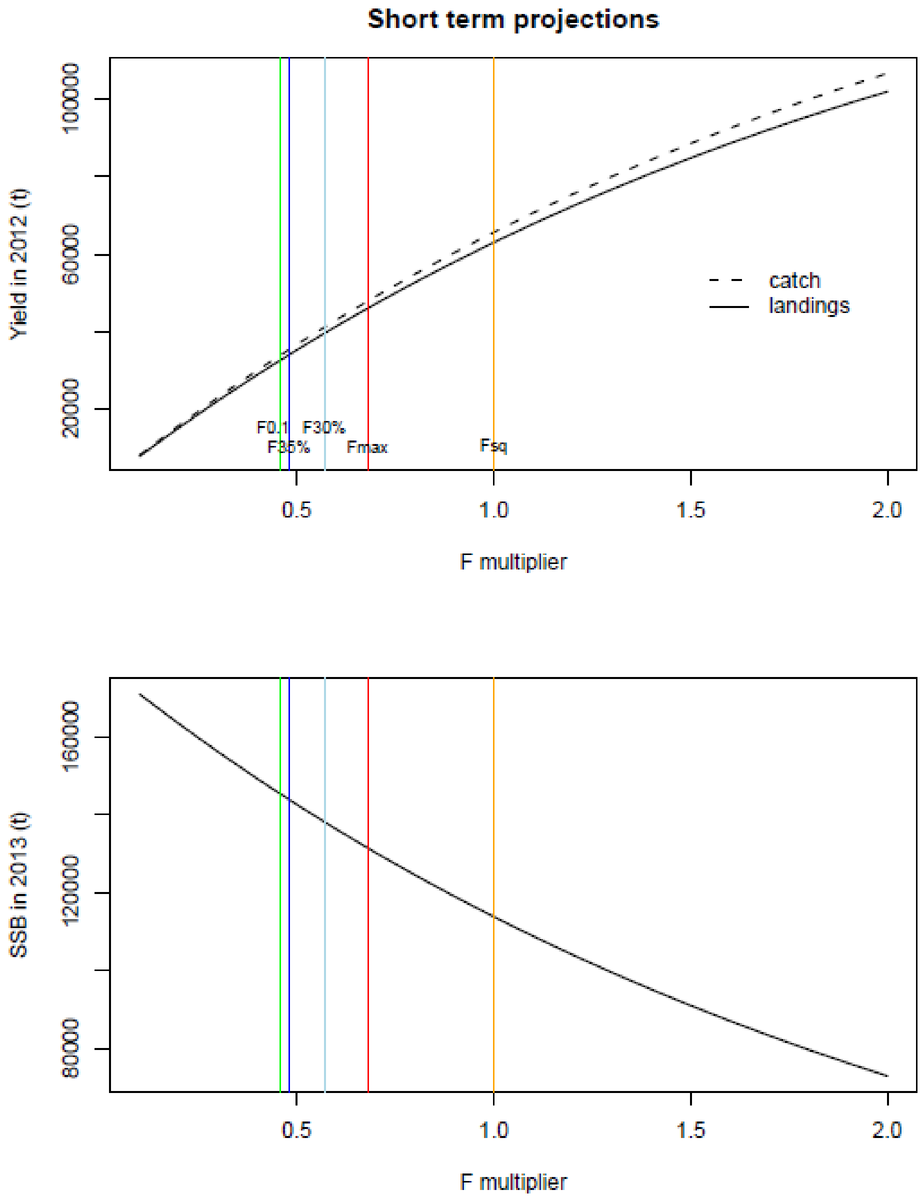
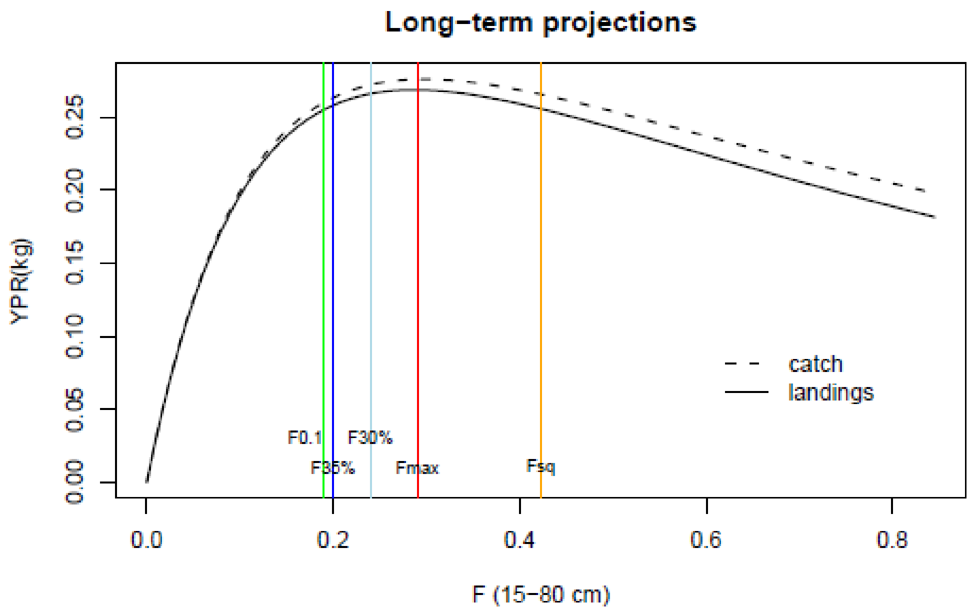


Figure 3.9. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Short term projections



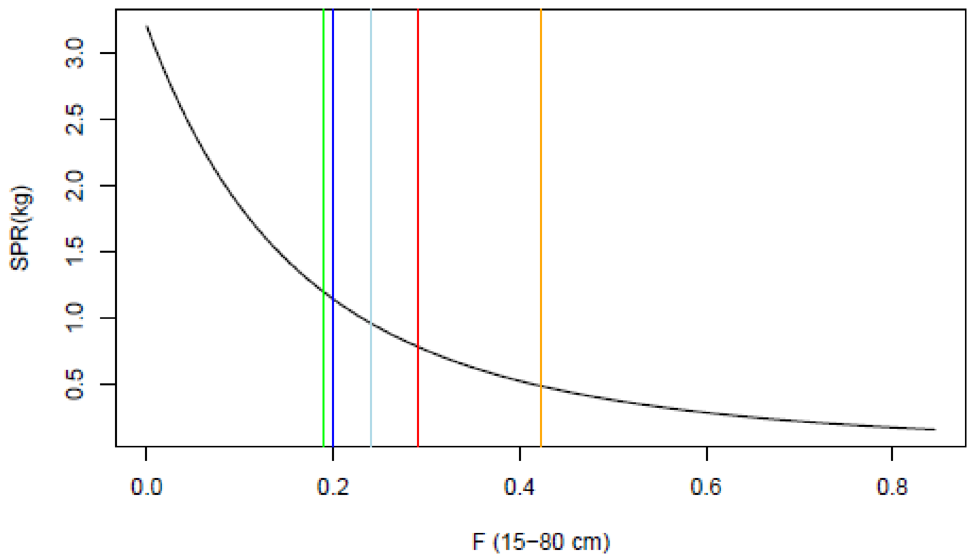


Figure 3.10. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Equilibrium yield and SSB per recruit.

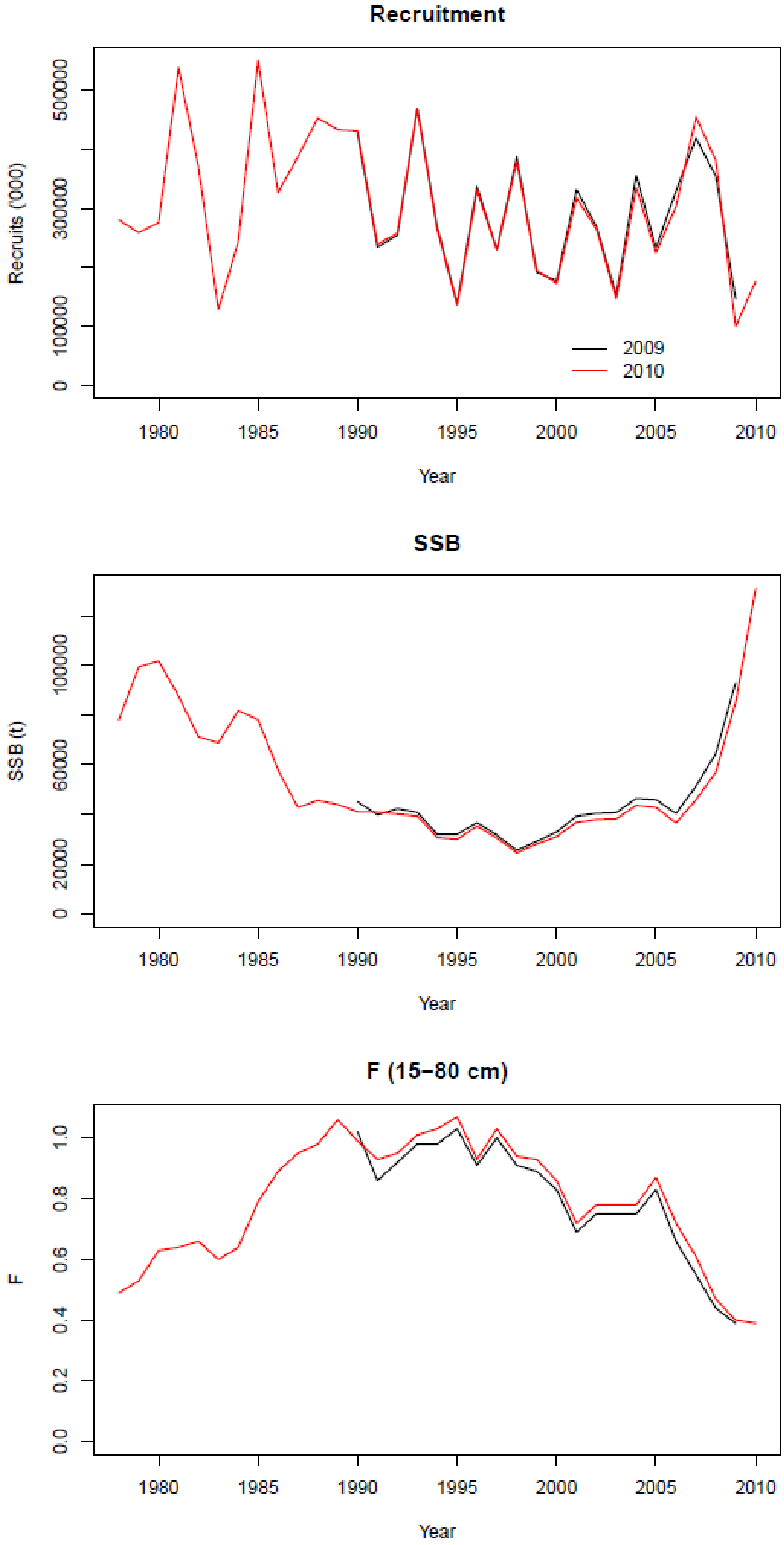


Figure 3.11. Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock). Comparison of assessment (red line: 2011 assessment; black line: 2010 benchmark assessment).

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

There was no accepted assessment for either *L. piscatorius* or *L. budegassa* in 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. No new analytical assessment has been proposed since then.

L. piscatorius and L. budegassa:

Type of assessment in 2011: Same Advice as Last Year (SALY).

Data revisions this year: 2003-2008 landings series

Review Group issues:

Comments by the previous year's Review Group indicate that there is a problem with ageing these species. Problems with ageing need to be resolved to move forward with an analytical assessment for this stock or a length based model should be tested. Reference points should be defined for this stock.

This stock is targeted as part of a mixed fishery (hake, megrim, sole, cod, plaice, and *Nephrops*), however, this was not noted in the 2009 report. Ecosystem information was not considered in examination of stock trends, the WG agree but since very few ecosystem data is available nothing can be stated. Discards have not been reported for this stock; however, preliminary information indicates an increasing proportion of small fish of both species are discarded in the fishery. There is a plan to evaluate the methodology of discard estimation as it is thought to overestimate discard levels (problems with raising procedure).

Overall, LPUE and survey data indicate that biomass has increased since 2000 for both species, with a continued increase for *L. budegassa* and stable biomass for *L. piscatorius* in recent years. Length distribution data confirm that peaks in survey abundance are attributable to strong year classes. Recent commercial landings appear to be at or below the current TAC, however discards have not been included in the catch data.

A suitable assessment framework is needed to allow an integrated analysis of the fishery and survey information. The recent increase in recruitment, clearly defined as modes in the length compositions, provides an opportunity for validating ages. It will also allow an evaluation of statistical assessment methods that can handle length data.

A benchmark assessment is scheduled for 2012 (see Annex N for details about a review on benchmark preparation).

4.1 General

4.1.1 Summary of ICES advice for 2011 and management for 2010 and 2011

ICES advice for 2011

Effort in fisheries that catch anglerfish should not increase.

Management applicable for 2010 and 2011

The TAC applied to both species and including Division VIIa was set at 41 400 t for 2010 and at 40 950 t for 2011.

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.

4.1.2 Landings

There has been a revision of landings for 2003-2009 that had however little influence on the total international landings data.

French data providers have not been able to produce definitive landing estimates for 2009 and 2010 (Total or by FU) due to lack of validation of the segmentation algorithms of metiers.

Landings have increased since 2000 and have fluctuated around 33 000 t since 2003. The landings of both species combined were estimated at 32 174 t in 2008, 28 455 t in 2009 and 29 686 t in 2010 (Table 4.1-1).

4.1.3 Discards

Estimation of discards has been carried out by some countries. This information shows that an increasing proportion of small fish of both species are caught and discarded. However last year the WG noted that the raising procedure to be used must be given high attention as some estimates seemed unrealistically high. The WG recommended that prior to the next benchmark assessment raising methodology be provided and discussed prior to incorporation in the catch data.

Table 4.1-1. Anglerfish in Divisions VIIb-k and VIIIa,b,d -Total landings from 1984 to 2010 – Working Group estimates

Year	VIIb-k	VIIIa,b,d	Total
1977			19895
1978			23445
1979			29738
1980			38880
1981			39450
1982			35285
1983			38280
1984	28847	7909	36756
1985	28491	7161	35652
1986	25987	5897	31883
1987	22295	7233	29528
1988	22494	5983	28477
1989	24731	5276	30007
1990	23434	5950	29384
1991	20385	4684	25069
1992	17554	3530	21084
1993	16633	3507	20140
1994	18093	3841	21934
1995	21922	4862	26784
1996	24132	6102	30233
1997	23928	5846	29774
1998	23295	4876	28171
1999	21845	3143	24989
2000	18129	2456	20585
2001	19729	2875	22604
2002	22848	3571	26419
2003*	28552	4681	33233
2004*	29510	5640	35150
2005*	27908	5167	33075
2006*	26795	4823	31618
2007*	30873	5213	36086
2008*	27142	5032	32174
2009**	23262	5193	28455
2010**	24144	5542	29686

* revised

** preliminar (all in 2010, only for French data in 2009)

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

4.2.1 Data

4.2.1.1 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 4.2-1 *Lophius piscatorius* in Divisions VIIb-k and VIIIa,b,d - Landings in tonnes by Fishery Unit.

The landings have declined steadily from 23 700 t in 1986 to 12 800 t in 1992, then increased to 22 200 t in 1996 and declined to 13 900 t in 2000. The landings have increased since then reaching the maximum of the time series in 2007 (29 600 t). The 2008 value show a 17% drop at 24 600 t.

Preliminary landings data are presented for 2009 and 2010 since French data have been processed with new algorithms for automated assignation of metiers that are not yet fully tested. These preliminary data show a drop in landings to 19 000 t in 2009 and 19 500 in 2010.

The preliminary information on discards shows that an increasing proportion of small fish are caught and discarded (See WD3).

4.2.1.2 Commercial LPUE

Effort and LPUE data for the four Spanish fleets and English FU6 were available in 2010 (Table 4.2-2 *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d- Effort and LPUE dataand Figure 4.2-1 *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d- Effort and LPUE data). Fishing effort for most fleets show a decrease until the mid 1990's. Effort remained relatively stable thereafter.

All the commercial LPUE series decreased steadily until 1992. Since then, they have increased up to 2007 except for the 2 BAKA fleet. 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 a decreasing one.

4.2.1.3 Surveys data

4.2.1.3.1 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 in Figure 4.2-2 *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d- Evolution of the EVHOE-WIBTS-Q4 survey's indices Kg (left) and Nb (right) per 30 minutes tow from 1997 to 2010. and the length distributions in Figure 4.2-3 - *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d. Evolution of the EVHOE-WIBTS-Q4 Length distributions in Nb per 30 minutes tow from 1997 to 2010..

The biomass indices show a continuous increase from 2000 to 2007 and a decrease after then, with the 2010 index value in between those from 2000 and 2001. Abundance in numbers shows four peaks in 2001, 2002, 2004 and to a lower extent in 2008. Numbers in 2009 and 2010 are very similar to the 2008 results.

The length distribution shows that these peaks in abundance in numbers 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 and 2009), 25 – 45 for the second (2002, 2003, 2005, 2009 and 2010) and 45-55 for the third (2003, 2004, 2005 and 2010) although the third mode is not as clearly identified.

These year classes are now still present in the recent survey catches at bigger sizes and account for the high biomass index. The length distribution in 2009 and 2010 indicates two good recruitments at the level of 2008, although not as strong as in 2001, 2002 and 2004.

In Figure 4.2-4 and, Figure 4.2-5 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 for 2010 show a uniform distribution of recruits through the sampling area of the survey.

4.2.1.3.2 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 4.2-6 and the length distributions in Figure 4.2-7. 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 2008 problems with the survey gear affected its geometry. It is very difficult to assess how these changes in gear behaviour have affected abundance indices, apparently the effect has not been dramatic in any species, though in both species of the genus *Lophius* a remarkable decrease has been found. Monkfish biomass stratified abundance index is within the limits of the survey's time series, with values close to those found in the beginning of the series, while the stratified index in number is the lowest of the time series after three years of a slight but steady decrease. The recruitment in 2008 was approximated with the number of individuals smaller than 21 cm, and results continue being poor as in the previous four years since 2005. For 2009 results were very similar to the ones from 2008 for all the parameters studied.

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

Abundance indices in Nb/sqKm from this survey are given in Table 4.2-3. They show 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 a value close to 2004 maximum has been found. Due to the overall low number caught in some years the length distributions are not presented.

4.2.1.3.4 The English Fisheries Science Partnership survey.

This survey covers Areas VIIe & VIIf. Trends in biomass and abundance are not presented as more detailed analysis of trends in abundance and biomass will be prepared in time for the next benchmark assessment, when factors such as size class and substrate type will be investigated.

Length distribution of *L. piscatorius* catches are available and presented in Figure 4.2-8. Here again the high recruitment of 2004 is detected and can be easily tracked in 2005 with a mode at 25-45 cm and in 2006 with a mode at 45-60 cm, as in the EVHOE-WIBTS-Q4 survey. The pulse of recruitment observed in the EVHOE-WIBTS-Q4 survey in 2008 was also present in the FSP-ENG-MONK survey. For 2009 the highest value of the series for recruitment was recorded by the survey and the good recruitment for 2008 was tracked too. In 2010 three different modes are evident corresponding to a good recruitment and the surviving individual from 2008 and 2009 recruitments.

4.2.2 Conclusion

LPUE's, survey data (biomass and abundance indices, 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 and 2010.

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

Preliminary information on discards shows that an increasing proportion of small fish are caught and discarded.

Measures should be taken to ensure good survival of the good incoming recruitments.

4.2.3 Comments on the assessment

Data from surveys tracking recent good recruitment give scope for growth studies and ageing validation that should be initiated as soon as possible.

Table 4.2-1 ***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)	Other	Neph.Trawl (Unit 9)	Shallow Trawl (Unit 10)	Medium/Deep Trawl (Unit 14)	Unallocated	TOTAL VII +VIII
1986	429	13781	2877	1437	1021		746	720	2657		23666
1987	560	11414	2900	1520	787		1035	542	3152		21909
1988	643	9812	3105	1814	774		927	534	2487		20095
1989	781	8448	5259	2342	754		673	444	1772		20474
1990	1021	8787	3950	1736	880		410	391	2578		19753
1991	1752	7565	2806	1196	752		284	218	1657		16229
1992	1773	6254	1489	1052	887		254	166	942		12818
1993	1742	5776	2125	1281	969		360	278	950		13481
1994	1377	7344	2595	1523	1236		261	198	1586		16120
1995	1915	8461	3195	1805	1242		501	429	1954	228	19730
1996	2244	9796	2637	2189	1149	138	441	379	2229	938	22141
1997	2538	9225	2945	2031	964	39	429	376	2045	1068	21660
1998	3398	8714	2138	1722	812	3	397	149	1699	542	19572
1999	3162	8419	2369	1407	780	19	98	116	1259	0	17630
2000	2034	7076	1642	1457	726	5	91	77	863	0	13972
2001	2002	8040	2293	1982	886	17	146	76	1402	0	16845
2002	2719	9626	2609	1836	915	5	247	96	1908	0	19961
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	15588	2382	2836	660	11	286	244	3015	0	29616
2008*	5107	11974	1885	1990	491	10	227	325	2573	1	24584
2009**	3957	10119	358	1880	48	16	221	0	2153	275	19024
2010**	3398	9863	539	2484	21	31	301	0	2373	504	19513

* revised

** preliminar (all in 2010, only for French data in 2009)

Table 4.2-2 ***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	6875	9527	418	N/A	123	N/A	N/A	N/A	N/A
1987	6662	10453	349	N/A	199	N/A	N/A	N/A	N/A
1988	6547	10886	334	N/A	150	N/A	N/A	N/A	N/A
1989	7585	10483	378	N/A	187	N/A	N/A	N/A	N/A
1990	8021	9630	380	N/A	208	N/A	N/A	N/A	N/A
1991	7822	8522	380	N/A	210	N/A	N/A	N/A	N/A
1992	6370	5852	331	N/A	186	N/A	100	N/A	N/A
1993	5988	5001	274	N/A	159	N/A	114	1094	5590
1994	5655	4990	249	N/A	148	N/A	116	980	5619
1995	5070	4403	287	N/A	174	N/A	127	1214	4474
1996	5416	3746	196	121	144	19	126	1170	4378
1997	5058	3738	178	133	133	33	126	540	4286
1998	5360	3684	182	134	117	40	121	1196	3002
1999	5084	3512	110	110	83	59	115	1384	2337
2000	5519	2773	165	104	87	49	104	1850	2227
2001	5678	2356	135	133	61	66	186	1451	2118
2002	5041	2258	116	120	57	75	111	949	2107
2003	5437	2597	147	136	68	81	166	1022	2296
2004	5347	2292	160	133	78	89	174	910	2159
2005	5246	2120	127	137	83	121	109	544	2263
2006	5392	2257	140	145	72	101	94	487	2398
2007	5952	2323	149	152	48	127	97	476	2098
2008	5840	1640	118	126	58	113	138	105	2017
2009	5852	1626	N/A	N/A	N/A	N/A	75	0	1807
2010**	5607	1988	N/A	N/A	N/A	N/A	77	138	1358

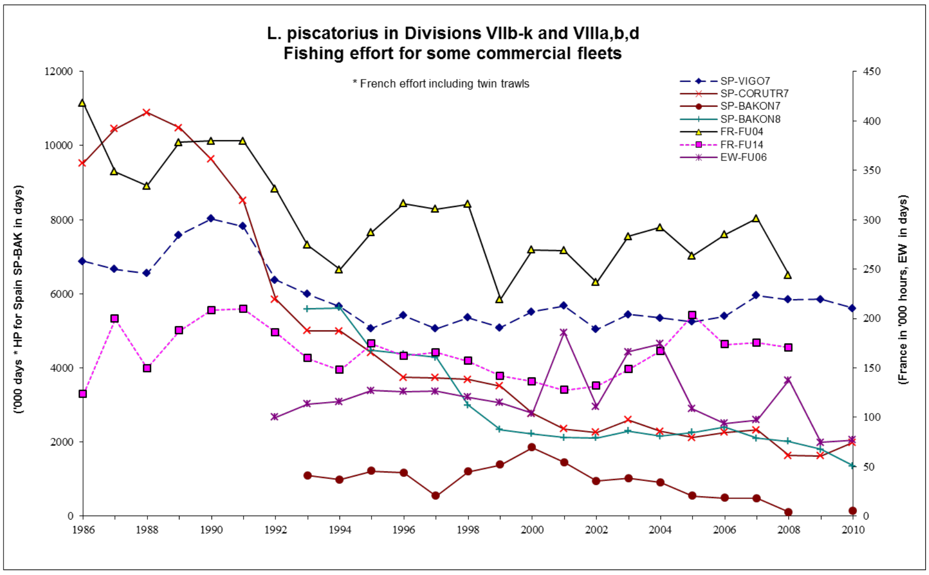
LPUE	Vigo in Sub-Area VII (kg/days*HP)	La Coruna in Sub-Area VII (kg/days*HP)	French Benthic trawlers* Celtic Sea FU04 (kg/10 hrs)	French Benthic Twin Trawls Celtic Sea (kg/10 hrs)	French Benthic trawlers* Bay of Biscay FU14 (kg/10 hrs)	French Benthic Twin Trawls Bay of Biscay (kg/10 hrs)	EW (FU06) Beam trawlers in VII (kg/10 days)	SP-BAKON7 (kg/day)	SP-BAKON8 (kg/day)
1986	286	383	143	N/A	131	N/A	N/A	N/A	N/A
1987	235	326	142	N/A	119	N/A	N/A	N/A	N/A
1988	182	272	132	N/A	110	N/A	N/A	N/A	N/A
1989	210	236	102	N/A	61	N/A	N/A	N/A	N/A
1990	206	228	104	N/A	85	N/A	N/A	N/A	N/A
1991	184	234	82	N/A	55	N/A	N/A	N/A	N/A
1992	188	200	56	N/A	35	N/A	94	N/A	N/A
1993	268	172	60	N/A	42	N/A	93	60	23
1994	289	187	111	N/A	75	N/A	81	73	44
1995	410	131	131	N/A	84	N/A	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	627	409	233	214	118	151	202	261	71
2008	465	542	214	190	97	122	106	171	101
2009	339	252	N/A	N/A	N/A	N/A	198		144
2010**	321	281	N/A	N/A	N/A	N/A	250	217	132

* Identified twin trawls excluded

** preliminary

Table 4.2-3 - ***L. piscatorius*** **in Divisions VIIb-k and VIIIa,b,d– Abundance indices in Nb/sq Km from 2003 to 2010from the IGFS-WIBTS-Q4.**

Year	2003	2004	2005	2006	2007	2008	2009	2010
Nb/sqKm	68.7	91.8	64.0	32.1	21.1	18.7	44.6	83.6



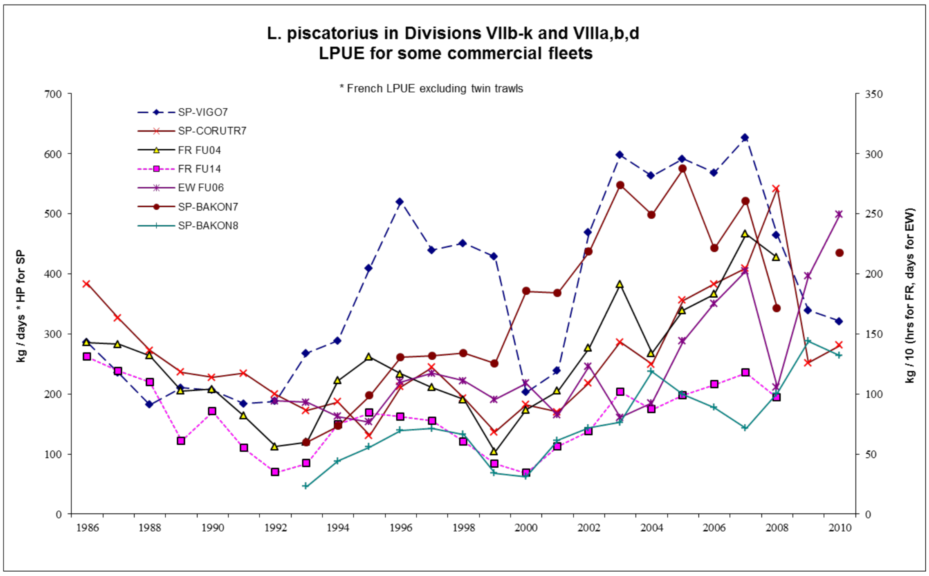
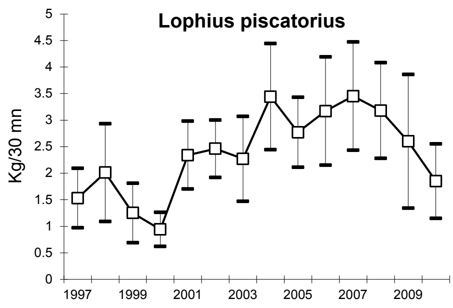


Figure 4.2-1 ***L. piscatorius*** **in Divisions VIIb-k and VIIIa,b,d- Effort and LPUE data**



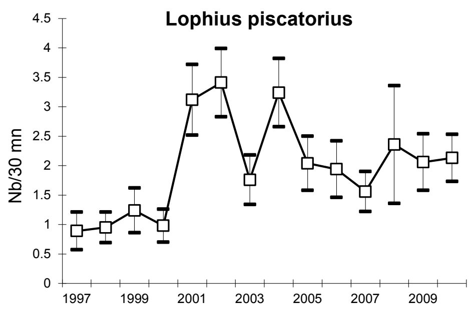


Figure 4.2-2 ***L. piscatorius*** **in Divisions VIIb-k and VIIIa,b,d- Evolution of the EVHOE-WIBTS-Q4 survey's indices Kg (left) and Nb (right) per 30 minutes tow from 1997 to 2010.**

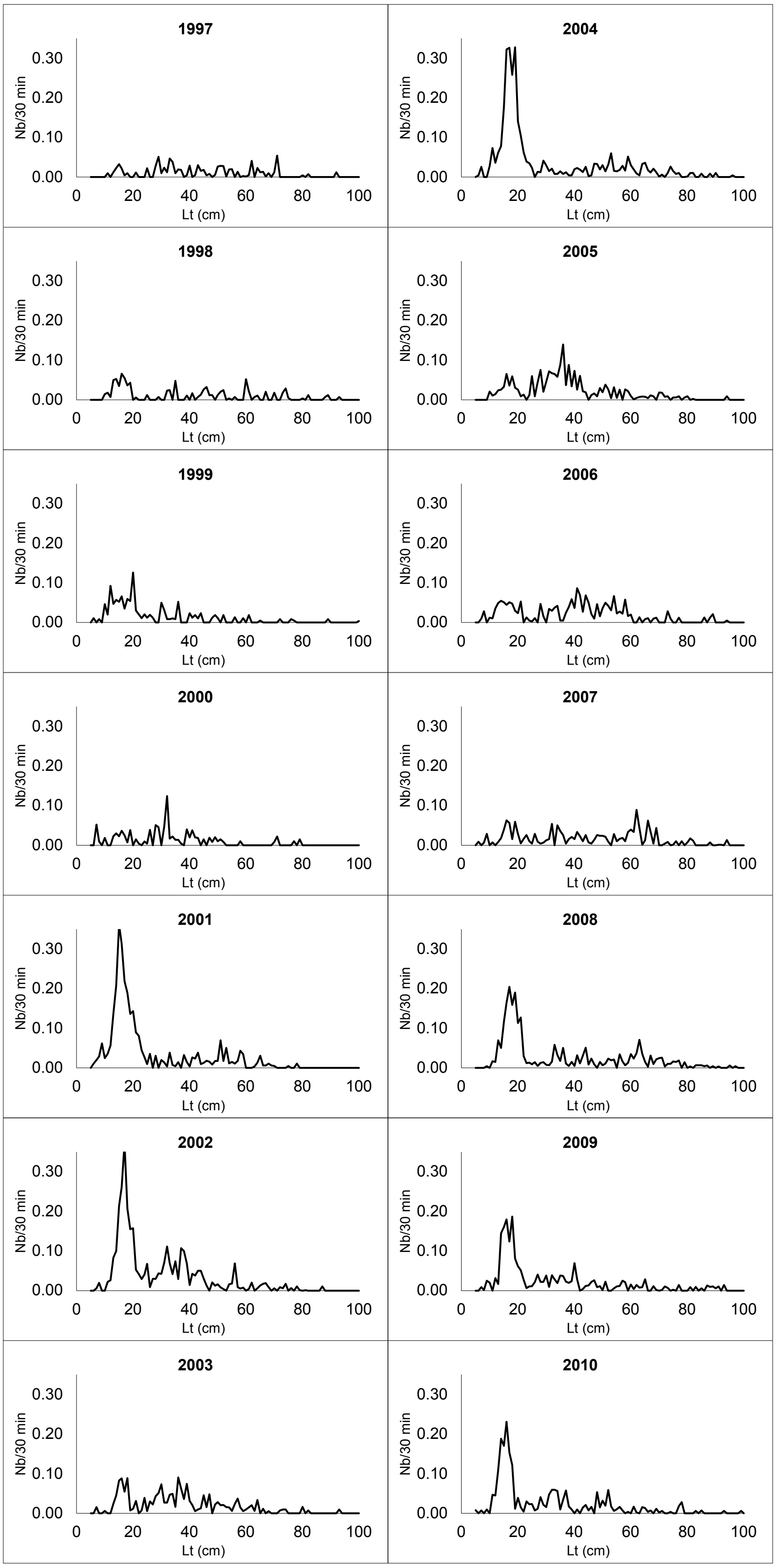


Figure 4.2-3 - ***L. piscatorius*** **in Divisions VIIb-k and VIIIa,b,d. Evolution of the EVHOE-WIBTS-Q4 Length distributions in Nb per 30 minutes tow from 1997 to 2010.**

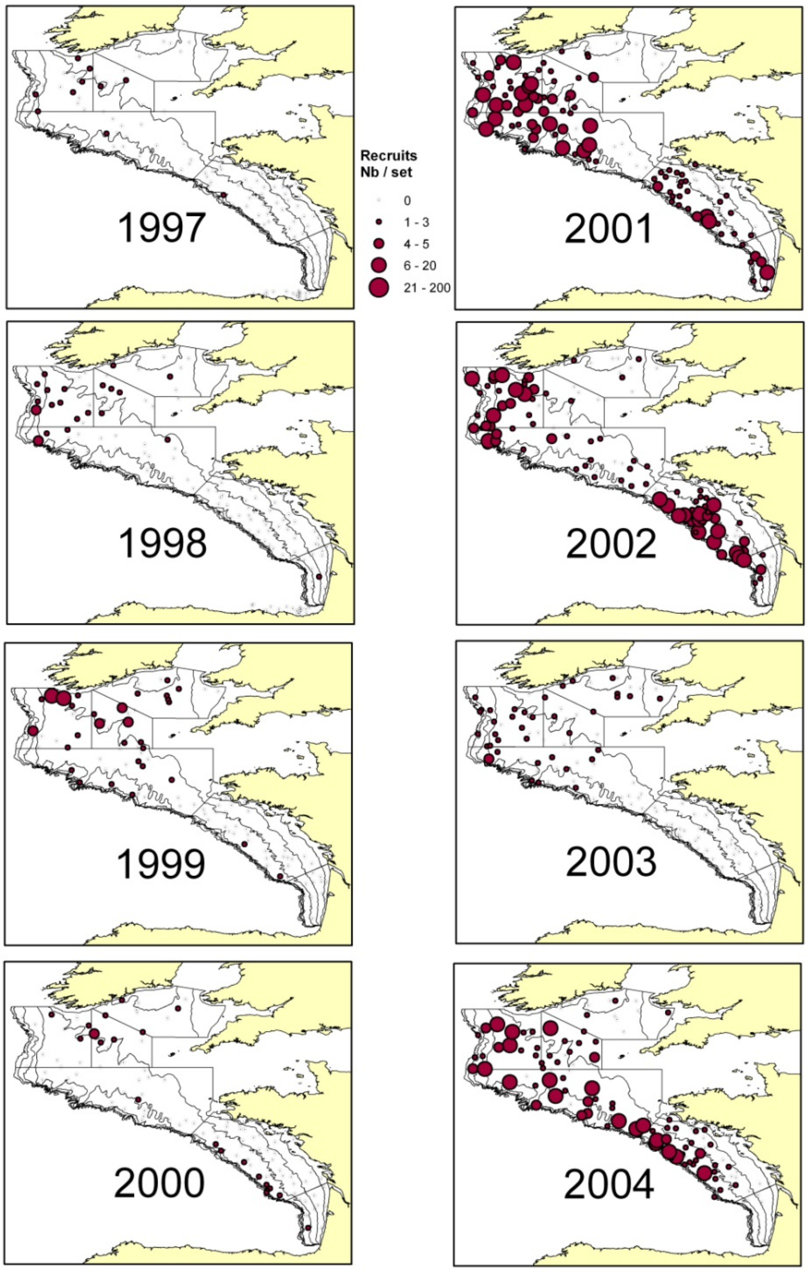


Figure 4.2-4 – *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d, distribution of recruits (lt < 23 cm) in Nb per 30m observed in the EVHOE-WIBTS-Q4 surveys from 1997 to 2004.

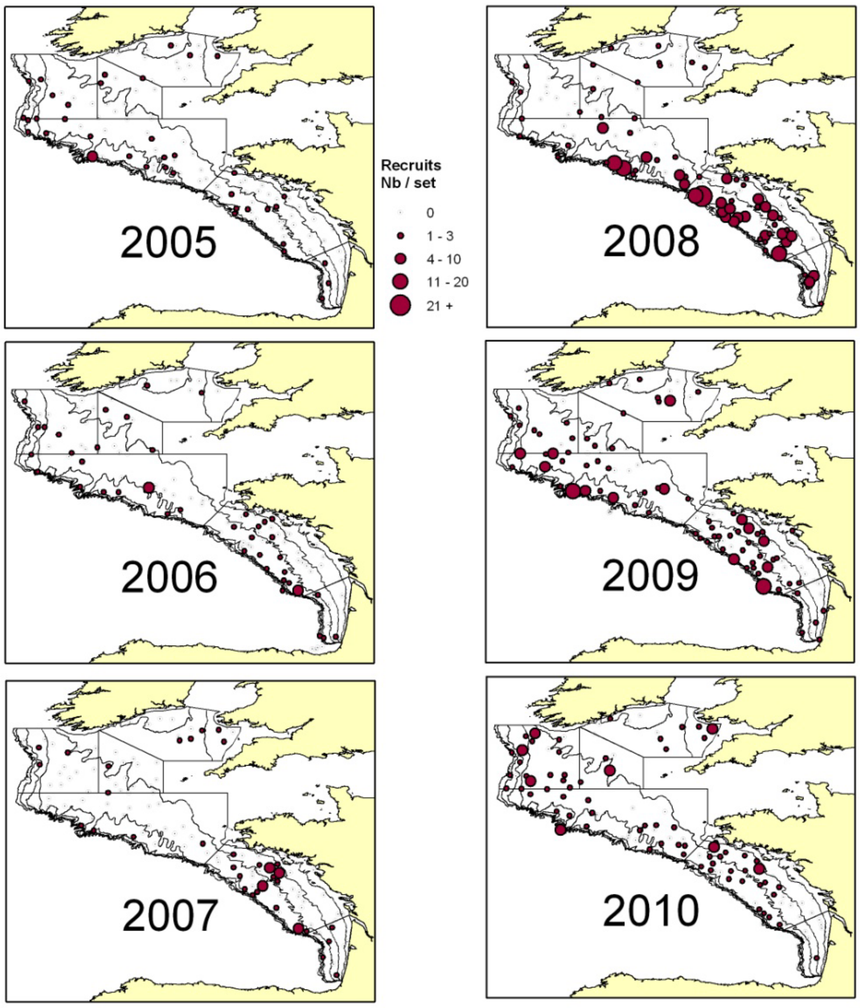


Figure 4.2-5 – *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d, distribution of recruits (lt < 23 cm) in Nb per 30m observed in the EVHOE-WIBTS-Q4 surveys from 2005 to 2010.

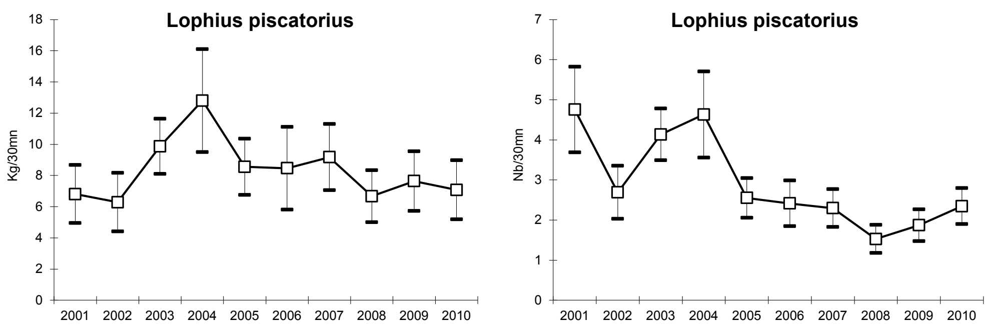


Figure 4.2-6 - *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d- Evolution of the SPPGFS (WIBTS-Q4) survey's indices Kg (left) and Nb (right) per 30 minutes tow from 2001 to 2010.

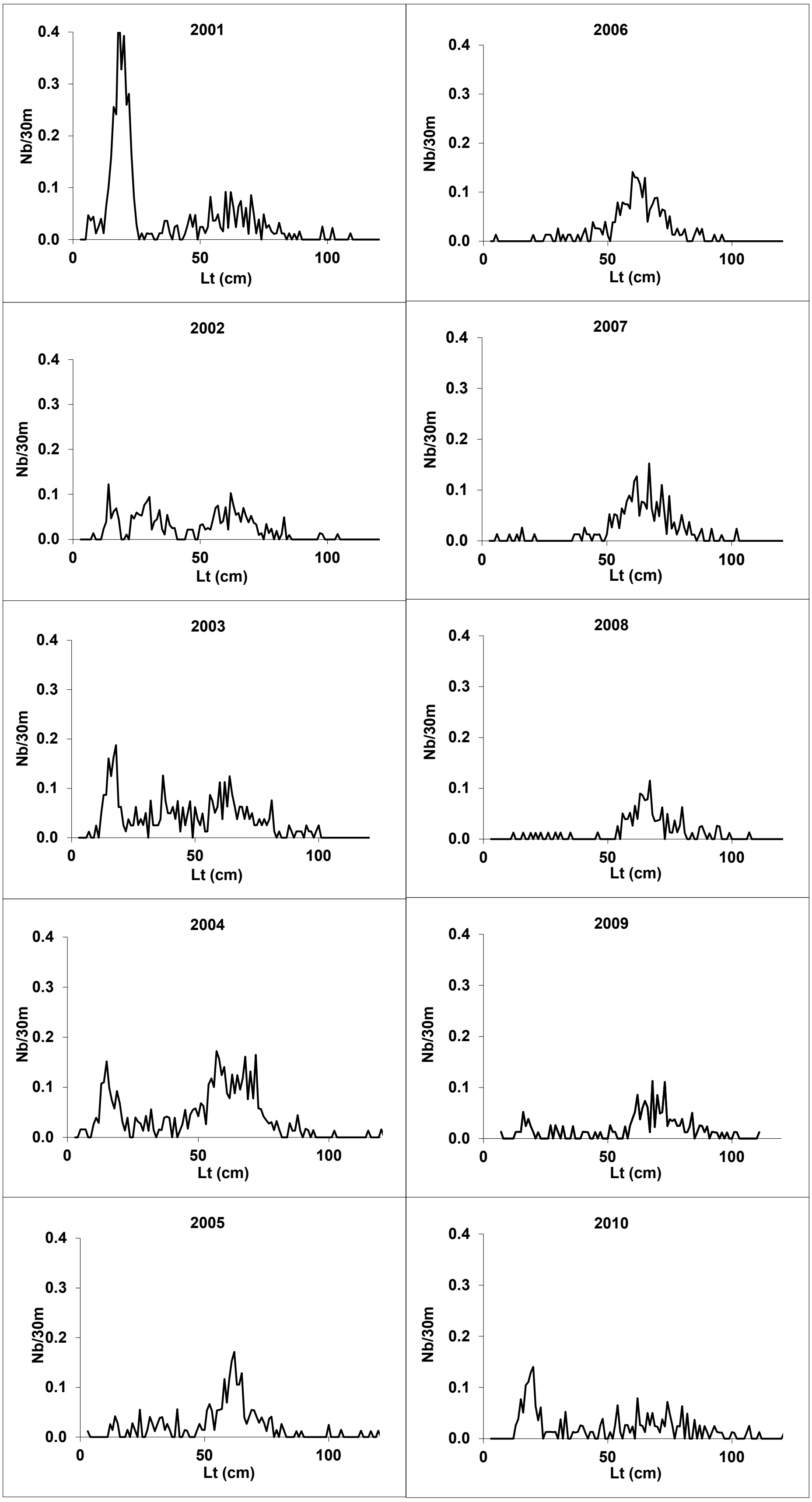


Figure 4.2-7 - ***L. piscatorius*** **in Divisions VIIb-k and VIIIa,b,d- Evolution of the SPPGFS (WIBTS-Q4) Length distributions in Nb per 30 minutes tow from 2001 to 2010**

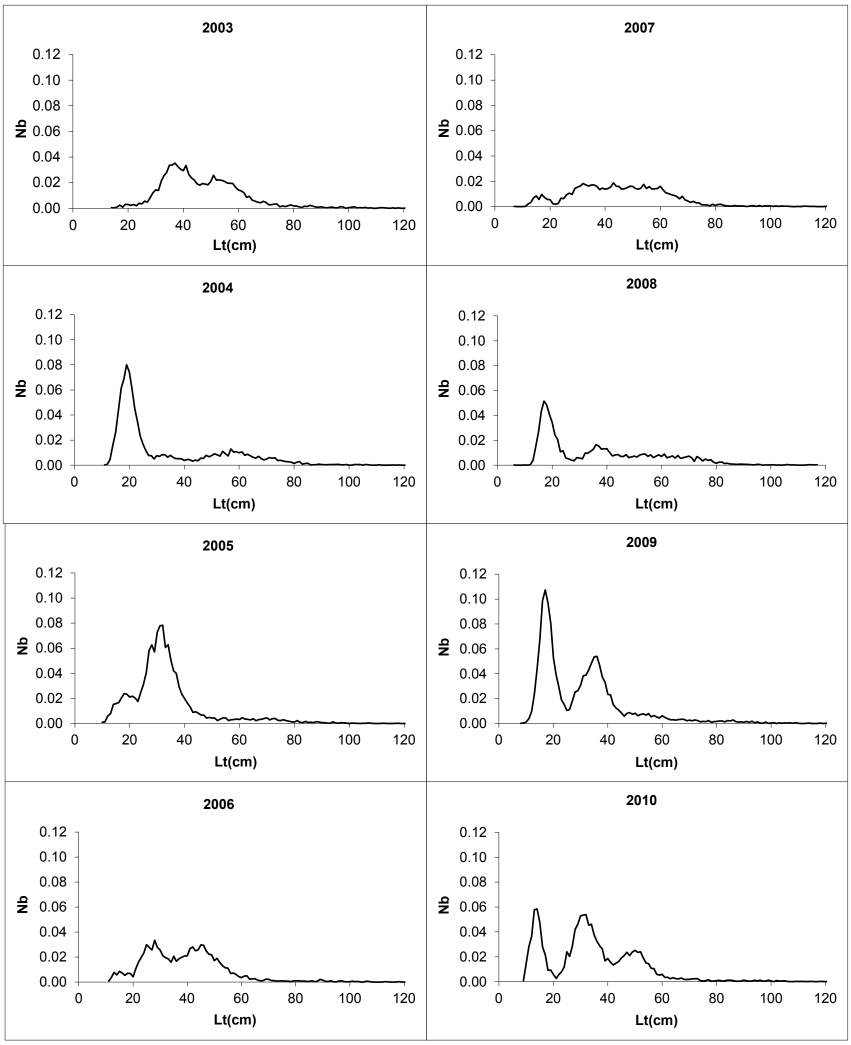


Figure 4.2-8 - *L. piscatorius* in Divisions VIIb-k and VIIIa,b,d- Evolution of the FSP-ENG-MONK Length distributions in Nb per meter beam per hour tow from 2003 to 2010

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

4.3.1 Data

4.3.1.1 Commercial Catch

The Working Group estimates of landings of *L. budegassa* by fishery unit (defined in Section 2) are given in Table 4.3-1.

The landings have fluctuated all over the studied period between 5 700 t to 9 600 t with a succession of high (1989-1992, 1996-1998 and 2003) and low values (1994, 2001 and 2006). The total estimated landings have dropped from 2003 to 2006 and since then are rising showing the series maximum in 2010 with 10 200 t landed.

Landings data for 2009 and 2010 have to be considered preliminary since French data have been processed with new algorithms for automated assignation of metiers that are not yet fully tested.

The preliminary information on discards shows that an increasing proportion of small fish are caught and discarded (see WD3).

4.3.1.2 Commercial LPUE

Effort and LPUE data were available in 2010 for the four Spanish fleets and for the English EW-FU06 (Table 4.3-2 and Figure 4.3-1**Error! Reference source not found.**). Fishing effort for most fleets shows a decrease until the mid 1990'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.

LPUEs from SP-VIGOTR7 and SP-BAKON7 show the same increasing trend from 1993 to 2000. Since then LPUEs have fluctuated with some conflicting trends for some fleets in the most recent period. In the last three years SP-VIGO7 and EW-FU06 have shown an increasing trend, while SP-BAKON7 and SP-BAKON8 are stable. In 2010 SP-CORUTR7 increased 7 times with respect to its 2003-2009 level without a known reason.

4.3.1.3 Surveys data

4.3.1.3.1 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 4.3-2. 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 and a decrease since then, returning in 2010 to average 2003-2005 levels. The abundance index shows a similar pattern to reach its highest values in the time series in 2008. In 2009 and 2010 the indices returned to 2004-2005 levels.

The length distributions (Figure 4.3-3.) 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 (2004, 2005 and 2006), 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 for recruitment nor the signal from 2008 strong recruitment can be followed. In 2010 a medium level recruitment has been found.

The localisation of juveniles (individuals smaller 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 4.3-4 and Figure 4.3-5). However, in 2008, juveniles are also found in the more southern area of the Bay of Biscay in deeper waters. In 2009 and 2010 the normal pattern was found again.

4.3.1.3.2 The English Fisheries Science Partnership survey.

This survey covers Areas VIIe & VIIf. Trends in biomass and abundance are not presented as more detailed analysis of trends in abundance and biomass will be prepared in time for the next benchmark assessment, when factors such as size class and substrate type will be investigated.

Length distribution of *L. budegassa* catches are available and presented in Figure 4.3-6. 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.

For 2009 the English survey has recorded its historical maximum for recruitment and the good recruitment from 2008 can be followed very well. In 2010 the recruitment found 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 recruitment signal according to this survey on the following year. This gives rise to the hypothesis that the first mode in the length frequency distribution of this survey might correspond to age 1 rather than to age 0 individuals (see WD04).

4.3.1.3.3 Other surveys

The other surveys (IGFS-WIBTS-Q4 and SPPGFS (WIBTS-Q4)) are covering areas mostly outside the preferred area of distribution of the species. Therefore information is too scarce to be presented.

4.3.2 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 from 2008 data and perhaps contradictory signals for 2009 and 2010 recruitment from the two available surveys (note however the point made above about possible different recruitment ages for both surveys).

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

Preliminary information on discards shows that an increasing proportion of small fish are caught and discarded.

Measures should be taken to ensure good survival of recent recruitment.

4.3.3 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 three years in English Fisheries Science Partnership.

Table 4.3-1 ***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)	Other	Neph.Trawl (Unit 9)	Shallow Trawl (Unit 10)	Medium/Deep Trawl (Unit 14)	Unallocated	TOTAL VII +VIII
1986	23	5126	348	540	406	0	443	150	1181	0	8217
1987	30	3493	696	462	434	0	483	116	1904	0	7619
1988	34	4072	1095	751	394	0	435	102	1498	0	8382
1989	40	4398	976	1217	515	0	446	112	1829	0	9533
1990	53	4818	631	905	653	0	550	156	1865	0	9632
1991	88	4414	921	384	507	0	475	117	1933	0	8840
1992	90	4808	301	305	594	0	459	191	1518	0	8266
1993	93	3415	429	405	399	0	433	101	1385	0	6659
1994	70	2935	265	209	540	0	232	49	1515	0	5814
1995	110	3963	455	159	617	0	312	62	1286	90	7053
1996	118	4587	477	245	524	28	374	109	1239	392	8092
1997	134	4836	602	132	474	9	313	17	1128	471	8114
1998	179	5565	246	230	288	1	258	72	1454	305	8599
1999*	18	4928	119	285	338	0	144	76	1450	0	7359
2000*	57	4480	161	261	228	0	124	31	1270	0	6613
2001*	41	3796	107	260	306	0	121	29	1100	0	5759
2002*	30	4327	147	251	382	0	112	14	1195	0	6458
2003*	92	5748	337	342	376	5	195	26	1248	0	8368
2004*	122	4684	242	343	376	0	254	9	1407	0	7436
2005*	73	4837	162	409	329	0	235	56	1431	0	7532
2006*	9	3661	145	271	218	0	286	1	1128	1	5720
2007*	92	3987	168	306	250	0	243	0	1424	0	6469
2008*	21	4831	187	392	254	0	235	0	1669	0	7590
2009**	72	6312	24	441	36	0	354	0	2047	145	9431
2010**	224	6962	9	587	27	0	379	0	1763	223	10173

* revised

** preliminar (all in 2010, only for French data in 2009)

Table 4.3-2 ***L. budegassa*** **in Divisions VIIb-k and VIIIa,b,d- Effort and LPUE data**

EFFORT	SP-VIGO7 in Division VII ('000 days*HP)	SP-CORUTR7 in Division VII ('000 days*HP)	French Benthic trawlers* Celtic Sea FU04 ('000 hrs)	French Benthic Twin Trawls Celtic Sea ('000 hrs)	French Benthic trawlers* Bay of Biscay FU14 ('000 hrs)	French Benthic Twin Trawls Bay of Biscay ('000 hrs)	EW FU06 Beam trawlers in VII ('00 days)	SP-BAKON7 (days)	SP-BAKON8 (days)
1986	6875	9527	418	N/A	123	N/A	N/A	N/A	N/A
1987	6662	10453	349	N/A	199	N/A	N/A	N/A	N/A
1988	6547	10886	334	N/A	150	N/A	N/A	N/A	N/A
1989	7585	10483	378	N/A	187	N/A	N/A	N/A	N/A
1990	8021	9630	380	N/A	208	N/A	N/A	N/A	N/A
1991	7822	8522	380	N/A	210	N/A	N/A	N/A	N/A
1992	6370	5852	331	N/A	186	N/A	100	N/A	N/A
1993	5988	5001	274	N/A	159	N/A	114	1094	5590
1994	5655	4990	249	N/A	148	N/A	116	980	5619
1995	5070	4403	287	N/A	174	N/A	127	1214	4474
1996	5416	3746	196	121	144	19	126	1170	4378
1997	5058	3738	178	133	133	33	126	540	4286
1998	5360	3684	182	134	117	40	121	1196	3002
1999	5084	3512	108	110	83	59	115	1384	2337
2000	5519	2773	160	103	87	49	104	1850	2227
2001	5678	2356	127	133	60	66	186	1451	2118
2002	5041	2258	114	120	56	75	111	949	2107
2003	5437	2597	144	134	65	78	166	1022	2296
2004	5347	2292	155	129	75	88	174	910	2159
2005	5246	2120	137	135	81	118	109	544	2263
2006	5392	2257	140	145	72	101	94	487	2398
2007	5952	2323	149	152	48	127	97	476	2098
2008	5840	1640	118	126	58	113	138	105	2017
2009	5852	1626	N/A	N/A	N/A	N/A	75	0	1807
2010**	5607	1988	N/A	N/A	N/A	N/A	77	138	1358

LPUE	Vigo in Division VII (kg/days*HP)	La Coruna in Division 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/10days)	SP-BAKON7 (kg/day)	SP-BAKON8 (kg/day)
1986	339	37	38	N/A	51	N/A	N/A	N/A	N/A
1987	294	16	25	N/A	48	N/A	N/A	N/A	N/A
1988	265	42	39	N/A	53	N/A	N/A	N/A	N/A
1989	272	25	47	N/A	65	N/A	N/A	N/A	N/A
1990	250	29	52	N/A	62	N/A	N/A	N/A	N/A
1991	231	30	44	N/A	54	N/A	N/A	N/A	N/A
1992	248	14	48	N/A	53	N/A	28	N/A	N/A
1993	194	15	43	N/A	50	N/A	30	51	55
1994	203	20	44	N/A	60	N/A	11	108	61
1995	286	8	51	N/A	47	N/A	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	403	11	31	28	50	64	10	256	70
2008	545	5	48	43	68	86	16	248	74
2009	646	18	N/A	N/A	N/A	N/A	30		118
2010**	625	93	N/A	N/A	N/A	N/A	34	326	117

* Identified twin trawls excluded

** Preliminar

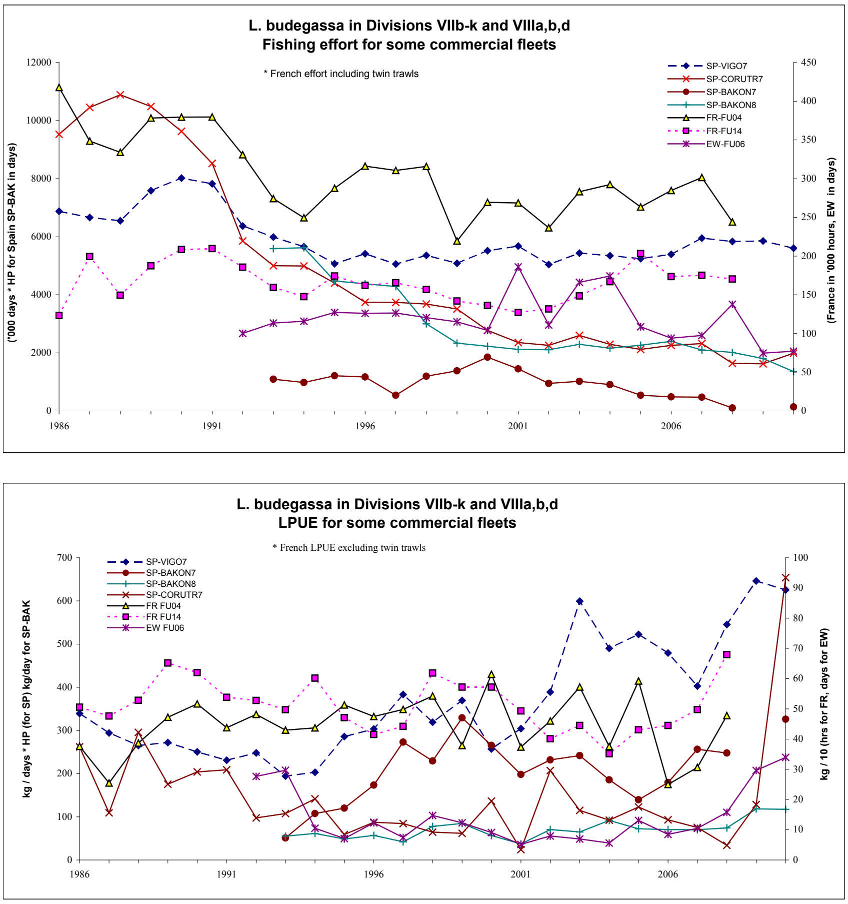


Figure 4.3-1 ***L. budegassa*** **in Divisions VIIb-k and VIIIa,b,d- Effort and LPUE data**

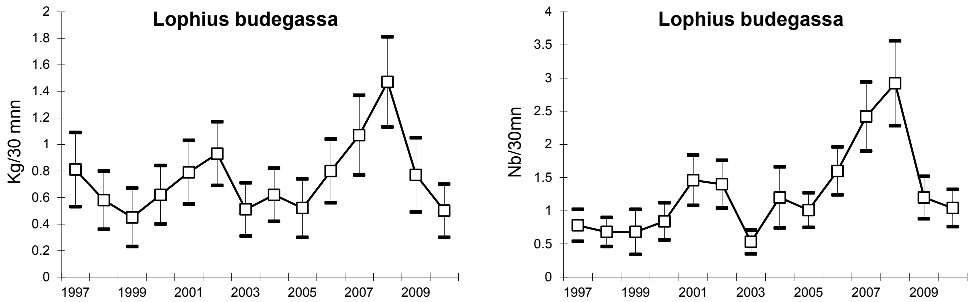


Figure 4.3-2 ***L. budegassa*** **in Divisions VIIb-k and VIIIa,b,d- Evolution of the EVHOE-WIBTS-Q4 survey' s indices Kg (left) and Nb (right) per 30 minutes tow from 1997 to 2010**

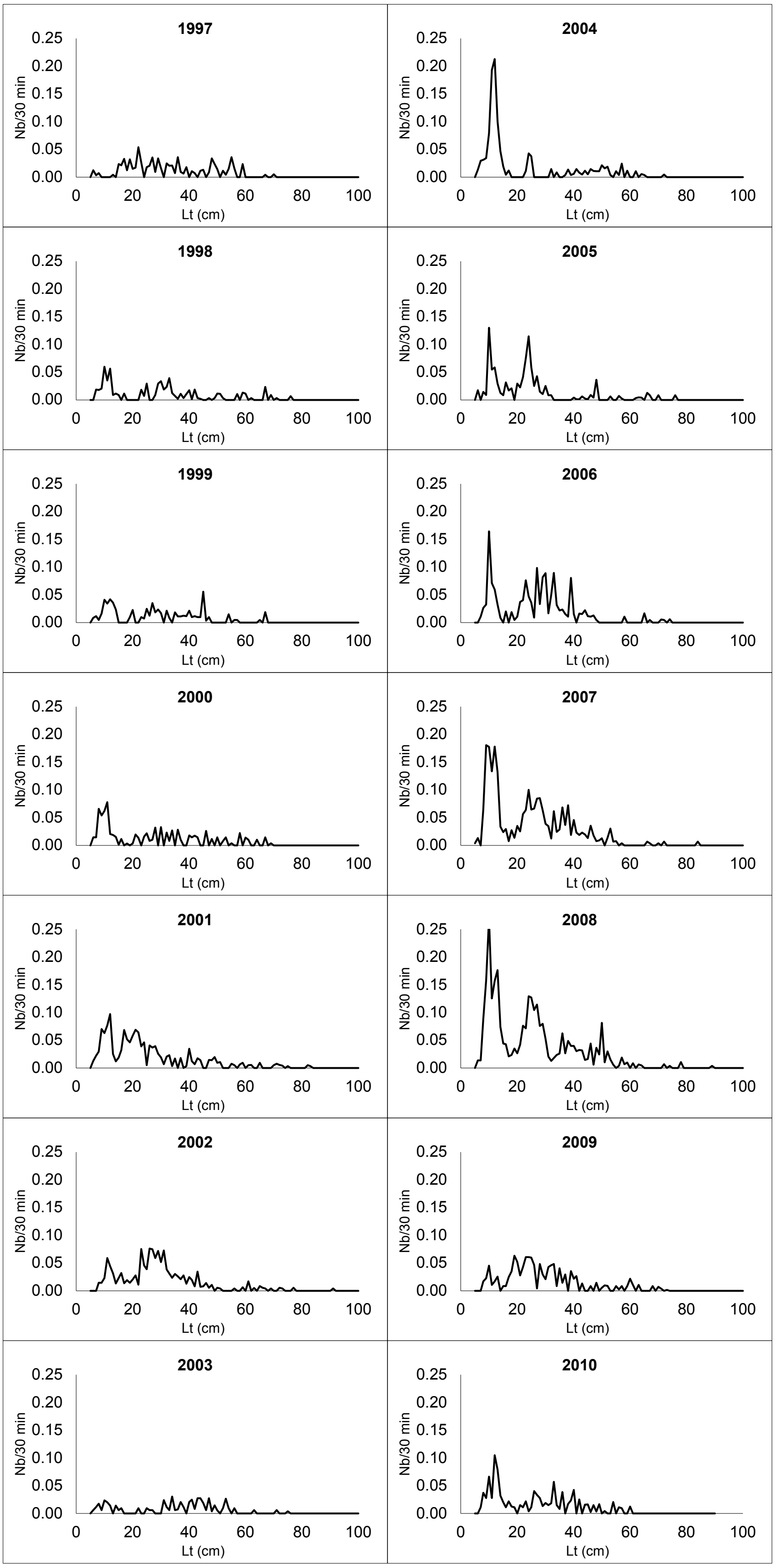


Figure 4.3-3 - *L. budegassa* in Divisions VIIb-k and VIIIa,b,d- Evolution of the EVHOE-WIBTS-Q4 Length distributions in Nb per 30 minutes tow from 1997 to 2010.

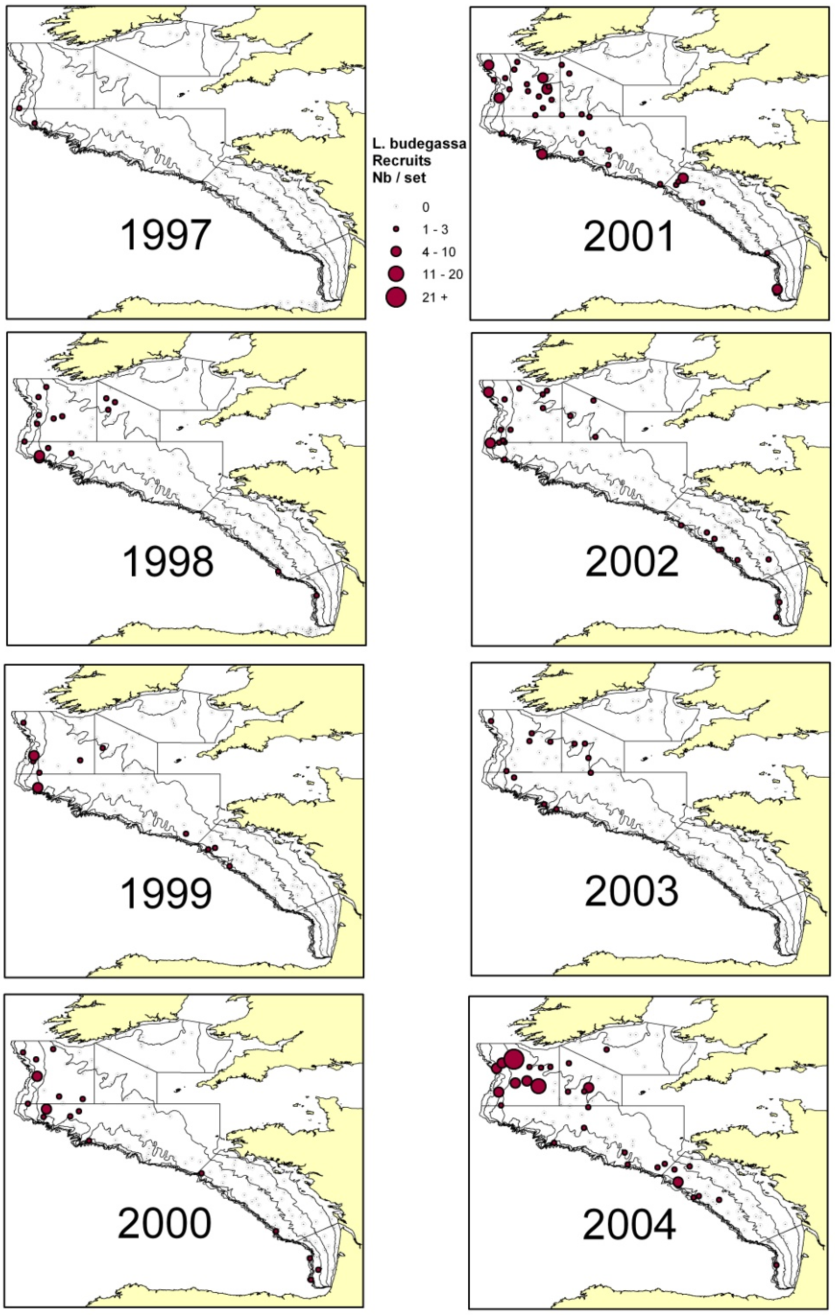


Figure 4.3-4 – *L. budegassa* in Divisions VIIb-k and VIIIa,b,d, distribution of recruits (lt < 16 cm) in Nb per 30m observed in the EVHOE-WIBTS-Q4 surveys from 1997 to 2004.

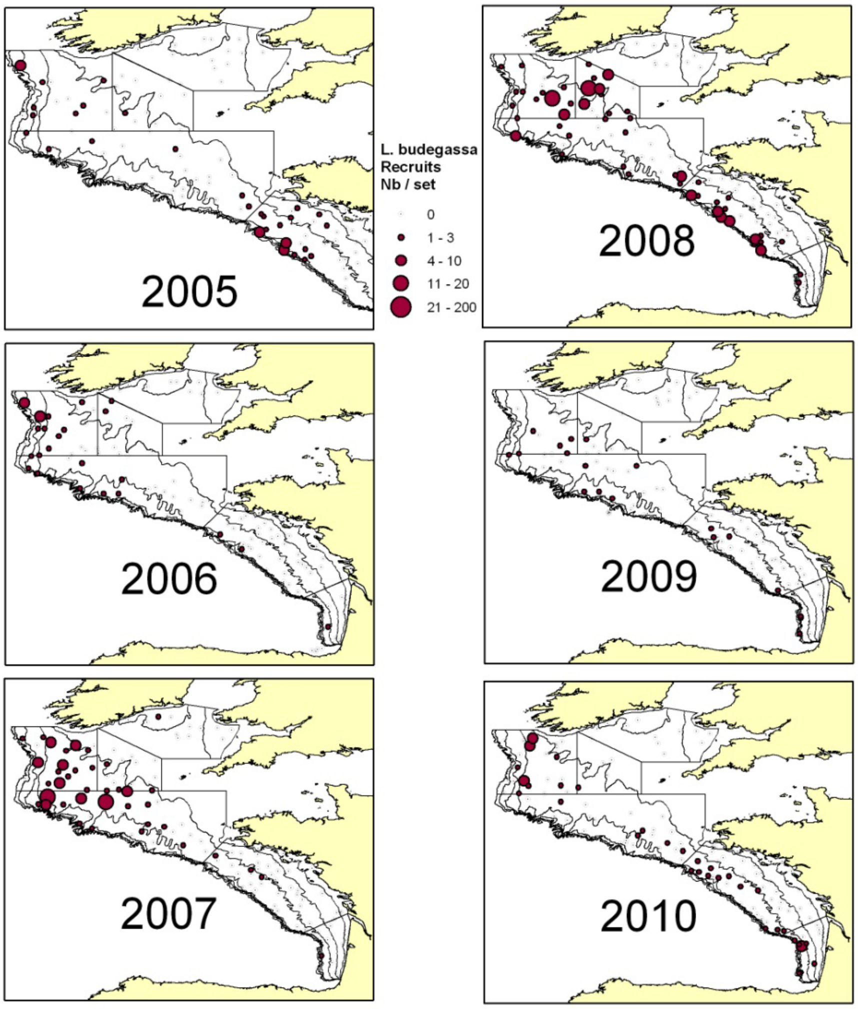


Figure 4.3-5 – *L. budegassa* in Divisions VIIb-k and VIIIa,b,d, distribution of recruits (lt < 16 cm) in Nb per 30m observed in the EVHOE-WIBTS-Q4 surveys from 2005 to 2010.

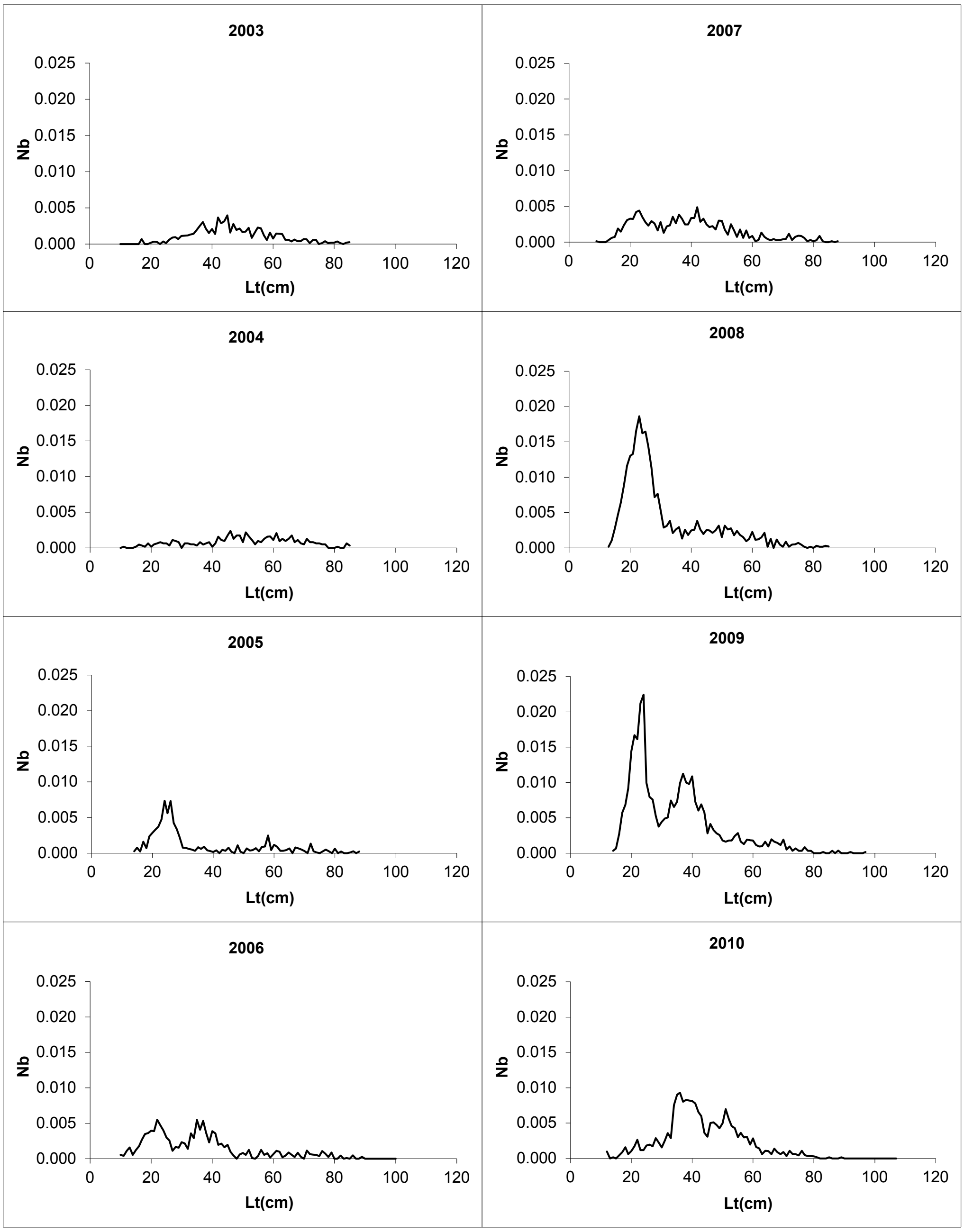


Figure 4.3-6 - *L. budegassa* in Divisions VIIb-k and VIIIa,b,d- Evolution of the FSP-ENG-MONK Length distributions in Nb per 30 minutes tow from 2003 to 20010.

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

Assessment type: SALY. No analytical assessment is available for this stock.

Data revisions this year: no data revision has been done.

Review Group comments: these were in relation to:

1) In section 5.2. The change in MLS seems to be used to explain both increase and decrease in discard levels.

2) The way discard numbers are provided by countries is very inconsistent. If it is not possible to raise discard numbers to total fleet with acceptable precision and accuracy, discard data should not be accepted. Currently discards are only estimated for the Spanish fleet. There are no explanations in the text why the Irish and UK discard numbers have not been supplied in raised form and why France does not supply discards data.

3) A table with landings in tonnes by country could be useful.

4) The WG does not provide any evaluation of the relative quality of the different tuning fleets, for example in terms of internal consistency of age compositions or presence of year effects, and if differences in trends are related to different spatio-temporal patterns across the range of the stock as opposed to accuracy problems in the surveys. Screening of such data using models such as SURBA is common in other Working groups. SURBA would also provide recruitment series that could be compared across surveys.

Reply to Review Group:

1) Corrected.

2) In pag.77 of the WGHMM2010 it is written: "Preliminary discard estimates from United Kingdom were available to the group at sampling level. Ireland presented raised discard data". Otherwise, discard data by country will be deeply analyzed in the benchmark of 2012.

3) It will be included in WGHMM 2011 as Table 5.1a.

4) An extensive analysis will be done for the Benchmark scheduled for the start of 2012 (see annex N).

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 Spanish followed by Irish, French and UK demersal vessels. In 2010, the four countries together have reported around 98% of the total landings (Table 5.1a). French data of years 2009 and 2010 have to be considered as preliminary. See more detailed description of the fishery in Annex E (Stock annex, Section A2).

Estimates of total landings (including unreported or miss-reported landings) and catches (landings + discards) as used by the Working Group up to 2010 are shown in Table 5.1b.

5.1.2 Summary of ICES Advice for 2011 and Management applicable for 2010 and 2011

ICES advice for 2011

ICES provided two advice options for 2011:

On the basis of the transition to an MSY approach, catch and effort reduction should take place in 2011.

On the basis of the Precautionary approach, catch and effort should not increase in 2011.

Management applicable for 2010 & 2011

The 2010 and 2011 TACs were set at 20 425 t and 20 106 t respectively, including a 5% contribution of *L. boscii* in the landings for which stock there is no assessment.

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

5.2 Data

5.2.1 Commercial catches and discards

Landings in 2010 (14 942 t) are a bit higher than in 2009 (14 414 t), but French landings data have been included as preliminary for both years.

Discard data available by country and the procedure to derive them are summarised in Table 5.2a. The discards decrease in 2000 and 2001 (Table 5.1b) can be partly explained by the reduction in the minimum landing size from 25 to 20 cm in year 2000. However, soon after year 2000, an increasing trend in the discards was observed again. This might be explained by a combination of the MLS (even if lower than before year 2000) plus the large number of small fish caught until 2004. In 2005, the decrease in the number of small fish resulted in a large decrease of discards. In 2006 discards increased again around 30 %, especially in ages 3 & 4, while a decrease occurred till 2008. In 2010 discards have doubled the discards of 2009. The reason for this increase is not known yet.

Since 1999, only Spanish discard data are used, applied only to Spanish fleets. This has led to an artificial decrease in the amount of total stock discards, since no estimates for French fleets were available. The group states strongly the importance of incorporating 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.

Preliminary discards estimates from United Kingdom were available to the group at sampling level. Ireland presented raised discard data. Data series available for discards are detailed in the Annex E-Stock annex- Section B2.

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

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Discard ratio (%)	19	7	7	8	17	24	13	17	14	11	12	22

5.2.2 Biological sampling

Age and Length distribution provided by countries are explained in Annex E-Stock annex- Section B3. Derivations of length compositions and ALK's used for 2009 and 2010 data are presented in Table 5.2b. Table 5.3 shows the available original length composition of landings by Fishing Unit in 2010.

The length compositions of the landings and discards show an increase in number of individuals between 1990 and 1992 and, subsequently, a constant decrease (Figure 5.1). Age distributions for landings and discards from 1990 to 2010 are presented in Figure 5.2. For year 2010 an important increase is observed in the number of individuals caught (and discarded) at age 2 and the percentage of individuals discarded at age 3.

5.2.3 Abundance indices from surveys

UK survey Deep Waters (UK-WCGFS-D, Depth > 180 m) and UK Survey Shallow Waters (UK-WCGFS-S, Depth < 180 m) indices for the period 1987–2004 and French EVHOE Groundfish Survey (EVHOE-WIBTS-Q4) results for the period 1997–2010 are summarised in Table 5.4a.

The UK-WCGFS-D and UK-WCGFS-S show the same pattern in the indices for ages 2 and 3 since 1997. 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 showed no evident general trend. Oscillations of high and low values are present from 2002 to 2006. In 2007 there is peak in age 1 and this cohort can be followed in the next years.

An abundance index by age was provided for the Spanish Porcupine Groundfish Survey (SpPGFS-WIBTS-Q4) from 2001 to 2010, Irish Groundfish Survey Q4 (IGFS-WIBTS-Q4) abundance indices are presented from 2003-20010.

When comparing Spanish and French biomass indices, some contradictory signals are detected (Figure 5.3a). The EVHOE-WIBTS-Q4 index decreased from 2001 until 2005 and since then has increased. The SpPGFS-WIBTS-Q4 biomass index appears to fluctuate without trend, with the lowest value of the period attained in 2008. However, some concerns about the good performance of the gear in 2008 were raised and thus the 2008 index may not be entirely reliable. In 2009, these performance problems were solved and the index increased.

Comparing the three scaled abundance indices from surveys, Irish Groundfish Survey Q4 gives the highest estimates of abundance index in 2005 with a decrease in trend to 2007 and it increased again till 2009, and a decrease in 2010. French EVHOE Groundfish Survey shows a slight increasing trend in the last three years and Spanish Porcupine Groundfish Survey remains stable in the last three years. (Figure 5.3b).

It must be noted that the areas covered by the three surveys almost do not overlap. 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 SpPGFS-WIBTS-Q4 essentially coincides with the western one of IGFS-WIBTS-Q4.

5.2.4 Commercial catch-effort data

Commercial series of catch-at-age and effort data were available for three Spanish fleets in Subarea VII: A Coruña (SP-CORUTR7), Baka trawlers from Ondarroa (SP-BAKON7) and Vigo (SP-VIGOTR7) from 1984–2010. From 1985 to 2008, LPUEs from four French trawling fleets: FR-FU04, Benthic Bay of Biscay, Gadoids Western Approaches and *Nephrops* Western Approaches are available. No update of these last data series has been provided to the WG (Table 5.4b).

The general level of effort in SP-CORUTR7 and SP-VIGOTR7 has decreased since 1991, stabilising the last years of the series. SP-VIGOTR7 showed a very slight increase in 2007 maintained till 2009. SP-BAKON7 remains quite stable since 1991 and decreased slightly since 2000. In 2009, no effort was deployed by this fleet but in 2010 it deployed some effort again. The effort of the French benthic trawlers fleet in the Celtic Sea decreased from 1991 to 1994, then increased in 1995-1996 and remained relatively stable until 2007, then it decreased again. IR-7-OT fleet showed fluctuating effort from 1995 with a peak in 2003 and a decreasing trend until 2005 (Figure 5.4a).

The CPUE of SP-CORUTR7 has fluctuated until 1990, when it started decreasing, with a slight increase in 2007. In 2009, CPUE for this fleet sharply increased and it remains stable in 2010 (Figure 5.4b). Over the same period, the CPUE of SP-VIGOTR7 has remained relatively stable until 1999, when it started to increase, reaching a peak in 2004. In 2005 a sharp decrease occurred, remaining at that level in 2006 and 2007. Then it has had sharp increases in 2009 and 2010, reaching the historical maximum in 2010 (almost identical to the 2004 year value). SP-BAKON7 has been fluctuating without clear trends. No CPUE value is available for this fleet in 2009, as it deployed no effort and for year 2010 a similar CPUE as for year 2008 is observed.

The LPUE of all French bottom trawlers fleets decreased from 1988 to 1991 and remained relatively stable until 1994 (Figure 5.4c). Since then, both benthic fleets have shown increasing LPUE until 1997 and 1998. Benthic trawlers in VIIIa,b,d follow a decreasing trend while the FU04: Benthic Western Approaches remained at an increasing trend until 2002, then a sharp decreasing trend is observed till 2004. From then, LPUE has increased and remain stable for the last 3 years of the series. From 1996, the demersal fleet LPUE started decreasing. No update of LPUE information for 2009 and 2010 was provided for French fleets.

5.2.5 Conclusions

Precise estimates of recent development of the stock population structure and SSB are not available. Spanish commercial CPUEs series give congruous trends and EVHOE-WIBTS-Q4 and SpPGFS-WIBTS-Q4 survey biomass indices both show an increase in 2009 and 2010. Discard data and survey indices do not appear to indicate the presence of either strong incoming recruitment or strong decreasing trend in the overall biomass.

In the context of the current problems and deficiencies of this assessment and in view of available data, the Group concludes that the stock appears stable at the present level of fishing.

The group states strongly the importance of delivering reliable French data, including 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.

Table 5.1a **Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d.**
Nominal landings and catches (t) provided by the Working Group.

	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
France			4896	5056	5206	5452	4336	3709	4104	3640	3214	3945	4146	4333	4232	3699	3626	3645	2930	3203	2758	2796	2735	2734	2383	1639	2045
Spain			10242	8772	9247	9482	7127	7780	7349	6526	5624	6129	5572	5472	4870	5078	6047	7603	8797	8340	7526	5841	5916	7173	5820	8804	8535
U.K.			2048	1600	1956	1451	1380	1617	1982	2131	2309	2658	2493	2875	2492	2193	2185	1710	1787	1732	1622	1764	1509	1462	1387	1842	1810
Ireland			1563	1561	995	2548	1381	1956	2113	2592	2420	2927	2699	1420	2621	2597	2512	2767	2413	2249	2288	2155	1755	1763	1523	1918	2283
Belgium			178	125	173	300	147	32	52	40	117	203	199	130	129	149	115	80	62	163	106	156	101	197	168	211	269
Total landings	16659	17865	18927	17114	17577	19233	14371	15094	15600	14929	13685	15862	15109	14230	14345	13715	14485	15806	15988	15687	14300	12712	12015	13330	11282	14413	14942
Total discards	2169	1732	2321	1705	1725	2582	3284	3282	2988	3108	2700	3206	3026	3066	5371	3135	2265	1275	1466	3147	4511	1831	2468	2238	1442	2028	4297
Total catches	18828	19597	21248	18819	19302	21815	17655	18376	18588	18037	16385	19068	18135	17296	19716	16851	16750	17081	17454	18834	18811	14542	14483	15568	12724	16442	19239
Agreed TAC (1)				16460	18100	18100	18100	18100	18100	21460	20330	22590	21200	25000	25000	20000	20000	16800	14900	16000	20200	21500	20425	20425	20425	20425	20106

Note: UK includes data from Northern Ireland from 2009 onwards.

**Table 5.1b Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d.
Nominal landings and catches (t) provided by the Working Group.
Revised values in bold.**

	Total landings	Total discards	Total catches	Agreed TAC (1)
1984	16659	2169	18828	
1985	17865	1732	19597	
1986	18927	2321	21248	
1987	17114	1705	18819	16460
1988	17577	1725	19302	18100
1989	19233	2582	21815	18100
1990	14371	3284	17655	18100
1991	15094	3282	18376	18100
1992	15600	2988	18588	18100
1993	14929	3108	18037	21460
1994	13685	2700	16385	20330
1995	15862	3206	19068	22590
1996	15109	3026	18135	21200
1997	14230	3066	17296	25000
1998	14345	5371	19716	25000
1999	13715	3135	16850	20000
2000	14485	1033	15517	20000
2001	15806	1275	17081	16800
2002	15988	1466	17454	14900
2003	15414	3147	18561	16000
2004	14300	4511	18811	20200
2005	12712	1831	14542	21500
2006	12015	2468	14483	20425
2007	13330	2238	15568	20425
2008	11282	1442	12724	20425
2009*	14414	2028	16442	20425
2010*	14942	4297	19239	20106

*: French data are preliminar

(1) for both megrim species and VIIa included

Table 5.2a Megrim (*Lepidorhombus whiffiagonis*) in Divisions 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)	-	-
1996	(FR91)	(SP94)	-	-
1997	(FR91)	(SP94)	-	-
1998	(FR91)	(SP94)	-	-
1999	-	**SP99**	-	-
2000	-	**SP00**	-	-
2001	-	**SP01**	-	-
2002	-	(SP01)	-	-
2003	-	**SP03**	**IR***	***UK****
2004	-	**SP04**	**IR***	-
2005	-	**SP05**	**IR***	-
2006	-	**SP06**	**IR***	***UK****
2007	-	**SP07**	**IR***	***UK****
2008	-	**SP08**	**IR***	***UK****
2009	-	**SP09**	**IR***	***UK****
2010	-	**SP10**	**IR***	***UK****

- In bold: years where discards sampling programs provided information
- In bold and * (italics): years where discards sampling programs provided information, just at sampling level, but are not used in the derivation
- In bold and *: years where discards sampling programs provided information but are not used in the derivation
- In (): years for which the length distribution of discards has been derived

Table 5.2b **Megrim (*Lepidorhombus whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d**
Derivations of length compositions and ALK's used for 2009.

2009					
Unit	**Data**	**France**	**Ireland**	**Spain**	**UK**
3	Landings	-			EW.03.09Q
	Discards	-			-
	ALK	-			EW.ALL FU.09Q
4	Landings	FR.04.09Y		SP.04.09Q	EW.04.09Q
	Discards	-		SP.ALL FU.09Y	-
	ALK	-		SP.04.09Y	EW.ALL FU.09Q
5	Landings	FR.05.09Y			EW.05.09Q
	Discards	-			-
	ALK	-			EW.ALL FU.09Q
6	Landings	-			EW.06.09Q
	Discards	-			-
	ALK	-			EW.ALL FU.09Q
8	Landings	FR.08.09Y			
	Discards	-			
	ALK	-			
9	Landings	-			
	Discards	-			
	ALK	-			
10	Landings	-			
	Discards	-			
	ALK	-			
14	Landings	FR.14.09Y		SP.14.09Q	
	Discards	-		-	
	ALK	-		-	
All fisheries	Landings	-	IR.ALL FU.09Q		
Units	Discards	-	-		
	ALK	-	IR.ALL FU.09Q		
No of samples		4541	139	160	56
No of fishes measured		26381	7935	19208	8340
No of fish aged		-	432	1194	1194

(-) : no discards assumed or available
ALL FU : all fishery units combined
Q : quarterly data
Sm : semestrial data
Y : annual data
S : by sex

Table 5.2b' **Megrim (*L.whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d.**
Derivations of length compositions and ALK's used for 2010

2010					
Unit	**Data**	**France**	**Ireland**	**Spain**	**UK**
3	Landings	-			EW.03.10Q
	Discards	-			-
	ALK	-			EW.ALL FU.10Q
4	Landings	FR.04.10Y		SP.04.10Q	EW.04.10Q
	Discards	-		SP.ALL FU.10Y	-
	ALK	-		SP.04.10Y	EW.ALL FU.10Q
5	Landings	FR.05.10Y			EW.05.10Q
	Discards	-			-
	ALK	-			EW.ALL FU.10Q
6	Landings	-			EW.06.10Q
	Discards	-			-
	ALK	-			EW.ALL FU.10Q
8	Landings	FR.08.10Y			
	Discards	-			
	ALK	-			
9	Landings	-			
	Discards	-			
	ALK	-			
10	Landings	-			
	Discards	-			
	ALK	-			
14	Landings	FR.14.10Y		SP.14.10Q	
	Discards	-		-	
	ALK	-		SP.14.10Y	
All fisheries	Landings	-	IR.ALL FU.10Q		
Units	Discards	-	-		
	ALK	-	IR.ALL FU.10Q		
No of samples		5158	173	140	46
No of fishes measured		28584	8415	16337	7099
No of fish aged		1119	428	2116	592

(-) : no discards assumed or available
ALL FU : all fishery units combined
Q : quarterly data
Sm : semestrial data
Y : annual data
S : by sex

Table 5.3 Megrim (*Lepidorhombus whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Original length composition by fleet (thousands). No raising to total landings. No length frequencies for France and Belgium are available.

Length	FRANCE	SPAIN		IRELAND	UNITED KINGDOM			
class (cm)	ALL FISHING U	FU04:Otter trawl-m	FU14:Otter trawl-med&	ALL FISHING (	FU03:Fixed ne	FU 04: Otte	FU05:Otter	FU06:Beam trawl-all d
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		0	0	0
20		6	4	0		0	0	0
21		2	20	1		0	0	0
22		12	76	3		0	0	0
23		221	140	7		0	0	0
24		1174	226	26		0	0	2
25		3277	243	117		0	2	7
26		4995	193	257		0	2	21
27		5528	143	386	0,007	0	6	45
28		4267	150	484	0,000	0	6	69
29		3325	140	599	0,007	0	7	76
30		3668	176	750	0,038	0	11	92
31		3205	174	868	0,013	0	14	77
32		2544	157	797	0,045	0	16	93
33		1711	147	697	0,027	0	22	111
34		1242	98	574	0,050	0	28	133
35		1115	73	466	0,044	0	23	98
36		828	60	422	0,043	0	25	106
37		672	38	311	0,068	0	21	111
38		481	29	269	0,080	0	19	110
39		447	15	198	0,062	0	18	92
40		230	10	140	0,091	0	15	70
41		231	6	107	0,026	0	12	53
42		222	4	90	0,043	0	10	44
43		189	3	74	0,013	0	6	31
44		103	2	46	0,018	0	5	30
45		85	2	40	0,012	0	5	19
46		121	1	37	0,018	0	3	16
47		117	1	29	0,012	0	2	11
48		75	1	26	0,012	0	1	10
49		40	1	13	0,007	0	1	10
50		23	0	14	0,006	0	1	6
51		17	0	5	0,006	0	0	7
52		13	0	7		0	0	7
53		10	0	5		0	0	4
54		24	0	3		0	0	3
55		0	0	2		0	0	2
56		0	0	0		0	0	1
57		0	0	2		0	0	1
58		0	0	0		0	0	1
59		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	0	40217	2335	7874	1	0	280	1570

Table 5.4a **Megrim (*Lepidorhombus whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d Abundance Indices for UK-WCGFS-D, UK-WCGFS-S, IGFS-WIBTS-Q4, SpPGFS (WIBTS-Q4) and EVHOE-WIBTS-Q4**

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

EVHOE-WIBTS-Q4

		Age								
	Effort	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1997	100	0,47	3,85	2,71	1,55	1,40	1,11	0,62	0,35	0,18
1998	100	1,62	0,65	4,35	3,06	1,49	0,98	0,78	0,40	0,13
1999	100	0,53	3,35	0,68	2,06	3,30	1,61	0,67	0,29	0,25
2000	100	1,38	2,62	2,52	1,36	1,20	0,73	0,41	0,28	0,14
2001	100	0,93	5,07	1,87	2,36	2,72	1,87	1,40	0,37	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	2,51	0,86	0,36	0,38	0,21	0,07
2007	100	4,04	3,91	1,63	1,38	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	
2010	100	2,71	2,67	2,75	4,59	1,20	0,54	0,25	0,21	0,13

Table 5.4a'

IGFS-WIBTS-Q4

		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	141	487	350	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

SpPGFS (WIBTS-Q4)

		Age								
	Effort	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
2001	100	43	1770	2208	2842	3434	1941	1357	487	132
2002	100	6	972	2064	3068	4265	2471	1209	340	118
2003	100	12	979	2292	3997	5653	3090	1393	417	144
2004	100	6	597	2841	4524	4616	2550	932	405	126
2005	100	65	541	532	1934	6987	4183	2193	407	100
2006	100	4	1426	1144	2592	3739	2619	713	161	88
2007	100	24	3937	5613	2836	2884	1444	681	191	66
2008	100	10	189	1595	3872	2861	1282	863	197	58
2009	100	4	360	445	3584	4840	1122	605	273	86
2010	100	30	236	1604	1913	5030	1732	366	165	114

Table 5.4b Megrim (*Lepidorhombus whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d French,Spanish and Irish CPUEs for different bottom trawler fleets.

	French (single and twin bottom trawls combined) CPUE (kg/h)				Spanish CPUE (kg/(100day*100 hp))			Irish LPUE ('000 h)
	Benthic Bay of Biscay	Benthic Western Approaches	Gadoids Western Approaches	Nephrops Western Approaches	A Coruña -VII	Baka trawl Ondarroa- VII	Vigo-VII	Otter trawlers
1984					16,3	130,1	99,1	-
1985	3,0	5,3	4,7	4,7	9,8	39,5	108,9	-
1986	3,2	4,8	2,8	4,4	21,1	52,8	105,1	-
1987	3,3	5,1	2,7	4,5	8,3	80,7	96,2	-
1988	3,8	5,8	3,0	4,1	9,8	78,3	106,1	-
1989	3,6	5,5	2,6	4,2	14,6	48,1	92,1	-
1990	3,1	4,2	1,8	3,4	15,1	18,4	73,8	-
1991	2,6	4,0	1,3	2,8	12,9	25,9	85,4	-
1992	2,5	4,5	1,5	3,4	6,9	32,8	105,6	-
1993	1,9	4,6	1,2	3,5	5,1	33,5	92,3	-
1994	1,9	4,2	1,2	3,4	7,4	52,7	78,7	-
1995	2,3	4,9	1,4	3,4	7,8	61,3	94,3	8,4
1996	2,5	5,7	1,4	3,5	3,9	58,4	79,3	9,2
1997	2,8	6,7	1,2	3,0	3,0	46,9	96,0	7,0
1998	2,4	8,2	1,5	3,7	2,4	35,7	82,4	6,4
1999	3,4	6,8	0,8	3,4	1,1	32,5	137,0	5,9
2000	3,1	8,0	0,6	3,9	5,5	45,0	128,9	5,8
2001	2,1	9,6	0,7	3,9	1,3	75,6	131,2	7,1
2002	2,3	8,1	0,5	3,1	1,3	76,4	185,3	6,7
2003	1,8	6,7	0,5	3,0	11,2	54,0	192,1	5,3
2004	1,7	4,9	0,4	3,3	3,3	60,0	211,0	4,7
2005	1,9	6,3	0,4	3,4	1,7	58,46	135,3	4,3
2006	2,3	6,6	0,3	3,0	1,4	76,42	146,1	-
2007	2,4	6,4	0,3	2,5	2,4	87,86	147,7	-
2008	2,3	6,5	0,4	2,5	3,0	37,58	114,8	-
2009	NA	NA	NA	NA	8,3	NA	168,8	-
2010	NA	NA	NA	NA	7,9	38,78	211,4	-

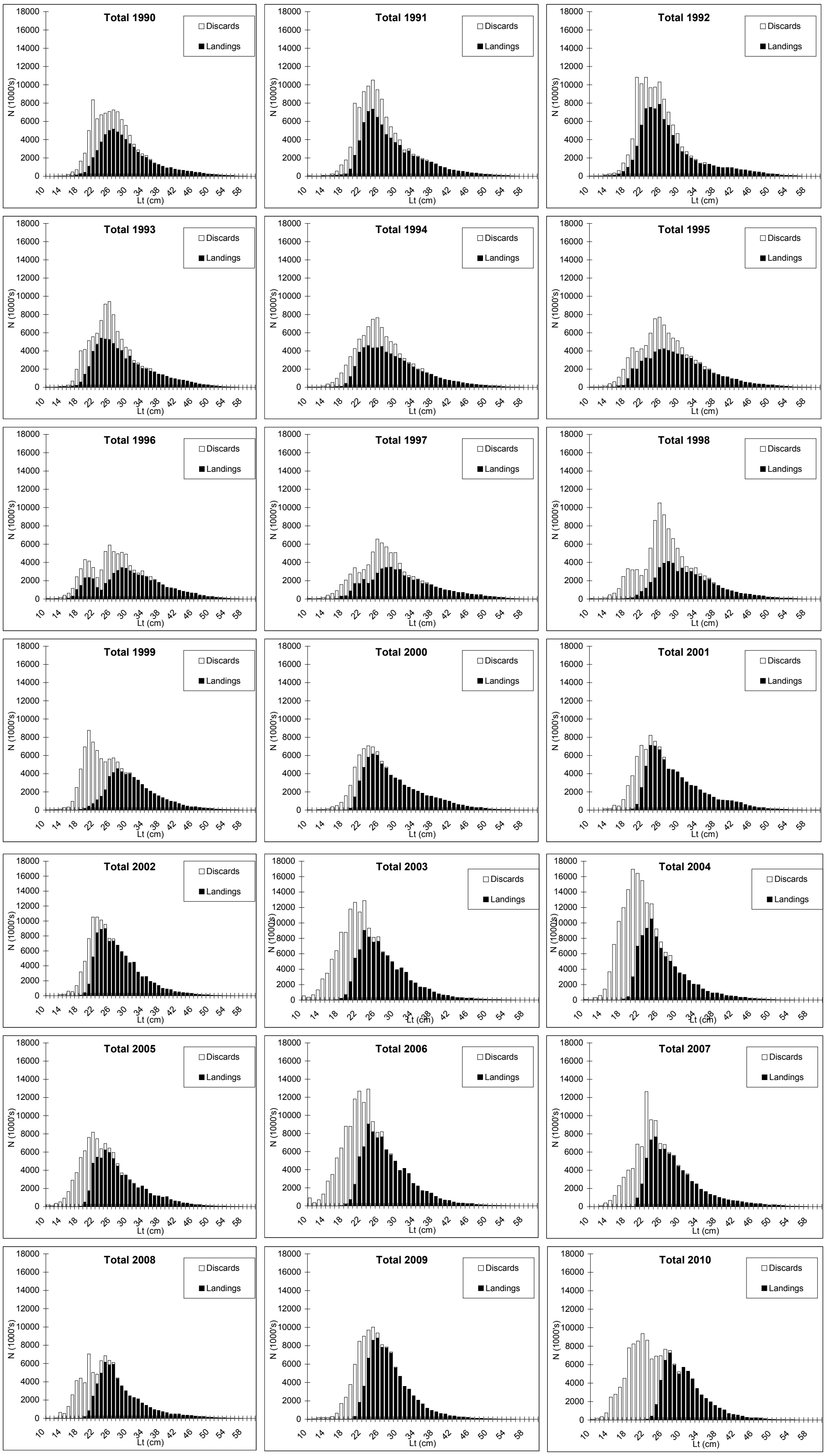


Figure 5.1. - Megrim (*L.whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Length composition of catches for the years 1990 to 2010.

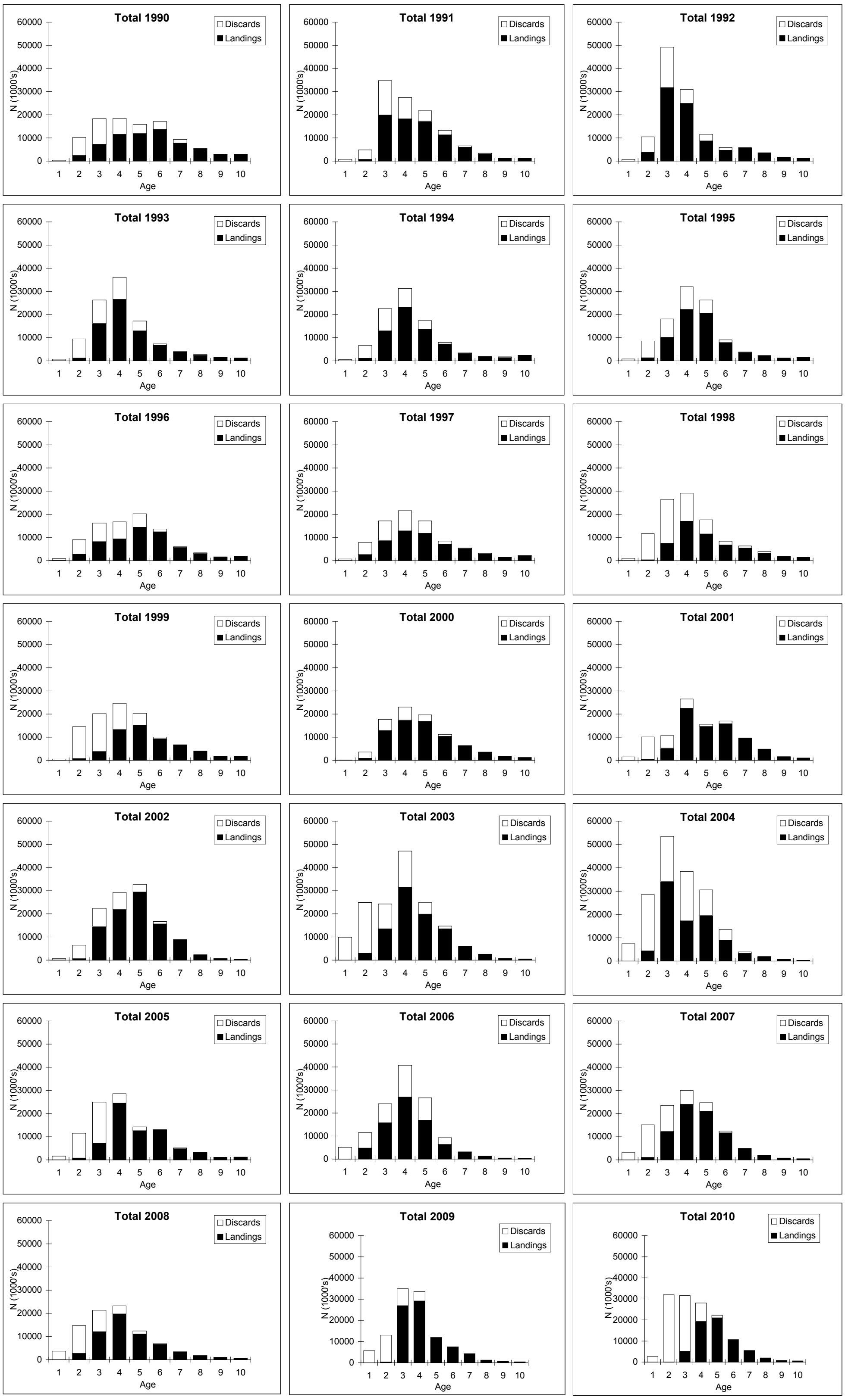


Figure 5.2. - Megrim (*L.whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Age composition of catches for the years 1990 to 2010.

Figure 5.3a **Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d.**
Scaled Biomass Indices for EVHOE Groundfish Survey (EVHOE-WIBTS-Q4),
Spanish Porcupine groundfish survey (SpPGFS WIBTS-Q4)

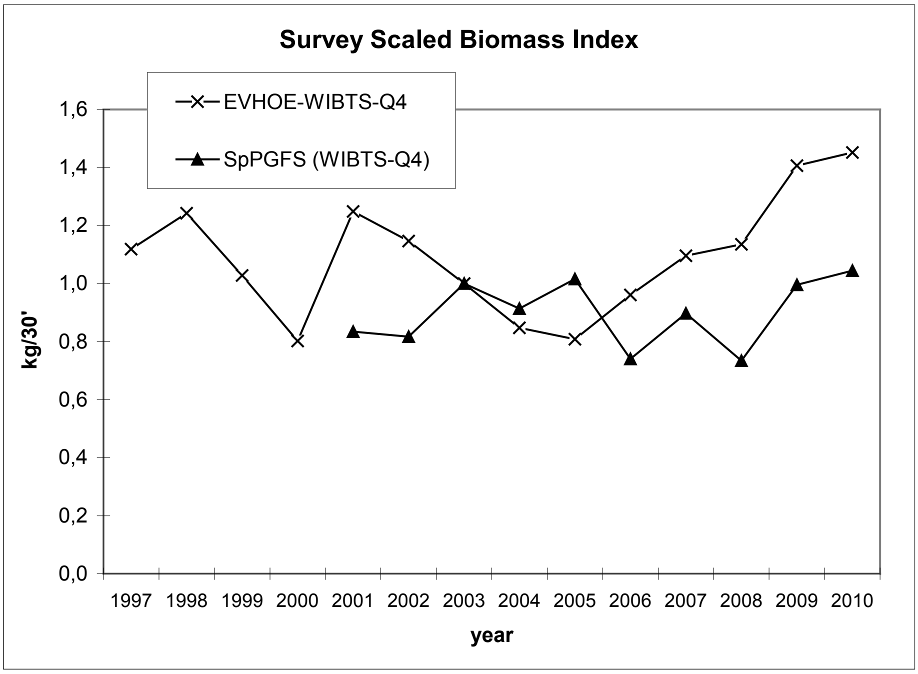


Figure 5.3b **Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d.Scaled abundance index.**
Irish groundfish survey-Q4 Abundance Index in number/10SQ Km. EVHOE Groundfish Survey and Spanish Porcupine groundfish survey Abundance Index in Number/ 30 min haul.

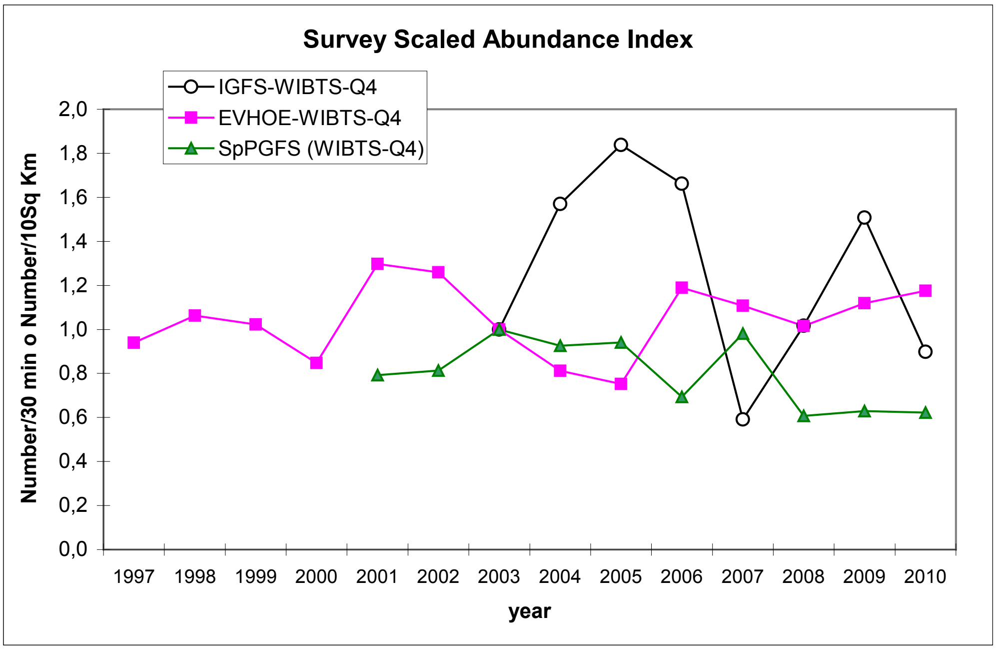


Figure 5.4a Megrim (*L. whiffiagonis*) in Divisions VIIb-k and VIIIa,b,d. Evolution of effort for different bottom trawler fleets.

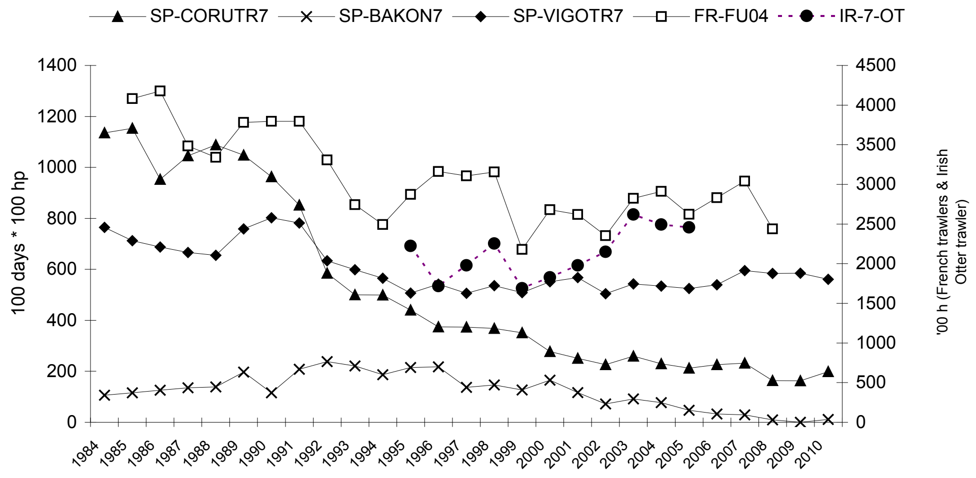


Figure 5.4b Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. Spanish CPUE for different bottom trawler fleets.

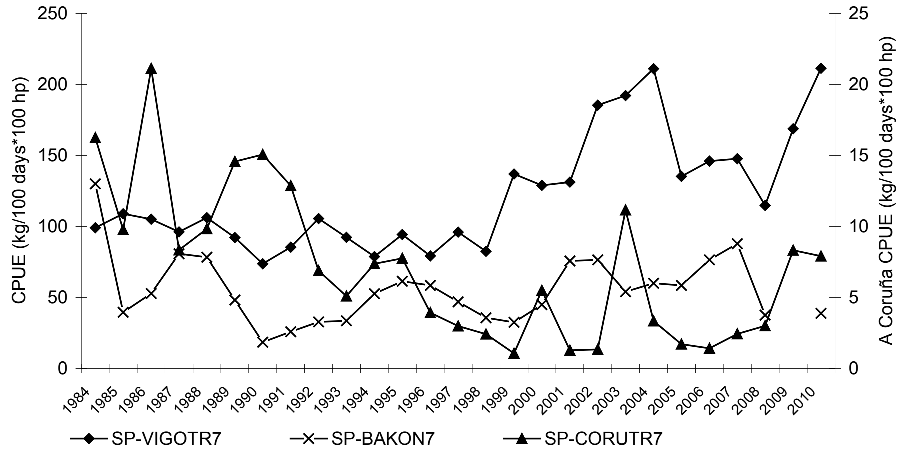
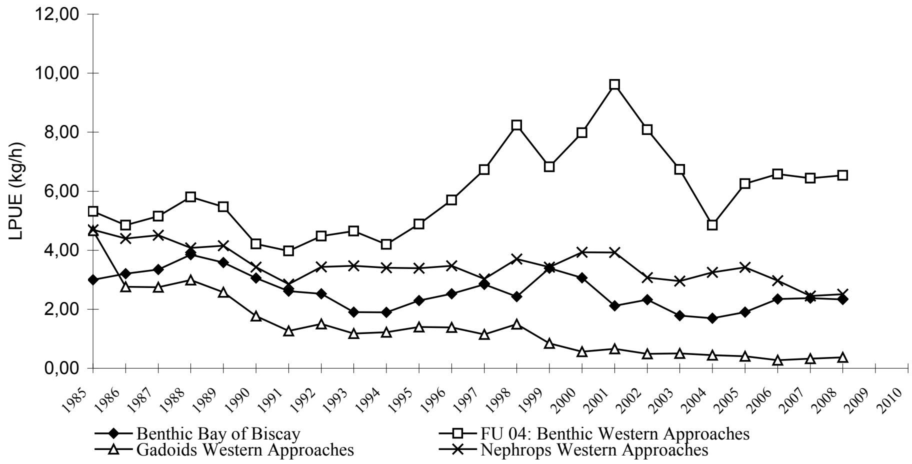


Figure 5.4c Megrim (*L. whiffiagonis*) in Divisions VIIb,c,e-k and VIIIa,b,d. French LPUE for different bottom trawler fleet.



6 Bay of Biscay Sole

Type of assessment in 2011: update.

Data revisions this year: Compared to last year assessment, there is only very limited change in data due to small revisions of 2009 landings and of 2009 commercial LPUE.

Review Group issues:

- The RG wondered about the risk of underestimating the decrease in stock abundance by using 10% limit on the species percentage to ensure that only trips which target the species of interest are included in the LPUE for this species.

6.1 General

6.1.1 Ecosystem aspects

See Stock Annex

6.1.2 Fishery description

See Stock Annex

6.1.3 Summary of ICES advice for 2011 and management applicable to 2010 and 2011

ICES advice for 2011:

Two advice options were provided for 2011:

Following the transition scheme towards the ICES MSY framework implies fishing mortality to be reduced to 0.32, resulting in landings of 4200 t in 2011.

Following the Precautionary Approach, fishing mortality in 2011 should be no more than F_{pa} corresponding to landings of less than 5300 t in 2011.

Management applicable to 2010 and 2011

The sole landings in the Bay of Biscay are subject to a TAC regulation. The 2010 TAC was set at 4829 t. The 2011 TAC is set at 4250 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 to be allowed to have more than 100 kg on board.

The Belgian vessel owners get monthly non transferable individual quota for sole. The amount is related to the capacity of the vessel.

A regulation establishing a management plan has been adopted in February 2006. The objective 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.

6.2 Data

6.2.1 Commercial catches and discards

The WG estimates of landings and catches are shown in Table 6.1a. 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. They are nearly exclusively landed in Bay of Biscay harbours. The record of the auction sales allows thus to consider that the reliability of the WG estimates is satisfactory all along the series.

The 2009 landings estimate was revised 1.4% higher to 3650 t.

In 2002, landings were increased to 5486 t by hydrodynamic conditions very favourable to the fixed nets' fishery (frequent strong swell periods in the first quarter). In the absence of such apparently rare conditions, the landings in 2003-2008 were ranging from between 4000t and 4800t before falling to 3650t in 2009 and increasing to 3966 t in 2010 (Table 6.1a).

The 2010 landings figure is 4 % below the landings predicted by the 2010 WG at status quo mortality (4142 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.

6.2.2 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 2009 split was slightly revised because of small correction in the database (Table 6.1 b).

Length compositions are available on a quarterly basis from 1984 for the French fleets and from 1994 for the Belgian beam trawlers. The 2010 sampling level is given in table 1.3. The French length distributions are shown on Figures 6.4 a, b & c from 1984 onwards. The relative length distribution of landings in 2010 is shown by country in Table 6.3.

Even though age reading from otoliths now uses the same method in France and Belgium (see Stock Annex), the discrepancy between French and Belgian mean weight at age, noticed by preceding WGs, was only slightly reduced. A better agreement between French and Belgian age readers would certainly reduce this gap a bit more (about 80% of agreement for a reading comparison carried out in 2006 on a set of otoliths). 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 6.4 and Figures 6.5 a & b, and the mean catch weight at age in Table 6.5.

6.2.3 Abundance indices from surveys

Two CPUE RESSGASC surveys are available for the tuning process from 1987, but they are both terminated after 2002. The WKFLAT 2011 workshop, in which this stock was benchmarked, decided not to include the RESSGASC series in the revised tuning process because the survey terminated in 2002 and no longer contributes to the estimates of terminal population numbers in the assessment.

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. The series was presented to the WKFLAT 2011 which considered that this series should be used to tune the assessment in the near future but its length is still too short to be inserted in the tuning process in the 2011 assessment. The WKFLAT 2011 highlighted that "*A particular attention must be paid to the tuning series which evolve by the adding of the ORHAGO survey as soon as its series is five years long*".

6.2.4 Commercial catch- effort data

The French La Rochelle and Les Sables trawler series of commercial fishing effort data and CPUE 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 CPUE. 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 CPUE are not driven by a fishing strategy evolution (the targeting of cephalopods more particularly).

The La Rochelle CPUE 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 6.2.a and Figure 6.1). 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.

The Belgian LPUE series was relatively constant from 1990 to 1996, declined severely afterwards until 2002 but has increased in 2003 to return to the 1997-2000 level (Table 6.2b). Later on, its trend is flat until 2009 (no available value in 2010).

6.3 Assessment

6.3.1 Input data

See stock annex

6.3.2 Model

As in previous years, the model chosen by the Group to assess this stock was XSA; this was confirmed by the WKFLAT 2011.

The age range in the assessment is 2-8+, as last year assessment.

The year range used is 1984-2010.

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 cpue series are used in the assessment: La Rochelle offshore trawlers (FR-ROCHELLE), Les Sables d'Olonne offshore trawlers (FR-SABLES), the Bay of Biscay offshore trawlers in the second quarter (FR-BB-OFF-Q2) and the Bay of Biscay inshore trawlers in the last quarter (FR-BB-IN-Q4). The data for these four tuning series are in table 6.6. The last two of these tuning series were incorporated during the benchmark assessment performed at WKFLAT 2011 and, hence, are used in the WGHMM assessment for the first time this year.

The tuning fleets of La Rochelle and Les Sables are based on a list of vessels. In recent years the number of active vessels in this list is steadily declining (Figure 6.2). For Les Sables, the numbers of vessels is 3 in the first quarter of 2010 and 2 in the rest of the year (zero in the second quarter). The number of vessels for La Rochelle is 3 for the beginning of the year and 4 for the third and fourth quarters. The main problem for La Rochelle is not only the decreasing numbers of vessels but the large decrease in effort in recent years. As a consequence, there is a strong concern that these series may no longer be representative of stock abundance.

The table below summarizes the available information on the commercial tuning fleets.

FLEET TYPE	ACRONYM	PERIOD	AGE RANGE	LANDING CONTRIBUTION
Offshore otter trawlers	FR-SABLES	1991 – 2010	1 – 8	<1 %
Offshore otter trawlers	FR-ROCHELLE	1991 – 2010	1 – 8	<1 %
Inshore otter trawlers	FR-BB-IN-Q4	2000 – 2010	1 – 8	<1 %
Offshore otter trawlers	FR-BB-OFF-Q2	2000 – 2010	1 – 8	<1 %

XSA tuning runs (low shrinkage s.e. = 2.5, no taper, other settings as in last year tuning) were carried out on data from each fleet individually. The results showed small residuals for all fleets.

Exploratory runs

To analyze the effect of the above-mentioned changes a retrospective analysis was made including the year 2010 for these two fleets and excluding year 2010 for them (figure 6.3, left and right panels, respectively). The trends in F, SSB and recruits at age 2 are different at the end of the series when the CPUE 2010 for Les Sables and La Rochelle are included. F increases substantially in 2009 and, conversely, SSB also decreases in 2009. Regarding the results for the retrospective graphs excluding the 2010 CPUE values for these series, they seem similar to previous assessments. Taking into account the change in the trend graph and, especially, the low number of vessels now in these tuning fleets, the WGHMM conclusion was to withdraw the 2010 CPUE value for the Les Sables and La Rochelle. This is in agreement with the decision of WKFLAT 2011 to withdraw these series when they became no longer relevant. The assessment this year is done by keeping these series from 1991 to 2009.

Final XSA run

The final XSA was run using the same settings than in last year assessment.

			2010 XSA			2011 XSA
Catch data range			84-09			84-10
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 – RESSGASC2	87-02	2-7	FR-BB-IN-Q4	00-10	3-7
	FR – RESSGASC4	87-02	2-7	FR-BB-OFF-Q2	00-10	2-6
Taper			No			No
Ages catch dep.			No			No
Q plateau			6			6
F shrinkage se			1.5			1.5
Year range			5			5
age range			3			3
Fleet se threshold			0.2			0.2
F bar range			3-6			3-6

The results are given in Table 6.7. The log-catchability residuals are shown in Figure 6.6 and retrospective results in Figure 6.7. The main difference in the retrospective patterns with respect to those obtained in last year's assessment is the large reduction of the diverging trends observed prior to 1991 with RESSGASC survey series due to the removal of them.

Only the fleet FR-BB-OFF-Q2 allows an information of survivors for age 2. Commercial fleet estimates are similar for ages 4 and 5 for all fleets, while Les Sables has a higher weight for ages 4 to 7. Les Sables and La Rochelle dominate the estimates for ages 6 and 7. Estimates of the two new fleets are higher for ages 2 and 3.

Fishing mortalities and stock numbers at age are given in Tables 6.8 and 6.9 respectively. The results are summarised in Table 6.10. Trends in yield, F, SSB and recruitments are plotted in Figure 6.8. Fishing mortality in 2010 is estimated by XSA to have been at 0.39. Fishing mortality in 2009 is now estimated at 0.37, a bit lower than last year WG report (0.39).

6.3.3 Assessment results

6.3.3.1 Estimating year class abundance

The 2007 year class is estimated to be 23.1 million 2 year olds by XSA. Last year's WG XSA estimate (19.9 million) was not accepted by the WG which preferred to overwrite this year class with the $GM_{93\text{-}07}$ (22.8 million) because of the lack of reliability of the XSA estimates that shows the retrospective analysis. The present value indicates that this year class strength is over the 1993-2008 average ($GM_{93\text{-}08}$ = 22.4 million). However, this year class strength is not largely above those of 2005-2006 year classes, as it was expected from the new ORHAGO survey indices (Figure 6.9).

The 2008 year class is estimated to be at 5.8 million 2 year olds by XSA. The WG considered that the reliability of XSA recruitment estimate in terminal year remains too low to change the usual process of overwriting it by the $GM_{93\text{-}08}$, as in previous WG assessment. The estimates are provided by only one tuning fleet and the F shrinkage mean. Furthermore, the new ORHAGO survey indices indicate that the 2008 year class strength should be above those of 2005-2006 year classes (Figure 6.9).

The XSA estimate was consequently overwritten by a short series $GM_{93\text{-}08}$ from 1993 up to two years before the terminal years (2008), as in preceding assessments, since there is observed fall in stock numbers at age 2 after 1993. This $GM_{93\text{-}08}$ is also used to estimate subsequent recruitments.

Recruitment at age 2

Year class	Thousands	Basis	Surveys	Commercial	Shrinkage
2007	23074	XSA	0 %	83 %	17 %
2008	22443	GM(93-08)			
2009 & subsequent	22443	GM(93-08)			

6.3.3.2 Historic trends in biomass, fishing mortality and recruitment

A full summary of the time series of XSA results is given in Table 6.10 and illustrated in Figure 6.8.

Since 1984, fishing mortality gradually has increased, peaked in 2002 and decreased substantially the following two years. It increased in 2005 and, later on stabilized at around 0.4. Fishing mortality was 0.43 in 2008, 0.37 in 2009 and 0.39 in 2010.

SSB trend in earlier years increases from 12300 t in 1984 to 16 500 t in 1993, afterwards it shows a continuous decrease to 9 700 t in 2003. After a 29 % increase between 2003 and 2006, the SSB remains close to 12000 t from 2007 onwards. It is estimated to be 11800 t in 2010, 1% lower than in 2009.

The recruitment values are lower since 1993. Since 2004 the series is fluctuating, but few values below the average are worth noting since 2001.

6.3.4 Catch options and prognosis

The exploitation pattern is the mean over the period 2008-2010 (over 2008-2009 at age 2), considering the absence of trend in F in the last three years of the assessment. This *status quo* F is estimated at 0.39.

The recruits at age 2 from 2011 to 2013 are assumed equal to $GM_{93\text{-}08}$. Stock numbers at age 3 in 2011 are derived from $GM_{93\text{-}08}$ reduced by total estimated mortality (M plus the average F at age 2 for years 2008 and 2009). Stock numbers at ages 4 and above in 2011 are the XSA survivor estimates.

Weights at age in the landings are the 2008-2010 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 2008-2010 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.

6.3.4.1 Short term predictions

Input values for the catch forecast are given in Table 6.11.

The landings forecasts is 4364 t in 2011 (TAC is set at 4250 t), 9 % higher than the 2010 landings.

Assuming recruitment at $GM_{93\text{-}08}$, the SSB is predicted to increase to 13400 t in 2011 and to 13900 t in 2012, fishing at *status quo* F in 2011. It will continue to grow at *status quo* F, to reach 14200 t in 2013 (Tables 6.12 and 6.13).

The proportional contributions of recent year classes to the landings in 2012 and to the SSB in 2013 are given in Table 6.14. Year classes for which $GM_{93\text{-}08}$ recruitment has been assumed (2008 to 2011) contribute 61 % of the 2012 landings and 67.5 % of the 2013 SSB.

6.3.4.2 Yield and Biomass Per Recruit

Results for yield and SSB per recruit, conditional on *status quo* F, are given in Table 6.15 and in Figure 6.10. The $\mathbf{F}_{sq}$ (0.40) is 36 % above $\mathbf{F}_{max}$ (= 0.25) and 3.2 times $\mathbf{F}_{0.1}$ (=0.12). Long-term equilibrium landings and SSB (at F *status quo* and assuming GM recruitment) are estimated to be 4800 t and 14900 t respectively.

6.3.5 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 $B_{trigger}$	13000 t	Bpa
Approach	F_{MSY}	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
	B_{lim}	Not defined	
Precautionary	B_{pa}	13 000t	The probability of reduced recruitment increases when SSB is below 13 000 t, based on the historical development of the stock.
Approach	F_{lim}	0.58	Based on the historical response of the stock.
	F_{pa}	0.42	F_{lim} * 0.72

The WKFLAT 2011 decided that F_{max} remains unchanged as well as F_{MSY} which is set to F_{max}. The basis for setting F_{lim} was kept (historical response of the stock) and its value remains coherent with the historical SSB trend. Consequently, F_{pa} 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.

6.3.6 Comments on the assessment

Sampling

The sampling level (table 1.3) for this stock is considered to be satisfactory.

The ORHAGO survey provides information on several year class at age 2 but this series must be continued to allow a better estimate of the incoming recruitment. Stopping the use of fleets of La Rochelle and Les Sables tuning series leads to a lack of information at age 2, which is now only given by the Offshore Q2 new tuning fleet. Therefore the rapid incorporation of ORHAGO in the assessment will be necessary.

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 (otoliths exchange and analysis of weight at age estimate process).

Discarding

Available data on discards have shown that discards may be important at age 1 but they are likely low at age 2 and above in recent years. The data available for discard do not seem representative to use them in the assessment but the WKFLAT 2011 recommended that further work should include investigation on the monitoring of the inshore trawlers discards.

Consistency

The RESSGASC series has been removed in the tuning series at WKFLAT 2011. They do not contribute to terminal year estimates, the removal of these series changes rather substantially the earlier part of the trends.

The retrospective results show that the XSA recruitment estimate in terminal year is very uncertain; it was consequently overwritten with a GM estimate, as in previous WG assessments. This GM estimate has a very large 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, 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 is low for the two last years of the assessment (Figure 6.7). The addition of two new tuning fleets decided at the benchmark (WKFLAT 2011) increased slightly the F mortality but does not change the general trend in the retrospective pattern

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 comparison with the last assessment WGHMM shows a change in SSB trends in the earlier part of this series (due to the removal of the RESSGASC survey-series from the tuning-series) has slightly modified the recruitment and SSB plots (Figure 6.11).
At the end of the series a higher fishing mortality is shown after 2007, between 9-13 % but it is decreasing every year. The difference for the SSB is lower, between 6-7%, and seems stable at the end.

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.

Industry input

A meeting with representatives of the fishing industry was held in France prior to the WG to present the data used by the 2011 WGHMM to assess the state of the Bay of Biscay sole stock. Participants expressed no reservations about these data or about the addition of the 2 news tuning fleets and the withdrawal from year 2010 of LA ROCHELLE and LES SABLES tuning series.

6.3.7 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 12500t in 2006 but it remains close to 12000 t thereafter, especially in 2008. It is estimated to be 13400t (above Bpa = 13000 t) in 2011 assuming GM recruitment for 2010.

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. The WKFLAT 2011 has confirmed the robustness of WGHMM assessment and indicated that there is no need to change the biological reference points. This plan was not evaluated by ICES.

Table 6.1 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[1]	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	-	-

[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 **6.1 b** : Bay of Biscay sole (Division VIIIa,b). Contribution (in %) to the total landings by differents fleets.

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	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
Shrimp trawlers	0	0
Inshore trawlers	6	8
Offshore otter trawlers	21	19
Offshore beam trawlers	10	11
Fixed nets	63	61

Table **6.2 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	CPUE Offshore (14-18m) trawlers of French sole fishery	LPUE La Rochelle offshore trawlers of French sole fishery	LPUE Les Sables offshore trawlers of French sole fishery	LPUE Other harbours * offshore trawlers of French sole fishery	LPUE All offshore trawlers of French sole fishery	effort index All offshore trawlers of French sole fishery
	Q4	Q2	(kg/h)	(kg/h)	(kg/h)	(kg/h)	(1000 h)
1984	-	-	6.0	6.9	5.0	5.9	557
1985	-	-	5.6	6.5	4.3	4.9	454
1986	-	-	7.2	7.2	4.5	5.5	526
1987	-	-	6.6	5.9	4.6	5.4	816
1988	-	-	6.4	6.7	4.1	5.1	944
1989	-	-	5.5	6.1	4.5	5.1	996
1990	-	-	7.1	6.3	4.9	5.7	975
1991	-	-	6.5	6.5	4.7	5.4	954
1992	-	-	5.4	5.6	4.9	5.1	884
1993	-	-	4.6	6.4	4.9	5.2	791
1994	-	-	5.0	6.6	5.8	5.6	944
1995	-	-	4.6	5.4	5.0	5.2	742
1996	-	-	4.9	6.0	5.0	5.4	628
1997	-	-	4.1	5.3	4.6	4.7	774
1998	-	-	4.2	5.3	4.2	4.2	834
1999	-	-	3.7	5.9	4.2	4.5	524
2000	6.3	3.6	4.0	5.7	4.7	4.7	577
2001	5.8	3.4	3.4	4.0	5.2	4.7	454
2002	4.8	4.3	4.4	5.0	4.6	4.6	430
2003	5.9	4.1	4.1	3.9	4.8	4.6	447
2004	5.5	3.6	4.0	4.1	4.7	4.4	448
2005	5.3	3.3	3.9	5.2	4.2	4.2	495
2006	6.4	2.2	3.4	5.4	4.5	4.5	465
2007	5.4	3.7	3.5	5.3	4.6	4.5	440
2008	4.4	3.2	4.1	5.6	4.6	4.5	468
2009	5.1	3.6	3.3	5.2	na	na	na
2010	4.7	3.4	3.6	5.7	na	na	na

* French offshore trawlers in other harbours than in La Rochelle and Les Sables
na : non available

Table **6.2 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	na	na

Table 6.3 : Bay of Biscay Sole - 2010
French and Belgian relative length distribution of landings

Length(cm)	France	Belgium
13	0.00	0.00
14	0.00	0.00
15	0.00	0.00
16	0.00	0.00
17	0.00	0.00
18	0.00	0.00
19	0.00	0.00
20	0.00	0.00
21	0.03	0.01
22	0.33	0.30
23	2.93	6.24
24	7.58	12.29
25	9.85	14.53
26	10.89	13.03
27	10.72	12.60
28	10.17	10.94
29	11.19	7.58
30	9.71	7.15
31	7.99	4.42
32	5.39	3.21
33	3.35	2.22
34	2.36	1.52
35	1.59	1.12
36	1.31	1.03
37	1.03	0.68
38	0.71	0.47
39	0.60	0.27
40	0.51	0.17
41	0.40	0.09
42	0.37	0.05
43	0.24	0.03
44	0.22	0.01
45	0.15	0.01
46	0.15	0.00
47	0.07	0.01
48	0.06	0.00
49	0.04	0.00
50	0.02	0.00
51	0.01	0.00
52	0.01	0.00
53	0.00	0.00
54	0.00	0.00
55	0.00	0.00
Total	100.00	100.00

MLS= 24 cm

Table 6.4: Bay of Biscay Sole, Catch number at age (in thousands)

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Age										
2	5901	8493	6126	3794	4962	4918	7122	4562	4640	1897
3	3164	4606	4208	5634	5928	6551	6312	6302	7279	7816
4	2786	2479	2673	3578	4191	3802	4423	4512	4920	6879
5	2034	1962	2301	2005	2293	3147	2833	2083	2991	3661
6	1164	906	1512	1482	1388	2046	972	1113	2236	1625
7	880	708	1044	690	874	967	1018	1063	1124	566
+gp	1181	729	1235	714	766	499	870	981	951	708
TOTALNUM	17110	19883	19099	17897	20402	21930	23550	20616	24141	23152
TONSLAND	4038	4251	4805	5086	5382	5845	5916	5569	6550	6420
SOPCOF %	107	103	102	102	101	101	100	102	100	100

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
2	2603	3249	3027	3801	4096	2851	5677	3180	5198	4274
3	5502	5663	5180	9079	5550	5113	7015	6528	4777	6309
4	8803	6356	5409	5380	6351	4870	5143	4948	4932	2236
5	5040	3644	2343	3063	2306	2764	2542	1776	3095	1220
6	1968	1795	1697	1578	1237	1314	955	899	1269	729
7	970	843	1366	692	785	902	421	513	615	377
+gp	696	986	1319	877	1188	977	444	486	432	250
TOTALNUM	25582	22536	20341	24470	21513	18791	22197	18330	20318	15395
TONSLAND	7229	6205	5854	6259	6027	5249	5760	4836	5486	4108
SOPCOF %	100	100	100	100	101	100	101	101	101	101

Year	2004	2005	2006	2007	2008	2009	2010
2	3411	3976	3535	3885	3173	2860	2074
3	5415	3464	4436	5181	4794	3986	7722
4	3291	3738	2747	2615	2886	2233	3832
5	917	2309	2012	1419	1353	1501	1303
6	661	991	1030	1262	938	946	494
7	272	461	530	686	892	541	274
+gp	333	508	1537	946	1193	960	283
TOTALNUM	14300	15447	15827	15994	15229	13027	15982
TONSLAND	4002	4539	4793	4363	4299	3650	3966
SOPCOF %	101	102	101	100	100	102	100

Table 6.5: Bay of Biscay Sole, Catch weight at age (in kg)

Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Age										
2	0.121	0.106	0.102	0.141	0.134	0.136	0.131	0.143	0.146	0.145
3	0.168	0.174	0.173	0.201	0.19	0.188	0.179	0.192	0.196	0.197
4	0.213	0.252	0.245	0.285	0.272	0.258	0.241	0.26	0.262	0.267
5	0.269	0.313	0.328	0.376	0.357	0.354	0.348	0.325	0.341	0.341
6	0.329	0.39	0.409	0.467	0.495	0.437	0.436	0.437	0.404	0.439
7	0.368	0.457	0.498	0.497	0.503	0.543	0.601	0.535	0.49	0.569
+gp	0.573	0.698	0.657	0.682	0.604	0.799	0.854	0.715	0.715	0.677
SOPCOFAC	1.0712	1.0302	1.0197	1.0248	1.008	1.0055	1.0039	1.0183	1.0004	1.0008

Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Age										
2	0.147	0.16	0.159	0.142	0.161	0.177	0.171	0.152	0.171	0.18
3	0.195	0.206	0.204	0.193	0.212	0.219	0.207	0.22	0.208	0.226
4	0.251	0.252	0.268	0.256	0.257	0.246	0.276	0.265	0.263	0.307
5	0.324	0.308	0.319	0.319	0.335	0.305	0.343	0.341	0.32	0.361
6	0.421	0.403	0.399	0.406	0.41	0.404	0.452	0.428	0.466	0.487
7	0.569	0.484	0.453	0.502	0.501	0.533	0.573	0.519	0.592	0.657
+gp	0.774	0.658	0.625	0.678	0.7	0.582	0.755	0.619	0.681	0.642
SOPCOFAC	1.0016	1.0023	0.9998	1.0048	1.0091	1.0006	1.0066	1.01	1.0122	1.0056

Year	2004	2005	2006	2007*	2008*	2009*	2010*
Age							
2	0.19	0.189	0.195	0.176	0.174	0.17	0.179
3	0.227	0.226	0.242	0.225	0.229	0.215	0.205
4	0.29	0.298	0.282	0.298	0.287	0.275	0.267
5	0.391	0.367	0.347	0.326	0.352	0.317	0.33
6	0.493	0.43	0.42	0.388	0.392	0.361	0.406
7	0.643	0.468	0.455	0.419	0.401	0.447	0.471
+gp	0.81	0.656	0.533	0.511	0.519	0.601	0.775
SOPCOFAC	1.0104	1.0153	1.0136	1.0026	1	1.0158	1.0024

(*) for 2007 to 2010, 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 1.05

Table 6.6: Sole 8ab, available tuning data (landings); SOLE VIIIa,b commercial landings (N in 10-3) - 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
2010	2305	0.6	16.0	36.1	5.8	1.1	0.4	0.2	0.2

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
2010	1028	0.3	6.4	11.6	2.4	0.5	0.2	0.1	0.1

FR-BB-IN-Q4

Year	Fishing effort	1	2	3	4	5	6	7	8
2000	1336	4.23	21.85	**11.66**	**3.47**	**1.04**	**0.35**	**0.24**	**0.09**
2001	2451	24.26	49.94	**8.82**	**2.73**	**1.04**	**0.88**	**0.42**	**0.69**
2002	2942	19.73	31.21	**14.52**	**2.13**	**1.30**	**1.30**	**0.84**	**0.66**
2003	3423	1.98	35.50	**38.68**	**5.46**	**1.04**	**0.63**	**0.46**	**0.60**
2004	2725	3.84	22.03	**21.64**	**7.90**	**3.14**	**2.67**	**0.50**	**1.25**
2005	4432	8.84	42.24	**14.57**	**11.70**	**4.75**	**1.89**	**0.99**	**2.42**
2006	5212	18.97	67.59	**22.00**	**5.47**	**3.76**	**3.17**	**2.12**	**4.93**
2007	3139	2.31	29.16	**13.61**	**6.15**	**3.15**	**2.61**	**0.58**	**1.86**
2008	3082	0.51	12.32	**14.05**	**7.62**	**2.64**	**1.48**	**1.09**	**1.10**
2009	1828	1.56	28.03	**8.62**	**1.97**	**1.06**	**0.90**	**0.37**	**0.80**
2010	2633	0.94	13.80	**21.21**	**6.00**	**1.91**	**0.60**	**0.28**	**0.67**

FR-BB-OFF-Q2

Year	Fishing effort	1	2	3	4	5	6	7	8
2000	4940	0.00	**20.77**	**25.67**	**21.00**	**8.64**	**2.47**	0.82	1.50
2001	4538	0.01	**13.50**	**27.47**	**18.90**	**5.17**	**3.31**	1.29	0.98
2002	4639	0.01	**31.90**	**29.40**	**14.88**	**7.87**	**3.55**	1.84	0.46
2003	3252	0.02	**23.23**	**28.04**	**7.10**	**1.88**	**0.82**	0.08	0.03
2004	4810	0.00	**14.05**	**44.18**	**14.60**	**1.38**	**0.70**	0.27	0.41
2005	4468	3.58	**12.78**	**19.09**	**15.79**	**5.63**	**0.54**	0.42	0.56
2006	2111	0.00	**3.29**	**8.97**	**2.73**	**1.41**	**0.91**	0.31	0.29
2007	3972	0.00	**13.33**	**45.84**	**6.37**	**1.17**	**1.68**	0.24	0.54
2008	3005	0.00	**15.28**	**21.67**	**6.78**	**2.15**	**0.36**	0.77	0.45
2009	1360	0.00	**1.69**	**12.24**	**4.09**	**1.29**	**0.39**	0.25	0.55
2010	2100	0.00	**1.41**	**24.88**	**7.22**	**1.96**	**0.10**	0.02	0.06

Table 6.7

```
Lowestoft VPA Version 3.1

    7/05/2011  21:54

 Extended Survivors Analysis

 SOLE VIIIa,b

 CPUE data from file tunfiltLRLS09.dat

 Catch data for  27 years. 1984 to 2010. Ages  2 to   8.

      Fleet,           First, Last, First, Last, Alpha,  Beta
                     ,    year, year,  age ,  age
 FR-SABLES           ,   1991, 2010,   2,     7,   .000,  1.000
 FR-ROCHELLE         ,   1991, 2010,   2,     7,   .000,  1.000
 FR-BB-IN-Q4         ,   2000, 2010,   3,     7,   .750,  1.000
 FR-BB-OFF-Q2        ,   2000, 2010,   2,     6,   .250,   .500


 Time series weights :

      Tapered time weighting not applied

 Catchability analysis :

      Catchability independent of stock size for all ages

      Catchability independent of age for ages >=    6


 Terminal population estimation :

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

      S.E. of the mean to which the estimates  are shrunk =   1.500

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

      Prior weighting not applied

 Tuning had not converged after   30 iterations


 Total absolute residual between iterations
 29 and  30 =     .00106

 Final year F values
 Age         ,      2,      3,      4,      5,      6,      7
 Iteration 29,  .4718,  .5927,  .4638,  .3250,  .1850,  .2024
 Iteration 30,  .4717,  .5925,  .4636,  .3248,  .1848,  .2021


 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,  2001,  2002,  2003,  2004,  2005,  2006,  2007,  2008,  2009,  2010

      2,  .220,  .246,  .202,  .233,  .253,  .204,  .239,  .171,  .140,  .472
      3,  .509,  .524,  .468,  .376,  .348,  .439,  .456,  .460,  .300,  .593
      4,  .650,  .808,  .441,  .422,  .429,  .455,  .444,  .439,  .358,  .464
      5,  .579, 1.001,  .416,  .289,  .522,  .384,  .399,  .386,  .381,  .325
      6,  .531,  .966,  .594,  .369,  .511,  .412,  .392,  .443,  .452,  .185
      7,  .520,  .754,  .764,  .408,  .422,  .501,  .471,  .469,  .438,  .202
```

Table 6.7 (cont'd)

1

XSA population numbers (Thousands)

YEAR	AGE 2	3	4	5	6	7
2001	1.70E+04	1.72E+04	1.09E+04	4.25E+03	2.29E+03	1.33E+03
2002	2.51E+04	1.23E+04	9.35E+03	5.14E+03	2.15E+03	1.22E+03
2003	2.45E+04	1.77E+04	6.60E+03	3.77E+03	1.71E+03	7.42E+02
2004	1.73E+04	1.81E+04	1.01E+04	3.84E+03	2.25E+03	8.54E+02
2005	1.87E+04	1.24E+04	1.13E+04	5.97E+03	2.60E+03	1.41E+03
2006	2.02E+04	1.31E+04	7.90E+03	6.64E+03	3.20E+03	1.41E+03
2007	1.92E+04	1.49E+04	7.66E+03	4.54E+03	4.09E+03	1.92E+03
2008	2.12E+04	1.37E+04	8.54E+03	4.44E+03	2.76E+03	2.50E+03
2009	2.31E+04	1.62E+04	7.81E+03	4.98E+03	2.73E+03	1.60E+03
2010	5.80E+03	1.82E+04	1.09E+04	4.94E+03	3.08E+03	1.57E+03

Estimated population abundance at 1st Jan 2011

, 0.00E+00, 3.27E+03, 9.09E+03, 6.18E+03, 3.23E+03, 2.32E+03,

Taper weighted geometric mean of the VPA populations:

, 2.33E+04, 1.81E+04, 1.11E+04, 6.06E+03, 3.32E+03, 1.81E+03,

Standard error of the weighted Log(VPA populations) :

, .3371, .2106, .2391, .2507, .2796, .3980,

1

Log catchability residuals.

Fleet : FR-SABLES

Age	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2	-.23	-.14	-.38	-.41	-.09	-.21	-.12	-.03	-.18	.19
3	.13	-.16	.19	-.08	-.15	.00	.23	.02	-.39	.42
4	.15	-.25	-.07	.39	.17	.04	.03	.46	-.20	.16
5	.10	-.14	-.09	.25	.02	-.10	-.22	.17	.29	-.06
6	-.18	.18	-.38	.04	-.24	.25	-.01	-.39	.42	-.04
7	-.06	-.15	-.27	.17	.06	.47	-.02	.11	.54	.06

Age	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
2	-.17	.21	-.13	.28	.45	.72	.17	.00	.09	99.99
3	.10	.28	.02	-.27	-.17	-.02	-.14	.05	-.03	99.99
4	-.03	.16	-.27	-.18	-.13	-.46	.02	.14	-.14	99.99
5	-.25	.36	-.14	-.47	.23	-.73	.34	.25	.19	99.99
6	-.21	.38	.05	-.32	.17	-.57	.27	.30	.28	99.99
7	-.24	.09	.10	-.14	.08	-.15	.59	.35	.25	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	-15.0706	-14.5473	-14.5057	-14.6919	-14.6814	-14.6814
S.E(Log q)	.2841	.1975	.2307	.2886	.2930	.2703

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	3.50	-2.478	27.58	.05	19	.88	-15.07
3	.91	.491	14.13	.65	19	.18	-14.55
4	.74	1.962	13.15	.77	19	.16	-14.51
5	.97	.107	14.53	.47	19	.29	-14.69
6	1.35	-.952	17.00	.31	19	.40	-14.68
7	.73	2.385	12.64	.82	19	.16	-14.58

1

Table 6.7 (cont'd)

Fleet : FR-ROCHELLE

Age	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
2	-.09	-.18	-.46	-.40	-.05	.32	-.06	.19	-.03	.19
3	.22	-.02	.02	-.19	-.09	.08	.14	-.07	-.46	-.24
4	.47	.15	-.19	.32	.33	-.12	-.05	.50	-.22	-.08
5	.48	.19	-.06	.22	.24	-.33	-.33	.02	.20	-.14
6	.13	.35	-.25	.12	-.34	-.10	.00	-.52	.52	-.30
7	.02	.08	-.04	-.01	-.07	-.11	-.11	.02	.23	-.24

Age	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
2	-.23	.69	.15	.35	.09	-.10	-.03	.06	-.43	99.99
3	-.05	.21	.24	-.07	-.37	-.26	.47	.47	-.02	99.99
4	.17	-.29	-.04	-.23	-.19	-.28	-.22	.16	-.17	99.99
5	-.03	-.04	-.04	-.45	.32	-.27	-.27	.20	.08	99.99
6	.11	.02	.11	-.18	.42	-.09	-.24	.11	.14	99.99
7	.10	-.08	-.20	-.04	.21	.00	-.27	.22	.11	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	-15.0049	-14.5886	-14.8086	-15.1660	-15.2188	-15.2188
S.E(Log q)	.2861	.2527	.2577	.2530	.2686	.1466

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	1.13	-.344	15.65	.29	19	.33	-15.00
3	1.01	-.044	14.64	.48	19	.26	-14.59
4	.72	1.976	13.25	.74	19	.17	-14.81
5	.80	1.155	13.84	.65	19	.20	-15.17
6	1.54	-1.461	19.12	.30	19	.40	-15.22
7	.85	1.786	14.08	.90	19	.12	-15.23

1

Fleet : FR-BB-IN-Q4

Age	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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	.26
4	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	.54
5	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	.26
6	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-.41
7	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-.14

Age	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
2	No data for this fleet at this age									
3	-.48	.19	.60	.15	-.38	-.11	-.19	-.05	-.33	.35
4	-.48	-.62	.19	.35	.15	-.39	.25	.37	-.44	.07
5	-.27	-.05	-.63	.58	.27	-.35	.37	.22	-.29	-.10
6	-.01	.64	-.33	.87	.02	.08	.13	.02	.06	-1.06
7	-.21	.58	.34	.20	-.09	.57	-.55	-.17	-.31	-1.14

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	-14.3707	-14.9571	-15.2578	-15.1082	-15.1082
S.E(Log q)	.3369	.4070	.3663	.5097	.5113

Table 6.7 (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
3,	.55,	1.332,	12.25,	.49,	11,	.18,	-14.37,
4,	.92,	.109,	14.51,	.18,	11,	.40,	-14.96,
5,	1.13,	-.167,	16.16,	.15,	11,	.44,	-15.26,
6,	1.53,	-.480,	18.98,	.08,	11,	.81,	-15.11,
7,	3.56,	-1.659,	35.57,	.04,	11,	1.65,	-15.19,

1

Fleet : FR-BB-OFF-Q2

Age	1991,	1992,	1993,	1994,	1995,	1996,	1997,	1998,	1999,	2000
2 ,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	.10
3 ,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	-.53
4 ,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	.42
5 ,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	.79
6 ,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	99.99,	.72
7 ,	No data for this fleet at this age									

Age	2001,	2002,	2003,	2004,	2005,	2006,	2007,	2008,	2009,	2010
2 ,	.12,	.57,	.62,	.09,	-.01,	-.71,	.12,	.41,	-1.09,	-.20
3 ,	-.25,	.14,	.06,	.07,	-.33,	-.36,	.52,	.14,	.13,	.40
4 ,	.29,	.24,	.06,	-.04,	.01,	-.64,	-.39,	-.16,	.18,	.03
5 ,	.51,	.87,	-.11,	-.88,	.25,	-.54,	-.98,	-.07,	.09,	.07
6 ,	1.17,	1.45,	.43,	-.48,	-.76,	.27,	.00,	-.85,	.04,	-1.98
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,	-15.5528,	-14.3853,	-14.7827,	-15.3880,	-15.8992,
S.E(Log q),	.5160,	.3281,	.3071,	.6124,	.9838,

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,	.83,	.510,	14.56,	.49,	11,	.44,	-15.55,
3,	.98,	.025,	14.31,	.21,	11,	.34,	-14.39,
4,	.58,	1.360,	12.41,	.54,	11,	.17,	-14.78,
5,	.57,	.661,	12.40,	.21,	11,	.36,	-15.39,
6,	-1.49,	-1.281,	-4.08,	.03,	11,	1.42,	-15.90,

1

Terminal year survivor and F summaries :

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

Year class = 2008

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 ,	2667.,	.539,	.000,	.00,	1,	.829,	.554
F shrinkage mean ,	8827.,	1.50,,,,				.171,	.202

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
3274.,	.52,	.50,	2,	.962,	.472

Table 6.7 (cont'd)

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

Year class = 2007

Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
FR-SABLES           ,      9987.,   .291,       .000,     .00,   1,  .251,     .551
FR-ROCHELLE         ,      5937.,   .294,       .000,     .00,   1,  .248,     .805
FR-BB-IN-Q4         ,     12855.,   .352,       .000,     .00,   1,  .198,     .452
FR-BB-OFF-Q2        ,      9196.,   .290,       .656,    2.26,   2,  .283,     .587

  F shrinkage mean  ,     14857.,   1.50,,,,                         .020,     .402

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
     9088.,       .15,      .20,    6,   1.308,   .593


1
Age  4   Catchability constant w.r.t. time and dependent on age

Year class = 2006

Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
FR-SABLES           ,      6024.,   .167,       .013,     .08,   2,  .343,     .473
FR-ROCHELLE         ,      6243.,   .195,       .037,     .19,   2,  .247,     .460
FR-BB-IN-Q4         ,      5393.,   .274,       .201,     .73,   2,  .155,     .516
FR-BB-OFF-Q2        ,      6892.,   .218,       .085,     .39,   3,  .245,     .425

  F shrinkage mean  ,      6856.,   1.50,,,,                         .010,     .426

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
     6182.,       .10,      .04,   10,    .417,   .464

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

Year class = 2005

Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
FR-SABLES           ,      3169.,   .141,       .081,     .57,   3,  .355,     .330
FR-ROCHELLE         ,      3436.,   .163,       .202,    1.24,   3,  .268,     .308
FR-BB-IN-Q4         ,      2691.,   .234,       .111,     .48,   3,  .185,     .379
FR-BB-OFF-Q2        ,      3740.,   .214,       .025,     .12,   4,  .184,     .286

  F shrinkage mean  ,      2406.,   1.50,,,,                         .008,     .416

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,   Ratio,
     3232.,       .09,      .06,   14,    .646,   .325

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

Year class = 2004

Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                 Survivors,    s.e,       s.e,   Ratio,    , Weights,    F
FR-SABLES           ,      2661.,   .134,       .138,    1.03,   4,  .350,     .163
FR-ROCHELLE         ,      2685.,   .146,       .096,     .66,   4,  .323,     .161
FR-BB-IN-Q4         ,      1619.,   .225,       .285,    1.26,   4,  .179,     .255
FR-BB-OFF-Q2        ,      1951.,   .218,       .338,    1.55,   5,  .140,     .216

  F shrinkage mean  ,       842.,   1.50,,,,                         .007,     .443

Weighted prediction :
```

Table 6.7 (cont'd)

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
2317.,	.08,	.10,	18,	1.239,	.185

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

Year class = 2003

Fleet,		Estimated,	Int,	Ext,	Var,	N,	Scaled,	Estimated
,		Survivors,	s.e,	s.e,	Ratio,	,	Weights,	F
FR-SABLES	,	1383.,	.131,	.076,	.58,	5,	.355,	.173
FR-ROCHELLE	,	1218.,	.137,	.091,	.66,	5,	.357,	.194
FR-BB-IN-Q4	,	902.,	.225,	.294,	1.31,	5,	.181,	.254
FR-BB-OFF-Q2	,	896.,	.218,	.085,	.39,	5,	.099,	.255
F shrinkage mean	,	678.,	1.50,,,,				.008,	.325

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	,	Ratio,	
1165.,	.08,	.08,	21,	.929,	.202

1
1

Table 6.8: Bay of Biscay Sole, Fishing mortality (F) at age

Terminal Fs derived using XSA (With F shrinkage)

YEAR / AGE		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
	2	0.2965	0.3597	0.2572	0.1741	0.2167	0.2023	0.265	0.1437	0.1483	0.0833
	3	0.2429	0.3534	0.2706	0.3539	0.3979	0.4354	0.3828	0.352	0.3183	0.3532
	4	0.3356	0.2719	0.3173	0.3453	0.4294	0.4253	0.5227	0.4595	0.4525	0.4966
	5	0.3476	0.3716	0.3864	0.3704	0.3455	0.5889	0.5736	0.4422	0.5574	0.636
	6	0.3193	0.2289	0.4834	0.4091	0.4201	0.5225	0.3199	0.41	1.0781	0.5942
	7	0.3351	0.2915	0.3969	0.3761	0.3996	0.5142	0.4738	0.608	0.8338	0.782
+gp		0.3351	0.2915	0.3969	0.3761	0.3996	0.5142	0.4738	0.608	0.8338	0.782
0 FBAR 3- 6		0.3113	0.3065	0.3644	0.3697	0.3982	0.493	0.4497	0.4159	0.6016	0.52

YEAR / AGE		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	2	0.1099	0.1558	0.1142	0.1844	0.2116	0.1308	0.2731	0.2197	0.2458	0.2022
	3	0.3265	0.3277	0.3524	0.5122	0.3957	0.3931	0.4781	0.5092	0.524	0.468
	4	0.7492	0.6792	0.5264	0.6635	0.7282	0.6363	0.7663	0.6497	0.8085	0.4405
	5	0.7355	0.7138	0.5044	0.5684	0.5906	0.7242	0.7197	0.5791	1.0011	0.4158
	6	0.7511	0.558	0.7682	0.67	0.418	0.7072	0.5207	0.5308	0.9661	0.5943
	7	0.7666	0.7547	0.9899	0.7359	0.7437	0.5417	0.4527	0.5202	0.7538	0.7645
+gp		0.7666	0.7547	0.9899	0.7359	0.7437	0.5417	0.4527	0.5202	0.7538	0.7645
0 FBAR 3- 6		0.6406	0.5697	0.5379	0.6035	0.5331	0.6152	0.6212	0.5672	0.8249	0.4797

YEAR / AGE		2004	2005	2006	2007	2008	2009	2010	FBAR **-**
	2	0.2328	0.2531	0.2037	0.2393	0.1709	0.1396	0.4717	0.2607
	3	0.3765	0.3485	0.4388	0.4557	0.46	0.2995	0.5925	0.4507
	4	0.4217	0.4289	0.4547	0.4445	0.4391	0.3577	0.4636	0.4201
	5	0.2889	0.5221	0.3836	0.3985	0.3857	0.3811	0.3248	0.3639
	6	0.3692	0.5108	0.4124	0.3917	0.4427	0.4521	0.1848	0.3599
	7	0.4075	0.422	0.501	0.4712	0.4693	0.4385	0.2021	0.37
+gp		0.4075	0.422	0.501	0.4712	0.4693	0.4385	0.2021	
0 FBAR 3- 6		0.3641	0.4526	0.4224	0.4226	0.4319	0.3726	0.3914	

Table 6.9: Bay of Biscay Sole, Stock number at age (start of year) Numbers*10**-3

Terminal Fs derived using XSA (With F shrinkage)

YEAR / AGE		1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
	2	24178	29550	28402	24968	26778	28230	32166	35821	35397	24941
	3	15425	16264	18659	19872	18983	19510	20866	22330	28072	27615
	4	10274	10947	10335	12881	12621	11538	11422	12876	14210	18477
	5	7283	6646	7548	6809	8252	7434	6823	6127	7359	8178
	6	4477	4655	4147	4641	4254	5285	3733	3479	3563	3813
	7	3249	2943	3350	2314	2789	2529	2836	2453	2089	1097
+gp		4347	3022	3948	2386	2435	1299	2413	2251	1755	1363
0 TOTAL		69232	74028	76389	73870	76112	75824	80258	85337	92445	85484

YEAR / AGE		1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
	2	26286	23679	29498	23728	22583	24445	24974	16951	25077	24546
	3	20763	21308	18335	23811	17854	16538	19406	17198	12313	17746
	4	17552	13554	13894	11663	12909	10876	10101	10887	9351	6597
	5	10175	7508	6218	7426	5435	5639	5208	4247	5144	3770
	6	3917	4413	3327	3397	3806	2725	2473	2295	2154	1711
	7	1905	1673	2285	1396	1573	2267	1215	1330	1221	742
+gp		1357	1943	2188	1758	2365	2444	1277	1254	852	488
0 TOTAL		81956	74078	75745	73181	66526	64934	64655	54160	56112	55600

YEAR / AGE		2004	2005	2006	2007	2008	2009	2010	2011	GMST 84-**	AMST 84-**
	2	17264	18691	20163	19189	21229	23074	(5798)	(0)	24685	25149
	3	18144	12376	13130	14882	13667	16190	18158	(3274)	18183	18603
	4	10056	11267	7904	7661	8537	7807	10858	9088	11228	11536
	5	3842	5968	6639	4538	4444	4980	4940	6182	6159	6346
	6	2251	2604	3204	4093	2757	2734	3078	3232	3359	3487
	7	854	1408	1414	1919	2503	1602	1574	2317	1829	1974
+gp		1042	1545	4082	2635	3334	2832	1623	2365		
0 TOTAL		53454	53860	56535	54918	56472	59219	46028	26458		

( ) age 2 replaced by GM 93-2008 = 22443
( ) age 3 replaced by GM e-(F08-09+M) = 17387

Table 6.10: Bay of Biscay Sole, Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS Age 2	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 3- 6
1984	24178	14823	12328	4038	0.3276	0.3113
1985	29550	16071	13377	4251	0.3178	0.3065
1986	28402	17091	14497	4805	0.3315	0.3644
1987	24968	18691	15507	5086	0.328	0.3697
1988	26778	18553	15397	5382	0.3495	0.3982
1989	28230	17836	14512	5845	0.4028	0.493
1990	32166	18468	14886	5916	0.3974	0.4497
1991	35821	19191	14879	5569	0.3743	0.4159
1992	35397	20620	16059	6550	0.4079	0.6016
1993	24941	19999	16467	6420	0.3899	0.52
1994	26286	19399	15951	7229	0.4532	0.6406
1995	23679	17773	14348	6205	0.4325	0.5697
1996	29498	17868	13931	5854	0.4202	0.5379
1997	23728	16592	13430	6259	0.466	0.6035
1998	22583	16564	13348	6027	0.4515	0.5331
1999	24445	16075	12437	5249	0.422	0.6152
2000	24974	15640	11970	5760	0.4812	0.6212
2001	16951	13142	10660	4836	0.4537	0.5672
2002	25077	13262	9836	5486	0.5577	0.8249
2003	24546	13449	9702	4108	0.4234	0.4797
2004	17264	14320	11302	4002	0.3541	0.3641
2005	18691	14670	11692	4539	0.3882	0.4526
2006	20163	15806	12526	4793	0.3827	0.4224
2007	19189	15095	11990	4363	0.3639	0.4226
2008	21229	15555	12258	4299	0.3507	0.4319
2009	23074	15411	11878	3650	0.3073	0.3726
2010	(5798)	13279	11764	3966	0.3371	0.3914
Arith. Mean	24356	16491	13220	5203	0.3953	0.4845
0 Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		
GM 93-2008 =	22443					

Table 6.11: Multifleet prediction input data

Sole in Bay of Biscay
Multi fleet input data

MFDP version 1a
Run: WG2011_BoB_sol
Time and date: 17:50 06/05/2011
Fbar age range (Total) : 3-6
Fbar age range Fleet 1 : 3-6

Input Fs are 2008-2009 means at age 2
Input Fs are 2008-2010 means at age 3 to 8
Catch and stock wts are 2008-2010 means
Recruits are 1993-2008 GM
unscaled F

2011

Age	N	M	Mat	PF	PM	Stock Wt	F Landings	Landing WT
2	22443	0.1	0.32	0	0	0.185	0.1553	0.174
3	17387	0.1	0.83	0	0	0.229	0.4507	0.216
4	9088	0.1	0.97	0	0	0.293	0.4201	0.276
5	6182	0.1	1	0	0	0.353	0.3639	0.333
6	3232	0.1	1	0	0	0.410	0.3599	0.386
7	2317	0.1	1	0	0	0.466	0.3700	0.440
8	2365	0.1	1	0	0	0.671	0.3700	0.632

2012

Age	N	M	Mat	PF	PM	Stock Wt	F Landings	Landing WT
2	22443	0.1	0.32	0	0	0.185	0.1553	0.174
3		0.1	0.83	0	0	0.229	0.4507	0.216
4		0.1	0.97	0	0	0.293	0.4201	0.276
5		0.1	1	0	0	0.353	0.3639	0.333
6		0.1	1	0	0	0.410	0.3599	0.386
7		0.1	1	0	0	0.466	0.3700	0.440
8		0.1	1	0	0	0.671	0.3700	0.632

2013

Age	N	M	Mat	PF	PM	Stock Wt	F Landings	Landing WT
2	22443	0.1	0.32	0	0	0.185	0.1553	0.174
3		0.1	0.83	0	0	0.229	0.4507	0.216
4		0.1	0.97	0	0	0.293	0.4201	0.276
5		0.1	1	0	0	0.353	0.3639	0.333
6		0.1	1	0	0	0.410	0.3599	0.386
7		0.1	1	0	0	0.466	0.3700	0.440
8		0.1	1	0	0	0.671	0.3700	0.632

Table 6.12: Bay of Biscay Sole Multifleet prediction, management option table

MFDP version 1a
Run: WG2011_BoB_sol
Time and date: 17:50 06/05/2011
Fbar age range (Total) : 3-6
Fbar age range Fleet 1 : 3-6

Basis
F(2011) = mean F(08–09) unscaled (age 2)
F(2011) = mean F(08–10) unscaled (age 3 to above)
R10–12 = GM(93–08) = 22.4 million

2011

Biomass	SSB	Landings FMult	Landings FBar	Yield
16975	13391	1.0000	0.3986	4364

2012

Biomass	SSB	Landings FMult	Landings FBar	Landing Yield	2013 Biomass	SSB
17491	13898	0.0000	0.0000	0	23279	19522
.	13898	0.1000	0.0399	530	22633	18895
.	13898	0.2000	0.0797	1041	22011	18291
.	13898	0.3000	0.1196	1534	21413	17710
.	13898	0.4000	0.1595	2008	20836	17150
.	13898	0.5000	0.1993	2465	20281	16612
.	13898	0.6000	0.2392	2906	19747	16094
.	13898	0.7000	0.2790	3330	19232	15595
.	13898	0.8000	0.3189	3740	18736	15114
.	13898	0.9000	0.3588	4134	18259	14652
.	13898	1.0000	0.3986	4515	17799	14206
.	13898	1.1000	0.4385	4881	17355	13777
.	13898	1.2000	0.4784	5235	16928	13364
.	13898	1.3000	0.5182	5576	16517	12966
.	13898	1.4000	0.5581	5905	16120	12583
.	13898	1.5000	0.5980	6223	15738	12214
.	13898	1.6000	0.6378	6529	15370	11858
.	13898	1.7000	0.6777	6824	15014	11515
.	13898	1.8000	0.7175	7109	14672	11185
.	13898	1.9000	0.7574	7384	14342	10867
.	13898	2.0000	0.7973	7650	14024	10560

Bpa = 13000 t
Fpa = 0.42

Input units are thousands and kg - output in tonnes

Table 6.13: Bay of Biscay sole

Detailed predictions

MFDP version 1a
Run: WG2011_BoB_sol
Time and date: 17:50 06/05/2011
Fbar age range (Total) : 3-6
Fbar age range Fleet 1 : 3-6

Year: 2011 F multiplier: 1 Fleet1 HCFba 0.3986

Age	Landings F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
2	0.1553	3076	536	22443	4159	7182	1331	7182	1331
3	0.4507	6025	1303	17387	3976	14431	3300	14431	3300
4	0.4201	2977	823	9088	2666	8815	2586	8815	2586
5	0.3639	1800	599	6182	2184	6182	2184	6182	2184
6	0.3599	932	360	3232	1324	3232	1324	3232	1324
7	0.37	684	301	2317	1080	2317	1080	2317	1080
8	0.37	698	441	2365	1586	2365	1586	2365	1586
Total		16193	4364	63014	16975	44524	13391	44524	13391

Year: 2012 F multiplier: 1 Fleet1 HCFba 0.3986

Age	Landings F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
2	0.1553	3076	536	22443	4159	7182	1331	7182	1331
3	0.4507	6025	1303	17386	3976	14431	3300	14431	3300
4	0.4201	3284	907	10025	2941	9724	2852	9724	2852
5	0.3639	1573	524	5402	1909	5402	1909	5402	1909
6	0.3599	1121	433	3888	1593	3888	1593	3888	1593
7	0.37	602	265	2041	951	2041	951	2041	951
8	0.37	864	546	2926	1963	2926	1963	2926	1963
Total		16545	4515	64111	17491	45593	13898	45593	13898

Year: 2013 F multiplier: 1 Fleet1 HCFba 0.3986

Age	Landings F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
2	0.1553	3076	536	22443	4159	7182	1331	7182	1331
3	0.4507	6025	1303	17386	3976	14431	3300	14431	3300
4	0.4201	3284	907	10024	2940	9724	2852	9724	2852
5	0.3639	1735	578	5959	2106	5959	2106	5959	2106
6	0.3599	980	379	3397	1392	3397	1392	3397	1392
7	0.37	725	319	2454	1144	2454	1144	2454	1144
8	0.37	916	579	3104	2082	3104	2082	3104	2082
Total		16741	4601	64769	17799	46251	14206	46251	14206

Input units are thousands and kg - output in tonnes

Table 6.14: 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	2006	2007	2008	2009	2010	2011
Stock No. (thousands) of 2 year-olds	21229	23074	22443	22443	22443	22443
Source	XSA	XSA	GM93-2008	GM93-2008	GM93-2008	GM93-2008
Status Quo F:						
% in 2011 landings	13.7	18.9	29.9	12.3	-	-
% in 2012	9.6	11.6	20.1	28.9	11.9	-
% in 2011 SSB	16.3	19.3	24.6	9.9	-	-
% in 2012 SSB	11.5	13.7	20.5	23.7	9.6	-
% in 2013 SSB	8.1	9.8	14.8	20.1	23.2	9.4

GM : geometric mean recruitment

Sole in VIIIa,b : Year-class % contribution to

a) 2012 landings **b) 2013 SSB**

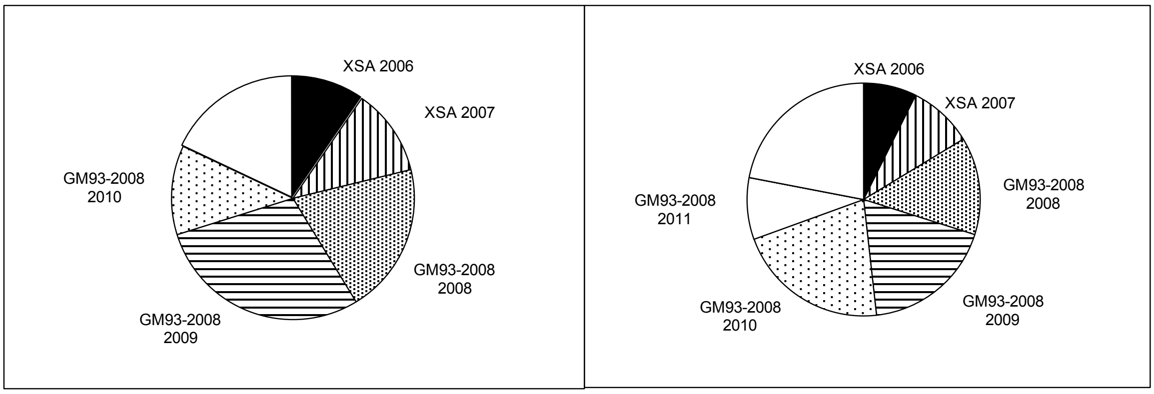


Table 6.15: Bay of Biscay Sole Multifleet Yield per recruit

MFYPR version 2a
Run: WG2011_BoB_sol
Time and date: 17:54 06/05/2011
Yield per results

Landings FMult	Landings Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0.0000	0.0000	0.0000	0.0000	10.5083	5.3192	9.6499	5.1508	9.6499	5.1508
0.1000	0.0399	0.2621	0.1176	7.8904	3.6533	7.0358	3.4859	7.0358	3.4859
0.2000	0.0797	0.4124	0.1717	6.3899	2.7274	5.5391	2.5609	5.5391	2.5609
0.3000	0.1196	0.5098	0.1982	5.4189	2.1481	4.5716	1.9825	4.5716	1.9825
0.4000	0.1595	0.5780	0.2111	4.7402	1.7575	3.8963	1.5928	3.8963	1.5928
0.5000	0.1993	0.6284	0.2170	4.2397	1.4801	3.3992	1.3162	3.3992	1.3162
0.6000	0.2392	0.6670	0.2189	3.8560	1.2752	3.0188	1.1121	3.0188	1.1121
0.7000	0.2790	0.6977	0.2187	3.5527	1.1193	2.7187	0.9570	2.7187	0.9570
0.8000	0.3189	0.7225	0.2174	3.3073	0.9977	2.4763	0.8362	2.4763	0.8362
0.9000	0.3588	0.7430	0.2154	3.1048	0.9010	2.2768	0.7402	2.2768	0.7402
1.0000	0.3986	0.7603	0.2132	2.9349	0.8227	2.1098	0.6626	2.1098	0.6626
1.1000	0.4385	0.7750	0.2109	2.7906	0.7584	1.9683	0.5990	1.9683	0.5990
1.2000	0.4784	0.7877	0.2086	2.6664	0.7049	1.8469	0.5462	1.8469	0.5462
1.3000	0.5182	0.7988	0.2064	2.5586	0.6598	1.7417	0.5018	1.7417	0.5018
1.4000	0.5581	0.8085	0.2044	2.4640	0.6215	1.6497	0.4641	1.6497	0.4641
1.5000	0.5980	0.8171	0.2024	2.3805	0.5887	1.5687	0.4319	1.5687	0.4319
1.6000	0.6378	0.8248	0.2006	2.3061	0.5602	1.4968	0.4040	1.4968	0.4040
1.7000	0.6777	0.8317	0.1990	2.2395	0.5353	1.4326	0.3797	1.4326	0.3797
1.8000	0.7175	0.8379	0.1975	2.1796	0.5135	1.3750	0.3585	1.3750	0.3585
1.9000	0.7574	0.8436	0.1961	2.1253	0.4942	1.3230	0.3397	1.3230	0.3397
2.0000	0.7973	0.8488	0.1948	2.0759	0.4770	1.2759	0.3231	1.2759	0.3231

Reference point	F multiplier	Absolute F
Fleet1 Landings Fbar(3-6)	1.0000	0.3986
FMax	0.6357	0.2534
F0.1	0.3059	0.1219
F35%SPR	0.3416	0.1362

Weights in kilograms

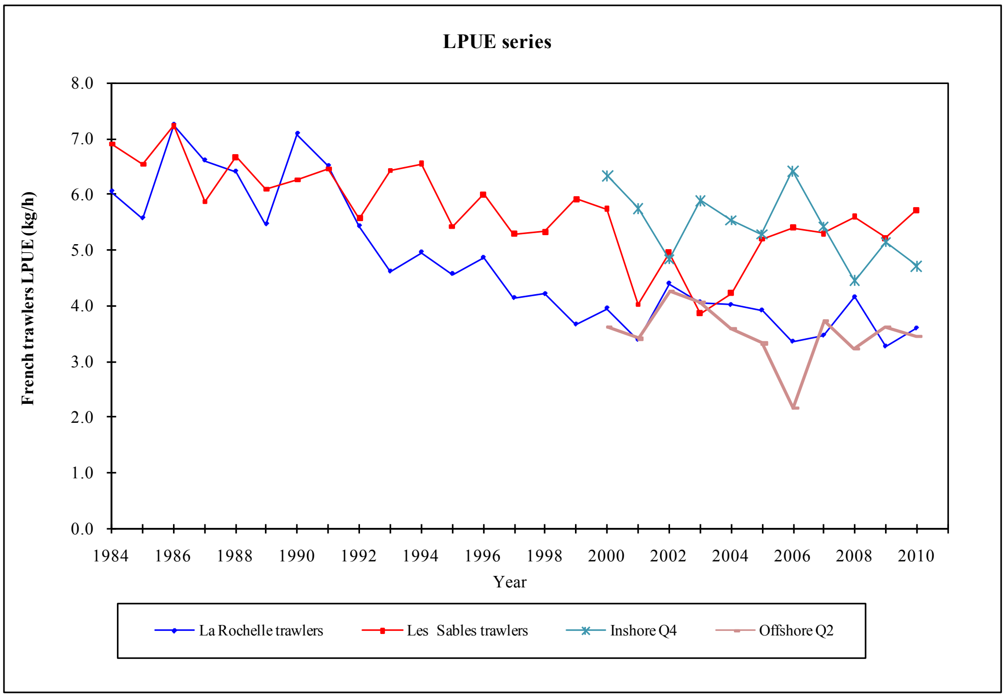


Figure 6.1: Bay of Biscay sole (Division VIIIa,b). LPUE trends of the 4 tuning fleets

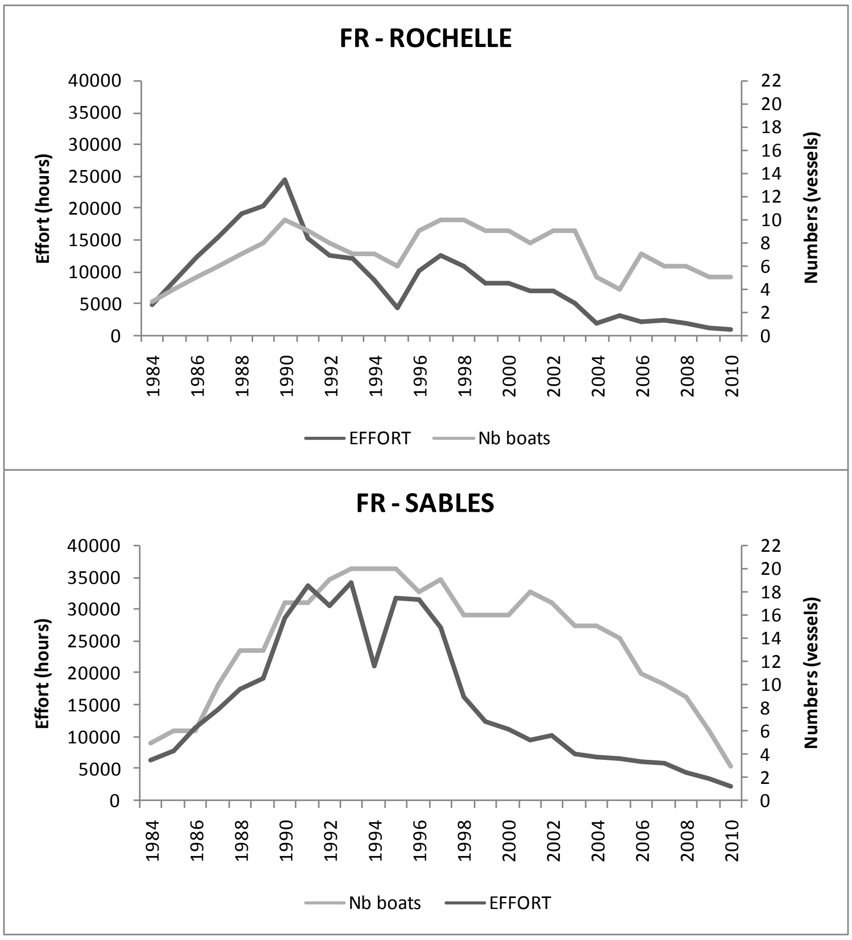


Figure 6.2: Bay of Biscay sole (Division VIIIa,b)Numbers of boats and effort (in hours) of the La Rochelle and Les Sables tuning fleets

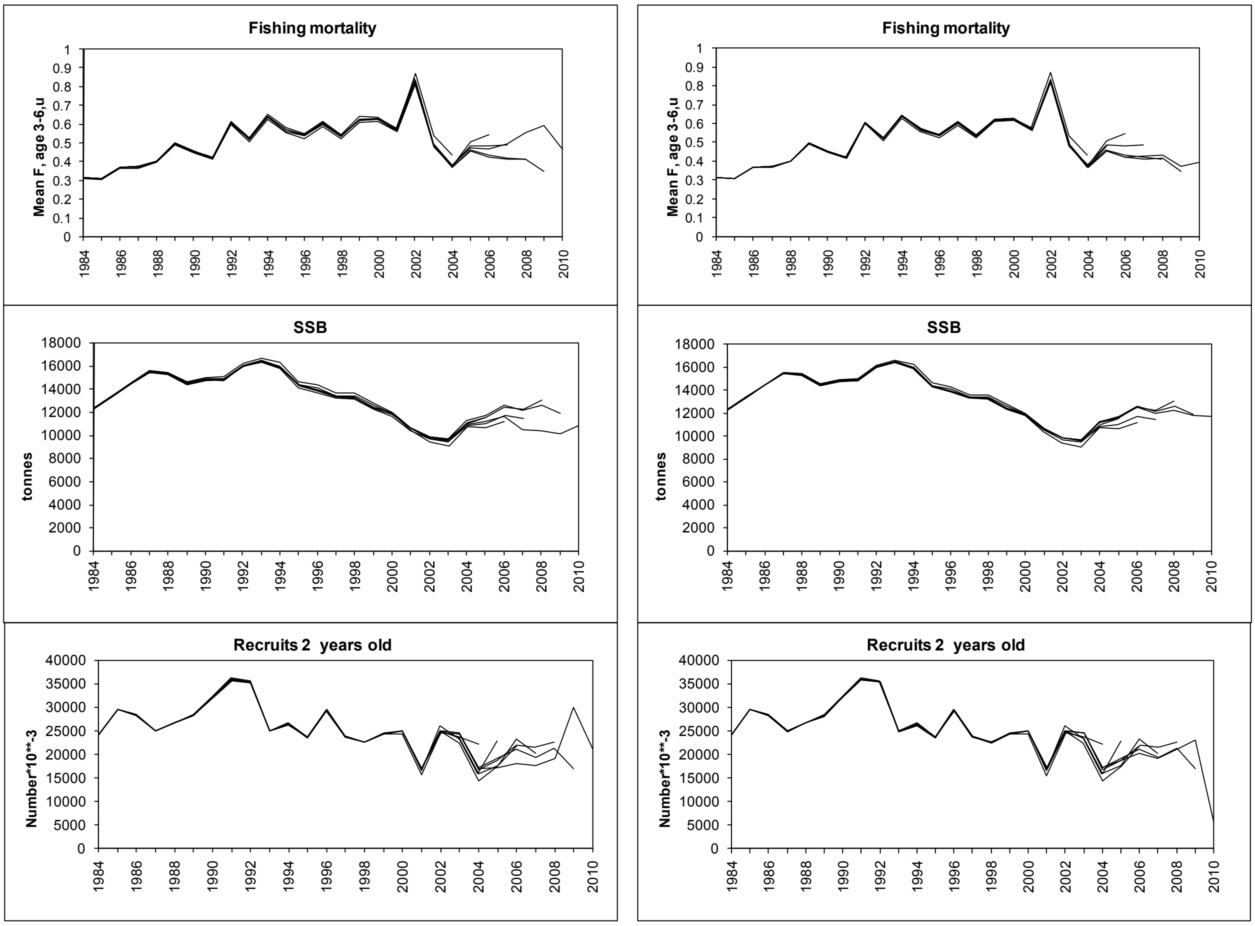


Figure 6.3: Bay of Biscay sole (Division VIIIa,b) - Retrospective results Comparison between assessment with and without 2010 for FR - ROCHELLE and FR – SABLES. (In the left, retrospective with 2010 for FR - ROCHELLE and FR - SABLES and without in the right)

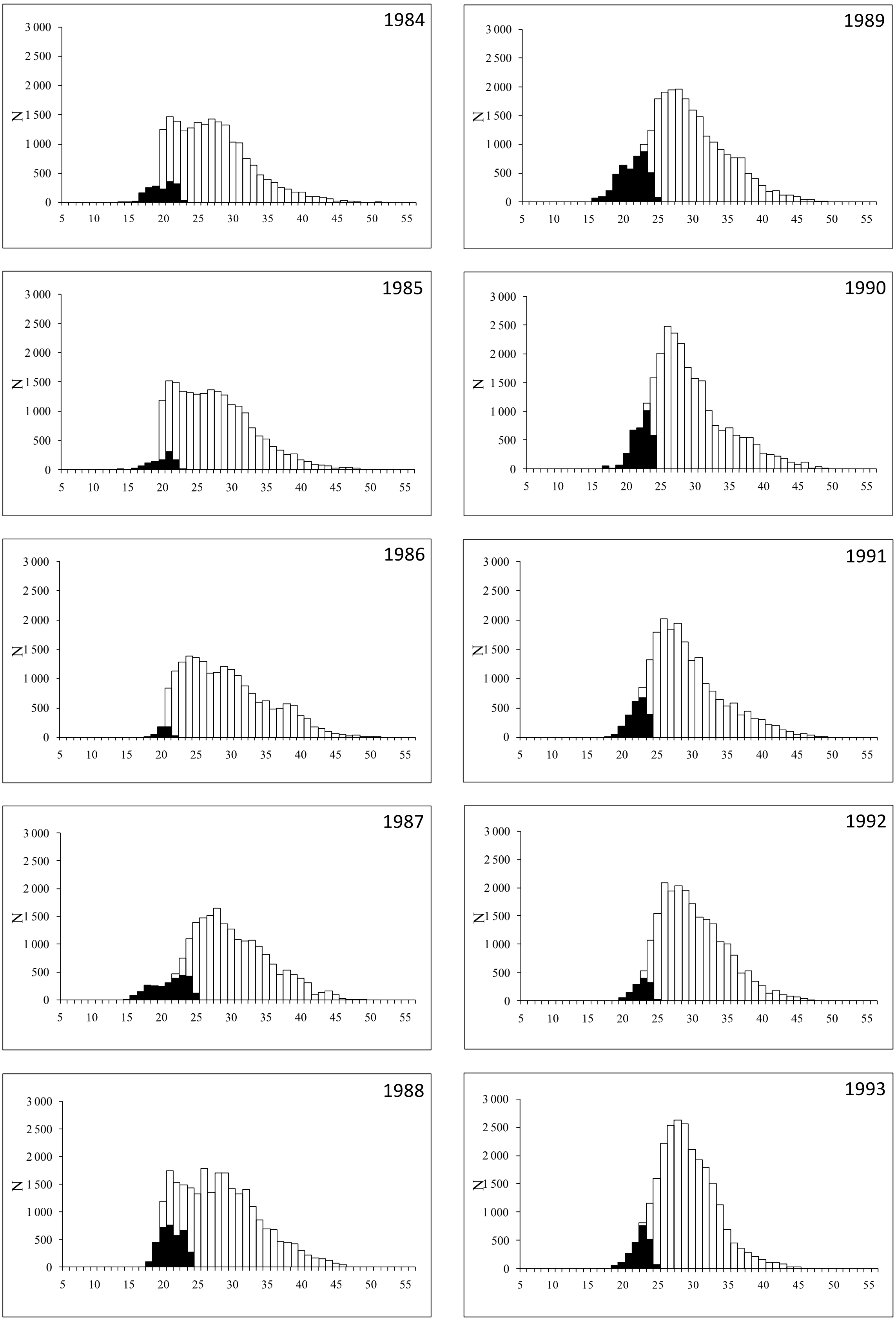


Figure 6.4 a: **Bay of Biscay sole French length distribution from 1984 to 1993**

Total French landings

Discard estimates of the French offshore trawlers fleet

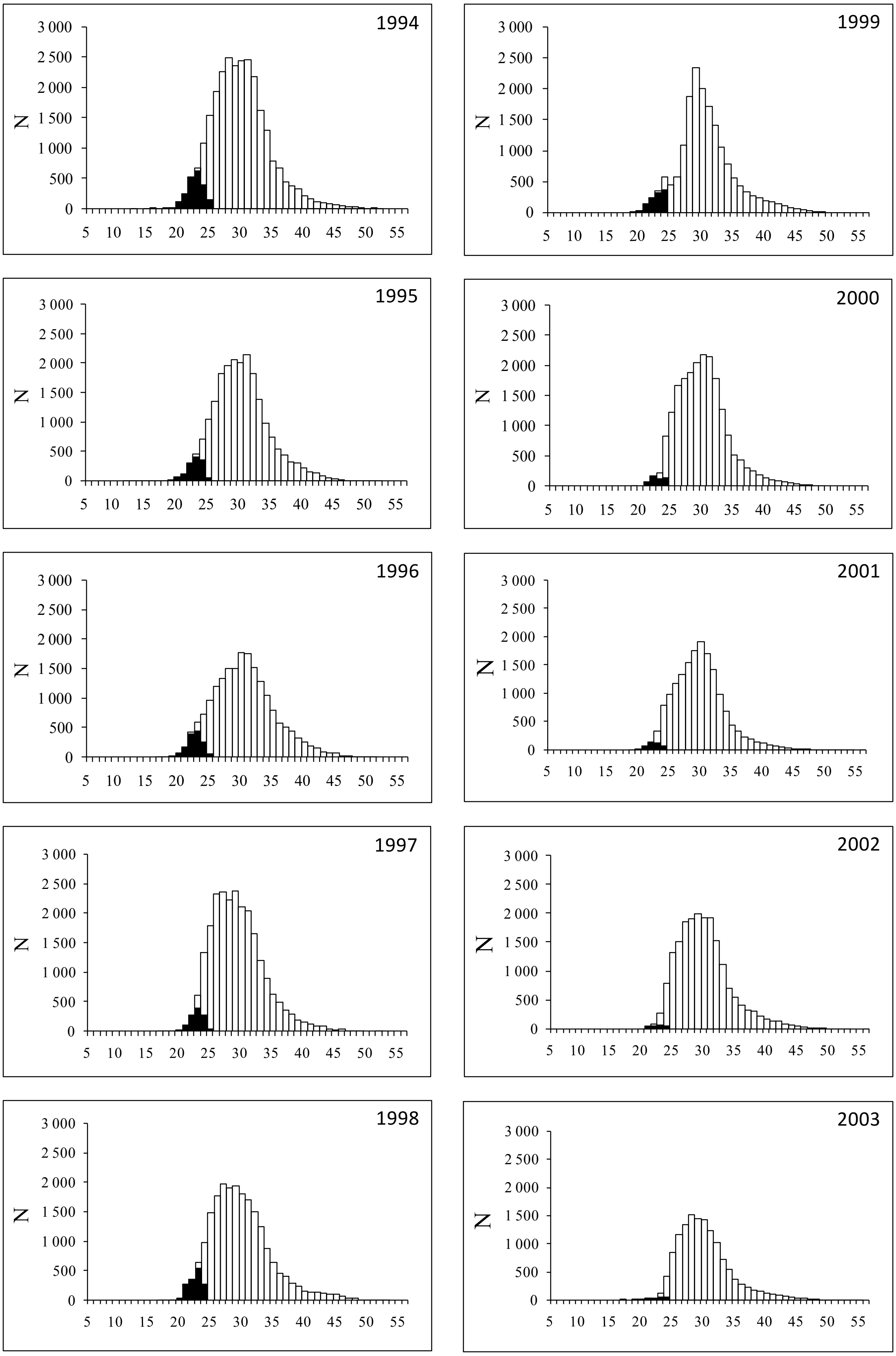


Figure 6.4 b: **Bay of Biscay sole French length distribution from 1994 to 2003**

Total French landings

Discard estimates of the French offshore trawler fleet (1994 to 2003)

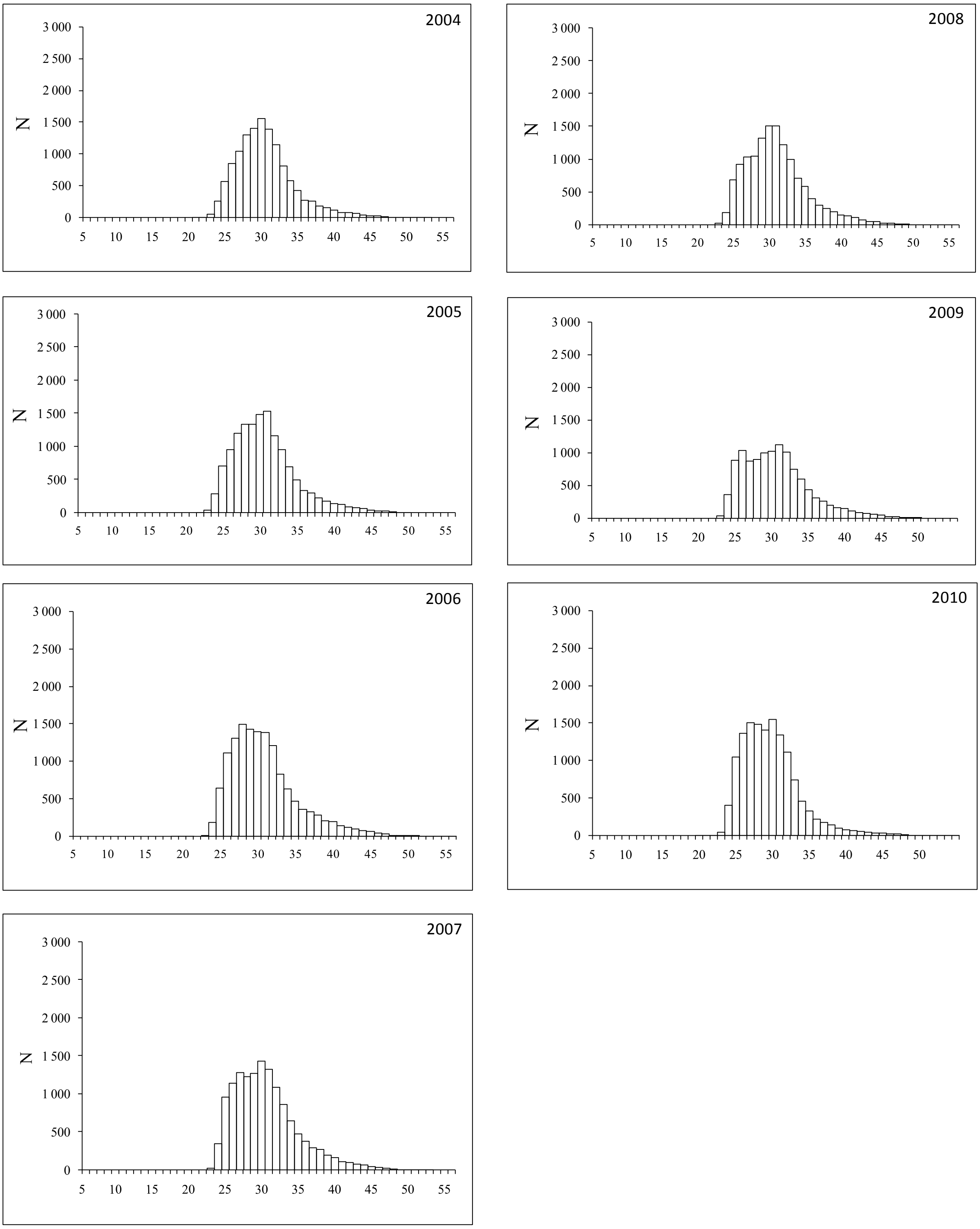


Figure 6.4 c: Bay of Biscay sole French length distribution from 2004 to 2010

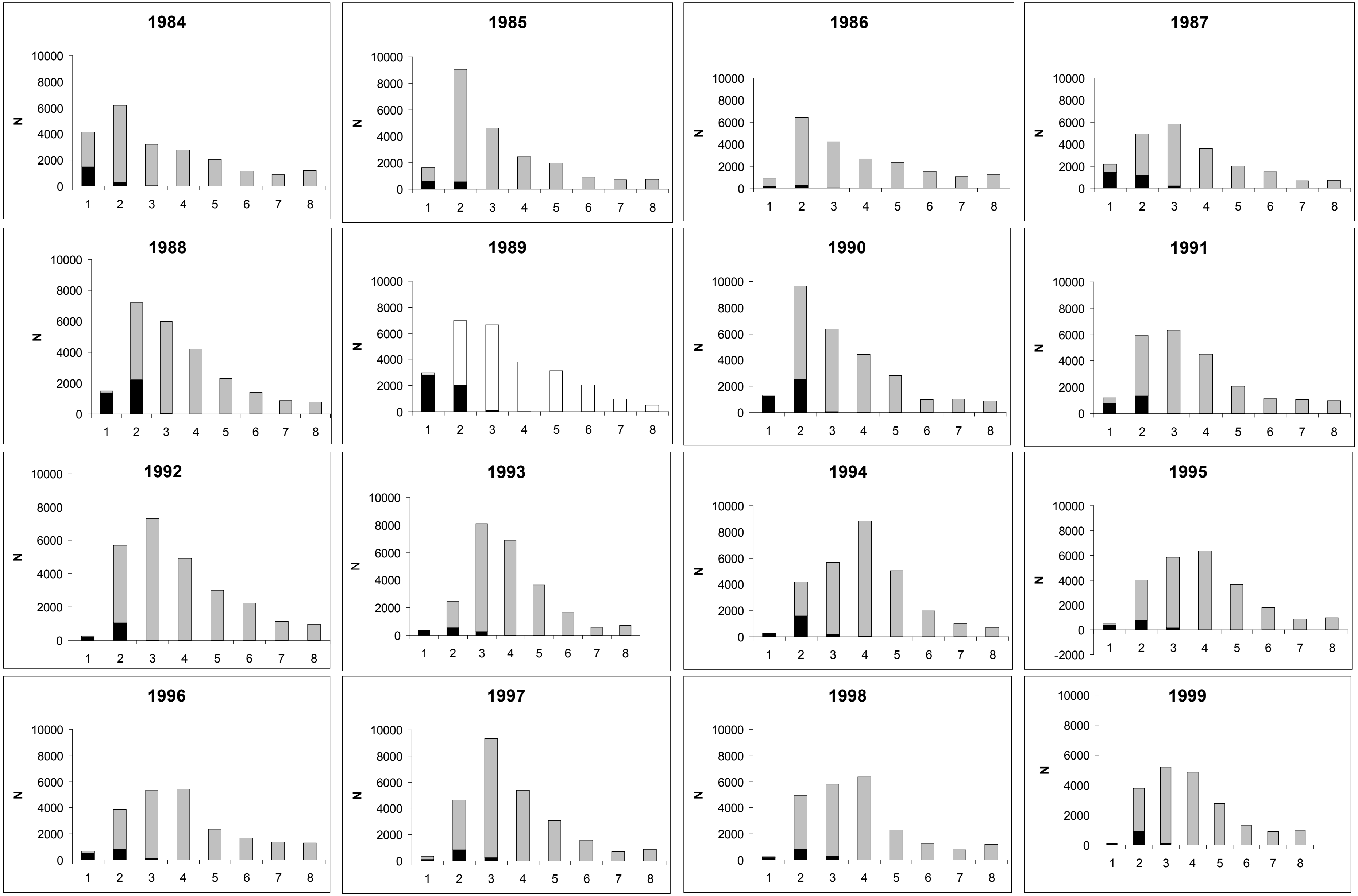


Figure 6.5 a: **Bay of Biscay sole landings and discards age distributions from 1984 to 19** **(numbers in thousands)**

Total landings
Discard estimates of the French offshore trawlers fleet

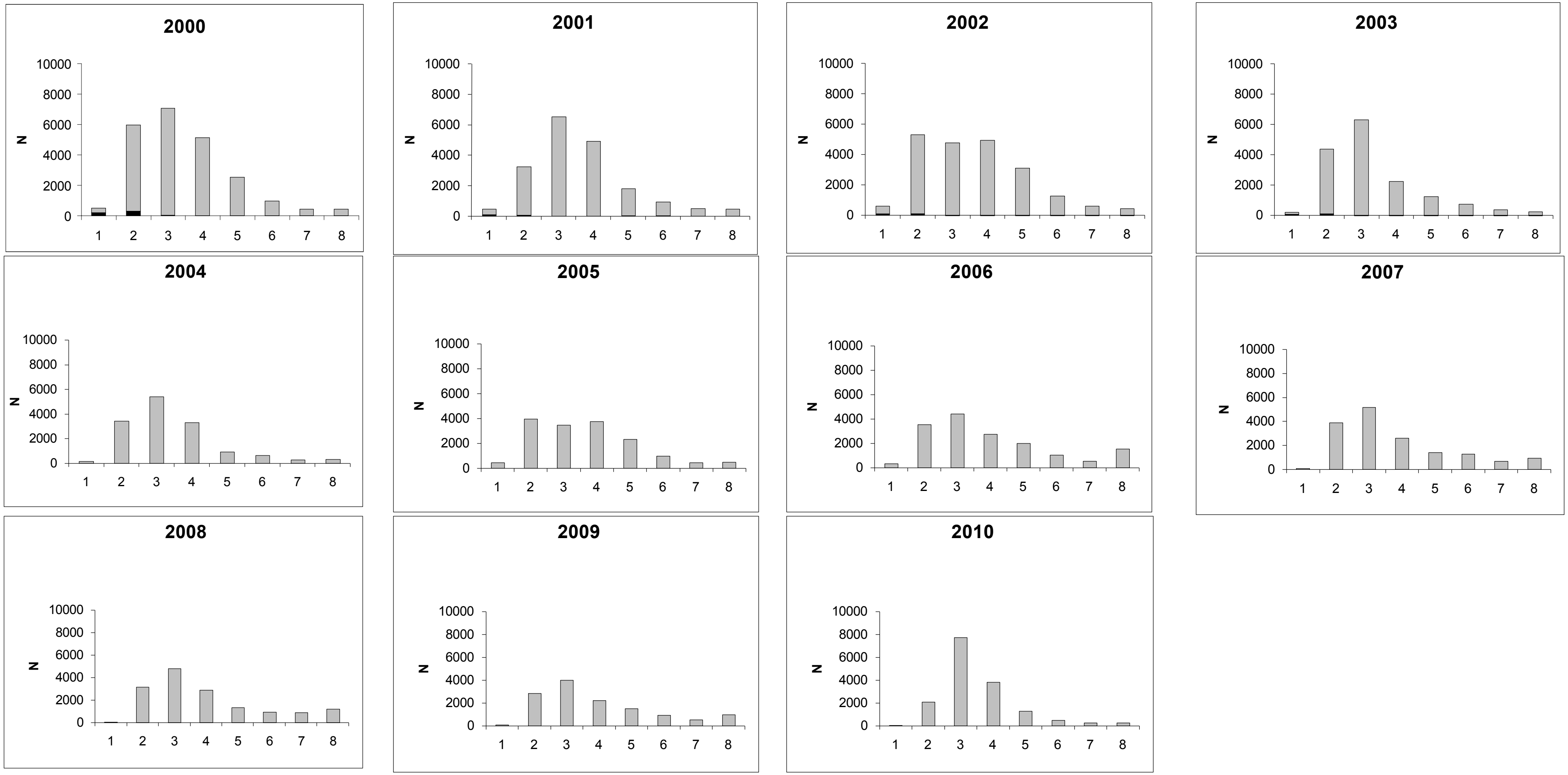
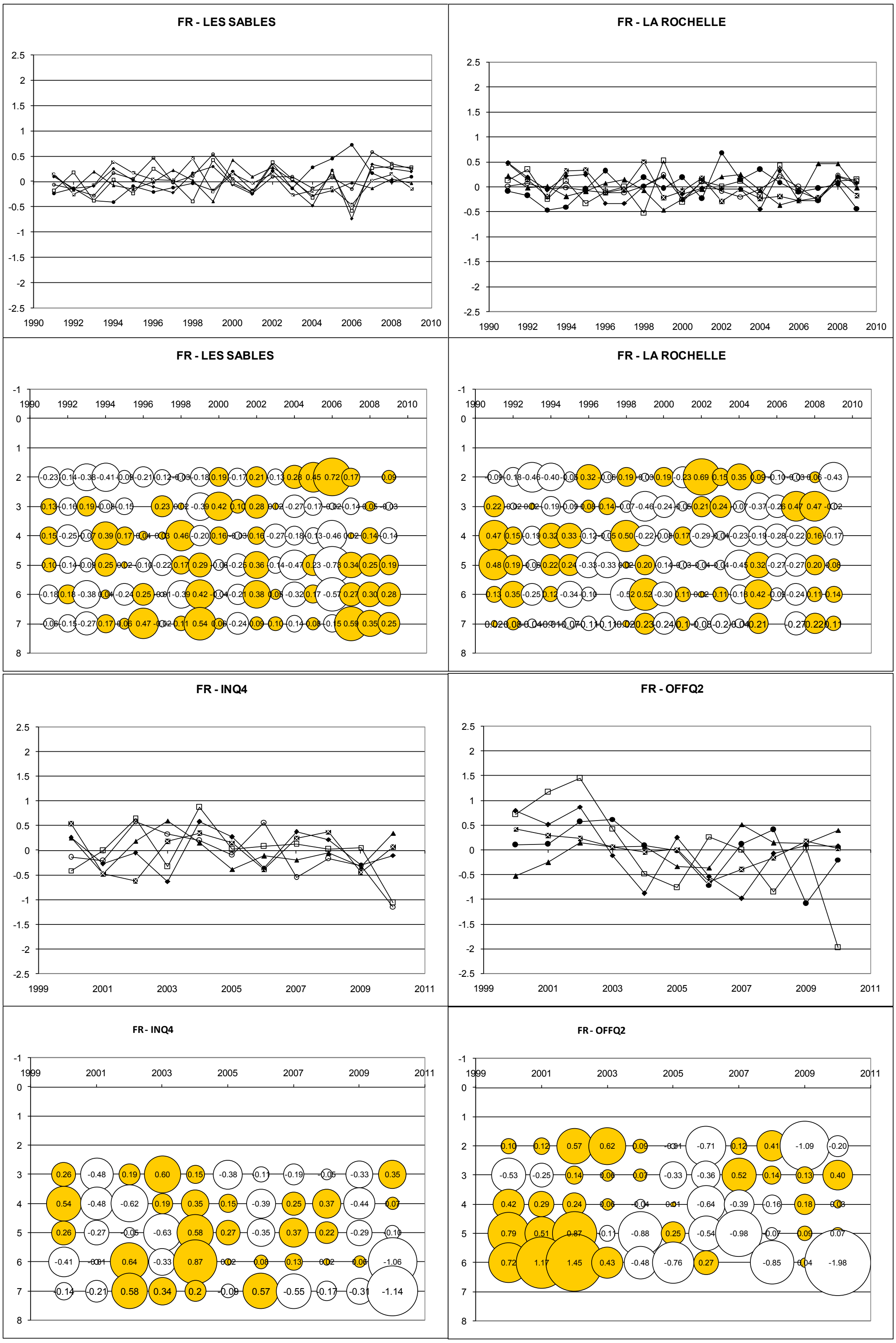


Figure 6.5 b: **Bay of Biscay sole landings and discards age distributions from 2000 to 2010 ; landings age distribtion since 2004 (numbers in thousands)**

Total landings
Discard estimates of the French offshore trawlers fleet

LOG CATCHABILITY RESIDUAL PLOTS (XSA)



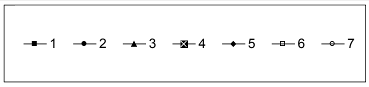


Figure 6.6: Bay of Biscay sole (Division VIIIa,b)

XSA (No Taper, mean q, s.e. shrink = 1.5, s.e. min = .2)

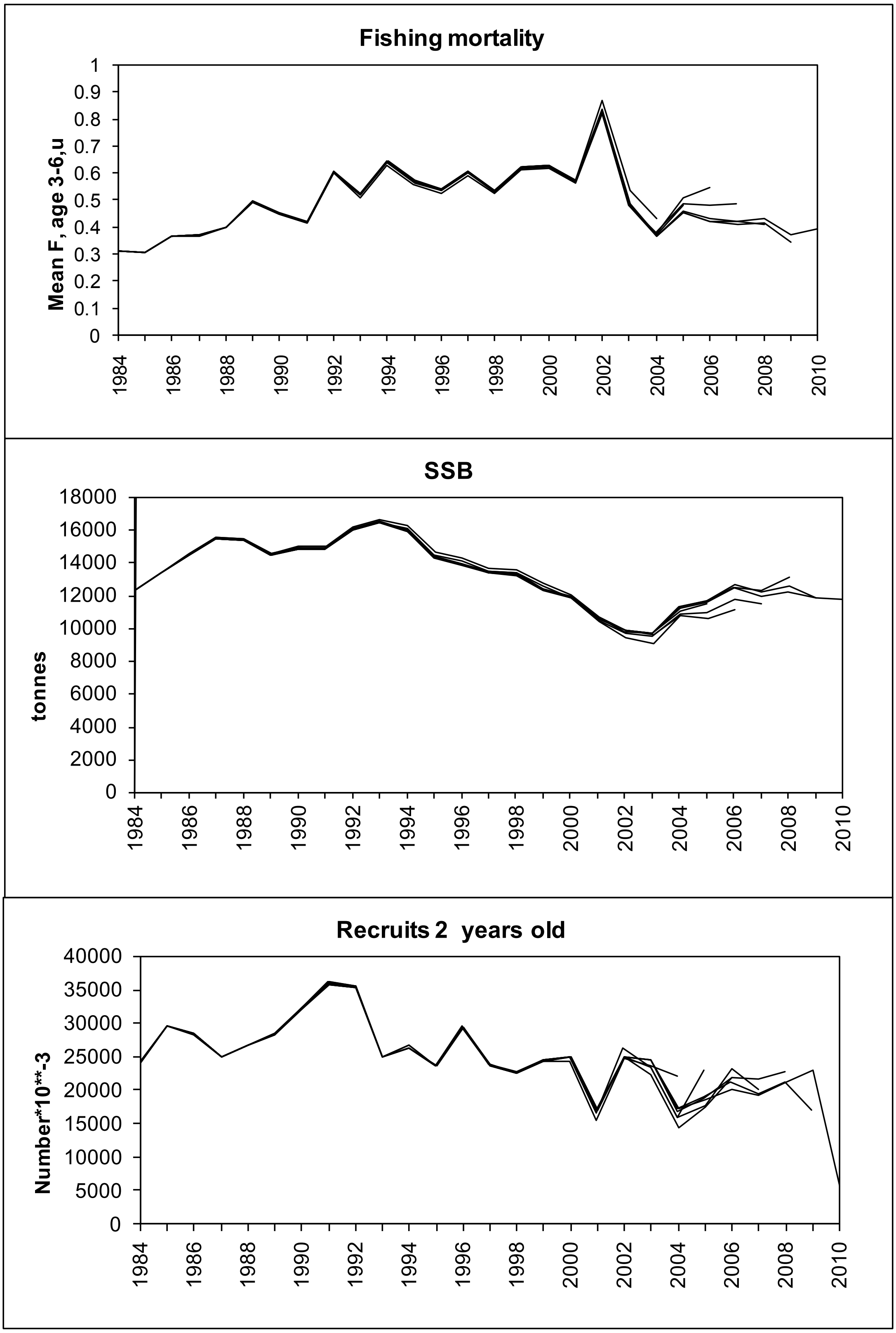


Figure 6.7: Bay of Biscay sole (Division VIIIa,b) - Retrospective results

(No taper, q indep. stock size all ages, q indep. of age>=6, shr.=1.5)

Figure 6.8: Sole in Division VIIIa,b (Bay of Biscay)

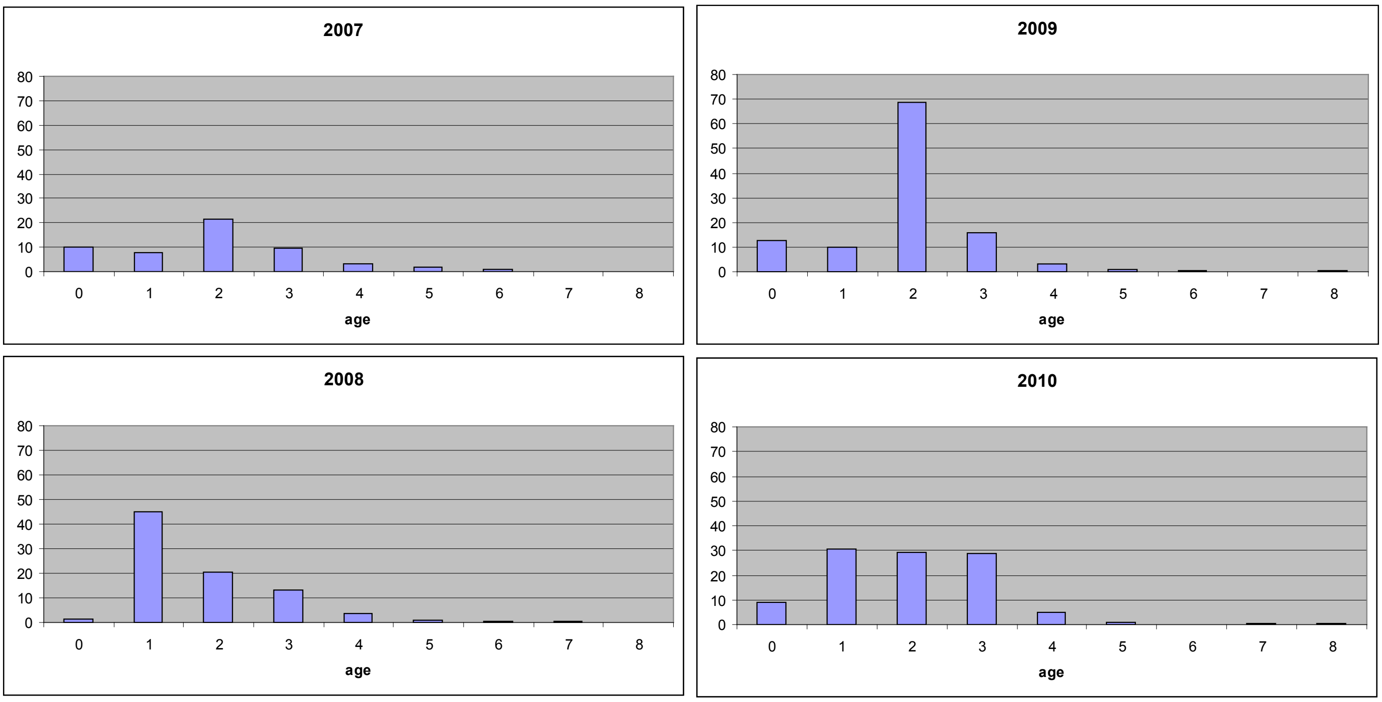
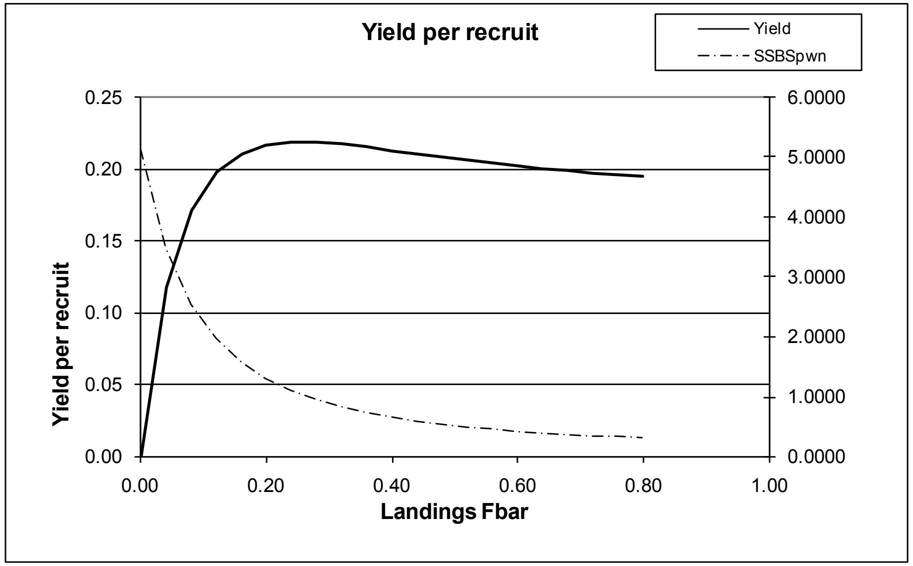
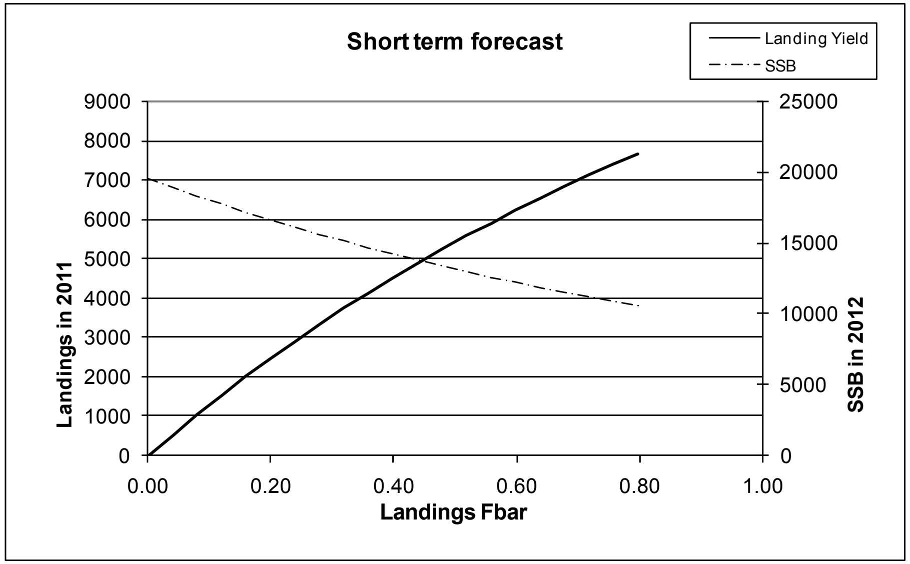


Figure 6.9: Sole in Division VIIIa,b (Bay of Biscay) – 2007 – 2010 ORHAGO numbers at age

(Numbers/10 nautical miles)





MFYPR version 2a
Run: WG2011_BoB_sol
Time and date: 17:54 06/05/2011

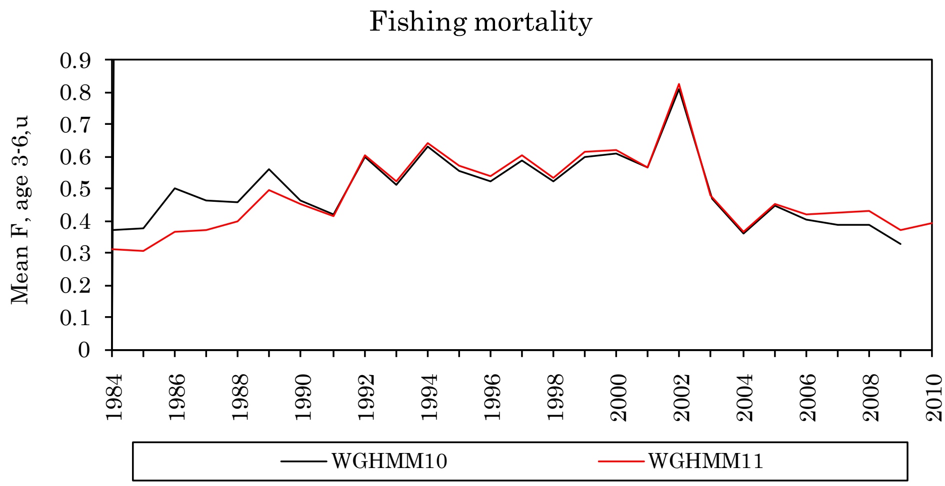
Reference point	F multiplier	Absolute F
Fleet1 Landings Fbar(3-6)	1.0000	0.3986
FMax	0.6357	0.2534
F0.1	0.3059	0.1219
F35%SPR	0.3416	0.1362

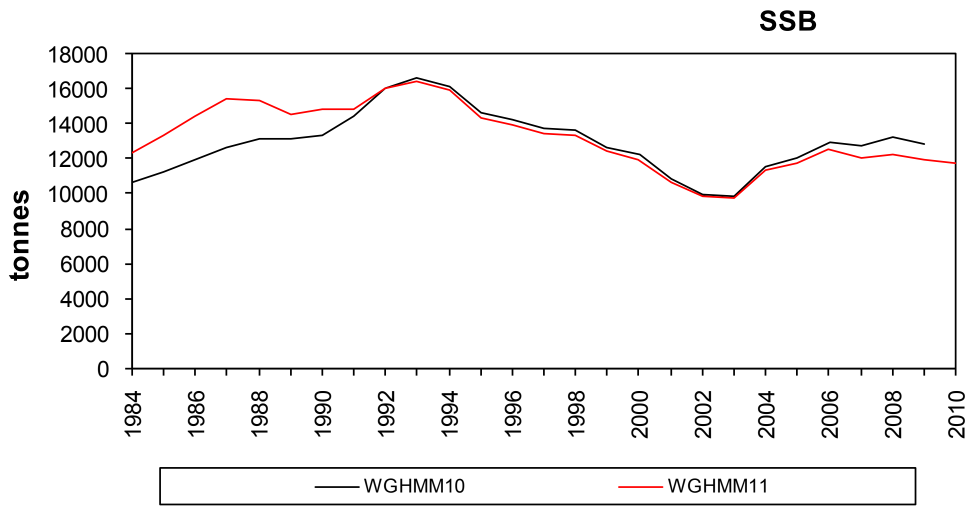
Weights in kilograms

MFDP version 1a
Run: WG2011_BoB_sol
Time and date: 17:50 06/05/2011
Fbar age range (Total) : 3-6
Fbar age range Fleet 1 : 3-6

Input units are thousands and kg - output in tonnes

Figure 6.10: Sole in Division VIIIa,b (Bay of Biscay)





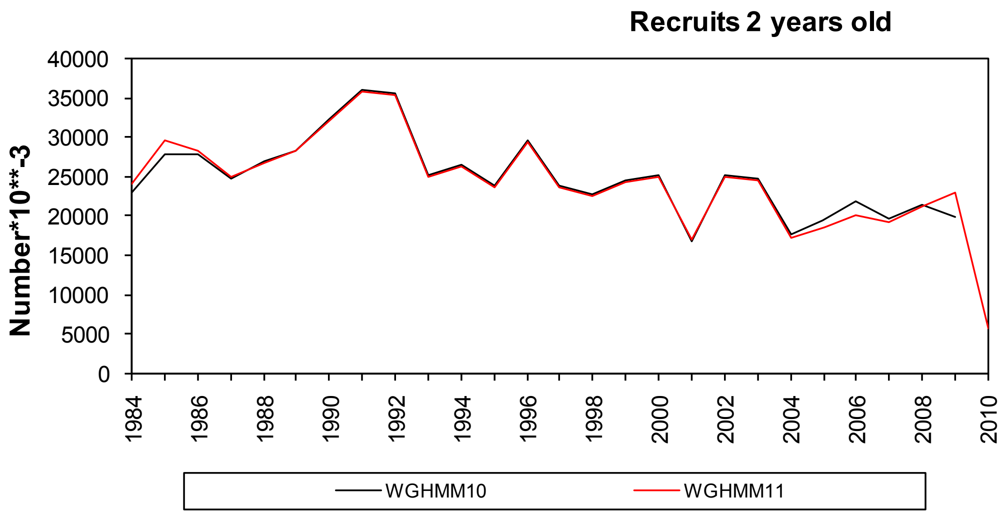


Figure 6.11: Bay of Biscay sole (Division VIIIa,b) - WG11 / WG10 comparison

7 Southern Stock of Hake

7.1 General

Past year assessment was reviewed in December 2010 after detecting an error in the predictions. The modified report was appended as annex V to the final report (WGHMM, 2010).

Type of assessment is "update" based on benchmark assessment (WKROUND, 2010).

Review group made some suggestions and asked to some clarifications that were addressed along the report.

7.1.1 Fishery description

Fishery description is available in the Stock Annex (Annex G).

7.1.2 ICES advice for 2011 and Management applicable to 2010 and 2011

ICES Advice for 2011

ICES advised on the basis of the transition to MSY approach with F_{pa} = 0.40, that landings for 2011 should not exceed 9 900 t.

Management Applicable for 2010 and 2011

Hake is managed by TAC, effort control and technical measures. The agreed TAC for Southern Hake, including Cadiz, in 2010 was 9 300 t and in 2011 was 10 695 t. Catches in 2010 were estimated to be 17 300 t. Landings were 15 700 t; and discards were 1 600 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 decreasing fishing mortality a maximum of 10% at year with a TAC constrain of 15%. SSB target (35 000 t) is not considered suitable under the new assessment model. This regulation also includes effort management in addition to TAC measures.

Since 2006 an annual reduction of 10% fishing days at sea was applied to all vessels, although with some exclusions. In 2011, vessels that landed less than 5 tonnes of hake and 2.5 tonnes of *Nephrops* in 2008 or 2009 are excluded.

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.

Spanish Regulations for 2010-11: In the second semester of 2010 a limitation of landings of 100-200 kg per vessel per week (depending on the fleet segment), was established under ARM/1808/2010. A closure of activity for 1 month was also established in the same period. In 2011 there will be 2 months of closure and a system to share the Spanish quota with maximum landings per quarter and fleet segment. (ARM/3361/2010 and ARM/1083/2011).

7.2 Data

Data Revisions

Portuguese (WD 16) and Spanish discards data series have been revised.

7.2.1 Commercial Catch: landings and discards

Catches: landings and discards

Southern Hake catches by country and gear for the period 1972-2010, as estimated by the WG, are given in Table 7.1. In 2010, the total catches estimate were 17 300 breaking the recent continuous increasing trend (22 100 t in 2009) since 2004 (7 800 t) when the historical minimum was achieved. 2010 landings were 22% lower than those of 2009.

In 2010, landings were 15 700 t (91% of total catches) and discards 1 560 t (9%). Spanish catches were 14 040 t (82%), Portuguese were 2 920 t (17%) and French catches were 360 t (2%). French catches were not considered into the assessment, as a historic review has not been performed. Trawl landings were 9 450 t (60%) and artisanal landings (mainly long liners and gill-netters) was 6 286 t (40%). Spanish landings in the first semester have been 9 080 t and 3 950 t in the second semester.

7.2.2 Biological Sampling

The sampling levels in 2010 are summarized in Table .1.3.

Length Composition

Length composition from Spain is considered provisional (Table 7.2), because of a change in the raising scheme used (based on "metiers" for the first time this year). A check for length distributions for every fleet in Table 7.2 was performed and no major changes were identified with respect to the length frequency distributions in previous years.

Table 7.2 presents the length compositions of catches by country and gear and mean length for 2010. Figure 7.1 shows the length distributions of landings and discards for 1982-2010. Whereas the mode of the landings remains about 30 cm, in recent years an increase in mean length from 33 cm in 2006 to 35-36 cm in 2007-2010 was observed. This was mainly caused by an increase of catches in larger fish mainly coming from long liners and gill-netters.

Growth, Length–weight relationship and M

An international length-weight relationship for the whole period has been used since 1999 (see Stock Annex G). WD 16 analyses these parameters in relation to information collected in 2010, showing that no major changes occurred. The assessment model follows a constant von Bertalanffy model with fixed Linf = 130 cm, t0=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. The maturity proportion in this assessment year is shown in Figure 7.2. There is a small increase in length of maturity compared with 3 recent years.

7.2.3 Abundance indices from surveys

Biomass, abundance and recruitment indices for the Portuguese and Spanish surveys respectively are presented in Table 7.3 and Table 7.4 and Figure 7.3.

Since 1989 the Portuguese Autumn survey (PtGFS-WIBTS-Q4) has shown variable abundance indices with a minimum in 1987. Biomass and recruitment (<20 cm) in 2010 were similar to 2009, the highest in the series.

The Spanish groundfish survey (SpGFS-WIBTS-Q4) shows low values for biomass and abundance in early 2000s, but abundance and biomass increases since 2004, being in 2009 at the historical maximum. In 2010 the recruitment index (<20 cm) and the biomass decreased in relation to 2009, with the recruitment index showing average values while the biomass index still shows high values.

The recruitment indices of the SpGFS-WIBTS-Q4, SPGFS-caut-WIBTS-Q4 and PtGFS-WIBTS-Q4 (Figure 7.3) were relatively inconsistent in the past. However, all show the same increasing pattern in recent years with high values in 2005, 2006 and 2007, a strong drop in 2008 and an increase in 2009. In 2010, SpGFS-WIBTS-Q4 and SPGFS-caut-WIBTS-Q4 show a drop to mean historical figures. However PtGFS-WIBTS-Q4 keeps near the historical maximum. The spatial distribution of hake recruits (individuals <20cm) in 2010 in Portugal, show a shift in the recruitment areas similar to 2009 (IBTS, 2010, 2011). The largest recruitment areas are now located in the northwest instead of the traditional southwest area. Such change raises doubts about recruitment survival, once that oceanographic conditions are different on both areas.

The Spanish (SpGFS-WIBTS-Q4 and SPGFS-caut-WIBTS-Q4) and the Portuguese (PtGFS-WIBTS-Q4) surveys are used to tune model, fitting the length proportions and the survey trends.

Commercial catch-effort data

Effort series is collected from Portuguese logbooks and compiled by IPIMAR. Spanish sales notes and Owners Associations data were compiled by IEO to estimate fleet effort.

Landings, LPUE and effort are available for A Coruña trawl (SP-CORUTR), A Coruña pair trawl (SP-CORUTRP), Vigo/Marin trawl (SP-VIMATR), Santander trawl, Cadiz Trawl (SP-CTR) and Portuguese trawl (P-TR) fleets. These data are given in Table 7.5 and shown in Figure 7.4. Just SP-CORUTR and P-TR are used in the assessment.

Historic effort trend have decreased for most fleets. In recent years (2007-2010) effort has also decreased (except SP-VIMATR that remains stable). In 2010 the 2 fleets used in the assessment (SP-CORUTR and P-TR) have experience a clear effort reduction. The other fleets remains stable or with a small increase.

LPUEs in Table 7.5 from SP-CORUTR, SP-CORUTRP, SP-VIMATR and P-TR continue in the historic maximum in 2010. SP-CTR LPUE is over the historic mean.

7.3 Assessment

The assessment carried out used the gadget model (length-age based) as decided by WKROUND (2010) and described on the stock annex (Annex G).

7.3.1 Model diagnostics

Likelihood profiles were presented in Figure 7.5 for each parameter estimated by the model. This analysis is carried out in each parameter individually and it does not guarantee that the model found 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 7.5, all parameter estimates correspond to the minimum of the likelihood.

Residuals for surveys and commercial LPUE indices are presented (Fig 7.6a-b, respectively), grouped in 15 cm classes (from 4 to 49 in surveys and 25 to 70 cm in LPUEs). Most residuals are within the range of -1 to 1. Surveys' residuals don't show any trend. SpGFS-WIBTS-Q4 (19-34 and 34-49 cm) show a larger residual in 2009. Regarding commercial LPUE, P-TR (25-40 cm) and SP-CORUTR (25-40 cm) show downwards trends in recent years. This effect may be due to the difficulty of these indices to follow the abundance generated by the recent increase in recruitment, given that discards are not included in their computation. Apart from this, the fits are quite consistent.

Figures 7.6 (c-i) present bubble plots of residuals for proportions at length. These proportions are grouped by 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 and discards. 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 once that the residuals' values are quite small (maximum ~0.3). On the hand the usage of a logistic curve for the landings suitability may contribute to such a pattern. The model takes into account the data quality when weighting the individual likelihood components (defined in Stock Annex), so data sets with larger residuals will have less impact on the overall model fit.

Sensitivity to the datasets used in the assessment is presented in the next table. The table shows the estimates (in terms of recruitment in 2009 and 2010; F 2010 and SSB 2010) obtained when a particular dataset is excluded divided by those obtained when all datasets are included (noting that exclusion of a dataset means exclusion of the corresponding entire time series). The most sensitive parameter is recruitment in 2010, and the datasets with highest impact are SpGFS-WIBTS-Q4 and PtGFS-WIBTS-Q4. These two data sets have conflicting impacts on this estimate, with exclusion of the first dataset leading to a higher recruitment estimate and exclusion of the second one to a lower recruitment estimate.

	NoPtLPUE	NoPtSurvLd	NoPtSurvTrd	NoSpLPUE	NoSpSurvLd	NoSpSurvTrd
R09	1.18	0.95	0.93	1.01	0.89	1.00
R10	0.95	1.03	0.59	0.99	1.59	1.00
F10	0.96	1.00	1.07	1.07	1.13	1.00
SSB10	0.97	1.00	0.93	0.91	0.95	1.00

7.3.2 Assessment results

Estimated parameters

The model estimates selection parameters for each "fleet" for which length proportions are fitted. Furthermore it estimates the growth parameter k (von Bertalanffy). Results are presented in Figure 7.7. The selection patterns of different "fleets" of catches (catches in 1982-93; landings in 1994-2010; discards 1992-2010 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 and landings (1994-2010) 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.

The von Bertalanffy k parameter was estimated to be 0.165, the same value as last year.

Historic trends in biomass, fishing mortality, yield and recruitment

Model estimated abundance at length in the beginning of the 4th quarter is presented in Figure 7.8. The figure shows a general increase of small fish after 2004 that contributes to an increase of large fish in more recent years.

Table 7.6 and Figure 7.9 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 in 2010 is estimated to be the maximum of the series and needs to be confirmed in the future. Catches (landings and discards) dropped from 22.1 Kt in 2009 to 16.9 Kt in 2010 (excluding the 2010 French landings data), as well as F, from 0.83year-1 in 2009 to 0.52year-1 in 2010. These results are due to the implementation of new regulations to control landings in Spain during the third and fourth quarters of 2010.

SSB continues to show an increasing trend since 1998, the minimum of the series, to 18.7 Kt in 2010.

Retrospective pattern for SSB, fishing mortality, yield and recruitment

Figure 7.10 presents the results from assessment performed with data until 2010, 2009, 2008, 2007, 2006 and 2005.

In the previous assessments SSB showed a trend to be underestimated and F to be overestimated. The present retrospective analysis does not show any particular trend in SSB or F, with 2009 and 2008 showing alternate patterns. Nevertheless, when looking only to 2009, the retrospective pattern shows a reverse direction than before, underestimating F and overestimating SSB. It will be necessary to confirm in the future if there is a shift in the retrospective pattern.

7.4 Catch options and prognosis

7.4.1 Short-term projections

The methodology used is the one developed in the benchmark (WKROUND, 2010) and described in the Stock Annex (Annex G). This annex text has been extended this year to clarify better the options for projections. This was considered necessary after last year review, when errors in these settings were identified.

Note that GADGET is length based and F multipliers are applied to the length exploitation pattern. This may cause some changes in F (ages 1-3) if the relative contributions of different length changes on these ages change. So, the average F of the last 3 assessment years is 0.7165; the modelled F in 2011 is 0.7158, and the F in 2012 with a multiplier of 1 is 0.7140. This produces an apparent inconsistency (F2011=0.72 and F_{sq} = 0.71) caused by changes in length composition in ages 1-3.

Management options are presented in Table 7.7 and Figure 7.11. F_{sq} is estimated as the average of the last 3 assessment years and recruitment for 2010-2012 was the geometric mean of 1989-2009 (80.8 mill).

During the intermediate year, 2011, the expected yield (landings) will be 25.0kt and the SSB at the end of the year is expected to be 25.1kt.

Different F multipliers applied in 2012 provide management alternatives according to different schemes. Under F_{sq} (0.71) and considering a recruitment of 80.8 mill (geo mean 1989-2009), expected yield (landings) would be 21.2 Kt and SSB in 2013 would be 20.6 kt. Decreasing F by 10% (0.64), yield and SSB would be 19.7 and 23.0 Kt. With the MSY transition scheme F would be 0.4, yield 14.0 kt and SSB 32.0 Kt. If landings in 2012 correspond to a 15% increase with respect to the 2011 TAC, then 2012 landings are 12.3 kt, corresponding to F in between 0.33 and 0.34 and SSB in 2013 in between 34.7 and 35.0 kt. At F_{max} (F_{msy} proxy = 0.24) yield in 2012 would be 9.3 kt and SSB in 2013 39.7 kt.

7.4.2 Yield and biomass per recruit analysis

F producing maximum landings per recruit was estimated following the Stock Annex (Annex G). This results in F_{max} = 0.24 and F0.1=0.17 (Figure 7.12). The same as last year.

Next table shows the expected figures for different F values. Equilibrium yield and SSB were estimated assuming recruitment is the geometric mean of 1989-2009 (80.8 mill).

	F	YPR	SPR	Yield	SSB
F01	0.17	0.24	1.24	19.5	100
F30%	0.23	0.25	0.93	20.3	75
F_{max}	0.24	0.25	0.88	20.4	71

F_{max} would drive the stock to equilibrium yields about 20.4 Kt and SSB to 71 Kt which is well above historical SSB estimates.

7.5 Biological reference points

F_{max} (F=0.24) was the Southern hake F_{msy} proxy proposed by WGHMM 2010.

F_{pa} was set to 0.4 by ACOM in 2010 based on "The historic dynamic of the southern hake stock shows that fishing mortality above 0.4 (from 1983 to 1995) have resulted in a continued decrease in SSB along that period, from 45 000 t to 8 000 t, with recruitment average level. Therefore, an F of 0.4 is provisionally adopted as F_{pa}." (2010 ICES Southern hake Advice).

	F	YPR	SPR	Yield	SSB
F_{pa}	0.4	0.23	0.48	18.9	39.2

The table shows that with the mean 1989-2009 recruitment (80.8 mill) F_{pa} would drive to yield around 18.9 and SSB around 39.2 Kt.

The stock recruitment plot is presented in Figure 7.13. Initial values after 1982 are not considered realistic because of lack of information to calibrate this period of time. Sensitivity analysis presented last year showed that a reduction in M (from 0.4 to 0.3 and 0.2) reduces considerably the SSB and increases the F estimates in this period. These results are expected to have an impact on the definition of the provisional F_{pa} (0.4year-1) set for this stock.

WD8 shows that F_{msy} (Ricker and Beverton & Holt) is quite sensitive to SSB values larger than 20Kt, where the lack of information does not allow a good fit of the shape of the S/R curve. However, with hake being a cannibal species, curves that take into account an over-compensatory behaviour (like Ricker) should be suitable for this species. Further research on this subject is needed.

The WG considers further research is required to propose a $B_{trigger}$ value for this stock.

7.6 Comments on the assessment

There was a revision of the discards estimates provided by Portugal and Spain.

The current assessment shows a change in the retrospective pattern with a tendency to underestimate F and overestimate SSB in the last year. Such pattern will have to be confirmed next year.

The table below summarises the consistency with last year's assessment.

	Year	WGHMM10	WGHMM11	% change	Comments
Fbar	2009	0.74	0.83	+12%	
SSB	2009	20.1	17.2	-14%	
R	2009	901.6	159.7	-465%	

In spite of these changes the relative perspective about stock status is similar to previous years. An increase in stock size is observed, mainly due to high recruitments.

Regarding stock exploitation, there is a recent decrease in fishing mortality, from 0.83year-1 to 0.52year-1, reflecting the decrease in Spanish catches in 2010.

The Portuguese and Spanish groundfish survey indices have a large impact on the estimation of 2010 recruitment and, to a lesser extent, on fishing mortality and SSB.

Gadget is sensitive to initial values (1982), consequently the starting years may have convergence problems and assessment results for those years should be considered with caution.

7.7 Management considerations

There are indications of good recruitments in recent years.

The retrospective pattern used to revise SSB towards higher values and F to lower values in recent years. However this pattern has been broken this year changing to corrections in the opposite direction, given more uncertainty to evaluate the reliability of F in 2011 and F for 2012.

Spanish regulation applied in the second semester of 2010 has been efficient to reduce landings. Landings for this period are about half of those in the first semester. Similar regulations are enforced in 2011 for the whole year and a reduction of 2011 landings is expected. If discards do not increase, a reduction in F could also be expected.

Initial estimated values after 1982 are not considered realistic because of lack of information to calibrate this period of time. This is expected to have an impact on the definition of the provisional F_{pa} (0.4year-1) set for this stock.

Considering F_{max} as a target for this fishery, the current exploitation level is still high.

Hake is a top predator which is caught in a multispecies fishery and decisions on hake management will have an impact on the trophic chain that was not accounted for in this assessment.

Table 7.1 HAKE SOUTHERN STOCK. Catch estimates (´000 t) by country and gear, 1972-2010

	SPAIN									PORTUGAL				FRANCE	TOTAL		
YEAR	ART	GILLNET	LONGLINE	Cd TRW	Pr-Bk TRW	PAIR TRW	BAKA TRW	DISC	LAND	ART	TRAWL	DISC	LAND	TOTAL	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	-	1.8	7.9	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	-	1.7	7.6	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	-	1.5	6.7	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	-	1.5	6.7	8.2
2004	0.45	0.42	0.13	1.06		1.66	1.13	0.22	4.8	1.27	0.80	0.69	2.1	-	0.9	6.9	7.8
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	-	2.0	8.3	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	-	3.3	10.8	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	-	2.5	14.9	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	-	2.3	16.8	19.1
2009	1.36	2.92	2.10	0.55		7.37	2.54	0.98	16.8	1.39	0.96	1.96	2.4	-	2.9	19.2	22.1
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 *	1.6	15.7	17.3

*** French catches not considered in assessment model until full time series review.**

Table 7.2 HAKE SOUTHERN STOCK - length compositions (thousands) by gear in 2010

Length (cm)	PORTUGAL			SPAIN							STOCK		
	Trawl	Art	Disc	Art	Cd-Trw	Ba-Trw	Pa-Trw	Gillnet	Longline	Disc	Land	Disc	Catch
4	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0
7	0	0	1	0	0	0	0	0	0	18	0	19	19
8	0	0	8	0	0	0	0	0	0	0	0	8	8
9	0	0	144	0	3	0	0	0	0	0	3	144	147
10	0	0	46	0	77	0	0	0	0	12	77	58	135
11	0	0	204	0	119	0	0	0	0	1	119	205	323
12	0	0	148	0	255	0	0	0	0	79	255	227	482
13	0	0	468	0	345	0	0	0	0	339	345	808	1152
14	0	0	848	0	430	0	0	0	0	814	430	1662	2092
15	0	0	1104	0	569	0	0	0	0	1127	569	2231	2799
16	1	0	1067	0	565	0	0	0	0	1552	566	2619	3185
17	1	0	848	0	510	0	0	0	0	1277	510	2125	2636
18	0	0	990	0	390	0	0	0	0	1425	390	2415	2805
19	0	0	669	0	365	0	0	0	0	847	366	1516	1882
20	1	3	584	0	366	0	0	0	0	1815	370	2399	2769
21	3	0	530	0	389	0	4	0	0	1060	396	1590	1985
22	2	3	496	1	376	0	12	0	0	1539	395	2036	2430
23	4	7	279	2	364	0	4	0	0	1070	381	1349	1730
24	17	23	455	3	318	5	26	0	0	816	391	1271	1662
25	42	37	405	3	240	5	181	0	0	759	509	1163	1672
26	69	87	284	2	249	39	460	0	0	330	905	613	1518
27	149	199	58	169	273	93	1009	1	0	270	1893	328	2221
28	210	189	49	158	197	107	1386	1	0	101	2248	150	2398
29	265	223	73	134	180	143	1339	1	0	49	2286	122	2408
30	279	176	12	186	137	206	1084	1	0	43	2070	56	2125
31	215	184	24	167	107	229	956	2	0	51	1860	75	1935
32	142	201	12	213	96	252	729	2	0	15	1635	27	1662
33	143	222	8	223	78	258	457	1	0	12	1384	20	1404
34	165	211	24	168	55	239	530	1	1	7	1369	31	1400
35	120	147	9	173	49	248	822	13	1	5	1573	14	1586
36	87	147	7	173	35	224	631	2	9	1	1307	9	1316
37	100	139	7	109	24	211	681	14	17	3	1294	10	1305
38	53	126	7	125	25	141	657	30	20	3	1177	10	1187
39	63	142	81	77	32	144	849	3	62	0	1371	81	1452
40	48	151	5	82	30	147	500	29	58	0	1045	5	1050
41	64	102	5	55	19	100	375	34	44	76	791	80	871
42	38	120	1	30	13	101	276	11	115	0	704	1	706
43	30	107	0	16	15	100	324	43	44	0	679	0	679
44	41	96	0	18	7	99	163	30	52	0	506	0	506
45	43	82	0	8	13	74	134	31	108	0	493	0	493
46	18	86	0	7	11	63	143	50	54	0	432	0	432
47	25	62	0	7	6	59	125	34	77	0	393	0	393
48	21	59	0	8	5	56	68	75	78	0	371	0	371
49	10	51	0	4	5	61	90	58	47	0	327	0	327
50	5	52	0	4	1	50	90	74	68	0	345	0	345
51	8	33	0	4	3	34	74	84	63	0	302	0	302
52	7	28	0	4	3	46	50	78	61	0	277	0	277
53	5	31	0	6	2	36	37	103	37	0	256	0	256
54	5	18	0	2	0	30	47	63	61	0	225	0	225
55	5	26	0	2	2	23	68	58	46	0	230	0	230
56	5	41	0	2	3	17	33	65	50	0	217	0	217
57	4	17	0	0	1	19	38	70	53	0	202	0	202
58	1	21	0	1	0	20	21	60	56	0	180	0	180
59	1	9	0	0	2	22	21	49	64	0	169	0	169
60	1	15	0	0	0	13	16	81	50	0	177	0	177
61	1	11	0	0	0	12	10	49	46	0	129	0	129
62	1	8	0	1	0	13	9	35	44	0	111	0	111
63	2	10	0	1	0	6	14	29	40	0	101	0	101
64	1	9	0	0	0	6	86	20	31	0	153	0	153
65	0	2	0	0	0	5	45	17	26	0	96	0	96
66	1	7	0	1	0	4	6	15	23	0	56	0	56
67	0	5	0	1	0	2	44	10	21	0	84	0	84
68	0	2	0	2	0	2	53	7	16	0	82	0	82
69	0	3	0	0	0	1	20	6	13	0	44	0	44
70	0	2	0	1	0	1	53	10	9	0	75	0	75
71	0	3	0	2	0	2	49	4	10	0	71	0	71
72	1	9	0	0	0	1	10	8	5	0	33	0	33
73	0	1	0	0	0	1	9	5	6	0	21	0	21
74	0	0	0	0	0	1	7	1	3	0	13	0	13
75	0	0	0	0	0	0	5	3	3	0	13	0	13
76	1	10	0	1	0	1	54	1	4	0	71	0	71
77	0	1	0	1	0	1	2	3	2	0	9	0	9
78	0	2	0	1	0	0	47	3	2	0	55	0	55
79	0	0	0	0	0	1	2	0	2	0	5	0	5
80	1	0	0	0	0	0	2	0	1	0	4	0	4
81	0	0	0	0	0	0	2	0	0	0	3	0	3
82	0	0	0	0	0	0	5	0	1	0	7	0	7
83	0	0	0	0	0	0	2	0	1	0	3	0	3
84	0	0	0	0	0	0	3	0	0	0	4	0	4
85	0	0	0	0	0	0	2	0	1	0	4	0	4
86	0	0	0	0	0	0	2	0	0	0	3	0	3
87	0	0	0	0	0	0	0	0	1	0	1	0	1
88	0	0	0	0	0	0	0	0	0	0	0	0	0
89	0	0	0	0	0	0	41	0	0	0	41	0	41
90	0	1	0	0	0	0	2	0	0	0	4	0	4
TOTAL	2528	3761	9962	2354	7359	3775	15096	1479	1706	15514	38060	25476	63536
Nominal Wei	0.73	1.61	0.58	0.72	0.68	1.71	6.33	1.71	1.88	1.00	15.37	1.58	16.95
SOP	0.78	1.72	0.57	0.72	0.68	1.71	6.33	1.70	1.88	1.00	15.52	1.57	17.10
SOP / NW	0.94	0.94	1.01	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00	0.99
Mean length	33.9	37.9	18.9	34.3	21.4	38.3	36.2	53.4	52.2	20.2	34.8	19.7	28.7

Table 7.3 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

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 7.4 HAKE SOUTHERN STOCK - Spanish groundfish surveys; abundances and recruitment indices for total area (Mino - Bidasoa). Biomass for Cadiz surveys.

	Spanish Survey (Sp-GFS) (/30 min)						Cadiz Survey (Sp-GFS-caut) (/hour)				Cadiz Survey (Sp-GFS-cspr) (/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						0								
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

Since 1997 new depth stratification: 70-120m, 121-200m and 201-500 m
Before 1997: 30-100m, 101-200m and 201-500 m

Table 7.5 HAKE SOUTHERN STOCK. Landings (tonnes), Catch per unit effort and effort for trawl fleets

	A Coruña Trawl			A Coruña Pair Trawl			Vigo and Marín trawl [1]			Santander trawl			Cadiz trawl			Portugal trawl		
YEAR	Landings	Ipue *	Effort	Landings	Ipue *	Effort	Landings	Ipue *	Effort	Landings	Ipue *	Effort	Landings	Ipue ***	Effort	Landings	Ipue **	Effort ****
1985	945	21	45920	1016	43	23700												
1986	842	21	39810	1009	39	25630				218	12.0	18153						
1987	695	20	34680	752	25	29820				455	30.3	14995						
1988	698	17	42180	410	32	12980				219	13.1	16660						
1989	715	16	44440	480	31	15240				245	13.9	17607				1847	38.6	47810
1990	749	17	44430	429	24	18250	438	17.5	25063	392	19.2	20469				1138	33.4	34106
1991	501	12	40440	609	20	30530	368	12.6	29260	340	15.2	22391				1245	37.7	33035
1992	589	15	38910	730	27	26670	666	21.4	31146	311	13.6	22833				1325	33.8	39257
1993	514	12	44504	350	16	21349	290	13.1	22198	390	18.2	21370				871	31.0	28053
1994	473	12	39589	319	15	20732	556	21.3	26115	296	13.0	22772	326	11.7	27823	789	31.1	25341
1995	831	20	41452	691	24	28988	1018	35.5	28677	336	23.9	14046	458	14.2	32194	1026	38.4	26690
1996	722	20	35728	249	14	17555	647	21.9	29480	274	22.7	12071	975	30.5	31951	894	34.2	26121
1997	732	21	35211	295	18	16307	347	9.2	37578	127	10.8	11776	880	27.0	32573	906	38.1	23781
1998	895	27	32563	198	12	16966	284	6.7	42371	122	11.4	10646	523	15.9	32824	913	35.0	26053
1999	691	23	30232	139	15	9322	402	10.1	39738	92	8.9	10349	570	17.4	32731	1092	40.4	27019
2000	590	20	30102	92	29	3190	371	11.0	33771	52	5.9	8779	584	19.5	29875	1162	32.0	36312
2001	597	20	29923	91	19	4873	293	8.7	33802	47	15.5	3053	1203	39.6	30416	1210	36.6	33048
2002	232	11	21823	266	37	7147	256	10.6	24288	30	7.6	3975	883	28.9	30526	970	36.0	26975
2003	274	15	18493	121	30	3988	397	17	23151	22	5.8	3837	1251	39.5	31643	962	35.8	26855
2004	259	12	21112	249	29	8582	259	23	11139	17	4.6	3776	1062	35.4	30029	800	35.0	22849
2005	330	16	20663	428	47	9025	286	29	9981	7	4.9	1404	885	27.3	32419	965	37.1	25997
2006	518	27	19264	489	78	6245	360	32	11128	24	9.0	2718	634	24.1	26248	908	35.8	25369
2007	621	29	21201	788	59	13471	375	34	11062	64	14.8	4334	505	20.7	24398	724	35.4	20447
2008	762	38	20212	631	70	8964	454	41	11034	64			529	27.7	19135	936	41.9	22353
2009	640	40	16162	886	112	7944	400	42	9468	31	27.6	1125	550	25.9	21218	964	42.2	22836
2010	553	40	13744	1440	179	8027	450	42	10672	15	15.9	1627	680	31.1	21863	727	43.1	16855

* - Kg/fishind day x100 HP

[1] since 2004 Vigo-Marin fleet change in sampling design

** - Kg/hour (new standarized Ipue serie)

***- Kg/fishing day

**** - Standardized effort

Portugal trawl series standarized in 2010

Cadiz Trawl include Ayamonte harbor in 2009. Not considered before.

Table 7.6. Southern Hake Stock Assessment summary

Year	F (1-3)	R (mill)	SSB (`000 tn)	Land ('000 tn)	Disc ('000 tn)	Catch ('000 tn)
1982	0.359	97.8	40.5	17.6		17.6
1983	0.445	81.9	44.5	22.9		22.9
1984	0.453	69.3	41.5	22.2		22.2
1985	0.420	44.8	41.8	18.9		18.9
1986	0.442	41.1	38.9	17.2		17.2
1987	0.502	50.1	36.1	16.2		16.2
1988	0.644	68.2	26.5	16.7		16.7
1989	0.648	77.9	19.5	13.8		13.8
1990	0.694	82.7	15.8	13.2		13.2
1991	0.684	69.6	16.0	12.8		12.8
1992	0.821	51.2	15.2	13.8	*0.5* *	14.3
1993	0.871	61.5	12.8	11.5	*0.7* *	12.2
1994	0.855	117.4	9.2	9.9	*1.0* *	10.9
1995	1.143	50.3	7.6	12.2	*2.1* *	14.3
1996	1.104	105.4	9.0	9.7	*1.9* *	11.6
1997	1.101	76.1	6.9	8.5	*2.3* *	10.8
1998	0.872	59.9	6.4	7.7	*1.7* *	9.4
1999	0.731	65.7	8.2	7.2	*1.5* *	8.7
2000	0.811	68.4	9.7	7.9	*1.8* *	9.7
2001	0.799	49.7	10.0	7.6	*1.7* *	9.2
2002	0.753	69.5	10.4	6.7	*1.5* *	8.2
2003	0.768	60.3	10.3	6.7	*1.5* *	8.2
2004	0.659	78.9	10.4	6.9	0.9	7.9
2005	0.693	127.4	10.9	8.3	2.0	10.3
2006	0.807	99.5	12.4	10.8	3.3	14.1
2007	0.830	159.2	14.7	14.9	2.5	17.4
2008	0.803	120.7	15.1	16.8	2.3	19.1
2009	0.825	159.7	17.2	19.2	2.9	22.2
2010	0.521	172.1**	18.7	15.4	1.6	16.9

* estimated from survey abundance, discards and discards/landings rate
** Recruitment 2010 = 80.8 mill (geo mean 1989-09)

Table 7.7. Catch Options Table.

	SSB 2011	BIO 2011	F 2011 = mean	Yield 2011	Catch 2011	SSB 2012	BIO 2012
number	27650	37987	0.72	25020	27206	25078	32325

Fmult	F 2012	Yield 2012	Catch 2012	SSB 2013	
0.00	0.00	0	0	55582	
0.1	0.07	2798	3002	50775	
0.20	0.13	5430	5828	46267	
0.30	0.20	7902	8486	42090	
0.35	0.24	9080	9754	40119	*-0.15%*
0.36	0.24	9311	10003	39734	*Fmax*
0.40	0.27	10221	10982	38224	
0.49	0.33	12181	13095	34997	*+15%*
0.50	0.34	12392	13322	34652	
0.58	0.40	14026	15086	31995	*MSY transition scheme / Fpa*
0.60	0.41	14421	15513	31357	*MSY transition scheme*
0.70	0.49	16314	17560	28323	
0.80	0.56	18077	19470	25533	
0.90	0.64	19715	21248	22972	-10%
1.00	0.71	21235	22901	20627	Fsq
1.20	0.87	23937	25851	16526	
1.40	1.04	26226	28363	13125	
1.60	1.22	28141	30481	10330	
1.80	1.40	29719	32242	8056	
2.00	1.60	30996	33685	6225	

There is a EC Recovery Plan (-10% annual F redution; +-15% TAC constrain)
Fmsy proxi = Fmax (0.24)
No B trigger decided
No other Biological Reference Points
TAC 2011 = 10695 (-+15% [9090-12299])
F transition min (0.6*F2010+0.4*Fmax: Fpa=0.4) = 0.4
Recruitment = 80.8 mill (geo mean 1989-09)

BIO= total biomass

Figure 7.1. Length distribution of catches used in the assessment. Landings (1982-10) plus Cadiz landings from 1994-2004. Discards from 1992-10. Minimum landing size (MLS) since 1992 at 27 cm.

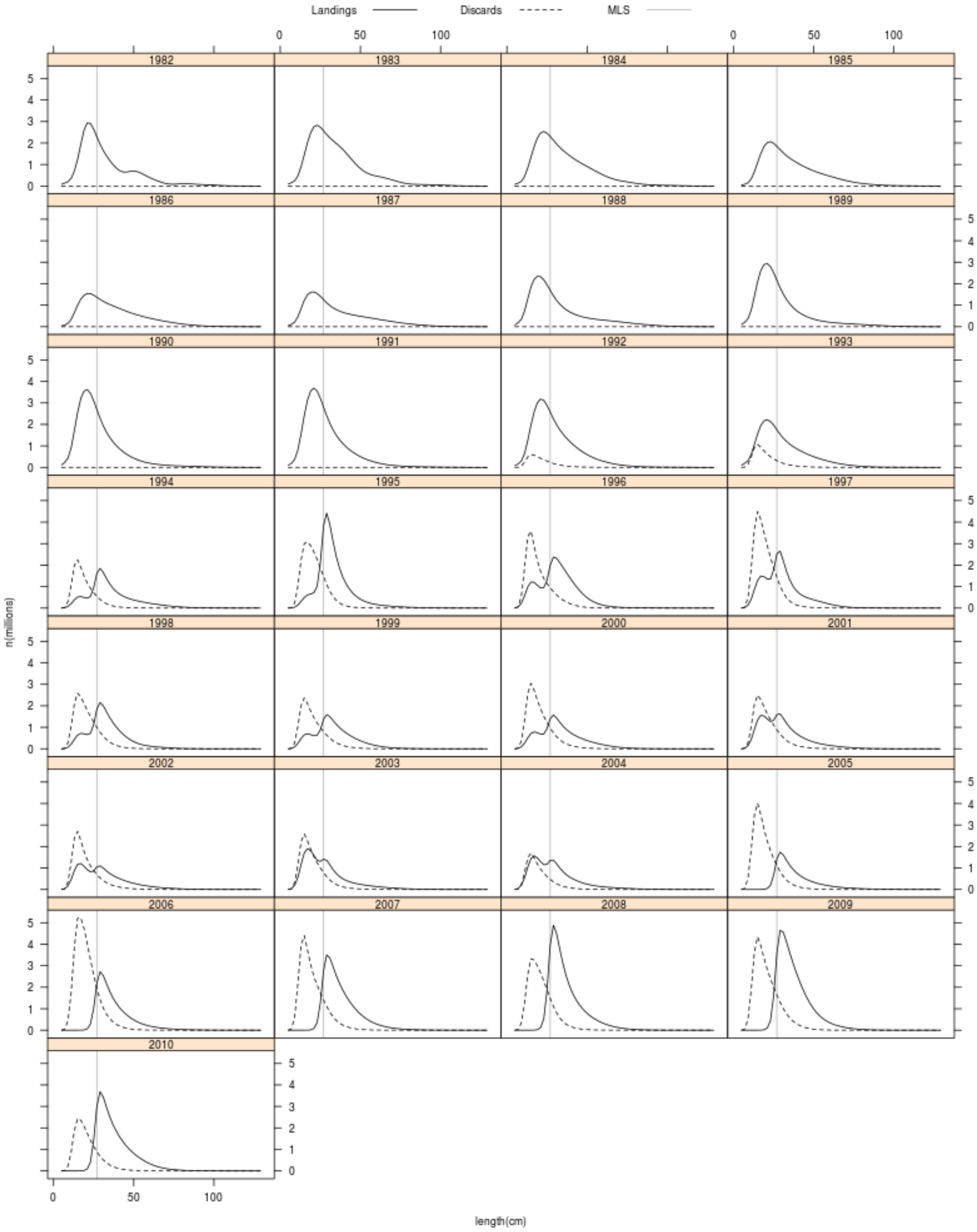


Figure 7.2 Maturity ogive

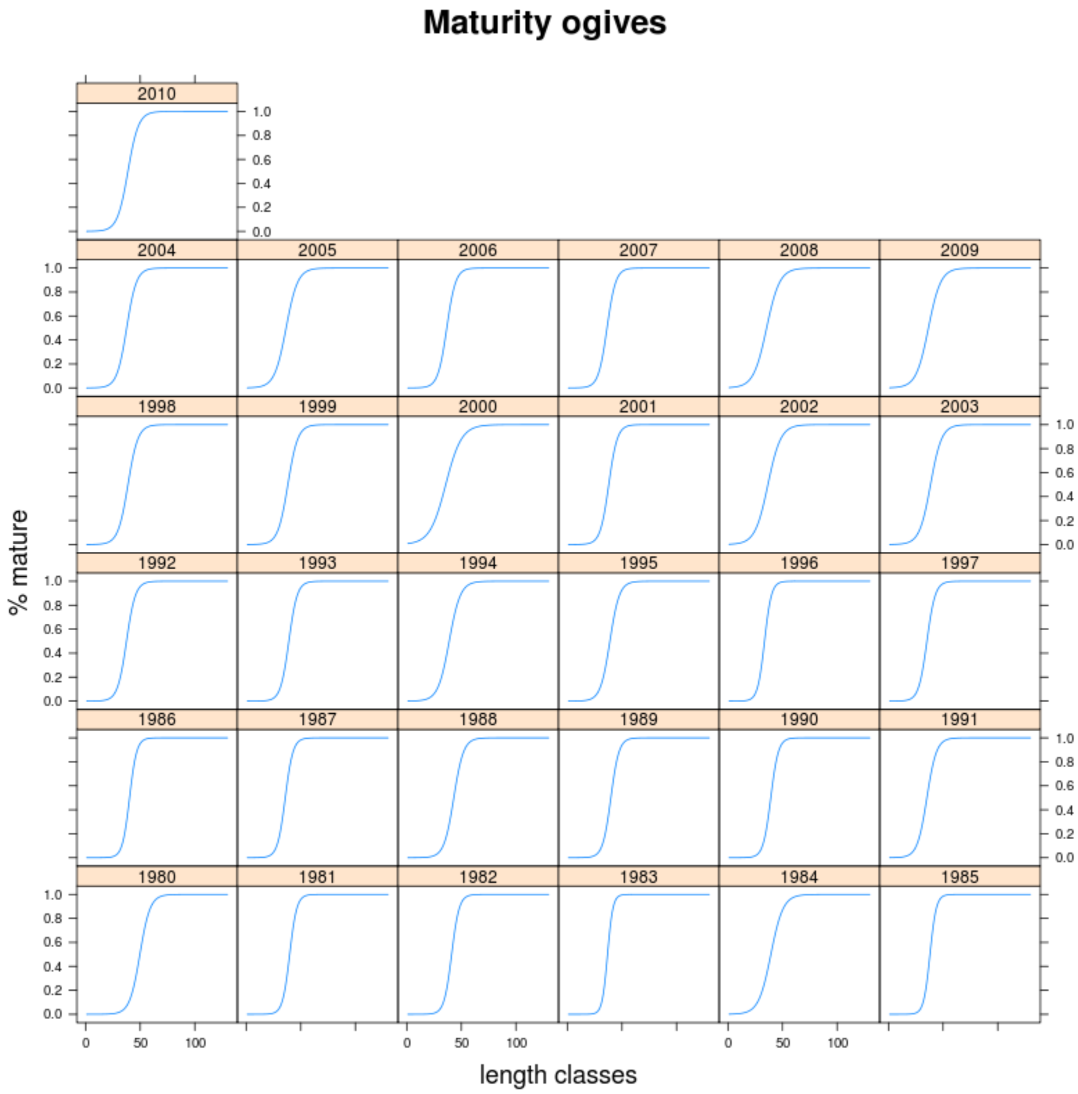


FIGURE 7.3 HAKE SOUTHERN STOCK - Recruitment and biomass Indices from groundfish surveys

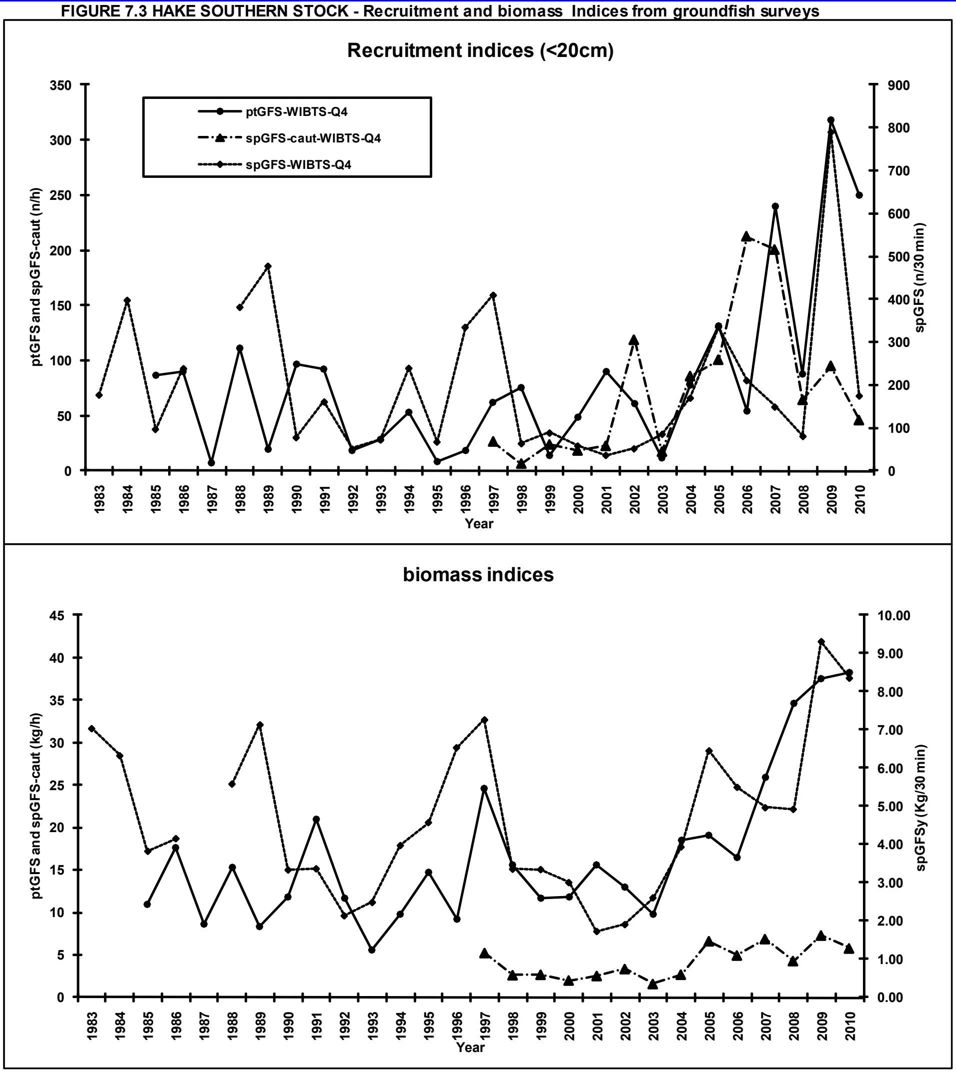


FIGURE 7.4 HAKE SOUTHERN STOCK - LPUE and fishing effort trends for trawl fleets

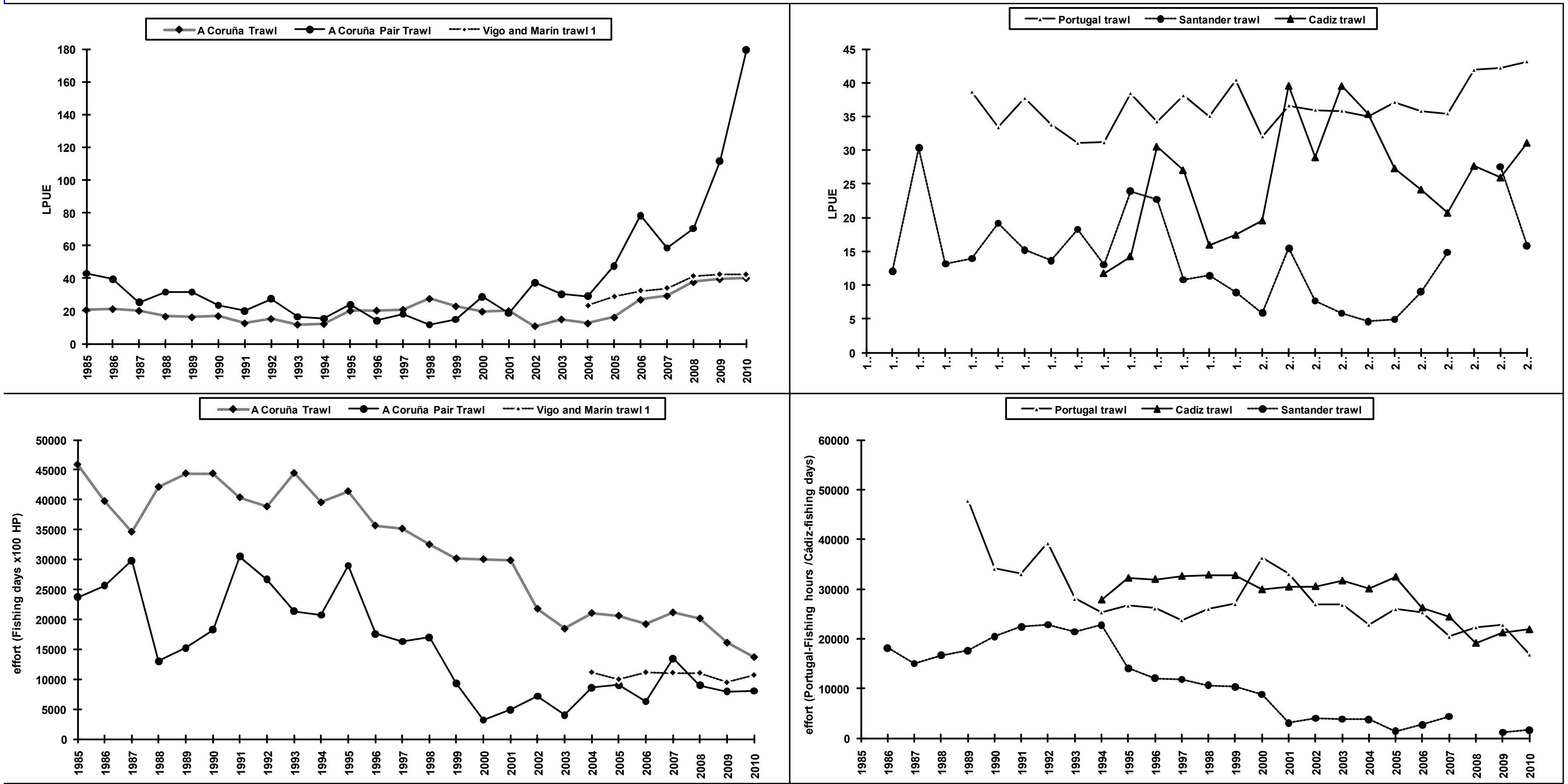
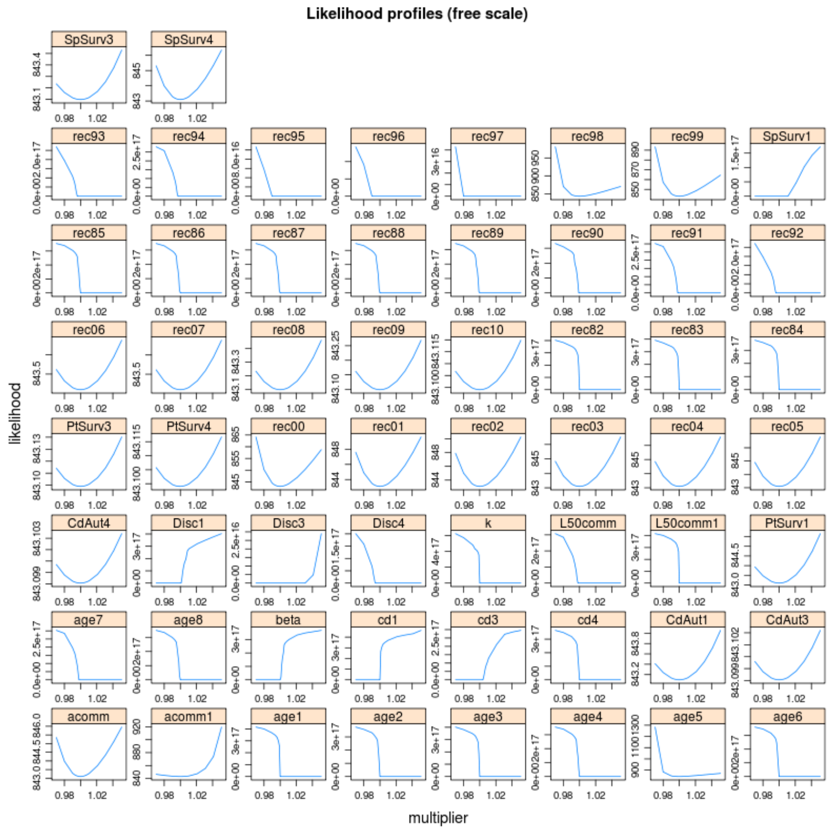


Figure 7.5. Gadget convergence with likelihood profiles. Free scaled (upper panel) and fixed scaled (lower panel)



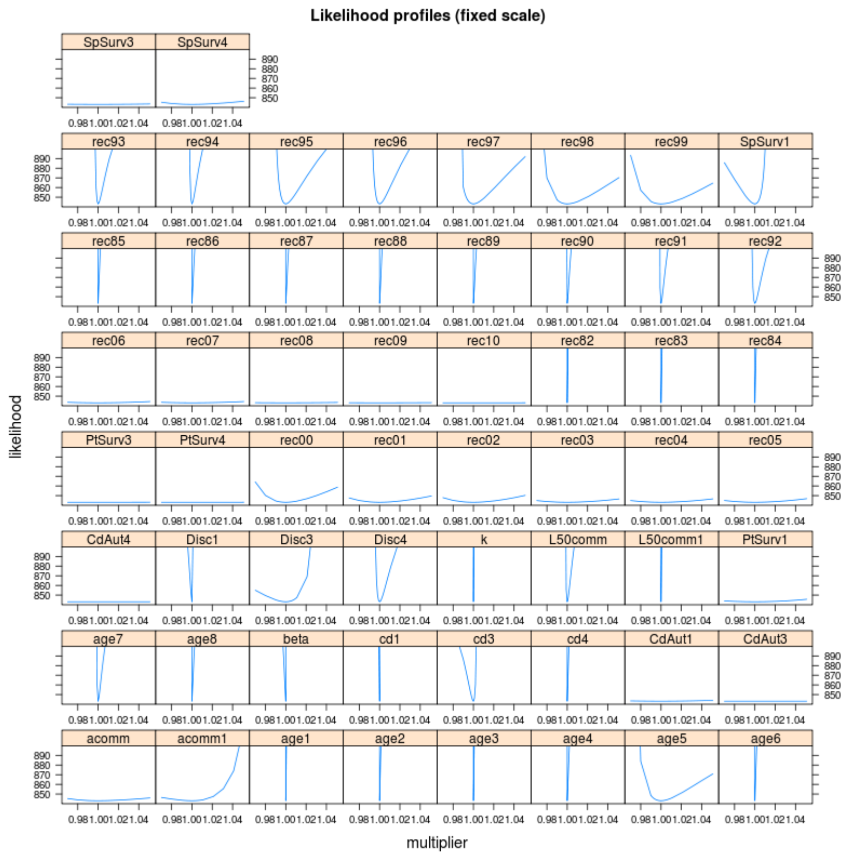
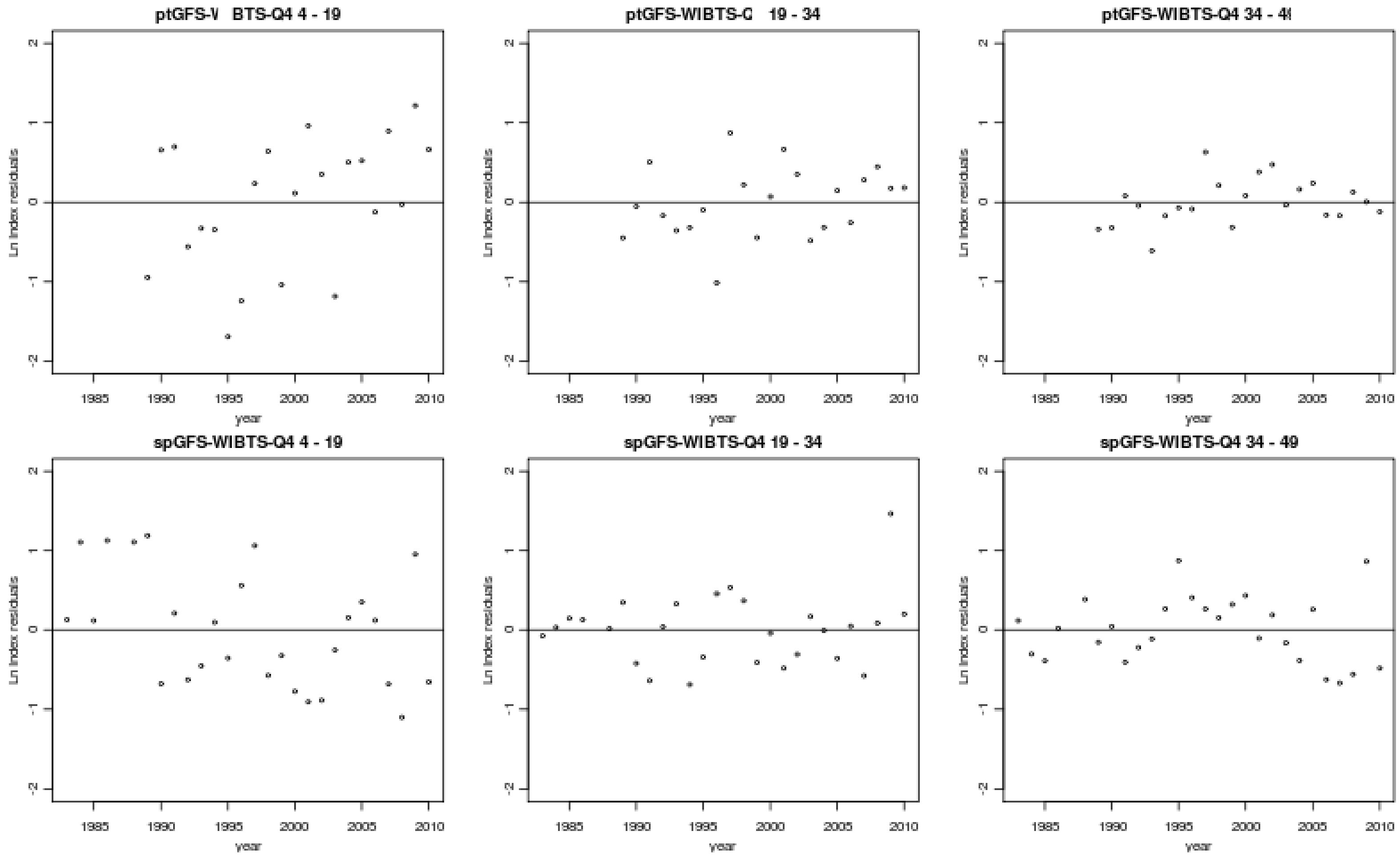
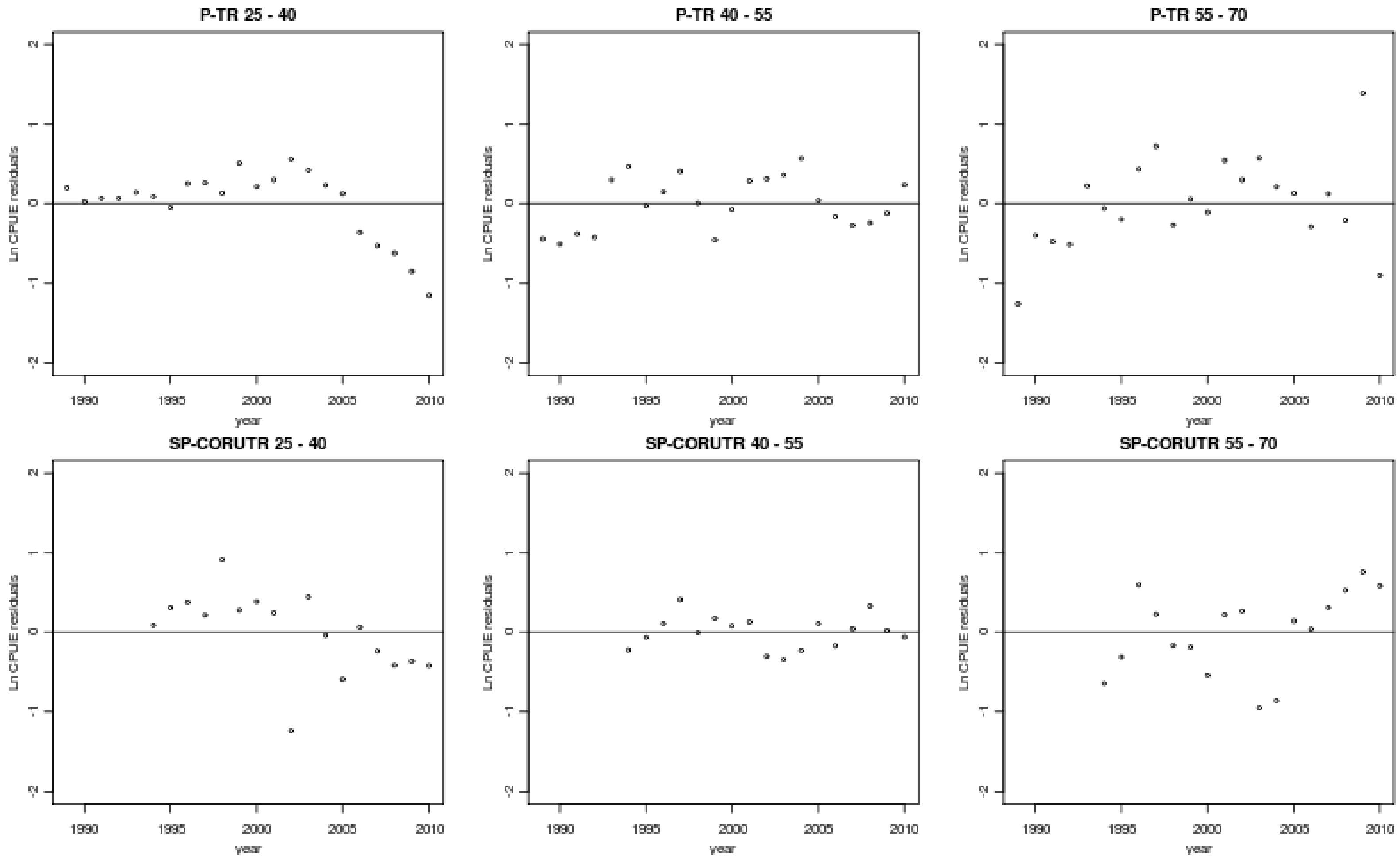


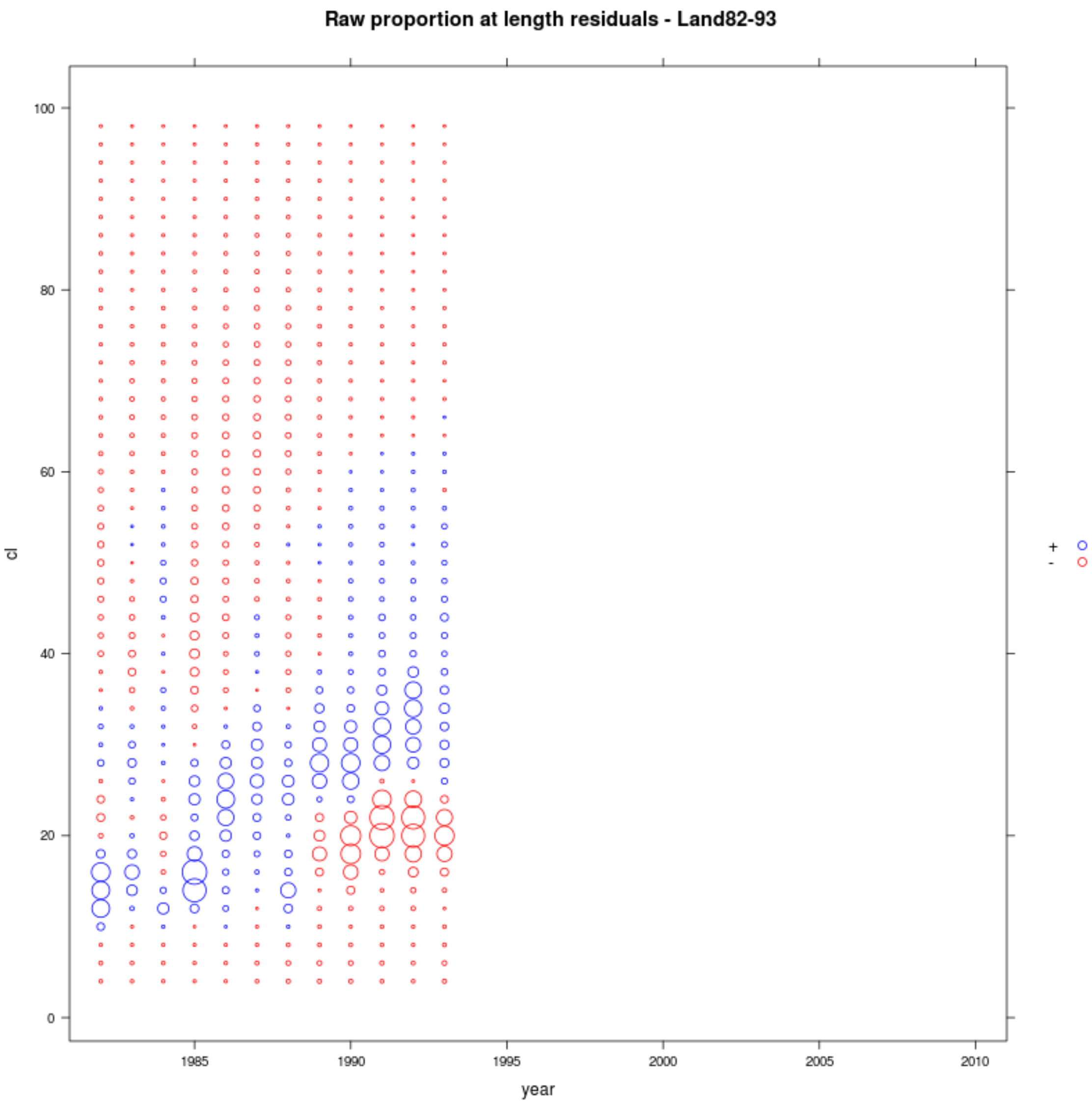
Figure 7.6 Diagnostics Residuals (7.6 a and b); observed vs. expected length proportions (7.6 c-i))



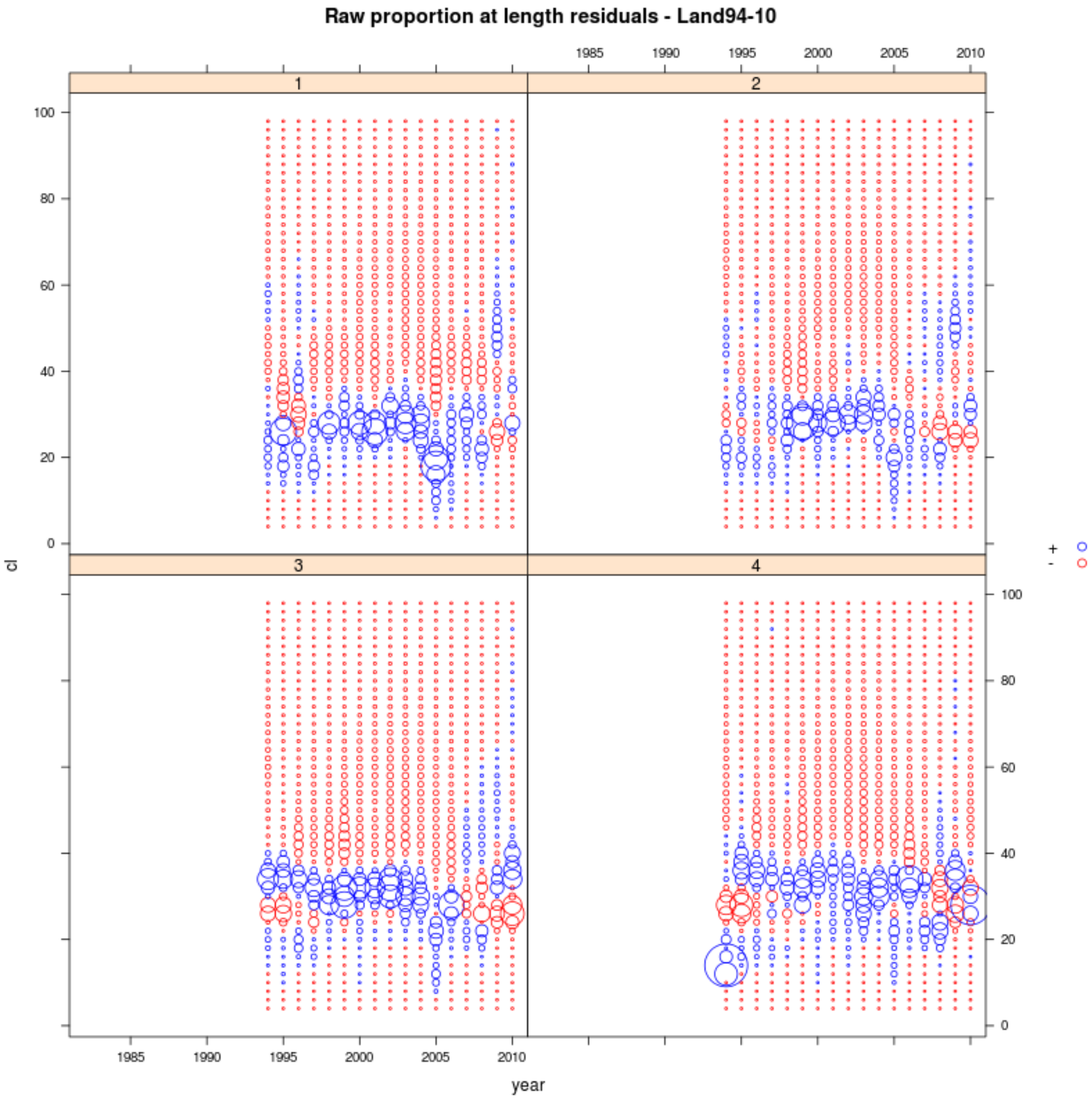
(7.6 a) Survey residuals by 15 cm groups (4-19, 19-34, 34-49 cm)



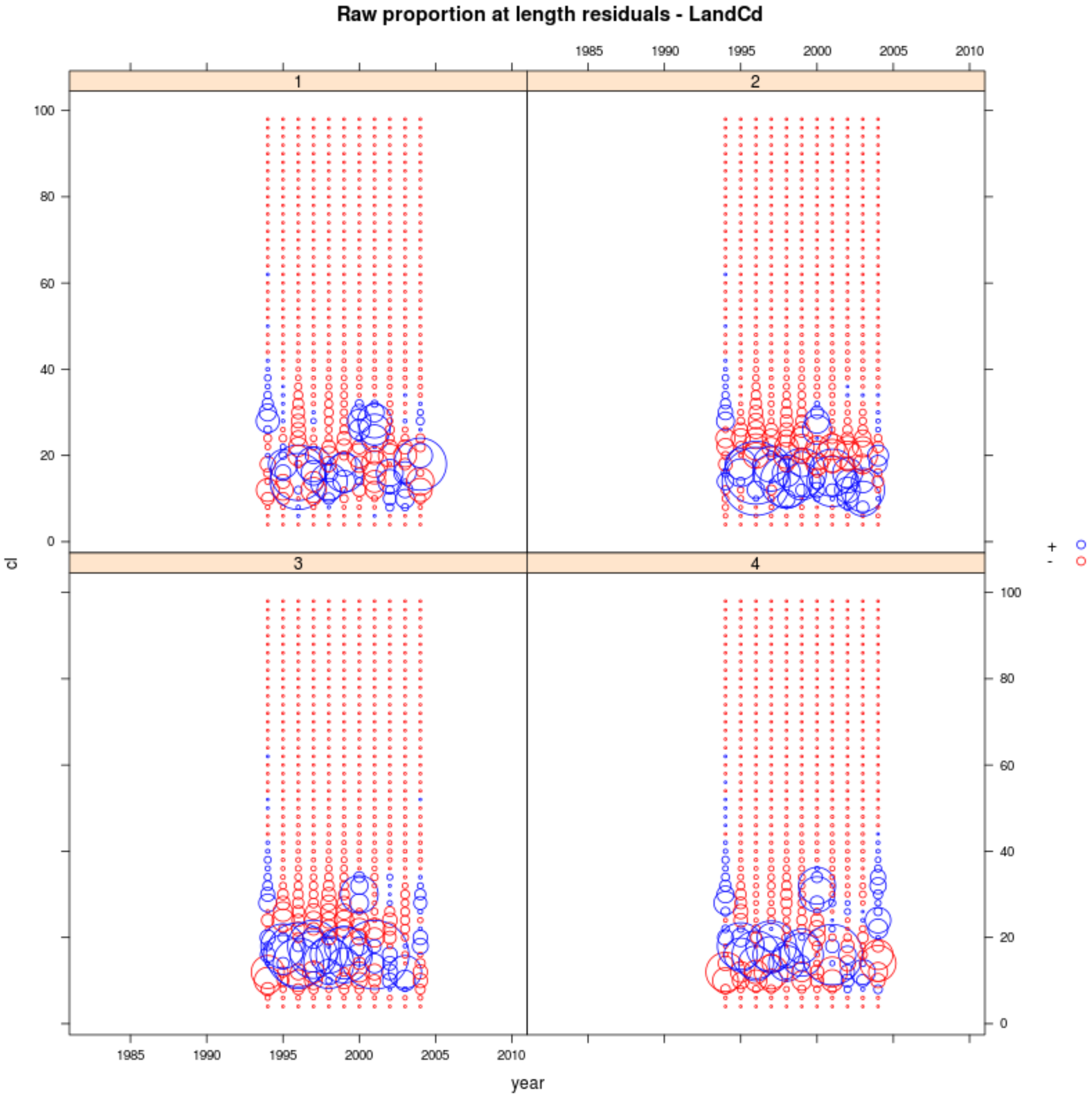
(7.6 b) LPUE residuals by 15 cm groups (25-40, 40-55, 55-70 cm)



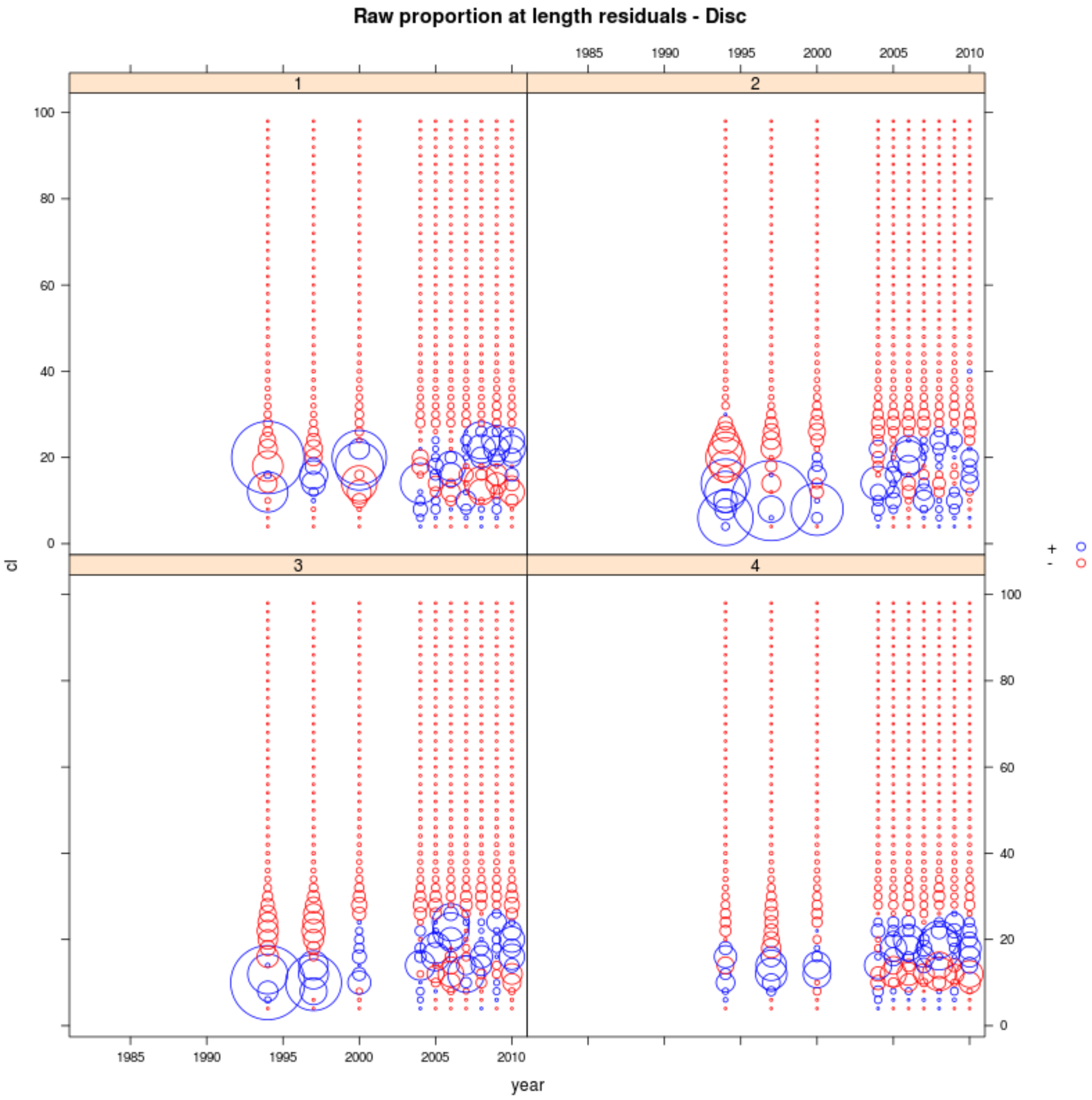
(7.6 c). Bubble plot for landings length distribution from 1982 to 1993.



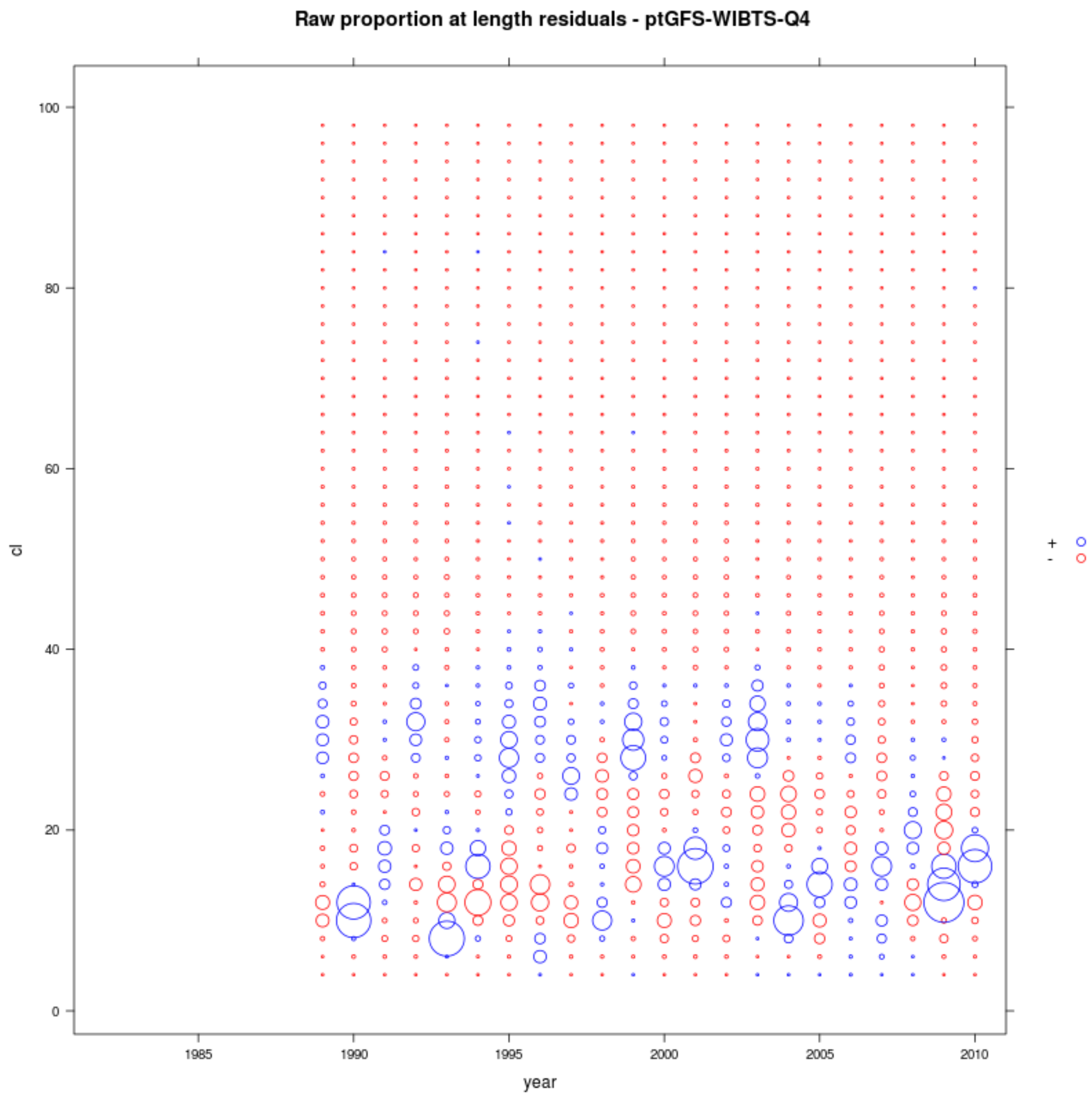
(7.6 d). Bubble plot for landings length distribution from 1994 to 2010.



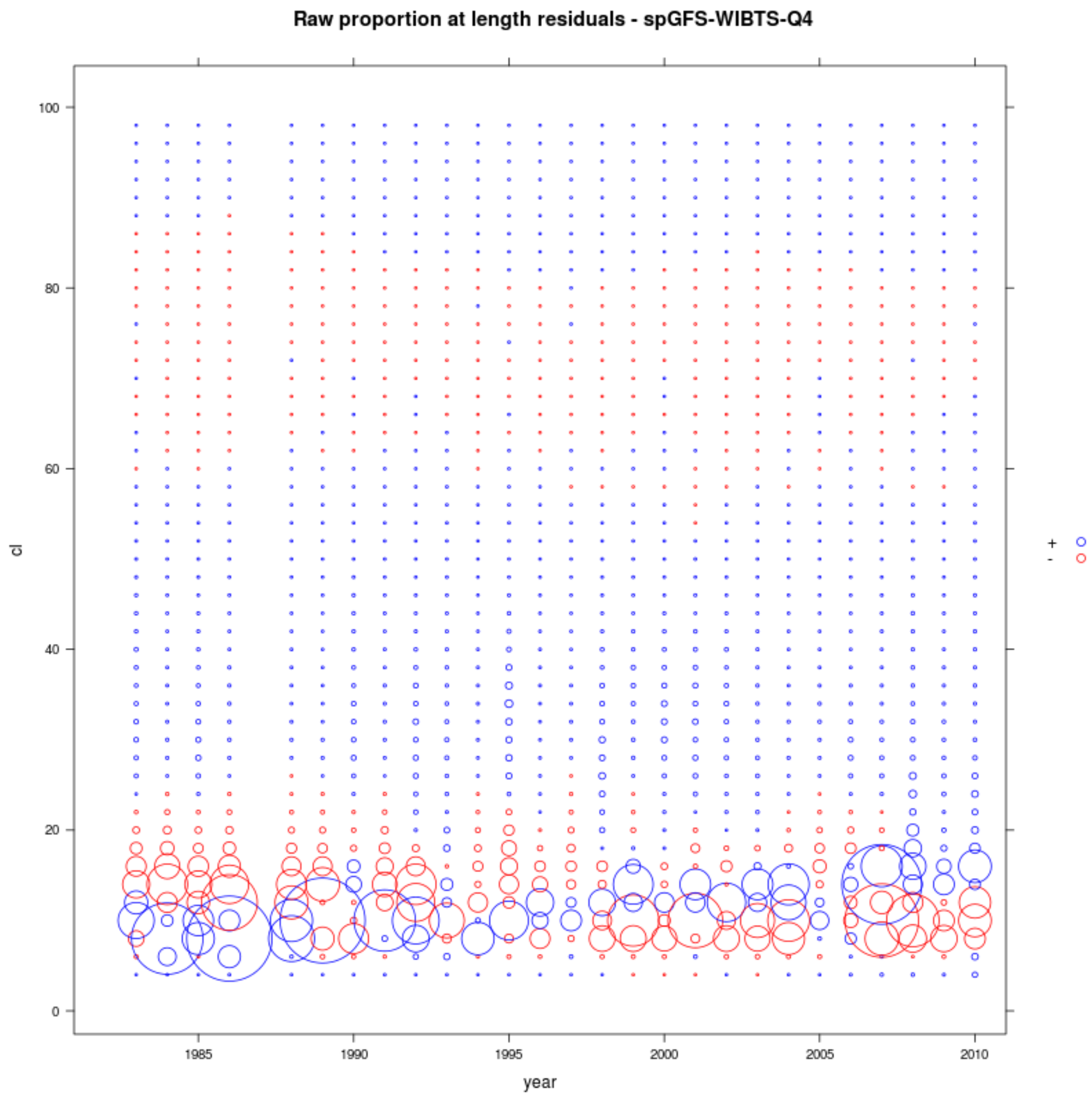
(7.6 e). Bubble plot for Cadiz landings length distribution from 1982 to 2004.



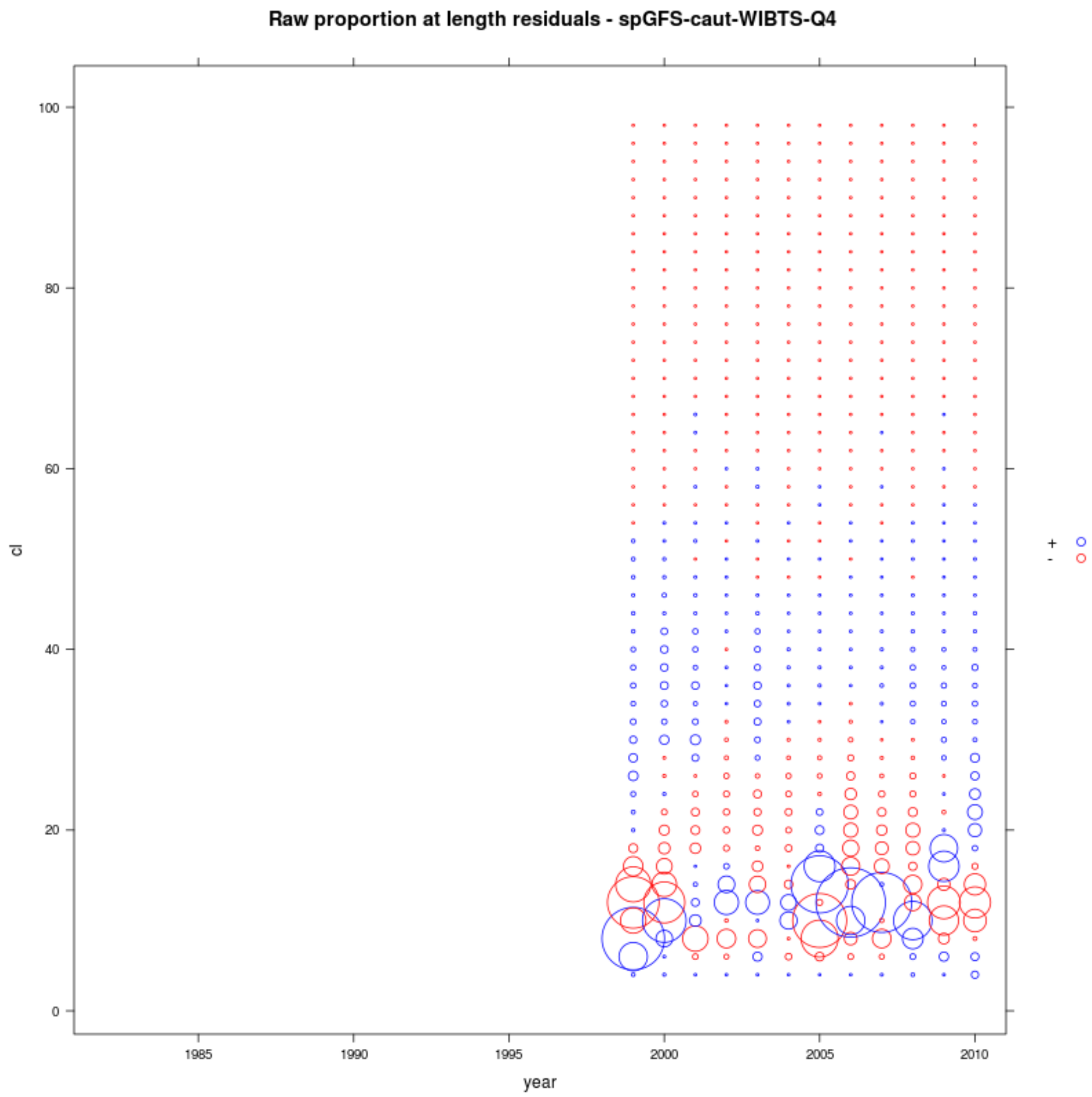
(7.6 f). Bubble plot for Discards length distribution for years 1993,97,99, 2004-2010



(7.6 g) Bubble plot for Portuguese demersal survey (ptGFS-WIBTS-Q4)



(7.6 h) Bubble plot for North Spain demersal survey (spGFS-WIBTS-Q4)



(7.6 i) Bubble plot for South Spain (Cadiz) demersal survey (spGFS-caut-WIBTS-Q4)

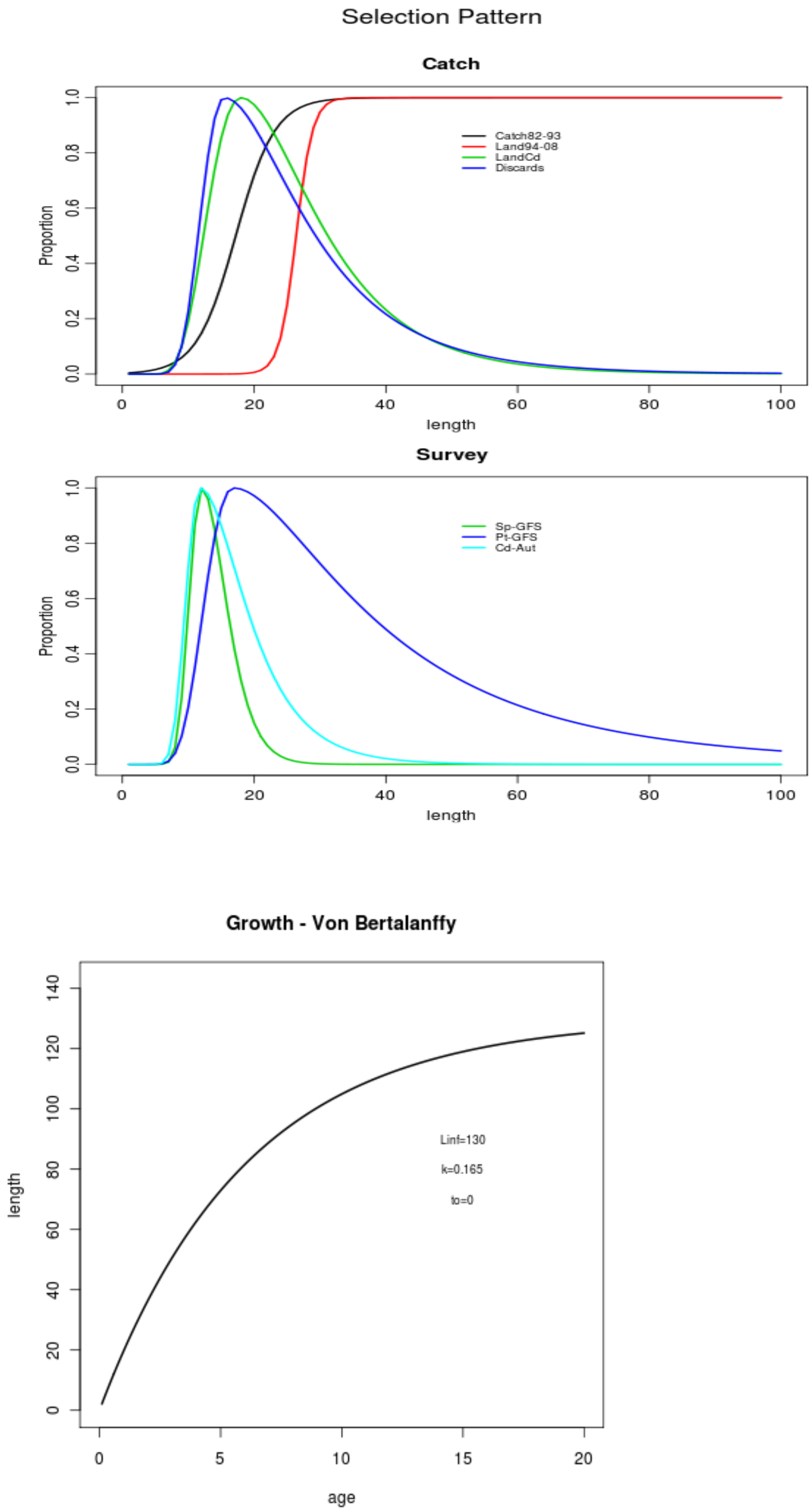


Figure 7.7. Selection pattern (upper panel) and von Bertalanffy growth with k parameter estimated by the model (lower panel)

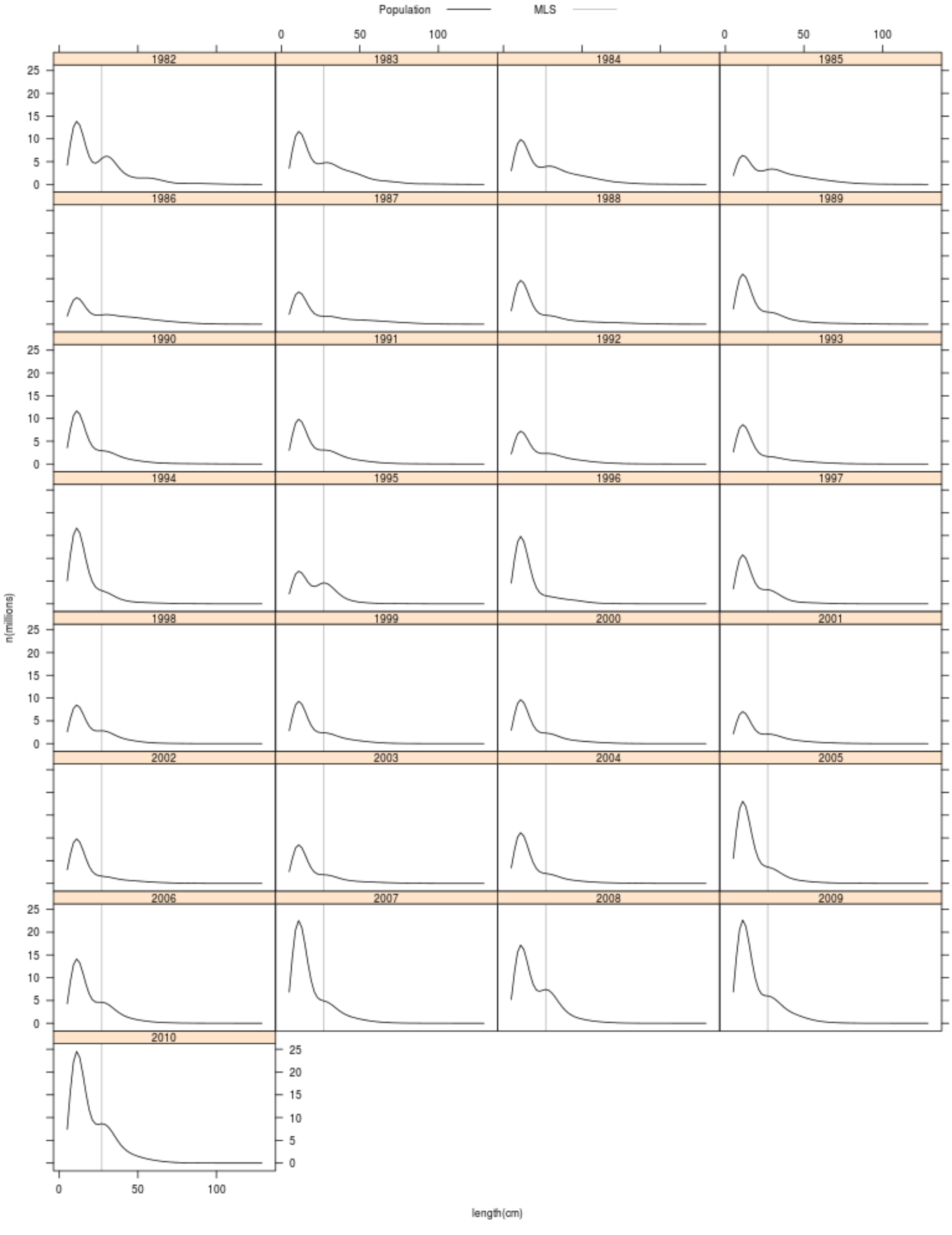


Figure 7.8. Population length distribution at beginning of 4rd quarter (MLS=27cm).

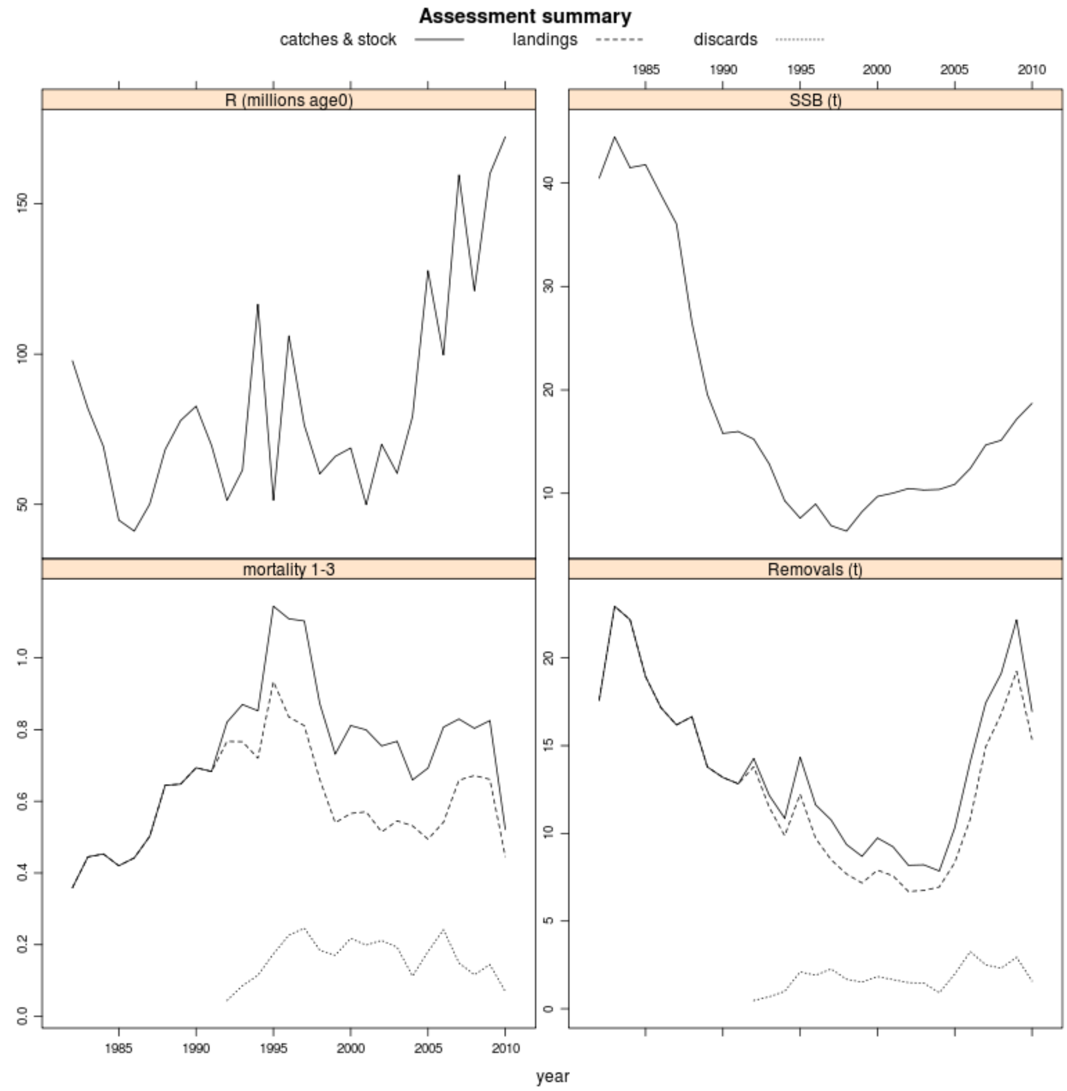
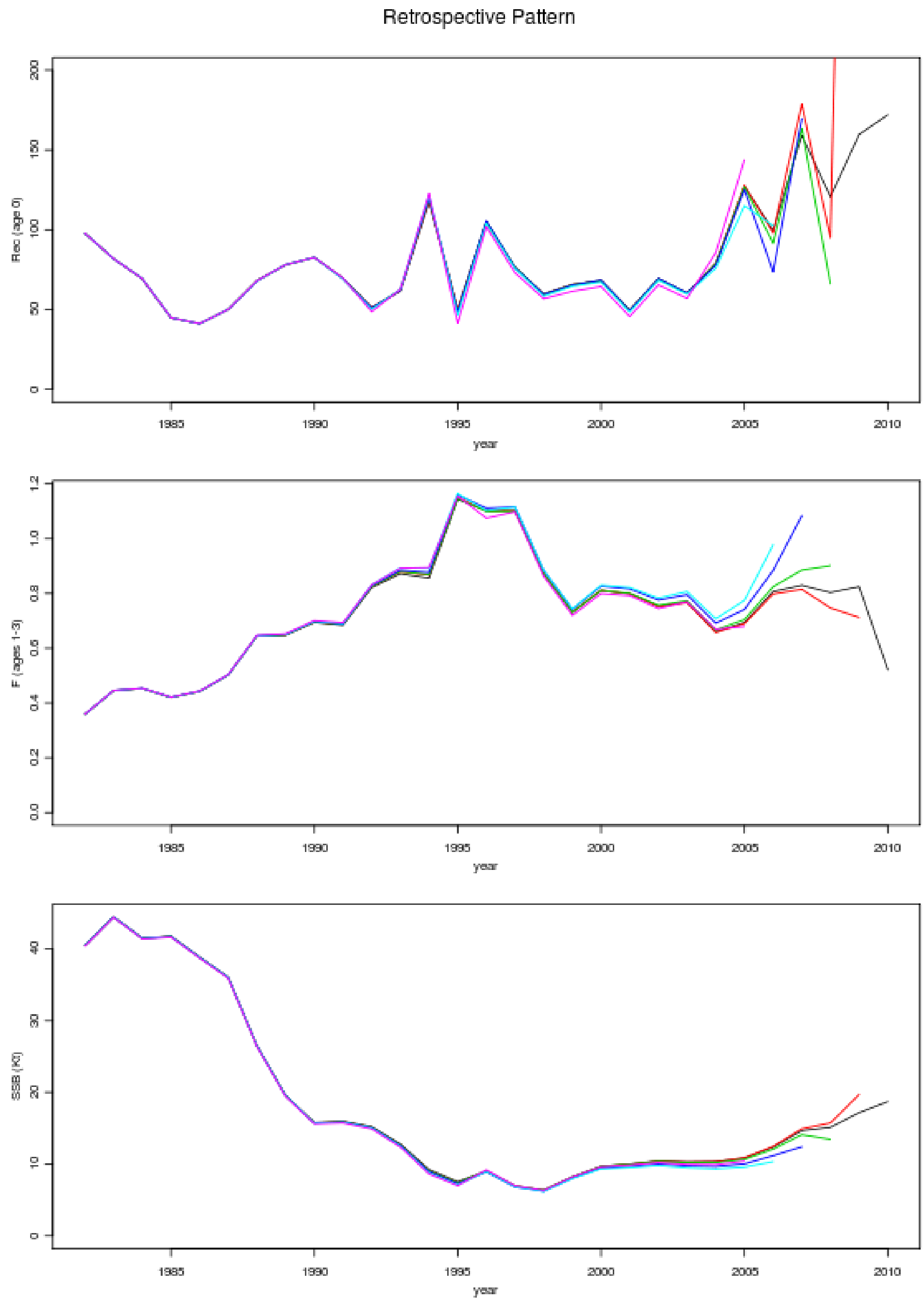


Figure 7.9. Summary plot. SSB and removals (catch, landings and discards) in '000 t. Recruitment in '000000 individuals.



Note that recruitment in 2010 year assessment (upper plot red line) reaches 880 mill and Y axis was cut at 200 mill.

Figure 7.10. Retrospective plot

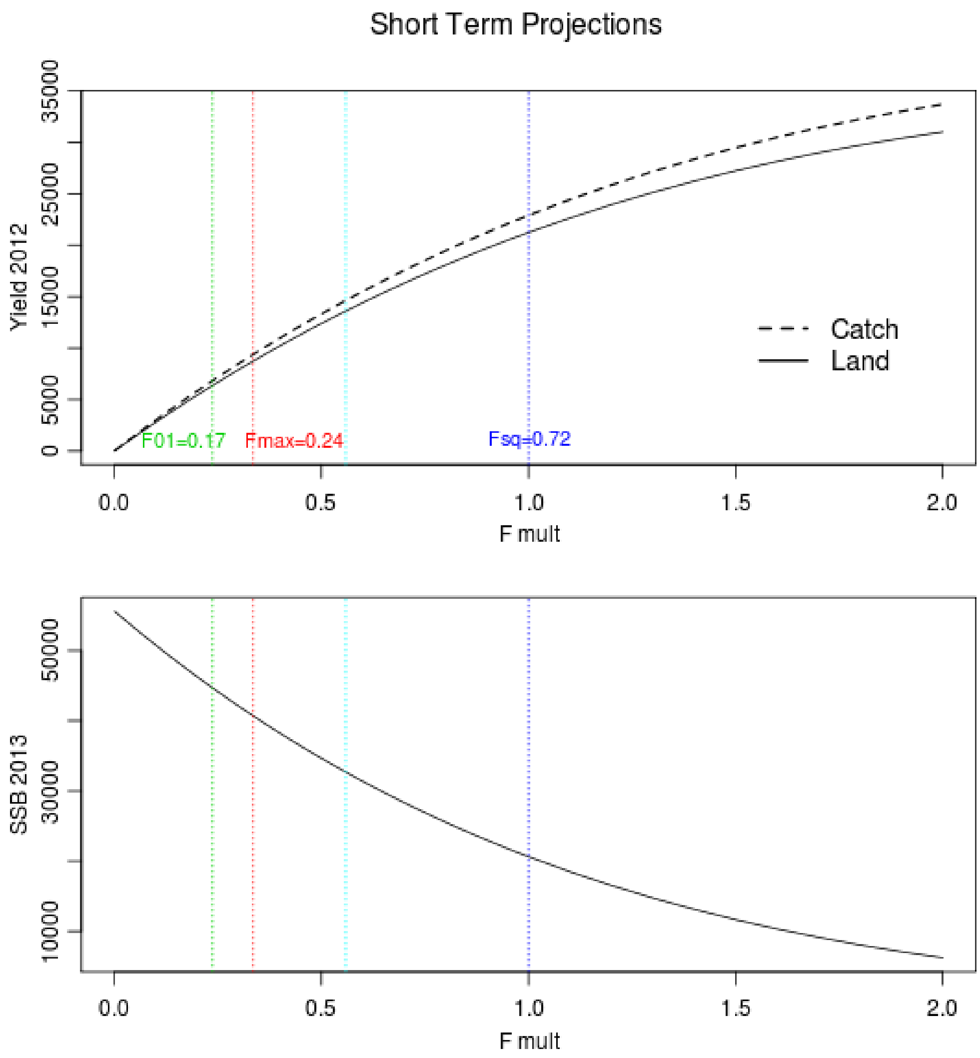


Figure 7. 11. Short term advice

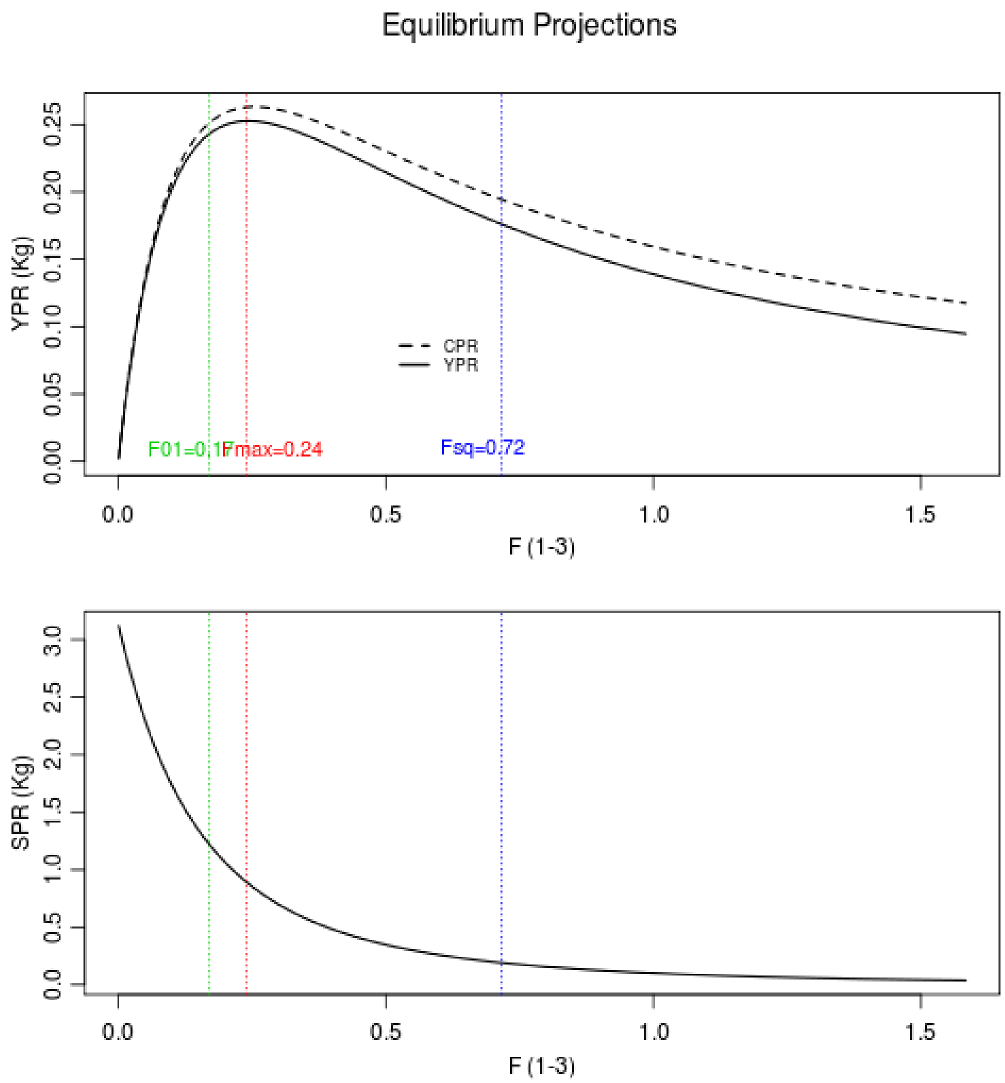


Figure 7. 12. Yield and SSB per recruit

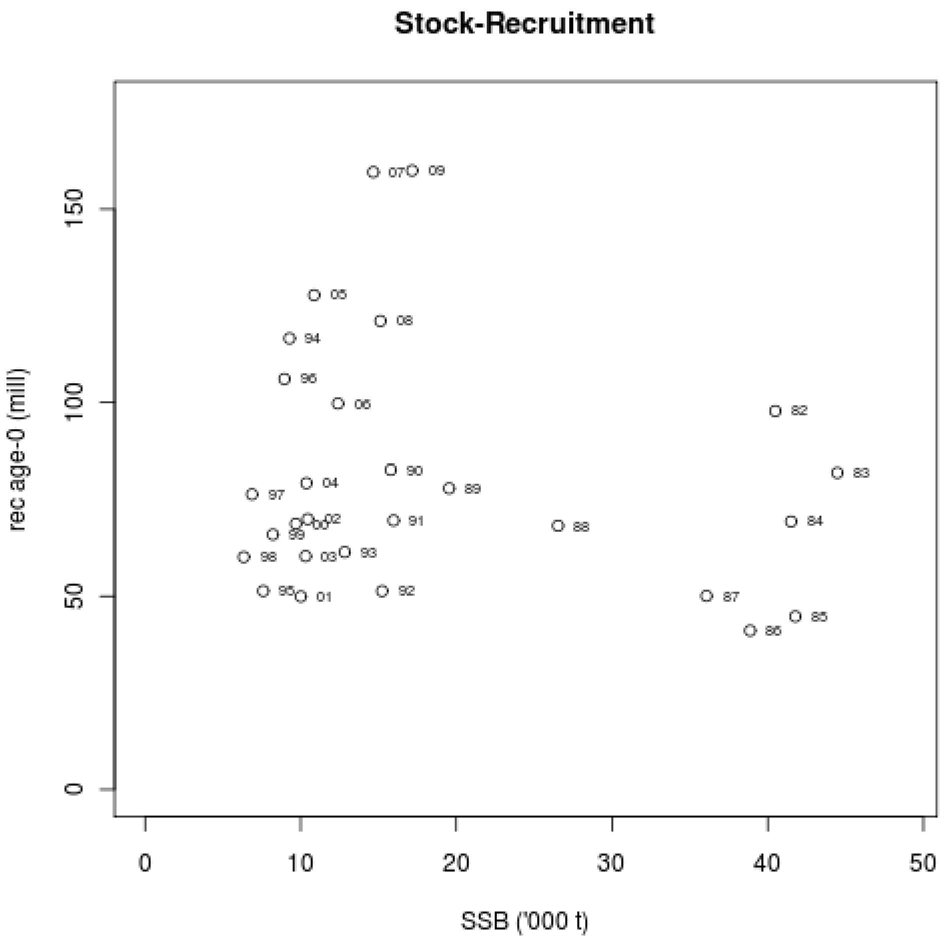


Figure 7.13 Stock-Recruitment plot.

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

L. piscatorius and L. budegassa

Type of assessment in 2011: update (of the WGHMM-2010 assessment)

Software used: ASPIC (separately for each of the species)

Data revisions this year: Portuguese crustacean and fish trawl 2009 landings, effort and LPUE values. Portuguese 2009 catch length frequencies.

RG2010 comments:

Because a benchmark for these two stocks is scheduled for the beginning of 2012, this year assessment was a simple update, and no changes or different approaches were attempted.

1. L. piscatorius. Number of bootstrap runs has been increased from 500 to 1000 following review of the 2009 assessment. However, they still talk about 80% CIs (instead of 95% CIs that can be reasonably estimated with the increased number of runs) when describing the results and in plots (e.g. Figure 8.1.5).

L. budegassa. Increased number of bootstrap runs and describes 95% confidence intervals in the text, but still plots 80% CIs.

For these new assessments 1000 bootstrap trials were run and 95% confidence intervals (CIs), provide in the output table of ASPIC, are used to describe the results in the text. Due to a possible bug in the code ASPIC is not able to provide straight 95% CIs for the whole time series of relative values of biomass and fishing mortality. Therefore it was decided to maintain the 80% CIs in the figures of the F/F_{MSY} and B/B_{MSY} ratios.

2. Both assessments have very low R-squared values for observed vs fitted CPUE values of the two series used (even negative – possible? – for L bud). What are the implications of this? Is the model still acceptable? The implications of this are not discussed too much despite saying: "The assessments are completely dependent on commercial LPUE data which may be biased due to targeting, local depletions, and changes in efficiency."

The concerns about the model fit are acknowledged but it was agreed to approve the assessment because a benchmark for these two stocks is scheduled for beginning of 2012 where the use of these and others LPUE series will be explored as any changes in settings or new approaches.

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.

A benchmark assessment of anglerfish in Divisions VIIIc and IXa was carried out in 2007. Due to the inconsistencies found in catch-at-age data, the Working Group did not accept the age-structured assessment and an ASPIC model was applied for each species separately.

The inconsistencies observed in the catch-at-age data are probably related to ageing estimation problems. Recent studies indicate that growth was underestimated (Azevedo *et al*., 2008; Landa *et al*., 2008) and new methods and analysis to validate the age information were recommended (see WGHMM2008 report).

Summary of ICES advice for 2011 and management for 2010 and 2011

ICES advice for 2011:

As both species of anglerfish are caught in the same fisheries and are subject to a combined TAC, the same reduction from current fishing mortality is assumed for both species. The reduction is driven by *L. piscatorius,* as it is the species in poor condition and whose current fishing levels are above FMSY. Following the ICES MSY framework implies fishing mortality to be reduced by 66%.

ICES advises the following landings for 2011 on the basis of the MSY approach (with caution at low stock size):

L. piscatorius: less than 1000 t; *L. budegassa*: less than 480 t; Combined anglerfish: less than 1500 t.

Management applicable for 2010 and 2011:

The two species are managed under a common TAC that was set at 1 496 t for 2010 and 1 571 t for 2011.

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.

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

8.1.1 General

8.1.1.1 Ecosystem aspects

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

8.1.1.2 Fishery description

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

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, the Spanish landings were on average 45% from the trawl fleet (mean lengths in 2010 of 58 cm and 62 cm in Divisions VIIIc and IXa, respectively) and 55% from the gillnet fishery (mean length of 78 cm in Division VIIIc in 2010). Since 2001, Portuguese landings were on average 8% from bottom trawlers (mean length of 47 cm in 2010) and 92% from the artisanal fleet (mean length of 65 cm in 2010).

8.1.2 Data

8.1.2.1 Commercial catches and discards

Total landings of *L. piscatorius* by country and gear for the period 1978–2010, as estimated by the Working Group, are given in Table 8.1.1. See historical landings analysis in Annex H. The landings in 2010 of only *L. piscatorius* are higher than the combined species 2010 TAC of 1496 t.

Spanish discards estimates of *L. piscatorius* in weight and associated coefficient of variation (CV) are shown in the Table 8.1.2. For the available time series anglerfish discards represent less than 4% of Spanish trawl catches. An increase in estimated discards was observed in 2004, 2005 and 2006 in relation to previous years. The maximum value of the time series occurred in 2004 with 48 t

Sampling effort and percentage of occurrence of *L. piscatorius* discards in the trawl Portuguese fisheries were presented for the 2004-2010 period (WD16). The maximum occurrence of discards in the trawl fleet targeting fish was 3% (sampling effort varies between 116 and 194 hauls per year). The maximum occurrence of discards in the trawl fleet targeting crustaceans was 7% (sampling effort varies between 30 and 111 hauls per year). Because the estimation algorithm, used for hake in the WD, may be sensitive to a large frequency of zeros in the samples and a reasonable number of observations is required for accurate length frequency estimation of annual fleet discards, estimates of discards have not been calculated for the moment. *L. piscatorius* discards in the Portuguese trawl fisheries seem to be negligible.

8.1.2.2 Biological sampling

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

The sampling levels for 2010 are shown in Table 1.3. The metier 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 (WD2) but an important reduction of Portuguese sampling levels was observed since 2009.

Length composition

Table 8.1.3 gives the annual length compositions by country and gear for 2010. The annual length compositions for all fleets combined for the period 1986–2010 are presented in Figure 8.1.1.

Landings in number, the mean length and mean weight in the landings between 1986 and 2010 are showed in Table 8.1.4. 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. 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 68 cm in 2010.

8.1.2.3 Abundance indices from surveys

Spanish and Portuguese survey results for the period 1983–2010 are summarized in Table 8.1.5. (See Stock Annex for background information).

8.1.2.4 Commercial catch-effort data

Landings, effort and LPUE data are given in Table 8.1.6 and Figure 8.1.2 for Spanish trawlers (Division VIIIc) from the ports of Santander, Avilés and A Coruña since 1986 and for the Portuguese trawlers (Division IXa) since 1989. For each fleet the proportion of the landings in the stock is 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 standardized LPUE series was updated this year with a new year of information by applying the same model used in previous Working Groups (Costas *et al.*, 2007). The new LPUE estimates from 1999 to 2010 have changed slightly in relation to the previous standardization estimates. A comparison of the standardized LPUEs series is shown in Figure 8.1.3. Standardized effort provided for A Coruña fleet (1994-2006) and for Portuguese trawl fleets (1989-2008) and their corresponding LPUEs are also given in Table 8.1.4, but not represented in Figure 8.1.2.

All fleets show a general decrease in landings during the late eighties and early nineties. A slight landings increase in 1996 and 1997 can be observed in all fleets. 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. For the last five years 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. The A Coruña fleet decreased its importance since 1991.

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. In 2009 and 2010 A Coruña and Cedeira fleet showed a decrease in effort. 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 the last two years an important increase of Cedeira LPUE was observed.

8.1.3 Assessment

In WGHMM2010 the assessment of the status of each anglerfish species was carried out separately based on ASPIC (Prager, 1994; Prager, 2004). This year an update of that assessment was carried out.

8.1.3.1 Input data

The input data comprising the LPUEs for the Spanish trawl fleet of A Coruña (SP-CORUTR8c) and the Spanish gillnet fleet of Cedeira (SP-CEDGNS8c) fleet, and the landings are presented in Table 8.1.7.

8.1.3.2 Model

The ASPIC (version 5.34.9) model (implements the Schaeffer population growth model) was used for the assessment. Run was performed conditioning on yield rather than on effort. The model options, the starting guesses and the minimum and maximum constraints of each parameter are indicated in Table 8.1.7. The input settings used were the same as in previous assessment. In order to estimate the 95% confidence intervals of the parameter estimates of the assessment the number of required bootstrap trials was set to 1000.

8.1.3.3 Assessment results

Figure 8.1.4 plots the model generated and the observed values for both fleets. The r square between observed and fitted CPUE values are respectively 0.555 and 0.306 for the A Coruña and the Cedeira fleet (see Annex M). The correlation coefficient between input fleets was 0.624.

Table 8.1.8 contains the results of the parameter estimates, including the point estimates and the Bootstrap results (the relative bias in percentage and bias-corrected confidence intervals for 80% and 95%). Bias and precision of parameter estimates vary depending on the parameter. The F_{2010}/F_{MSY} and B_{2011}/B_{MSY} ratios show respectively 3.46% and 45.41% of bias and 37.20% and 38.10% values of inter-quartile range. The total biomass at the beginning of 2011 is estimated to be at 29% of B_{MSY} with the 95% bias-corrected confidence interval between 0% and 55%. F_{2010}/F_{MSY} is estimated to be 0.85 with the 95% bias-corrected confidence interval between 0.47 and 1.47. Fishing mortality in 2010 is therefore estimated to be below F_{MSY} and total biomass in 2011 is estimated to be under B_{MSY}. MSY is estimated to be 7 288 t with 95% CI from 6 292 t to 11 500 t.

Figure 8.1.5 shows the trends of the F and B-ratios. The trends show that fishing mortality has been over F_{MSY} along the time series except in 2001, 2002 and in 2010. The biomass shows a decreasing trend since the beginning of the time series being relatively stable at low levels through the last 10-15 years. During the last 4 years the biomass shows a slow increasing to be at 29% of B_{MSY} in 2011. The 80% confidence intervals in Figure 8.1.5 also indicate that fishing mortality has been above F_{MSY} for the total period (except 2001 and 2002 and 2010) and that biomass has never been above B_{MSY}. In 2010, biomass is estimated to be below B_{MSY} and fishing mortality is estimated to be below $F_{MSY.}$ Figure 8.1.6 shows the values of F_{2010}/F_{MSY} and B_{2011}/B_{MSY} for the 1000 bootstrap replicates and their cumulative distribution function. Only the 0.8% of the bootstrap estimates of current biomass was greater than or equal to B_{MSY}, while 80% of bootstrap estimates of current fishing mortality were less than F_{MSY}.

Figure 8.1.7 shows the F and B ratio trends for last assessment and this year assessment. Both assessments are very consistent for the common period and only slight differences in relative values of biomass and fishing mortality are observed at the beginning of the time series. A comparison of parameter estimates from the 2010 and 2011 assessments is shown in the Table 8.1.9.

8.1.4 Projections

Projections were performed based on ASPIC estimates. The projected B/B_{MSY} and yield are presented in Table 8.1.10, with each column of the table corresponding to a fishing mortality scenario. Projections were performed for F *status quo* (assumed as F_{2010}), for reductions in F in the first projection year from 10% to 50% and for F_{MSY} level and for F equal to zero. Another set of projections were performed with the necessary F reductions to obtain combined yield for both anglerfish species in 2012 corresponding to the 2011 TAC (1 571 t) and +/-15% 2011 TAC. The *L. piscatorius* biomass is expected to increase under all scenarios. Under all scenarios considered, except for the F_{MSY} scenario and the F *status quo* scenario, the biomass is expected to achieve B_{MSY} within the next ten years. However, under F *status quo*, $B(2020)/B_{MSY}$ is predicted to be 0.99, very close to 1. Zero catch is expected to bring biomass to B_{MSY} in 2015.

8.1.5 Biological Reference Points

Comments on the biological reference points are in section 8.3.

8.1.6 Comments on the assessment

Comments on the assessment are in section 8.3.

8.1.7 Management considerations

Management considerations are in section 8.3.

Table 8.1.1. ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Tonnes landed by the main fishing fleets for 1978-2010 as determined by the Working Group.

	Div. VIIIc			Div. IXa				Div. VIIIc+IXa
	SPAIN			SPAIN	PORTUGAL			
Year	Trawl	Gillnet	TOTAL	Trawl	Trawl	Artisanal	TOTAL	TOTAL
1978	n/a	n/a	n/a	258		115	373	
1979	n/a	n/a	n/a	319		225	544	
1980	2806	1270	4076	401		339	740	4816
1981	2750	1931	4681	535		352	887	5568
1982	1915	2682	4597	875		310	1185	5782
1983	3205	1723	4928	726		460	1186	6114
1984	3086	1690	4776	578	186	492	1256	6032
1985	2313	2372	4685	540	212	702	1454	6139
1986	2499	2624	5123	670	167	910	1747	6870
1987	2080	1683	3763	320	194	864	1378	5141
1988	2525	2253	4778	570	157	817	1543	6321
1989	1643	2147	3790	347	259	600	1206	4996
1990	1439	985	2424	435	326	606	1366	3790
1991	1490	778	2268	319	224	829	1372	3640
1992	1217	1011	2228	301	76	778	1154	3382
1993	844	666	1510	72	111	636	819	2329
1994	690	827	1517	154	70	266	490	2007
1995	830	572	1403	199	66	166	431	1834
1996	1306	745	2050	407	133	365	905	2955
1997	1449	1191	2640	315	110	650	1075	3714
1998	912	1359	2271	184	28	497	710	2981
1999	545	1013	1558	79	9	285	374	1932
2000	269	538	808	107	4	340	451	1259
2001	231	294	525	57	16	190	263	788
2002	385	341	726	110	29	168	307	1032
2003	911	722	1633	312	29	305	645	2278
2004	1262	1269	2531	264	27	335	626	3157
2005	1378	1622	3000	371	29	244	643	3644
2006	1166	1247	2413	260	29	260	549	2963
2007	955	1009	1964	181	13	192	386	2350
2008	894	1168	2062	138	11	127	275	2337
2009	850	1058	1909	213	10	148	371	2280
2010	370	955	1325	158	2	119	279	1604

n/a: not available

Table 8.1.2. ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Weight and percentage of discards for Spanish trawl fleet.

Year	Weight (t)	CV	% Trawl 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	2.1

n/a: not available
CV: coefficient of variation

Table 8.1.3. ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Length composition by fleet for landings in 2010 (thousands).

	Div. VIIIc			Div. IXa				Div. VIIIc+IXa
	SPAIN			SPAIN	PORTUGAL			
Length (cm)	Trawl	Gillnet	TOTAL	Trawl	Trawl	Artisanal	TOTAL	TOTAL
14	0.058	0.000	0.058	0.045	0.000	0.000	0.045	0.103
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
21	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
22	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23	0.000	0.000	0.000	0.014	0.000	0.000	0.014	0.014
24	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
25	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26	0.268	0.000	0.268	0.000	0.000	0.000	0.000	0.268
27	0.057	0.000	0.057	0.060	0.000	0.000	0.060	0.117
28	0.453	0.000	0.453	0.000	0.000	0.000	0.000	0.453
29	0.673	0.000	0.673	0.176	0.000	0.000	0.176	0.849
30	0.766	0.000	0.766	0.290	0.000	0.000	0.290	1.056
31	1.697	0.000	1.697	0.228	0.000	0.000	0.228	1.925
32	2.148	0.000	2.148	0.426	0.000	0.000	0.426	2.574
33	3.373	0.000	3.373	1.160	0.000	0.000	1.160	4.533
34	2.702	0.000	2.702	0.581	0.000	0.000	0.581	3.283
35	2.427	0.000	2.427	1.099	0.000	0.000	1.099	3.526
36	2.267	0.000	2.267	0.377	0.000	0.000	0.377	2.644
37	1.994	0.000	1.994	0.432	0.000	0.000	0.432	2.426
38	2.941	0.000	2.941	0.753	0.000	0.000	0.753	3.694
39	2.141	0.000	2.141	0.601	0.000	0.000	0.601	2.742
40	1.520	0.000	1.520	0.455	0.000	0.000	0.455	1.975
41	1.838	0.000	1.838	0.719	0.000	0.000	0.719	2.557
42	1.459	0.000	1.459	0.305	0.022	0.000	0.327	1.786
43	1.221	0.000	1.221	0.443	0.000	0.000	0.443	1.664
44	1.647	0.040	1.687	0.851	0.498	0.000	1.349	3.036
45	1.629	0.000	1.629	0.530	0.000	0.000	0.530	2.159
46	1.858	0.000	1.858	0.700	0.022	0.000	0.722	2.580
47	1.561	0.000	1.561	0.569	0.000	0.000	0.569	2.130
48	1.291	0.000	1.291	0.640	0.010	2.592	3.242	4.533
49	1.572	0.000	1.572	0.358	0.000	0.000	0.358	1.930
50	2.095	0.063	2.158	0.702	0.010	1.238	1.950	4.108
51	1.089	0.657	1.746	0.196	0.014	0.000	0.210	1.957
52	1.538	0.726	2.265	0.504	0.000	0.000	0.504	2.769
53	1.205	0.461	1.667	0.254	0.000	0.000	0.254	1.921
54	1.877	0.549	2.426	0.542	0.000	0.000	0.542	2.968
55	2.036	0.294	2.330	0.345	0.000	3.841	4.185	6.516
56	2.330	1.613	3.943	0.508	0.032	0.000	0.540	4.483
57	1.521	0.795	2.316	0.562	0.010	1.278	1.850	4.166
58	1.510	1.707	3.217	0.559	0.000	1.875	2.434	5.651
59	2.740	2.042	4.782	0.919	0.000	0.000	0.919	5.701
60	2.238	3.849	6.087	0.738	0.000	0.000	0.738	6.825
61	1.605	1.531	3.136	0.700	0.010	4.467	5.176	8.313
62	1.599	3.490	5.089	0.542	0.000	0.000	0.542	5.631
63	2.942	2.790	5.732	0.792	0.000	0.000	0.792	6.523
64	2.383	1.333	3.716	0.828	0.000	0.197	1.025	4.741
65	2.243	3.299	5.542	0.519	0.000	0.000	0.519	6.062
66	1.740	3.759	5.499	0.483	0.000	0.556	1.038	6.537
67	1.695	3.441	5.137	0.795	0.018	0.000	0.813	5.950
68	1.697	3.598	5.295	0.572	0.000	0.000	0.572	5.866
69	2.097	4.399	6.496	0.812	0.000	0.000	0.812	7.308
70	1.439	4.219	5.657	0.463	0.000	1.219	1.683	7.340
71	1.135	3.941	5.076	0.394	0.000	0.000	0.394	5.470
72	1.922	3.795	5.717	0.713	0.000	0.233	0.946	6.663
73	1.530	5.058	6.588	1.069	0.000	0.000	1.069	7.657
74	1.226	4.224	5.450	0.454	0.000	1.875	2.329	7.780
75	1.196	5.629	6.825	0.559	0.000	0.000	0.559	7.384
76	1.161	3.143	4.304	0.979	0.000	0.278	1.257	5.562
77	0.718	3.843	4.561	0.207	0.000	0.274	0.480	5.041
78	0.773	2.786	3.559	0.317	0.000	2.456	2.773	6.332
79	1.368	3.045	4.413	0.683	0.010	0.197	0.890	5.303
80	0.792	3.468	4.260	0.230	0.014	1.283	1.527	5.787
81	0.602	2.811	3.413	0.299	0.000	0.023	0.322	3.734
82	1.063	3.351	4.414	0.469	0.000	0.045	0.514	4.928
83	0.678	2.551	3.229	0.178	0.000	0.549	0.727	3.956
84	0.864	1.538	2.403	0.140	0.000	0.000	0.140	2.543
85	0.799	2.172	2.971	0.380	0.000	0.132	0.512	3.484
86	1.286	2.518	3.804	0.265	0.000	0.045	0.311	4.114
87	1.130	2.610	3.740	0.519	0.000	0.137	0.656	4.396
88	1.005	2.184	3.189	0.577	0.000	0.242	0.819	4.009
89	0.455	2.267	2.722	0.184	0.000	0.069	0.254	2.976
90	0.503	2.950	3.453	0.363	0.000	0.069	0.433	3.885
91	0.361	1.273	1.634	0.329	0.000	0.387	0.716	2.350
92	0.293	2.488	2.781	0.194	0.000	0.045	0.239	3.020
93	0.780	2.078	2.858	0.239	0.000	0.092	0.331	3.189
94	0.594	1.662	2.256	0.340	0.000	0.115	0.455	2.710
95	0.721	1.400	2.121	0.207	0.000	0.045	0.252	2.374
96	0.373	1.433	1.807	0.335	0.000	0.069	0.404	2.211
97	0.486	1.593	2.079	0.101	0.000	0.069	0.171	2.250
98	0.539	1.453	1.993	0.140	0.000	0.080	0.220	2.213
99	0.173	1.736	1.909	0.089	0.000	0.000	0.089	1.998
100+	1.302	11.637	12.940	1.513	0.000	0.478	1.991	14.931
TOTAL	105	135	240	37	1	27	64	304
Tonnes	370	955	1326	158	2	119	279	1604
Mean Weight (g)	3528	7060	5517	4315	2561	4480	4365	5275
Mean length (cm)	57.6	77.6	68.8	61.7	47.3	65.4	63.1	67.6
Measured weight (t)	10.0	19.9	29.9	5.4	0.0	1.1	6.5	36.4

Table 8.1.4. ANGLERFISH (*L. piscatorius*). Divisions VIIIc and IXa.
Numbers, mean weight and mean length of landings between 1986 and 2010.

Year	Total (thousands)	Mean Weight (g)	Mean Length (cm)
1986	1872	3670	61
1987	2806	1832	44
1988	2853	2216	50
1989	1821	2744	54
1990	1677	2261	49
1991	1657	2197	50
1992	1256	2692	54
1993	857	2719	54
1994	704	2850	54
1995	876	2093	48
1996	1153	2564	52
1997	1043	3560	60
1998	583	5113	68
1999	289	6682	72
2000	190	6885	72
2001	127	6189	64
2002	381	2766	50
2003	784	2907	54
2004	793	3881	61
2005	856	4259	63
2006	923	3211	58
2007	553	4251	62
2008	540	4327	63
2009	492	4630	64
2010	304	5275	68

Table 8.1.5. 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	+	+

Ysts = 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

Table 8.1.6. 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.

Landings (t)

	Div. VIIIc								Div. IXa			
Year	Avilés	%	Santander	%	A Coruña	%	Cedeira	%	Portugal Crustacean	%	Portugal Fish	%
1986	500	7	516	8	1070	16						
1987	500	10	529	10	949	18						
1988	401	6	387	6	1565	25						
1989	214	4	305	6	961	19			85	2	175	3
1990	260	7	278	7	781	21			106	3	219	6
1991	245	7	281	8	865	24			73	2	151	4
1992	198	6	222	7	694	21			25	1	51	2
1993	76	3	186	8	386	17			36	2	75	3
1994	116	6	188	9	245	12			23	1	47	2
1995	192	10	186	10	260	14			22	1	45	2
1996	322	11	270	9	413	14			45	2	88	3
1997	345	9	381	10	411	11			51	1	59	2
1998	286	10	316	11	138	5			11	<1	17	1
1999	108	6	182	9	162	8	342	18	3	<1	6	<1
2000	28	2	75	6	85	7	140	11	2	<1	2	<1
2001	23	3	54	7	84	11	87	11	9	1	7	1
2002	75	7	57	6	130	13	130	13	18	2	11	1
2003	111	5	85	4	228	10	159	7	13	1	16	1
2004	216	7	106	3	279	9	382	12	12	<1	14	<1
2005	278	8	59	2	391	11	434	12	12	<1	17	<1
2006	148	5	89	3	242	8	415	14	13	<1	16	1
2007	101	4	103	4	222	9	233	10	7	<1	6	<1
2008	99	4	n/a	n/a	273	12	228	10	6	<1	5	<1
2009	69	3	35	2	165	7	183	8	5	<1	5	<1
2010	n/a	n/a	44	3	153	10	231	14	1	<1	1	<1

Fishing effort

	Div. VIIIc						Div. IXa			
Year	[1] Avilés	[1] Santander	[1] A Coruña	[2] A Coruña standardized	[3] Cedeira standardized 2010	[3] Cedeira standardized 2009	[4] Portugal Crustacean	[5] Portugal Crustacean standardized	[4] Portugal Fish	[5] Portugal Fish standardized
1986	10845	18153	39810							
1987	8309	14995	34680							
1988	9047	16660	42180							
1989	8063	17607	44440				76	23	52	18
1990	8497	20469	44430				90	20	61	17
1991	7681	22391	40440				83	17	57	15
1992	n/a	22833	38910				71	15	49	14
1993	7635	21370	44504				75	13	56	13
1994	9620	22772	39589	4738			41	8	36	10
1995	6146	14046	41452	5298			38	8	41	9
1996	4525	12071	35728	5084			64	14	54	12
1997	5061	11776	35211	4801			43	11	27	9
1998	5929	10646	32563	3668			48	11	35	10
1999	6829	10349	30232	6424	4860	4895	24	8	18	6
2000	4453	8779	30072	5125	3726	3768	42	10	19	6
2001	1838	3053	29923	6103	2167	2197	85	18	19	5
2002	2748	3975	21823	2581	2464	2491	62	10	14	4
2003	2526	3837	18493	2515	2764	2792	42	10	17	6
2004	n/a	3776	21112	5056	5696	5748	21	7	14	4
2005	n/a	1404	20663	5161	3485	3511	20	5	13	4
2006	n/a	2718	19264	3949	4429	4464	22	5	12	4
2007	n/a	4334	21201	n/a	4599	4648	22	6	8	3
2008	n/a	n/a	20212	n/a	5168	5233	14	4	5	2
2009	n/a	1125	16163	n/a	2299	2324	15	n/a	6	n/a
2010	n/a	1628	13744	n/a	1902	n/a	21	n/a	14	n/a

[1] Fishing days per 100 HP
[2] Fishing days
[3] Soaking days
[4] 1000 Hours trawling with occurrence of anglerfish
[5] 1000 Hauls
n/a - not available

LPUE

	Div. VIIIc						Div. IXa			
Year	[1] Avilés	[1] Santander	[1] A Coruña	[2] A Coruña standardized	[3] Cedeira standardized 2010	[3] Cedeira standardized 2009	[4] Portugal Crustacean	[5] Portugal Crustacean standardized	[4] Portugal Fish	[5] Portugal Fish standardized
1986	46.1	28.4	26.9							
1987	60.2	35.3	27.4							
1988	44.3	23.3	37.1							
1989	26.5	17.3	21.6				1.1	3.7	3.3	9.9
1990	30.6	13.6	17.6				1.2	5.2	3.6	12.8
1991	31.9	12.6	21.4				0.9	4.4	2.6	9.8
1992	n/a	9.7	17.8				0.3	1.6	1.0	3.7
1993	9.9	8.7	8.7				0.5	2.7	1.3	5.7
1994	12.0	8.2	6.2	49.5			0.6	3.0	1.3	4.9
1995	31.2	13.2	6.3	44.3			0.6	2.8	1.1	4.9
1996	71.1	22.4	11.6	77.2			0.7	3.1	1.6	7.1
1997	68.1	32.3	11.7	81.3			1.2	4.5	2.2	6.7
1998	48.3	29.7	4.2	32.0			0.2	1.0	0.5	1.8
1999	15.8	17.6	5.4	24.8	70.3	69.8	0.1	0.4	0.3	1.0
2000	6.3	8.6	2.8	16.1	37.4	37.0	0.0	0.2	0.1	0.4
2001	12.5	17.6	2.8	12.2	40.0	39.4	0.1	0.5	0.4	1.4
2002	27.5	14.3	6.0	46.9	52.8	52.3	0.3	1.9	0.8	2.4
2003	44.0	22.1	12.3	83.4	57.7	57.1	0.3	1.3	0.9	2.8
2004	n/a	28.1	13.2	55.1	67.0	66.4	0.6	1.9	1.0	3.3
2005	n/a	41.9	18.9	75.6	124.4	123.5	0.6	2.2	1.3	4.7
2006	n/a	32.7	12.6	60.9	93.7	93.0	0.6	2.4	1.3	4.2
2007	n/a	23.8	10.5	n/a	50.7	50.1	0.3	1.1	0.8	2.1
2008	n/a	n/a	13.5	n/a	44.0	43.5	0.4	1.5	1.0	2.9
2009	n/a	31.3	10.2	n/a	79.5	78.7	0.3	n/a	0.7	n/a
2010	n/a	27.1	11.1	n/a	121.3	n/a	0.0	n/a	0.1	n/a

[1] kg/day*100HP
[2] kg/day
[3] kg/soaking day
[4] kg/hour trawl
[5] kg/haul

Table 8.1.7. ANGLERFISH (*L. piscatorius*) - Division VIIIc and IXa.

ASPIC input settings and data

Input	**Value**
Error type	YLD - Condition on yield
Number of bootstrap trials	1000
Maximum F when estimating effort	8.0d0 (y-1)
Statistical weight for B1 > K	1
Statistical weights for fisheries	F1: 1, F2:
B1-ratio (starting guess)	0.5
MSY (starting guess)	5 000 (t)
K (starting guess)	50 000 (t)
q (starting guess)	F1: 1d-5, F2: 1d-6
Estimated parameters	All: B1-Ratio, MSY, K, qF1, qF2
Min and max allowable MSY	2 000 (t) - 11 500 (t)
Min and max K	5 000 (t) - 112 000 (t)
Random number seed	1964185

F1:	SP-CORUTR8c	
Type:	CC (CPUE and Catch)	
Year	CPUE (t/effort)	Catch (t)
1980	-1	4816
1981	-1	5568
1982	-1	5782
1983	-1	6114
1984	-1	6032
1985	-1	6139
1986	0.0269	6870
1987	0.0274	5141
1988	0.0371	6321
1989	0.0216	4996
1990	0.0176	3790
1991	0.0214	3640
1992	0.0178	3381
1993	0.0087	2329
1994	0.0062	2007
1995	0.0063	1834
1996	0.0116	2955
1997	0.0117	3715
1998	0.0042	2981
1999	0.0054	1932
2000	0.0028	1259
2001	0.0028	788
2002	0.0060	1032
2003	0.0123	2278
2004	0.0132	3157
2005	0.0189	3644
2006	0.0126	2963
2007	0.0105	2350
2008	0.0135	2337
2009	0.0102	2280
2010	0.0111	1604

F2:	SP-CEDGNS8c
Type:	I1 (Index of biomass – annual average)
Year	CPUE (t/effort)
1980	-1
1981	-1
1982	-1
1983	-1
1984	-1
1985	-1
1986	-1
1987	-1
1988	-1
1989	-1
1990	-1
1991	-1
1992	-1
1993	-1
1994	-1
1995	-1
1996	-1
1997	-1
1998	-1
1999	0.0703
2000	0.0374
2001	0.0400
2002	0.0528
2003	0.0577
2004	0.0670
2005	0.1244
2006	0.0937
2007	0.0507
2008	0.0440
2009	0.0795
2010	0.1213

Table 8.1.8. ANGLERFISH (*L. piscatorius*) - 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(2011): equilibrium yield available in 2011; Y(Fmsy): yield availabe at Fmsy in 2011; Ye2011/MSY: equilibrium yield available in 2011 as proportion of MSY; fmsy (1): fishing effort rate at MSY for SP-CORUTR8c; fmsy (2): fishing effort rate at MSY for SP-CEDGNS8c.

WG2011

Parameter	Point estimates	Relative bias	Bias Corrected Bootstrap Confidence Interval 80% Lower	80% Upper	95% Lower	95% Upper	IQ-Range	Relative IQ-Range
B1/K	0.25	61.67%	0.12	0.26	0.12	0.30	0.03	11.00%
K	51450	-11.74%	49420	80030	38250	99460	9230	17.90%
q(1)	2.05E-06	-6.69%	1.52E-06	2.39E-06	1.06E-06	2.54E-06	3.34E-07	16.30%
q(2)	1.36E-05	-3.96%	1.07E-05	1.87E-05	7.07E-06	2.96E-05	3.53E-06	26.00%
MSY	7288	-11.36%	7225	11500	6292	11500	4200	57.60%
Ye (2011)	3622	-2.08%	2752	4805	2243	5667	985	27.20%
Y (Fmsy)	2042	-3.20%	1925	2145	1829	2243	100	4.90%
Bmsy	25720	-11.74%	24710	40010	19120	49730	4615	17.90%
Fmsy	0.283	13.43%	0.208	0.315	0.155	0.383	0.034	12.00%
fmsy(1)	138000	38.81%	119000	156000	113800	174200	17520	12.70%
fmsy(2)	20890	43.48%	15930	24950	12190	29410	4112	19.70%
B_{2011}/Bmsy	0.29	45.41%	0.16	0.38	0.00	0.55	0.11	38.10%
F_{2010}/Fmsy	0.85	3.46%	0.63	1.25	0.47	1.47	0.32	37.20%
Ye_{2011}/MSY	0.50	16.74%	0.14	0.64	0.14	0.81	0.18	36.70%
q2/q1	6.61	3.54%	5.44	8.41	4.96	10.39	1.51	22.90%

Table 8.1.9. ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.

Comparison of parameter estimates between 2010 an 2011 assesments.

Parameter	Assessment	
Point estimates	2010	2011
B1/K	0.2624	0.2528
K	54350	51450
MSY	7096	7288
Y(Fmsy)	2419	2042
Bmsy	27180	25720
Fmsy	0.2611	0.2833
B./Bmsy	0.2242	0.2908
F./Fmsy	1.46	0.85
q(1)	1.91E-06	2.05E-06
q(2)	1.20E-05	1.36E-05
q2/q1	6.284	6.608

B./Bmsy: B_{2010}/Bmsy for 2010; B_{2011}/Bmsy for 2011.

F./Fmsy: F_{2009}/Fmsy for 2010; F_{2010}/Fmsy for 2011.

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

Table 8.1.10. ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Point estimates of B/BMSY(from 2011 to 2020) and Yield (from 2011 to 2020) for projections with F status quo (Fsq), FMSY, zero catches and first year reduction in F of 10, 20, 30, 40 and 50%. Reductions to obtain yields equal to 2011 TAC and +/- 15% of 2011.

Fishing mortality trends in relation to F_{MSY}

			Decrease in first year						-15% TAC (1 571 t)	TAC (1 571 t)	+15% TAC (1 571 t)
year	Fsq	F_{MSY}	zero catches	reduction 50%	reduction 40%	reduction 30%	reduction 20%	reduction 10%	reduction 67.05%	reduction 60.97%	reduction 54.80%
2011	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
2012	0.85	1	0	0.43	0.51	0.60	0.68	0.77	0.28	0.33	0.39
2013	0.85	1	0	0.43	0.51	0.60	0.68	0.77	0.28	0.33	0.39
2014	0.85	1	0	0.43	0.51	0.60	0.68	0.77	0.28	0.33	0.39
2015	0.85	1	0	0.43	0.51	0.60	0.68	0.77	0.28	0.33	0.39
2016	0.85	1	0	0.43	0.51	0.60	0.68	0.77	0.28	0.33	0.39
2017	0.85	1	0	0.43	0.51	0.60	0.68	0.77	0.28	0.33	0.39
2018	0.85	1	0	0.43	0.51	0.60	0.68	0.77	0.28	0.33	0.39
2019	0.85	1	0	0.43	0.51	0.60	0.68	0.77	0.28	0.33	0.39
2020	0.85	1	0	0.43	0.51	0.60	0.68	0.77	0.28	0.33	0.39

Biomass trends in relation to B_{MSY}

year	Fsq	F_{MSY}	zero catches	reduction 50%	reduction 40%	reduction 30%	reduction 20%	reduction 10%	reduction 67.05%	reduction 60.97%	reduction 54.80%
2011	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
2012	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
2013	0.45	0.43	0.57	0.51	0.49	0.48	0.47	0.46	0.53	0.52	0.51
2014	0.54	0.50	0.82	0.67	0.64	0.62	0.59	0.57	0.72	0.70	0.68
2015	0.64	0.58	1.10	0.84	0.80	0.75	0.71	0.67	0.93	0.90	0.87
2016	0.72	0.64	1.37	1.01	0.95	0.89	0.83	0.78	1.13	1.09	1.04
2017	0.81	0.70	1.59	1.16	1.08	1.01	0.94	0.87	1.30	1.25	1.20
2018	0.88	0.76	1.74	1.28	1.20	1.11	1.03	0.95	1.43	1.38	1.32
2019	0.94	0.81	1.84	1.37	1.28	1.19	1.11	1.02	1.53	1.48	1.42
2020	0.99	0.85	1.91	1.44	1.35	1.25	1.16	1.08	1.60	1.54	1.48

Yield

year	Fsq	F_{MSY}	zero catches	reduction 50%	reduction 40%	reduction 30%	reduction 20%	reduction 10%	reduction 67.05%	reduction 60.97%	reduction 54.80%
2011	2042	2042	2042	2042	2042	2042	2042	2042	2042	2042	2042
2012	2545	2917	0	1352	1603	1847	2085	2318	910	1070	1229
2013	3095	3423	0	1826	2120	2393	2646	2880	1273	1478	1677
2014	3670	3937	0	2355	2691	2987	3248	3475	1687	1940	2180
2015	4240	4440	0	2894	3269	3587	3852	4068	2109	2411	2692
2016	4776	4913	0	3391	3807	4147	4418	4626	2494	2843	3164
2017	5256	5342	0	3812	4268	4634	4917	5122	2811	3201	3559
2018	5669	5719	0	4142	4638	5032	5332	5542	3049	3475	3866
2019	6011	6039	0	4385	4917	5341	5661	5882	3217	3671	4089
2020	6285	6306	0	4556	5120	5571	5913	6149	3330	3806	4245

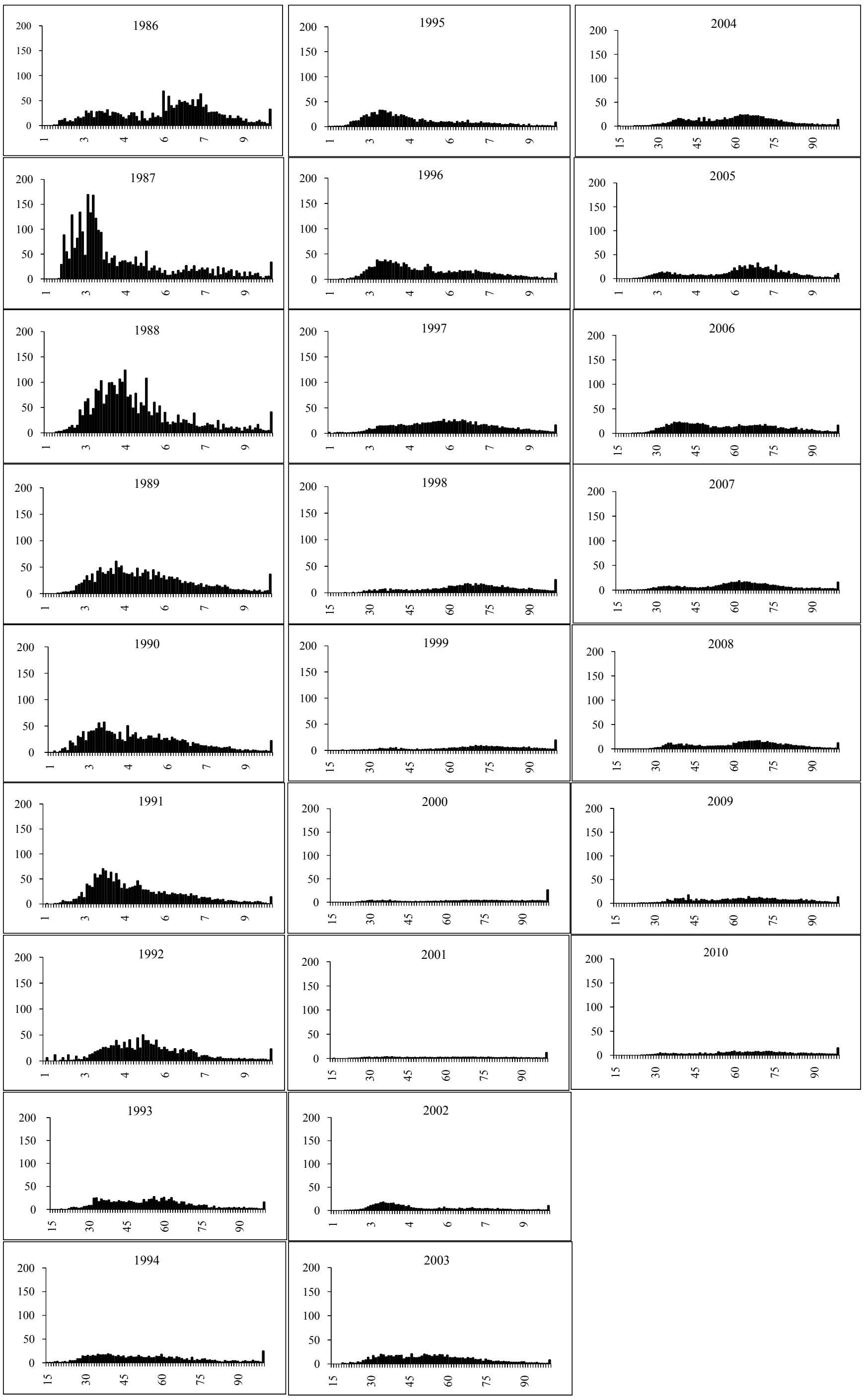


Figure 8.1.1 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Length distributions of landings (thousands for 1986 to 2010).

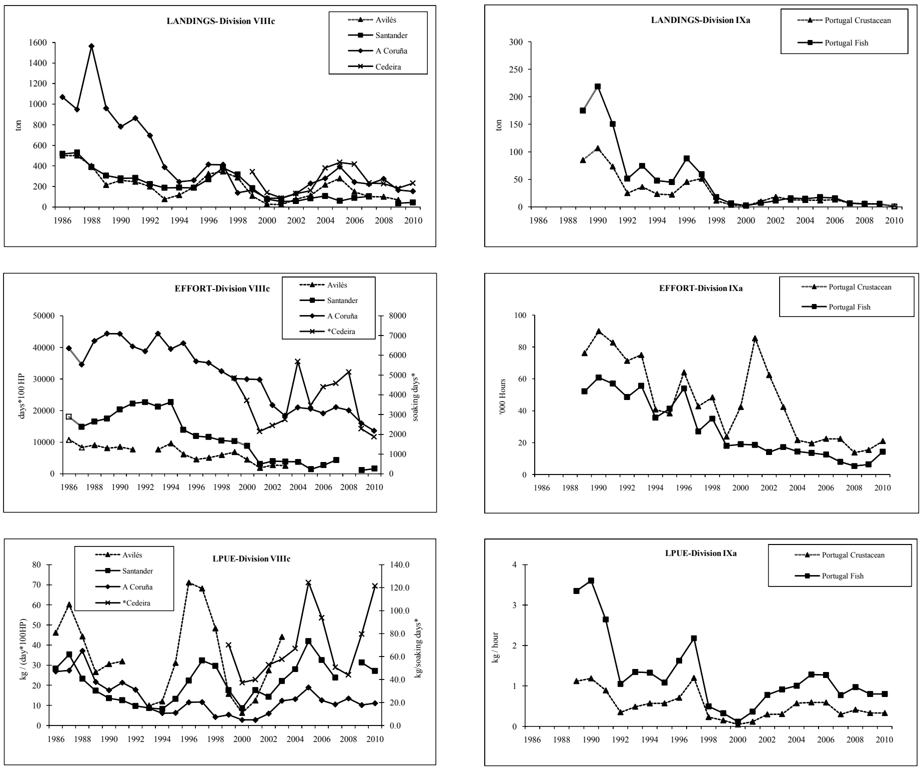


Figure 8.1.2 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.
Trawl and gillnet landings, effort and LPUE data between 1986-2010.

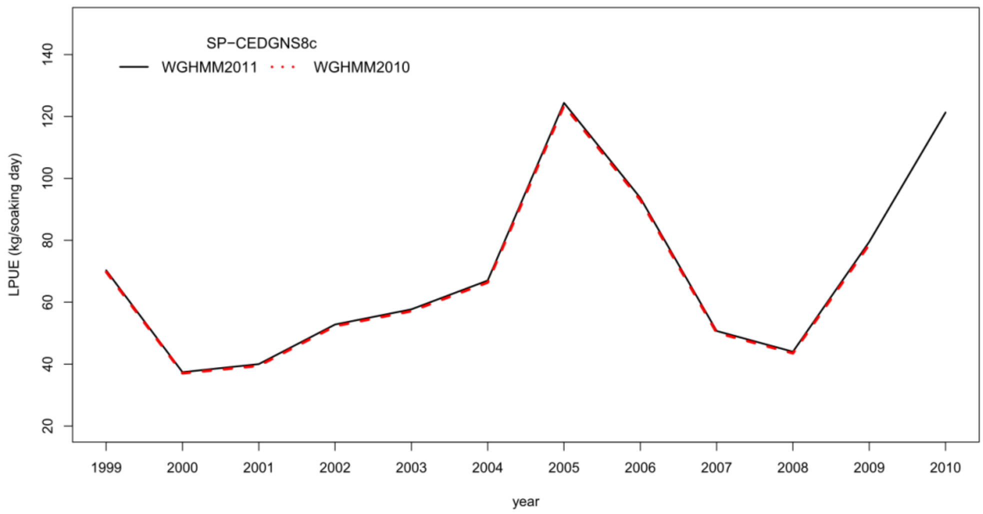
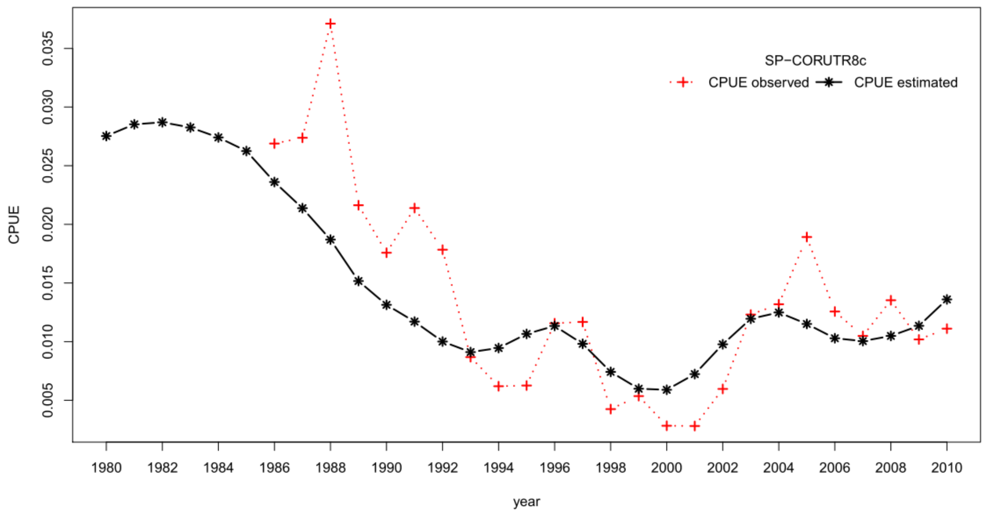


Figure 8.1.3 ANGLERFISH (L. piscatorius) - Divisions VIIIc and IXa. Comparison of LPUE estimates of Cedeira fleet from the 2010 and 2011 standardization runs.



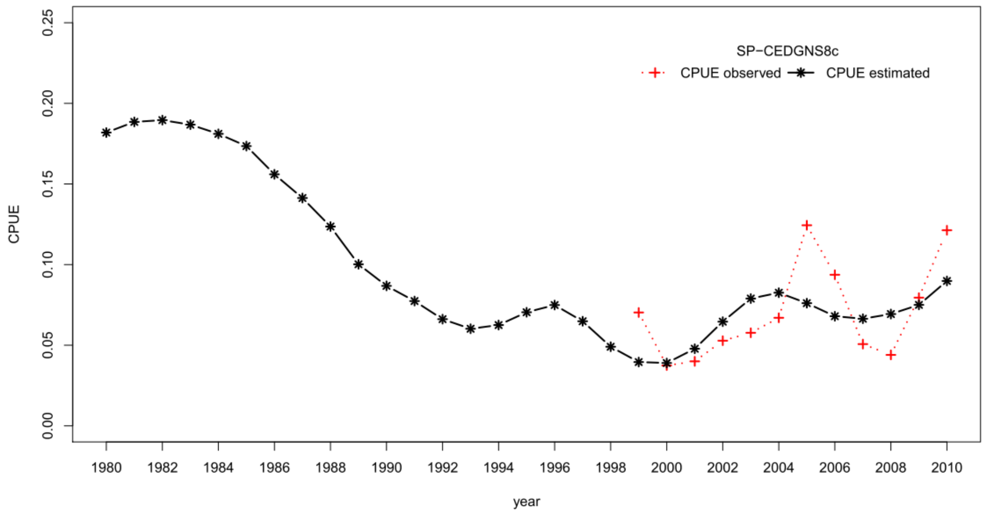
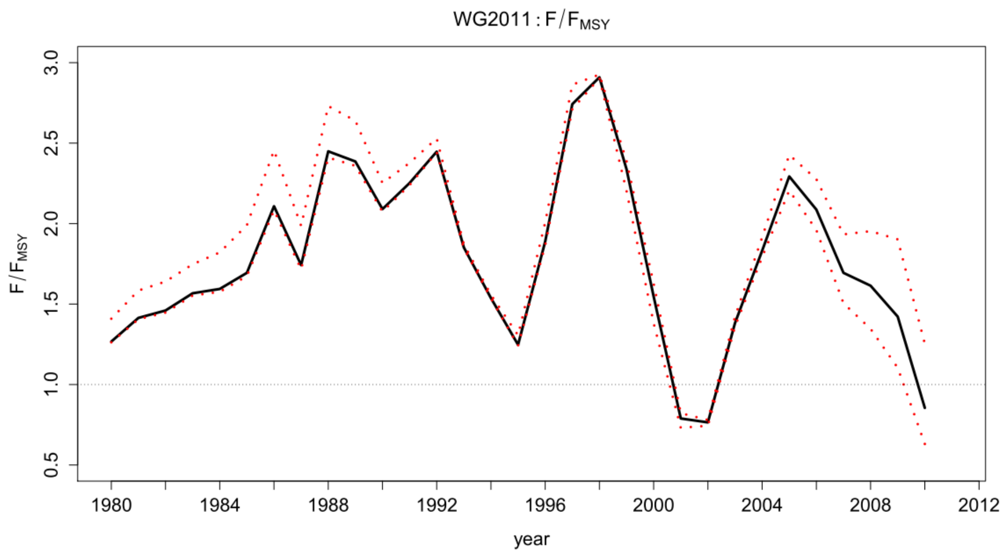


Figure 8.1.4 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa. Observed CPUE for the two commercial fleets and estimated values by the model.



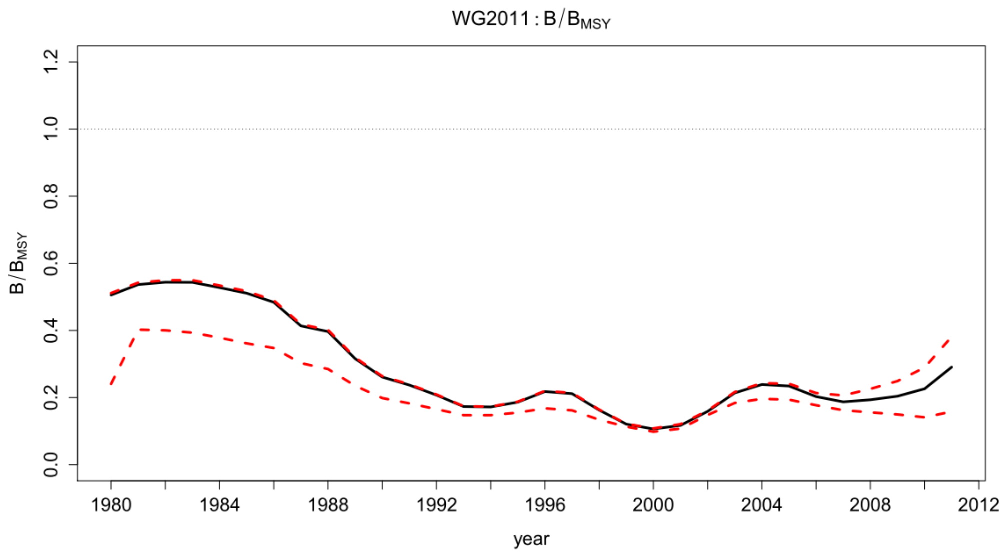
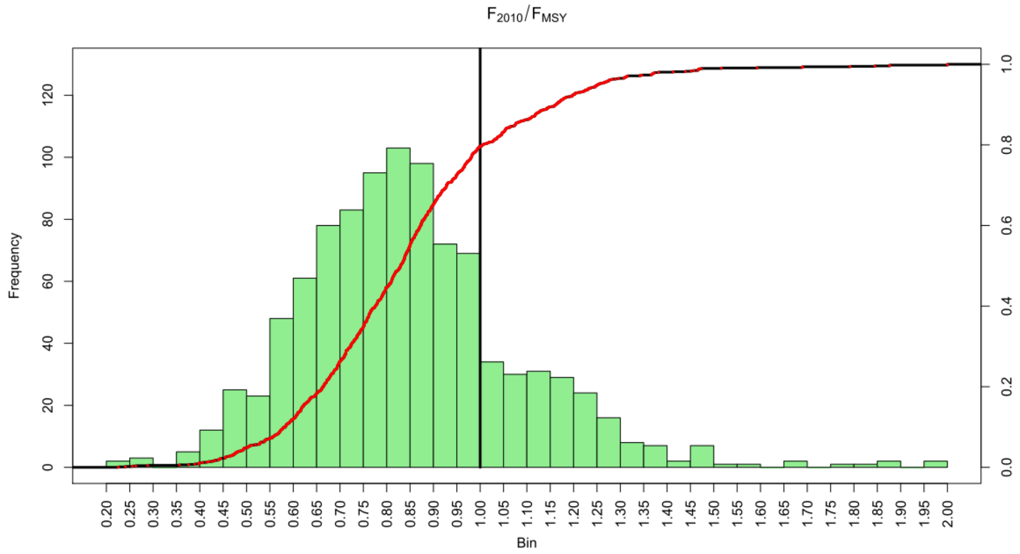


Figure 8.1.5 ANGLERFISH (L. piscatorius) - Divisions VIIIc and IXa. Confidence intervals (80%) of the F/F_{MSY} and B/B_{MSY} ratios.



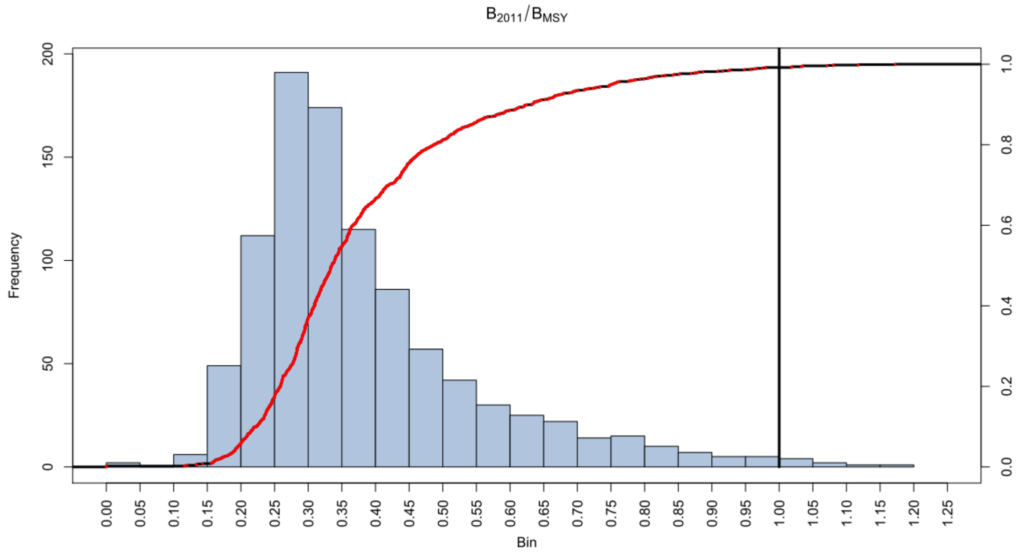


Figure 8.1.6 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.

Histograms and cumulative frequency distributions of estimated values of F_{2010}/ F_{MSY} and B_{2011}/ B_{MSY} by bootstrap (1000 replicates). The black line shows the estimate at reference point of one (F_{MSY}, B_{MSY}).

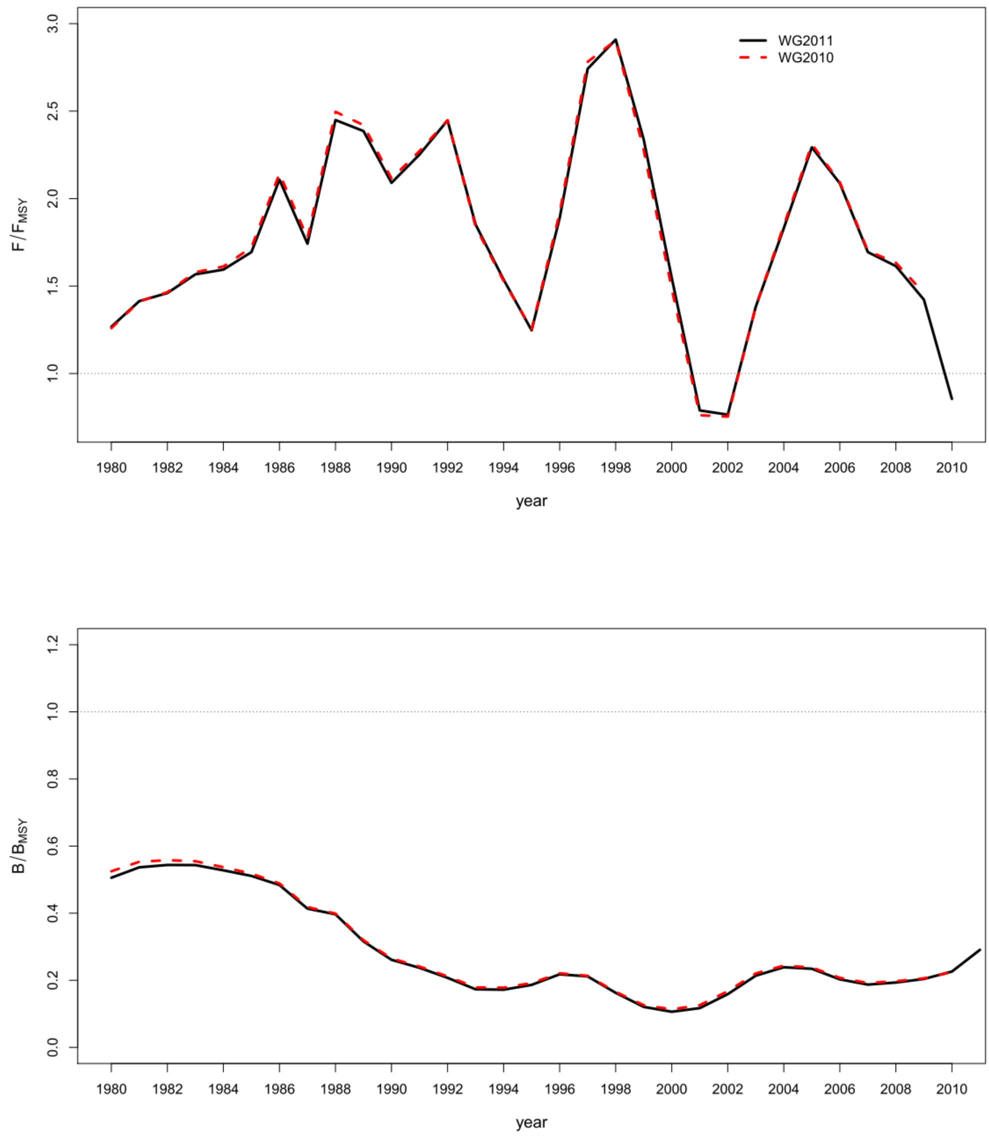


Figure 8.1.7 ANGLERFISH (*L. piscatorius*) - Divisions VIIIc and IXa.

Ratio trends of F/F_{MSY} and B/B_{MSY} estimated by ASPIC for the period 1980-2010 for WG2011 and WG2010.

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

8.2.1 General

8.2.1.1 Ecosystem aspects

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

8.2.1.2 Fishery description

L. budegassa is caught by Spanish and Portuguese bottom trawlers and gillnet fisheries. As with *L. piscatorius*, it is an important target species for the artisanal fleet, while it is a by catch for the trawl fleet targeting hake or crustaceans (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, the Spanish landings were on average split 77% from the trawl fleet (mean lengths in 2010 of 44 cm in both Divisions VIIIc and IXa) and 23% from the artisanal fleet (mean length of 63 cm in 2010 in Division VIIIc). Portuguese landings were on average for the same period split, 26 % from the trawl fleet (mean length of 40 cm in 2010) and 74% from the artisanal fleet (mean length of 63 cm in 2010).

8.2.2 Data

8.2.2.1 Commercial catches and discards

Total landings of *L. budegassa* by country and gear for the period 1978–2010, as estimated by the Working Group, are given in Table 8.2.1. See historical landings analysis in the Stock Annex. From 2002 to 2007 landings increased to 1 301 t, decreasing afterwards to a minimum in 2010 of 751 t.

Spanish trawl discards estimates of *L. budegassa* in weight and associated coefficient of variation (CV) are shown in Table 8.2.2.

An increase in estimated discards rate was observed from 2004 to 2006, Spanish discards decreased to negligible values in 2007 and 2008 but since 2009 increased again, being 61 t in 2010. The maximum value of the time series occurred in 2006 with 92 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 2004-2010 period (WD16). The maximum occurrence of discards in the trawl fleet targeting fish was 1% (sampling effort varies between 116 and 194 hauls per year). The maximum occurrence of discards in the trawl fleet targeting crustaceans was 8% (sampling effort varies between 30 and 111 hauls per year). Because the estimation algorithm, used for hake in the WD, may be sensitive to a large frequency of zeros in the samples and a reasonable number of observations is required for accurate length frequency estimation of annual fleet discards, estimates of discards have not been calculated for the moment. *L. budegassa* discards in the Portuguese trawl fisheries seem to be negligible.

8.2.2.2 Biological sampling

The procedure for sampling of this species is the same as for *L. piscatorius* (see Stock Annex). The sampling levels for 2010 are shown in Table 1.3. The metier sampling adopted in Spain and Portugal in 2010, 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 since 2009.

Length composition

Table 8.2.3 gives the length compositions by country and gear for 2010. The annual length compositions between 1986 and 2010 are presented in Figure 8.2.1.

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. In 2008 and 2009 these small fish were not observed, but in 2010 some increase was observed. The total annual landings in numbers and the annual mean length and mean weight are in Table 8.2.4.

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. Since then, the number of landed fish decreased to a minimum in 2009. In 2010 the number increased, while mean weight and length continue at high levels.

8.2.2.3 Abundance indices from surveys

Spanish and Portuguese survey results for the period 1983–2010 are summarized in Table 8.2.5. Considering the very small amount of caught anglerfish in the two surveys, these indices were not considered to reflect the change in the abundance of this species.

8.2.2.4 Commercial catch-effort data

Landings, effort and LPUE data are given in Table 8.2.6 and Figure 8.2.2 for Spanish trawlers from ports of Santander, Aviles and A Coruña (all in Division VIIIc) since 1986 and for Portuguese trawlers (Division IXa) since 1989. For each fleet the proportion of the landings in the stock is also given in the table.

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 1996 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. In 2010 the observed landings showed a lightly increase.

Effort trends are analysed in section 8.1.2.4.

LPUEs of all Spanish fleets show high values during the second half of the 90's, while the Portuguese fleets have fluctuated. From 2002 to 2005 LPUE's have remained relatively stable at low values for all fleets. Since then an increasing trend was observed in most of the fleets, except for PT-TRF9a fleet, which declined in the last three years.

8.2.3 Assessment

In WGHMM2010 the assessment of the status of each anglerfish species was carried out separately based on ASPIC (Prager, 1994; Prager, 2004). This year an update of that assessment was carried out.

8.2.3.1 Input data

The input data, comprising the LPUEs for the Portuguese trawl crustacean fleet (PT-TRC9a), the LPUEs for the Portuguese trawl fish fleet (PT-TRF9a) and the landings, are presented in Table 8.2.7. As in the last assessment the LPUE series of PT-TRC9a was introduced as CC and the PT-TRF9a as a biomass index.

8.2.3.2 Model

The ASPIC (version 5.34.9) model (which implements the Schaeffer population growth model) was used for the 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 8.2.7). They are the same ones used in previous assessments.

8.2.3.3 Assessment results

The correlation coefficient between input fleets is high (0.811) but the r square between observed and fitted CPUE values are negative, -0.436 for PT-TRC9a and -0.549 for PT-TRF9a (see Annex M). Point estimates and bias-corrected bootstrap confidence intervals for parameters are presented in Table 8.2.8, whereas Figure 8.2.3 plots observed and estimated CPUEs for each of the series used in the model. B_{2011}/B_{MSY} and F_{2010}/F_{MSY} have respectively -1.34% and 9.04% of bias and both have around 25% relative inter-quartile ranges. Biomass in 2011 is estimated to be 91% of B_{MSY} with 95% bias-corrected confidence interval between 59% and 124%. Fishing mortality in 2010 is estimated to be 0.39 times F_{MSY} with 95% bias-corrected confidence interval between 0.27 and 0.61 times F_{MSY}. MSY is estimated to be 2 515 t with 95% CI from 2 507 t to 2 521 t. This parameter shows no bias and a negligible inter-quartile range. More detailed results can be found in Annex M.

Trends in relative biomass (Figure 8.2.4) indicate a decrease since the late eighties with a slight recovery in the late nineties and in recent years. Fishing mortality remained at high levels between late eighties and late nineties, dropping after that. In 2010, biomass is estimated to be below B_{MSY} and fishing mortality is estimated to be below F_{MSY}.

Figure 8.2.5 shows the values of F_{2010}/F_{MSY} and B_{2011}/B_{MSY} for the 1000 bootstrap replicates and their cumulative distribution function. Only the 26.0% of the bootstrap estimates of current biomass were greater than or equal to B_{MSY}, while 99.99% of bootstrap estimates of current fishing mortality were less than F_{MSY}.

Comparison between the 2010 and 2011 assessments show that both assessments are very consistent for the common period (Table 8.2.9 and Figure 8.2.6), although the figure shows some revision of F/F_{MSY} and B/B_{MSY} values in the last few assessment years.

8.2.4 Projections

Projections were performed based on the ASPIC estimates. The projected B/B_{MSY} and yield are presented in Table 8.2.10, where each column corresponds to a fishing mortality scenario. Projections were performed for F *status quo* (assumed as F_{2010}), F_{MSY}, with zero catches and for reductions in F in the first projection year from 10% to 50% of F *status quo*. A set of projections were performed with the necessary F reductions to obtain 2012 yield for both anglerfish species combined corresponding to the 2011 TAC (1 571 t) and +/-15% 2011 TAC. A projection was performed for the multiplicative factor of F *status quo* required for *L. piscatorius* to be at F_{MSY}. The reason for this projection scenario is that *L. piscatorius* is the species in worse condition, so it will likely drive the advice for both anglerfish species combined.

For *L. budegassa*, fishing mortality equal to F *status quo* in 2011 is expected to bring the stock above B_{MSY} in 2012. The biomass is expected to increase to well above B_{MSY} in the next ten years under all fishing mortality scenarios examined, except for the F_{MSY} scenario that will bring the stock to very near B_{MSY} (Table 8.2.10).

8.2.5 Biological Reference Points

Comments on the biological reference points are in section 8.3.

8.2.6 Comments on the assessment

Comments on the assessment are in section 8.3.

8.2.7 Management considerations

Management considerations are in section 8.3.

Table 8.2.1. ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Tonnes landed by the main fishing fleets for 1978-2010 as determined by the Working Group.

	Div. VIIIc			Div. IXa				Div. VIIIc+IXa
	SPAIN			SPAIN	PORTUGAL			
Year	Trawl	Gillnet	TOTAL	Trawl	Trawl	Artisanal	TOTAL	TOTAL
1978	n/a	n/a	n/a	248	n/a	107	355	355
1979	n/a	n/a	n/a	306	n/a	210	516	516
1980	1203	207	1409	385	n/a	315	700	2110
1981	1159	309	1468	505	n/a	327	832	2300
1982	827	413	1240	841	n/a	288	1129	2369
1983	1064	188	1252	699	n/a	428	1127	2379
1984	514	176	690	558	223	458	1239	1929
1985	366	123	489	437	254	653	1344	1833
1986	553	585	1138	379	200	847	1425	2563
1987	1094	888	1982	813	232	804	1849	3832
1988	1058	1010	2068	684	188	760	1632	3700
1989	648	351	999	764	272	542	1579	2578
1990	491	142	633	689	387	625	1701	2334
1991	503	76	579	559	309	716	1584	2163
1992	451	57	508	485	287	832	1603	2111
1993	516	292	809	627	196	596	1418	2227
1994	542	201	743	475	79	283	837	1580
1995	913	104	1017	615	68	131	814	1831
1996	840	105	945	342	133	210	684	1629
1997	800	198	998	524	81	210	815	1813
1998	748	148	896	681	181	332	1194	2089
1999	571	127	698	671	110	406	1187	1885
2000	441	73	514	377	142	336	855	1369
2001	383	69	452	190	101	269	560	1013
2002	173	74	248	234	75	213	522	770
2003	279	49	329	305	68	224	597	926
2004	251	120	371	285	50	267	603	973
2005	273	97	370	283	31	214	527	897
2006	323	124	447	541	39	121	701	1148
2007	372	68	440	684	66	111	861	1301
2008	386	70	456	336	40	119	495	951
2009	301	148	449	172	34	114	320	769
2010	319	81	399	197	70	84	351	751

n/a: not available

Table 8.2.2 ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa. Weight and percentage of discards for Spanish trawl fleet.

Year	Weight (t)	CV	% Trawl Catches
1994	6.1	24.4	0.6
1995	n/a	n/a	n/a
1996	n/a	n/a	n/a
1997	21.3	35.2	1.6
1998	n/a	n/a	n/a
1999	19.7	43.7	1.6
2000	8.7	35.1	1.1
2001	n/a	n/a	n/a
2002	n/a	n/a	n/a
2003	1.1	53.6	0.2
2004	8.1	70.2	1.5
2005	13.6	45.6	2.4
2006	92.0	56.8	9.6
2007	0.3	98.8	0.0
2008	1.9	59.4	0.3
2009	29.3	53.8	5.8
2010	61.2	63.2	10.6

n/a: not available

CV: coefficient of variation

Table 8.2.3 ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Length composition by fleet for landings in 2010 (thousands).

	Div. VIIIc			Div. IXa				Div. VIIIc+IXa
	SPAIN			SPAIN	PORTUGAL			
Length (cm)	Trawl	Gillnet	TOTAL	Trawl	Trawl	Artisanal	TOTAL	TOTAL
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
14	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
15	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
17	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18	0.063	0.000	0.063	0.048	0.000	0.000	0.048	0.111
19	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.000	0.000	0.014	0.000	0.000	0.014	0.014
21	0.271	0.000	0.271	0.278	0.000	0.000	0.278	0.549
22	0.550	0.000	0.550	0.261	0.000	0.000	0.261	0.811
23	1.154	0.000	1.154	0.166	0.000	0.000	0.166	1.320
24	2.057	0.000	2.057	0.042	0.000	0.000	0.042	2.099
25	0.801	0.000	0.801	0.630	0.924	0.000	1.554	2.355
26	0.542	0.000	0.542	0.391	0.227	0.000	0.617	1.160
27	0.360	0.000	0.360	0.422	1.441	0.000	1.863	2.223
28	3.322	0.000	3.322	1.364	1.267	0.000	2.631	5.953
29	3.421	0.000	3.421	1.967	1.148	0.000	3.116	6.536
30	5.080	0.000	5.080	3.632	1.119	0.000	4.751	9.831
31	7.678	0.000	7.678	6.309	2.246	0.000	8.554	16.233
32	8.578	0.000	8.578	6.038	5.010	0.000	11.048	19.626
33	10.532	0.000	10.532	4.264	2.362	0.000	6.626	17.158
34	7.246	0.000	7.246	4.720	9.267	0.000	13.987	21.233
35	10.345	0.000	10.345	6.857	2.916	0.000	9.773	20.118
36	7.492	0.000	7.492	5.376	2.119	0.000	7.495	14.987
37	7.657	0.000	7.657	5.023	2.278	0.000	7.301	14.958
38	7.689	0.000	7.689	3.683	2.162	0.096	5.941	13.629
39	4.789	0.000	4.789	3.041	1.525	0.000	4.566	9.355
40	6.290	0.000	6.290	2.604	0.877	0.000	3.480	9.771
41	4.756	0.000	4.756	2.006	1.203	0.000	3.208	7.965
42	4.718	0.000	4.718	2.032	0.889	0.000	2.922	7.639
43	6.933	0.036	6.969	2.548	1.069	0.000	3.616	10.585
44	5.676	0.000	5.676	2.426	0.862	0.000	3.288	8.963
45	6.063	0.000	6.063	2.663	0.314	0.895	3.872	9.935
46	6.394	0.019	6.413	3.223	1.218	1.067	5.508	11.921
47	4.868	0.000	4.868	3.310	0.461	0.000	3.770	8.638
48	3.385	0.102	3.487	2.115	0.887	0.000	3.001	6.489
49	2.964	0.383	3.347	1.727	0.214	0.531	2.473	5.820
50	2.946	0.167	3.113	1.817	0.590	0.254	2.661	5.774
51	1.989	0.777	2.766	1.444	0.903	0.385	2.732	5.499
52	1.669	0.515	2.184	1.622	0.265	0.096	1.982	4.166
53	2.392	0.562	2.954	1.141	0.488	0.096	1.724	4.678
54	1.387	0.449	1.836	1.164	0.600	0.254	2.017	3.854
55	0.756	0.568	1.324	0.443	0.016	0.893	1.352	2.676
56	1.007	0.674	1.681	0.557	0.192	5.413	6.161	7.842
57	0.831	0.737	1.568	0.236	0.180	0.313	0.730	2.298
58	0.858	0.521	1.379	0.338	0.241	0.000	0.578	1.957
59	1.364	0.400	1.764	0.674	0.000	0.096	0.770	2.534
60	0.713	1.961	2.674	0.438	0.284	0.096	0.818	3.492
61	0.473	0.399	0.872	0.233	0.087	0.096	0.416	1.287
62	2.108	1.049	3.157	0.787	0.000	0.349	1.136	4.293
63	1.984	0.710	2.694	0.949	0.279	0.000	1.228	3.922
64	2.286	1.027	3.313	1.270	0.337	0.627	2.234	5.547
65	2.475	0.583	3.058	1.548	0.126	0.627	2.301	5.360
66	1.783	0.811	2.594	0.402	0.405	0.349	1.156	3.750
67	2.246	1.470	3.716	1.171	0.815	0.044	2.030	5.746
68	2.424	0.544	2.968	1.646	0.087	0.358	2.091	5.060
69	2.253	0.898	3.151	1.315	0.287	0.254	1.856	5.007
70	2.355	0.763	3.118	1.606	0.000	0.271	1.877	4.995
71	2.842	0.727	3.569	1.382	0.301	1.012	2.696	6.264
72	1.043	0.684	1.727	1.043	0.144	0.228	1.415	3.142
73	1.554	0.754	2.308	0.907	0.135	0.473	1.515	3.824
74	1.594	0.063	1.657	1.298	0.078	0.385	1.762	3.418
75	1.158	0.019	1.177	0.778	0.354	0.615	1.747	2.924
76	0.218	0.494	0.712	0.247	0.000	0.298	0.544	1.257
77	0.518	0.326	0.844	0.429	0.000	0.227	0.656	1.500
78	0.058	0.287	0.345	0.068	0.000	0.000	0.068	0.413
79	0.024	0.000	0.024	0.099	0.000	0.096	0.195	0.219
80	0.087	0.032	0.119	0.135	0.198	0.000	0.333	0.452
81	0.109	0.263	0.372	0.161	0.043	0.227	0.431	0.803
82	0.035	0.024	0.059	0.097	0.260	0.000	0.357	0.416
83	0.057	0.000	0.057	0.125	0.000	0.263	0.388	0.445
84	0.150	0.000	0.150	0.186	0.114	0.000	0.300	0.450
85	0.155	0.000	0.155	0.194	0.000	0.644	0.839	0.993
86	0.079	0.000	0.079	0.209	0.135	0.000	0.343	0.423
87	0.000	0.000	0.000	0.038	0.000	0.096	0.134	0.134
88	0.034	0.000	0.034	0.035	0.000	0.113	0.148	0.182
89	0.000	0.000	0.000	0.133	0.000	0.000	0.133	0.133
90	0.000	0.000	0.000	0.118	0.043	0.893	1.054	1.054
91	0.000	0.000	0.000	0.049	0.000	0.223	0.272	0.272
92	0.000	0.000	0.000	0.074	0.000	0.000	0.074	0.074
93	0.000	0.000	0.000	0.064	0.000	0.000	0.064	0.064
94	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
95	0.000	0.000	0.000	0.009	0.180	0.000	0.189	0.189
96	0.000	0.000	0.000	0.000	0.144	0.113	0.256	0.256
97	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
98	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
99	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
100+	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TOTAL	188	20	207	108	52	19	180	387
Tonnes	319	81	399	197	70	84	351	751
Mean Weight (g)	1698	4083	1925	1824	1345	4355	1957	1940
Mean Length	43.7	63.3	45.5	44.3	39.7	63.1	45.0	45.3
Measured weight (t)	6.1	2.6	8.7	6.5	0.6	0.3	0.9	9.6

Table 8.2.4 ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.
Number, mean weight and mean length of landings between 1986 and 2010.

	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

Table 8.2.5 ANGLERFISH (*L. budegassa*) - 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		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

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

Table 8.2.6 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.

Landings (t)

	Div. VIIIc								Div. IXa			
Year	Avilés	%	Santander	%	A Coruña	%	Cedeira	%	Portugal Crustacean	%	Portugal Fish	%
1986	64	3	21	1	353	14						
1987	85	2	16	0	636	17						
1988	125	3	30	1	435	12						
1989	119	5	32	1	280	11			89	3	183	7
1990	58	2	40	2	258	11			127	5	261	11
1991	52	2	62	3	182	8			101	5	208	10
1992	33	2	107	5	180	9			94	4	193	9
1993	53	2	143	6	201	9			64	3	132	6
1994	65	4	196	12	166	11			26	2	53	3
1995	141	8	126	7	341	19			22	1	46	3
1996	162	10	89	5	334	21			45	3	88	5
1997	143	8	122	7	298	16			38	2	43	2
1998	91	4	114	5	323	15			70	3	111	5
1999	41	2	67	4	380	20	14	1	41	2	69	4
2000	23	2	44	3	287	21	4	<1	66	5	76	6
2001	12	1	28	3	281	28	6	1	59	6	42	4
2002	11	1	16	2	76	10	7	1	47	6	28	4
2003	9	1	15	2	85	9	3	<1	30	3	38	4
2004	32	3	23	2	68	7	5	1	23	2	27	3
2005	54	6	7	1	54	6	2	<1	12	1	19	2
2006	16	1	18	2	70	6	4	<1	18	2	22	2
2007	11	1	19	1	109	8	2	<1	34	3	31	2
2008	10	1	n/a	n/a	163	17	0.4	<1	21	2	19	2
2009	5	1	8	1	80	10	4	1	18	2	16	2
2010	n/a	n/a	19	3	79	10	4	1	37	5	34	4

Fishing effort

	Div. VIIIc						Div. IXa			
Year	[1] Avilés	[1] Santander	[1] A Coruña	[2] A Coruña standardized	[3] Cedeira standardized 2010	[3] Cedeira standardized 2008	Portugal [4] Crustacean	Portugal [5] Crustacean standardized	Portugal [4] Fish	Portugal [5] Fish standardized
1986	10845	18153	39810							
1987	8309	14995	34680							
1988	9047	16660	42180							
1989	8063	17607	44440				76	23	52	18
1990	8497	20469	44430				90	20	61	17
1991	7681	22391	40440				83	17	57	15
1992	n/a	22833	38910				71	15	49	14
1993	7635	21370	44504				75	13	56	13
1994	9620	22772	39589	4738			41	8	36	10
1995	6146	14046	41452	5298			38	8	41	9
1996	4525	12071	35728	5084			64	14	54	12
1997	5061	11776	35211	4801			43	11	27	9
1998	5929	10646	32563	3668			48	11	35	10
1999	6829	10349	30232	6424	4860	4939	24	8	18	6
2000	4453	8779	30073	5125	3726	3813	42	10	19	6
2001	1838	3053	29923	6103	2167	2221	85	18	19	5
2002	2748	3975	21823	2581	2464	2520	62	10	14	4
2003	2526	3837	18493	2515	2764	2822	42	10	17	6
2004	n/a	3776	21112	5056	5696	5806	21	7	14	4
2005	n/a	1404	20663	5161	3485	3546	20	5	13	4
2006	n/a	2718	19264	3949	4429	4511	22	5	12	4
2007	n/a	4334	21202	n/a	4599	4691	22	6	8	3
2008	n/a	n/a	20212	n/a	5168	5285	14	4	5	2
2009	n/a	1125	16163	n/a	2299		15	n/a	6	n/a
2010	n/a	1628	13744		1902		21	n/a	14	n/a

[1] Fishing days per 100 HP
[2] Fishing days
[3] Soaking days
[4] 1000 Hours trawling with occurrence of anglerfish
[5] 1000 Hauls
n/a - not available

LPUE

	Div. VIIIc						Div. IXa			
Year	[1] Avilés	[1] Santander	[1] A Coruña	[2] A Coruña standardized	[3] Cedeira standardized 2010	[3] Cedeira standardized 2008	Portugal [4] Crustacean	Portugal [5] Crustacean standardized	Portugal [4] Fish	Portugal [5] Fish standardized
1986	5.9	1.1	8.9							
1987	10.3	1.1	18.3							
1988	13.9	1.8	10.3							
1989	14.7	1.8	6.3				1.17	3.9	3.51	10.4
1990	6.8	1.9	5.8				1.41	6.2	4.29	15.2
1991	6.7	2.8	4.5				1.22	6.1	3.65	13.5
1992	n/a	4.7	4.6				1.32	6.2	3.97	14.1
1993	7.0	6.7	4.5				0.85	4.8	2.37	10.1
1994	6.7	8.6	4.2	37.4			0.64	3.4	1.50	5.5
1995	23.0	9.0	8.2	69.1			0.58	2.8	1.11	5.0
1996	35.8	7.4	9.4	69.9			0.70	3.1	1.62	7.1
1997	28.3	10.4	8.5	66.4			0.88	3.3	1.60	4.9
1998	15.3	10.7	9.9	93.7			1.45	6.3	3.16	11.5
1999	5.9	6.5	12.6	59.6	2.8	2.7	1.72	5.0	3.85	12.2
2000	5.1	5.0	9.6	56.6	1.1	1.0	1.56	6.5	4.04	12.6
2001	6.7	9.3	9.4	47.7	2.7	2.6	0.69	3.2	2.27	8.5
2002	4.1	4.1	3.5	33.0	2.9	2.8	0.75	4.8	2.00	6.2
2003	3.6	4.0	4.6	40.8	0.9	0.9	0.71	3.1	2.17	6.7
2004	n/a	6.0	3.2	13.5	0.9	0.9	1.07	3.5	1.90	6.2
2005	n/a	4.9	2.6	10.6	0.7	0.6	0.63	2.4	1.38	5.0
2006	n/a	6.8	3.6	18.2	0.9	0.9	0.80	3.3	1.73	5.6
2007	n/a	4.5	5.2	n/a	0.5	0.5	1.53	5.6	3.98	10.5
2008	n/a	n/a	8.1	n/a	0.1	0.1	1.50	5.4	3.56	10.6
2009	n/a	6.8	5.0	n/a	1.7		1.14	n/a	2.65	n/a
2010	n/a	11.9	5.7		2.1		1.75	n/a	2.37	n/a

[1] kg/days*100HP
[2] kg/day
[3] kg/soaking day
[4] kg/hour trawl
[5] kg/haul

Table 8.2.7 ANGLERFISH (*L. budegassa*) – Divisions VIIIc and IXa.

ASPIC input settings and data.

Input	Value
Error type	YLD – Condition on yield
Number of bootstrap trials	1000
Maximum F when estimating effort	8.0d0 (y^{-1})
Statistical weight for B1 > K	1
Statistical weights for fisheries	F1: 1, F2: 1
B1-ratio (starting guess)	0.5
MSY (starting guess)	3000 (t)
K (starting guess)	20000 (t)
q (starting guess)	F1: 1d-5, F2: 1d-4
Estimated parameters	All: B1-Ratio, MSY, K, qF1, qF2
Min and max allowable MSY	2 000 (t) – 10 000 (t)
Min and max K	5000 (t) – 100 000 (t)
Random number seed	1964185

F1:	P-TRC	
Type:	CC (CPUE and Catch)	
Year	**CPUE (t/effort)**	**Catch (t)**
1980	-1	2110
1981	-1	2300
1982	-1	2369
1983	-1	2379
1984	-1	1929
1985	-1	1833
1986	-1	2563
1987	-1	3832
1988	-1	3700
1989	0.00117	2578
1990	0.00141	2334
1991	0.00122	2163
1992	0.00132	2111
1993	0.00085	2227
1994	0.00064	1580
1995	0.00058	1831
1996	0.00070	1629
1997	0.00088	1813
1998	0.00145	2089
1999	0.00172	1885
2000	0.00156	1369
2001	0.00069	1013
2002	0.00075	770
2003	0.00071	926
2004	0.00107	973
2005	0.00063	897
2006	0.00080	1148
2007	0.00153	1301
2008	0.00150	951
2009	0.00114	769
2010	0.00175	751

F2:	P-TRF
Type:	I1 (Index of biomass – annual average)
Year	**CPUE (t/effort)**
1980	-1
1981	-1
1982	-1
1983	-1
1984	-1
1985	-1
1986	-1
1987	-1
1988	-1
1989	0.00351
1990	0.00429
1991	0.00365
1992	0.00397
1993	0.00237
1994	0.00150
1995	0.00111
1996	0.00162
1997	0.00160
1998	0.00316
1999	0.00385
2000	0.00404
2001	0.00227
2002	0.00200
2003	0.00217
2004	0.00190
2005	0.00138
2006	0.00173
2007	0.00398
2008	0.00356
2009	0.00265
2010	0.00237

Table 8.2.8 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(2011): equilibrium yield available in 2011; Y(Fmsy): yield availabe at Fmsy in 2011; Ye2011/MSY: equilibrium yield available in 2011 as proportion of MSY;fmsy (1): fishing effort rate at MSY for P-TRC; fmsy (2): fishing effort rate at MSY for P-TRF.

	WG2011								
			Bootstrap Confidence Interval						
Parameter	Point estimates	Relative bias	Lower 80%	Higher 80%	Lower 95%	Higher 95%		IQ-Range	Relative IQ-Range
B1/K	0.40	0.00%	0.40	0.40	0.40	0.40		0.00	0.00%
K	11700	-0.18%	11670	11770	11460	12040		16	0.10%
q(1)	4.65E-07	0.23%	4.10E-07	5.41E-07	3.78E-07	5.98E-07		7.24E-08	15.60%
q(2)	1.12E-06	33.95%	1.02E-06	1.23E-06	1.01E-06	1.33E-06		1.12E-07	10.00%
MSY	2515	0.01%	2513	2515	2507	2521		0	0.00%
Ye(2011)	2495	-3.02%	2420	2516	2295	2524		35	1.40%
Y.@Fmsy	1013	-0.32%	958	1050	928	1056		49	4.90%
Bmsy	5850	-0.18%	5833	5884	5732	6020		7.893	0.10%
Fmsy	0.430	0.23%	0.427	0.431	0.417	0.440		0.001	0.10%
fmsy(1)	924600	1.29%	799700	1054000	729700	1145000		137000	14.80%
fmsy(2)	384900	-3.16%	348700	421600	325400	426600		38850	10.10%
B./Bmsy	0.91	-1.34%	0.70	1.13	0.59	1.24		0.22	24.20%
F./Fmsy	0.39	9.04%	0.30	0.51	0.27	0.61		0.10	26.60%
Ye./MSY	0.99	-3.04%	0.96	1.00	0.91	1.00		0.01	1.40%
q2/q1	2.4	42.93%	1.93	2.72	1.71	3.01		0.41	17.10%

Table 8.2.9 ANGLERFISH (*L. budegassa*) – Divisions VIIIc and IXa
Comparasion of parameter estimates between 2010 and 2011 assessments

Parameter	Assessment year	
point estimates	2010	2011
B1/K	0.40	0.40
K	11480	11700
MSY	2515	2515
Y.@Fmsy	1062	1013
Bmsy	5740	5850
Fmsy	0.438	0.430
B./Bmsy	0.80	0.91
F./Fmsy	0.45	0.39
q(1)	4.60E-07	4.65E-07
q(2)	1.13E-06	1.12E-06
q2/q1	2.5	2.4

B./Bmsy: B_{2010}/Bmsy for 2010; B_{2011}/Bmsy for 2011.

F./Fmsy: F_{2009}/Fmsy for 2010; F_{2010}/Fmsy for 2011.

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

Table 8.2.10. ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa.

Point estimates of B/BMSY(from 2011 to 2020) and Yield (from 2011 to 2020) for projections with F status quo (Fsq), FMSY, zero catches and first year reduction in Fof 10, 20, 30, 40 and 50%. Reductions to obtain yields equal to 2011 TAC, and +/- 15% 2011 TAC are also presented. The value of F2011/FMSY is equal to Fsq in all scenarios proposed. Values for F/FMSY are also given.

Fishing mortality trends in relation to F_{MSY}

			Decrease in first year					
year	Fsq	F_{MSY}	zero catches	reduction 50 %	reduction 40 %	reduction 30 %	reduction 20 %	reduction 10 %
2011	0.39	0.39	0.39	0.39	0.39	0.39	0.39	0.39
2012	0.39	1	0.00	0.19	0.23	0.27	0.31	0.35
2013	0.39	1	0.00	0.19	0.23	0.27	0.31	0.35
2014	0.39	1	0.00	0.19	0.23	0.27	0.31	0.35
2015	0.39	1	0.00	0.19	0.23	0.27	0.31	0.35
2016	0.39	1	0.00	0.19	0.23	0.27	0.31	0.35
2017	0.39	1	0.00	0.19	0.23	0.27	0.31	0.35
2018	0.39	1	0.00	0.19	0.23	0.27	0.31	0.35
2019	0.39	1	0.00	0.19	0.23	0.27	0.31	0.35
2020	0.39	1	0.00	0.19	0.23	0.27	0.31	0.35

Biomass trends in relation to B_{MSY}

year	Fsq	F_{MSY}	zero catches	reduction 50 %	reduction 40 %	reduction 30 %	reduction 20 %	reduction 10 %
2011	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
2012	1.17	1.17	1.17	1.17	1.17	1.17	1.17	1.17
2013	1.35	1.10	1.54	1.44	1.42	1.41	1.39	1.37
2014	1.47	1.06	1.77	1.62	1.59	1.56	1.53	1.50
2015	1.54	1.04	1.90	1.72	1.68	1.64	1.61	1.57
2016	1.58	1.03	1.96	1.76	1.73	1.69	1.65	1.61
2017	1.60	1.02	1.98	1.79	1.75	1.71	1.67	1.63
2018	1.60	1.01	1.99	1.80	1.76	1.72	1.68	1.64
2019	1.61	1.01	2.00	1.80	1.76	1.73	1.69	1.65
2020	1.61	1.01	2.00	1.81	1.77	1.73	1.69	1.65

Yield

year	Fsq	F_{MSY}	zero catches	reduction 50 %	reduction 40 %	reduction 30 %	reduction 20 %	reduction 10 %
2011	1013	1013	1013	1013	1013	1013	1013	1013
2012	1229	2844	0	637	759	879	998	1114
2013	1377	2719	0	747	882	1013	1139	1260
2014	1466	2644	0	812	955	1092	1223	1347
2015	1515	2597	0	846	994	1134	1268	1395
2016	1541	2568	0	863	1013	1156	1291	1420
2017	1554	2549	0	871	1022	1166	1303	1432
2018	1561	2537	0	874	1027	1171	1308	1438
2019	1564	2529	0	876	1029	1174	1311	1441
2020	1566	2524	0	877	1030	1175	1313	1443

Fishing mortality trends in relation to F_{MSY}

	-15% TAC (1571)	TAC=1571	+15% TAC (1571)	*L. piscatorius* F_{MSY}
year	reduction 67.05%	reduction 60.97%	reduction 54.80%	[Fsq * 1.17]
2011	0.39	0.39	0.39	0.39
2012	0.13	0.15	0.17	0.45
2013	0.13	0.15	0.17	0.45
2014	0.13	0.15	0.17	0.45
2015	0.13	0.15	0.17	0.45
2016	0.13	0.15	0.17	0.45
2017	0.13	0.15	0.17	0.45
2018	0.13	0.15	0.17	0.45
2019	0.13	0.15	0.17	0.45
2020	0.13	0.15	0.17	0.45

Biomass trends in relation to B_{MSY}

year	reduction 67.05%	reduction 60.97%	reduction 54.80%	L. piscatorius F_{MSY} [Fsq * 1.17]
2011	0.91	0.91	0.91	0.91
2012	1.17	1.17	1.17	1.17
2013	1.47	1.46	1.45	1.33
2014	1.67	1.65	1.63	1.43
2015	1.78	1.75	1.73	1.48
2016	1.83	1.81	1.78	1.51
2017	1.85	1.83	1.81	1.53
2018	1.86	1.84	1.82	1.54
2019	1.87	1.85	1.82	1.54
2020	1.87	1.85	1.82	1.55

Yield

year	reduction 67.05%	reduction 60.97%	reduction 54.80%	*L. piscatorius* F_{MSY} [Fsq * 1.17]
2011	1013	1013	1013	1013
2012	425	501	578	1421
2013	506	593	681	1567
2014	553	648	741	1655
2015	578	676	773	1704
2016	590	689	788	1730
2017	595	696	795	1744
2018	597	699	799	1751
2019	598	700	800	1755
2020	599	701	801	1757

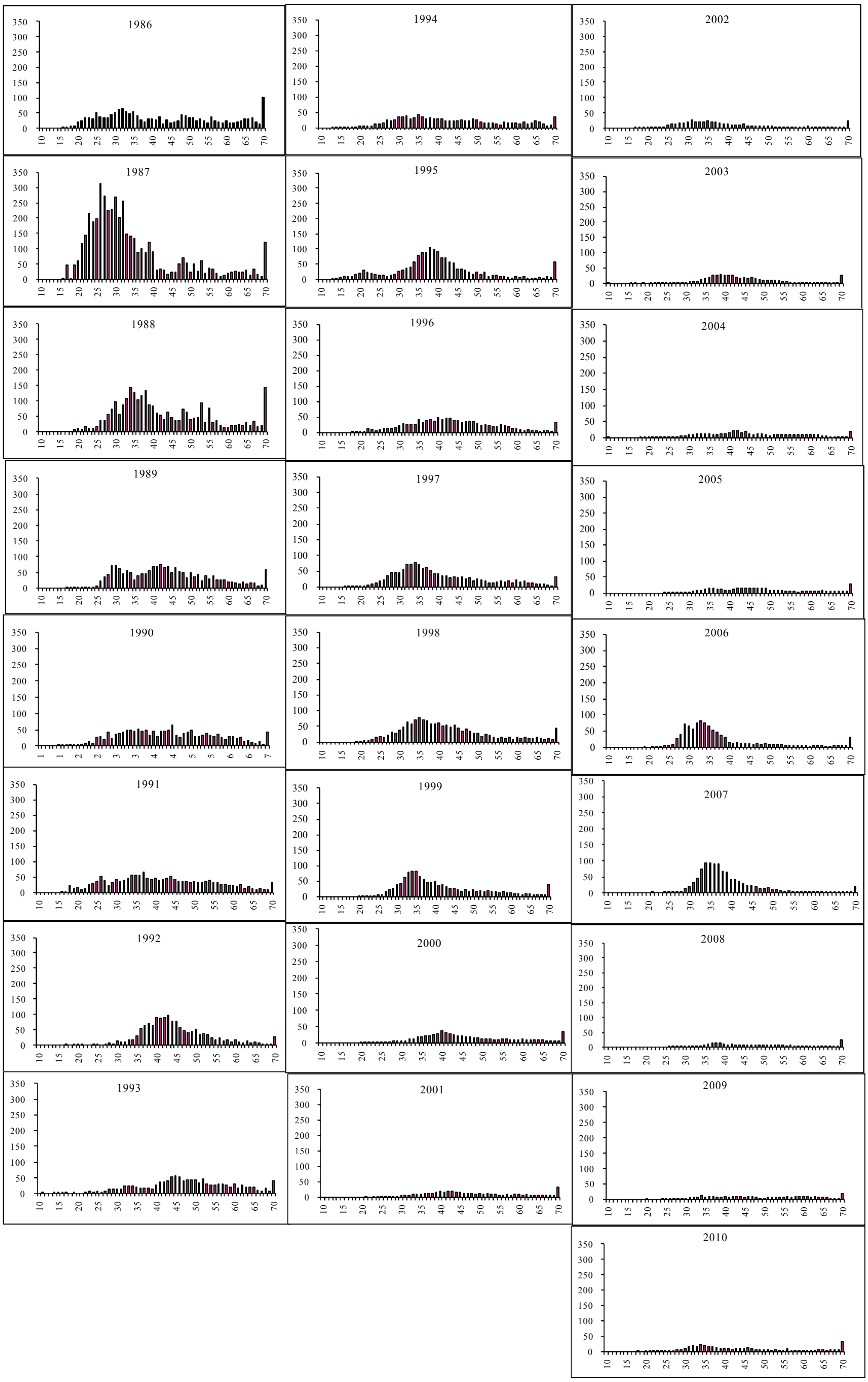


Figure 8.2.1 **ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa. Length distributions of landings (thousands for 1986 to 2010).**

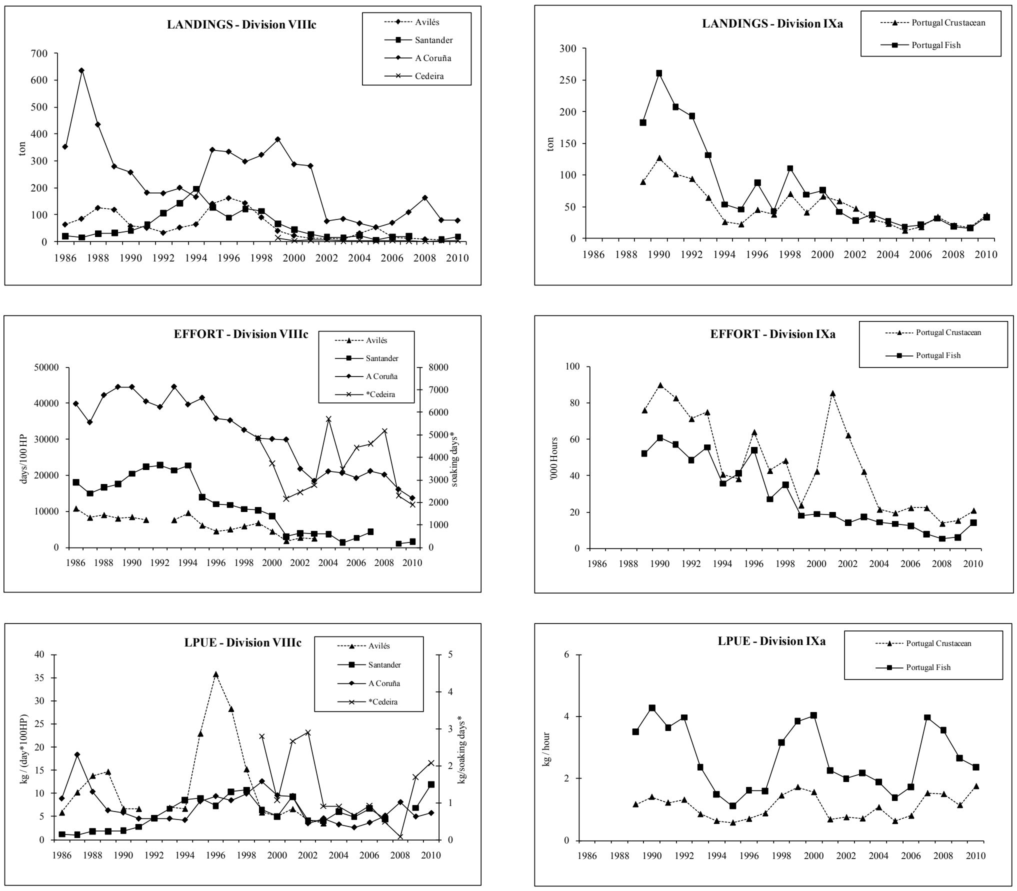
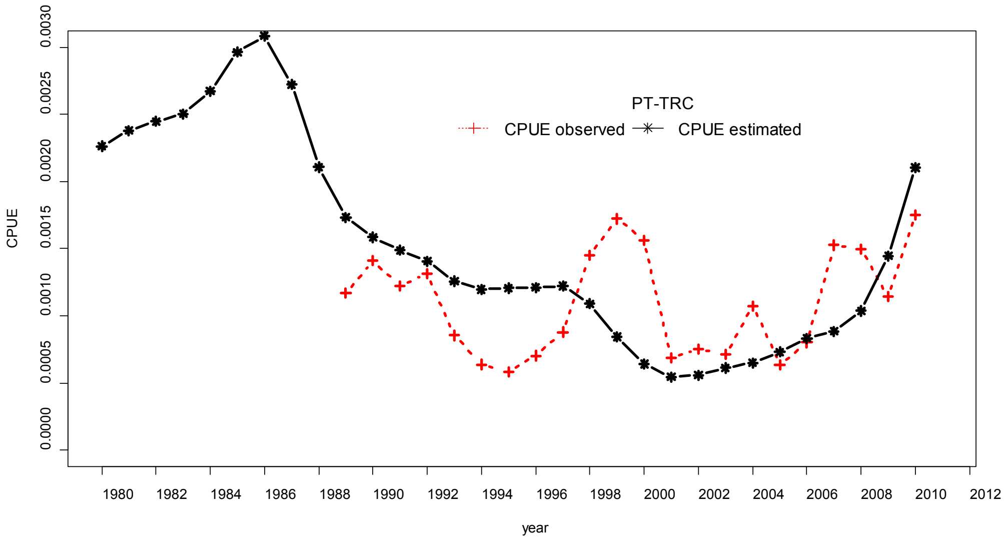


Figure 8.2.2 **ANGLERFISH (*L. budegassa*) - Divisions VIIIc and IXa. Trawl and gillnet landings, effort and LPUE data between 1986-2010.**



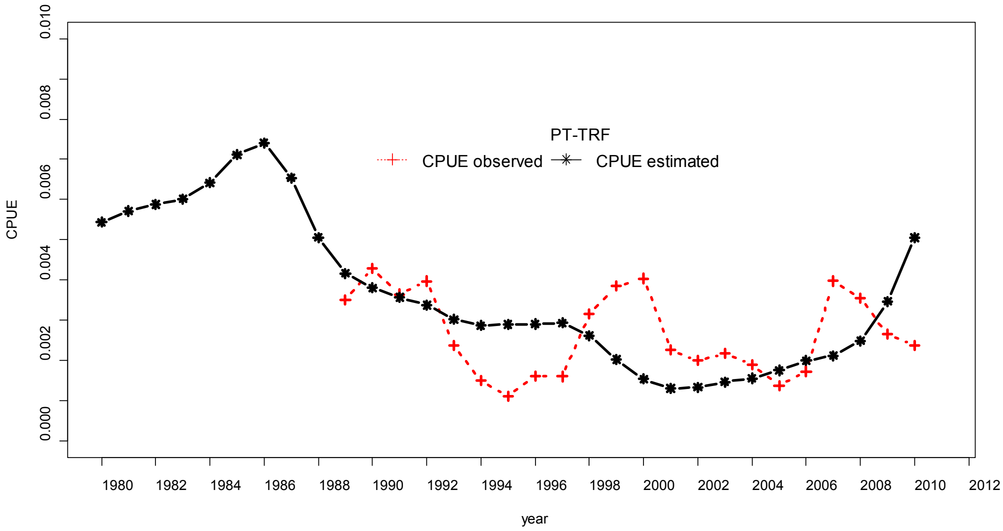


Figure 8.2.3. ANGLERFISH (*L. budegassa*)– Divisions VIIIc and IXa. Observed CPUE for the two commercial fleets and estimated values by the model.

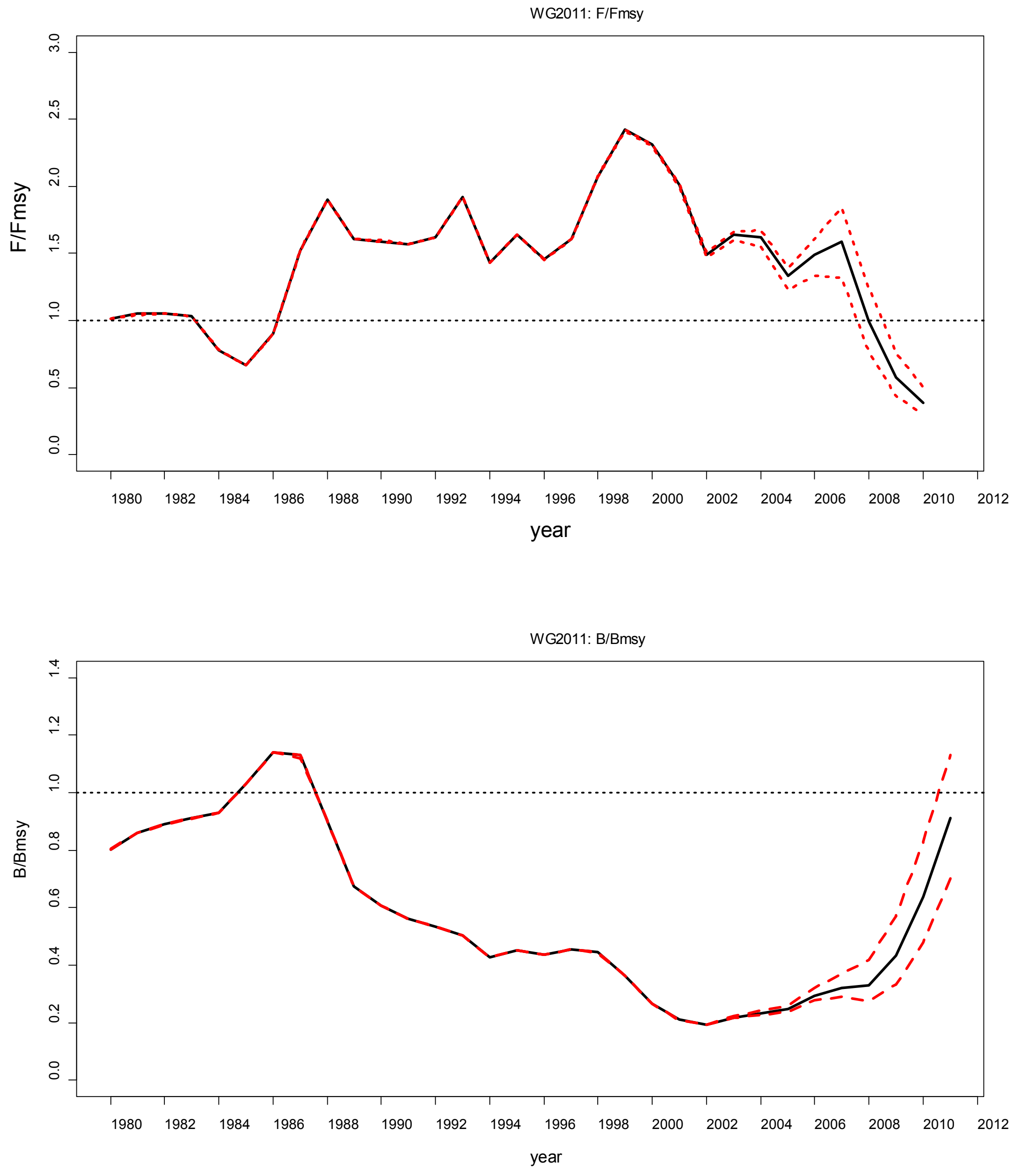
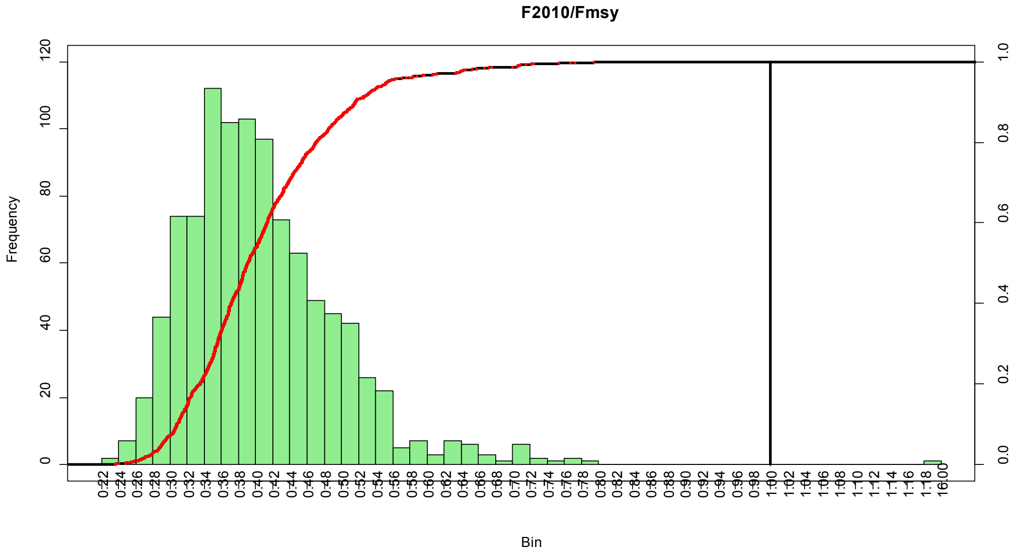


Figure 8.2.4. ANGLERFISH (*L. budegassa*) – Divisions VIIIc and IXa. Confidence intervals (80%) of the F/FMSY and B/BMSY ratios.



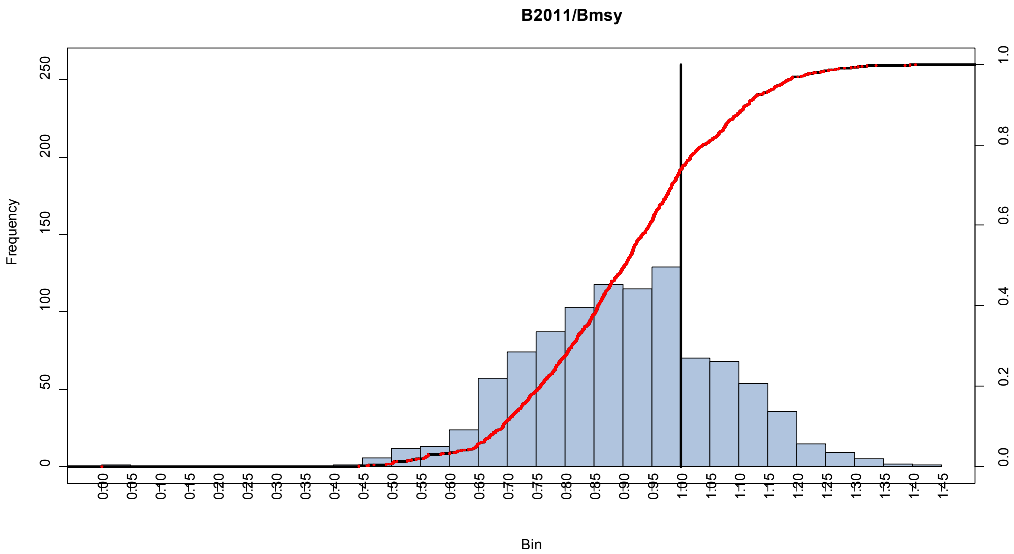


Figure 8.2.5. ANGLERFISH (*L. budegassa*) – Divisions VIIIc and IXa. Histograms and cumulative frequency distributions of estimated values of F2010/F_{msy} and B2011/B_{msy} by bootstrap (1000 replicates). The black line shows the estimate at reference point of one (F_{msy},B_{msy})

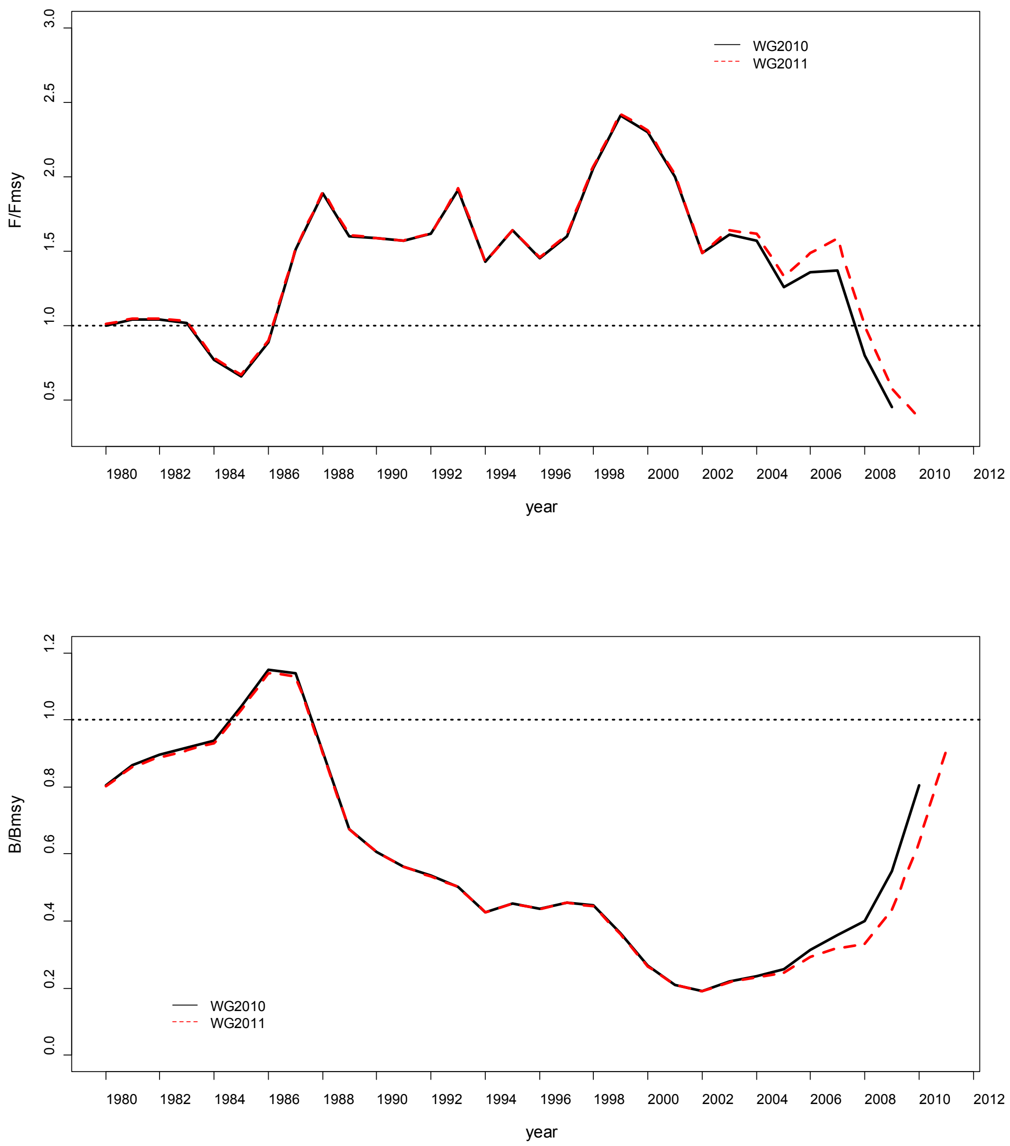


Figure 8.2.6. ANGLERFISH (*L. budegassa*) – Divisions VIIIc and IXa. Trends of the F/FMSY and B/BMSY ratios from the 2010 and 2011 assessments.

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

The total anglerfish (*Lophius*) landings are given in Table 8.3.1 by ICES division, country and fishing gear. The general trend reflects the trends described for each species, with landings increasing in the early eighties and reaching maximum in 1986 (9 433 t) and 1988 (10 021 t), and decreasing after that to the minimum of the time series in 2001 (1 801 t) and 2002 (1 802 t). From 2002 to 2005 landings increased reaching 4 541 t. During the last four years, landings decreased to 2 355 t (1 604 t *L. piscatorius* and 751 t *L. budegassa*) in 2010.

The species proportion in the landings has changed since 1986. In the beginning of the time series (1980-1986) *L. piscatorius* represented more than 70% of the total anglerfish landings. After 1986 the proportion of *L. piscatorius* decreased and since 1999 both species had approximately the same weight in the annual landings. Since 2002, *L. piscatorius* again gained more importance and represents 68% of the 2010 landings.

The TAC (1 496 t in 2010 and 1 571 t in 2011) is set for both species of anglerfish combined. Landings in 2010 were 1.57 times the established TAC.

The landings, effort and LPUE data series of the combined species are presented in Table 8.3.2 and Figure 8.3.1. During the late 1980s and early 1990s a decrease in LPUE is observed for all series while an increase is apparent in the middle of the 1990s. Since then, LPUE values have decreased and reached the minimum of the series in 2002 for the A Coruña fleet and in 2003 for the Portuguese fleets. Both Portuguese trawl fleets show afterwards an increasing trend till 2007 but since then a declined in LPUE was observed, while the data available for the Spanish fleets indicates stability or an increasing trend.

8.3.1 Assessment

The Working Group has performed assessments for each species separately (Sections 8.1 and 8.2).

8.3.2 Comments on the assessment

In the update of the last assessment, no changes in input settings have been made for *L. piscatorius*. The model fit for *L. piscatorius* shows sensitivity to the variation in the defined boundaries for MSY and K. Although this sensitivity has an effect in the estimated values of fishing mortality and biomass, it only affects the beginning of the time series.

For *L. budegassa* the correlation coefficient between input fleets is high but the r square between observed and fitted CPUE values are negative, which is a matter of concern.

The assessment conducted this year was an update, any changes in settings or new approaches were not attempted because a benchmark is schedule for the beginning of 2012, where these will be done (see Annex N which gives the benchmark preparation plan).

8.3.3 Biological Reference Points

As was done last year, the F_{MSY} estimates from the ASPIC assessments are proposed as reference points but biomass reference points $B_{MSY\text{-}trigger}$ were not defined in this Working Group due to the concerns explained in Section 8.3.2.

8.3.4 Management considerations

Lophius piscatorius and *L. budegassa* are subject to a common TAC (1 496 t in 2010 and 1 571 t in 2011), so the joint status of these species should be taken into account when formulating management advice. Combined landings in 2010 (2 355 t) were 1.57 times the TAC. Both species of anglerfish are reported together because of their similarity but are assessed separately.

In 2010, biomass of *L. piscatorius* is estimated to be below B_{MSY} and fishing mortality is estimated to be below F_{MSY}. Under all projection scenarios considered, except for F_{MSY}, the stock biomass is expected to achieve B_{MSY} within the next ten years. F *status quo* is expected to bring biomass to 99% of B_{MSY} in 2020 and under a zero catch scenario biomass will reach B_{MSY} in 2015.

Fishing mortality for *L. budegassa* shows a decreasing trend since 1999 and in 2009 and 2010 it is below F_{MSY}. This has led to an increase in biomass but it is still below B_{MSY}. Fishing mortality equal to F *status quo* in 2011 is expected to bring the stock above B_{MSY} in 2012. The biomass is expected to increase well above B_{MSY} under all fishing mortality scenarios examined in projections, except for the F_{MSY} scenario that will bring the stock in the next 10 years to very near B_{MSY} (Table 8.2.10).

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 8.3.1 ANGLERFISH (*L. piscatorius* and *L. budegassa*) - Divisions VIIIc and IXa.
Tonnes landed by the main fishing fleets for 1978-2010 as determined by the Working Group.

	Div. VIIIc			Div. IXa				Div. VIIIc+IXa
	SPAIN			SPAIN	PORTUGAL			
Year	Trawl	Gillnet	TOTAL	Trawl	Trawl	Artisanal	TOTAL	TOTAL
1978	n/a	n/a	n/a	506	0	222	728	
1979	n/a	n/a	n/a	625	0	435	1060	
1980	4008	1477	5485	786	0	654	1440	6926
1981	3909	2240	6149	1040	0	679	1719	7867
1982	2742	3095	5837	1716	0	598	2314	8151
1983	4269	1911	6180	1426	0	888	2314	8494
1984	3600	1866	5466	1136	409	950	2495	7961
1985	2679	2495	5174	977	466	1355	2798	7972
1986	3052	3209	6261	1049	367	1757	3172	9433
1987	3174	2571	5745	1133	426	1668	3227	8973
1988	3583	3263	6846	1254	344	1577	3175	10021
1989	2291	2498	4789	1111	531	1142	2785	7574
1990	1930	1127	3057	1124	713	1231	3068	6125
1991	1993	854	2847	878	533	1545	2956	5803
1992	1668	1068	2736	786	363	1610	2758	5494
1993	1360	959	2319	699	306	1231	2237	4556
1994	1232	1028	2260	629	149	549	1327	3587
1995	1743	677	2420	814	134	297	1245	3665
1996	2146	850	2995	749	265	574	1589	4584
1997	2249	1389	3638	838	191	860	1889	5527
1998	1660	1507	3167	865	209	829	1903	5070
1999	1116	1140	2256	750	119	692	1561	3817
2000	710	612	1322	485	146	675	1306	2628
2001	614	364	978	247	117	459	823	1801
2002	559	415	974	344	104	380	828	1802
2003	1190	771	1961	617	96	529	1242	3203
2004	1513	1389	2901	549	77	602	1229	4130
2005	1651	1719	3370	653	60	458	1171	4541
2006	1489	1371	2860	801	68	381	1250	4111
2007	1327	1076	2404	866	78	303	1247	3651
2008	1280	1238	2518	474	51	246	770	3288
2009	1151	1207	2358	386	43	262	691	3049
2010	689	1036	1725	355	72	203	630	2355

n/a: not available

Table 8.3.2 ANGLERFISH (*L. piscatorius* and *L. budegassa*) - Divisions VIIIc and IXa.

Landings, effort and landings per unit effort for trawl and gillnet fisheries. For landings the percentage relative to total annual stock landings is given.

Landings (t)

	Div. VIIIc								Div. IXa			
Year	Avilés	%	Santander	%	A Coruña	%	Cedeira	%	Portugal Crustacean	%	Portugal Fish	%
1986	564	6	537	6	1423	15						
1987	585	7	545	6	1585	18						
1988	526	5	418	4	2000	20						
1989	333	4	338	4	1241	16			174	2	358	5
1990	317	5	318	5	1038	17			233	4	480	8
1991	297	5	344	6	1047	18			174	3	359	6
1992	232	4	329	6	874	16			118	2	244	4
1993	129	3	329	7	587	13			100	2	206	5
1994	181	5	384	11	412	11			49	1	101	3
1995	333	9	312	9	601	16			44	1	90	2
1996	484	11	359	8	748	16			90	2	175	4
1997	488	9	503	9	709	13			89	2	102	2
1998	377	7	430	8	461	9			81	2	128	3
1999	148	4	249	7	542	14	355	9	44	1	75	2
2000	51	2	119	5	373	14	143	5	68	3	78	3
2001	35	2	82	5	366	20	92	5	68	4	49	3
2002	87	5	73	4	206	11	137	8	65	4	39	2
2003	120	4	100	3	312	10	162	5	43	1	53	2
2004	248	6	129	3	347	8	387	9	35	1	42	1
2005	332	7	66	1	445	10	436	10	24	1	36	1
2006	164	4	107	3	312	8	419	10	31	1	37	1
2007	113	3	123	3	332	9	235	6	47	1	38	1
2008	109	3	n/a	n/a	436	13	228	7	26	1	24	1
2009	74	2	42.9	1	245	8	228	7	23	1	21	1
2010	n/a	n/a	63.4	3	231	10	235	10	38	2	35	1

Fishing effort

	Div. VIIIc						Div. IXa			
Year	[1] Avilés	[1] Santander	[1] A Coruña	[2] A Coruña	[3] Cedeira	[3] Cedeira	[4] Portugal	[5] Portugal	[4] Portugal Fish	[5] Portugal
1986	10845	18153	39810							
1987	8309	14995	34680							
1988	9047	16660	42180							
1989	8063	17607	44440				76	23	52	18
1990	8497	20469	44430				90	20	61	17
1991	7681	22391	40440				83	17	57	15
1992	n/a	22833	38910				71	15	49	14
1993	7635	21370	44504				75	13	56	13
1994	9620	22772	39589	4738			41	8	36	10
1995	6146	14046	41452	5298			38	8	41	9
1996	4525	12071	35728	5084			64	14	54	12
1997	5061	11776	35211	4801			43	11	27	9
1998	5929	10646	32563	3668			48	11	35	10
1999	6829	10349	30232	6424	4860	4939	24	8	18	6
2000	4453	8779	30072	5125	3726	3813	42	10	19	6
2001	1838	3053	29923	6103	2167	2221	85	18	19	5
2002	2748	3975	21823	2581	2464	2520	62	10	14	4
2003	2526	3837	18493	2515	2764	2822	42	10	17	6
2004	n/a	3776	21112	5056	5696	5806	21	7	14	4
2005	n/a	1404	20663	5161	3485	3546	20	5	13	4
2006	n/a	2718	19264	3949	4429	4511	22	5	12	4
2007	n/a	4334	21201	n/a	4599	4691	22	6	8	3
2008	n/a	n/a	20212	n/a	5168	5285	14	4	5	2
2009	n/a	1125	16163	n/a	2299	n/a	15	n/a	6	n/a
2010	n/a	1628	13744	n/a	1902	n/a	21	n/a	14	n/a

[1] Fishing days per 100 HP
[2] Fishing days
[3] Soaking days
[4] 1000 Hours trawling with occurrence of anglerfish
[5] 1000 Hauls
n/a - not available

LPUE

	Div. VIIIc						Div. IXa			
Year	[1] Avilés	[1] Santander	[1] A Coruña	[2] A Coruña	[3] Cedeira	[3] Cedeira	[4] Portugal	[5] Portugal	[4] Portugal Fish	[5] Portugal
1986	52.0	29.6	35.7							
1987	70.4	36.3	45.7							
1988	58.1	25.1	47.4							
1989	41.3	19.2	27.9				2.3	7.7	6.9	20.3
1990	37.4	15.5	23.4				2.6	11.4	7.9	28.0
1991	38.6	15.3	25.9				2.1	10.4	6.3	23.3
1992	n/a	14.4	22.5				1.7	7.8	5.0	17.8
1993	16.9	15.4	13.2				1.3	7.5	3.7	15.8
1994	18.8	16.8	10.4	86.9			1.2	6.4	2.8	10.5
1995	54.1	22.2	14.5	113.4			1.1	5.6	2.2	9.9
1996	106.9	29.7	20.9	147.1			1.4	6.2	3.2	14.3
1997	96.4	42.7	20.1	147.7			2.1	7.8	3.8	11.6
1998	63.6	40.4	14.2	125.7			1.7	7.3	3.6	13.3
1999	21.7	24.1	17.9	84.4	73.1	71.9	1.9	5.4	4.2	13.2
2000	11.4	13.6	12.4	72.7	38.5	37.6	1.6	6.7	4.2	12.9
2001	19.1	26.9	12.2	59.9	42.6	41.6	0.8	3.7	2.6	9.8
2002	31.6	18.4	9.4	79.9	55.7	54.5	1.0	6.7	2.8	8.7
2003	47.6	26.1	16.9	124.2	58.6	57.4	1.0	4.4	3.1	9.5
2004	n/a	34.1	16.4	68.6	67.9	66.6	1.6	5.4	2.9	9.5
2005	n/a	46.9	21.5	86.2	125.1	122.9	1.2	4.7	2.7	9.7
2006	n/a	39.4	16.2	79.1	94.7	92.9	1.4	5.8	3.0	9.9
2007	n/a	28.3	15.7	n/a	51.1	n/a	2.1	8.0	4.7	12.9
2008	n/a	n/a	21.6	n/a	44.1	n/a	1.9	6.9	4.5	13.6
2009	n/a	38.2	15.2	n/a	99.2	n/a	1.5	n/a	3.4	n/a
2010	n/a	39.0	16.8	n/a	123.4	n/a	1.8	n/a	2.4	n/a

[1] kg/day*100HP
[2] kg/day
[3] kg/soaking day
[4] kg/hour trawl
[5] kg/haul
n/a - not available

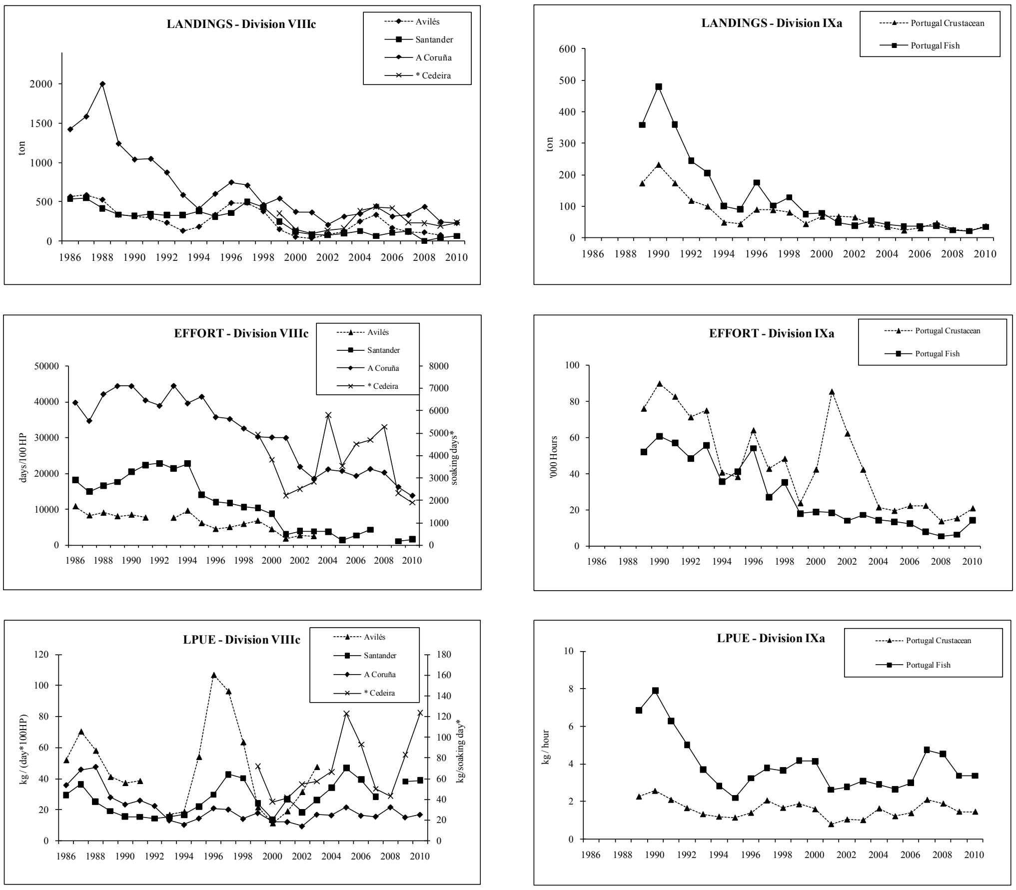


Figure 8.3.1 ANGLERFISH (*L. budegassa* and *L. piscatorius*) - Divisions VIIIc and IXa. Trawl and gillnet landings, effort and LPUE data between 1986-2010.

9 Megrims in Divisions VIIIc and IXa

Lepidorhombus whiffiagonis:

Type of assessment in 2011: update

Data revisions this year: None. Spanish discards data in numbers-at-age available for the first time this year.

Review Group issues for *L.whiffiagonis*: Following recommendations from RG in 2010, the following actions were taken:

1) A stock annex has been included (Annex I of this WG report).

Lepidorhombus boscii:

Type of assessment in 2011: update

Data revisions this year: Discards None. Spanish discards data in numbers-at-age available for the first time this year.

Review Group issues for *L. boscii*: According RG in 2010 recommendations, next issues were made:

1) A stock annex has been included (Annex I of this WG report).

2) A working document (WD06) about incorporating Spanish discards data of *L. boscii* in a Bayesian assessment model has been presented and it is intended to continue developing this model leading towards a benchmark assessment of both megrim stocks, possibly in 2013.

General

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 2011 and management for 2010 and 2011

ICES advice for 2011 (as extracted from ICES Advice 2010, Book 7):

Following the ICES MSY framework implies fishing mortality to be reduced to 0.14 for *L. whiffiagonis* and to 0.18 for *L. boscii*. For *L. whiffiagonis* this results in landings of 110 t in 2011 and expected SSB of 950 t in 2012. For *L. boscii* this results in landings of 780 t in 2011 and expected SSB of 5200 t in 2012. This corresponds to 890 t of landings in 2011 for both species combined. As both species of megrim (*L.whiffiagonis* and *L.boscii*) are caught in the same fisheries and are subject to a combined TAC, the same proportional reduction from current fishing mortality is assumed for both species. The reduction necessary for *L.boscii* to reach F_{MSY} is applied, as it is the species whose current fishing levels are further from F_{MSY}.

Management applicable for 2010 and 2011:

The agreed combined TAC for megrim and four-spot megrim in ICES Divisions VIIIc and IXa was 1287 t in 2010 and 1094 in 2011.

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

9.1.1 General

See general section for both species.

9.1.2 Data

9.1.2.1 Commercial catches and discards

Working Group estimates of landings for the period 1986 to 2010 are given in Table 9.1.1. The total estimated international landings in Divisions VIIIc and IXa for 2010 was 83 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. The landings in 2010 represent the lowest value of the entire series. Historical landings for both species combined are shown in Figure 9.1.1.

Discards estimates are available for Spain in the years displayed in Table 9.1.2(a). Annual discards of megrim are estimated to between 5 and 52 t along the whole series. Discards in number represent between 10-45% of the total catch, with the exception of the year 2007 when discards have been very low. Discards data are not used in this assessment because of the lack of data in several years of the series. Discard/Total Catch ratio and estimated CV are shown in the same table. In Table 9.1.2(b), the available series of years with Spanish discards in numbers-at-age for *L. whiffiagonis* are presented. With the exception of 1994, 1997 and 2006, discarded numbers are largest at age 1. Discarded numbers-at-age are presented in this WG for the first time (details provided in WD07).

9.1.2.2 Biological sampling

Annual length compositions of total stock landings are displayed in Figure 9.1.2 for the period 1986 – 2010. Although the bulk of the landings in numbers in recent years corresponded to fish of 20-30 cm, in 2010 this has moved to bigger lengths, between 24-34 cm as Table 9.1.3(a) with total length distribution shows.

Sampling levels for both species are given in Table 1.3.

Mean lengths and mean weights in landings since 1990 are shown in Table 9.1.3(b). The mean length and mean weight values in 2010 are the highest in the historic series.

Age compositions of landings are presented in Table 9.1.4 and weights-at-age of landings in Table 9.1.5. 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.

9.1.2.3 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 9.1.6.

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 (Figure 9.1.3(a), bottom right panel). In 2010, the index increases, being the highest value since 2003.

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.

Catch numbers-at-age per unit effort and effort values for the Spanish survey are given in Table 9.1.7. In addition, Figure 9.1.3(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. Only the years used to tune the XSA assessment are represented. 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, presenting a high value above the average of the entire series.

9.1.2.4 Commercial catch-effort data

Fishing effort and LPUE data were available for the period 1986 - 2010 for the Spanish trawlers from A Coruña (SP-CORUTR8c) fishing in Division VIIIc, and for Portuguese trawlers fishing in Division IXa for the period 1988 – 2010 (Table 9.1.8 and Figure 9.1.3(a)). No effort information from the Avilés fleet (SP-AVILESTR) fishing in Division VIIIc is available after 2003.

Commercial fleets used in the assessment to tune the model

Before 1993, A Coruña (SP-CORUTR8c) effort was generally stable, with a decreasing trend observed after that year. The 2010 effort value is the lowest in the series. The LPUE shows relatively high stable values for 1986 – 1992. Since 1998 LPUE has declined, but has increased in 2010.

Avilés (SP-AVILESTR) effort has decreased throughout the whole period to a very low level in 2003. LPUE shows an increasing trend between 1986 and 1990, with a sharp decrease in 1991. Since then, it has had a further upward and downward fluctuation, with a peak in 1997, reaching its lowest value in 2003. No effort data are available for this fleet after 2003.

Landed numbers-at-age per unit effort and effort data for these fleets are given in Table 9.1.7.

Figure 9.1.3(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. Only the years used to tune the XSA are represented. The panel corresponding to A Coruña trawl fleet clearly indicates below average values since about year 2003.

Commercial fleets not used in the assessment to tune the model

Portuguese effort values are quite variable, except in 1999 and 2000 when they are significantly lower (Table 9.1.8 and Figure 9.1.3(a)). 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.

9.1.3 Assessment

An update assessment was conducted, according to the Stock Annex specifications. Assessment years are 1986-2010 and ages 1-7+.

9.1.3.1 Input data

It follows the Stock Annex, incorporating the 2010 landed numbers-at-age and the 2010 indices from A Coruña (SP-CORUTR8c) tuning fleet and the Spanish survey (SpGFS-WIBTS-Q4). The Avilés tuning fleet (SP-AVILESTR) is only available until 2003. See Table 9.1.7.

9.1.3.2 Model

Data screening

The top panel of Figure 9.1.4 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+. Visual inspection of Figures 9.1.3(b) and 9.1.3(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 trawl fleet. These figures also indicate a certain degree of agreement between the three tuning indices.

Final run

XSA settings are the same used last year and are detailed in the Stock Annex.

The retrospective analysis shows a small but consistent pattern of overestimation of recruitment and SSB and underestimation of F in recent years (Figure 9.1.5).

9.1.3.3 Assessment results

As has been the case in the last few years, there were convergence problems with the XSA run. The results presented in this report correspond to a run of 30 iterations, as increasing the number of iterations led to larger total absolute residuals value between iterations.

Diagnostics from the XSA run are presented in Table 9.1.9 and log catchability residuals plotted in Figure 9.1.6. For all tuning fleets the magnitude of the residuals is larger for older ages. The sign of ages 5 and 6 residuals from the SP-CORUTR8c commercial fleet changed from positive to negative at around year 2000. Until 1996 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.

Fishing mortality and population numbers at age from the final XSA run are given in Tables 9.1.10 and 9.1.11, respectively, and summary results presented in Table 9.1.12 and Figure 9.1.7(a).

Fishing mortality is estimated to have dropped considerably in 2009 and 2010, after the local peak reached in 2006, which may be explained by the relatively high landings in that year. The SSB values in 2007-2010 are the lowest in the series. After the second lowest recruitment (at age 1) in the series in 2009, this year presents a high recruitment value similar to those that occurred in the late nineties.

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 9.1.7(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, which are not accounted for in the current assessment, which is based just on landings. 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. In 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+.

9.1.3.4 Year class strength and recruitment estimations

The 2008 year class is estimated to have 1.2 million individuals at 1 year of age based on the information from the Spanish survey (SpGFS-WIBTS-Q4) (61% of weight) and one commercial fleet (SP-CORUTR8c) (19% of weight). P-shrinkage and F-shrinkage contributed 18% and 2% of the weight, respectively. The estimate from the run in the 2010 Working Group was 1.6 million at one year of age.

The 2009 year class is estimated to have 5.3 million fish at 1 year of age, based on the Spanish survey (SpGFS-WIBTS-Q4) (72% of weight), P-shrinkage (23% of the weight) and F shrinkage (5%).

In accordance with the stock annex specifications, GM recruitment is computed over years 1998-2008. 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
2007	1491	XSA	41%	44%	15%
2008	1234	XSA	60%	19%	21%
2009	5338	XSA	73%		27%
2010	2504	GM $_{(98\text{-}08)}$			

9.1.3.5 Historic trends in biomass, fishing mortality and recruitment

From Table 9.1.12 and Figure 9.1.7, we see that SSB decreased from 2576 t in 1990 to 935 t in 1995. From 1996 to 2003, it remained relatively stable at low levels with an average value of around 1100 t. Starting from 2004, SSB is estimated to have been even lower, below 900 t in every year. The values for 2004-2010 are the lowest in the series, with SSB in 2009 (650 t) corresponding to the lowest value. In 2010 the SSB value is 717 t, still very low.

F has declined in recent years from the high levels observed prior to 1995 (Fbar, for ages 2-4, in the range of 0.29-0.45 before 1995) and the high value reached in 1998 (0.38). Fbar increased every year between 2003 and 2006 (Fbar=0.34 in 2006), but has decreased every year since then, reaching in 2010 the lowest value of the entire series at 0.08.

Recruitment (at age 1) varies substantially throughout the time series, but shows a general decline from the high levels seen until the 1991 year class. The 1993 year class is the lowest value in the time series. Since 1998 recruitment has been continuously at low levels (recruitment in 2009 is estimated to be the second lowest value of the series). However, in 2010 a good recruitment appears to have occurred, with a value more similar to those estimated for the previous decade.

9.1.3.6 Catch Options and prognosis

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

9.1.3.7 Short-term projections

The input data for deterministic short-term predictions are shown in Table 9.1.13. The exploitation pattern used was the unscaled average of 2008-2010 (corresponding to Fbar = 0.14, F *status quo*). Management options for catch prediction are in Table 9.1.14. Figure 9.1.8 shows the short-term forecast summary. The detailed output by age group assuming *status quo* F for 2011-2013 is given in Table 9.1.15.

Under *status quo* F, landings in 2011 and 2012 are predicted to be 141 t and 158 t respectively. SSB would increase from the 962 t estimated for 2011 to 1067 t in 2012 and 1125 t in 2013. Hence the 2012 and 2013 SSB values would be comparable to those reached around year 2000. This must result from a combination of the strong 2009 year class (*i.e.* the 2010 age 1 recruitment) and the low *status quo* F value (0.14, below $F_{MSY,}$ which was provisionally set as 0.17 in WGHMM 2010 – see Stock Annex).

The contributions of recent year classes to the predicted landings in 2012 and SSB in 2013, assuming $GM_{98\text{-}08}$ recruitment, are presented in Table 9.1.16. The assumed $GM_{98\text{-}08}$ age 1 recruitment for the 2010 and 2011 year classes contributes 11% to landings in 2012 and 31% to the predicted SSB at the beginning of 2013. Megrim starts to contribute strongly to SSB at 2 years of age (see maturity ogive in Table 9.1.13).

9.1.3.8 Yield and biomass per recruit analysis

The results of the yield- and SSB-per-recruit analyses are in Table 9.1.17 (see also left panel of Figure 9.1.8, which plots yield-per-recruit and SSB-per-recruit versus Fbar). Assuming s*tatus quo* exploitation (Fbar = 0.14) and $GM_{98\text{-}08}$ for recruitment, the equilibrium yield would be around 187 t with an SSB of 1112 t.

9.1.4 Biological reference points

The stock-recruitment time series is plotted in Figure 9.1.9. Most of the high recruitment values are at the beginning, and the first four correspond to years in which a combined ALK was used. Ignoring the first 4 years, both low and high recruitments have been estimated. However, all recruitment values since 1998 have been low, with the only exception of 2010.

See Stock Annex for information about Biological reference points.

WGHMM 2010 was asked to provide an F_{MSY} value for this stock. Possible proxies considered for F_{MSY} were in the range of F_{max}, F0.1 and F35% and F40%. F_{max} is not well defined for this stock, as the yield-per-recruit curve generally shows a very flat top.

In order to establish a proxy, a rough exercise including discards was conducted in WGHMM 2010 (see description and results in the Stock Annex). The following sensitivity table also complemented the discards exercise and has been updated in this WG:

	WG2005	WG2006	WG2007	WG2008	WG2009	WG2010	WG2011
FMax	0.35	0.36	0.38	0.39	0.37	0.32	0.24
F0.1	0.15	0.16	0.16	0.18	0.17	0.14	0.10
F35%	0.21	0.22	0.22	0.23	0.22	0.21	0.18
F40%						0.17	0.14

F_{MSY}=0.17 was preliminarily proposed in WGHMM 2010, corresponding to F40% as calculated in that WG. Even though all biological reference points have been estimated to be lower in WG2011, it seems precipitate to change the 0.17 value proposed as F_{MSY} last year. However, this F_{MSY} value should still be considered as preliminary and is likely to be revised as further work continues on this assessment (particularly when including discards information and developing an assessment model providing uncertainty estimates).

9.1.5 Comments on the assessment

The inclusion of discards in the assessment would be likely to have an influence in the perception of the state of the stock. With the exception of years 2007 for which we get much lower discard estimates, discards in number represent between 10-45% of the total catch and they are thought to be important for younger ages. It is therefore recommended to continue with the collection of discards data to provide annual estimates with a view to incorporate them in the assessment soon.

The behaviour of commercial fleets with regards to landings of age 1 individuals appears to have changed in time. Hence, data from commercial fleets used for tuning is only taken for ages 2 and older. However, the Spanish survey (SpGFS-WIBTS-Q4) provides good information on age 1 abundance.

Comparison of this assessment with the one performed last year shows very similar trends for F, recruitment and SSB (Figure 9.1.10).

The assessment indicates that SSB has been at lower levels since 1991, with a slow but gradually declining trend since 1997. The last years (2004-2010) correspond to the lowest SSB estimates, although SSB is expected to increase during 2010. Both high and low recruitments have been observed during the period of low SSB (recruitments since 1992), although all recruitments between 1998 and 2009 have been low, with the second lowest value in the whole time series in 2009. The 2010 recruitment estimate is considerably higher than in previous years.

Megrim starts to contribute strongly to SSB at 2 years of age. Around 30% of the predicted SSB in 2013 relies on year classes for which recruitment has been assumed to be GM_{98-08}. Additionally, the good 2010 recruitment estimate is contributing strongly to the predicted increase in SSB between 2010 and 2013.

9.1.6 Management considerations.

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

Table. 9.1.1 Megrim (*L. whiffiagonis*) in Divisions VIIIc, IXa. Total landings (t).

	Spain			Portugal	Total
Year	VIIIc	IXa	Total	IXa	VIIIc, IXa
1986	508	98	606	53	659
1987	404	46	450	47	497
1988	657	59	716	101	817
1989	533	45	578	136	714
1990	841	25	866	111	977
1991	494	16	510	104	614
1992	474	5	479	37	516
1993	338	7	345	38	383
1994	440	8	448	31	479
1995	173	20	193	25	218
1996	283	21	305	24	329
1997	298	12	310	46	356
1998	372	8	380	66	446
1999	332	4	336	7	343
2000	238	5	243	10	253
2001	167	2	169	5	175
2002	112	3	115	3	117
2003	113	3	116	17	134
2004	142	1	144	5	149
2005	120	1	121	26	147
2006	173	2	175	35	210
2007	139	2	141	14	155
*2008	114	2	116	17	133
2009	74	2	77	7	84
2010	66	8	74	10	83

* Data revised in WG2010 from original value presented

Table. 9.1.2(a) Megrim (*L. whiffiagonis*) in Divisions VIIIc, IXa. Discard/Total Catch ratio and estimated CV for Spain

Year	1994	1997	1999	2000	2003	2004	2005	2006	2007	2008	2009	2010
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
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
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

*All discard data revised in WG2011

Table. 9.1.2(b) Megrim (*L. whiffiagonis*) in Divisions VIIIc, IXa. Discards in numbers at age (thousands) for Spanish trawlers

	1994	1997	1999	2000	2003	2004	2005	2006	2007	2008	2009	2010
0	104	41	270	27	0	4	20	0	0	0	96	16
1	93	453	471	611	239	164	223	19	11	126	142	119
2	136	857	284	160	57	28	61	108	0	86	21	6
3	51	142	197	73	12	6	38	115		8	15	1
4	3	1	26	19	4	5	11	28		5	7	2
5	1	5	6		0	3	4	13		2	7	0
6		3				2	1	4		0	3	1
7						1	0	0			1	0

Table 9.1.3(a) Megrim (*L. whiffiagonis*) Divisions VIIIc and IXa. Length distribution by ICES area (in thousands).

Length (cm)	Div. VIIIc	Div. IXa	Total
10			
11			
12			
13			
14			
15			
16			
17			
18	0.7	0.1	0.7
19	4.6	0.6	5.2
20	9.8	1.3	11.1
21	12.0	1.6	13.6
22	10.6	2.0	12.6
23	10.4	1.8	12.3
24	24.1	6.5	30.6
25	16.6	3.4	20.0
26	25.7	8.7	34.3
27	33.2	9.7	43.0
28	34.9	8.9	43.7
29	30.6	5.4	36.0
30	21.0	5.6	26.6
31	23.3	6.6	29.9
32	22.4	8.2	30.6
33	17.4	6.3	23.7
34	12.2	2.8	15.0
35	9.5	3.7	13.2
36	7.2	1.9	9.1
37	8.1	2.0	10.1
38	4.6	1.1	5.7
39	3.7	0.8	4.5
40	2.8	0.5	3.4
41	2.8	0.6	3.4
42	1.9	0.4	2.3
43	0.8	0.2	1.0
44	0.3	0.1	0.4
45	0.8	0.1	0.9
46	0.2	0.0	0.2
47	0.3	0.0	0.3
48	0.2	0.1	0.3
49			
50+	0.8	0.6	1.4
Total	353	92	445

Table 9.1.3(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
*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
Mean weight (g)	105	108	129	108	124	121	120	118	119	127	134	124	137	134	137	127	137	148	147	163	187

*Values slightly revised in WGHMM 2011

Table 9.1.4 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Landed numbers at age.

Catch numbers at age Numbers*10**-3

YEAR		1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	*2008	2009	2010
AGE																										
	(*)0	(15)	(0)	(0)	(0)	(8)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
	1	1013	2020	2977	760	4230	1018	1062	519	40	509	198	82	77	20	9	40	31	129	46	123	91	79	7	28	30
	2	1952	2303	3344	1903	2135	2352	392	1703	432	36	1486	1062	882	240	122	305	151	242	236	215	418	161	284	90	33
	3	668	752	1038	678	775	801	677	312	1784	254	37	1011	1205	960	598	300	310	265	205	401	467	232	207	144	52
	4	639	394	738	631	868	690	1120	526	549	620	279	76	881	693	507	244	86	175	242	160	248	297	148	95	110
	5	501	289	530	501	329	643	591	357	624	241	502	362	214	442	361	220	164	80	184	152	170	142	166	73	97
	6	201	80	181	190	376	141	77	102	330	69	147	305	328	105	83	160	80	54	100	86	106	81	60	57	80
+gp		194	71	130	253	558	59	68	36	119	72	81	116	149	207	161	118	37	48	71	41	36	56	35	28	43
TOTALNUM		5168	5909	8938	4916	9271	5704	3987	3555	3878	1801	2733	3014	3735	2667	1841	1387	860	993	1084	1177	1536	1048	907	515	445
TONSLAND		659	497	817	714	977	614	516	383	479	218	329	356	446	343	253	175	117	134	149	147	210	155	133	84	83
SOPCOF %		95	95	95	99	99	100	100	100	100	101	102	100	101	101	101	101	100	101	100	98	100	100	100	100	100

(*) Age 0 was not used in the assessment.
* Data revised in WG2010 from original value presented

Table 9.1.5 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Landed 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
AGE																										
	1	0.045	0.049	0.045	0.051	0.041	0.039	0.034	0.036	0.046	0.06	0.054	0.056	0.046	0.056	0.056	0.058	0.058	0.056	0.0623	0.0610	0.0633	0.0652	0.0587	0.0648	0.0617
	2	0.102	0.084	0.09	0.102	0.098	0.091	0.095	0.08	0.069	0.071	0.088	0.083	0.07	0.07	0.072	0.085	0.082	0.089	0.0850	0.0798	0.0917	0.0884	0.0915	0.0906	0.0938
	3	0.121	0.092	0.103	0.122	0.129	0.108	0.125	0.117	0.1	0.102	0.121	0.102	0.099	0.089	0.094	0.088	0.115	0.116	0.1094	0.1105	0.1228	0.1095	0.119	0.1345	0.1168
	4	0.164	0.143	0.15	0.164	0.166	0.146	0.155	0.147	0.13	0.127	0.128	0.126	0.13	0.119	0.121	0.118	0.119	0.15	0.1297	0.1426	0.1589	0.144	0.1467	0.1603	0.1684
	5	0.216	0.176	0.191	0.224	0.207	0.173	0.209	0.195	0.15	0.165	0.164	0.141	0.155	0.16	0.161	0.148	0.162	0.194	0.1574	0.1647	0.1816	0.1971	0.188	0.1881	0.2029
	6	0.316	0.314	0.29	0.293	0.241	0.252	0.321	0.237	0.19	0.212	0.211	0.199	0.189	0.216	0.215	0.172	0.206	0.252	0.2038	0.1994	0.228	0.236	0.2465	0.2492	0.2277
+gp		0.477	0.415	0.424	0.52	0.369	0.42	0.534	0.538	0.344	0.34	0.354	0.341	0.324	0.296	0.296	0.256	0.388	0.382	0.3197	0.3801	0.3925	0.3657	0.4091	0.408	0.3706
SOPCOFAC		0.9488	0.9495	0.9485	0.9937	0.9855	1.0024	0.9998	1.0029	1.0007	1.0064	1.0197	0.998	1.0078	1.0073	1.0101	1.0073	1.001	1.0059	1.0018	0.9837	0.9999	0.9991	0.9996	1.0009	0.9955

* Data revised in WG2010 from original value presented

Table 9.1.6 Megrim (*L. whiffiagonis*) Divisions VIIIc, IXa.

Abundance and Recruitment indices from Portuguese and Spanish surveys.

	Biomass Index						**Abundance index**					**Recruitment index**		
	Portugal (k/h)			Spain (k/30 min)			Portugal (n/h)		Spain (n/30 min)			**At age 1**	**At age 0**	**At age 1**
												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

+ 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

Table 9.1.7 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Tuning data.

FLT01: SP-CORUTR8c. 1000 Days by 100 HP (thousand) (*)

1986	2010								
1	1	0	1						
1	7							Eff.	
10	34.4	91.2	37.7	45.2	38.7	14.8	8.5	39.8	1986
10	242.1	187.3	62.2	32.6	25.9	9.2	7.5	34.7	1987
10	67.8	215.4	75.8	71.3	54.0	19.0	9.5	42.2	1988
10	12.6	87.8	36.3	46.6	35.8	13.1	8.8	44.4	1989
10	22.1	80.4	48.6	81.3	34.5	36.3	36.5	44.4	1990
10	13.1	107.9	47.0	59.7	61.9	15.1	5.4	40.4	1991
10	5.7	23.7	66.6	144.5	91.3	11.8	10.0	38.9	1992
10	0.2	42.5	20.4	49.2	37.8	9.7	1.6	44.5	1993
10	0.0	3.5	52.5	28.8	42.2	30.1	6.3	39.6	1994
10	51.1	3.2	15.4	33.6	12.1	3.3	2.3	41.5	1995
10	1.2	54.7	2.7	17.6	46.7	14.7	8.6	35.7	1996
10	0.9	32.6	49.7	5.0	25.4	23.6	8.1	35.2	1997
10	0.5	15.3	42.5	52.9	15.0	30.9	13.9	32.6	1998
10	0.7	7.9	40.4	42.5	35.0	9.7	19.5	30.2	1999
10	1.2	5.5	36.8	50.8	48.6	12.3	14.4	30.1	2000
10	1.9	18.3	18.4	22.1	23.7	19.3	13.5	29.9	2001
10	1.7	10.6	35.9	9.9	27.1	14.3	5.6	21.8	2002
10	20.2	15.0	15.6	15.7	9.5	7.8	6.7	18.5	2003
10	1.4	7.5	8.5	12.8	12.1	9.0	8.4	21.1	2004
10	3.9	8.4	18.6	8.5	9.1	5.6	3.8	20.7	2005
10	2.2	11.6	16.1	11.3	8.6	6.2	2.5	19.3	2006
10	7.8	11.7	13.2	16.9	10.2	6.1	4.9	21.2	2007
10	0.1	14.2	13.1	9.7	10.6	3.6	2.4	20.2	2008
10	4.2	12.0	15.7	8.8	6.1	4.1	2.0	16.2	2009
10	1.1	4.8	8.3	17.4	16.8	12.4	7.0	13.7	2010

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

1986	2003								
1	1	0	1						
1	7							Eff.	
10	251	317	263	128	112	94	56	10.8	1986
10	410	327	355	168	101	117	39	8.3	1987
10	1177	731	605	288	125	156	69	9.0	1988
10	750	461	484	227	130	156	61	8.1	1989
10	3704	805	191	147	39	42	60	8.5	1990
10	870	759	203	89	74	13	7	7.7	1991
10								0.0	1992
10	544	705	43	47	25	12	9	7.6	1993
10	17	154	479	119	116	45	21	9.6	1994
10	34	2	36	117	58	22	12	6.1	1995
10	117	689	12	101	223	64	54	4.5	1996
10	88	812	573	31	141	118	43	4.7	1997
10	18	349	424	263	59	79	43	5.4	1998
10	10	105	382	252	156	36	67	6.8	1999
10	25	48	210	201	128	31	46	4.5	2000
10	43	234	226	142	135	98	100	1.8	2001
10	46	132	199	54	78	45	39	2.7	2002
10	23	76	95	63	28	22	25	2.5	2003

FLT03: SpGFS-WIBTS-Q4 (n/30 min)

1988	2010								
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	127	2010

* **Age 1 excluded in this year assessment for SP-CORUTR8c and SP-AVILESTR fleets.**

Table 9.1.8 Megrim (*L. whiffiagonis*). LPUE data by fleet in Divisions VIIIc and IXa.

	A Coruña Trawl in VIIIc			Avilés Trawl in VIIIc			Portugal trawl in IXa		
Year	Landings (t)	Effort	LPUE [1]	Landings (t)	Effort	LPUE [1]	Landings (t)	Effort	LPUE [2]
1986	156	39.8	3.92	141	10.8	13.04			
1987	155	34.7	4.47	102	8.3	12.23			
1988	263	42.2	6.24	180	9.0	19.94	74.9	38.5	1.95
1989	196	44.4	4.41	143	8.1	17.75	92.2	44.7	2.06
1990	270	44.4	6.08	266	8.5	31.33	86.0	39.0	2.20
1991	211	40.4	5.22	102	7.7	13.28	85.5	45.0	1.90
1992	255	38.9	6.55	56	na		32.6	50.9	0.64
1993	121	44.5	2.72	67	7.6	8.76	31.7	44.2	0.72
1994	108	39.6	2.73	96	9.6	9.95	25.8	45.8	0.56
1995	28	41.5	0.67	50	6.1	8.16	21.4	37.0	0.58
1996	72	35.7	2.01	67	4.5	14.72	22.2	46.5	0.48
1997	75	35.2	2.12	83	4.7	17.70	41.5	33.4	1.24
1998	90	32.6	2.78	74	5.4	13.78	60.1	43.1	1.39
1999	73	30.2	2.40	83	6.8	12.21	4.3	25.3	0.17
2000	79	30.1	2.63	41	4.5	9.26	6.9	27.0	0.25
2001	49	29.9	1.65	24	1.8	13.01	1.3	43.1	0.03
2002*	36	21.8	1.66	21	2.7	7.78	1.0	31.2	0.03
2003*	25	18.5	1.36	13	2.5	5.06	15.3	40.5	0.38
2004	22	21.1	1.06	27	na		3.4	35.4	0.10
2005	18	20.7	0.88	35	na		19.0	42.6	0.45
2006	18	19.3	0.94	29	na		26.3	40.3	0.65
2007**	23	21.2	1.10	12	na		10.5	43.8	0.24
2008**	17	20.2	0.82	11	na		14.4	38.4	0.37
2009	12	16.2	0.76	12	na		6.0	49.3	0.12
2010	19	13.7	1.37	25	na		7.3	48.0	0.15

[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

Table 9.1.9. Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Tuning diagnostic.

Lowestoft VPA Version 3.1

28/04/2011 12:22

Extended Survivors Analysis

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

CPUE data from file fleetw.txt

Catch data for 25 years. 1986 to 2010. Ages 1 to 7.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
SP-CORUTR8c	1990	2010	2	6	0	1
SP-AVILESTR	1990	2010	2	6	0	1
SpGFS-WIBTS-Q4	1990	2010	1	6	0.75	0.83

Time series weights :

Tapered time weighting not applied

Catchability analysis :

Catchability dependent on stock size for ages < 5

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

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 30 iterations

Total absolute residual between iterations
29 and 30 = .00680

Final year F values

Age	1	2	3	4	5	6
Iteration 29	0.0063	0.0379	0.0653	0.1256	0.2208	0.3454
Iteration 30	0.0062	0.0377	0.065	0.125	0.2188	0.3417

Regression weights

1	1	1	1	1	1	1	1	1	1

Fishing mortalities

Age	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1	0.016	0.014	0.054	0.018	0.059	0.05	0.034	0.005	0.025	0.006
2	0.143	0.076	0.149	0.133	0.109	0.288	0.117	0.166	0.085	0.038
3	0.311	0.212	0.186	0.182	0.348	0.364	0.257	0.217	0.119	0.065
4	0.224	0.137	0.177	0.259	0.211	0.379	0.417	0.259	0.146	0.125
5	0.253	0.231	0.182	0.287	0.258	0.363	0.39	0.435	0.196	0.219
6	0.3	0.137	0.111	0.364	0.21	0.288	0.293	0.282	0.259	0.342

XSA population numbers (Thousands)

YEAR	AGE 1	2	3	4	5	6
2001	2.82E+03	2.53E+03	1.24E+03	1.34E+03	1.09E+03	6.83E+02
2002	2.40E+03	2.27E+03	1.80E+03	7.44E+02	8.78E+02	6.92E+02
2003	2.70E+03	1.93E+03	1.72E+03	1.19E+03	5.31E+02	5.70E+02
2004	2.87E+03	2.10E+03	1.36E+03	1.17E+03	8.16E+02	3.63E+02
2005	2.39E+03	2.31E+03	1.50E+03	9.31E+02	7.40E+02	5.02E+02
2006	2.06E+03	1.85E+03	1.69E+03	8.68E+02	6.18E+02	4.68E+02
2007	2.59E+03	1.61E+03	1.13E+03	9.63E+02	4.86E+02	3.52E+02
2008	1.49E+03	2.05E+03	1.17E+03	7.18E+02	5.20E+02	2.70E+02
2009	1.23E+03	1.21E+03	1.42E+03	7.71E+02	4.54E+02	2.76E+02
2010	5340	985	913	1030	546	305

Estimated population abundance at 1st Jan 2011

0	4360	780	704	751	362

Taper weighted geometric mean of the VPA populations:

4120	3150	2180	1420	835	416

Standard error of the weighted Log(VPA populations) :

0.7296	0.6846	0.5324	0.4547	0.375	0.4142

Log catchability residuals.

Fleet : SP-CORUTR8c

Age	1990
1	No data for this fleet at this age
2	0.42
3	0.06
4	0.12
5	0.47
6	0.28

Age	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1	No data for this fleet at this age									
2	0.85	0.27	-0.15	-1.19	-0.22	0.36	-0.2	-0.59	-0.64	-0.29
3	-0.14	0.43	-0.12	-0.11	-0.32	-0.63	-0.08	-0.22	-0.06	0.24
4	0.1	0.38	0.13	0.1	-0.26	-0.22	-0.06	-0.09	-0.22	0.04
5	0.93	1.42	0.31	0.84	-0.38	0.21	0.03	0.36	0.21	0.32
6	0.4	0.19	0.17	1.09	-0.53	0.32	0.83	1.47	1.12	-0.22

Age	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1	No data for this fleet at this age									
2	0.22	-0.12	0.34	-0.28	-0.3	0.24	0.32	0.24	0.61	0.1
3	0.36	0.43	-0.13	-0.32	0.19	-0.03	0.2	0.15	0.05	0.03
4	-0.06	0.1	-0.13	-0.2	-0.19	0.07	0.18	0.15	0.01	0.05
5	-0.33	0	-0.56	-0.71	-0.91	-0.73	-0.31	-0.32	-0.84	-0.01
6	-0.05	-0.44	-0.87	-0.15	-1.02	-0.82	-0.55	-0.82	-0.71	0.33

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

Age	5	6
Mean Log q	-5.5765	-5.5765
S.E(Log q)	0.6147	0.718

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	0.77	1.362	7.47	0.65	21	0.48	-7.34
3	0.71	2.552	6.88	0.8	21	0.27	-6.59
4	0.51	5.817	6.63	0.88	21	0.17	-6.1

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
5	0.52	2.607	6.09	0.61	21	0.28	-5.58
6	1.13	-0.298	5.52	0.22	21	0.83	-5.58
1							

Fleet : SP-AVILESTR

Age	1990
1	No data for this fleet at this age
2	-0.09
3	-0.19
4	-0.1
5	-0.65
6	-0.8

Age	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1	No data for this fleet at this age									
2	0.07	99.99	-0.2	0.08	-0.62	-0.06	0.02	-0.13	-0.12	0.17
3	-0.34	99.99	-0.63	0.11	-0.74	-0.38	0.29	0.08	0.22	0.23
4	-0.36	99.99	-0.72	0.25	-0.22	0.01	-0.09	0.36	0.3	0.28
5	-0.12	99.99	-1.34	0.62	-0.04	0.67	0.51	0.49	0.47	0.05
6	-0.98	99.99	-0.86	0.26	0.12	0.83	1.2	1.16	1.21	-0.52

Age	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1	No data for this fleet at this age									
2	0.41	0.27	0.22	99.99	99.99	99.99	99.99	99.99	99.99	99.99
3	0.9	0.43	0.02	99.99	99.99	99.99	99.99	99.99	99.99	99.99
4	0.34	0.14	-0.2	99.99	99.99	99.99	99.99	99.99	99.99	99.99
5	0.19	-0.16	-0.7	99.99	99.99	99.99	99.99	99.99	99.99	99.99
6	0.36	-0.52	-1.06	99.99	99.99	99.99	99.99	99.99	99.99	99.99

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

Age	5	6
Mean Log q	-4.3429	-4.3429
S.E(Log q)	0.6019	0.8736

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	0.4	4.994	6.9	0.86	13	0.27	-5.04
3	0.59	1.579	6.02	0.58	13	0.47	-4.8
4	0.77	0.999	5.31	0.64	13	0.34	-4.72

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
5	0.83	0.373	4.77	0.29	13	0.52	-4.34
6	2.79	-1.331	1.18	0.05	13	2.36	-4.31

Fleet : SpGFS-WIBTS-Q4

Age	1990
1	-0.31
2	0.02
3	0.04
4	0.27
5	0.36
6	0.18

Age	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
1	-0.45	-0.14	-0.02	-0.98	-0.23	0.06	-0.08	-0.02	0.24	0.71
2	-0.3	-0.48	0.01	-0.79	-0.52	-0.05	0.05	-0.11	0.36	0.6
3	-0.74	-0.33	-0.76	0.15	-0.92	-0.64	-0.02	0.16	0.35	0.37
4	-0.1	-0.05	-0.06	0.04	-0.28	-0.33	-0.11	-0.11	-0.05	0.33
5	0.03	0.4	-0.32	0.24	-0.06	-0.16	-0.03	0.04	0.23	0.33
6	-0.6	-0.74	-0.71	-0.16	-0.34	0.12	0.13	1.21	1.52	-0.01

Age	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1	0.15	0.44	0.19	0.1	0.39	0.06	0.21	-0.35	-0.22	0.22
2	0.6	0.43	0.13	0.23	-0.01	0.23	0.03	0.12	-0.19	-0.34
3	0.25	0.76	0.14	0.19	0.54	0.23	0.4	0.31	0.22	-0.69
4	0.32	-0.34	-0.1	0.06	0.33	0.09	0.31	-0.06	0.15	-0.29
5	0.04	0.1	-0.41	-0.32	0.43	0.11	0.11	-0.21	-0.5	-0.41
6	-0.41	-0.73	-1.23	0.36	-0.19	-0.04	-0.08	-0.71	-0.24	0.23

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

Age	5	6
Mean Log q	-6.2192	-6.2192
S.E(Log q)	0.2817	0.6485

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	3.802	7.65	0.77	21	0.37	-7.2
2	0.64	2.834	7.29	0.76	21	0.37	-6.94
3	0.78	1.02	6.96	0.54	21	0.49	-6.79
4	0.72	2.454	6.67	0.8	21	0.23	-6.47

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
5	0.74	2.024	6.33	0.76	21	0.19	-6.22
6	1.6	-1.131	6.54	0.16	21	1.01	-6.34

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 2009

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c	1	0	0	0	0	0	0
SP-AVILESTR	1	0	0	0	0	0	0
SpGFS-WIBTS-Q4	5414	0.384	0	0	1	0.723	0.005
P shrinkage mean	3148	0.68				0.229	0.009
F shrinkage mean	768	1.5				0.048	0.035

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
4357	0.33	0.35	3	1.08	0.006

Age 2 Catchability dependent on age and year class strength

Year class = 2008

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c	860	0.51	0	0	1	0.191	0.034
SP-AVILESTR	1	0	0	0	0	0	0
SpGFS-WIBTS-Q4	587	0.285	0.059	0.21	2	0.604	0.05
P shrinkage mean	2177	0.53				0.182	0.014
F shrinkage mean	180	1.5				0.023	0.154

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
780	0.22	0.29	5	1.291	0.038

Age 3 Catchability dependent on age and year class strength

Year class = 2007

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c	826	0.249	0.248	1	2	0.435	0.055
SP-AVILESTR	1	0	0	0	0	0	0
SpGFS-WIBTS-Q4	489	0.25	0.134	0.54	3	0.411	0.092
P shrinkage mean	1423	0.45				0.141	0.033
F shrinkage mean	157	1.5				0.013	0.262

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
704	0.16	0.19	7	1.159	0.065

Age 4 Catchability dependent on age and year class strength

Year class = 2006

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c	799	0.155	0.037	0.24	3	0.496	0.117
SP-AVILESTR	1	0	0	0	0	0	0
SpGFS-WIBTS-Q4	687	0.169	0.137	0.81	4	0.397	0.135
P shrinkage mean	835	0.38				0.101	0.113
F shrinkage mean	303	1.5				0.006	0.284

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
751	0.11	0.07	9	0.608	0.125

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

Year class = 2005

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c	382	0.151	0.055	0.36	4	0.474	0.207
SP-AVILESTR	1	0	0	0	0	0	0
SpGFS-WIBTS-Q4	347	0.147	0.129	0.88	5	0.518	0.225
F shrinkage mean	224	1.5				0.007	0.33

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
362	0.11	0.07	10	0.656	0.219

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

Year class = 2004

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c	197	0.151	0.136	0.91	5	0.473	0.312
SP-AVILESTR	1	0	0	0	0	0	0
SpGFS-WIBTS-Q4	162	0.149	0.146	0.98	6	0.516	0.37
F shrinkage mean	494	1.5				0.011	0.137

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
180	0.11	0.1	12	0.948	0.342

Table 9.1.10. Megrim (*L. whiffiagonis*) Div. VIIIc and IXa. Estimates of fisihing mortality at age.

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

At 28/04/2011 12:26

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR	1986	1987	1988	1989	1990
AGE					
1	0.1322	0.2042	0.3638	0.092	0.4875
2	0.3307	0.4982	0.6125	0.4195	0.4015
3	0.2487	0.2039	0.4393	0.2348	0.3001
4	0.453	0.2274	0.3162	0.5269	0.5341
5	0.7989	0.3805	0.544	0.3687	0.5829
6	0.5047	0.2726	0.4373	0.3806	0.5255
+gp	0.5047	0.2726	0.4373	0.3806	0.5255
FBAR 2- 4	0.3441	0.3098	0.456	0.3937	0.4119

Table 8 Fishing mortality (F) at age

YEAR	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
AGE										
1	0.2712	0.1217	0.1465	0.0354	0.0691	0.0285	0.0145	0.0224	0.0109	0.0032
2	0.5564	0.1584	0.2923	0.1748	0.0404	0.2943	0.2103	0.2126	0.0902	0.0853
3	0.2567	0.3034	0.1826	0.5699	0.1476	0.0532	0.3346	0.392	0.3781	0.3388
4	0.479	0.6928	0.41	0.563	0.3946	0.24	0.1473	0.5497	0.4112	0.3516
5	1.0179	1.0294	0.4927	1.3256	0.5197	0.6508	0.5618	0.7894	0.5961	0.3909
6	0.5347	0.2991	0.4769	1.2693	0.4674	0.7089	1.1412	1.7969	1.2743	0.2069
+gp	0.5347	0.2991	0.4769	1.2693	0.4674	0.7089	1.1412	1.7969	1.2743	0.2069
FBAR 2- 4	0.4307	0.3849	0.295	0.4359	0.1942	0.1958	0.2307	0.3848	0.2932	0.2586

Table 8 Fishing mortality (F) at age

YEAR	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	FBAR 08-10
AGE											
1	0.0158	0.0144	0.0542	0.0179	0.0585	0.0499	0.0342	0.0052	0.0254	0.0062	0.0123
2	0.1429	0.0763	0.1489	0.1329	0.1088	0.288	0.1173	0.166	0.0854	0.0377	0.0964
3	0.3111	0.2116	0.1863	0.1816	0.3485	0.3637	0.2565	0.2174	0.1186	0.065	0.1337
4	0.2244	0.1367	0.1773	0.2593	0.2105	0.3793	0.4165	0.2586	0.1463	0.125	0.1766
5	0.2527	0.2313	0.182	0.2866	0.2576	0.3626	0.3895	0.435	0.1958	0.2188	0.2832
6	0.2997	0.1366	0.1106	0.3635	0.21	0.288	0.2934	0.2821	0.2595	0.3417	0.2944
+gp	0.2997	0.1366	0.1106	0.3635	0.21	0.288	0.2934	0.2821	0.2595	0.3417	
FBAR 2- 4	0.2261	0.1415	0.1708	0.1913	0.2226	0.3437	0.2634	0.214	0.1168	0.0759	

Table 9.1.11. Megrim (*L. whiffiagonis*) Div. VIIIc and IXa. Estimates of stocks numbers at age

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

At 28/04/2011 12:26

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
AGE					
1	9042	12089	10788	9555	12115
2	7661	6487	8069	6138	7135
3	3353	4506	3227	3581	3304
4	1939	2141	3009	1703	2318
5	1006	1009	1396	1795	823
6	561	371	565	663	1017
+gp	536	327	402	876	1493
TOTAL	24097	26928	27455	24312	28206

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

YEAR	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
AGE										
1	4737	10243	4209	1271	8430	7779	6308	3840	2037	3102
2	6092	2957	7426	2976	1004	6442	6189	5090	3074	1650
3	3910	2859	2066	4539	2046	790	3929	4107	3370	2300
4	2004	2476	1728	1409	2102	1445	613	2302	2272	1890
5	1113	1016	1014	939	657	1160	931	433	1088	1233
6	376	329	297	507	204	320	495	435	161	491
+gp	156	289	104	179	211	174	185	192	311	947
TOTAL	18387	20170	16844	11821	14655	18109	18651	16399	12312	11612

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

YEAR	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	GMST 98-08
AGE												
1	2819	2396	2703	2867	2391	2065	2593	1491	1234	5338	0	2504
2	2531	2272	1934	2096	2305	1846	1608	2052	1215	985	4357	
3	1240	1796	1723	1364	1502	1693	1133	1171	1423	913	780	
4	1342	744	1190	1171	931	868	963	718	771	1035	704	
5	1089	878	531	816	740	618	486	520	454	546	751	
6	683	692	570	363	502	468	352	270	276	305	362	
+gp	500	319	505	255	238	158	242	156	135	163	275	
TOTAL	10204	9097	9156	8932	8609	7716	7378	6378	5506	9285	7229	

Table 9.1.12 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 28/04/2011 12:26

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	9042	2562	2215	659	0.2975	0.3441
1987	12089	2287	1842	497	0.2698	0.3098
1988	10788	2596	2203	817	0.3708	0.456
1989	9555	2882	2498	714	0.2859	0.3937
1990	12115	2973	2576	977	0.3793	0.4119
1991	4737	1807	1629	614	0.3769	0.4307
1992	10243	1843	1585	516	0.3256	0.3849
1993	4209	1565	1406	383	0.2724	0.295
1994	1271	1200	1141	479	0.42	0.4359
1995	8430	1276	935	218	0.2331	0.1942
1996	7779	1587	1253	329	0.2626	0.1958
1997	6308	1638	1353	356	0.2631	0.2307
1998	3840	1450	1298	446	0.3436	0.3848
1999	2037	1200	1103	343	0.3108	0.2932
2000	3102	1322	1195	253	0.2117	0.2586
2001	2819	1053	923	175	0.1895	0.2261
2002	2396	1029	919	117	0.1274	0.1415
2003	2703	1142	1024	134	0.1308	0.1708
2004	2867	941	806	149	0.185	0.1913
2005	2391	941	826	147	0.1779	0.2226
2006	2065	927	824	210	0.255	0.3437
2007	2593	841	716	155	0.2166	0.2634
2008	1491	748	672	133	0.198	0.214
2009	1234	714	650	84	0.1292	0.1168
2010	5338	943	717	83	0.1158	0.0759
Arith. Mean	5258	1499	1292	360	0.2539	0.2794
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		

Table 9.1.13. Megrim (*L. whiffiagonis*) in Division VIIIc, IXa. Prediction with management option table: Input data

MFDP version 1a
Run: meg
Time and date: 20:39 29/04/2011
Fbar age range: 2-4

Age	2011	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
	1	2504	0.2	0.34	0	0	0.062	0.012	0.062
	2	4357	0.2	0.9	0	0	0.092	0.096	0.092
	3	780	0.2	1	0	0	0.123	0.134	0.123
	4	704	0.2	1	0	0	0.158	0.177	0.158
	5	751	0.2	1	0	0	0.193	0.283	0.193
	6	362	0.2	1	0	0	0.241	0.294	0.241
	7	275	0.2	1	0	0	0.396	0.294	0.396

Age	2012	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
	1	2504	0.2	0.34	0	0	0.062	0.012	0.062
	2	.	0.2	0.9	0	0	0.092	0.096	0.092
	3	.	0.2	1	0	0	0.123	0.134	0.123
	4	.	0.2	1	0	0	0.158	0.177	0.158
	5	.	0.2	1	0	0	0.193	0.283	0.193
	6	.	0.2	1	0	0	0.241	0.294	0.241
	7	.	0.2	1	0	0	0.396	0.294	0.396

Age	2013	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
	1	2504	0.2	0.34	0	0	0.062	0.012	0.062
	2	.	0.2	0.9	0	0	0.092	0.096	0.092
	3	.	0.2	1	0	0	0.123	0.134	0.123
	4	.	0.2	1	0	0	0.158	0.177	0.158
	5	.	0.2	1	0	0	0.193	0.283	0.193
	6	.	0.2	1	0	0	0.241	0.294	0.241
	7	.	0.2	1	0	0	0.396	0.294	0.396

Input units are thousands and kg - output in tonnes

Table 9.1.14. Megrim (*L. whiffiagonis*) in Div. VIIIc and IXa catch forecast: management option table

MFDP version 1a
Run: meg
Megrim (L. whiffiagonis.) in Divisions VIIIc and IXa
Time and date: 20:39 29/04/2011
Fbar age range: 2-4

2011				
Biomass	SSB	FMult	FBar	Landings
1104	962	1	0.1356	141

2012					2013	
Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
1188	1067	0	0	0	1428	1307
.	1067	0.1	0.0136	17	1408	1287
.	1067	0.2	0.0271	34	1388	1267
.	1067	0.3	0.0407	51	1369	1248
.	1067	0.4	0.0542	67	1350	1230
.	1067	0.5	0.0678	83	1332	1211
.	1067	0.6	0.0813	99	1314	1193
.	1067	0.7	0.0949	114	1296	1176
.	1067	0.8	0.1084	129	1279	1159
.	1067	0.9	0.122	144	1262	1142
.	1067	1	0.1356	158	1246	1125
.	1067	1.1	0.1491	172	1230	1109
.	1067	1.2	0.1627	186	1214	1093
.	1067	1.3	0.1762	200	1198	1078
.	1067	1.4	0.1898	213	1183	1063
.	1067	1.5	0.2033	226	1168	1048
.	1067	1.6	0.2169	239	1154	1033
.	1067	1.7	0.2304	251	1139	1019
.	1067	1.8	0.244	264	1126	1005
.	1067	1.9	0.2576	276	1112	991
.	1067	2	0.2711	288	1098	978

Input units are thousands and kg - output in tonnes

Table 9.1.15. Megrim (L. whiffiagonis) in Divisions VIIIc and IXa. Single option prediction: Detail Tables.

MFDP version 1a
Run: meg
Time and date: 20:39 29/04/2011
Fbar age range: 2-4

Year:	2011	F multiplier:	1	Fbar:	0.1356				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0.0123	28	2	2504	155	851	53	851	53
2	0.0964	363	33	4357	401	3921	361	3921	361
3	0.1337	89	11	780	96	780	96	780	96
4	0.1766	104	16	704	112	704	112	704	112
5	0.2832	169	33	751	145	751	145	751	145
6	0.2944	84	20	362	87	362	87	362	87
7	0.2944	64	25	275	109	275	109	275	109
Total		900	141	9733	1104	7645	962	7645	962

Year:	2012	F multiplier:	1	Fbar:	0.1356				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0.0123	28	2	2504	155	851	53	851	53
2	0.0964	169	16	2025	186	1823	168	1823	168
3	0.1337	368	45	3239	400	3239	400	3239	400
4	0.1766	82	13	559	89	559	89	559	89
5	0.2832	108	21	483	93	483	93	483	93
6	0.2944	108	26	463	112	463	112	463	112
7	0.2944	90	36	389	154	389	154	389	154
Total		953	158	9662	1188	7807	1067	7807	1067

Year:	2013	F multiplier:	1	Fbar:	0.1356				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0.0123	28	2	2504	155	851	53	851	53
2	0.0964	169	16	2025	186	1823	168	1823	168
3	0.1337	171	21	1506	186	1506	186	1506	186
4	0.1766	342	54	2320	368	2320	368	2320	368
5	0.2832	86	17	383	74	383	74	383	74
6	0.2944	69	17	298	72	298	72	298	72
7	0.2944	121	48	519	206	519	206	519	206
Total		985	174	9556	1246	7701	1125	7701	1125

Input units are thousands and kg - output in tonnes

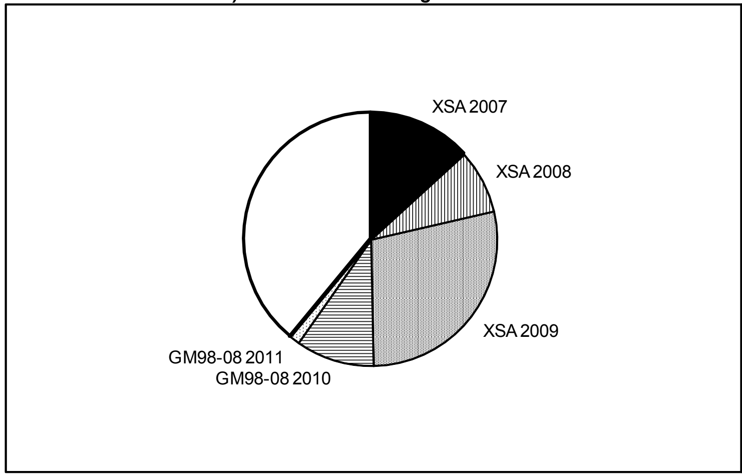
Table 9.1.16 Megrim (L. whiffiagonis) in Divisions VIIIc and IXa
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class	2007	2008	2009	2010	2011
Stock No. (thousands) of 1 year-olds	1491	1234	5338	2504	2504
Source	XSA	XSA	XSA	GM98-08	GM98-08
Status Quo F:					
% in 2011 landings	11.4	7.9	23.6	1.4	-
% in 2012	13.2	8.2	28.3	10.1	1.3
% in 2011 SSB	11.6	10.0	37.5	5.5	-
% in 2012 SSB	8.7	8.3	37.4	15.7	5.0
% in 2013 SSB	6.4	6.6	32.7	16.5	14.9

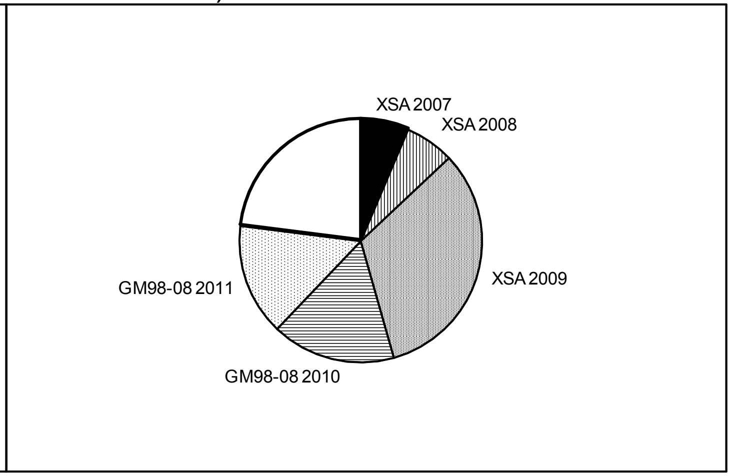
GM : geometric mean recruitment

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

a) 2012 landings



b) 2013 SSB



XSA 2007	XSA 2008	XSA 2009	GM98-08 2010	GM98-08 2011

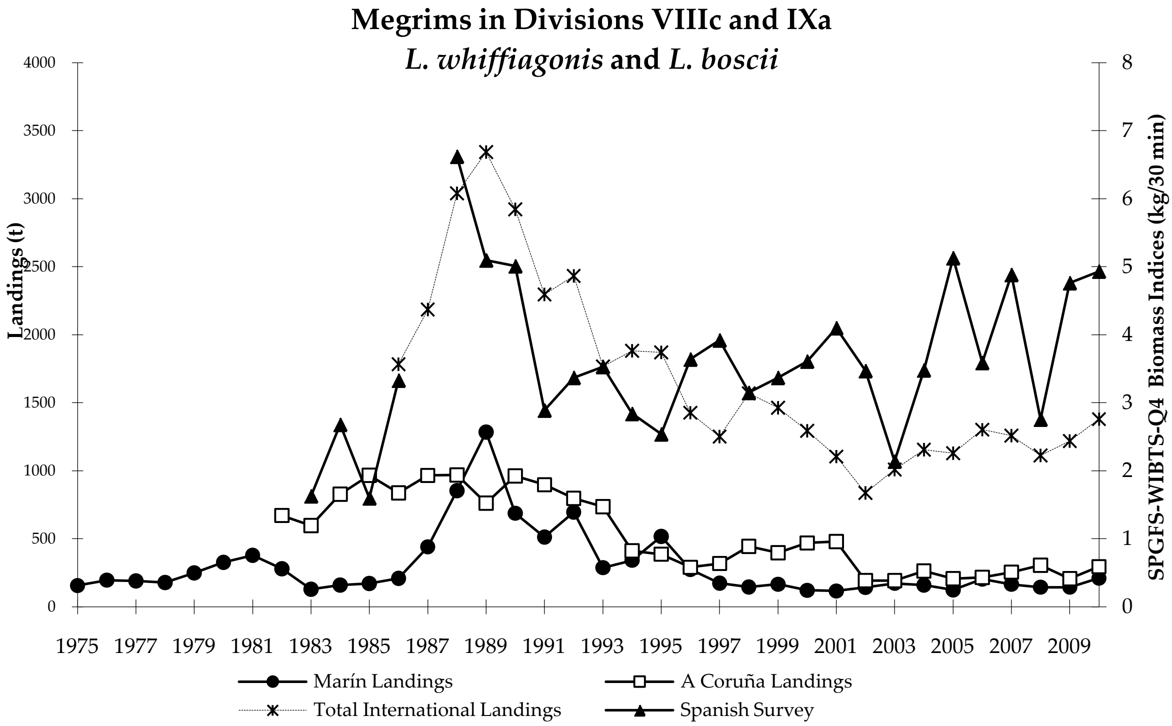
Table 9.1.17. Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa, yield per recruit results.

MFYPR version 2a
Run: meg
Time and date: 15:59 30/04/2011
Yield per results

FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0	0.0000	0.0000	0.0000	5.5167	1.1400	4.7748	1.0917	4.7748	1.0917
0.1	0.0136	0.0796	0.0212	5.1200	0.9960	4.3783	0.9477	4.3783	0.9477
0.2	0.0271	0.1419	0.0362	4.8103	0.8858	4.0686	0.8376	4.0686	0.8376
0.3	0.0407	0.1920	0.0470	4.5609	0.7991	3.8193	0.7508	3.8193	0.7508
0.4	0.0542	0.2334	0.0550	4.3551	0.7292	3.6136	0.6809	3.6136	0.6809
0.5	0.0678	0.2683	0.0610	4.1820	0.6717	3.4406	0.6235	3.4406	0.6235
0.6	0.0813	0.2982	0.0654	4.0339	0.6238	3.2927	0.5756	3.2927	0.5756
0.7	0.0949	0.3241	0.0688	3.9055	0.5833	3.1644	0.5350	3.1644	0.5350
0.8	0.1084	0.3469	0.0713	3.7929	0.5486	3.0518	0.5004	3.0518	0.5004
0.9	0.1220	0.3671	0.0732	3.6930	0.5186	2.9520	0.4704	2.9520	0.4704
1	0.1356	0.3852	0.0746	3.6037	0.4924	2.8628	0.4442	2.8628	0.4442
1.1	0.1491	0.4015	0.0757	3.5231	0.4694	2.7824	0.4213	2.7824	0.4213
1.2	0.1627	0.4163	0.0764	3.4501	0.4491	2.7094	0.4009	2.7094	0.4009
1.3	0.1762	0.4299	0.0770	3.3833	0.4310	2.6428	0.3828	2.6428	0.3828
1.4	0.1898	0.4423	0.0773	3.3221	0.4147	2.5816	0.3666	2.5816	0.3666
1.5	0.2033	0.4538	0.0776	3.2656	0.4001	2.5252	0.3520	2.5252	0.3520
1.6	0.2169	0.4645	0.0777	3.2132	0.3869	2.4729	0.3387	2.4729	0.3387
1.7	0.2304	0.4744	0.0778	3.1645	0.3748	2.4243	0.3267	2.4243	0.3267
1.8	0.2440	0.4837	0.0778	3.1190	0.3638	2.3789	0.3157	2.3789	0.3157
1.9	0.2576	0.4924	0.0777	3.0763	0.3537	2.3364	0.3056	2.3364	0.3056
2	0.2711	0.5006	0.0777	3.0363	0.3444	2.2964	0.2963	2.2964	0.2963

Reference point	F multiplier	Absolute F
Fbar(2-4)	1	0.1356
FMax	1.7481	0.237
F0.1	0.7483	0.1014
F35%SPR	1.3042	0.1768
Flow	0.6765	0.0917
Fmed	1.5438	0.2093
Fhigh	7.1072	0.9634

Weights in kilograms



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

Figure 9.1.1 Historical landings and biomass indices of Spanish survey of megrims (both species combined).

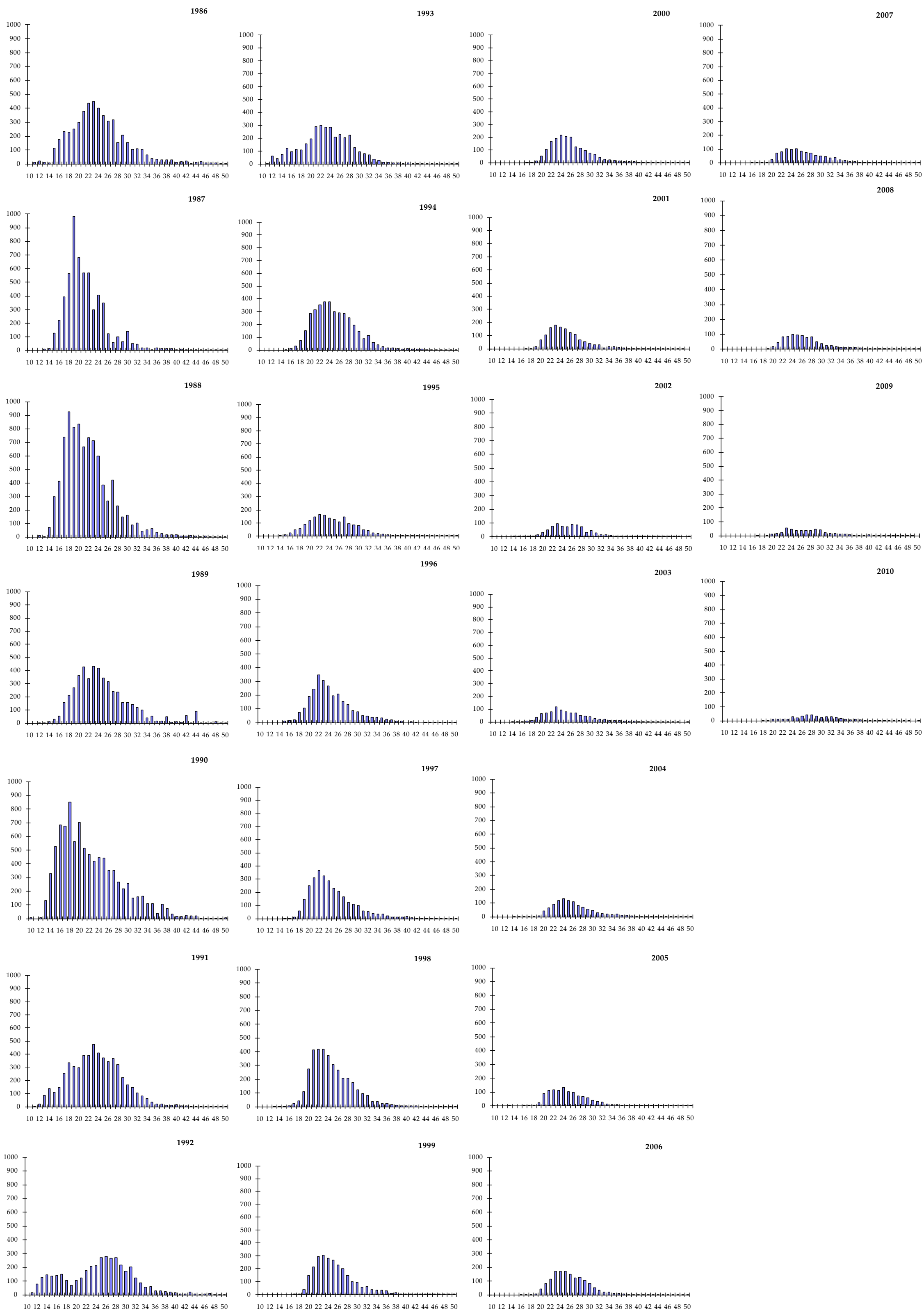
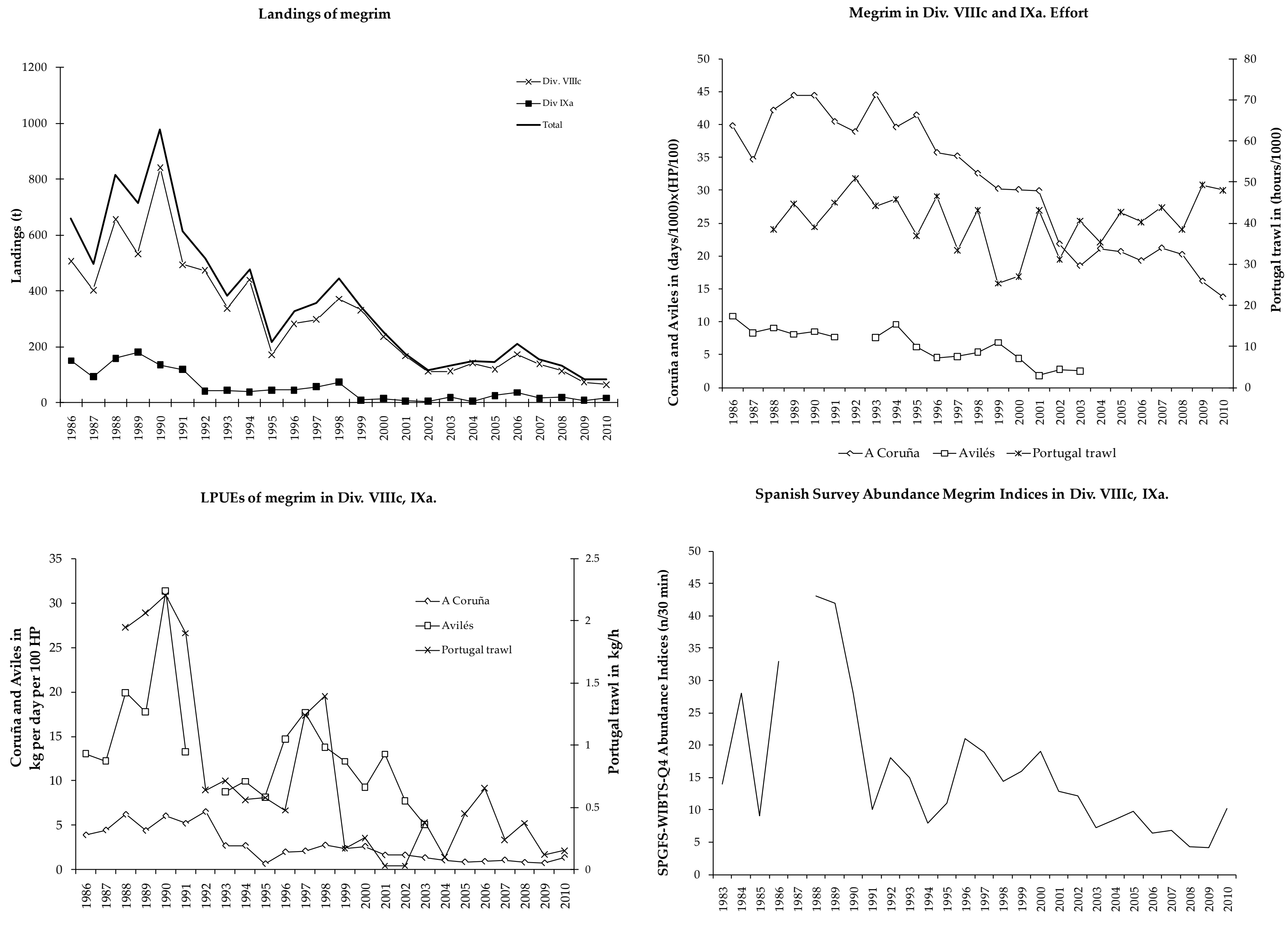


Figure 9.1.2 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Annual length compositions of landings ('000)



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 9.1.3(a) Megrim (*L.whiffiagonis*) in Divisions VIIIc, IXa. Landings (t), Efforts, LPUEs and Abundance Indices.

Standardized log (abundance index at age) from survey SpGFS-WIBTS-Q4

(black bubbles means <0)

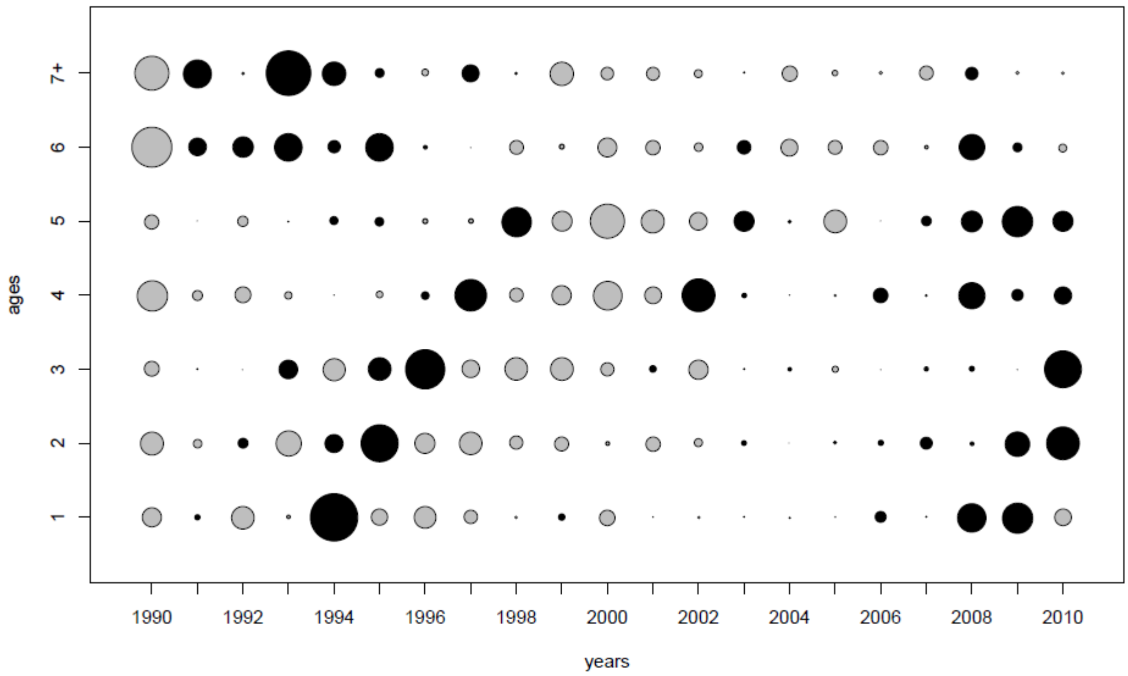
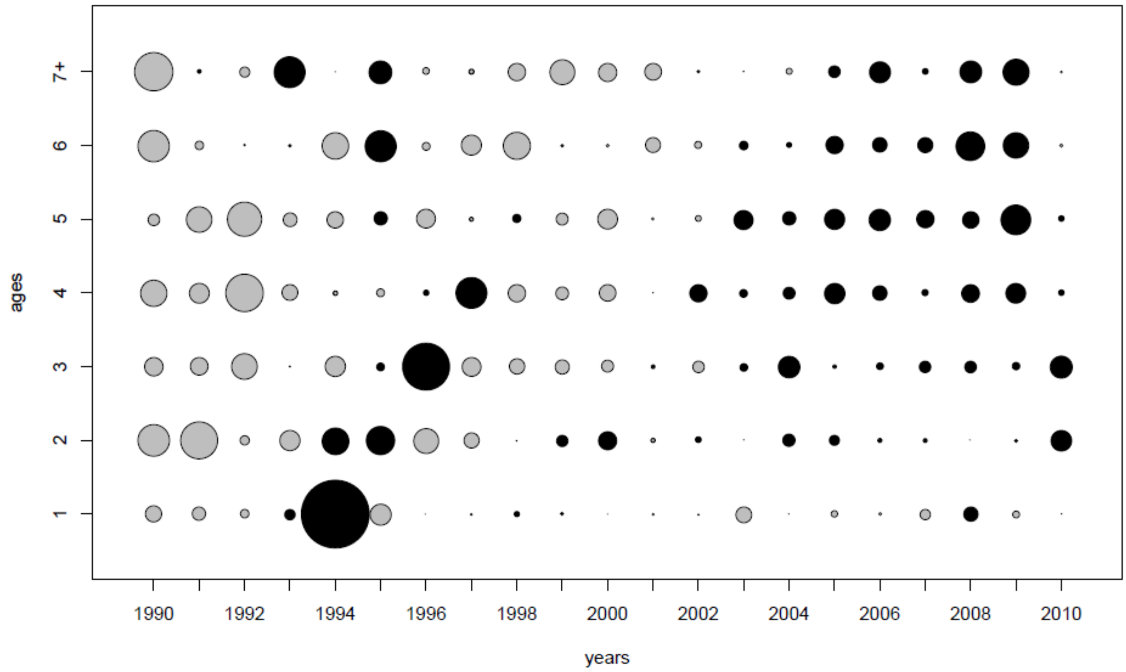


Figure 9.1.3(b): Megrim (*L. whiffiagonis*) in Divisions VIIIc & IXa

Standardized log (abundance index at age) from A Coruña VIIIc trawl fleet

(black bubble means < 0)



Standardized log (abundance index at age) from Avilés VIIIc trawl fleet

(black bubble means < 0)

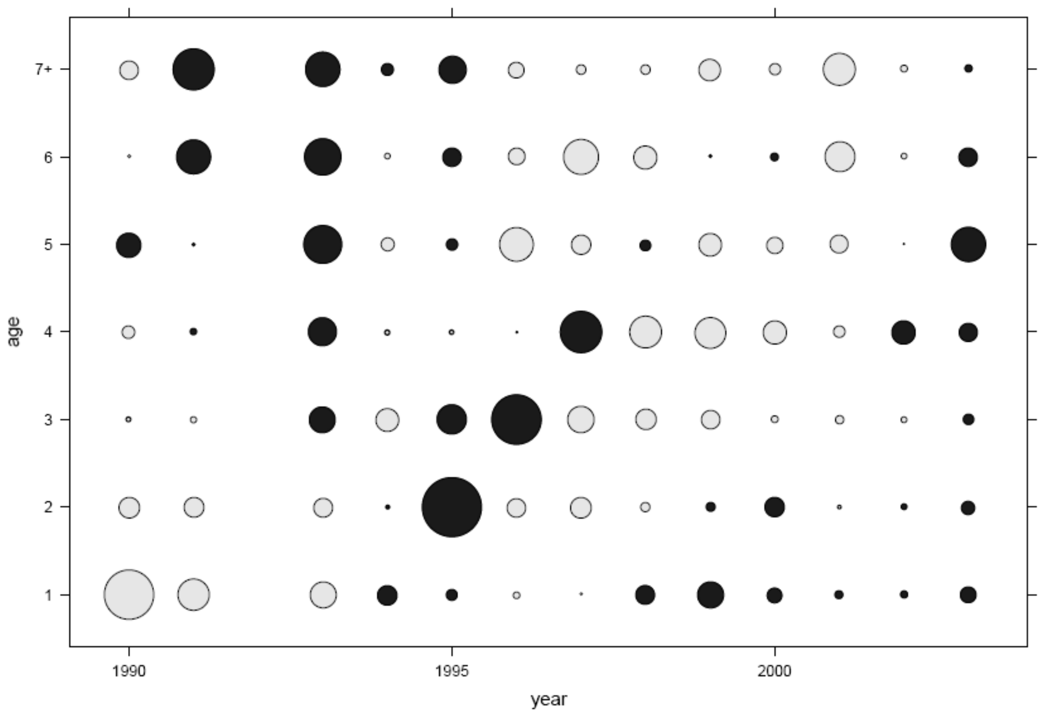
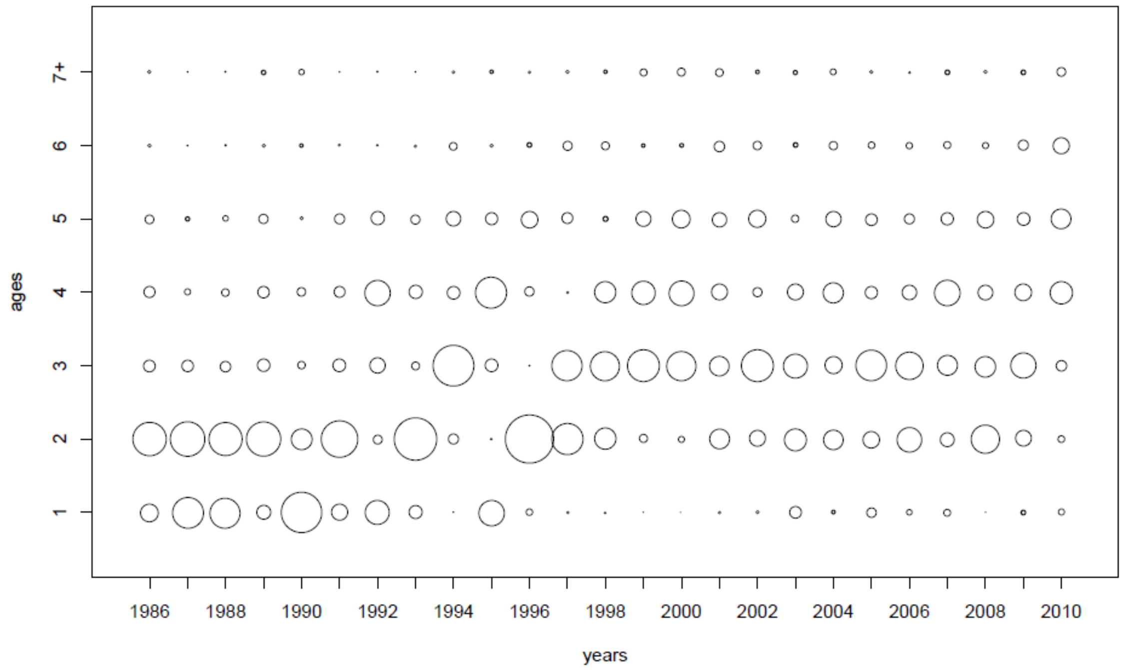


Figure 9.1.3(c): Megrim (*L. whiffiagonis*) in Divisions VIIIc & IXa

Landings proportions at age



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

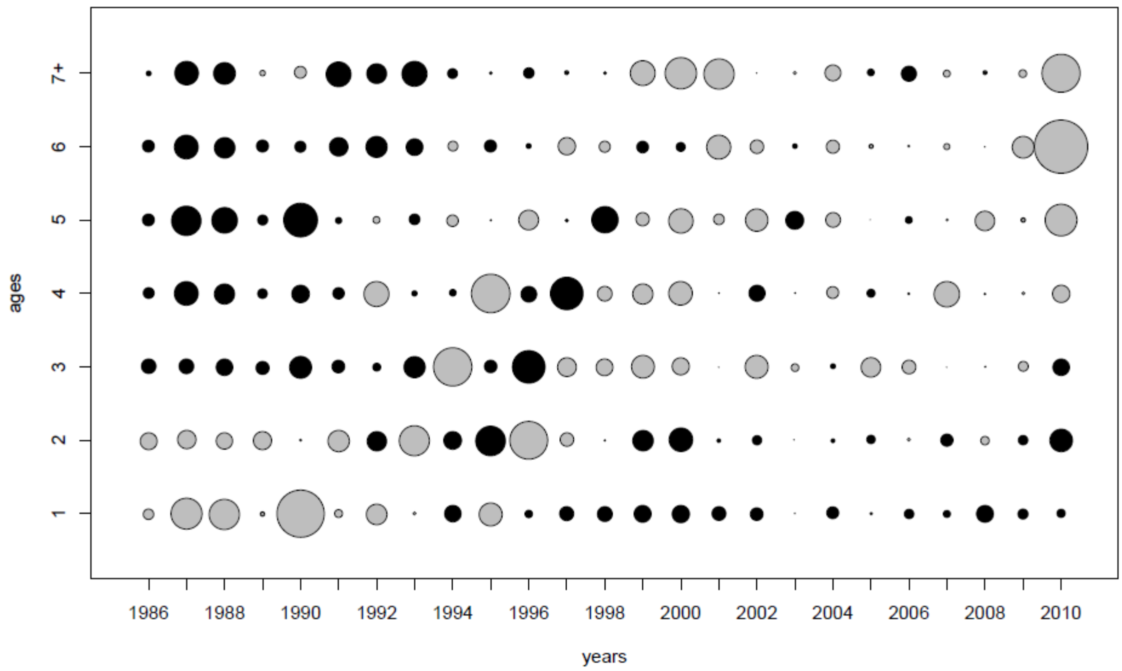


Figure 9.1.4. Megrim (*L. whiffiagonis*) in Divisions VIIIc & IXa.

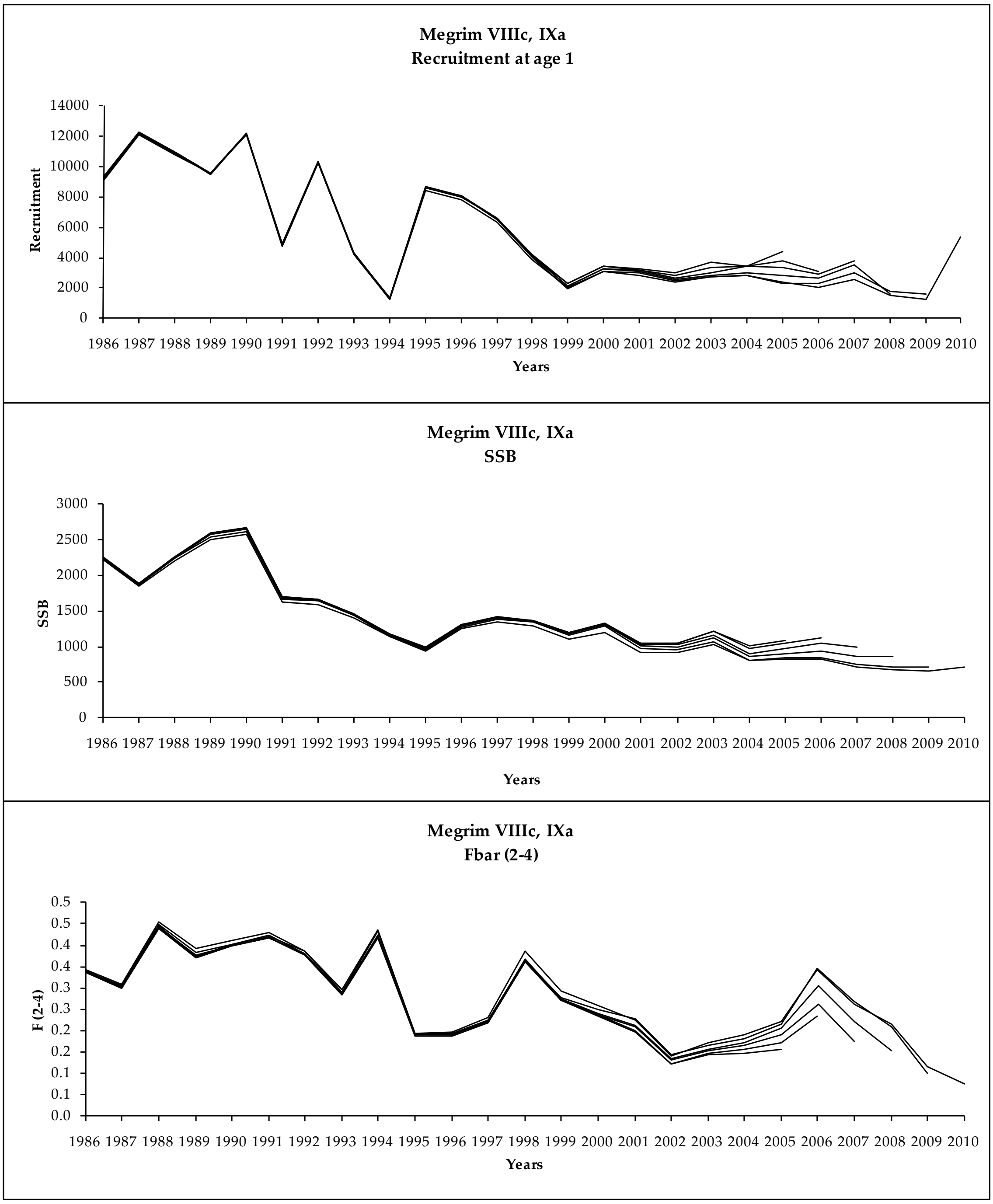


Figure 9.1.5. Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Retrospective XSA

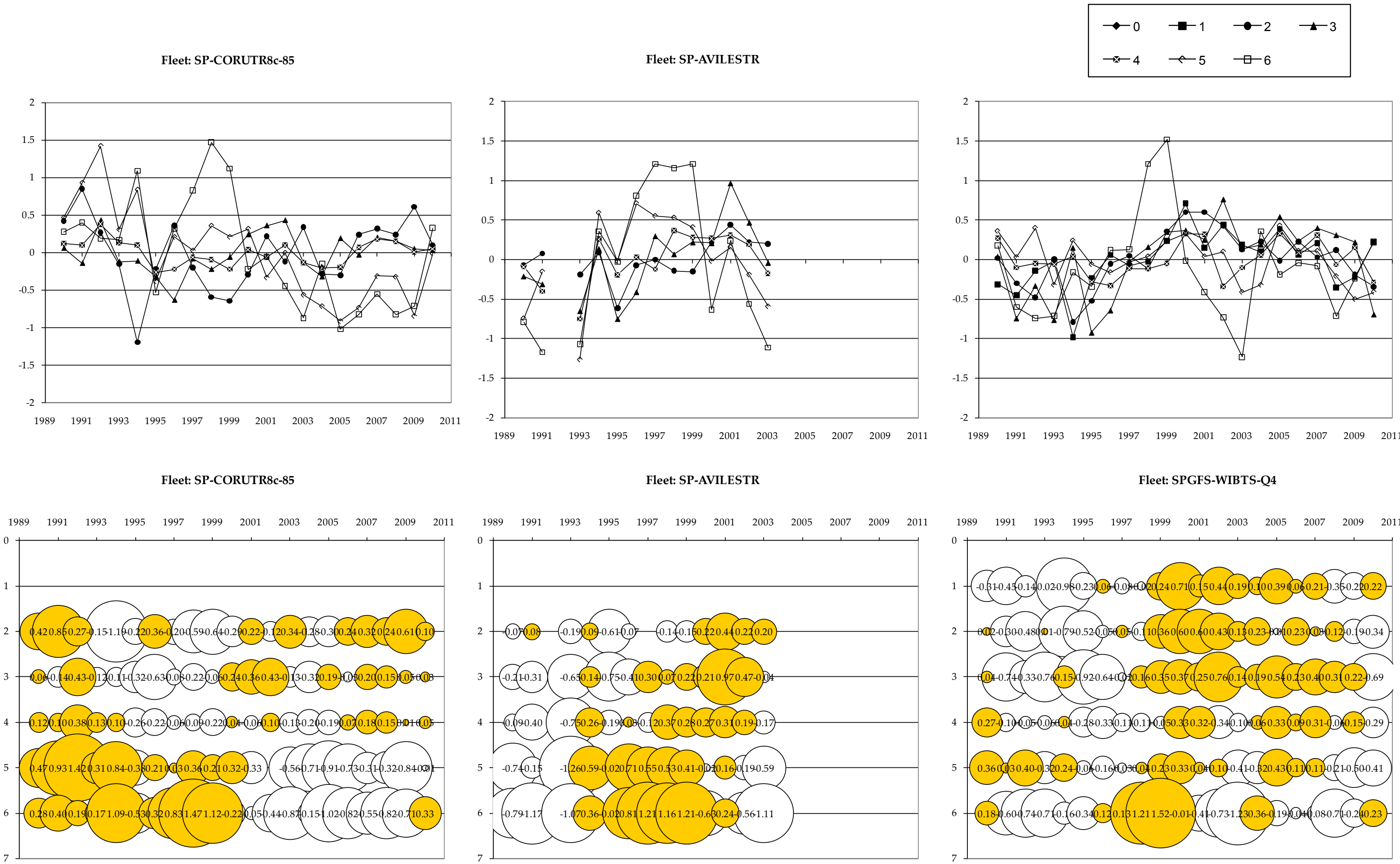


Figure 9.1.6. Megrim in Divisions VIIIc and IXa. LOG CATCHABILITY RESIDUAL PLOTS (XSA)

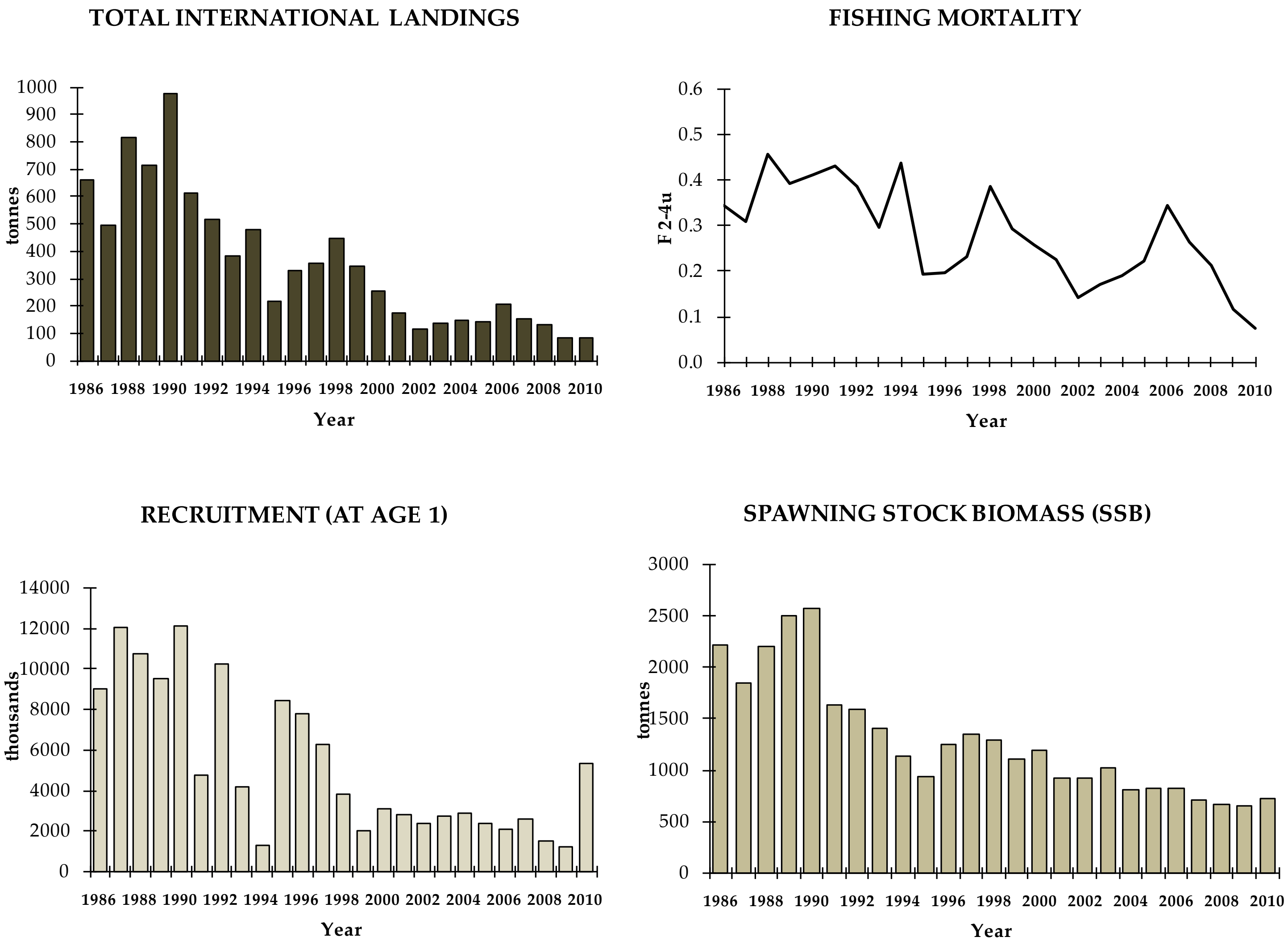
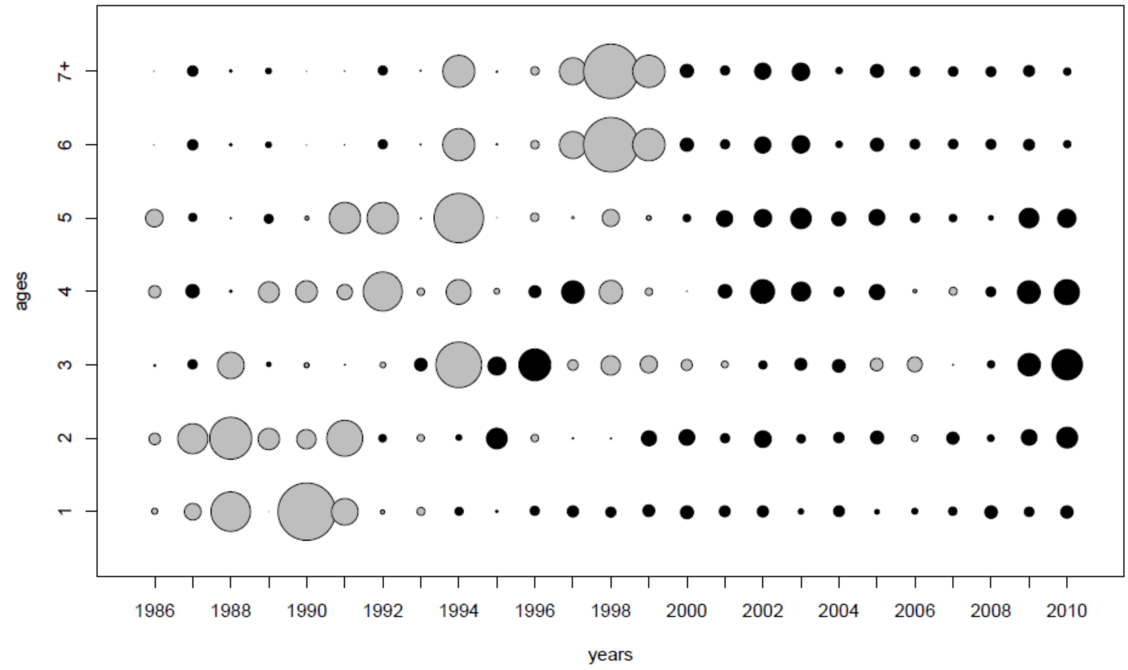


Figure 9.1.7(a) Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Stock Summary

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



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

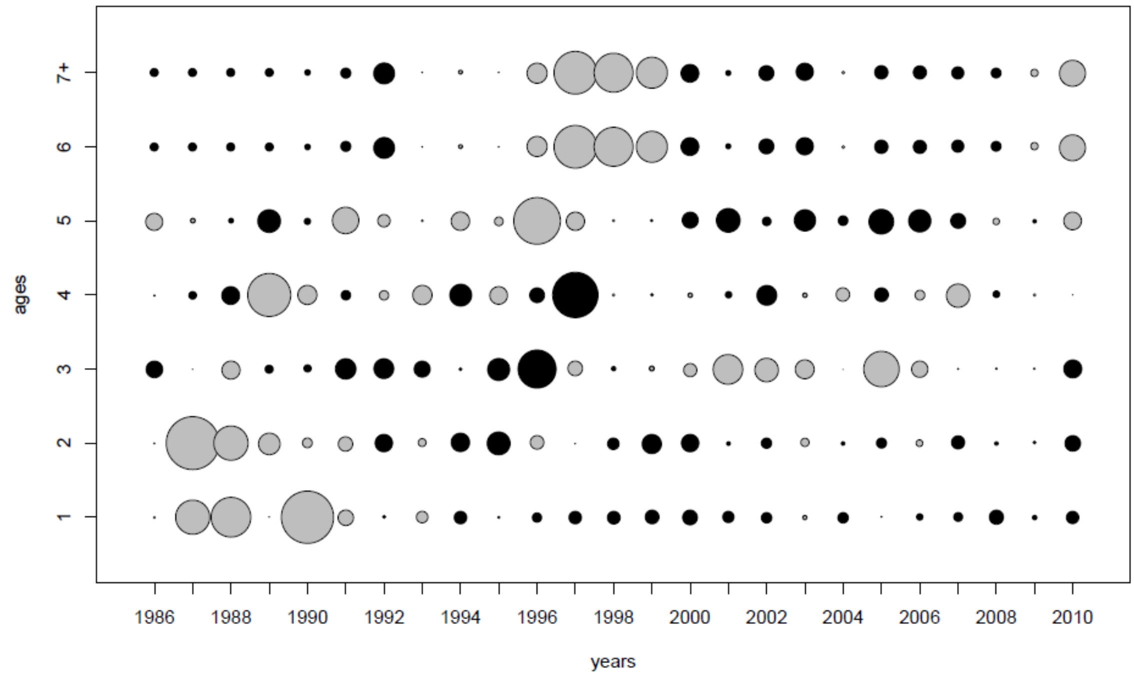
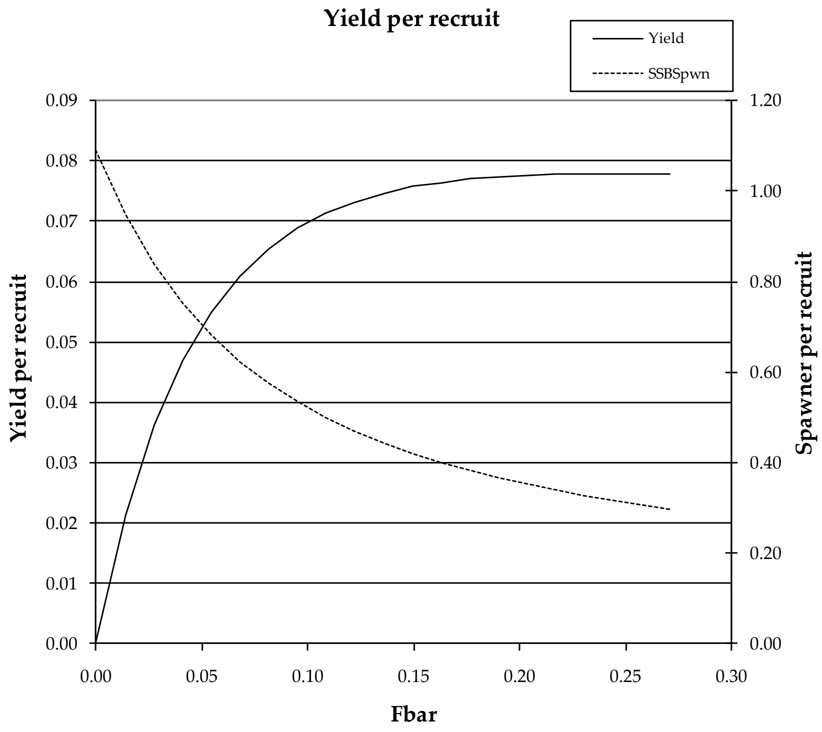


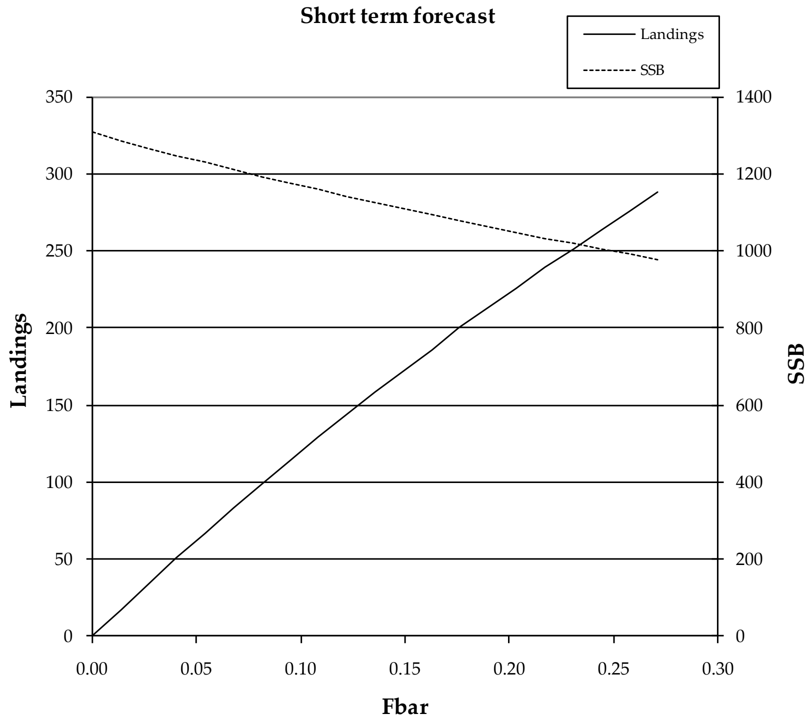
Figure 9.1.7(b): Megrim (*L. whiffiagonis*) in Divisions VIIIc & IXa



MFYPR version 2a
Run: meg
Time and date: 12:59 30/04/2011

Reference point	F multiplier	Absolute F
Fbar(2-4)	1.0000	0.1356
FMax	1.7481	0.2370
F0.1	0.7483	0.1014
F35%SPR	1.3042	0.1768
Flow	0.6765	0.0917
Fmed	1.5438	0.2093
Fhigh	7.1072	0.9634

Weights in kilograms



MFDP version 1a
Run: meg
Megrim (L. whiffiagonis.) in Divisions VIIIc and IXa
Time and date: 20:39 29/04/2011
Fbar age range: 2-4

Input units are thousands and kg - output in tonnes

Figure 9.1.8. Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa, forecast summary

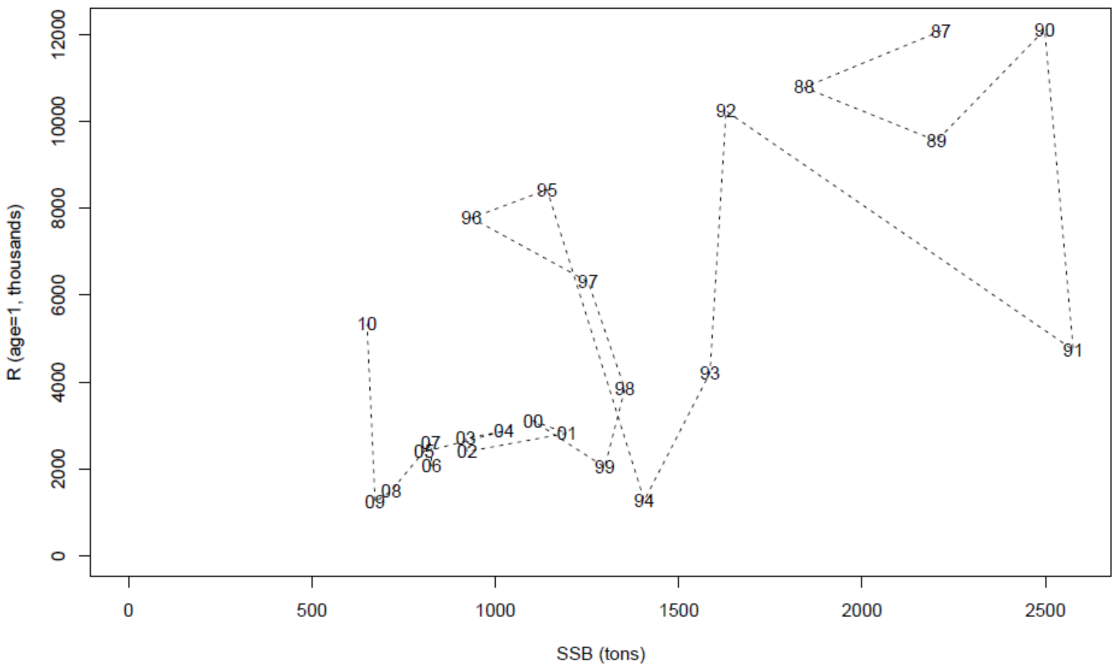


Figure 9.1.9. Megrim (*L.whiffiagonis*) in Divisions VIIIc and IXa. SSB-Recruitment plot.

(numbers in graph, 1987-2010, are recruitment years)

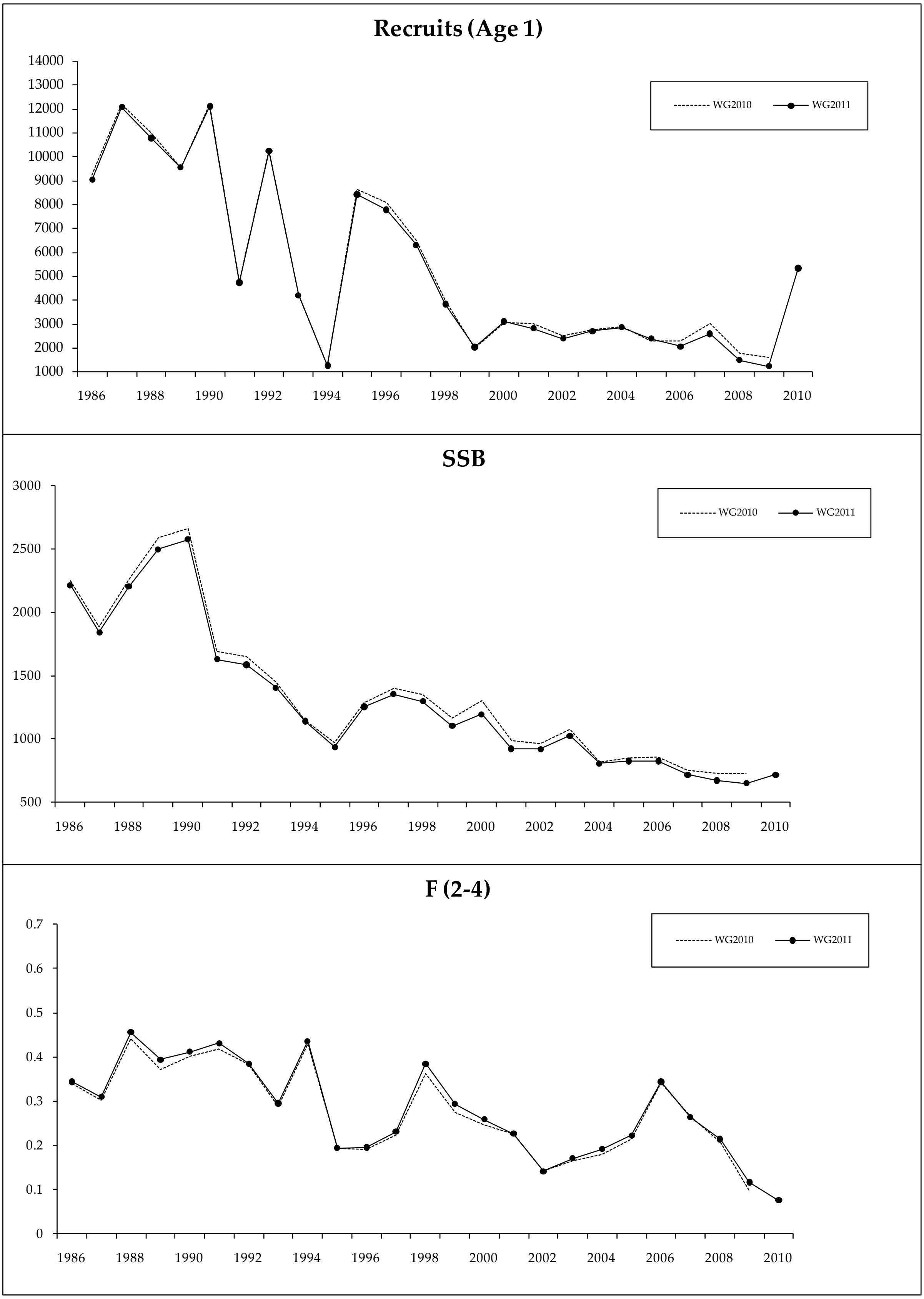


Figure 9.1.10. Megrim (*L. whiffiagonis*) in Div. VIIIc and IXa. Recruits, SSB and F estimates from WG10 and WG11

9.2 Four-spot megrim (*Lepidorhombus boscii*)

9.2.1 General

See general section for both species.

9.2.2 Data

9.2.2.1 Commercial catches and discards

The estimates of four-spot megrim international landings for the period 1986 to 2010 used by the WG are given in Table 9.2.1. 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.

Discards estimates are available for Spanish trawlers in some years. Annual discards of four-spot megrim are estimated to be from around 190 t to 520 t along the whole time series. Discard / Total Catch ratio and CV are presented in Table 9.2.2(a), where discards in number represent between 39-63% of the total catch. Discards are not incorporated in this assessment due to the lack of data in some years of the series but a working document (WD06) describing the application of a Bayesian model incorporating discards has been presented to be considered as a possible alternative assessment model. Spanish discards in numbers at age are shown in Table 9.2.2(b), indicating that the bulk of discards (in numbers) is for ages 1 to 3. These data are presented to the WG for the first time this year (more details can be found in WD07).

9.2.2.2 Biological sampling

Annual length compositions of total stock landings are given in Figure 9.2.1 for the period 1986-2010. Table 9.2.3(a) shows the length distribution by fleet and country for 2010.

The sampling levels for both species are given in Table 1.3.

Mean length and weights in landings since 1990 are shown in the Table 9.2.3(b).

Due to very low landings in the age 0 group over the whole period (see Table 9.2.4), the values of these landings were replaced by zeros in the assessment.

Weights-at-age of landings (given in Table 9.2.5) 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.

9.2.2.3 Abundance indices from surveys

Portuguese and Spanish survey indices are summarised in Table 9.2.6.

Two Portuguese surveys, named ``Crustacean´´ (PT-CTS(UWTV(FU28-29))) and ``October´´ (PtGFS-WIBTS-Q4), provide indices for 2010. The October survey was conducted with a different vessel and gear in 2003 and 2004. Excluding these two years, the biomass index from this survey in 2007 was the highest observed since 1994, whereas the value in 2010 is the second lowest in the series. In 2010, both the biomass and abundance indices from the Crustacean survey are the highest in the time series.

Total biomass, abundance and recruitment indices from the Spanish Groundfish Survey (SpGFS-WIBTS-Q4) are also presented in Table 9.2.6. 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). This was followed by a period of higher values, with a high one in 2005. In 2010, the biomass and the abundance indices are the highest of the series and the recruitment index for age 1, the second highest. The very high index in 2005 applies to all ages and not just the recruitment ages (see Table 9.2.7, which gives abundance indices by age, and the top panel of Figure 9.2.2, 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). In 2010, only the age 0 index is below average, whereas indices for ages older than 2 are very high. From Figure 9.2.2, the survey appears to have been quite good at tracking cohorts through time until about 2002, whereas the signal seems more blurred in recent years.

9.2.2.4 Commercial catch-effort data

Landed numbers-at-age per unit effort and effort data were available for commercial Spanish trawl fleets based in A Coruña (SP-CORUTR8c, for years 1986-2010) and Avilés (SP-AVILESTR, for years 1986–2003), fishing in ICES Division VIIIc (see Table 9.2.7). 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 9.2.8 displays landings (in tonnes), fishing effort and LPUE for the two Spanish trawl fleets just mentioned as well as for the Portuguese trawl fleet fishing in Division IXa for the period 1988–2010 (see also Figure 9.2.3). The LPUE of A Coruña presents a very high value in 2010, similar to those at the beginning of the series.

Commercial fleets used in the assessment to tune the model

A Coruña trawl fleet (SP-CORUTR8c) was used for tuning, considering only values until 1999, as indicated in the Stock Annex. The effort of this fleet had been generally stable until year 1993, after which a steady declined started. A low effort value was reached in 2003, when restrictions imposed on fishing activity due to the Prestige oil spill influenced effort. A stable period followed this value till year 2008, when effort is declining again to its lowest value in the series, reached in 2010.

Commercial fleets not used in the assessment to tune the model

The effort of the Avilés trawl fleet (SP-AVILESTR) decreased along the whole period, reaching very low levels in the last years of the available data series.

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 until 1995 and a decreasing one from then. The LPUE of the Portuguese trawl fleet has generally declined since 1992, with an increase in recent years.

9.2.3 Assessment

The assessment is an update of the one performed last year and follows the Stock Annex specifications incorporating the 2010 data. The assessment corresponds to years 1986-2010 and ages 0-7+.

9.2.3.1 Input data

Input data are the same as in last year's WG but incorporating the 2010 commercial catch data and tuning indices from the Spanish survey (SpGFS-WIBTS-Q4).

As in previous years, due to the very low and irregular landings of age 0 individuals, values corresponding to age 0 in the catch-at-age matrix (displayed in Table 9.2.4) were replaced by zeros.

Model

Data screening

Figure 9.2.4 is a bubble plot representing catch proportions at age, clearly indicating that the bulk of the landings generally corresponds to ages 2 to 4. The bottom panel of Figure 9.2.4 is another bubble plot corresponding to standardized catch proportions at age, indicating that age composition of landings in 2010 is fairly typical of what has been observed in recent years.

Very weak cohorts corresponding to year classes of 1993 and 1998 can be clearly identified from the standardized catch proportions at age matrix and good cohorts corresponding to year classes of 1991, 1992, 1995 and 2005 can also be tracked (bottom panel of Figure 9.2.4).

Final XSA run

Settings for this year's assessment were the same ones used in the last assessment and are detailed in the Stock Annex.

The retrospective analysis shows no particular worrying features (Figure 9.2.5).

9.2.3.2 Assessment results

Diagnostics from the XSA final run are presented in Table 9.2.9 and log catchability residuals plotted in Figure 9.2.6. Note that because of the taper weighting used (tricubic over 20 years), tuning (and, therefore, residuals) starts in year 1991. 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 obtained for many ages in 2001, 2005, 2007, 2009 and 2010, in line with the high values registered by the survey in those years. Mostly negative residuals are obtained for the survey indices in 2006 and 2008. The fact that in many recent years survey residuals are either positive or negative for most ages may be indicative of year effects in the survey.

Since the commercial fleet data are stopped in 1999, they do not intervene directly in the estimates of survivors at the end of 2010. Hence, survivor estimates are given by the survey and P-shrinkage for ages 0 to 2, and only by the survey for ages 3 to 6. F-shrinkage gets very low weight, due to the large s.e. value set for it (1.5).

Table 9.2.10 presents the fishing mortality-at-age estimates. Fbar ($=F_{2-4}$) is estimated to be 0.34 in 2010, in line with the range of F values estimated for the last decade.

Population numbers-at-age estimates are presented in Table 9.2.11.

9.2.3.3 Year class strength and recruitment estimations

The 2008 year class estimate is 20 million individuals, obtained by averaging estimates coming from the Spanish survey tuning data (73% of weight), P-shrinkage (25% weight) and F-shrinkage (2% weight).

The 2009 year class estimate is 35 million individuals, estimated from the Spanish survey (55% of weight), P-shrinkage (43% weight) and F-shrinkage (2% weight).

The 2010 year class estimate is 22 million individuals, obtained by averaging a lower value coming from the Spanish survey (43% weight) and a higher one from P-shrinkage (57% weight).

Following the procedure stated in the Stock Annex, the geometric mean of estimated recruitment over the years 1990-2008 has been used for computation of 2011 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
2008	20385	XSA	73%	-	27%
2009	34771	XSA	55%	-	46%
2010	21810	XSA	43%	-	57%
2011	24016	GM_{90-08}			

9.2.3.4 Historic trends in biomass, fishing mortality, and recruitment

Estimated fishing mortality and population numbers-at-age from the XSA run are given in Tables 9.2.10 and 9.2.11. Further results, including SSB estimates, are summarised in Table 9.2.12 and Figure 9.2.7(a).

SSB decreased gradually from 8038 t in 1988 to 3260 t in 2001, the lowest value in the series, and has since experienced some increase. The 2008 SSB is estimated to be 5103 t, the highest value after 1994. SSB is a bit lower in 2010, with an estimated value of 4797 t.

Recruitment has fluctuated around 25 million fish from 1990 to 2002, with the exception of the very weak 1993 and 1998 year classes. In 2003, 2005 and 2009 recruitment has been above this level.

Estimates of fishing mortality values show two different periods: an initial one with higher values from 1989 to 1995 and, following a sharp decrease in 1997, a second period stabilised at a lower level, with small ups and downs. The value of 0.34 in 2010 represents some increase in relation to recent years

There seems to be interannual variability in the relative fishing exploitation pattern at age (F over Fbar, see Figure 9.2.7(b), bottom panel), with alternating periods of time with higher and lower relative exploitation pattern on the older ages.

9.2.4 Catch options and prognosis

Projection settings follow the Stock Annex specifications. The exploitation pattern used (F *status quo*) was the unscaled average of 2008-2010, which gives an Fbar value of 0.29.

9.2.4.1 Short-term projections

The input data for deterministic short-term projections are given in Table 9.2.13.

Table 9.2.14 gives the management options for 2012, and their consequences in terms of projected landings and stock biomass. Figure 9.2.8 (right panel) plots short-term yield and SSB versus Fbar.

The detailed output by age group, assuming F *status quo* for 2011-2013, is given in Table 9.2.15. Under this scenario, projected landings for 2011 and 2012 are 1062 and 1136 t, respectively. Landings in 2010 were 1297 t.

Under F *status quo* for 2011 and 2012 projected SSB values for 2012 and 2013 are about 4900 t in 2012 and 4850 t in 2013. Hence, SSB in 2012 and 2013 would increase very slightly from the 4800 t value estimated for 2011.

The contributions of recent year classes to the projected landings and SSB are presented in Table 9.2.16 (under F *status quo*). The year classes for which $GM_{90\text{-}08}$ recruitment is assumed contribute less than 1% to landings in 2012 and 28% to SSB in 2013.

9.2.4.2 Yield and biomass per recruit analysis

The analysis is conducted following the Stock Annex specifications and results presented in Table 9.2.17. The left panel of Figure 9.2.8 plots yield-per-recruit and SSB-per-recruit versus Fbar.

Under F *status quo* (Fbar=0.29), yield-per-recruit is 0.046 kg and SSB-per-recruit is 0.195 kg. Assuming $GM_{90\text{-}08}$ recruitment of 24 million, the equilibrium yield would be around 1105 t with an SSB value of 4680 t.

9.2.4.3 Biological reference points

Stock-recruitment data from before 1990 are not considered reliable. For the remaining years there is no evidence of reduced recruitment at the lower SSB levels observed (Figure 9.2.9). At present, there is no new information to define biomass reference points B_{lim} and B_{pa} for this stock.

See Stock Annex for more information about Biological reference points.

In previous Working Groups, reference points were not proposed because of the interannual variability detected in the relative exploitation pattern-at-age. However, WGHMM 2010 was asked to provide an F_{MSY} value for this stock. Possible proxies considered for F_{MSY} were in the range of Fmax, F0.1 and F35% and F40%. Fmax is not well defined for this stock, as the yield-per-recruit curve generally shows a very flat top.

In order to establish a proxy, a rough exercise to assess the impact of discards was conducted in WGHMM 2010 (see description and results in the stock annex). The following sensitivity table also complemented the discards exercise and has been updated in this WG:

	WG2005	WG2006	WG2007	WG2008	WG2009	WG2010	WG2011
Fmax	0.63	0.48	0.55	0.57	0.62	0.39	0.37
F0.1	0.27	0.17	0.18	0.14	0.18	0.14	0.15
F35percent	0.31	0.26	0.27	0.25	0.28	0.24	0.24
F40percent						0.18	0.19

F_{MSY}=0.18 was preliminarily proposed in WGHMM 2010, corresponding to F40% as calculated in that WG, for consistency with the rationale followed for *L. whiffiagonis*. The value of F40% remains very similar this year, so this WG sees no reason to change the 0.18 value proposed as F_{MSY} last year. However, this F_{MSY} value should still be considered as preliminary and is likely to be revised as further work continues on this assessment (particularly when including discards information and developing an assessment model providing uncertainty estimates).

9.2.5 Comments on the assessment

One commercial fleet (SP-CORUTR8c) 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. Only data up to year 1999 were used, as the increasing use of HVO trawl gear (targeting horse mackerel and with very few four-spot megrim catches) in the traditional Baca trawl fishery in recent years makes it difficult to compare effort values from recent years with those from earlier years. The Spanish survey covers a large part of the distribution area of the stock. The survey appears to have been quite good at tracking cohorts through time until about 2002, but the signal seems more blurred in recent years.

Comparison of this assessment with the one performed last year shows similar results for the common years (Figure 9.2.10).

Four-spot megrim starts to contribute strongly to SSB at 2 years of age, with 28% of the predicted SSB in 2013 relying on year classes with recruitment assumed to be given by GM_{90-08}.

The fact that discards data are not used in the assessment of this stock may modify the perception of its state. Discards data were not used in this assessment because of the lack of data in some years of the series. Discards in number represent between 39-63% of the total catch. Including discards would produce a more real picture of fishing exploitation and stock dynamics. It could also have an impact on biological reference points and predictions.

9.2.6 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 between 2001 and 2008, with some drop in 2009 and a slight increase again in 2010. Fishing at *status quo* F (Fbar=0.29) during 2011 and 2012 would result in some biomass increase from the 2010 value.

There is no evidence of reduced recruitment at low stock levels.

As with *L. whiffiagonis*, it should be noted that four-spot megrim (*L. boscii*) is 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.

9.3 Combined Forecast for Megrims (*L. whiffiagonis* and *L. boscii*)

Figure 9.3.1 plots total international landings and estimated stock trends for both species of megrim in the same graph, in order to facilitate comparisons.

The two species of megrim are included in the landings from ICES Divisions VIIIc and IXa. Both are taken as by-catch in mixed bottom trawl fisheries. Assuming status quo F for both species in 2011 (average of estimated F over 2008-2010, corresponding to Fbar=0.14 for *L. whiffiagonis* and Fbar=0.29 for *L. boscii*), Figure 9.3.2 gives the combined predicted landings for 2012 and individual SSB for 2013, 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 2008-2010) for both species in 2012, predicted combined landings in 2012 are 1294 t and individual SSBs in 2013 are 1125 t for *L. whiffiagonis* and 4851 t for *L. boscii*. The equilibrium combined yield at status quo F level for both species, would be around 1290 t with a combined SSB 5790 t.

Table 9.2.1. Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Total landings (t).

	Spain			Portugal	Total
Year	**VIIIc**	**IXa**	**Total**	**IXa**	**VIIIc IXa**
1986	799	197	996	128	1124
1987	995	586	1581	107	1688
1988	917	1099	2016	207	2223
1989	805	1548	2353	276	2629
1990	927	798	1725	220	1945
1991	841	634	1475	207	1682
1992	654	938	1592	324	1916
1993	744	419	1163	221	1384
1994	665	561	1227	176	1403
1995	685	826	1512	141	1652
1996	480	448	928	170	1098
1997	505	289	794	101	896
1998	725	284	1010	113	1123
1999	713	298	1011	114	1125
2000	674	225	899	142	1041
2001	629	177	807	124	931
2002	343	247	590	130	720
2003	393	314	707	169	876
2004	534	295	829	177	1006
2005	473	321	794	189	983
2006	542	348	891	201	1092
2007	591	295	886	218	1104
*2008	546	262	808	172	980
2009	577	342	919	215	1134
2010	616	484	1100	197	1297

* Data revised in WG2010 from original value presented

Table. 9.2.2(a) Megrim (*L. boscii*) in Divisions VIIIc, IXa. Discard/Total Catch ratio and estimated CV for Spain

Year	1994	1997	1999	2000	2003	2004	2005	2006	2007	2008	2009	2010
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
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
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

*All discard data revised in WG2011

Table. 9.2.2(b) Megrim (*L. boscii*) in Divisions VIIIc, IXa. Discards in numbers at age (thousands) for Spanish trawlers

	1994	1997	1999	2000	2003	2004	2005	2006	2007	2008	2009	2010
0	678	256	2933	354	238	33	10	1	100	202	2	2879
1	2741	3273	3954	6148	4479	6393	3515	1233	3248	2342	1525	10362
2	4134	6099	2734	1207	989	3053	5482	2497	4541	2374	2490	1301
3	2710	2108	1815	1888	495	693	609	1445	757	1384	1970	696
4	581	146	1088	1218	50	163	183	486	105	52	480	283
5	189	90	3	171	2	27	56	168	44	10	51	83
6	55	3	0	12	0		23	22	7	3	7	11
7	11	0	1	2			6	9	1	3		1
8	0						1					
9	0						1					

Table 9.2.3(a) Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa, Length compositions of landings in 2010 ('000 fish)

	Spain		Portugal		Total		
Length (cm)	Div. VIIIc	Div. IXa	Trawler	Artisanal	Spain	Portugal	Total
10							
11							
12		0.6			0.6		0.6
13	0.2	0.1			0.4		0.4
14	1.1	0.7			1.9		1.9
15	2.3	2.1			4.4		4.4
16	5.1	3.2	1.1		8.3	1.1	9.4
17	16.0	15.7	3.7		31.8	3.7	35.4
18	69.1	49.0	8.3		118.1	8.3	126.4
19	256.4	195.6	11.5	17.9	452.0	29.4	481.4
20	514.1	406.9	45.1	3.6	920.9	48.8	969.7
21	678.6	550.5	54.9	15.6	1229.1	70.5	1299.6
22	789.5	652.7	94.6	44.5	1442.2	139.1	1581.3
23	703.3	594.7	161.9	2.7	1298.1	164.5	1462.6
24	609.0	514.2	108.8	25.6	1123.2	134.4	1257.6
25	457.1	350.2	116.0	70.4	807.3	186.3	993.6
26	358.2	246.8	86.9	36.6	605.0	123.4	728.4
27	281.5	189.8	90.7	16.8	471.3	107.5	578.8
28	201.5	142.6	80.1	34.8	344.1	114.9	458.9
29	136.3	93.7	50.3	3.2	230.0	53.5	283.5
30	95.6	65.9	36.6	7.5	161.5	44.0	205.5
31	56.7	40.8	16.2	26.0	97.5	42.3	139.8
32	42.1	30.5	24.9		72.6	24.9	97.5
33	21.0	21.0	5.9	4.3	42.1	10.2	52.3
34	17.7	13.9	5.5		31.6	5.5	37.1
35	9.6	9.2	3.0		18.8	3.0	21.8
36	5.2	5.3	0.9		10.5	0.9	11.5
37	2.9	2.9	0.9		5.8	0.9	6.7
38	0.9	1.0	2.1		1.9	2.1	3.9
39	0.3	0.8	0.6		1.0	0.6	1.6
40	0.0	0.0			0.1		0.1
41	0.1				0.1		0.1
42	0.0				0.0		0.0
43							
44							
45							
46		0.7			0.7		0.7
47							
48							
49							
50+	0.0	0.0			0.1		0.1
Total	5332	4201	1010	309	9533	1320	10853

Table 9.2.3(b) 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	2003	2004	2005	2006	2007	2008	2009	2010
Mean length (cm)	23.1	23.5	23.8	24.2	23.3	22.3	23	23.3	23.3	23.5	24.2	23.8	23.1	22.9	22.7	22.7	22.9	23.5	23.6	23.6	24.1
Mean weight (g)	116	118	122	128	111	96	107	112	109	113	121	114	105	101	98	97.0	99.4	109.1	109.7	110.7	118.4

Table 9.2.4 Four-spot megrim (*L. boscii*) in Divisions VIIIc, IXa. Landed 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
AGE																									
(*)0	(4)	(1)	(9)	(2)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
1	110	2283	1525	733	1444	1160	846	546	83	1421	397	35	45	38	45	167	190	367	392	123	34	9	15	21	15
2	3475	11580	10092	7140	5184	3679	2667	2334	2915	2205	2136	1244	1204	1161	655	1138	2389	2802	2515	2522	2735	1606	1561	646	1063
3	3690	5073	5455	5392	1885	3328	4000	2096	4515	6138	1267	2870	4236	2781	1645	1251	2361	2873	3084	2995	4506	2633	3495	2917	2872
4	3940	3593	4779	5909	3829	1911	5179	3799	2268	5596	3814	744	2940	3908	2782	2393	743	1476	2439	1841	2153	2600	2152	4160	3534
5	1132	1344	2366	3479	2311	2650	2200	1151	1612	1056	1896	1624	698	1402	1849	1870	387	499	1128	1370	988	1865	993	1611	2446
6	849	569	1161	1778	1383	1028	738	635	839	582	204	1066	829	235	785	937	236	447	279	779	252	848	351	633	485
+gp	229	141	463	630	803	479	67	278	446	280	551	443	349	488	838	357	359	142	337	393	219	460	295	222	437
TOTALNUM	13425	24583	25841	25061	16839	14235	15694	10839	12678	17278	10265	8026	10301	10013	8599	8149	6665	8606	10174	10023	10887	10021	8861	10210	10852
TONSLAND	1124	1688	2223	2629	1945	1682	1916	1384	1403	1652	1098	896	1123	1125	1041	931	720	876	1006	983	1092	1104	980	1134	1297
SOPCOF %	100	100	100	100	100	99	103	99	100	97	100	102	100	101	101	101	100	101	101	101	101	101	101	100	101

(*) Age 0 was not used in the assessment.

* Data revised in WG2010 from original value presented

Table 9.2.5 Four-spot megrim (*L. boscii*) in Divisions VIIIc, IXa. Mean weights at age in landings (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
AGE																									
1	0.022	0.036	0.039	0.043	0.028	0.033	0.032	0.023	0.033	0.043	0.038	0.032	0.033	0.036	0.035	0.042	0.042	0.043	0.040	0.049	0.034	0.041	0.044	0.034	0.033
2	0.046	0.053	0.057	0.066	0.065	0.073	0.073	0.074	0.069	0.066	0.062	0.056	0.063	0.070	0.080	0.069	0.071	0.071	0.066	0.060	0.07	0.067	0.076	0.061	0.073
3	0.065	0.071	0.079	0.090	0.106	0.117	0.110	0.118	0.092	0.092	0.074	0.080	0.086	0.090	0.086	0.091	0.103	0.094	0.086	0.087	0.094	0.088	0.091	0.081	0.091
4	0.095	0.094	0.104	0.112	0.141	0.125	0.125	0.143	0.121	0.100	0.112	0.097	0.112	0.101	0.100	0.106	0.128	0.125	0.111	0.111	0.107	0.116	0.113	0.108	0.11
5	0.132	0.127	0.139	0.145	0.156	0.166	0.161	0.178	0.153	0.146	0.137	0.126	0.142	0.147	0.132	0.123	0.170	0.142	0.132	0.123	0.138	0.124	0.151	0.143	0.142
6	0.160	0.152	0.168	0.167	0.184	0.191	0.226	0.220	0.181	0.169	0.213	0.180	0.180	0.197	0.170	0.166	0.210	0.201	0.175	0.133	0.179	0.153	0.201	0.175	0.183
+gp	0.265	0.242	0.281	0.276	0.273	0.264	0.359	0.297	0.245	0.256	0.232	0.252	0.294	0.268	0.228	0.255	0.247	0.247	0.235	0.198	0.236	0.198	0.235	0.288	0.271
SOPCOFAC	1.0015	1.0017	1.0028	1.0015	0.9968	0.9907	1.0339	0.9865	1.0011	0.9719	0.9987	1.0174	1.0010	1.0128	1.0091	1.0072	0.9999	1.0115	1.0115	1.0111	1.0114	1.0097	1.01	1.0029	1.0111

* Data revised in WG2010 from original value presented

Table 9.2.6 Four-spot megrim (*L. boscii*) Divisions VIIIc, IXa.

Abundance and Recruitment indices of 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	Crustacean	SE	Mean	SE		Crustacean	SE	Mean	SE		October		
1983				0.67	0.13	1983			11.80	1.80	1983		0.98	5.74
1984				0.76	0.08	1984			15.80	2.00	1984		1.80	7.83
1985				0.71	0.11	1985			14.00	1.74	1985		0.15	7.45
1986				1.68	0.28	1986			32.60	3.82	1986		2.99	16.36
1987				ns	-	1987			ns	-	1987		ns	ns
1988				3.10	0.33	1988			59.20	6.49	1988		2.90	24.64
1989				1.97	0.28	1989			40.75	6.24	1989		8.49	16.68
1990	0.26			1.93	0.14	1990			40.30	3.00	1990	153	0.44	19.06
1991	0.18			1.67	0.17	1991			27.70	2.62	1991	26	2.53	9.25
1992	0.14			1.98	0.20	1992			49.10	5.20	1992	42	2.37	35.00
1993	0.11			2.07	0.25	1993			43.30	5.39	1993	8	0.30	21.38
1994	0.16			1.82	0.23	1994			26.90	3.63	1994	2	3.48	2.94
1995	0.08			1.51	0.12	1995			32.30	2.78	1995	4	1.92	19.58
A,1996	0.10			2.00	0.19	A,1996			44.80	4.05	A,1996	16	3.57	20.56
1997	0.06	2.97	1.31	2.17	0.22	1997	31.57	15.52	43.50	3.84	1997	1	3.54	13.34
1998	0.04	2.66	0.87	1.80	0.20	1998	26.46	10.68	34.30	4.45	1998	+	0.27	9.57
A,B,1999	+	0.04	0.02	1.93	0.24	A,B,1999	1.23	1.07	29.30	3.22	A,B,1999	+	0.94	7.46
2000	0.08	2.18	0.84	1.89	0.28	2000	20.61	8.47	33.00	4.56	2000	16	1.07	13.96
2001	0.09	1.72	0.75	2.65	0.25	2001	17.17	7.08	42.70	3.35	2001	25	0.59	16.95
2002	0.02	2.78	1.02	2.21	0.22	2002	40.61	13.69	34.60	3.33	2002	1	1.04	9.95
A,2003	1.36	3.65	1.20	1.32	0.16	A,2003	60.80	20.97	16.90	1.54	A,2003	8	0.65	4.95
A,2004	1.27	ns		2.40	0.24	A,2004	ns		43.94	3.71	A,2004	5	1.19	21.10
2005	0.05	2.62	0.85	3.84	0.41	2005	34.51	12.03	62.89	6.16	2005	+	4.71	17.70
2006	0.10	1.63	0.56	2.56	0.24	2006	19.89	6.49	41.47	3.02	2006		0.59	14.70
2007	0.14	2.20	0.70	3.75	0.35	2007	32.30	11.30	51.10	4.30	2007		0.88	11.30
2008	0.07	2.50	0.87	2.08	0.22	2008	26.27	9.60	32.20	3.00	2008		0.37	8.13
2009	0.06	*1.50	0.65	3.96	0.32	2009	*12.22	5.88	52.83	3.97	2009		3.37	7.42
2010	0.03	4.03	1.44	4.04	0.38	2010	63.78	22.64	72.75	6.82	2010		0.65	34.22

+ 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

Table 9.2.7 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Tuning data

FLT01: SP-CORUTR8c. 1000 Days by 100 HP (thousand)(*)

1986	2009								
1	1	0	1						
1	7							Eff.	
10	16.1	481.7	526.6	641.7	191.7	131.9	28.4	39.8	1986
10	463.7	1870.3	671.2	430.3	170.6	77.8	23.9	34.7	1987
10	59.5	528.9	354.0	360.9	203.8	106.2	45.5	42.2	1988
10	17.8	204.7	189.2	257.9	201.4	116.9	48.4	44.4	1989
10	8.6	195.7	114.0	328.2	197.5	137.6	72.5	44.4	1990
10	17.8	154.5	251.2	161.1	327.5	138.4	70.5	40.4	1991
10	0.8	38.8	199.2	334.7	209.8	77.6	4.6	38.9	1992
10	0.2	60.7	162.9	377.3	140.9	77.5	27.4	44.5	1993
10	0.0	44.7	149.5	121.8	112.2	62.4	33.3	39.6	1994
10	0.9	25.8	217.6	236.1	96.9	65.3	18.8	41.5	1995
10	0.7	28.3	29.0	189.7	113.4	17.1	43.8	35.7	1996
10	0.3	19.7	97.0	34.9	124.8	109.4	51.4	35.2	1997
10	0.2	61.9	318.9	265.2	74.5	96.3	47.0	32.6	1998
10	0.3	56.6	191.4	302.2	150.9	29.8	40.7	30.2	1999
10	0.3	55.6	113.4	275.1	239.2	129.5	121.0	30.1	2000
10	10.1	105.3	155.9	338.3	310.6	172.5	58.8	29.9	2001
10	5.9	103.5	176.7	75.2	54.3	36.9	57.7	21.8	2002
10	15.2	224.4	283.4	167.0	58.8	52.0	17.5	18.5	2003
10	18.2	214.5	311.3	276.7	137.6	37.8	51.1	21.1	2004
10	7.0	167.1	257.9	170.0	131.9	76.9	46.1	20.7	2005
10	4.5	235.7	404.5	197.2	97.6	26.7	26.0	19.3	2006
10	1.1	159.3	246.0	253.4	181.7	87.2	50.0	21.2	2007
10	1.7	203.0	471.3	311.7	147.4	56.8	52.2	20.2	2008
10	5.9	101.4	365.5	446.5	157.9	61.0	23.4	16.2	2009
10	0.0	99.8	356.1	509.2	422.3	90.7	72.2	13.7	2010

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

1986	2003								
1	1	0	1						
1	7							Eff.	
10	1.8	135.5	130.9	110.7	38.7	33.2	16.6	10.8	1986
10	7.2	149.2	151.6	195.0	105.9	48.1	7.2	8.3	1987
10	295.1	1099.8	357.0	187.9	63.0	28.7	21.0	9.0	1988
10	121.5	623.8	276.6	165.0	76.9	39.7	21.1	8.1	1989
10	963.9	1591.1	204.8	180.1	97.7	37.7	28.2	8.5	1990
10	717.4	699.1	214.8	101.5	98.9	36.5	26.0	7.7	1991
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1992
10	470.2	637.9	150.6	153.2	21.0	11.8	5.2	7.6	1993
10	26.0	670.5	642.4	175.7	81.1	33.3	19.8	9.6	1994
10	292.1	324.2	896.1	961.7	128.5	64.5	17.1	6.1	1995
10	16.4	300.7	199.2	568.4	251.1	18.0	54.5	4.5	1996
10	0.7	249.7	710.0	207.0	344.8	157.3	53.4	4.7	1997
10	0.5	120.9	474.2	347.9	74.5	91.4	23.4	5.4	1998
10	1.7	140.0	306.2	422.0	121.2	17.9	23.6	6.8	1999
10	3.3	79.6	351.0	536.0	217.7	50.9	54.6	4.5	2000
10	30.1	224.8	270.7	469.2	251.2	132.8	47.1	1.8	2001
10	4.1	260.6	348.8	155.1	84.9	30.6	37.3	2.7	2002
10	2.6	119.8	159.0	87.8	32.3	29.3	10.3	2.5	2003

FLT03: SpGFS-WIBTS-Q4 (n/30 min)

1988	2009									
1	1	0.75	0.83							
0	7								Eff.	
1	2.9	24.6	20.6	7.3	1.9	1.1	0.4	0.3	101	1988
1	8.5	16.7	8.4	3.6	2.1	1.1	0.3	0.1	91	1989
1	0.4	19.1	13.0	2.2	2.8	1.6	0.7	0.4	120	1990
1	2.5	9.3	9.3	3.7	1.6	1.0	0.2	0.1	107	1991
1	2.4	35.0	4.1	4.1	2.1	1.0	0.4	0.0	116	1992
1	0.3	21.4	16.7	2.3	1.5	0.5	0.4	0.2	109	1993
1	3.5	2.9	11.2	6.3	1.5	0.7	0.4	0.4	118	1994
1	1.9	19.6	2.4	4.4	3.2	0.3	0.2	0.2	116	1995
1	3.6	20.6	14.4	1.4	1.9	2.4	0.3	0.3	114	1996
1	3.5	13.3	14.0	8.7	1.1	1.5	1.0	0.3	116	1997
1	0.3	9.6	10.0	9.2	3.6	0.7	0.8	0.3	114	1998
1	0.9	7.5	10.9	6.0	2.9	1.0	0.2	0.3	116	1999
1	1.1	14.0	5.4	5.2	4.1	1.7	0.6	0.9	113	2000
1	0.6	17.0	12.7	4.7	3.8	2.2	1.0	0.7	113	2001
1	1.0	10.0	12.7	7.4	1.8	0.7	0.3	0.6	110	2002
1	0.7	5.0	4.1	4.1	1.7	0.6	0.5	0.3	112	2003
1	1.2	21.1	11.3	6.1	2.7	0.8	0.2	0.5	114	2004
1	4.7	17.7	22.4	11.2	4.0	1.6	0.6	0.7	116	2005
1	0.6	14.7	13.3	8.2	2.5	1.0	0.5	0.6	115	2006
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	127	2010

*SP-AVILESTR fleet excluded from the assessment.

Table 9.2.8 Four-spot megrim (*L. boscii*). LPUE data by fleet in Divisions VIIIc, IXa.

	A Coruña Trawl in VIIIc			Avilés Trawl in VIIIc			Portugal trawl in IXa		
Year	Landings(t)	Effort	LPUE [1]	Landings(t)	Effort	LPUE [1]	Landings(t)	Effort	LPUE [2]
1986	682	39.8	17.1	45	10.8	4.1			
1987	811	34.7	23.4	60	8.3	7.2			
1988	706	42.2	16.7	102	9.0	11.3	146	38.5	3.8
1989	593	44.4	13.3	79	8.1	9.8	183	44.7	4.1
1990	692	44.4	15.6	142	8.5	16.8	164	39.0	4.2
1991	680	40.4	16.8	83	7.7	10.9	166	45.0	3.7
1992	542	38.9	13.9	56	na		280	50.9	5.5
1993	615	44.5	13.8	58	7.6	7.6	180	44.2	4.1
1994	303	39.6	7.7	118	9.6	12.3	146	45.8	3.2
1995	359	41.5	8.7	127	6.1	20.7	121	37.0	3.3
1996	219	35.7	6.1	64	4.5	14.1	155	46.5	3.3
1997	244	35.2	6.9	81	4.7	17.3	76	33.4	2.3
1998	355	32.6	10.9	67	5.4	12.5	83	43.1	1.9
1999	324	30.2	10.7	74	6.8	10.8	73	25.3	2.9
2000	389	30.1	12.9	54	4.5	12.1	93	27.0	3.4
2001	431	29.9	14.4	27	1.8	14.6	89	43.1	2.1
2002	234	21.8	10.7	26	2.7	9.5	97	31.2	3.1
2003	168	18.5	9.1	13	2.5	5.0	117	40.5	2.9
2004	241	21.1	11.4	27	na		111	35.4	3.1
2005	189	20.7	9.1	48	na		140	42.6	3.3
2006	198	19.3	10.3	35	na		149	40.3	3.7
2007*	232	21.2	10.9	22	na		165	43.8	3.8
2008*	288	20.2	14.3	15	na		146	38.4	3.8
2009	195	16.2	12.1	44	na		183	49.3	3.7
2010	276	13.7	20.1	54	na		150	48.0	3.1

[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

Table 9.2.9. Four-spot megrim (*L.boscii*) in Divisions VIIIc and IXa. Tuning diagnostic.

Lowestoft VPA Version 3.1

28/04/2011 13:51

Extended Survivors Analysis

Four spot megrim (L. boscii) Division VIIIc and IXa

CPUE data from file fleetb.txt

Catch data for 25 years. 1986 to 2010. Ages 0 to 7.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
SP-CORUTR8c	1986	1999	3	6	0	1
SPGFS-WIBTS-Q4	1988	2010	0	6	0.75	0.83

Time series weights :

Tapered time weighting applied
Power = 3 over 20 years

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 = .300

Prior weighting not applied

Tuning had not converged after 40 iterations

Total absolute residual between iterations
39 and 40 = .00049

Final year F values

Age	0	1	2	3	4	5	6
Iteration 39	0	0.0006	0.09	0.3204	0.6183	0.5879	0.4616
Iteration 40	0	0.0006	0.09	0.3204	0.6186	0.5878	0.4615

1

Regression weights

0.751	0.82	0.877	0.921	0.954	0.976	0.99	0.997	1	1

Fishing mortalities

Age	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0	0	0	0	0	0	0	0	0	0	0
1	0.009	0.01	0.02	0.017	0.007	0.001	0	0.001	0.001	0.001
2	0.1	0.181	0.206	0.181	0.147	0.201	0.075	0.099	0.049	0.09
3	0.366	0.308	0.345	0.369	0.34	0.423	0.304	0.233	0.271	0.32
4	0.611	0.387	0.323	0.557	0.393	0.44	0.463	0.437	0.482	0.619
5	1.073	0.182	0.49	0.439	0.716	0.379	0.878	0.322	0.696	0.588
6	0.567	0.352	0.331	0.564	0.625	0.268	0.66	0.39	0.35	0.461

XSA population numbers (Thousands)

	AGE						
YEAR	0	1	2	3	4	5	6
2001	2.50E+04	1.96E+04	1.33E+04	4.51E+03	5.79E+03	3.14E+03	2.39E+03
2002	2.56E+04	2.05E+04	1.59E+04	9.84E+03	2.56E+03	2.57E+03	8.80E+02
2003	3.10E+04	2.09E+04	1.66E+04	1.09E+04	5.92E+03	1.42E+03	1.76E+03
2004	2.49E+04	2.54E+04	1.68E+04	1.11E+04	6.31E+03	3.51E+03	7.15E+02
2005	3.65E+04	2.04E+04	2.04E+04	1.15E+04	6.26E+03	2.96E+03	1.85E+03
2006	2.73E+04	2.99E+04	1.66E+04	1.44E+04	6.69E+03	3.46E+03	1.18E+03
2007	2.22E+04	2.24E+04	2.44E+04	1.11E+04	7.75E+03	3.53E+03	1.94E+03
2008	2.04E+04	1.82E+04	1.83E+04	1.86E+04	6.72E+03	3.99E+03	1.20E+03
2009	3.48E+04	1.67E+04	1.49E+04	1.36E+04	1.20E+04	3.55E+03	2.37E+03
2010	2.18E+04	2.85E+04	1.36E+04	1.16E+04	8.47E+03	6.08E+03	1.45E+03

Estimated population abundance at 1st Jan 2011

0.00E+00	1.79E+04	2.33E+04	1.02E+04	6.88E+03	3.73E+03	2.77E+03

Taper weighted geometric mean of the VPA populations:

2.46E+04	2.01E+04	1.58E+04	1.14E+04	6.72E+03	3.31E+03	1.43E+03

Standard error of the weighted Log(VPA populations) :

	0.2944	0.3168	0.3205	0.3616	0.4044	0.3929	0.4611
1							

Log catchability residuals.

Fleet : SP-CORUTR8c

Age	1986	1987	1988	1989	1990
0	No data for this fleet at this age				
1	No data for this fleet at this age				
2	No data for this fleet at this age				
3	99.99	99.99	99.99	99.99	99.99
4	99.99	99.99	99.99	99.99	99.99
5	99.99	99.99	99.99	99.99	99.99
6	99.99	99.99	99.99	99.99	99.99

Age	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
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	0.24	0.17	0.49	-0.53	0.14	-0.63	-0.49	0.4	0.3	99.99
4	-0.19	0.48	0.76	0.13	-0.15	-0.17	-0.66	0.32	0.18	99.99
5	0.73	0.37	0.06	0.09	0.22	-0.59	-0.28	0.39	0.04	99.99
6	0.28	0.32	0.32	0.05	0.26	-0.29	0.11	0.22	0.37	99.99

Age		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	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	-6.4571	-5.6741	-5.221	-5.221
S.E(Log q)	0.59	0.509	0.4424	0.3716

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	0.68	0.19	7.41	0.75	9	1.08	-6.46
4	0.67	0.321	6.72	0.89	9	0.77	-5.67
5	2.46	-0.611	1.14	0.6	9	1.65	-5.22
6	1	-0.004	5.04	0.91	9	0.89	-5.05
1							

Fleet : SPGFS-WIBTS-Q4 ●

Age		1986	1987	1988	1989	1990
	0	99.99	99.99	99.99	99.99	99.99
	1	99.99	99.99	99.99	99.99	99.99
	2	99.99	99.99	99.99	99.99	99.99
	3	99.99	99.99	99.99	99.99	99.99
	4	99.99	99.99	99.99	99.99	99.99
	5	99.99	99.99	99.99	99.99	99.99
	6	99.99	99.99	99.99	99.99	99.99

Age		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
	0	-0.13	-0.08	0.04	0.42	-0.06	0.66	0.89	0.24	0.12	0
	1	-0.13	0.38	-0.01	-0.72	0.25	0.08	0.06	-0.02	0.41	0.25
	2	-0.58	-0.91	-0.31	-0.64	-0.9	-0.01	-0.33	-0.28	0.06	0
	3	-1.11	-0.8	-0.88	-0.82	-0.93	-0.74	-0.02	-0.26	-0.28	-0.22
	4	-0.99	-0.6	-0.79	-0.36	-0.59	-0.89	-0.27	-0.11	-0.58	0.21
	5	-0.27	-0.27	-0.92	-0.22	-0.39	0.15	-0.08	0.4	-0.41	-0.1
	6	-1.59	-0.29	-0.41	-0.17	-0.3	0.16	0.03	0.1	-0.14	-0.02

Age		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
	0	-0.34	-0.08	99.99	0.02	0.34	-0.43	-0.02	-0.38	0.21	-0.16
	1	0.25	-0.3	99.99	0.21	0.25	-0.31	-0.27	-0.37	-0.38	0.54
	2	0.13	0.02	99.99	-0.16	0.33	0.04	0.05	-0.28	0.05	0.38
	3	0.45	0.09	99.99	-0.16	0.37	-0.09	0.29	-0.53	0.39	0.32
	4	0.32	0.23	99.99	-0.16	0.12	-0.38	0.17	-0.36	0.41	0.58
	5	1.06	-0.63	99.99	-0.55	0.49	-0.41	0.34	-0.87	0.97	-0.01
	6	0.16	-0.09	99.99	-0.18	-0.05	-0.02	0.12	0.01	0.02	-0.11

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	-6.8848	-7.0068	-7.3022	-7.3022
S.E(Log q)	0.3863	0.3924	0.6207	0.1212

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
0	0.51	1.365	9.97	0.46	19	0.34	-9.86
1	0.95	0.155	7.3	0.49	19	0.36	-7.15
2	1.05	-0.214	6.69	0.63	19	0.27	-6.85

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	1.51	-1.064	5.62	0.32	19	0.58	-6.88
4	1.01	-0.046	6.98	0.53	19	0.42	-7.01
5	1.33	-0.385	7.02	0.13	19	0.86	-7.3
6	0.88	1.965	7.32	0.97	19	0.09	-7.32
1							

Terminal year survivor and F summaries :

Age 0 Catchability dependent on age and year class strength

Year class = 2010

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c	1	0	0	0	0	0	0
SPGFS-WIBTS-Q4	15243	0.363	0	0	1	0.432	0
P shrinkage mean	20141	0.32				0.568	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
17855	0.24	0.21	2	0.879	0

Age 1 Catchability dependent on age and year class strength

Year class = 2009

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c	1	0	0	0	0	0	0
SPGFS-WIBTS-Q4	33326	0.286	0.161	0.56	2	0.546	0
P shrinkage mean	15770	0.32				0.435	0.001
F shrinkage mean	6330	1.5				0.02	0.002

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
23296	0.21	0.32	4	1.527	0.001

Age 2 Catchability dependent on age and year class strength

Year class = 2008

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c	1	0	0	0	0	0	0
SPGFS-WIBTS-Q4	9886	0.203	0.266	1.31	3	0.733	0.093
P shrinkage mean	11375	0.36				0.252	0.081
F shrinkage mean	7915	1.5				0.015	0.115

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
10209	0.18	0.17	5	0.941	0.09

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

Year class = 2007

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c	1	0	0	0	0	0	0
SPGFS-WIBTS-Q4	6877	0.178	0.13	0.73	4	0.98	0.321
F shrinkage mean	6989	1.5				0.02	0.316

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
6879	0.18	0.11	5	0.627	0.32

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

Year class = 2006

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c	1	0	0	0	0	0	0
SPGFS-WIBTS-Q4	3687	0.165	0.202	1.22	5	0.972	0.625
F shrinkage mean	5686	1.5				0.028	0.446

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
3732	0.17	0.18	6	1.09	0.619

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

Year class = 2005

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c	1	0	0	0	0	0	0
SPGFS-WIBTS-Q4	2770	0.167	0.145	0.87	6	0.961	0.587
F shrinkage mean	2672	1.5				0.039	0.603

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
2766	0.17	0.13	7	0.762	0.588

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

Year class = 2004

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
SP-CORUTR8c	1	0	0	0	0	0	0
SPGFS-WIBTS-Q4	752	0.18	0.118	0.65	7	0.967	0.46
F shrinkage mean	655	1.5				0.033	0.513

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
749	0.18	0.11	8	0.594	0.461

Table 9.2.10 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 28/04/2011 13:52

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR	1986	1987	1988	1989	1990
AGE					
0	0	0	0	0	0
1	0.0024	0.0596	0.0624	0.0263	0.0594
2	0.1158	0.3782	0.403	0.4595	0.2615
3	0.2104	0.2471	0.3071	0.3913	0.2083
4	0.4273	0.3265	0.3895	0.6457	0.5369
5	0.3317	0.2512	0.3719	0.5506	0.5681
6	0.3251	0.2764	0.3585	0.5335	0.4409
+gp	0.3251	0.2764	0.3585	0.5335	0.4409
FBAR 2- 4	0.2512	0.3173	0.3665	0.4988	0.3356

Table 8 Fishing mortality (F) at age

YEAR	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
AGE										
0	0	0	0	0	0	0	0	0	0	0
1	0.078	0.0274	0.0191	0.0093	0.0691	0.0158	0.0021	0.0033	0.0055	0.0031
2	0.2113	0.2584	0.0983	0.1341	0.362	0.1408	0.0628	0.0904	0.1118	0.1234
3	0.2671	0.3746	0.3327	0.2797	0.4607	0.3655	0.2852	0.3141	0.3105	0.229
4	0.338	0.8719	0.7489	0.7373	0.6706	0.5873	0.3805	0.5327	0.5377	0.5886
5	0.9181	0.8335	0.4744	0.8621	0.9678	0.5032	0.5371	0.7562	0.5273	0.5301
6	0.5371	0.7169	0.6139	0.7774	0.9247	0.4863	0.5962	0.5858	0.6251	0.644
+gp	0.5371	0.7169	0.6139	0.7774	0.9247	0.4863	0.5962	0.5858	0.6251	0.644
FBAR 2- 4	0.2721	0.5016	0.3933	0.3837	0.4978	0.3645	0.2428	0.3124	0.32	0.3136

Table 8 Fishing mortality (F) at age

YEAR	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	FBAR 08-10
AGE											
0	0	0	0	0	0	0	0	0	0	0	0
1	0.0094	0.0103	0.0196	0.0172	0.0067	0.0013	0.0004	0.0009	0.0014	0.0006	0.001
2	0.0996	0.1811	0.2064	0.1809	0.1467	0.2011	0.0754	0.0991	0.0493	0.09	0.0794
3	0.366	0.3083	0.3449	0.3685	0.3402	0.4228	0.3036	0.2335	0.2714	0.3204	0.2751
4	0.6109	0.3865	0.3226	0.5569	0.3929	0.4398	0.4634	0.4371	0.4818	0.6186	0.5125
5	1.0728	0.1819	0.4895	0.439	0.7161	0.379	0.8781	0.3216	0.6958	0.5878	0.5351
6	0.5669	0.3517	0.3306	0.5644	0.6253	0.268	0.66	0.3905	0.35	0.4615	0.4006
+gp	0.5669	0.3517	0.3306	0.5644	0.6253	0.268	0.66	0.3905	0.35	0.4615	
FBAR 2- 4	0.3588	0.292	0.2913	0.3688	0.2933	0.3545	0.2808	0.2566	0.2675	0.343	

Table 9.2.11 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 28/04/2011
13:52

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
AGE					
0	53249	34015	38131	33796	20878
1	49762	43597	27849	31219	27670
2	35113	40642	33628	21421	24897
3	21489	25604	22797	18401	11077
4	12523	14255	16373	13728	10186
5	4431	6688	8420	9080	5893
6	3381	2604	4259	4753	4287
+gp	905	641	1686	1666	2467
TOTAL	180853	168044	153142	134065	107355

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

YEAR	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
AGE										
0	42252	39025	12081	28729	34229	23014	18163	9351	19859	23998
1	17094	34593	31951	9891	23521	28025	18842	14871	7656	16259
2	21348	12945	27557	25665	8023	17972	22585	15395	12134	6234
3	15693	14149	8186	20450	18375	4574	12781	17366	11515	8884
4	7364	9837	7965	4805	12657	9490	2598	7868	10385	6911
5	4875	4300	3368	3084	1882	5300	4319	1454	3781	4966
6	2734	1594	1530	1716	1066	585	2623	2067	559	1827
+gp	1261	143	662	899	504	1566	1078	860	1147	1927
TOTAL	112620	116585	93298	95238	100259	90525	82990	69230	67036	71006

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

YEAR	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	GMST 90-08
AGE												
0	25023	25556	31005	24925	36496	27302	22180	20385	34771	21810	0	24016
1	19648	20487	20923	25385	20407	29880	22353	18160	16690	28468	17855	
2	13271	15935	16602	16798	20428	16596	24433	18293	14854	13645	23296	
3	4511	9836	10885	11057	11478	14443	11113	18551	13565	11577	10209	
4	5785	2561	5917	6312	6262	6687	7748	6716	12026	8466	6879	
5	3141	2571	1425	3509	2961	3461	3527	3991	3552	6082	3732	
6	2393	880	1755	715	1852	1185	1940	1200	2369	1450	2766	
+gp	902	1328	554	854	923	1023	1039	1000	825	1294	1417	
TOTAL	74674	79154	89064	89554	100807	100578	94333	88296	98651	92793	66154	

Table 9.2.12 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 28/04/2011 13:52

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	53249	6822	5890	1124	0.1908	0.2512
1987	34015	8384	7206	1688	0.2343	0.3173
1988	38131	8981	8038	2223	0.2766	0.3665
1989	33796	8622	7653	2629	0.3435	0.4988
1990	20878	7427	6760	1945	0.2877	0.3356
1991	42252	6670	6007	1682	0.28	0.2721
1992	39025	6059	5252	1916	0.3648	0.5016
1993	12081	6036	5355	1384	0.2585	0.3933
1994	28729	5649	5106	1403	0.2748	0.3837
1995	34229	5184	4489	1652	0.368	0.4978
1996	23014	4841	4139	1098	0.2653	0.3645
1997	18163	4485	3949	896	0.2269	0.2428
1998	9351	4695	4256	1123	0.2638	0.3124
1999	19859	4263	3899	1125	0.2885	0.32
2000	23998	4024	3573	1041	0.2914	0.3136
2001	25023	3853	3260	931	0.2856	0.3588
2002	25556	4385	3703	720	0.1944	0.292
2003	31005	4657	3925	876	0.2232	0.2913
2004	24925	4614	3917	1006	0.2568	0.3688
2005	36496	4822	4054	983	0.2425	0.2933
2006	27302	5237	4514	1092	0.2419	0.3545
2007	22180	5437	4690	1104	0.2354	0.2808
2008	20385	5776	5103	980	0.192	0.2566
2009	34771	5101	4603	1134	0.2464	0.2675
2010	21810	5509	4797	1297	0.2704	0.343
Arith. Mean	28009	5661	4965	1322	0.2641	0.3391
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		

Table 9.2.13 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa.

Prediction with management option table: Input data

MFDP version 1a
Run: ldb
Time and date: 20:38 29/04/2011
Fbar age range: 2-4

2011 Age	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
0	24016	0.2	0	0	0	0.003	0.000	0.003
1	17855	0.2	0.55	0	0	0.037	0.001	0.037
2	23296	0.2	0.86	0	0	0.070	0.079	0.070
3	10209	0.2	0.97	0	0	0.088	0.275	0.088
4	6879	0.2	0.99	0	0	0.110	0.513	0.110
5	3732	0.2	1	0	0	0.145	0.535	0.145
6	2766	0.2	1	0	0	0.186	0.401	0.186
7	1417	0.2	1	0	0	0.265	0.401	0.265

2012 Age	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
0	24016	0.2	0	0	0	0.003	0.000	0.003
1	.	0.2	0.55	0	0	0.037	0.001	0.037
2	.	0.2	0.86	0	0	0.070	0.079	0.070
3	.	0.2	0.97	0	0	0.088	0.275	0.088
4	.	0.2	0.99	0	0	0.110	0.513	0.110
5	.	0.2	1	0	0	0.145	0.535	0.145
6	.	0.2	1	0	0	0.186	0.401	0.186
7	.	0.2	1	0	0	0.265	0.401	0.265

2013 Age	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
0	24016	0.2	0	0	0	0.003	0.000	0.003
1	.	0.2	0.55	0	0	0.037	0.001	0.037
2	.	0.2	0.86	0	0	0.070	0.079	0.070
3	.	0.2	0.97	0	0	0.088	0.275	0.088
4	.	0.2	0.99	0	0	0.110	0.513	0.110
5	.	0.2	1	0	0	0.145	0.535	0.145
6	.	0.2	1	0	0	0.186	0.401	0.186
7	.	0.2	1	0	0	0.265	0.401	0.265

Input units are thousands and kg - output in tonnes

Table 9.2.14. Megrim (*L. boscii*) in Div. VIIIc and IXa catch forecast: management option table

Run: ldb
Four spot megrim (L. boscii) Division VIIIc and IXa
Time and date: 20:38 29/04/2011
Fbar age range: 2-4

2011 Biomass	SSB	FMult	FBar	Landings
5458	4818	1	0.289	1062

2012 Biomass	SSB	FMult	FBar	Landings	2013 Biomass	SSB
5506	4902	0	0	0	6729	6116
.	4902	0.1	0.0289	134	6578	5966
.	4902	0.2	0.0578	263	6433	5822
.	4902	0.3	0.0867	387	6294	5683
.	4902	0.4	0.1156	506	6160	5550
.	4902	0.5	0.1445	621	6031	5422
.	4902	0.6	0.1734	732	5907	5298
.	4902	0.7	0.2023	838	5788	5180
.	4902	0.8	0.2312	941	5673	5066
.	4902	0.9	0.2601	1040	5563	4956
.	4902	1	0.289	1136	5457	4851
.	4902	1.1	0.3179	1228	5355	4749
.	4902	1.2	0.3468	1316	5256	4651
.	4902	1.3	0.3757	1402	5162	4557
.	4902	1.4	0.4046	1484	5070	4466
.	4902	1.5	0.4335	1564	4983	4379
.	4902	1.6	0.4624	1641	4898	4295
.	4902	1.7	0.4913	1715	4816	4214
.	4902	1.8	0.5202	1787	4738	4136
.	4902	1.9	0.5491	1856	4662	4061
.	4902	2	0.578	1923	4589	3988

Input units are thousands and kg - output in tonnes

Table 9.2.15 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Single option prediction. Detail Tables.

MFDP version 1a
Run: ldb
Time and date: 20:38 29/04/2011
Fbar age range: 2-4

Year:	2011	F multiplier:	1	Fbar:	0.289				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
0	0	0	0	24016	80	0	0	0	0
1	0.001	16	1	17855	661	9820	363	9820	363
2	0.0795	1615	113	23296	1631	20035	1402	20035	1402
3	0.2751	2236	196	10209	895	9903	868	9903	868
4	0.5125	2521	278	6879	759	6810	751	6810	751
5	0.5351	1414	206	3732	542	3732	542	3732	542
6	0.4007	833	155	2766	515	2766	515	2766	515
7	0.4007	427	113	1417	375	1417	375	1417	375
Total		9062	1062	90170	5458	54483	4818	54483	4818

Year:	2012	F multiplier:	1	Fbar:	0.289				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
0	0	0	0	24016	80	0	0	0	0
1	0.001	17	1	19663	728	10814	400	10814	400
2	0.0795	1012	71	14604	1022	12560	879	12560	879
3	0.2751	3858	338	17616	1544	17088	1498	17088	1498
4	0.5125	2327	257	6348	700	6285	693	6285	693
5	0.5351	1278	186	3374	490	3374	490	3374	490
6	0.4007	539	100	1789	333	1789	333	1789	333
7	0.4007	691	183	2294	607	2294	607	2294	607
Total		9722	1136	89704	5506	54204	4902	54204	4902

Year:	2013	F multiplier:	1	Fbar:	0.289				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
0	0	0	0	24016	80	0	0	0	0
1	0.001	17	1	19663	728	10814	400	10814	400
2	0.0795	1115	78	16083	1126	13831	968	13831	968
3	0.2751	2418	212	11044	968	10712	939	10712	939
4	0.5125	4015	443	10954	1209	10845	1197	10845	1197
5	0.5351	1180	171	3113	452	3113	452	3113	452
6	0.4007	487	91	1618	301	1618	301	1618	301
7	0.4007	675	179	2240	593	2240	593	2240	593
Total		9907	1174	88730	5457	53173	4851	53173	4851

Input units are thousands and kg - output in tonnes

Table 9.2.16 **Four-spot megrim (L. boscii) in Divisions VIIIc and IXa**
Stock numbers of recruits and their source for recent year classes used in predictions, and the relative (%) contributions to landings and SSB (by weight) of these year classes

Year-class			2008	2009	2010	2011	2012
Stock No. (thousands)			20385	34771	21810	24016	24016
of	0 year-olds						
Source			XSA	XSA	XSA	GM90-08	GM90-08
Status Quo F:							
% in	2011	landings	18.5	10.6	0.1	0.0	-
% in	2012		22.6	29.8	6.3	0.1	0.0
% in	2011	SSB	18.0	29.1	7.5	0.0	-
% in	2012	SSB	14.1	30.6	17.9	8.2	0.0
% in	2013	SSB	9.3	24.7	19.4	20.0	8.2

GM : geometric mean recruitment

Four-spot megrim (L. boscii) in Divisions VIIIc and IXa : Year-class % contribution to

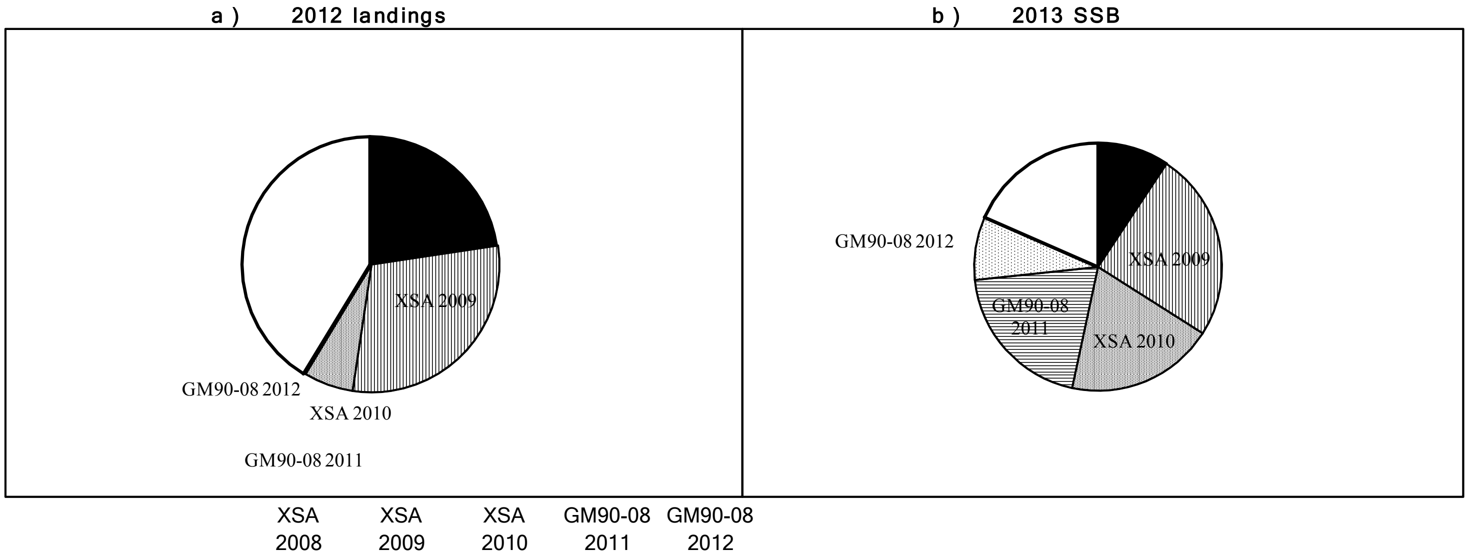


Table 9.2.17 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Yield per recruit results.

MFYPR version 2a
Run: ldb
Time and date: 13:02 30/04/2011
Yield per results

FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0	0	0	0	5.5167	0.6479	4.0334	0.6224	4.0334	0.6224
0.1	0.0289	0.0976	0.0168	5.0308	0.5292	3.5479	0.5038	3.5479	0.5038
0.2	0.0578	0.1665	0.0272	4.6879	0.4476	3.2052	0.4222	3.2052	0.4222
0.3	0.0867	0.2178	0.0338	4.4336	0.3888	2.9512	0.3634	2.9512	0.3634
0.4	0.1156	0.2573	0.038	4.238	0.3448	2.7559	0.3194	2.7559	0.3194
0.5	0.1445	0.2886	0.0409	4.0831	0.311	2.6013	0.2857	2.6013	0.2857
0.6	0.1734	0.3141	0.0427	3.9575	0.2844	2.476	0.2591	2.476	0.2591
0.7	0.2023	0.3352	0.0439	3.8537	0.2632	2.3724	0.2379	2.3724	0.2379
0.8	0.2312	0.353	0.0447	3.7665	0.2459	2.2855	0.2206	2.2855	0.2206
0.9	0.2601	0.3682	0.0453	3.6922	0.2316	2.2114	0.2064	2.2114	0.2064
1	0.289	0.3814	0.05	3.6281	0.2197	2.1476	0.19	2.1476	0.1945
1.1	0.3179	0.3929	0.0457	3.5722	0.2096	2.0919	0.1844	2.0919	0.1844
1.2	0.3468	0.403	0.0458	3.5229	0.201	2.0429	0.1758	2.0429	0.1758
1.3	0.3757	0.4121	0.0458	3.4792	0.1936	1.9994	0.1684	1.9994	0.1684
1.4	0.4046	0.4202	0.0458	3.4401	0.1871	1.9605	0.162	1.9605	0.162
1.5	0.4335	0.4275	0.0458	3.4048	0.1815	1.9254	0.1564	1.9254	0.1564
1.6	0.4624	0.4342	0.0457	3.3728	0.1765	1.8936	0.1515	1.8936	0.1515
1.7	0.4913	0.4403	0.0456	3.3436	0.1721	1.8647	0.1471	1.8647	0.1471
1.8	0.5202	0.4459	0.0456	3.3168	0.1682	1.8381	0.1431	1.8381	0.1431
1.9	0.5491	0.4511	0.0455	3.2921	0.1646	1.8136	0.1396	1.8136	0.1396
2	0.578	0.4559	0.0454	3.2693	0.1614	1.791	0.1364	1.791	0.1364

Reference point	F multiplier	Absolute F
Fbar(2-4)	1	0.289
FMax	1.2917	0.3733
F0.1	0.5128	0.1482
F35%SPR	0.8182	0.2365
Flow	0.4729	0.1367
Fmed	1.1733	0.3391
Fhigh	2.317	0.6697

Weights in kilograms

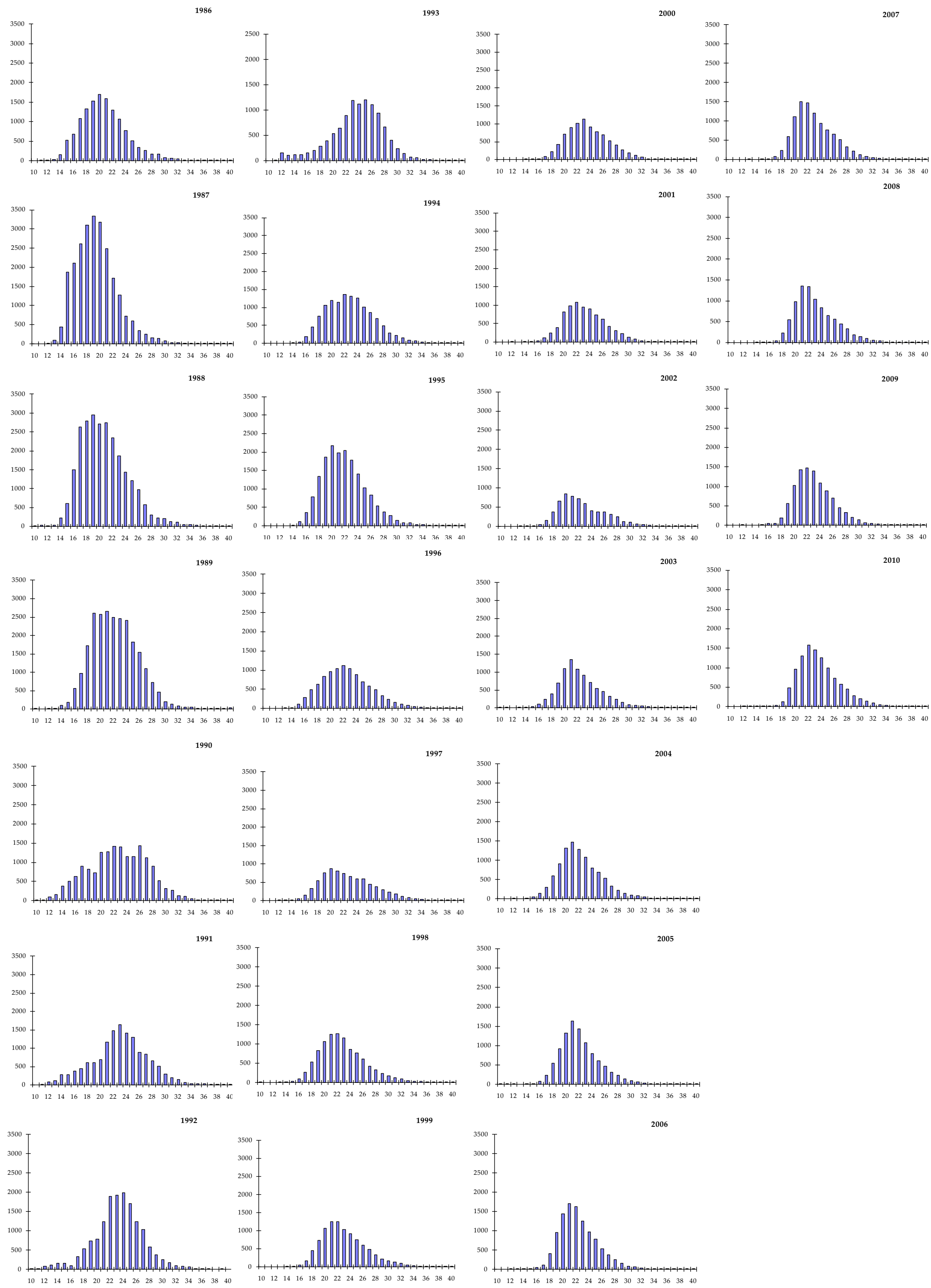
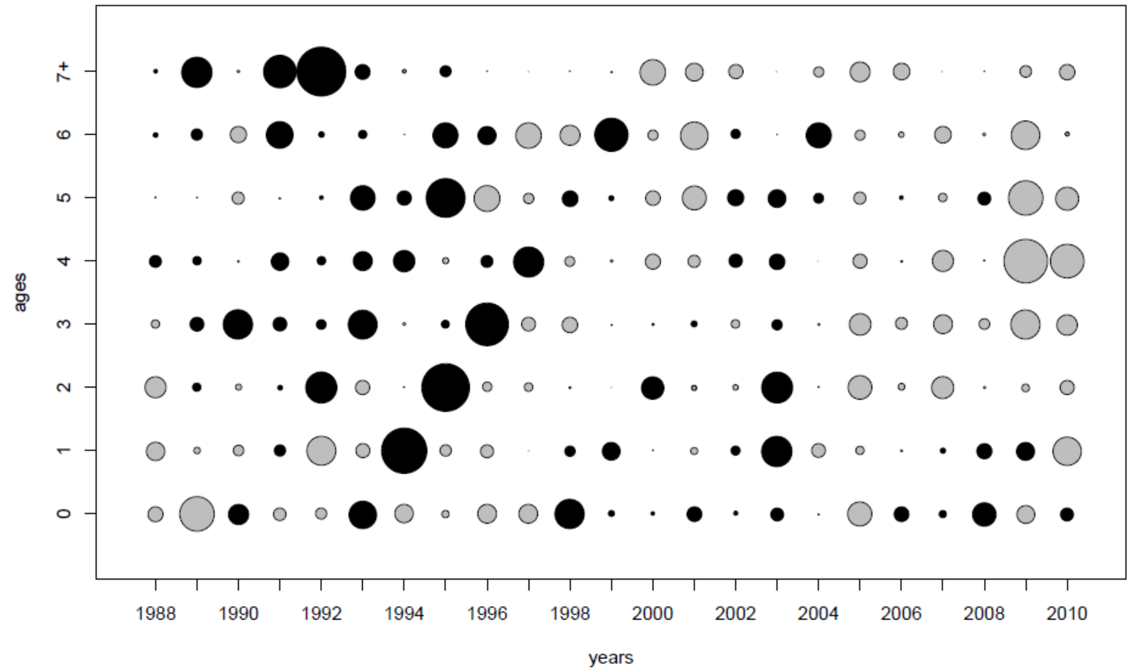


Figure 9.2.1 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Annual length compositions of landings ('000)

Standardized log(abundance index at age) from SpGFS-WIBTS-Q4

(black bubble means < 0)



Standardized log(abundance index at age) from A Coruña VIIIc trawl fleet

(black bubble means < 0)

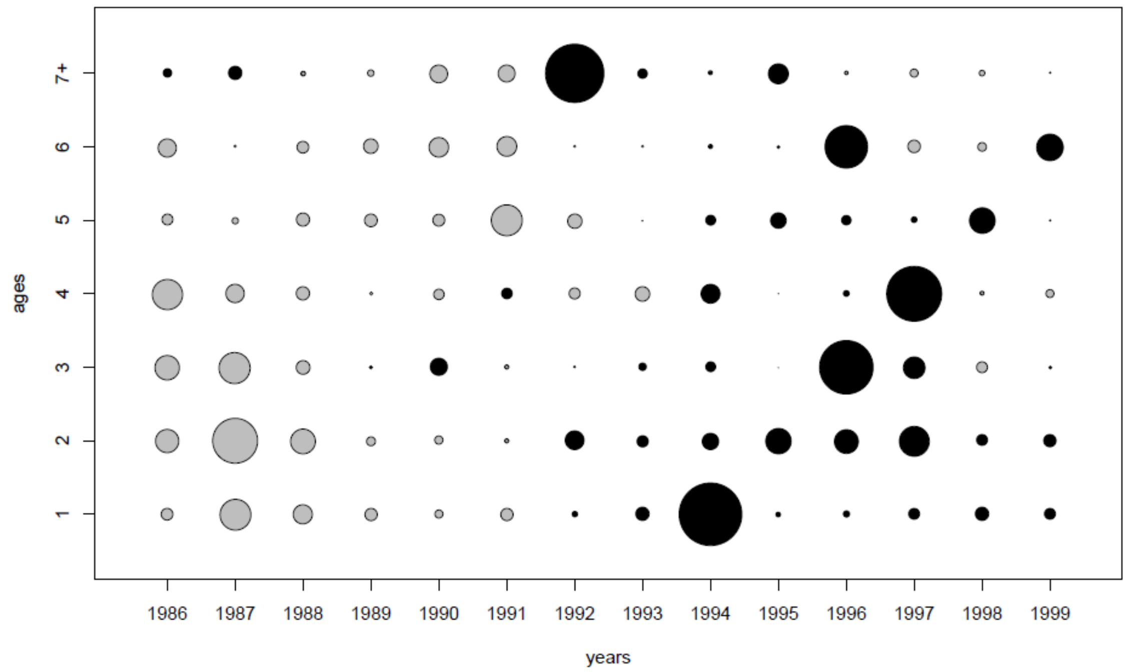
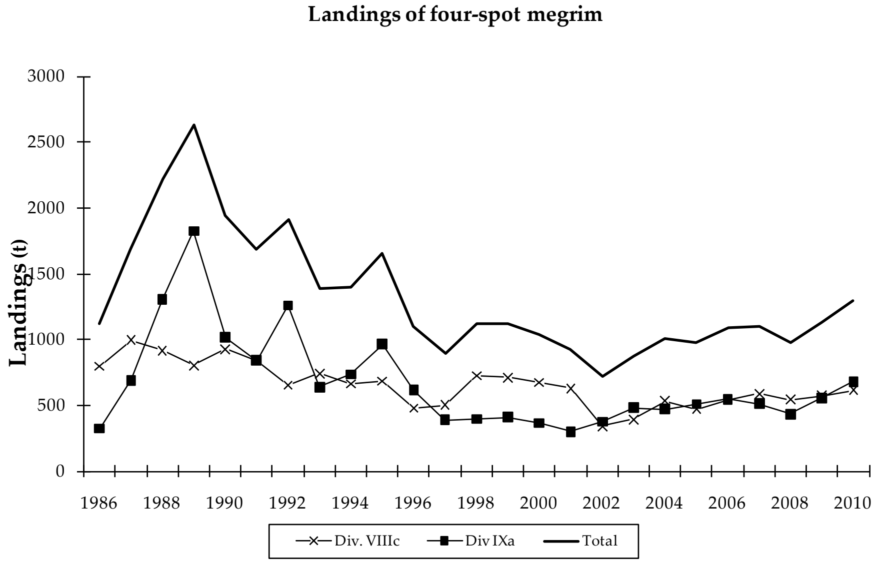
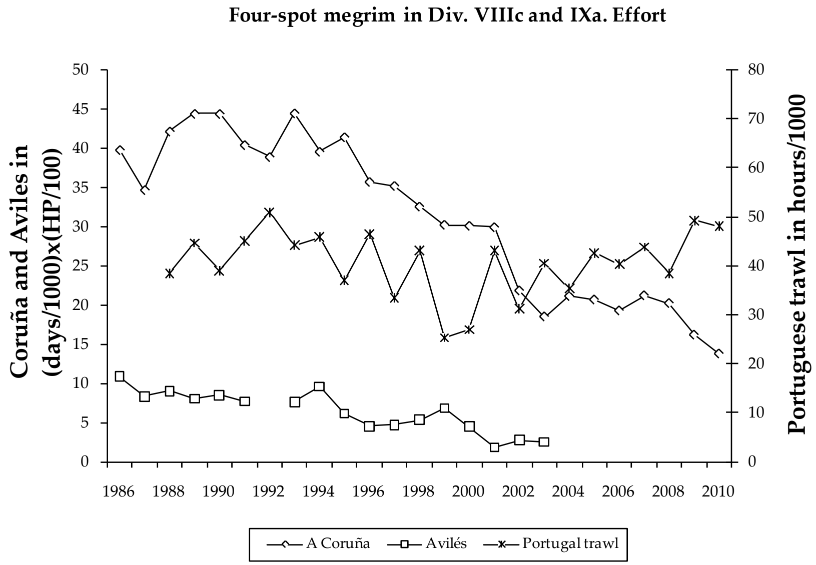
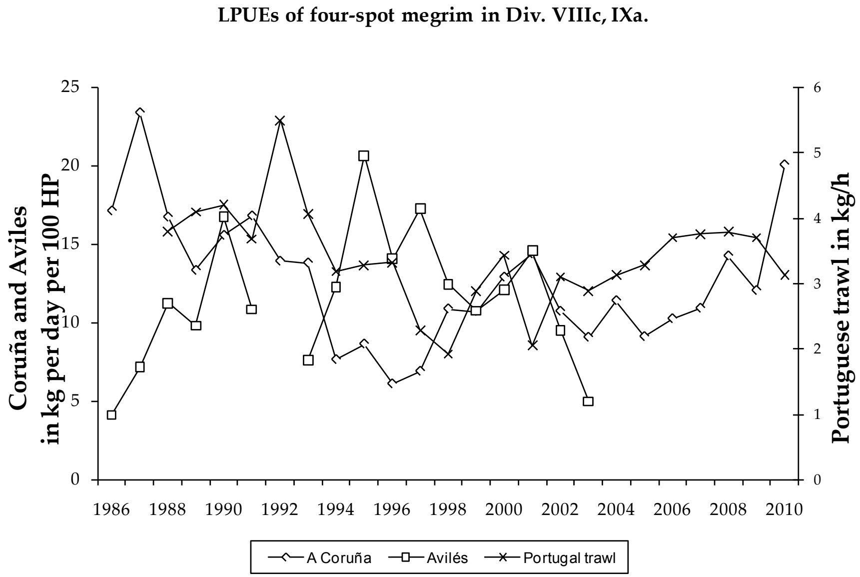


Figure 9.2.2: Four-spot megrim (*L. boscii*) in Divisions VIIIc&IXa







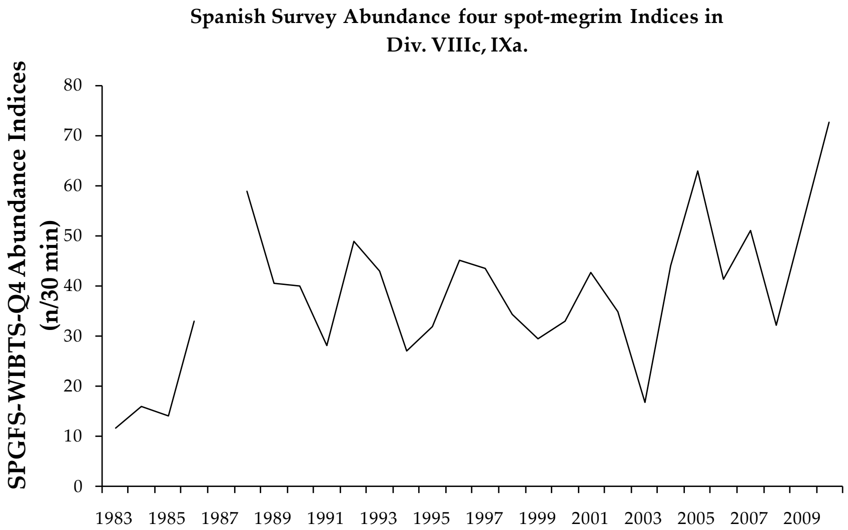
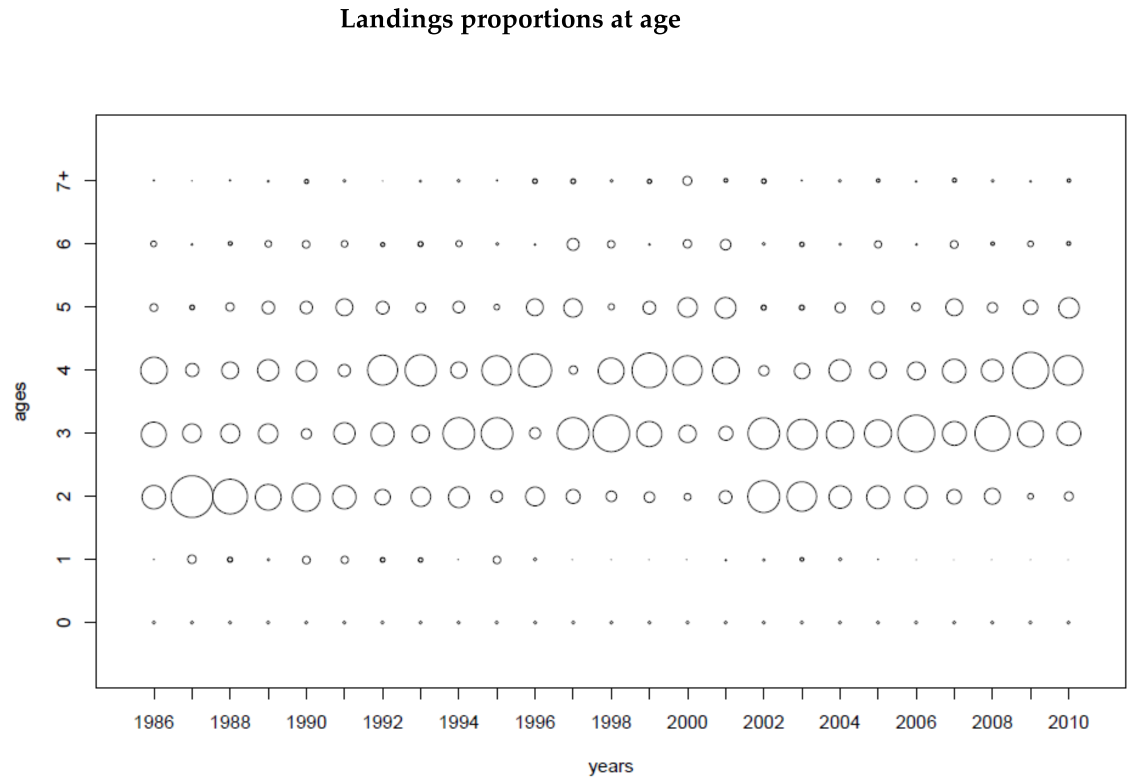


Figure 9.2.3 Four-spot megrim (*L.boscii*) in Divisions VIIIc and IXa. Landings (t), Efforts, LPUEs and Abundance Indices.



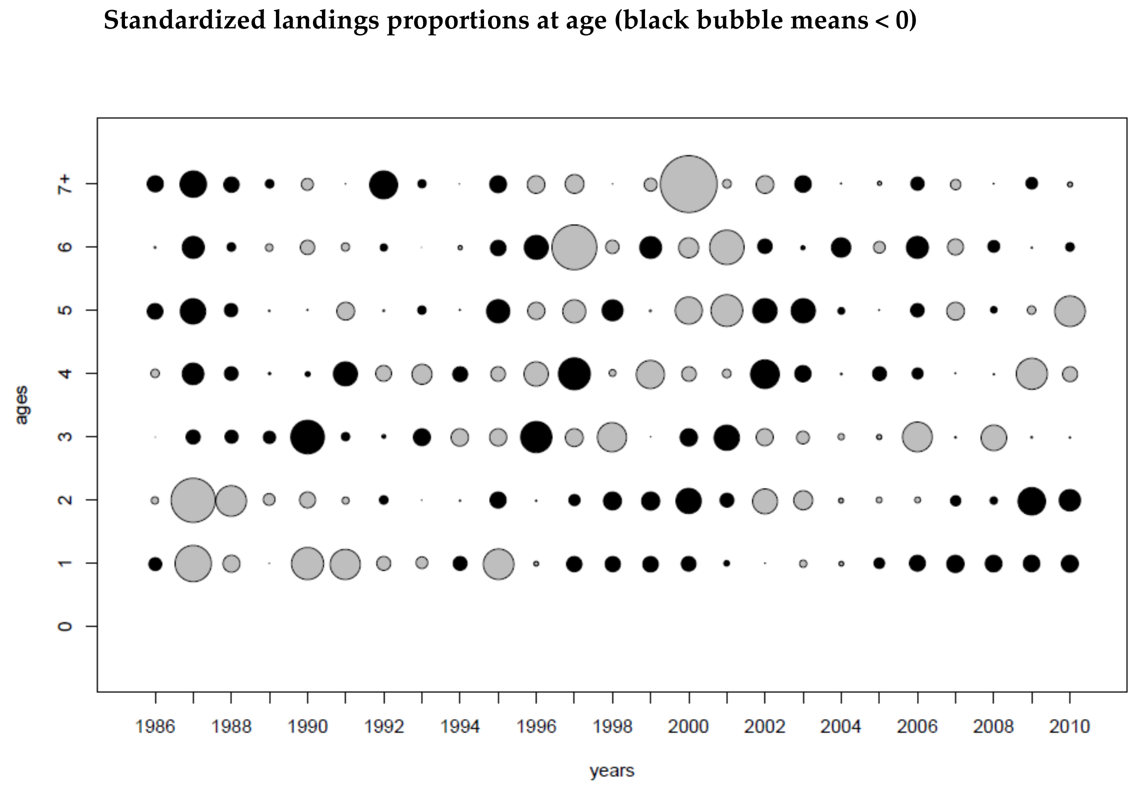


Figure 9.2.4. Four-spot megrim (*L. boscii*) in Divisions VIIIc & IXa.

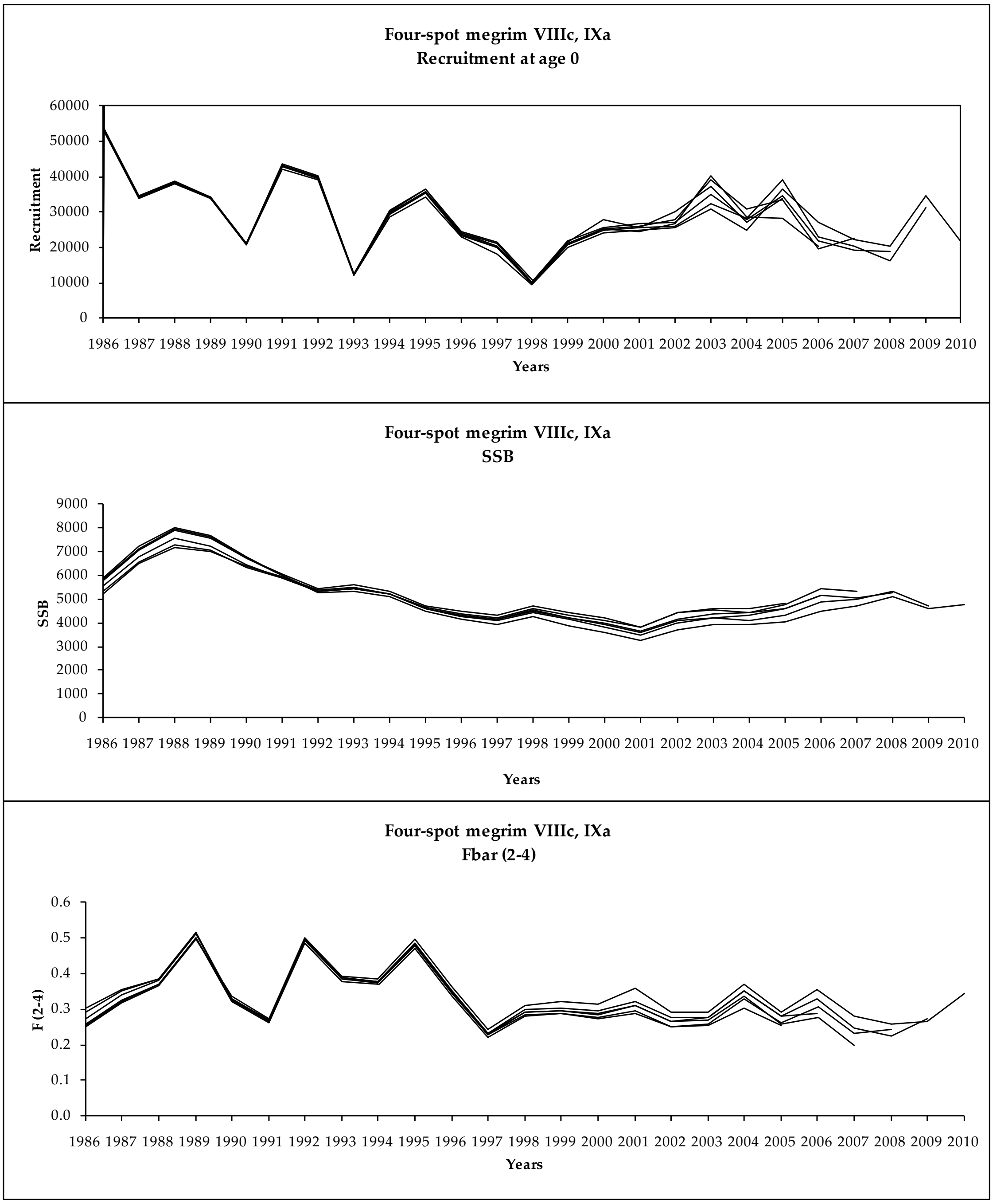


Figure 9.2.5. Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Retrospective XSA

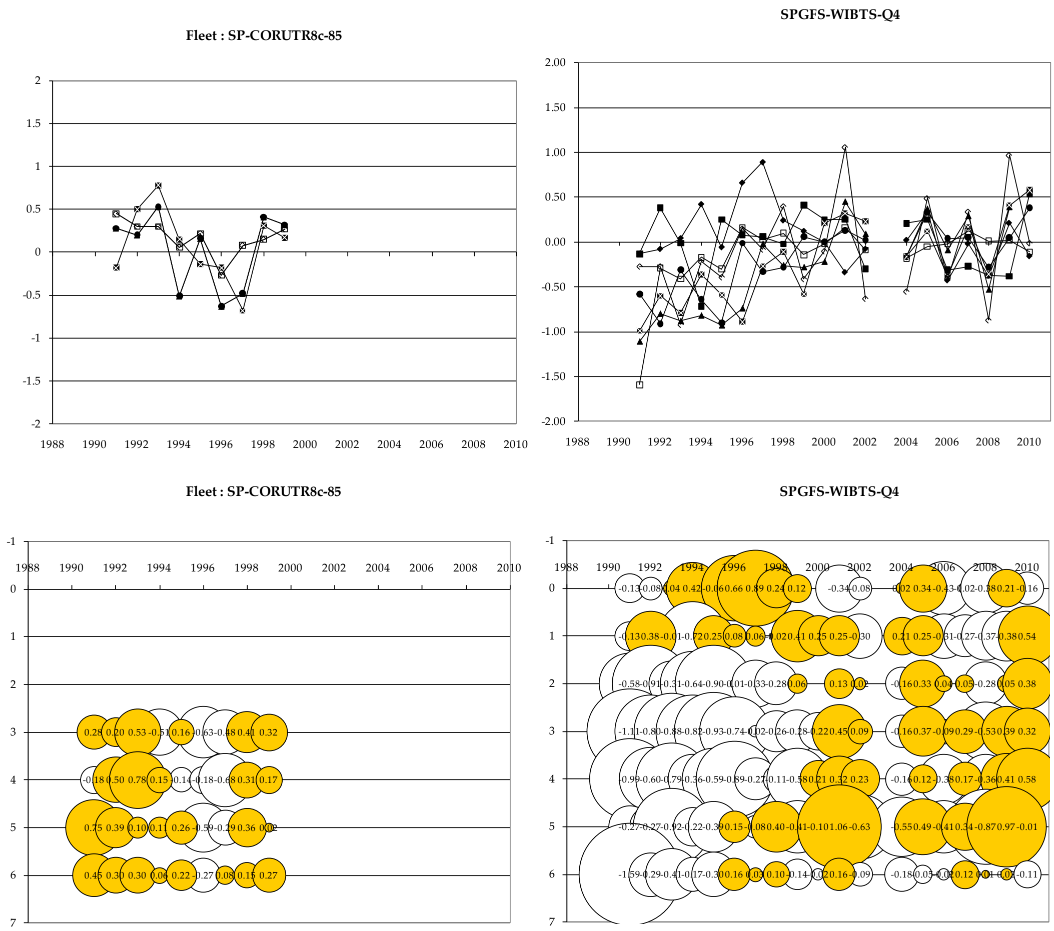


Figure 9.2.6. Four spot megrim (*L. boscii*) in Divisions VIIIc and IXa. LOG CATCHABILITY RESIDUAL PLOTS (XSA)

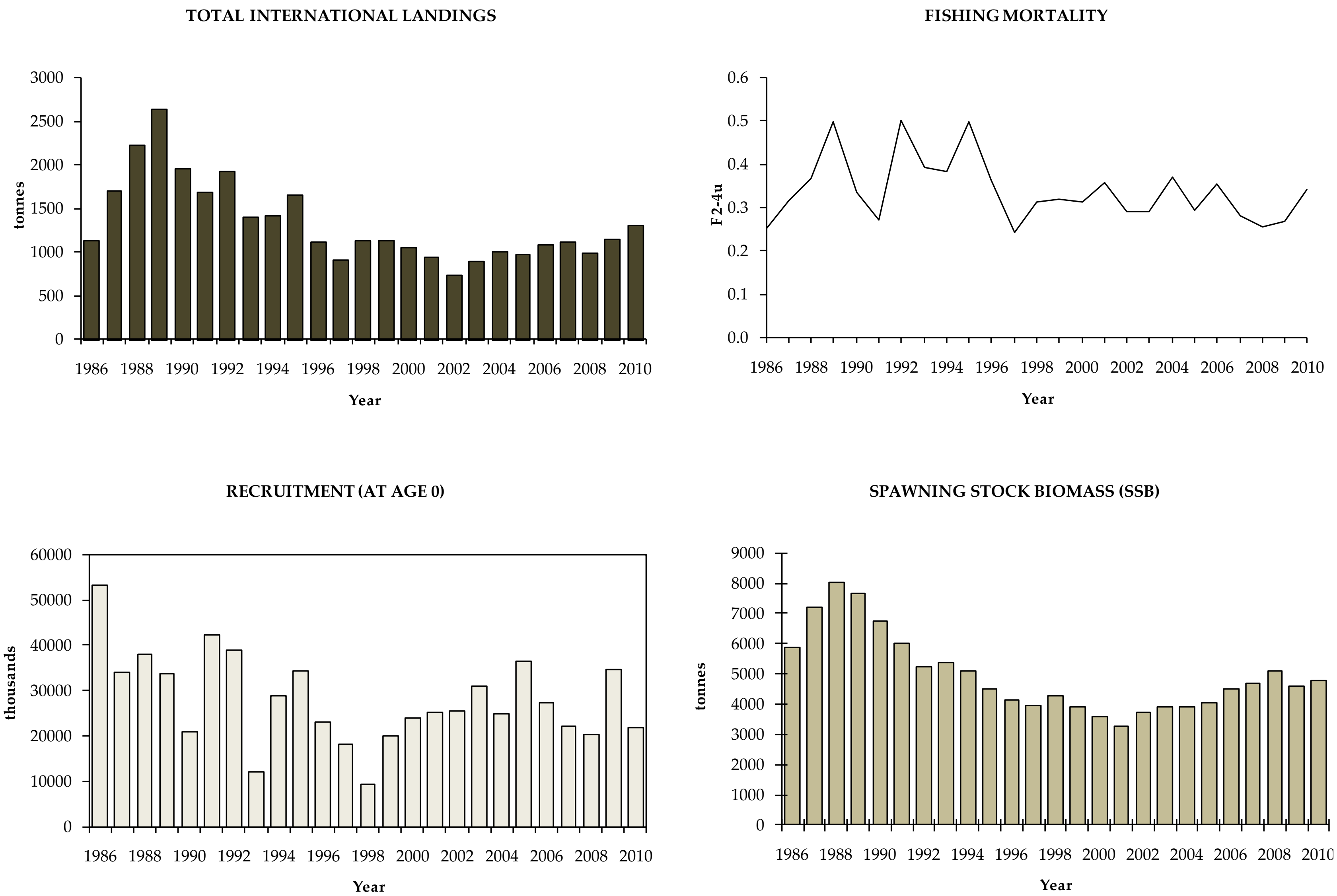
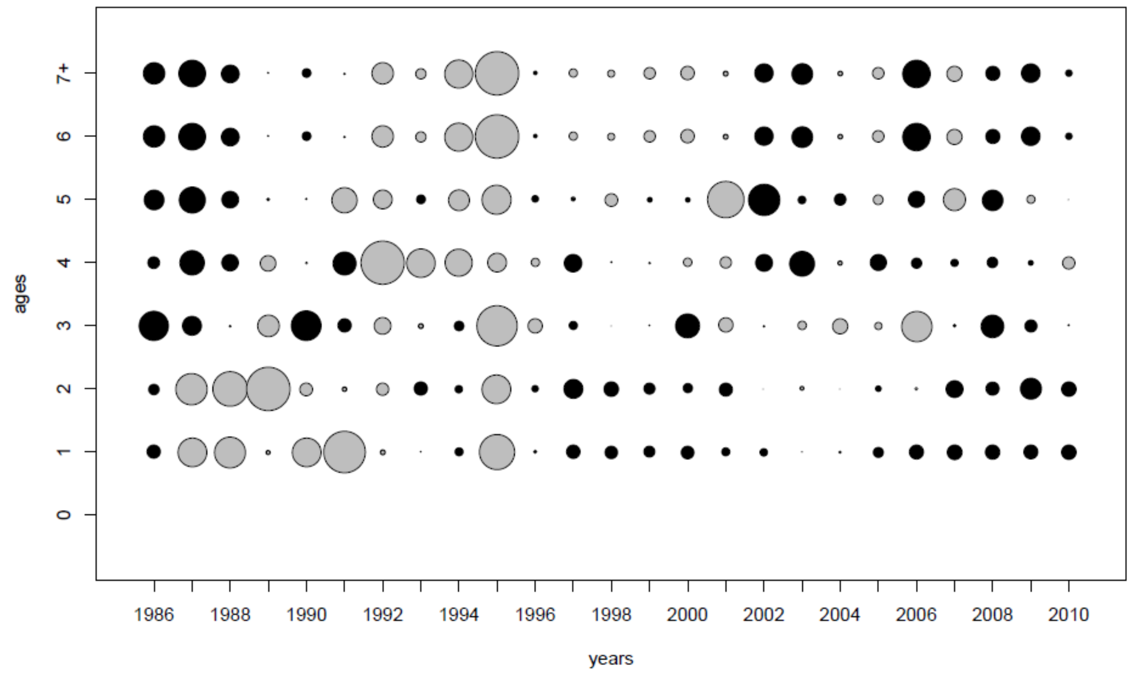


Figure 9.2.7(a). Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Stock Summary

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



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

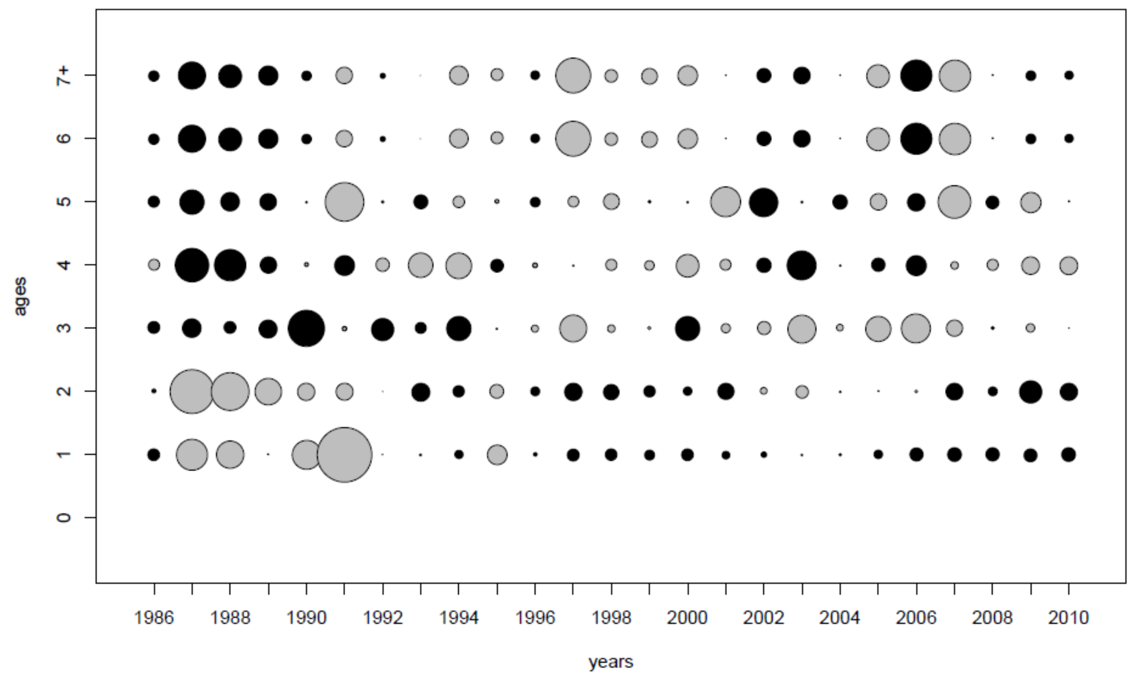
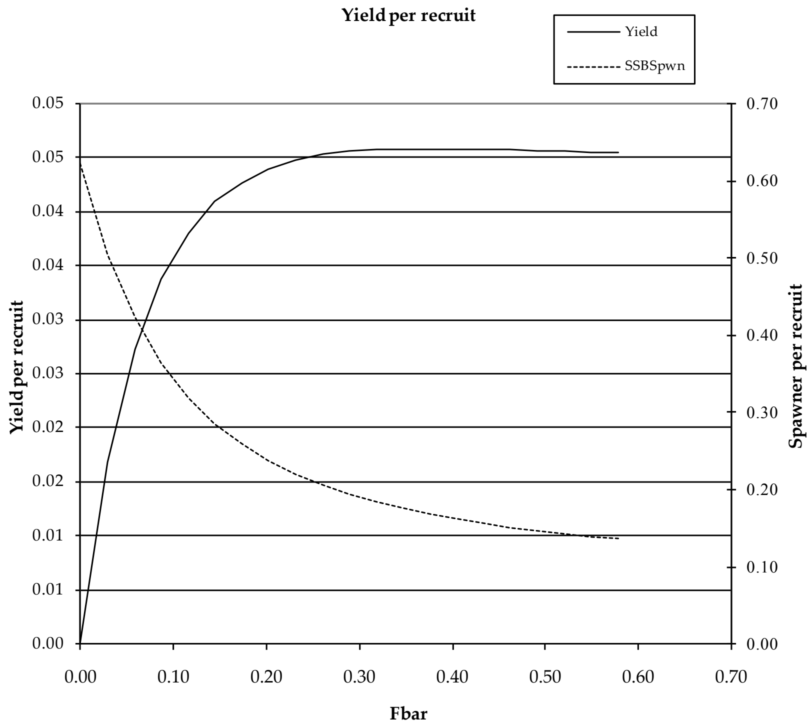
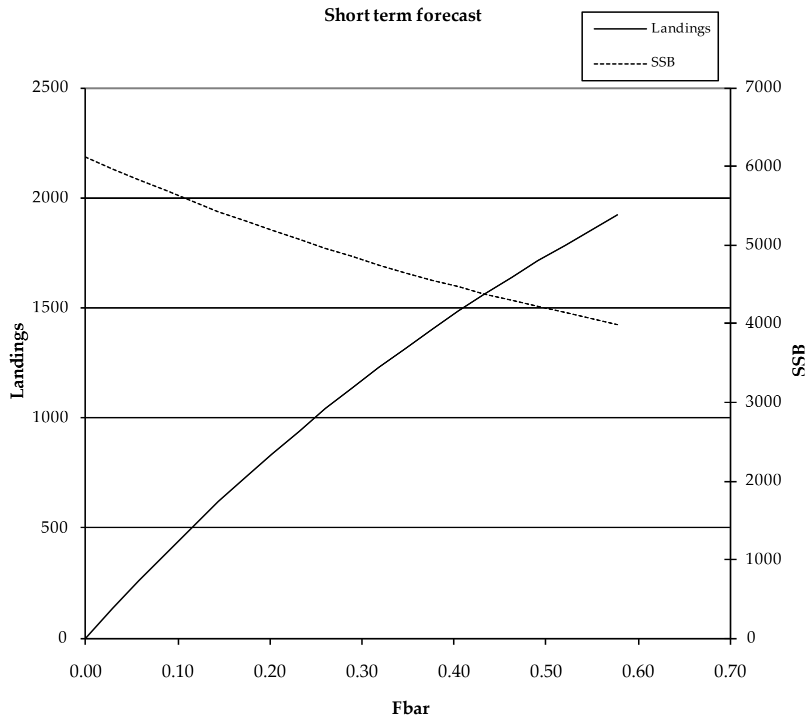


Figure 9.2.7(b): Four-spot megrim (*L. boscii*) in Divisions VIIIc&IXa





MFYPR version 2a
Run: ldb
Time and date: 13:02 30/04/2011

Reference point	F multiplier	Absolute F
Fbar(2-4)	1.0000	0.2890
FMax	1.2917	0.3733
F0.1	0.5128	0.1482
F35%SPR	0.8182	0.2365
Flow	0.4729	0.1367
Fmed	1.1733	0.3391
Fhigh	2.3170	0.6697

Weights in kilograms

MFDP version 1a
Run: ldb
Four spot megrim (L. boscii) Division VIIIc and IXa
Time and date: 20:38 29/04/2011
Fbar age range: 2-4

Input units are thousands and kg - output in tonnes

Figure 9.2.8. Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Forecast summary

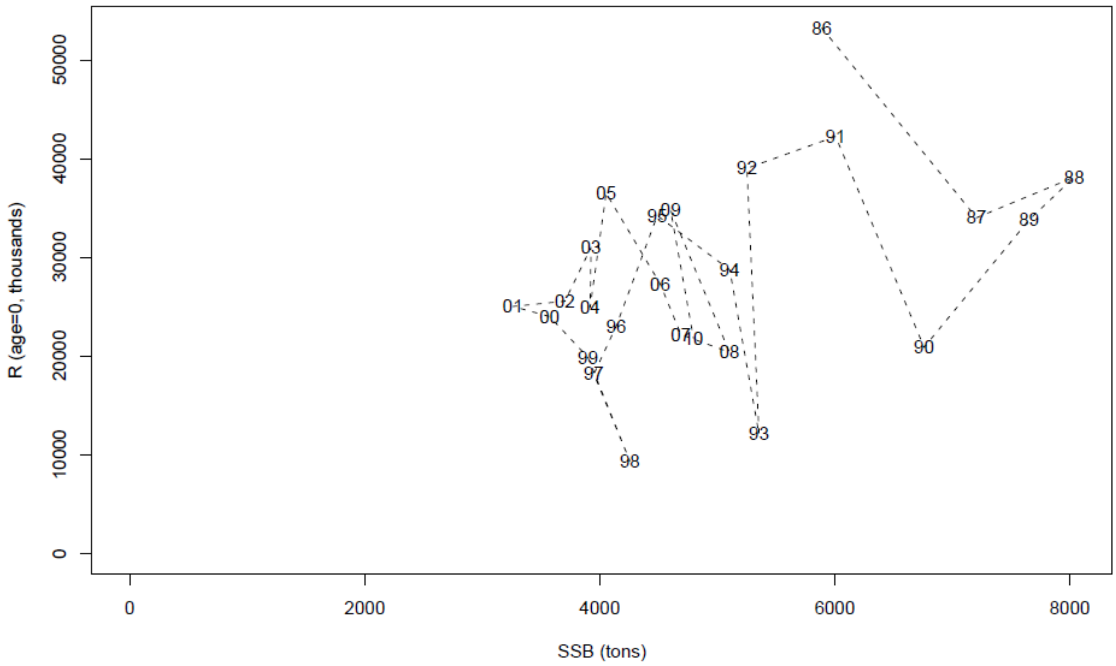


Figure 9.2.9. Four spot megrim (*L.boscii*) in Divisions VIIIc and IXa. SSB-Recruitment plot.

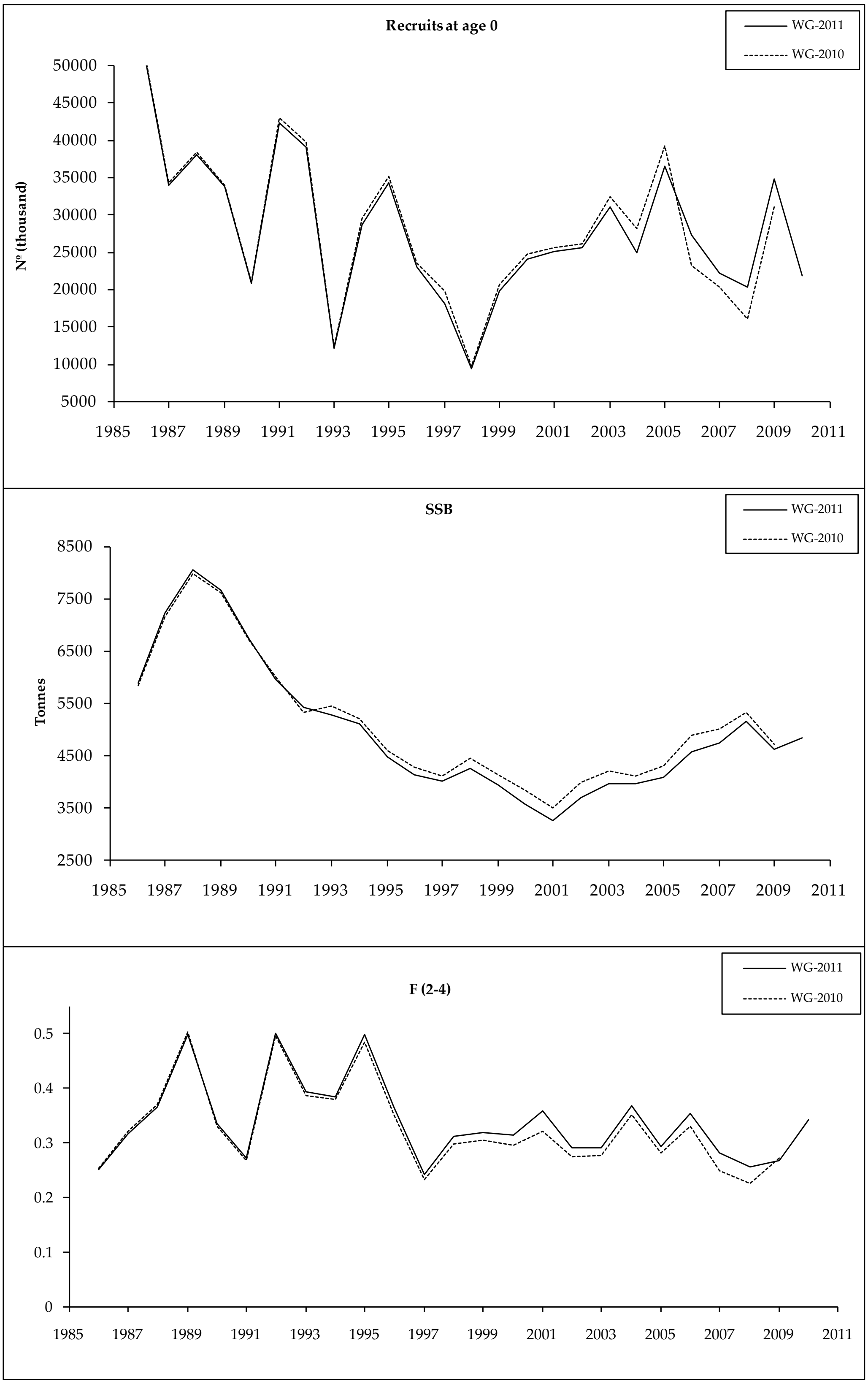


Figure 9.2.10. Four-spot megrim (*L. boscii*) Recruits, SSB and Fs from WG10 and WG11

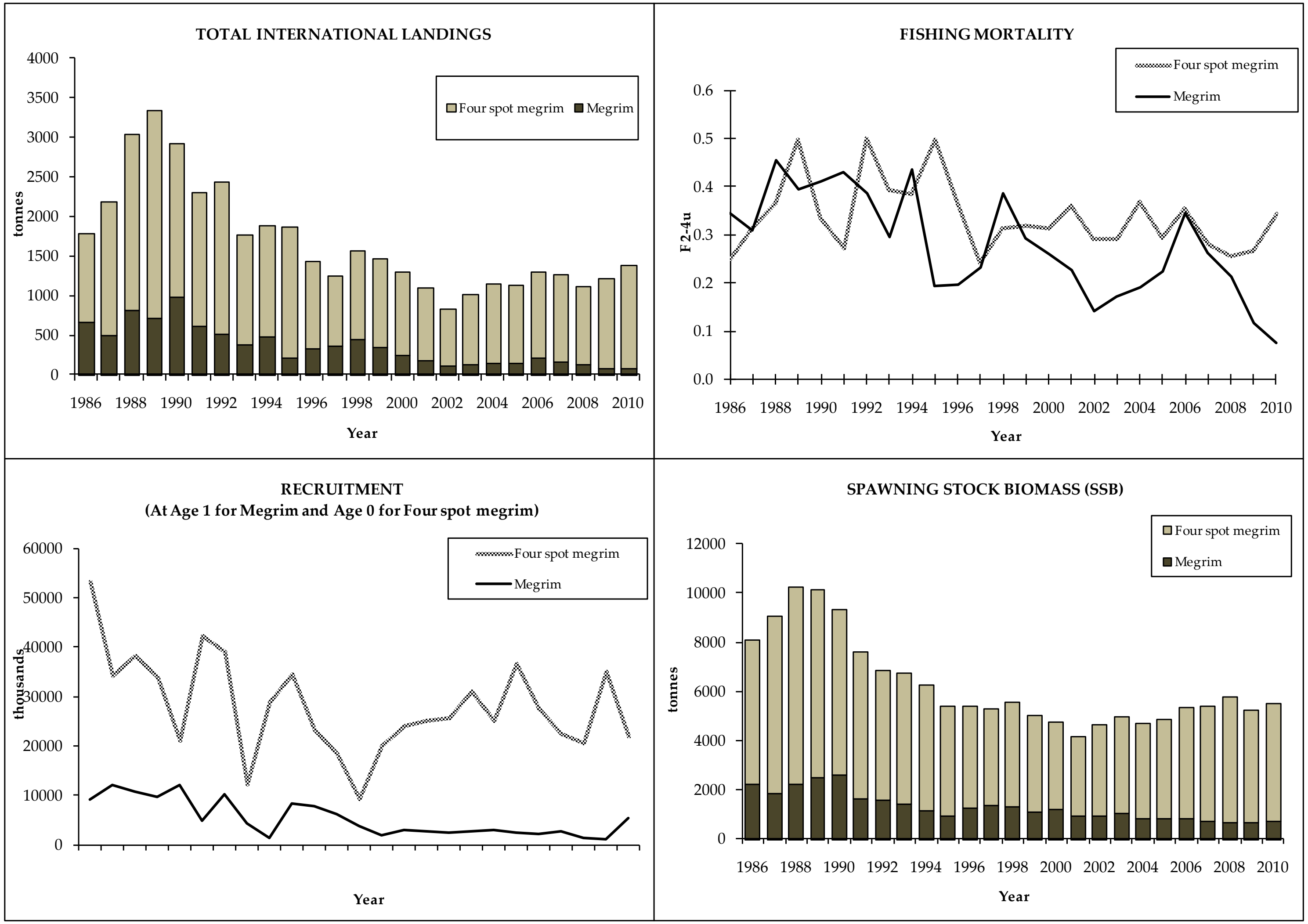


Figure 9.3.1. Stock trends for both stocks. Megrin and Four-spot megrim in Divisions VIIIc and IXa.

Combined Short Term Forecasts assuming status quo in 2011

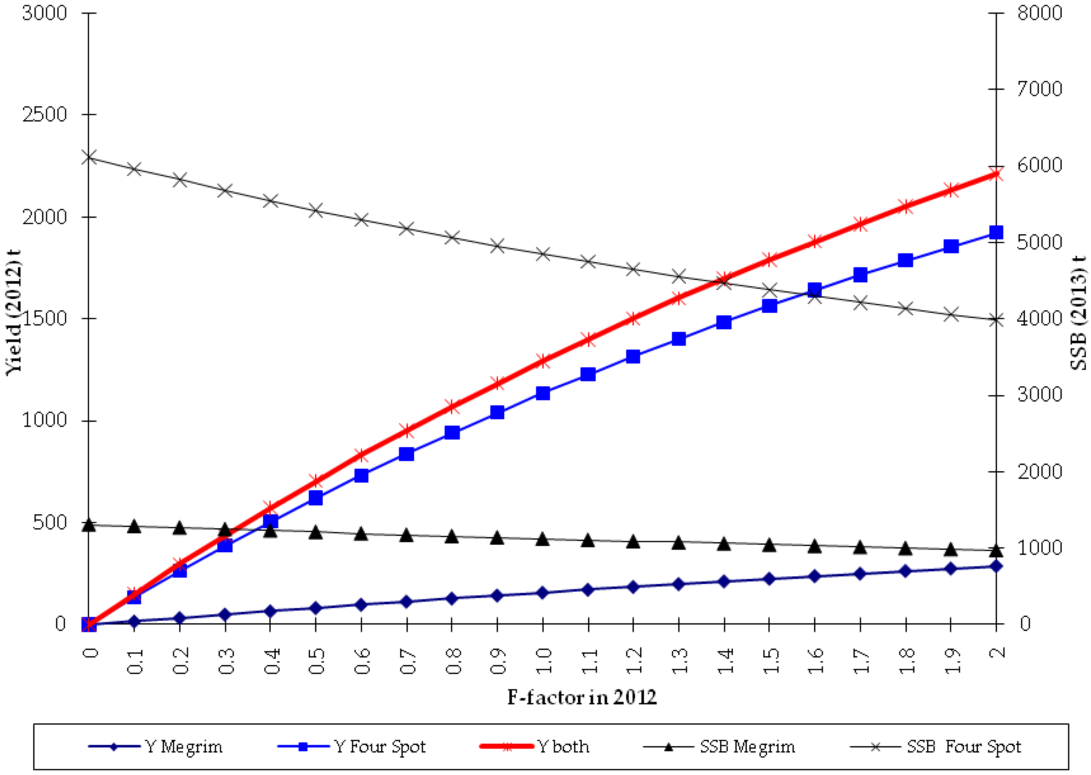


Figure 9.3.2. Megrims (*L. whiffiagonis and L. boscii*) in Divisions VIIIc and IXa.

10 *Nephrops* (Divisions VIII ab, FU 23-24)

Type of assessment:	no assessment in 2011
Functional Units:	Bay of Biscay North, VIII a (FU 23)
	Bay of Biscay South, VIII b (FU 24)

10.1 General

10.1.1 Ecosystem aspects

This section is detailed in Stock Annex (Annex J).

10.1.2 Fishery description

The general features of the fishery are given in Stock Annex.

10.1.3 ICES Advice for 2011

ICES gave two advice possibilities for 2011 and 2012:

Based on a transition to an MSY approach, landings should be reduced from recent levels.

Based on the Precautionary Approach, landings should not exceed recent levels (3100 t).

10.1.4 Management applicable for 2010 and 2011

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 2011 was 3899 t (the same as for 2010). In 2010, total nominal landings reached 3400 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. Since 2006, it should be noted that *Nephrops* trawlers were allowed to fish in the hake box with the mesh size of 70 mm once they have adopted a square mesh panel of 100 mm.

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 whole 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 vessels (≈80%; mainly Districts of South Brittany) chose the increase of the codend mesh size, but the ventral squared panel was also adopted (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 (224 in 2010). 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.

10.2 Data

10.2.1 Commercial catches and discards

Total catches, landings and discards, of *Nephrops* in division VIIIa,b for the period 1960-2010 are given in Table 10.1.

Throughout the mid-60's, the French landings gradually increased to a peak value of 7000 t in 1973-1974, then fluctuated between 4500 and 6000 t during the 80's and the mid-90's. An increase has been noticeable during the early 2000's. An increase occurred in 2010 (3398 t compared to 2987 in 2009 [revised data; WD 15: in the place of 3030 t as considered by WGHMM 2010], 3030 t in 2008 and 3176 t in 2007). The landings since 2008 have been reached under the new selectivity regulations. It is expected that these landings should be higher under the previous selectivity parameters, but the accurate effect of the new devices remains unknown.

Males usually predominate in the landings (sex ratio defined as number of females divided by total fluctuating between 0.31 and 0.46 for the overall period 1987-2010). 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 early 2000's, but this trend was not confirmed in recent years because of a less typical seasonal fishing profile affecting sex ratio and because of the MLS increase (December 2005). For removals, the increasing trend of sex ratio has remained for 2000's: the discarded proportion has been higher since the early 2000's mainly after the adoption of larger MLS before the new selectivity regulations, but it decreased in 2010.

Discards represent most of the catches of the smallest individuals as indicated by the available data (Figure 10.1). The average weight of discards per year in the period up to late 90's (not routinely sampled) is about 1480 t whereas discard estimates of the recent sampled years (2003-2010) reached a higher level of 2350 t. This change in the amount of discards could be due to the restriction of individual quotas (notably applied since 2006), the strength of the recent recruitments 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 2010, 114 million individuals were estimated to have been discarded (1270 t) against 138 million landed (3400 t).

10.2.2 Biological sampling

Discard data by sampling on board are available for 1987, 1991, 1998 and since 2003. For the intermediate years up to 2002, numbers discarded at length were derived by the "proportional method" (Table 10.2) described in Stock Annex. The derivation method uses ratios at each length between discards and total numbers landed for sexes combined by quarter.

Since 2003, discards have been estimated from sampling catches programme on board *Nephrops* trawlers (264 trips and 849 hauls have been sampled over eight years). The analytical investigations, estimates and variances, are provided in the Stock Annex. In spite of improvements in agreement between logbook declarations and auction hall sales (89% of landings were cross-validated item by item between sales and logbooks in 2007, but this percentage dropped in 2008: 69% and slightly increased in 2009: 79%), the total number of trips is usually not well known and needs to be estimated. This can be done using the number of auction hall sales, when boats conduct daily trips, which is the case in the northern part of the fishery, but not in the southern one. Discard sampling from the southern part of the fishery was carried out only once in the past (2005), thus, the poor set of available data cannot yet be used by WG.

The derivation effect for the discards as explained above is shown in Figure 10.2. Derived discards mean length are obviously the same, however, change was observed when a new discard sampling programme was conducted.

These variations in discard mean lengths reflect the annual variability influence of recruitment on the discard rate which is related to regulations on MLS and codend mesh size. The integration of a set of independent variables (recruitment strength, density of probability of discards, regulations, market considerations) to extrapolate reliable discard rate from sampled to missing years was already considered by WG in methodological analysis (WD 13). This method looked promising, but, it has been considered premature to switch to a new discard derivation method until there is a benchmark assessment.

The length distribution of landings, discards, catches and removals are presented in Tables 10.3.a-d and in Figure 10.1. Removals at length are obtained by adding the landings and "dead discards", applying a discard mean survival rate of 30% (Charuau *et al.*, 1982; recent studies suggest that discard survival is higher than the historical reference; see WD 14). Combined sexes mean lengths are presented for catches, landings and discards in Figure 10.2.

10.2.3 Abundance indices from surveys

Currently, abundance indices are not available for this stock. This situation will be improved in the future once a data time series has been collected. A survey specifically designed to evaluate abundance indices of *Nephrops* commenced in 2006 (with the most appropriate season: 2nd quarter, hours of trawling: around dawn and dusk and fishing gear: twin trawl). This survey (called LANGOLF; see Stock Annex) occurs once a year in May. Therefore, its results for abundance indices cannot be available for the WG of the same year, but can provide useful additional information before reviewing stock status in autumn. In medium-term, tuning data currently based on commercial catch-effort set (see §10.2.4) should be extended by using LANGOLF data.

10.2.4 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 are available for the overall time series (Table 10.4; Figure 10.3). Effort increased from 1987 to 1992, but there has been a decreasing trend since then. In 2007, 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 "Le Guilvinec district" 2nd Quarter *Nephrops* fleet are reasonably stable, fluctuating around a long-term average of 12.5 kg/hour (Figure 10.3), with a maximum in the series of 16.5 kg/hour occurring in 1988 and 2001. LPUE almost remained stable between 2005 and 2009 (12.9 to 13.8 kg/hour with a slight increase in 2008: 15.1 kg/h). In 2010, the increase of LPUE was larger (18.6 kg/hour *i.e.* +35%).

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) and also the number of vessels using rock-hopper gear. Moreover, an increase in onboard computer technology has occurred. The effects of these changes are difficult to quantify as twin-trawling is not always recorded explicitly in the fisheries statistics and improvement due to computing technology is not continuous for the overall time series.

Annual age compositions for the "Le Guilvinec district" 2nd Quarter tuning series (Table 10.5) were obtained by using the ratios of Quarter 2-fleet-landings to Total-Quarter 2-landings.

10.3 Assessment

No assessment was carried out in 2011.

10.4 Catch options and prognosis

No catch option and prognosis is provided in 2011.

10.5 Biological reference points

No reference point is defined for this stock.

10.6 Comments on the assessment

The continuation of the French *Nephrops* trawlers sampling programme onboard will avoid the use of "derived" data for missing years. Applying discard data from 'sampled' to 'non-sampled' years bears the risk of inconsistency between the different data sets because it induces an inter-dependence between years and also prevents detection of any signal on recruitment strength. The additional exploratory runs based on discard derivation by applying probability concepts as performed by WGHMM since 2007result in more contrast in recruitment, more regular residuals of Log catchabilities and better consistency in retrospective pattern for recruitment, especially the exploratory run with simulated discards for 2006.

In 2011 there was no assessment, but it was attempted to compare consistency of predictions provided by WG 2010 with the actual status 2010.

scenario for discards on missing years	landings (t)	discards (t)	removals (t)
status quo (proportional)	3584	1580	4690
proba+data for 2006	3417	1210	4264
proba+simulation for 2006	3479	1282	4376
actual status 2010	3398	1275	4290

Even if the comparison should be done under *status quo* on fishing effort (reduction of –7% between 2009 and 2010 for the tuning commercial fleet), it may be noted that the explorations based on probabilistic derivation for discards (mainly if discards for 2006 are simulated) provide closer results to the actual values than the *status quo* derivation retained by ICES. This should be taken into consideration for a future benchmark assessment of the stock.

Information from the fishing industry

The French fishing industry and scientists have met to discuss information which could be used in the assessments. The industry has not provided any additional quantitative information, but they supported information on landings and fishing effort compiled by WG. The partnership commented on the application of one tuning series involving in the northern part of the fishery and its extrapolation to the southern one. They underlined the heterogeneous feature of the whole area of the stock. Thus, they emphasized the necessity of applying additional tuning information on the southern part of fishery. The perception of the stock trends by the industry generally reflects the signals given by the data used during the recent assessments of the stock.

10.7 Management considerations

There is no proposal for precautionary reference points for this stock. From the assessment conducted last year, WGHMM in 2010 concluded that recruitment level in the early 2000's (2004 and 2005) was probably higher than historical average values, but it remains uncertain and contributes significantly to uncertainty of catches in the short-term.

The use of selective devices for *Nephrops* since 2008 resulted in reduced discards (in number), but it is not currently obvious how to separate selectivity effects from those linked to the positive signal of recruitment in the middle 2000's.

The license system in operation since 2004 and the restrictions applied by the Producers' Organisations since 2006 should increase the regulation of inputs by limiting the fishing time.

Table 10.1. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Estimates of catches (t) by FU for 1960-2010

	Landings (1)					Total Discards		Catches
Year	FU 23-24 (2)	FU 23	FU 24	Unallocated (MA N)(3)	Total VIIIa,b used by WG	FU 23-24		Total
	VIIIa,b	VIIIa	VIIIb			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	1909		7784
1989	-	4253	582	77	4835	1459		6295
1990	1	4613	359	87	4972	1280		6252
1991	1	4353	401	55	4754	1213	*	5967
1992	0	5123	558	47	5681	1583		7264
1993	0	4577	532	49	5109	1406		6515
1994	0	3721	371	27	4092	1060		5152
1995	0	4073	380	14	4452	1086		5539
1996	0	4034	84	15	4118	1005		5123
1997	2	3450	147	41	3610	1049		4658
1998	2	3565	300	40	3865	1453	*	5318
1999	2	2873	337	26	3209	1177		4386
2000	0	2848	221	36	3069	1213		4282
2001	1	3421	309	22	3730	1512		5242
2002	2	3323	356	36	3679	1645		5324
2003	1	3399	343	49	3742	1977	*	5719
2004	na	2970	315	5	3285	1932	*	5216
2005	na	3306	383	na	3689	2698	*	6387
2006	na	3000	430	na	3430	4544	*	7974
2007	na	2881	292	na	3176	2411	*	5587
2008	na	2774	256	na	3030	2123	*	5154
2009	na	2816	212	na	2987 (4)	1833	*	4820
2010	na	3153	245	na	3398	1275	*	4673

(1) WG estimates
(2) landings from VIIIa and VIIIb aggregated until 1974
(3) outside FU 23-24
(4) Revised data

Table 10.2. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b)
Derivation and estimations of discards

1987	sampled
1988	derived from 1987
1989	derived from 1987
1990	derived from 1987
1991	sampled
1992	derived from 1991
1993	derived from 1991
1994	derived from 1991
1995	derived from 1991
1996	derived from 1991
1997	derived from 1991
1998	sampled
1999	derived from 1998
2000	derived from 1998
2001	derived from 1998
2002	derived from 1998
2003	sampled
2004	sampled
2005	sampled
2006	sampled
2007	sampled
2008	sampled
2009	sampled
2010	sampled

Table 10.3.a Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) landings length distributions in 1987-2010.

Table 10_3_Length Distr

Landings CL mm/Y	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	158	59	0	0	0	0	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0
17	149	230	77	12	35	62	0	0	0	0	0	0	0	0	0	0	19	6	0	0	0	0	0	0
18	331	553	131	64	30	0	0	31	20	0	0	0	0	14	13	0	13	0	23	5	4	12	0	0
19	1296	1886	901	48	79	138	0	72	61	0	0	0	0	11	38	0	0	15	24	0	0	0	0	0
20	3129	4227	2791	529	474	450	464	206	341	48	448	25	72	116	284	107	73	52	77	5	4	77	37	14
21	6476	8882	7039	1947	1572	1595	1285	482	1573	414	1313	288	219	433	643	925	241	224	250	69	14	191	73	75
22	13501	16050	12971	5913	4733	3948	3878	2824	2395	1311	2799	985	849	1015	2116	1122	578	825	718	130	18	208	288	252
23	21337	25374	18073	10910	7854	9701	7398	5366	5523	2799	4638	3171	1888	2531	6261	5513	1387	2002	2404	226	48	322	473	386
24	24339	33950	21960	13293	15521	20948	11949	9650	8731	6071	10005	6484	4032	5462	8915	10061	3450	5157	6013	816	188	721	1929	1238
25	32476	36294	25650	16440	19747	27876	21011	15079	14348	13239	19837	13980	10717	11357	17106	12951	7275	9987	12573	2821	1201	2742	3670	3940
26	29670	29808	22747	18205	22106	26617	23732	18312	19769	16779	19380	13535	10590	10212	13745	21403	11881	12797	16423	6327	5684	6319	8258	8499
27	28086	28380	22091	16109	21900	28410	26044	21181	25126	18384	22823	16602	12724	11528	17098	19433	15915	14422	20320	11915	9439	10891	12759	14173
28	24925	26017	19087	19595	21214	32091	27580	20488	20914	15744	19466	14432	12058	12639	15835	22074	16896	13964	20240	14531	13248	12640	15732	15390
29	18703	20920	14227	16250	17138	24760	20627	16527	15909	16332	20878	11832	9448	11473	13779	16559	15343	13221	16684	14478	12516	12890	13524	15340
30	18407	17862	13688	12055	14762	19828	21414	15903	19164	20214	21487	16335	16187	13888	16168	18105	15840	12552	14416	13587	12219	10726	13271	15736
31	11419	13156	9037	11088	12408	14281	13452	11207	13333	14009	9791	8539	9209	9828	11316	9989	12217	10635	11675	11728	10698	9772	10859	12749
32	10185	12822	8410	8540	8635	12786	12711	11490	13667	14392	9622	9237	9745	8936	11335	10284	10349	8973	9181	9626	9274	8845	9310	11366
33	8528	8848	7127	10649	7273	9297	11369	7022	7117	8576	6334	5947	6000	6333	8250	7813	7575	7321	7206	8367	7859	7436	7086	8851
34	5926	7812	6967	10543	7987	7318	7355	6684	7584	6524	4816	6619	5910	5225	6185	5308	5847	5530	6045	7068	6539	6425	5985	7140
35	5763	5935	6214	7637	5425	5928	6307	5646	4677	6578	4737	6700	5267	4895	5213	4309	4493	4213	4721	5108	6529	5366	4568	5852
36	4033	5064	4532	6274	4979	4998	4608	4337	3709	4133	2568	5308	4291	3242	4037	3157	3821	3092	3115	4085	4735	3867	3697	3626
37	4024	3754	3545	4841	4541	4195	4089	3752	3496	4226	2135	4722	3230	2946	2901	2049	3185	2708	2392	3182	3839	3121	2565	3024
38	3131	3106	3193	4966	2993	3933	2991	2771	2879	2788	1142	3527	2588	2687	2369	2224	2816	2026	2193	2652	2639	2398	1871	2247
39	2151	2778	2154	3339	2869	2987	2290	1841	1746	1596	927	2169	2186	2027	2297	1559	2316	1645	1525	1946	2245	2043	1491	1630
40	2425	2159	2175	2766	2414	2574	2206	1738	2015	1956	982	3084	2353	1862	1908	1398	2135	1523	1519	1595	1711	1633	1190	1280
41	1375	1753	1461	1951	2076	1546	1452	1150	1123	1250	520	1558	1362	1020	941	764	1553	1167	1078	1167	1227	1190	878	966
42	1350	1542	1130	1668	1662	1599	1111	1118	1558	1142	508	1490	1124	797	863	632	1576	875	898	989	1111	1015	742	742
43	1150	1209	1087	1908	1495	1348	1069	687	1039	610	370	1049	761	534	530	640	1156	743	798	739	710	805	540	560
44	965	704	1192	1401	1089	1050	745	500	915	414	219	748	708	413	383	432	876	690	612	634	746	706	473	509
45	641	581	1194	955	1058	766	684	550	700	464	253	902	429	421	523	416	882	603	571	597	518	536	396	442
46	645	689	669	713	666	734	584	353	460	374	135	525	424	248	294	328	596	485	396	479	373	405	307	305
47	509	391	641	715	431	567	417	407	437	397	140	327	276	213	368	241	506	379	327	442	311	361	262	290
48	343	333	526	863	636	588	456	270	494	264	92	382	104	205	188	188	378	321	304	384	257	294	245	237
49	290	254	378	470	377	263	145	178	254	205	57	132	151	177	183	79	227	332	263	320	237	262	196	204
50	319	216	351	230	263	256	238	273	255	179	76	154	159	154	160	115	283	328	250	287	190	228	156	160
51	135	241	240	181	210	107	126	156	214	123	38	191	58	109	135	73	192	221	157	247	163	201	115	135
52	192	48	180	335	180	159	202	107	175	77	30	115	93	85	102	46	171	155	166	201	138	116	110	120
53	137	70	150	121	124	111	55	136	91	84	26	156	23	133	82	51	134	131	129	137	140	121	98	97
54	111	112	218	99	189	94	120	77	55	75	11	93	11	63	40	20	89	100	92	157	115	95	63	95
55	76	85	187	53	63	61	128	66	91	53	9	114	16	75	53	30	63	57	96	138	79	73	75	79
56	111	41	123	26	28	66	50	49	47	62	12	7	5	18	24	13	26	95	61	118	60	67	54	75
57	74	39	116	43	34	61	72	36	77	48	8	31	14	20	46	6	52	60	51	134	70	41	31	67
58	39	65	70	2	11	68	58	47	88	48	9	14	5	16	29	6	22	36	39	135	45	40	48	47
59	32	60	36	13	17	28	13	31	36	30	8	10	2	7	26	3	12	42	38	86	33	19	23	48
60	21	7	30	5	24	7	54	26	32	9	5	8	4	2	21	11	9	17	17	115	33	23	14	42
61	21	15	15	4	11	0	25	12	4	4	0	0	3	8	7	0	6	9	26	41	23	7	8	30
62	0	0	21	10	0	44	3	8	0	9	1	10	0	1	2	0	5	3	14	21	9	9	9	16
63	19	13	10	0	3	28	0	5	20	4	5	4	0	0	5	1	1	5	8	19	9	7	10	7
64	0	7	0	0	0	14	7	10	0	0	0	0	0	4	0	0	0	7	7	19	10	6	3	16
65	8	0	4	0	0	0	30	16	4	0	0	4	2	1	0	1	0	1	12	12	9	1	3	9
66	0	0	0	0	0	0	7	0	20	2	4	0	0	0	0	0	2	1	6	10	1	0	2	3
67	0	0	0	0	0	0	18	3	0	0	0	0	0	0	0	0	0	1	4	9	1	0	2	3
68	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	4	8	3	0	0	4
69	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	2	0	1	6	2	0	1	1
70	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	2	5	0	0	0	1
71	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	1	0	1	5	0	0	0	1
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0
Total	**288974**	**324498**	**244875**	**213779**	**217338**	**274286**	**240638**	**188879**	**202294**	**182041**	**188694**	**161549**	**135304**	**133383**	**172819**	**180442**	**152485**	**139753**	**166167**	**127942**	**117273**	**115274**	**123504**	**138120**
Weights	**5397**	**5875**	**4835**	**4972**	**4754**	**5681**	**5109**	**4092**	**4452**	**4118**	**3610**	**3865**	**3209**	**3069**	**3730**	**3679**	**3742**	**3285**	**3689**	**3430**	**3176**	**3030**	**2987**	**3398**

Table 10.3.b Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) discards length distributions in 1987-2010.

Table 10_3_Length Distr

Total Discards

CL mm/3	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0	22	0	82	0
11	0	0	0	0	114	167	143	109	148	128	92	85	59	74	75	94	0	0	94	0	171	38	135	2
12	0	0	0	0	0	0	0	0	0	0	0	128	89	110	113	141	70	363	413	70	202	98	79	0
13	0	0	0	0	93	147	139	84	56	65	76	162	138	143	191	217	294	1722	1085	234	122	235	177	97
14	78	97	76	59	258	384	337	245	301	268	210	660	507	564	684	822	636	3152	3190	1138	900	389	291	83
15	2074	2174	1821	1673	1249	1895	1728	1148	1073	1058	1028	1741	1370	1462	1861	2186	1198	5548	7287	3102	1288	189	1157	155
16	3974	4053	3469	3140	2240	3339	3073	2019	1736	1786	1884	1861	1474	1554	2010	2349	3386	6784	13528	7810	2959	1027	2315	822
17	13577	14887	10425	8655	4638	6824	6302	4133	3347	3497	3914	3527	2744	2957	3624	4197	5927	8836	15094	11655	3636	1832	3059	1333
18	29288	32816	23482	19987	10619	14908	13531	9408	8483	8297	8987	5003	4016	4207	5254	5880	8078	10161	19795	16139	4590	2626	4843	2309
19	28370	31363	23215	19980	12852	17524	15718	11346	10790	10148	10853	5991	4770	5041	6271	7098	11506	17361	19522	25891	5244	6473	6485	3532
20	60253	63749	49546	43147	22797	30242	26971	19970	19533	18146	19453	12091	9630	10098	12509	13968	12142	19250	22265	39742	8735	11444	12766	5692
21	45446	48597	37609	33037	18043	24296	21757	15876	15497	14594	15429	9973	7931	8238	10357	11586	18597	25898	32409	54220	11585	15630	16772	7699
22	51268	55078	42614	37864	24289	32524	29063	21354	21039	19695	20776	23278	18405	19216	23711	26333	21416	25210	35523	69870	17930	24730	18701	11689
23	23074	24630	19336	17235	15611	20115	17713	13687	14986	13676	13624	21641	17276	17526	22103	23990	28429	26756	40041	70094	24086	27560	21693	13672
24	7213	8375	6179	5468	13741	17107	15018	11903	13375	12258	12285	19750	15994	16182	20628	22367	26501	21343	36279	55408	30615	29638	24105	16963
25	2686	2850	2369	2172	14722	17933	15639	12662	14027	12581	13036	20487	16780	16884	21505	22987	23211	20085	30222	52660	32917	28007	20736	14670
26	672	806	485	391	7131	8990	7917	6166	6350	5744	6176	10676	8631	8817	10928	11696	17357	12006	19003	38812	27376	23127	14205	11852
27	270	350	255	242	1711	2447	2217	1532	1395	1348	1424	7502	5870	6421	7474	8420	9680	6436	8498	20124	20567	10129	9188	8558
28	0	0	0	0	999	1258	1098	867	890	777	844	3019	2394	2647	3034	3394	6187	3487	4603	10263	10365	5893	5927	5986
29	0	0	0	0	138	168	146	118	118	102	117	1357	1133	1241	1443	1573	2537	2115	1201	4188	4464	3225	3163	3360
30	0	0	0	0	291	344	296	248	256	216	247	686	613	608	778	782	1605	1901	1600	2578	2868	1923	3261	1876
31	0	0	0	0	97	115	99	83	85	72	82	129	135	123	173	155	1326	1115	1417	1109	1316	925	1824	1274
32	0	0	0	0	0	0	0	0	0	0	0	481	433	426	549	548	574	735	526	592	737	454	839	716
33	0	0	0	0	0	0	0	0	0	0	0	231	195	214	249	271	313	503	296	544	484	421	671	350
34	0	0	0	0	0	0	0	0	0	0	0	151	150	135	190	174	261	385	553	411	537	1025	830	274
35	0	0	0	0	0	0	0	0	0	0	0	88	92	93	119	114	176	424	260	230	265	206	332	242
36	0	0	0	0	0	0	0	0	0	0	0	48	61	57	80	68	113	108	46	73	336	78	197	55
37	0	0	0	0	0	0	0	0	0	0	0	74	95	89	124	106	83	74	246	25	299	153	188	162
38	0	0	0	0	0	0	0	0	0	0	0	44	56	53	73	63	93	31	116	99	40	93	269	16
39	0	0	0	0	0	0	0	0	0	0	0	36	46	43	61	52	15	139	147	0	3	369	55	33
40	0	0	0	0	0	0	0	0	0	0	0	57	73	68	95	81	37	73	37	169	47	0	66	38
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	60	20	0	40	0	8	4
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	12	31	0	20	53	0	4
43	0	0	0	0	0	0	0	0	0	0	0	6	7	7	9	8	14	13	0	0	11	0	38	0
44	0	0	0	0	0	0	0	0	0	0	0	30	39	36	50	43	0	13	0	0	0	0	14	6
45	0	0	0	0	0	0	0	0	0	0	0	2	3	3	4	4	13	0	0	36	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0
49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
67	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
69	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0
Total	268244	289827	220879	193050	151634	200725	178905	132957	133485	124457	130538	150995	121209	125340	156331	171768	201841	222102	315346	487288	214788	198031	174480	113530
Weights	1767	1909	1459	1280	1213	1583	1406	1060	1086	1005	1049	1453	1177	1213	1512	1645	1977	1932	2698	4544	2411	2123	1833	1275

Table 10.3.c Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) catches length distributions in 1987-2010.

Table 10_3_Length Distr

Total catches

CL mm/Y	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28	0	0	0	22	0	82	0
11	0	0	0	0	114	167	143	109	148	128	92	85	59	74	75	94	0	0	94	0	171	38	135	2
12	0	0	0	0	0	0	0	0	0	0	0	128	89	110	113	141	70	363	413	70	202	98	79	0
13	0	0	0	0	93	147	139	84	56	65	76	162	138	143	191	217	294	1722	1085	234	122	235	177	97
14	78	97	76	59	258	384	337	245	301	268	210	660	507	564	684	822	636	3152	3190	1138	900	389	291	83
15	2074	2174	1821	1673	1249	1895	1728	1148	1073	1058	1042	1741	1370	1462	1861	2186	1198	5548	7287	3102	1289	189	1157	155
16	3974	4210	3528	3140	2240	3339	3073	2019	1736	1786	1897	1861	1474	1554	2010	2349	3386	6784	13528	7810	2959	1027	2315	822
17	13727	15117	10502	8667	4673	6886	6302	4133	3347	3497	3914	3527	2744	2957	3624	4197	5946	8842	15094	11655	3636	1832	3059	1333
18	29620	33369	23613	20052	10649	14908	13531	9439	8503	8297	8987	5003	4016	4222	5267	5880	8092	10161	19819	16144	4593	2638	4843	2309
19	29666	33249	24116	20028	12931	17662	15718	11418	10850	10148	10853	5991	4770	5052	6309	7098	11506	17377	19547	25891	5244	6473	6485	3532
20	63382	67976	52337	43676	23271	30692	27435	20176	19874	18194	19901	12116	9701	10214	12793	14075	12215	19302	22342	39747	8738	11521	12803	5706
21	51922	57479	44647	34984	19615	25891	23042	16358	17070	15008	16741	10260	8150	8671	11000	12511	18838	26122	32659	54289	11598	15820	16845	7775
22	64770	71128	55584	43777	29023	36472	32941	24178	23435	21006	23575	24263	19254	20231	25827	27455	21994	26035	36241	70000	17948	24938	18989	11941
23	44411	50004	37409	28145	23464	29817	25111	19053	20509	16475	18261	24812	19164	20057	28364	29503	29815	28758	42445	70320	24134	27882	22167	14058
24	31551	42325	28138	18762	29262	38055	26967	21554	22106	18329	22290	26235	20026	21643	29544	32428	29951	26500	42292	56224	30803	30359	26034	18202
25	35162	39143	28020	18612	34469	45809	36650	27741	28375	25820	32874	34467	27497	28240	38612	35939	30486	30072	42795	55482	34119	30750	24406	18610
26	30342	30615	23232	18596	29237	35607	31650	24478	26119	22524	25556	24211	19222	19030	24673	33099	29238	24803	35426	45140	33060	29446	22463	20352
27	28357	28730	22346	16351	23611	30858	28261	22713	26521	19733	24247	24104	18594	17949	24573	27852	25595	20858	28818	32039	30006	21020	21948	22730
28	24925	26017	19087	19595	22213	33349	28678	21355	21804	16521	20310	17450	14453	15286	18869	25468	23082	17451	24843	24794	23613	18533	21659	21375
29	18703	20920	14227	16250	17276	24927	20773	16645	16027	16434	20995	13189	10581	12714	15223	18132	17880	15336	17885	18666	16980	16115	16687	18700
30	18407	17862	13688	12055	15053	20173	21710	16151	19420	20430	21735	17021	16800	14496	16946	18886	17445	14453	16016	16165	15087	12649	16531	17612
31	11419	13156	9037	11088	12505	14396	13551	11289	13419	14081	9874	8668	9344	9951	11489	10144	13544	11751	13092	12836	12014	10697	12682	14024
32	10185	12822	8410	8540	8635	12786	12711	11490	13667	14392	9622	9718	10178	9362	11884	10832	10923	9709	9707	10218	10011	9299	10150	12082
33	8528	8848	7127	10649	7273	9297	11369	7022	7117	8576	6334	6178	6196	6547	8499	8083	7888	7824	7502	8911	8343	7857	7757	9201
34	5926	7812	6967	10543	7987	7318	7355	6684	7584	6524	4816	6770	6060	5360	6375	5482	6108	5916	6598	7479	7076	7449	6815	7414
35	5763	5935	6214	7637	5425	5928	6307	5646	4677	6578	4737	6787	5359	4988	5332	4423	4669	4637	4981	5339	6793	5573	4900	6094
36	4033	5064	4532	6274	4979	4998	4608	4337	3709	4133	2568	5356	4352	3299	4116	3225	3934	3200	3161	4158	5071	3945	3894	3681
37	4024	3754	3545	4841	4541	4195	4089	3752	3496	4226	2135	4796	3325	3034	3025	2155	3268	2782	2638	3207	4138	3273	2753	3186
38	3131	3106	3193	4966	2993	3933	2991	2771	2879	2788	1142	3571	2645	2740	2443	2287	2908	2057	2309	2751	2679	2491	2139	2263
39	2151	2778	2154	3339	2869	2987	2290	1841	1746	1596	927	2205	2232	2070	2358	1611	2331	1784	1672	1946	2247	2412	1546	1662
40	2425	2159	2175	2766	2414	2574	2206	1738	2015	1956	982	3140	2425	1930	2002	1480	2172	1596	1556	1764	1758	1633	1257	1318
41	1375	1753	1461	1951	2076	1546	1452	1150	1123	1250	520	1558	1362	1020	941	764	1588	1227	1098	1167	1267	1190	886	971
42	1350	1542	1130	1668	1662	1599	1111	1118	1558	1142	508	1490	1124	797	863	632	1580	887	929	989	1130	1069	742	746
43	1150	1209	1087	1908	1495	1348	1069	687	1039	610	370	1055	769	541	540	649	1170	755	798	739	722	805	578	560
44	965	704	1192	1401	1089	1050	745	500	915	414	219	778	747	449	433	476	876	703	612	634	746	706	487	515
45	641	581	1194	955	1058	766	684	550	700	464	253	904	432	424	527	419	895	603	571	633	518	536	396	442
46	645	689	669	713	666	734	584	353	460	374	135	525	424	248	294	328	596	485	396	479	373	405	307	312
47	509	391	641	715	431	567	417	407	437	397	140	327	276	213	368	241	506	379	327	442	311	361	262	290
48	343	333	526	863	636	588	456	270	494	264	92	382	104	205	188	188	378	321	304	384	257	294	254	237
49	290	254	378	470	377	263	145	178	254	205	57	132	151	177	183	79	227	332	263	320	237	262	196	204
50	319	216	351	230	263	256	238	273	255	179	76	154	159	154	160	115	283	328	250	287	201	228	156	160
51	135	241	240	181	210	107	126	156	214	123	38	191	58	109	135	73	192	221	157	247	163	201	115	135
52	192	48	180	335	180	159	202	107	175	77	30	115	93	85	102	46	171	155	166	201	138	116	110	120
53	137	70	150	121	124	111	55	136	91	84	26	156	23	133	82	51	134	131	129	137	140	121	98	97
54	111	112	218	99	189	94	120	77	55	75	11	93	11	63	40	20	89	100	92	157	115	95	63	95
55	76	85	187	53	63	61	128	66	91	53	9	114	16	75	53	30	63	57	96	138	79	73	75	79
56	111	41	123	26	28	66	50	49	47	62	12	7	5	18	24	13	26	95	61	118	60	67	54	75
57	74	39	116	43	34	61	72	36	77	48	8	31	14	20	46	6	52	60	51	134	70	41	31	67
58	39	65	70	2	11	68	58	47	88	48	9	14	5	16	29	6	22	36	39	135	45	80	48	47
59	32	60	36	13	17	28	13	31	36	30	8	10	2	7	26	3	12	42	38	86	33	19	23	48
60	21	7	30	5	24	7	54	26	32	9	5	8	4	2	21	11	9	17	17	115	33	23	14	42
61	21	15	15	4	11	0	25	12	4	4	0	0	3	8	7	0	6	9	26	41	23	7	8	30
62	0	0	21	10	0	44	3	8	0	9	1	10	0	1	2	0	5	3	14	21	9	9	9	16
63	19	13	10	0	3	28	0	5	20	4	5	4	0	0	5	1	1	5	8	19	9	7	10	7
64	0	7	0	0	0	14	7	10	0	0	0	0	0	4	0	0	0	7	7	19	10	6	3	16
65	8	0	4	0	0	0	30	16	4	0	0	4	2	1	0	1	0	1	12	12	9	1	3	9
66	0	0	0	0	0	0	7	0	20	2	4	0	0	0	0	0	2	1	6	10	1	0	2	3
67	0	0	0	0	0	0	18	3	0	0	0	0	0	0	0	0	0	1	4	9	1	0	2	3
68	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	4	8	3	0	0	4
69	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	2	0	1	6	2	0	1	1
70	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	2	5	0	0	0	1
71	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	1	0	1	5	0	0	0	1
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0
Total	557218	614325	465754	406829	368972	475011	419544	321836	335779	306498	319232	312544	256513	258723	329150	352210	354326	361855	481512	615230	332060	313305	297984	251649
Weights	7164	7784	6295	6252	5967	7264	6515	5152	5539	5123	4658	5318	4386	4282	5242	5324	5719	5216	6387	7974	5587	5154	4820	4673

Table 10.3.d Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) removals length distributions in 1987-2010.

Table 10_3_Length Distr

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	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19	0	0	0	16	0	58	0
11	0	0	0	0	80	117	100	76	104	89	65	60	42	52	53	66	0	0	66	0	119	27	94	1
12	0	0	0	0	0	0	0	0	0	0	0	90	62	77	79	99	49	254	289	49	142	69	56	0
13	0	0	0	0	65	103	97	59	39	45	54	114	97	100	134	152	206	1205	760	164	85	164	124	68
14	55	68	53	41	181	269	236	171	210	188	147	462	355	395	479	575	445	2206	2233	797	630	272	204	58
15	1452	1522	1274	1171	875	1327	1209	803	751	741	734	1219	959	1024	1303	1530	839	3883	5101	2171	902	132	810	108
16	2782	2995	2488	2198	1568	2337	2151	1413	1215	1250	1332	1302	1032	1088	1407	1644	2370	4749	9469	5467	2072	719	1621	575
17	9654	10651	7375	6070	3282	4839	4411	2893	2343	2448	2740	2469	1921	2070	2537	2938	4168	6192	10565	8158	2545	1282	2141	933
18	20833	23524	16568	14055	7464	10435	9472	6617	5958	5808	6291	3502	2811	2959	3691	4116	5668	7112	13880	11302	3216	1851	3390	1616
19	21155	23840	17151	14034	9075	12405	11003	8014	7613	7104	7597	4194	3339	3540	4428	4968	8055	12168	13690	18124	3671	4531	4540	2472
20	45306	48851	37473	30732	16432	21619	19344	14185	14014	12750	14065	8489	6812	7185	9040	9884	8572	13527	15662	27825	6118	8087	8973	3998
21	38288	42900	33365	25073	14202	18602	16515	11595	12421	10630	12113	7269	5771	6200	7893	9036	13259	18353	22936	38023	8123	11131	11813	5465
22	49389	54605	42800	32418	21736	26715	24222	17772	17123	15097	17342	17280	13732	14466	18714	19555	15569	18472	25584	49039	12569	17519	13379	8434
23	37489	42615	31609	22974	18781	23782	19797	14947	16013	12372	14174	18320	13981	14800	21733	22306	21287	20731	30433	49292	16909	19614	15659	9957
24	29387	39813	26285	17121	25139	32923	22461	17983	18093	14652	18604	20310	15228	16789	23355	25717	22001	20097	31408	39602	21619	21468	18803	13113
25	34356	38288	27309	17960	30052	40429	31958	23943	24167	22046	28963	28321	22463	23175	32160	29042	23523	24046	33728	39684	24243	22348	18185	14209
26	30141	30373	23087	18479	27098	32910	29275	22628	24214	20800	23703	21008	16632	16384	21394	29590	24031	21202	29725	33496	24847	22508	18202	16796
27	28276	28625	22270	16278	23098	30124	27596	22253	26102	19328	23820	21853	16833	16023	22330	25327	22691	18927	26269	26002	23835	17982	19191	20163
28	24925	26017	19087	19595	21914	32972	28349	21095	21537	16288	20057	16545	13735	14492	17959	24450	21226	16405	23462	21715	20503	16765	19881	19579
29	18703	20920	14227	16250	17235	24877	20729	16609	15992	16403	20960	12782	10241	12342	14790	17660	17119	14701	17525	17409	15641	15148	15738	17692
30	18407	17862	13688	12055	14965	20069	21621	16077	19343	20366	21661	16815	16616	14314	16713	18652	16963	13883	15536	15391	14227	12072	15553	17049
31	11419	13156	9037	11088	12476	14362	13521	11265	13393	14059	9849	8629	9304	9914	11437	10097	13146	11416	12667	12504	11619	10419	12135	13641
32	10185	12822	8410	8540	8635	12786	12711	11490	13667	14392	9622	9574	10048	9234	11719	10667	10751	9488	9549	10041	9790	9163	9898	11867
33	8528	8848	7127	10649	7273	9297	11369	7022	7117	8576	6334	6109	6137	6483	8424	8002	7794	7673	7413	8748	8197	7731	7556	9096
34	5926	7812	6967	10543	7987	7318	7355	6684	7584	6524	4816	6725	6015	5320	6318	5430	6030	5800	6432	7356	6915	7142	6566	7332
35	5763	5935	6214	7637	5425	5928	6307	5646	4677	6578	4737	6761	5332	4960	5296	4389	4616	4510	4903	5269	6714	5511	4801	6021
36	4033	5064	4532	6274	4979	4998	4608	4337	3709	4133	2568	5341	4333	3282	4093	3205	3900	3168	3147	4136	4971	3921	3835	3665
37	4024	3754	3545	4841	4541	4195	4089	3752	3496	4226	2135	4774	3296	3008	2988	2123	3243	2760	2564	3199	4048	3228	2696	3138
38	3131	3106	3193	4966	2993	3933	2991	2771	2879	2788	1142	3558	2628	2724	2421	2268	2881	2048	2274	2721	2667	2463	2059	2258
39	2151	2778	2154	3339	2869	2987	2290	1841	1746	1596	927	2195	2218	2057	2340	1596	2327	1742	1628	1946	2246	2301	1529	1652
40	2425	2159	2175	2766	2414	2574	2206	1738	2015	1956	982	3123	2403	1910	1974	1455	2161	1574	1545	1713	1744	1633	1237	1306
41	1375	1753	1461	1951	2076	1546	1452	1150	1123	1250	520	1558	1362	1020	941	764	1577	1209	1092	1167	1255	1190	884	969
42	1350	1542	1130	1668	1662	1599	1111	1118	1558	1142	508	1490	1124	797	863	632	1579	883	920	989	1125	1053	742	745
43	1150	1209	1087	1908	1495	1348	1069	687	1039	610	370	1053	767	539	537	646	1166	752	798	739	718	805	567	560
44	965	704	1192	1401	1089	1050	745	500	915	414	219	769	735	438	418	463	876	699	612	634	746	706	483	514
45	641	581	1194	955	1058	766	684	550	700	464	253	904	431	423	526	418	891	603	571	622	518	536	396	442
46	645	689	669	713	666	734	584	353	460	374	135	525	424	248	294	328	596	485	396	479	373	405	307	310
47	509	391	641	715	431	567	417	407	437	397	140	327	276	213	368	241	506	379	327	442	311	361	262	290
48	343	333	526	863	636	588	456	270	494	264	92	382	104	205	188	188	378	321	304	384	257	294	251	237
49	290	254	378	470	377	263	145	178	254	205	57	132	151	177	183	79	227	332	263	320	237	262	196	204
50	319	216	351	230	263	256	238	273	255	179	76	154	159	154	160	115	283	328	250	287	198	228	156	160
51	135	241	240	181	210	107	126	156	214	123	38	191	58	109	135	73	192	221	157	247	163	201	115	135
52	192	48	180	335	180	159	202	107	175	77	30	115	93	85	102	46	171	155	166	201	138	116	110	120
53	137	70	150	121	124	111	55	136	91	84	26	156	23	133	82	51	134	131	129	137	140	121	98	97
54	111	112	218	99	189	94	120	77	55	75	11	93	11	63	40	20	89	100	92	157	115	95	63	95
55	76	85	187	53	63	61	128	66	91	53	9	114	16	75	53	30	63	57	96	138	79	73	75	79
56	111	41	123	26	28	66	50	49	47	62	12	7	5	18	24	13	26	95	61	118	60	67	54	75
57	74	39	116	43	34	61	72	36	77	48	8	31	14	20	46	6	52	60	51	134	70	41	31	67
58	39	65	70	2	11	68	58	47	88	48	9	14	5	16	29	6	22	36	39	135	45	68	48	47
59	32	60	36	13	17	28	13	31	36	30	8	10	2	7	26	3	12	42	38	86	33	19	23	48
60	21	7	30	5	24	7	54	26	32	9	5	8	4	2	21	11	9	17	17	115	33	23	14	42
61	21	15	15	4	11	0	25	12	4	4	0	0	3	8	7	0	6	9	26	41	23	7	8	30
62	0	0	21	10	0	44	3	8	0	9	1	10	0	1	2	0	5	3	14	21	9	9	9	16
63	19	13	10	0	3	28	0	5	20	4	5	4	0	0	5	1	1	5	8	19	9	7	10	7
64	0	7	0	0	0	14	7	10	0	0	0	0	0	4	0	0	0	7	7	19	10	6	3	16
65	8	0	4	0	0	0	30	16	4	0	0	4	2	1	0	1	0	1	12	12	9	1	3	9
66	0	0	0	0	0	0	7	0	20	2	4	0	0	0	0	0	2	1	6	10	1	0	2	3
67	0	0	0	0	0	0	18	3	0	0	0	0	0	0	0	0	0	1	4	9	1	0	2	3
68	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	2	4	8	3	0	0	4
69	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	2	0	1	6	2	0	1	1
70	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	2	5	0	0	0	1
71	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	1	0	1	5	0	0	0	1
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	0	0	0	0
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0
74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0
75	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	4	0	0	0	0
Total	**476745**	**527377**	**399490**	**348914**	**323482**	**414794**	**365872**	**281949**	**295733**	**269161**	**280070**	**267245**	**220150**	**221121**	**282250**	**300679**	**293774**	**295224**	**386908**	**469044**	**267624**	**253896**	**245640**	**217590**
Weights	**6634**	**7211**	**5857**	**5868**	**5603**	**6789**	**6093**	**4834**	**5213**	**4822**	**4344**	**4882**	**4033**	**3918**	**4788**	**4831**	**5126**	**4637**	**5578**	**6611**	**4864**	**4517**	**4270**	**4290**

Table 10.4. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b).
Effort and LPUE values of commercial fleets used in the assessment to tune the model.
Sub-area VIII a,b

	Le Guilvinec District Quarter 2		
Year	Landings(t)	Effort(100h)	LPUE(Kg/h)
1987	603	437	13.8
1988	777	471	16.5
1989	862	664	13.0
1990	801	708	11.3
1991	717	728	9.8
1992	841	757	11.1
1993	805	735	11.0
1994	690	671	10.3
1995	609	627	9.7
1996	715	598	12.0
1997	638	539	11.8
1998	622	489	12.7
1999	505	423	11.9
2000	438	405	10.8
2001	697	417	16.7
2002	527	371	14.2
2003	480	357	13.4
2004	387	327	11.8
2005	433	335	12.9
2006	409	306	13.4
2007	401	291	13.8
2008	410	271	15.1
2009	384	279	13.8
2010	471	253	18.6

Table 10.5. Nephrops in FUs 23-24 Bay of Biscay (VIIIa,b) - Tune data

bay	of	biscay	TUNE	DATA	:		EFFORT	100HRS	
101									
FLEET	QGV	Q2							
1987	2010								
1	1	0.25	0.5						
1	9								
436.7	2038.3	23308.9	12847.9	5447.0	1854.7	669.1	311.0	143.5	166.3
470.6	2695.2	29783.6	17583.8	7337.2	2397.9	884.8	379.7	199.9	292.7
663.5	2648.0	29789.8	14875.8	6866.0	2901.9	1656.7	840.3	352.5	789.3
707.8	2088.7	19070.8	11166.9	8860.4	3778.1	1833.2	796.4	362.7	370.8
728.2	582.7	14687.8	13389.3	8283.4	3342.9	1302.1	483.7	230.6	225.7
756.6	746.4	19581.8	17246.3	9023.5	3920.1	1446.4	491.5	189.3	242.4
734.7	642.0	15853.5	14705.2	7927.1	3733.1	1966.0	959.4	422.7	653.8
670.6	573.8	13077.7	15461.9	8340.0	2378.7	940.9	429.6	233.5	445.1
626.9	495.9	11677.5	13228.4	5969.2	2784.4	1123.2	459.7	160.7	292.5
597.9	533.1	10521.1	12661.4	8264.6	3959.6	1550.5	743.8	307.4	371.3
539.0	590.9	13531.3	15653.4	8438.8	2863.2	1140.7	442.6	242.5	228.2
489.2	356.2	11080.9	11486.1	6575.5	2874.3	1431.5	789.4	426.4	527.2
422.9	305.0	9210.1	10053.8	6013.5	2828.6	985.2	546.9	250.7	253.2
405.2	271.6	8914.2	8186.3	5408.1	2461.7	1002.3	381.9	231.9	255.5
417.1	430.1	13370.9	13968.6	8169.1	3850.7	1731.9	716.9	399.1	294.8
371.3	379.1	12992.1	15801.6	5399.0	1904.3	714.2	249.9	217.3	181.6
357.0	310.4	8195.0	10153.6	6228.1	2708.0	908.4	444.4	256.5	361.9
327.1	1154.3	10057.4	7886.9	4891.8	2536.2	1033.7	473.0	211.2	284.8
334.6	1409.8	14030.9	10522.3	4993.1	2127.6	1062.8	439.2	186.8	280.2
306.3	1394.2	20254.7	13349.6	5258.6	1967.3	811.8	428.9	239.7	366.9
291.2	205.4	6519.2	11001.9	6020.5	1786.9	749.7	326.1	152.5	230.7
270.7	287.1	10365.2	10534.4	6389.4	2540.6	1040.0	323.5	175.5	170.0
278.8	474.1	6682.7	9893.1	5995.8	2090.1	808.9	302.6	146.2	178.8
253.0	227.7	6169.6	11862.0	7440.7	2701.3	991.5	315.6	157.8	201.8

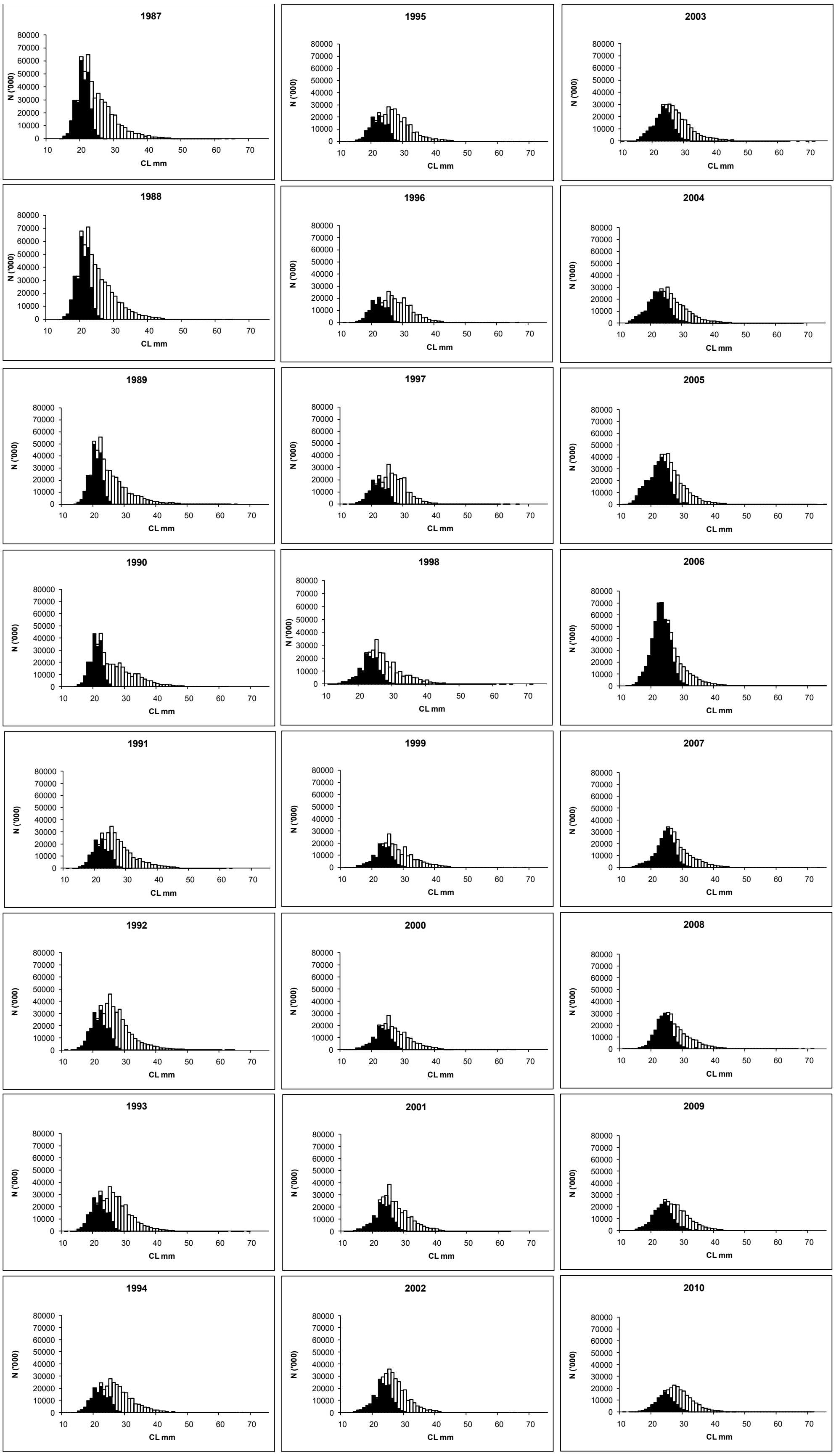


Figure 10.1. Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) catches (landings in white, discards in black); length distributions in 1987-2010.

Figure 10.2. Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) - mean length of landings, discards and catches

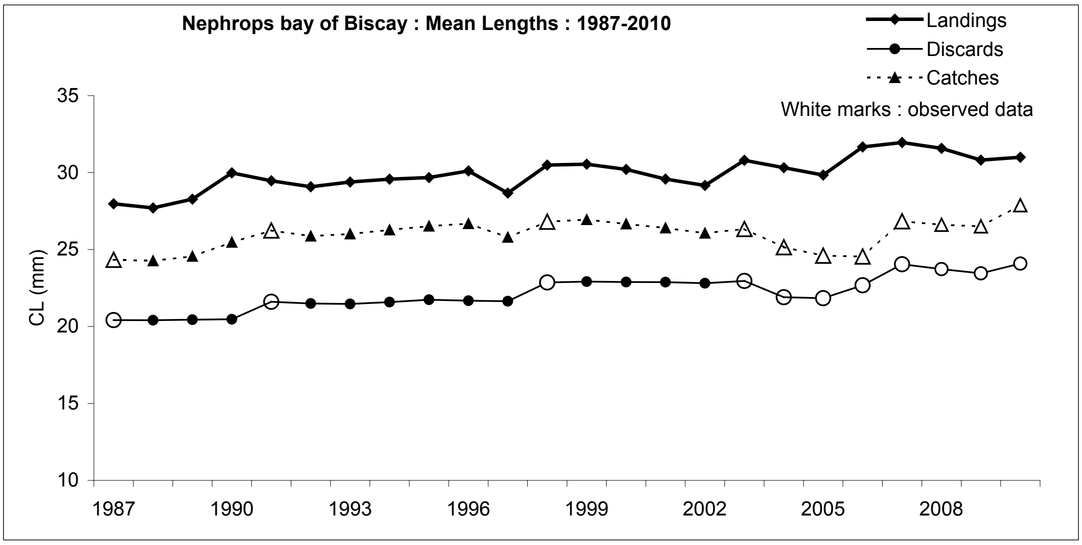
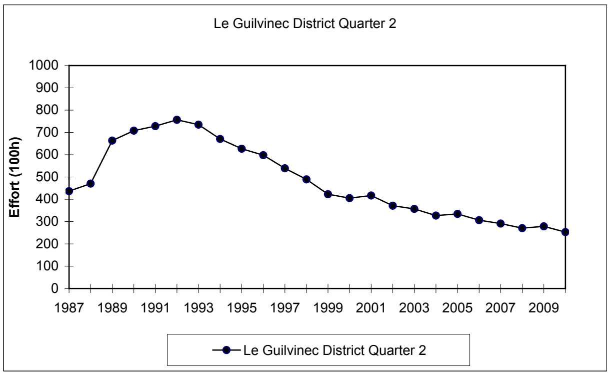
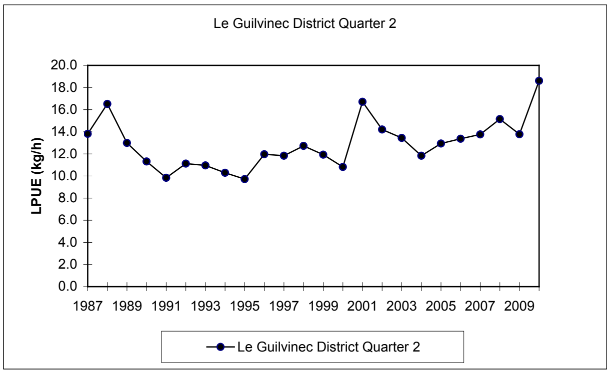


Figure 10.3. Nephrops in FUs 23-24 bay of Biscay (VIIIa,b) - Effort and LPUE values of commercial fleets used in the assessment to tune the model.

I. Effort

II. LPUE





11 *Nephrops* in Division VIIIc

11.1 *Nephrops* FU 25 (North Galicia)

11.1.1 General

11.1.1.1 Ecosystem aspects

See Annex K

11.1.1.2 Fishery description

See Annex K

11.1.1.3 Summary of ICES Advice for 2011 and management applicable to 2010 and 2011

ICES advice for2011

The advice for these *Nephrops* stocks is biennial and valid for 2011 and 2012.

Given the depleted state of FU 25 it is not relevant to provide MSY based advice. The new data (landings and lpue) available do not change the perception of FU 25 status, and give no reason to change the advice given in 2008 *Given the very low state of the stock, ICES repeats its advice of a zero catch for the stock in FU 25*.

To protect the stock in this Functional Unit, management should be implemented at the Functional Unit level.

Management applicable to 2010 and 2011

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 101 and 91 t were set for the whole of Division VIIIc for 2010 and 2011, respectively.

11.1.2 Data

11.1.2.1 Commercial catches and discards

Landings were reported only by Spain (Table 11.1.1). Since the early 90s landings declined from about 400 t to less than 50 t. There was slight increase to 143 t in 2002, despite of the fishery being virtually closed during November and December, due to the “Prestige” oil spill off Galicia in November 2002. Landings declined again to 89 t in 2003, when the fishery remained partially closed from January to April 2003. The estimates of landings in 2009 were 21 t, the lowest value recorded during the time series. In 2010, landings increased to 34 t. The time series of the commercial landings (Figure 11.1.1) shows a clear declining trend, with present figures representing less than 10% of the landings in the 70s. Discards in this functional unit remain insignificant.

11.1.2.2 Biological sampling

Length frequencies by sex of the *Nephrops* landings are collected as a rule on a monthly basis. The sampling levels are showed in Table 1.3.

The monthly sampling programme of the landings from this FU is considered to be at a sufficient level of intensity to produce reliable length compositions of the landings.

Annual length compositions for males and females combined, mean size and mean weight in the landings are given in Table 11.1.2 for the period 1982-2010 (see also Figure 11.1.2). Mean sizes in the landings in the last decade, 1999-2010, varied between 37.3 and 48.5 mm CL for the males, and between 36.8 and 45.5 mm CL for the females. The mean size time series shows an increasing trend although the mean size in 2010 decreasing decreased to the 2008 level (Figure 11.1.1). Since 1982, several regulations were applied to the bottom trawl fishery (i.e. closed areas, fishing plans, changes in mesh sizes from 40 mm to the 70 mm, etc.), but discarding practices and fishing grounds for *Nephrops* remain basically unchanged. This suggests that the overall increasing trend of mean sizes can reflect a continuous low level of recruitment during the last period of the series.

11.1.2.3 Commercial catch-effort data

Fishing effort and LPUE data were available for the A Coruña trawl fleet (SP-CORUTR8c) (Table 11.1.3 and Figure 11.1.1). This fleet accounted for more than 80% of the *Nephrops* landings from FU 25 up to 2003, diminishing afterwards but still account for a large proportion of the landings.

The overall trend in fishing effort is decreasing, with recent effort being approximately half the level in 2000. The long time series of effort (Figure 11.1.1) shows a marked decrease between 1976 and 1987, then effort remained quite stable (fluctuating around 5000 trips per year) until 1995. Since then, fishing effort decreased to 1700 trips in 2006, with a slight increase in 2007 and 2008. In 2009, the fishing effort reached the lowest value of the series with 1552 fishing trips but the effort increased to 2079 fishing trip in 2010 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 overall landings.

LPUE shows an overall decreasing trend (Figure 11.1.1). After a period of quite variable LPUE until 1993, LPUE remained relatively stable at around 40 kg/trip between 1993 and 1997. Since then, LPUE has fluctuated at low levels and further declined in 2009 to 7.3 kg/trip, the lowest recorded value in the time series. In 2010, LPUE increased to 10.4 Kg/trip.

11.1.3 Assessment

No assessment was carried out in this WG.

11.1.4 Biological reference points

There are no reference points defined for this stock.

11.1.5 Management Considerations

Nephrops is taken as by catch in the mixed bottom fishery. The overall trend in landings of *Nephrops* from the North Galicia FU 25 is of a strong decline. Landings have dramatically decreased since 1992. Recently, landings represent about 4% of the mean landings in the early period of the time series (1975-1980).

Nephrops is managed by TAC and technical measures. The TAC for the whole of Division VIIIc in 2010 was 91 t. Landings of *Nephrops* from Division VIIIc (FU 25 and FU 31) in 2010 were estimated to be 43 t, around 50% of the TAC.

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 11.1.1 *Nephrops* FU 25, North Galicia.
Landings in tonnes.

Year	Trawl
1975	731
1976	559
1977	667
1978	690
1979	475
1980	412
1981	318
1982	431
1983	433
1984	515
1985	477
1986	364
1987	412
1988	445
1989	376
1990	285
1991	453
1992	428
1993	274
1994	245
1995	273
1996	209
1997	219
1998*	103
1999*	124
2000*	81
2001*	147
2002	143
2003	89
2004*	75
2005*	63
2006*	62
2007*	67
2008*	39
2009*	21
2010	34

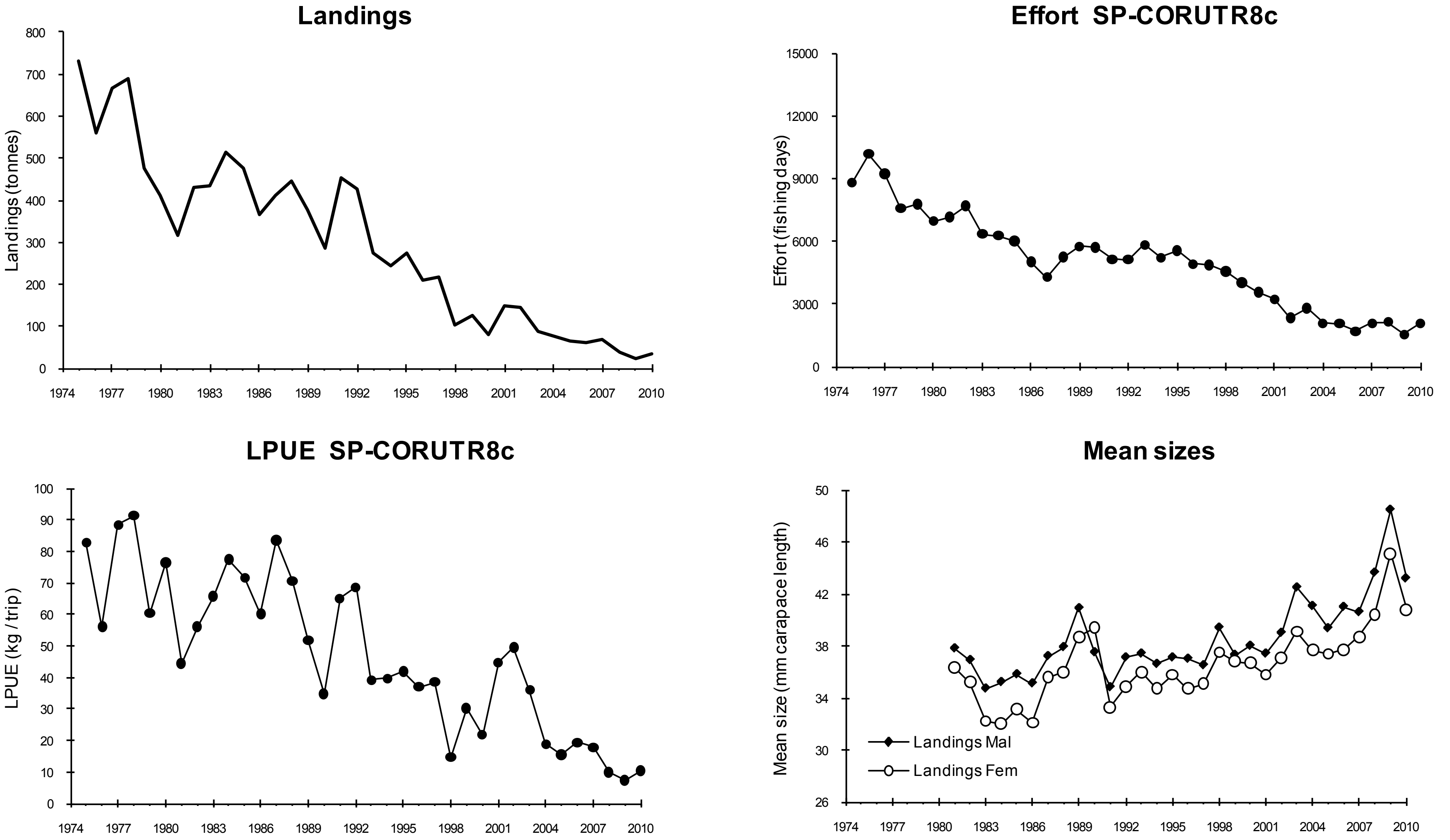
* estimated landings from sampling program

Table 11.1.2 *Nephrops* FU 25, North Galicia.
Length compositions of landings, mean weight (kg) and mean length (CL, mm), 1982-2010.

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
19	1	8	0	0	6	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	1	17	0	16	1	0	0	0	2	0	0	34	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	7	31	9	0	0	0	0	0	0	1	0	49	1	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0
22	10	99	20	8	50	0	0	0	0	0	0	32	1	7	5	5	0	0	0	0	0	0	1	1	0	1	0	0	0
23	41	143	18	68	68	6	4	0	5	15	0	15	10	6	6	7	1	1	0	10	2	0	1	1	1	1	0	0	0
24	53	350	138	198	136	38	1	0	8	20	13	80	10	19	29	16	2	5	2	0	2	1	2	2	1	1	0	0	0
25	105	496	150	300	192	191	16	0	30	71	19	57	60	64	38	18	6	15	7	10	2	0	7	5	2	1	1	0	0
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	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
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	0	2
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
57	4	1	0	6	0	7	4	8	5	3	0	0	5	1	2	1	0	2	3	0	5	7	4	3	4	2	5	3	5
58	1	3	1	0	11	8	0	5	1	3	0	0	2	1	5	0	1	2	4	1	9	4	4	3	2	2	4	3	3
59	3	2	0	2	1	0	10	2	2	1	0	0	1	1	5	0	1	0	0	1	4	5	3	2	1	1	3	3	2
60	2	2	1	1	0	3	2	8	1	0	1	0	0	1	3	1	1	0	2	1	2	2	2	2	1	1	2	3	3
61	0	2	0	1	0	0	0	4	2	0	0	0	1	1	2	0	0	0	2	0	1	1	3	1	1	1	2	1	1
62	3	2	0	1	0	0	0	2	0	1	1	0	0	1	3	0	0	0	0	0	3	3	2	1	7	1	1	2	1
63	1	1	0	1	0	1	0	1	0	0	0	0	1	1	1	2	0	0	0	0	10	0	2	1	1	1	1	2	1
64	2	0	0	3	0	1	2	3	1	0	0	0	0	1	1	0	0	0	0	0	0	1	2	1	6	0	1	1	0
65	1	0	0	0	0	1	12	1	0	2	1	0	0	0	4	0	0	0	0	0	4	1	2	1	1	0	1	1	1
66	0	1	0	1	0	0	0	1	1	0	0	0	0	0	1	1	0	0	0	0	1	2	1	1	0	0	1	1	1
67	1	2	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	2	1	1	1	1	0	1	1	0
68	0	1	0	1	0	0	2	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0	1	1	1
69	1	0	0	1	0	0	2	1	1	0	0	0	0	0	1	0	0	0	0	0	0	2	1	1	0	0	1	1	0
70	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	2	1	1	1	0	0	0	1	0
71	1	1	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	6	0	0	1	0
72	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	6	0	0	1	0
73	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	1	0
74	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0
75	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0
76	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
77	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	2	0	1	0	0	0	1	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	0	0
80	1	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	0
86																													
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
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
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
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

Table 11.1.3 *Nephrops* FU 25, North Galicia.
Fishing effort and LPUE for SP-CORUTR8c fleet.

	SP-CORUTR8c		
Year	Landings (t)	Effort (trips)	LPUE (kg/trip)
1986	302	5017	60.1
1987	356	4266	83.5
1988	371	5246	70.7
1989	297	5753	51.7
1990	199	5710	34.9
1991	334	5135	65.1
1992	351	5127	68.5
1993	229	5829	39.2
1994	207	5216	39.6
1995	233	5538	42.0
1996	182	4911	37.0
1997	187	4850	38.5
1998	67	4560	14.7
1999	121	4023	30.1
2000	77	3547	21.7
2001	145	3239	44.8
2002	115	2333	49.5
2003	65	1804	35.9
2004	40	2091	18.9
2005	32	2063	15.5
2006	33	1699	19.4
2007	37	2075	17.6
2008	21	2128	9.9
2009	11	1552	7.3
2010	22	2079	10.4



1*-weekend break, 2*- 70 mm mesh size, 3*- recovery plan

Figure 11.1.1. ***Nephrops*** **FU 25, North Galicia: Long-term trends in landings, effort, LPUE and mean sizes.**

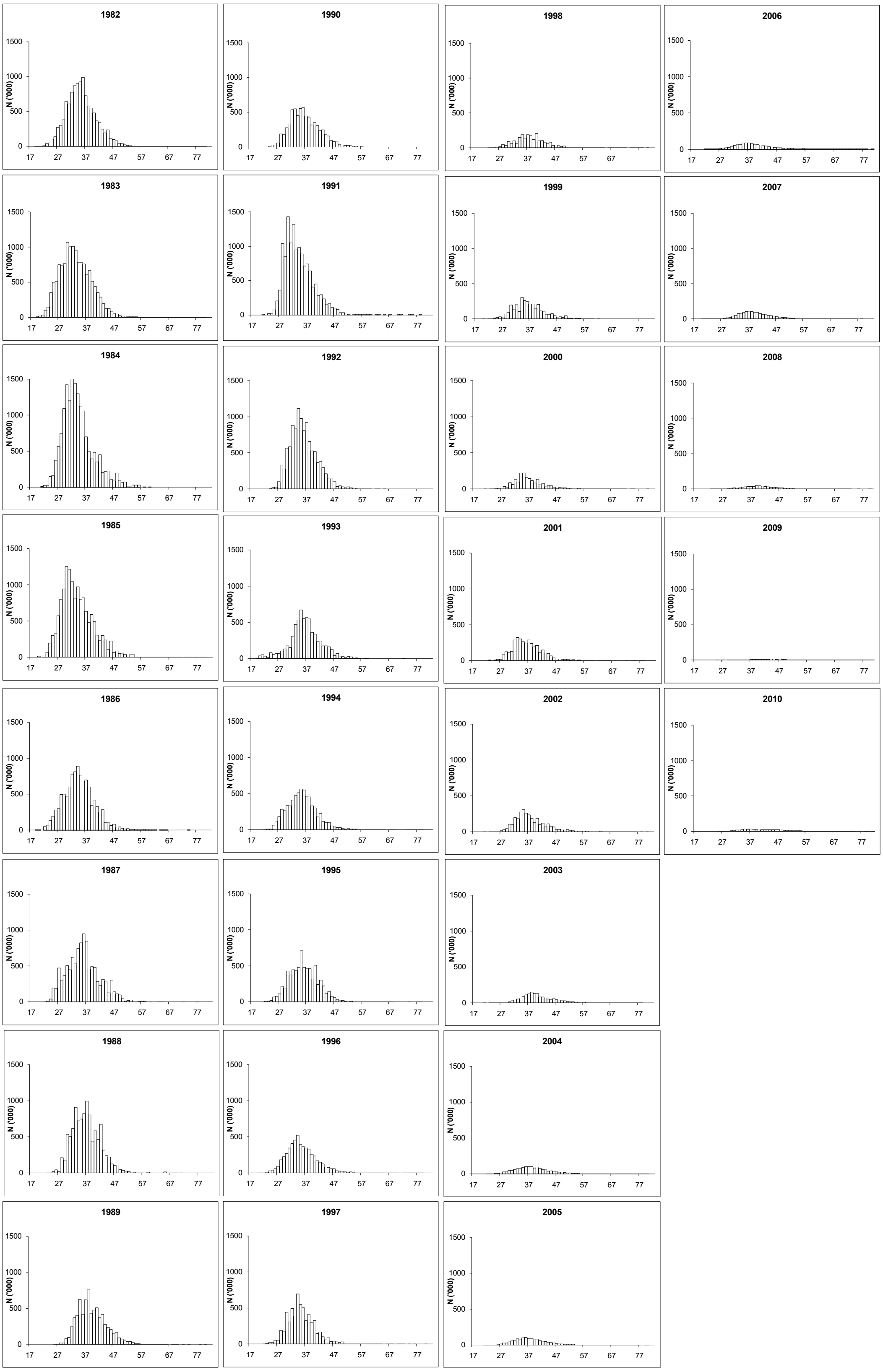


Figure 11.1.2. ***Nephrops*** **FU 25, North Galicia: length distributions in landings, 1982-2010.**

11.2 *Nephrops* FU 31 (Cantabrian Sea)

11.2.1 General

11.2.1.1 Ecosystem aspects

Sea Annex K

11.2.1.2 Fishery description

Sea Annex K

11.2.1.3 Summary of ICES Advice for 2011 and management applicable to 2010 and 2011

ICES advice for 2011

The advice for these *Nephrops* stocks is biennial and valid for 2011 and 2012.

Given the depleted state of FU 31 it is not relevant to provide MSY based advice. According to Precautionary Approach, the new data (landings and lpue) available do not change the perception of FU 31 status, and give no reason to change the advice given in 2008 *Given the very low state of the stock, ICES repeats its advice of a zero catch for the stock in FU 31.*

To protect the stock in this Functional Unit, management should be implemented at the Functional Unit level.

Management applicable to 2010 and 2011

TACs of 101 and 91 t were set for the whole of Division VIIIc for 2010 and 2011, respectively. A fishing effort limitation is also applicable in accordance with the southern hake and *Nephrops* recovery plan.

11.2.2 Data

11.2.2.1 Commercial catches and discards

Nephrops landings from FU 31 are reported by Spain (the only participant in the fishery) (Table 11.2.1 and Figure 11.2.1) and are available for the period 1983-2010. The highest landings were recorded in 1989 and 1990, with 177 and 174 tonnes, respectively. Since 1996 landings have declined sharply from 129 t to less than 20 t in recent years, with a minimum value in 2009 of 6 tonnes. In 2010, landings increased to 8.5 tonnes.

11.2.2.2 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 1988-2010, but shows a general increasing trend for both sexes (Figure 11.2.1), with the highest values in 2009 (males with 55.8 mm and females with 45.9 mm CL). In 2010, the mean size decreased one mm of carapace length in both sexes.

11.2.2.3 Commercial catch-effort data

The fishing effort data series includes two bottom trawl fleets operating in the Cantabrian Sea with home ports in Avilés and Santander. However, fishing effort data from Avilés is not available since 2004 and from the fleet of Santander was not available in 2008. The available time series of effort shows a period of relative stability from the early 1980s to the beginning of the 1990s. Since 1992, effort shows a marked downward trend (Figure 11.2.1) with the lowest value recorded in 2005 (364 fishing days corresponding to Santander fleet). The increased use of other gears (HVO and pair trawl in recent years) has resulted in the reduction in effort by the baca trawl fleet, the only gear fishing for *Nephrops*. In 2007 fishing effort increased to 1304 fishing days but it declined again to values about 400 fishing days in 2009 and 2010. Information about fishing effort from the Gijon fleet of the three last years has been presented for the first time in this WG (Figure 11.2.1). The fishing effort from this fleet is low level with a decreasing trend. Since 2008, the fishing effort has declined by 42%.

The LPUE data series (no data available in 2008) shows fluctuations around the general downward trend. In recent years the LPUE corresponding to Santander fleet has been at low levels (Figure 11.2.1), with a recent decreasing trend, reaching the lowest value of the time series in 2009. In 2010, the Santander and Gijon LPUE increase by 50% respect the previous year.

11.2.3 Assessment

No assessment was carried out in this WG.

11.2.4 Management considerations

A recovery plan for southern hake and Atlantic Iberian *Nephrops* stocks including a fishing effort reduction was implemented and enforced in 2006. The fishing effort data available for the Santander fleet showed an increase in 2006 and 2007 (no data is available for 2008), but with a great decrease in 2009 and remaining close to the 2009 level in 2010.

Table 11.2.1 *Nephrops* FU 31, 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	8.5

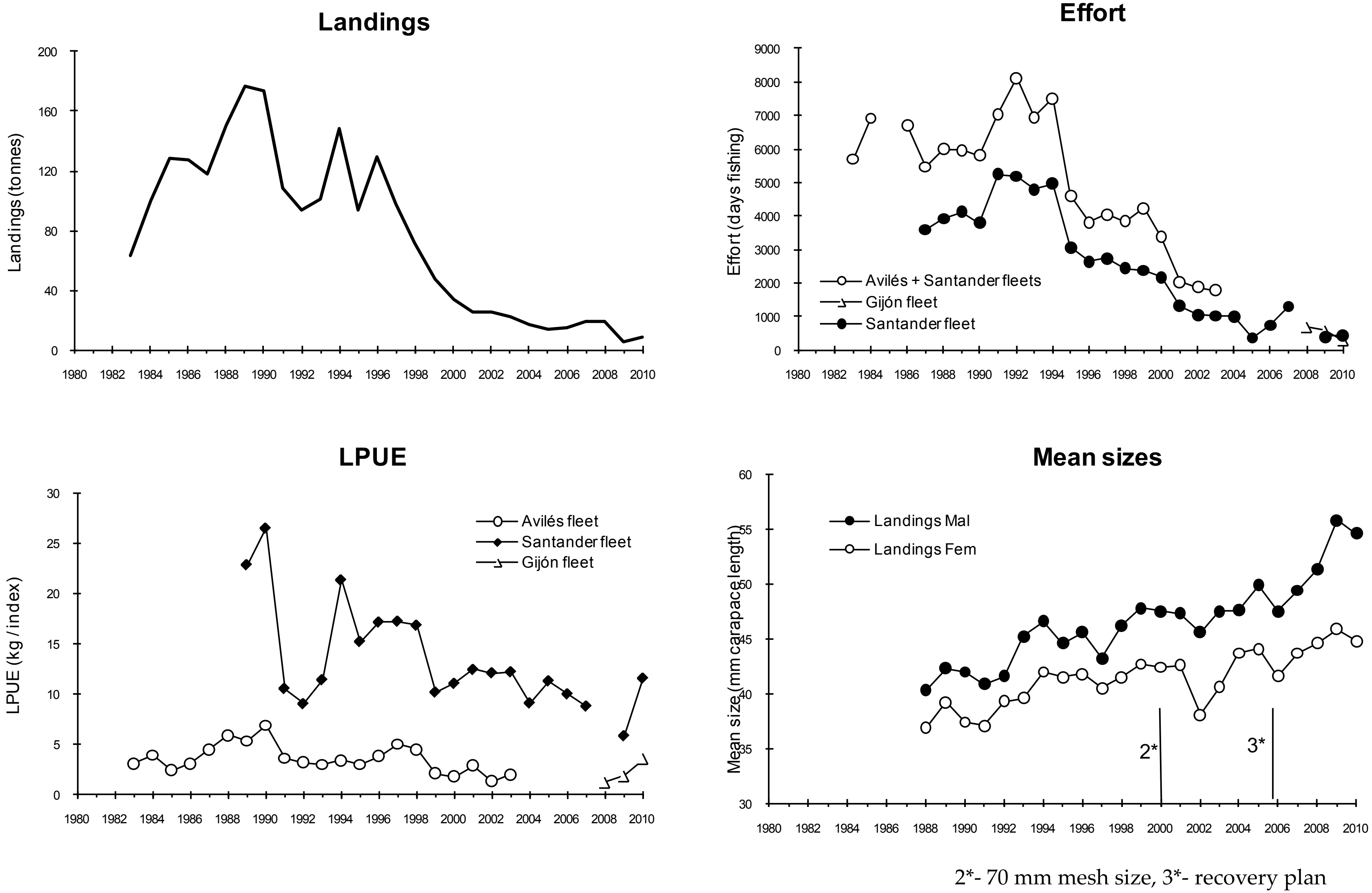


Figure 11.2.1 ***Nephrops*** **FU 31, Cantabrian Sea: Long-term trends in landings, effort, LPUE, and mean sizes.**

11.3 Summary for Division VIIIc

Nephrops in Division VIIIc includes two FUs (North Galicia, FU 25 and Cantabrian Sea, FU 31). Table 11.3.1 gives the landings in Division VIIIc. Landings from both FUs have declined dramatically in recent years. The agreed *Nephrops* TAC for the whole of Division VIIIc in 2011 was 91 t. Landings were 43 t below the TAC. In 2009, landings were only 27 t, corresponding to the lowest value of the time series.

The very low levels of landings from FU 25 and FU 31 and the decreasing LPUE trends 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 11.3.1 *Nephrops* SubDivision VIIIc.
Landings in tonnes by FU and SubDivision VIIIc.

Year	FU 25	FU 31	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	8.5	43

12 *Nephrops* in Division IXa

The ICES Division IXa has five *Nephrops* Functional Units: FU 26, West Galicia; FU 27 North Portugal; FU 28, Alentejo, Southwest Portugal; FU 29, Algarve, South Portugal and FU 30, Gulf of Cádiz.

Tables 12.1 and 12.2 show the time series of recorded landings and TAC for the Division IXa.

Table 12.1. Total recorded landings in Division IXa

	Division IXa - Management Area Q																
	FU 26+27 West Galicia + North Portugal							FU 28+29 SW+S Portugal						FU 30 Gulf Cadiz			Q Total
	26*	27						28	29	28+29				30			
	Spain	Portugal			Spain	Total	Total	Spain	Spain	Portugal			Total	Portugal	Spain	Total	
Year	Trawl	Artisanal	Trawl	Total	Trawl			Trawl	Trawl	Artisanal	Trawl	Total		Unalloc	Trawl		
1975	622						622	137	1510		34	34	1681				2303
1976	603						603	132	1752		30	30	1914				2517
1977	620						620	95	1764		15	15	1874				2494
1978	575						575	120	1979		45	45	2144				2719
1979	580						580	96	1532		102	102	1730				2310
1980	599						599	193	1300		147	147	1640				2239
1981	823						823	270	1033		128	128	1431				2254
1982	736						736	130	1177		86	86	1393				2129
1983	786						786				244	244	244				1030
1984	604		14	14		14	618				461	461	461				1079
1985	750	4	11	15		15	765				509	509	509		257	257	1531
1986	657	9	28	37		37	694				465	465	465		221	221	1380
1987	671	19	52	71		71	742			11	498	509	509		302	302	1553
1988	631	41	55	96		96	727			15	405	420	420		139	139	1286
1989	620	22	66	88		88	708			6	463	469	469		174	174	1351
1990	401	17	31	48		48	449			4	520	524	524		220	220	1193
1991	549	14	40	54		54	603			5	473	478	478		226	226	1307
1992	584	15	37	52		52	636			1	469	470	470		243	243	1349
1993	472	14	36	50		50	522			1	376	377	377		160	160	1059
1994	426	8	14	22		22	448				237	237	237		108	108	793
1995	501	1	9	10		10	511			1	272	273	273		131	131	915
1996	264		17	17	50	67	331			4	128	132	132		49	49	512
1997	359		6	6	68	74	433			2	134	136	136		97	97	666
1998	295		8	8	42	50	345			2	159	161	161		85	85	591
1999	194	5	0	6	48	54	248			5	206	211	211		120	120	578
2000	102	8	1	9	21	30	132			4	197	201	201		129	129	462
2001	105	4	2	6	21	27	132			2	269	271	271		178	178	582
2002	59	4	0	4	24	28	87			1	358	359	359		262	262	708
2003	39	7		7	26	33	72			35	327	362	362	4	303	307	740
2004	38	8	0	8	24	32	70			31	415	445	445	4	143	147	663
2005	16	10	0	10	16	26	42			31	382	413	413	3	243	246	701
2006	15	12	0	12	17	29	44			17	233	249	249	4	242	245	539
2007	20	8	0	9	17	26	46			18	218	236	236	4	211	214	496
2008	17	7	0	7	12	19	36			35	173	208	208	3	117	120	363
2009	16	4	0	4	5	9	25			17	105	122	122	2	117	120	267
2010**	3	2	0	2	14	16	19			16	108	124	124	1	106	107	250

* Prior 1996, landings of Spain recorded in FU 26 include catches in FU 27

** Preliminary values

Table 12.2. Division IXa. TAC and recorded landings

Year	TAC (tonnes)	Total Landings (tonnes)
1995	2500	915
1996	2500	512
1997	2500	666
1998	2500	591
1999	2000	578
2000	1500	462
2001	1200	582
2002	800	693
2003	600	718
2004	600	663
2005	540	690
2006	486	539
2007	437	496
2008	415	363
2009	374	267
2010	337	250
2011	303	

12.1 *Nephrops* FU 26-27, West Galicia and North Portugal (Division IXa)

12.1.1 General

12.1.1.1 Ecosystem aspects

See Annex L

12.1.1.2 Fishery description

See Annex L

12.1.2 Summary of ICES Advice for 2011 and management applicable to 2010 and 2011

ICES advice for 2011

The advice for these *Nephrops* stocks is biennial and valid for 2011 and 2012.

Given the depleted state of the FU it is not relevant to provide MSY based advice. The new data (landings and lpue) available do not change the perception of FU 26-27 status, and give no reason to change the previous advice of zero catch.

To protect the stock in this Functional Unit, management should be implemented at the Functional Unit level.

Management applicable to 2010 and 2011

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 337 and 303 t for 2010 and 2011, respectively, and the maximum number of fishing days per vessel was fixed at 158 days for Spanish vessels and at 158 and 172 days for Portuguese vessels for these two years (Annex IIb of Council Regulations nos. 53/2010 and 57/2011). 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. The number of fishing days included in these regulations is not applicable to the Gulf of Cadiz (FU 30), which has a different regime.

12.1.3 Data

12.1.3.1 Commercial catches and discards

Landings are reported by Spain and minor quantities by Portugal (Table 12.1.1). The catches are taken by the Spanish fleets fishing on the West Galicia (FU 26) and North Portugal (FU 27) fishing grounds, and by the Portuguese artisanal fleet fishing on FU 27. *Nephrops* represents a minor percentage in the composition of total trawl landings but is a very valuable species.

Along the time series, landings by the Spanish fleets are mostly from FU 26, together with smaller quantities taken from FU 27. Prior to 1996, no distinction was made between the two FUs, and therefore they are considered together. Two periods can be distinguished in the time series of landings available 1975-2009 (Figure 12.1.1). During 1975-1989, landings fluctuated between 600 and 800 t. From 1990 onwards there has been a marked downward trend in landings. Since 2005 landings were below 50 t (19 t in 2010), representing less than 5 % of the landings realized prior to 1990. Considering functional units separately, landings from FU26 decreased 13 t in 2010 respect to the respect previous year while in FU27 landings increased 9 t. Fishery statistics are considered to be reliable since the landings data are extracted from the sale sheets. Discards rates are very low, due to the high value of the species.

Total Portuguese landings from FU 27 have decreased from almost 100 t in 1988 to just 2 t in 2010.

12.1.3.2 Biological sampling

Length frequencies by sex of the *Nephrops* landings are collected monthly. The sampling levels are shown in Table 1.3.

The length frequency distributions were obtained by sampling the commercial landings at the Spanish ports of Marín and Vigo. The monthly sampling programme of the *Nephrops* landings from the FU 26 is considered to be at a sufficient level of intensity to produce reliable length compositions.

Annual length compositions for males and females combined, mean size and mean weight in landings for the period 1988-2010 are given in Table 12.1.2 and Figure 12.1.2.

12.1.3.3 Commercial catch–effort data

Fishing effort and LPUE data are available for Marín trawl fleet (SP-MATR) for the period 1994-2010 (Table 12.1.3). The overall trend for the LPUE of SP-MATR is decreasing, with some stability in 2007-2009 but a very big drop in 2010. In 2009, this fleet accounted for 60 % of the landings from these FUs but in 2010 this percentage decreased to 27%. 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.

12.1.4 Assessment

No assessment was carried out in this WG.

12.1.5 Biological reference points

There are no reference points defined for this stock

12.1.6 Management Considerations

Nephrops is taken as by catch in a mixed bottom trawl fishery. Landings of *Nephrops* have substantially declined since 1995. Current landings represent 6% of the average landings in the early period of the time series (1975-1992). Fishing effort indices for FU26-27 have 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 procedure for setting the TACs for *Nephrops* stocks, complemented by a system of fishing effort limitation (i.e. a reduction of 10% in the fishing mortality rate in the year of its application as compared with the fishing mortality rate estimated for the preceding year, within the limits of ±15% of the preceding year TAC). This plan also includes a seasonal closure (June-August) for *Nephrops* in an area of the West Galicia (FU 26) fishing grounds.

Table 12.1.1 *Nephrops* FU 26-27, West Galicia and North Portugal.
Landings in tonnes.

	Spain		Portugal	Total
Year	FU 26*	FU 27	FU 27	FU 26-27
1975	622			622
1976	603			603
1977	620			620
1978	575			575
1979	580			580
1980	599			599
1981	823			823
1982	736			736
1983	786			786
1984	604		14	618
1985	750		15	765
1986	657		37	694
1987	671		71	742
1988	631		96	727
1989	620		88	708
1990	401		48	449
1991	549		54	603
1992	584		52	636
1993	472		50	522
1994	426		22	448
1995	501		10	511
1996	264	50	17	331
1997	359	68	6	433
1998	295	42	8	345
1999	194	48	6	248
2000	102	21	9	132
2001	105	21	6	132
2002	59	24	4	87
2003	39	26	7	72
2004	38	24	8	70
2005	16	16	10	42
2006	15	17	12	44
2007	20	17	9	46
2008	17	12	7	36
2009	16	5	4	25
2010	3	14	2	19

*Prior 1996 landings of Spain from FU 26 include catches in FU 27

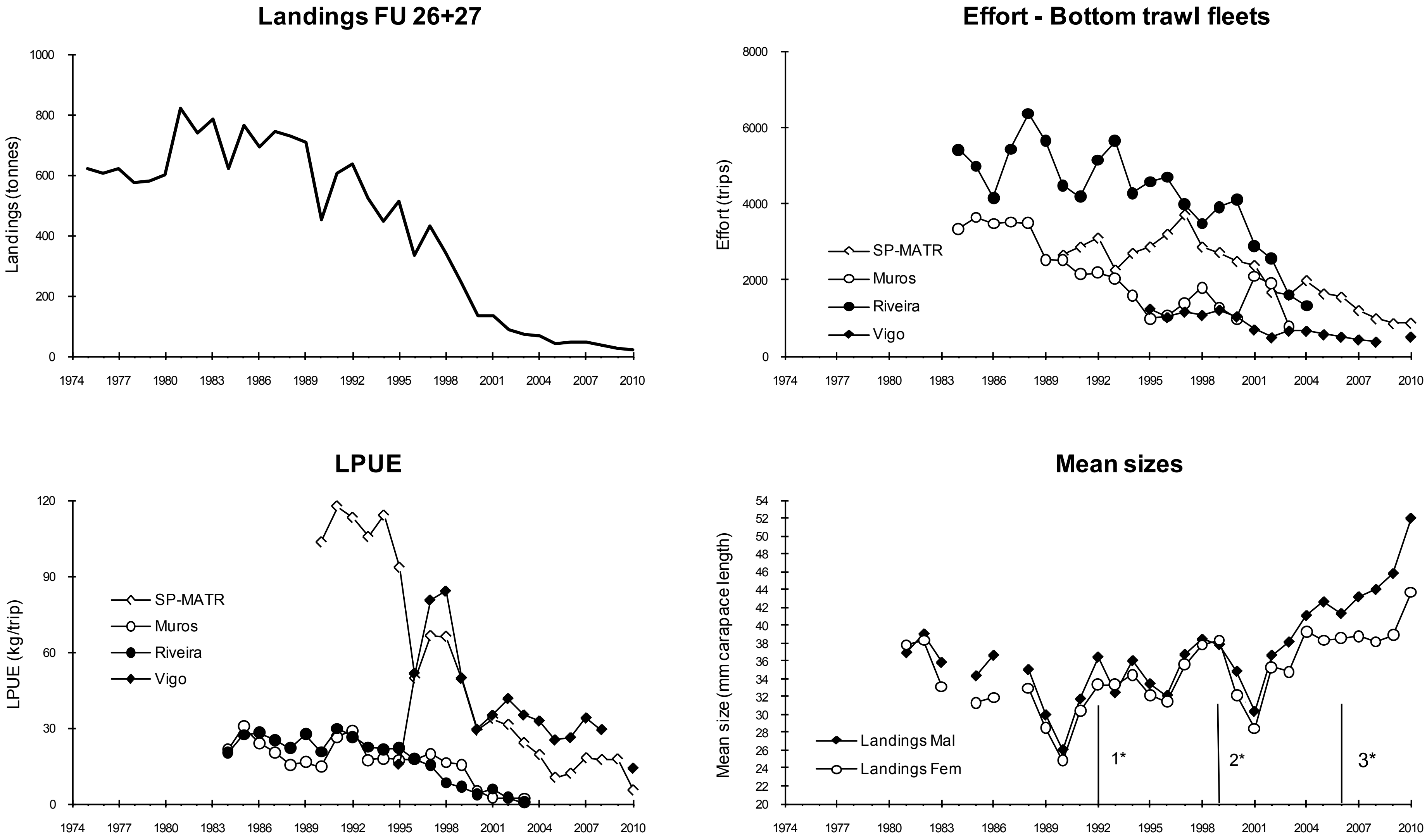
Table 12.1.2 Nephrops FU 26-27, West Galicia and North Portugal.

Length compositions, mean weight (kg) and mean size (CL, mm) in landings, 1988-2010.

ze, 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
12	0	0	6	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
14	0	69	27	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
16	0	191	289	13	0	0	0	0	0	0	0	0	3	17	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
18	0	683	898	25	0	0	2	1	0	0	0	0	16	19	0	4	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
20	27	1057	2044	97	6	5	10	7	25	3	0	0	86	151	3	29	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
22	39	1657	2642	398	48	99	84	47	202	12	1	0	129	348	11	11	1	0	1	0	0	0	0
23	109	1901	3063	568	103	99	77	151	373	26	6	0	127	518	16	31	0	0	0	0	1	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
25	290	2212	1802	1477	541	381	199	672	906	113	45	15	134	441	35	28	1	2	1	0	3	1	0
26	574	1675	1451	1516	829	542	289	709	960	184	40	43	145	365	56	22	7	2	2	1	2	1	0
27	854	1878	1333	1351	926	904	409	933	746	306	80	68	129	419	106	40	18	8	5	2	3	1	0
28	1272	1560	1319	1940	1079	1017	524	1298	842	402	138	109	123	274	74	46	23	12	8	6	9	4	0
29	1487	1716	913	1797	1023	987	613	1223	706	489	191	134	143	266	86	60	20	15	13	7	7	9	0
30	1615	1510	845	1501	1069	1140	767	1371	792	681	295	195	172	252	118	90	31	25	20	12	13	11	0
31	1960	1106	632	1450	1180	890	802	1378	609	719	359	239	182	209	105	102	27	21	21	13	16	9	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
33	2288	1313	601	1126	1378	878	898	1444	517	780	525	377	176	201	167	84	56	26	40	47	23	11	2
34	1581	1299	572	1160	1001	849	853	1255	542	745	551	376	192	156	131	83	56	31	51	43	37	22	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
36	1161	634	407	879	776	901	611	744	433	527	484	360	176	120	110	85	56	21	42	36	22	15	4
37	838	545	284	651	627	736	546	580	348	484	417	321	175	143	106	111	70	31	51	49	31	17	7
38	1196	608	294	616	545	682	621	542	346	534	425	308	128	110	76	72	86	35	61	38	28	20	6
39	837	451	226	600	505	510	475	425	285	406	292	240	128	85	95	79	65	27	43	36	21	14	6
40	501	325	199	450	666	573	412	455	284	466	393	218	115	65	76	60	90	24	55	39	32	21	7
41	428	288	165	375	431	385	321	321	213	399	312	182	112	58	88	48	60	21	40	32	23	16	8
42	367	287	144	220	362	375	314	214	182	360	249	210	66	57	81	54	101	22	47	43	26	14	6
43	433	296	156	203	425	307	293	188	165	325	292	219	64	36	76	47	73	25	38	49	25	13	9
44	164	277	87	136	301	251	200	152	127	290	207	193	61	44	52	33	62	20	32	38	36	13	10
45	165	286	58	110	303	219	178	125	118	218	196	162	58	42	44	34	56	17	18	29	17	12	8
46	96	135	23	90	350	153	129	116	94	191	178	152	40	28	49	26	29	20	18	24	18	8	10
47	94	117	45	82	228	104	92	84	56	123	120	84	38	47	42	31	38	26	18	28	17	8	8
48	71	100	25	49	222	58	96	55	70	117	147	96	23	18	22	13	28	18	12	15	16	7	7
49	73	76	29	42	148	84	71	46	23	60	105	64	21	16	15	16	18	13	11	14	9	5	7
50	83	127	14	46	63	81	69	29	31	81	95	54	17	12	12	15	16	15	13	14	9	9	10
51	15	48	9	14	71	27	59	13	21	43	59	21	17	6	7	15	7	15	7	7	9	6	4
52	20	75	14	33	71	21	59	18	22	43	55	30	18	6	7	10	12	10	8	10	9	6	5
53	23	34	13	26	34	20	28	6	13	30	37	33	5	5	6	10	5	7	6	8	4	6	5
54	14	10	11	23	23	14	12	6	15	42	28	27	8	3	2	8	4	11	10	6	7	4	5
55	6	27	1	6	13	17	12	1	9	25	26	12	6	7	3	4	5	8	3	6	6	5	7
56	6	9	1	5	5	10	5	1	9	14	14	14	7	4	3	5	3	4	2	3	6	6	4
57	10	5	1	2	6	5	10	0	4	8	12	6	5	3	3	2	2	3	2	4	5	5	3
58	11	5	1	4	6	5	14	0	3	6	11	5	4	5	4	3	3	4	4	4	5	5	4
59	7	0	4	0	7	2	7	0	0	2	1	5	3	3	0	1	4	3	1	3	2	2	1
60	2	0	2	0	4	3	3	0	0	1	2	3	2	2	2	2	7	4	2	1	3	3	4
61	4	0	1	0	3	2	12	0	0	0	2	0	3	2	0	2	1	14	1	2	1	1	3
62	2	0	1	0	1	0	7	0	0	0	0	0	1	5	0	2	2	4	2	1	3	2	1
63	1	0	1	0	3	0	5	0	0	1	0	0	3	3	0	2	1	2	1	1	1	1	2
64	2	0	1	0	3	1	4	0	0	0	1	0	2	2	0	2	1	1	1	1	2	3	2
65	2	0	1	0	1	0	2	0	0	0	0	0	1	1	1	1	2	2	1	1	1	2	2
66	3	0	1	0	1	0	2	0	0	0	1	0	2	2	0	1	0	1	1	1	1	1	1
67	2	4	1	0	1	1	1	0	0	0	1	0	3	1	0	2	1	2	1	1	1	1	1
68	2	11	1	0	2	2	6	0	0	0	0	0	2	1	0	2	1	1	2	2	2	1	2
69	1	4	1	0	1	1	0	0	0	0	0	0	2	1	0	1	1	1	2	1	1	1	1
70	12	25	1	2	12	6	8	0	1	0	3	0	11	1	1	5	4	8	1	1	4	1	1
71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1
72	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
73	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
74	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
76	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
78	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
80	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
82	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
84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(thousand)	22409	31275	29319	23087	17811	15360	12003	17411	11828	10827	7383	5302	3822	5712	2169	1666	1257	638	800	752	569	355	191
al 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
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
ength (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

Table 12.1.3 *Nephrops* FU 26-27, West Galicia and North Portugal.
Fishing effort and LPUE for SP-MATR fleet

	SP-MATR		
Year	Landings (t)	trips	LPUE (kg/trip)
1994	234	2692	113.9
1995	267	2859	93.3
1996	158	3191	49.5
1997	245	3702	66.3
1998	188	2857	66.0
1999	134	2714	49.5
2000	72	2479	28.9
2001	80	2374	33.6
2002	52	1671	31.2
2003	59	1597	24.0
2004	31	1980	19.3
2005	17	1629	10.3
2006	18	1547	11.9
2007	22	1196	18.0
2008	17	980	17.3
2009	15	854	17.4
2010	5	867	5.3



1* -weekend break in West Galicia, 2*- 70 mm mesh size, 3*-recovery plan

Figure 12.1.1 Nephrops FU 26+27, West Galicia and North Portugal: Long-term trends in landings, effort, LPUE and mean sizes.

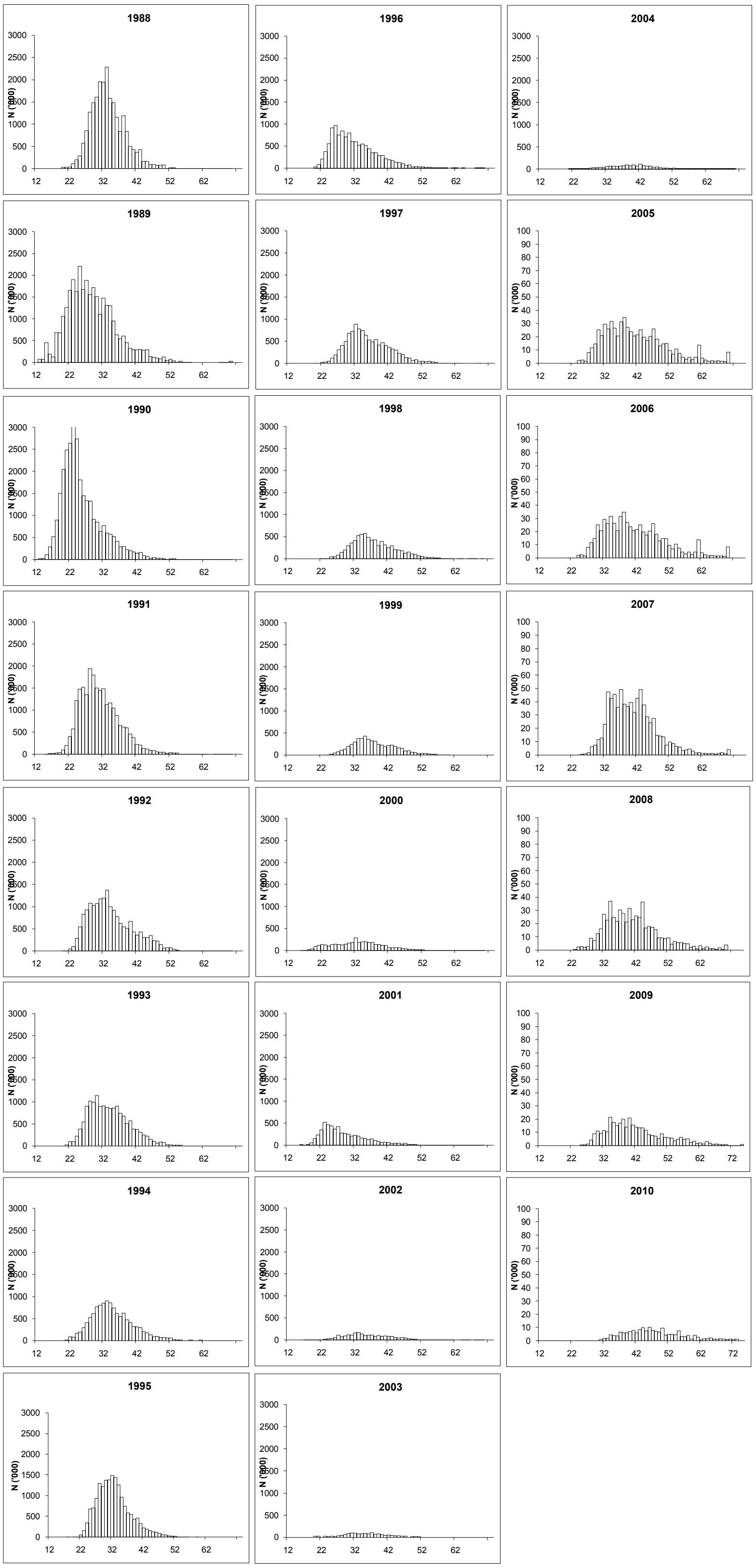


Figure 12.1.2 Nephrops FU 26-27, West Galicia and North Portugal: length distributions in landings, 1988-2010. Y-Axis has been changed from 2005 to 2010.

12.2 FU 28 – 29 (SW and S Portugal)

12.2.1 General

12.2.1.1 Ecosystem aspects

See the Stock Annex (in Annex L of WG report)

12.2.1.2 Fishery description

See the Stock Annex (in Annex L of WG report)

12.2.1.3 ICES Advice for 2011 and Management applicable for 2011 and 2012

ICES Advice for 2011

The advice for these stocks is biennial and valid for 2011 and 2012. Management should be implemented at the Functional Unit level.

The stock trend is stable and the exploitation status is unknown. According to ICES MSY approach, catches should be reduced from recent levels. According to PA approach, catches should not exceed the recent average catch (2007-2009), corresponding to landings of 190 t.

Management applicable for 2011 and 2012

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 337 and 303 t for 2010 and 2011, respectively, and the maximum number of fishing days per vessel was fixed at 158 days for Spanish vessels and at 158 and 172 days for Portuguese vessels for these two years (Annex IIb of Council Regulations nos. 53/2010 and 57/2011). 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). The number of fishing days included in these regulations is not applicable to the Gulf of Cadiz (FU 30), which has a different regime.

12.2.2 Data

12.2.2.1 Commercial catches and discards

Table 12.1 and Figure 12.2.1 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 of total landings in 2010 was 124 t, approximately the same level of 2009.

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 last eight years male to female sex-ratio has been close to 1.5:1.

Discards are negligible in this fishery (Jardim *et al.*, WD16).

12.2.2.2 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 2010 was at the same level as in the years before. The sampling data are raised to the total landings by market category, vessel and month.

The length compositions of the landings are presented in Tables 12.2.1a-b and Figures 12.2.2a-b. The number of samples and measured individuals are presented in Table 1.3.

12.2.2.3 Abundance indices from surveys

Over the past decade, several groundfish (PtGFS-WIBTS-Q4) and crustacean trawl surveys (PT-CTS UWTV FU 28-29) were carried out in FUs 28 and 29. Table 12.2.3 and Figure 12.2.1 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 should provide a better estimation of the abundance for the first ages. There is an increase in the overall biomass index in the period 2003-2005, and also of small individuals in a particular juvenile concentration area in 2005, which could be an indication of higher recruitment. The CPUE index for 2010 was the highest value of the series.

In 2008 and 2009, the crustacean trawl survey conducted in the Functional Units 28 and 29, was combined with an experimental video sampling. The collection of images covered the whole area in 2009. The methodology is described in the Stock Annex.

Abundance indices from trawl, sediment composition and video images from the 2008 survey were available for FU 28 and looked in more detail. Higher abundances of *Nephrops* were found in muddy and sandy mud sediments. Images from hauls showing different levels of density and different mean individual sizes were visualized. These images contribute to the characterization of the burrow systems in deep waters (ICES, 2009).

12.2.2.4 Mean sizes

Mean carapace length (CL) data for males and females in the landings and surveys are presented for the period 1994-2010 (Table 12.2.4). Figure 12.2.1 shows the mean CL trends since 1984. The mean sizes of males and females have fluctuated along the period with no apparent trend.

12.2.2.5 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.

This model has been updated each year with the addition of new data.

The data on effort were updated using the standardized CPUE of Crustacean trawlers estimated from the revised model. Due to low number of records, the effort estimated for the year 2001 was replaced by the average of the years 2000 and 2002. The CPUE series used in Working Groups prior to 2008 was estimated based on all trawl vessels (fish and crustacean vessels).

Total fishing effort decreased from a peak in 1985 to much lower values in the early 1990s. In the period 1999-2002, fishing effort increased substantially (Table 12.2.2 and Figure 12.2.1).

The effort in 2003-2004 corresponds to only eleven months 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 from 240 days in the year 2006 to 216 in 2007, 194 in 2008, 175 in 2009 and 158 days in 2010 (Council Regulations (EC) No 51/2006, 41/2007, 40/2008, 43/2009, 53/2010). 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). 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 effort in 2006 to 2010 corresponds to 11 months each year but it was not possible to evaluate if the effort applied previously in the box in FU 28 was transferred to other areas in FU 28 and 29.

Since 1989, CPUE has declined considerably, from almost 100 kg/day in 1989 to an average of about 25 kg/day in the period 1999-2001 (Figure 12.2.1). The total CPUE shows an increase in 2003-2005, declining again in 2006-2009.

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, 2010c) and during WKSHAKE2 (ICES, 2010d). 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 2006-2009, the landings of rose shrimp increased showing a change in the objectives of the fishery (Figure 12.2.3).

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, 2010b). 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 daily catches of this species and the proportion of *Nephrops* in the total daily catch were incorporated and two approaches for the CPUE standardization with GLMs were presented to WKSHAKE2 showing their effects in the assessment model and comparing with the 2010 assessment (ICES, 2010d, Silva and Cardador, 2010, WD12).

The first approach used a delta model to model the probability of obtaining a zero catch (binomial distribution with logit link function) and the catch rate (Gamma distribution with log link function), given that the catch is non-zero, separately. The final unconditioned CPUE estimate is the product of separate estimates of the probability of positive catch and the catch rates from the second step model.

The second approach modelled only the non-zero catches assuming that when the catch of *Nephrops* is zero, the fishery is not directed at this species. This assumption is based on the different depth distribution of rose shrimp and *Nephrops*, although some overlap occurs. This second approach used a Gamma distribution with log link function.

The logistic model fitted to the presence/absence of *Nephrops* explains 31% of the total variability. The most influential explanatory variable was the daily catch rate of rose shrimp. The Gamma model fitted to the positive values of *Nephrops* CPUE explains 45% of the total variability, with the proportion of *Nephrops* in the total daily catches as the most important factor.

Although the CPUE estimates differ in the scale, the year effects resulting from both approaches are similar. Taking into account the knowledge of the fishery, the more consistent results in the assessment and improved diagnostics (catchability residuals and retrospective patterns), the second model – with non-zero catches, Gamma distribution with log link function – is considered more appropriate.

Figure 12.2.4 shows the comparison among the observed and the standardized CPUE values (absolute and relative) using the previous model and the proposed model, incorporating the variables related to the shrimp catch and *Nephrops* proportion.

As the distributions of rose shrimp and *Nephrops* are fishing ground and depth dependent, the availability and use of VMS data may provide this information and improve the standardization model, as suggested in Silva and Afonso-Dias, 2011 (WD11).

12.2.3 Assessment

No assessment was carried out in this WG.

12.2.4 Short-term Projections

No projections were performed.

12.2.5 Biological reference points

Biological reference points were estimated at WKSHAKE2 (ICES, 2010d) on the basis of the Yield per Recruit curve and the same results are presented here. Considering the retrospective pattern, WGHMM 2010 estimated the biological reference points based on the convergent part of the XSA, the selection pattern and weights-at-age being the average of the years 2002-2004.

However, since the extent to which the fishery targets *Nephrops* depends on rose shrimp abundance, and this might potentially impact on the relative exploitation pattern-at-age, a sensitivity analysis of the potential F_{msy} proxies was conducted, with the average selection pattern of a three-year moving window since the beginning of the series. The $F_{0.1}$ shows some stability over the time series, either for males or females, and may be considered as an F_{msy} proxy. At $F_{0.1}$ the %SPR are above 35% (table below). The Y/R curves for this species are flat-top and F_{max} is not well defined.

The following table summarizes the BRPs for males and females:

	Males		**Females**	
BRPs	F	%SPR	F	%SPR
$F_{0.1}$	0.21	40%	0.18	42%
$F_{35\%SPR}$	0.26	35%	0.24	35%

12.2.6 Management considerations

Nephrops is taken by a multi-species and mixed bottom trawl fishery.

A recovery plan for southern hake and Iberian *Nephrops* stocks was approved in December 2005 and in action since the end of January 2006. This recovery plan includes a reduction of 10% in F relative to the previous year and TAC set accordingly, within the limits of ±15% of the previous year TAC (Council Regulation (EC) No 2166/2005). The number of allowed fishing days are set in each year regulations (Council Regulations (EC) Nos. 51/2006, 41/2007, 40/2008, 43/2009 and 53/2010).

Besides the recovery plan, the Council Regulation (EC) No 850/98 was amended with the introduction of two boxes in Division IXa, one of them located in FU 28. In the period of higher catches (May-August), these boxes are closed for *Nephrops* fishing (Council Regulation (EC) No 2166/2005).

With the aim of reducing effort on crustacean stocks, a Portuguese national regulation (Portaria no. 1142, 13th September 2004) closed the crustacean fishery in January-February 2005 and enforced a ban in *Nephrops* fishing for 30 days in September – October 2005, in FUs 28-29. This regulation was revoked in January 2006, after the entry in force of the recovery plan and the amendment to the Council Regulation (EC) No 850/98, keeping only one month of closure of the crustacean fishery in January (Portaria no. 43/2006, 12th January 2006).

Table 12.2.1.a. FU 28-29 - Length Composition of Nephrops Males (1984-2010)

Landings	(thousands)																										
Age/Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
17																											
18																											
19					4	21					0									0				1	0		
20			0	16	4			6	4							4				0		4		2	1	0	0
21		17	9			84		16	37	9						3	3	0	2	0	0	33		4	0	0	0
22	7	5	14	15		97	9	29	96	38	9				2	0	16	1	2	13	5	51	9	16	7	1	
23	24	7	7	8		143	5	19	55	34			8	4		5	8	3	1	3	19	32	20	26	9	3	
24	14	40	121	209	51	272	27	53	202	42	18		17	9	8	9	20	5	2	11	26	106	49	43	23	23	6
25	109	83	115	81	97	229	116	69	181	149	34	3	23	6	16	39	13	6	3	39	57	117	42	49	25	24	8
26	250	170	137	446	128	205	182	111	263	72	68	0	36	43	32	33	58	8	11	56	155	150	64	95	29	31	6
27	282	326	170	718	208	269	149	94	185	95	77	0	54	95	81	49	85	24	24	87	233	202	77	89	47	51	17
28	374	500	289	871	399	280	337	139	506	272	157	0	56	78	65	68	44	24	48	60	257	280	114	113	55	72	11
29	439	559	341	727	456	283	415	159	462	382	95	28	38	88	65	109	148	53	60	145	297	326	173	150	57	68	27
30	412	742	328	584	442	317	695	239	725	548	187	11	68	104	160	133	87	74	139	244	361	522	225	240	55	106	35
31	277	670	389	742	457	230	813	325	755	548	231	24	92	172	129	272	111	92	123	186	329	565	220	201	85	95	61
32	373	784	680	806	446	367	866	260	670	674	383	108	151	283	289	88	161	274	233	325	563	744	310	240	114	111	96
33	339	531	213	236	428	265	702	133	345	365	149	83	70	90	95	182	92	139	281	245	424	439	206	192	97	66	63
34	389	635	609	721	656	328	785	239	451	655	270	215	159	251	269	152	160	224	257	263	421	566	268	267	134	79	88
35	478	525	590	245	664	291	755	171	296	475	224	169	147	169	118	175	100	173	274	270	416	330	171	200	110	63	70
36	378	463	519	342	572	295	449	138	399	639	221	147	78	154	166	143	158	163	265	193	271	262	146	202	75	47	63
37	528	346	322	406	424	356	465	77	351	391	107	262	172	149	167	128	162	167	247	231	202	293	152	177	98	46	66
38	496	383	606	355	571	302	479	120	378	344	179	134	113	58	85	75	106	99	254	193	176	228	143	216	69	48	108
39	353	309	361	240	326	332	611	126	348	306	95	151	62	46	47	180	81	109	229	169	110	176	85	138	68	51	58
40	447	337	323	156	366	316	829	200	248	174	144	232	83	82	83	83	96	159	254	209	197	152	86	147	71	52	69
41	247	230	316	335	164	314	797	141	243	158	93	247	78	37	53	184	102	130	163	158	128	129	106	131	93	42	45
42	371	246	507	264	215	360	628	174	246	170	168	293	85	33	167	58	91	195	163	164	209	152	156	162	122	83	60
43	199	156	198	62	102	364	335	121	242	107	127	65	31	21	43	102	47	181	167	168	132	119	80	66	76	31	42
44	194	233	422	215	128	481	553	125	371	179	150	88	42	28	69	63	86	173	122	119	145	174	120	70	57	40	52
45	165	144	233	206	93	339	324	90	220	150	87	27	22	21	34	111	61	140	113	101	153	140	79	66	58	21	32
46	148	178	189	170	72	231	228	128	167	55	79	58	21	33	38	67	85	144	106	75	123	116	96	56	34	20	21
47	129	161	140	74	76	191	202	122	191	96	68	31	38	20	34	59	88	120	111	74	116	113	51	48	44	21	36
48	176	212	149	79	85	193	121	62	178	102	78	25	15	9	24	40	55	80	104	81	108	64	46	53	45	19	28
49	89	138	104	58	43	73	92	78	111	47	47	16	20	4	13	50	37	79	86	58	71	53	35	30	31	20	19
50	91	142	50	34	53	94	58	67	69	30	50	12	9	3	33	32	65	93	103	92	99	70	24	34	32	16	21
51	66	120	63	27	34	114	59	44	50	38	29	4	6	7	14	32	34	71	72	63	50	41	26	30	24	14	16
52	64	135	66	44	38	77	33	40	35	15	46	11	16	7	31	8	53	88	94	72	78	46	32	39	25	25	25
53	45	99	32	37	23	40	19	16	29	18	22	5	6	6	11	13	18	41	69	57	37	23	18	17	21	11	14
54	73	101	35	45	22	35	27	29	50	23	18	5	8	16	19	15	31	54	53	56	59	25	29	22	21	15	18
55	20	67	25	31	22	37	30	26	29	19	9	3	4	10	8	9	19	34	28	45	31	12	12	8	19	10	11
56	20	35	14	20	16	20	30	19	5	5	11	2	4	3	6	13	19	29	43	29	66	15	9	7	14	10	7
57	10	33	5	15	12	22	7	10	6	5	11	3	7	16	8	8	19	37	37	24	19	9	5	5	16	9	7
58	13	14	8	14	11	17	14		11	4	6		5	3	5	4	13	23	26	20	15	10	5	5	18	6	9
59	7	10	3	9	4	16	5	2	9	3	10	0	5	2	3	4	10	15	16	13	18	8	8	4	10	3	4
60	3	6	3	4	3	13	2		10	8	1	1	1	4	1	1	8	15	25	16	28	13	5	2	9	6	4
61	3	1	4	4	1	5		1	3	2	1	0	1	9	1	2	14	9	11	8	13	9	6	3	7	3	4
62	3	1	2	1	2	3		1	7	5	1		2	7	1	3	6	10	11	15	19	8	7	3	14	7	5
63	1	1		1	1	4		5	0	1	0		2	3	0	2	1	4	11	11	9	7	6	1	7	3	5
64		2	0	2	1			1	3	1	2		0	4	0	1	1	9	11	8	11	10	6	1	10	5	4
65	0	0		2	2				3	1	1		0	4		0	4	6	5	4	4	9	6	0	9	1	3
66	0			0	1					1			0	4	0		1	5	8	3	8	3	4	1	11	1	3
67	0			0	0	0			6	5				6	0			4	3	5	2	2	5	1	6	1	2
68					0	2				0	1			0	0			1	6	6	2	3	3	0	7	0	4
69				0										0	0		0	3	3	2	3	2	3	1	4	1	0
70	0			1		0				2				0	0		0	6	2	4	3	4	4	0	3	1	0
71										0					0			2	2	4	1	1	2	0	2	0	0
72				0		0				1					0			2	2	4	2	3	3	0	3	1	0
73														0			0	0	1	1	1	2	2		1	0	0
74	0									1								0	1	1	1	3	1		1	1	0
75																		0	1	0	0	1	1		1	1	2
76																		0	0	0	0	0	1		1	0	
77																			0	0	0	0	1		1	0	0
78		0			0																0	1			0		
79																			0		0	1	0		0	0	
80									0													0			0		
81																							0		0	0	
82																			0				0		0	0	
83																									0		
Total	8106	9897	8709	9679	7925	8329	12255	4023	9249	7463	3766	2466	1854	2200	2491	2811	2680	3602	4486	4503	6286	6977	3563	3680	2088	1487	1356
Landings (t)	292	353	315	277	249	318	351	345	304	232	139	98	65	74	88	116	117	190	222	201	245	230	136	128	105	60	65

Table 12.2.1.b. FU 28-29 - Length Composition of Nephrops Females (1984-2010)

Landings (thousands)

Age/Year	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
17																				0							
18					4																0				0		
19		0				35					0									1				2	0		
20	3	1	7		8	21				18								0		0	0	8		4	1		
21	1	1	22	3	21	102		21	9	49							3	1	0	3	15	47	3	12	2	1	
22	8	21	30	78		88	19	11	102	63			0	13	2	5	18	0		3	12	86	12	20	10	1	0
23	66	21	7	31	28	135	15	69	38	21	2		0	0	4	4	6	7	0	9	54	53	33	28	10	3	1
24	79	102	118	270	153	258	38	173	164	41	22	2	11	20	15	25	49	7	10	19	80	133	39	40	21	17	8
25	228	205	104	357	163	197	138	198	203	191	73		13	20	25	27	24	15	11	36	126	125	48	108	20	18	9
26	272	284	186	684	220	282	140	436	361	111	92	1	35	102	74	94	81	24	15	66	261	266	94	182	36	65	10
27	345	491	359	902	429	326	247	418	448	235	134	0	37	77	91	76	139	34	34	66	332	285	123	238	67	111	16
28	431	523	322	1421	471	231	345	598	597	413	170	6	36	152	148	100	64	44	107	96	422	234	144	279	75	135	21
29	443	672	419	1253	516	285	491	590	514	523	269	31	45	178	114	121	171	90	127	171	481	416	310	365	114	122	42
30	422	588	381	928	499	317	575	771	599	775	326	104	50	199	199	236	152	131	237	238	488	649	256	298	135	168	54
31	487	593	418	948	482	501	639	414	736	752	427	182	95	394	168	263	131	167	195	150	400	567	255	245	119	107	81
32	485	653	700	946	766	306	859	807	617	824	558	322	198	502	376	485	283	316	296	355	629	860	433	330	227	171	121
33	613	415	406	227	527	314	596	375	430	449	283	251	53	163	116	187	153	184	467	265	530	454	235	197	167	90	74
34	618	467	654	774	813	511	734	310	369	359	353	641	209	278	298	346	235	252	429	307	481	463	296	314	159	101	115
35	562	563	447	447	460	435	519	284	287	194	246	674	184	150	112	287	193	158	470	248	391	258	221	280	169	83	98
36	469	329	316	386	489	274	243	130	267	203	237	811	142	135	166	317	225	174	351	188	272	206	141	164	94	66	119
37	505	353	400	223	206	318	189	108	333	154	147	692	267	129	171	201	213	144	302	198	218	186	126	185	110	73	98
38	383	284	330	269	265	285	207	135	251	100	128	348	151	39	48	184	85	108	300	199	183	184	133	199	125	68	90
39	274	142	211	146	288	148	216	74	176	150	66	194	67	35	59	151	92	112	213	153	137	92	150	106	112	70	78
40	171	119	80	119	132	131	230	131	147	110	114	344	120	21	89	111	79	133	186	273	163	87	98	84	116	50	67
41	58	106	55	65	128	149	73	39	68	108	77	361	63	31	64	81	66	79	110	163	99	75	113	60	86	66	53
42	50	36	133	54	43	127	210	62	69	95	73	165	111	18	84	73	67	91	80	184	149	119	95	46	71	74	42
43	30	27	21	40	28	109	58	82	26	43	23	64	29	2	34	38	41	55	87	127	85	72	36	13	29	20	23
44	17	13	47	147	27	91	77	6	46	42	43	88	90	18	71	34	49	56	57	72	81	62	38	18	23	34	32
45	14	11	27	84	19	27	41	21	40	34	13	54	36	8	22	18	23	29	51	65	82	52	29	14	26	13	20
46	7	6	5	40	14	38	31	45	25	37	11	13	15	4	28	18	38	33	40	36	63	40	45	15	12	17	16
47	5	3	3	26	9	24	16	7	12	29	7	18	23	3	23	7	52	26	25	24	55	35	20	7	24	13	15
48	4	1		71	11	29	7	15	18	15	4	15	8	2	6	9	25	12	24	27	46	19	9	6	18	6	9
49	1	0	3	17	4	9	1	17	17	23	4	1	6	7	6	4	21	15	19	18	29	25	6	5	12	5	6
50	1	0		2	6	3	1	2	32	8	17	1	2	1	6	5	10	15	26	24	24	24	6	2	11	6	6
51	0	0	3	4	3	7	2	4	4	5	0			1	2	2	10	9	22	13	15	17	8	4	9	2	5
52	1			5	5	8	1		5	6	1	1	0	1	1	3	16	6	19	20	16	17	6	2	6	3	3
53	2			2	3	1			9	6	0			0	0		6	6	10	12	9	10	1	0	7	2	2
54				4	1	1			1	1			1	0	1		5	2	2	14	9	6	7	0	7	1	2
55				0	1	1			6	2							1	2	3	9	4	5	1	1	3	3	0
56				3	0	2		5	14	5					0		3	1	3	7	7	2	1	0	2	0	0
57				0	0	1			4	1			0		0		1	0	2	4	2	3	0		1	0	0
58				0		0			4	1								1	1	1	2	0	0	0	1	1	0
59				1	0	0											0	1	0	0	1	1	1			0	0
60					0				1	0								0		0		2			1		0
61						1											3	1		0	1					0	0
62																			0	0	0	1	0				0
63									4	1								0	0			0				0	0
64																					1	0		0	0	0	
65																					0	0					
66																	0	0				0					
67																											
68									4	1																	
69																											
70																					0					0	
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	3509	2829	2540	4332	3866	6458	6247	3573	3871	2240	1788	1336
Landings (t)	169	156	150	232	171	151	174	134	165	145	97	174	67	62	72	95	84	79	135	126	170	152	95	90	67	48	43

Table 12.2.2. - SW and S Portugal (FUs 28-29): Effort and CPUE of Portuguese trawlers, 1994-2010 (standardized/revised).

Year	No. of trawlers	CPUE (t/boat)	Estimated days	CPUE (kg/day)
1994	31	7.6	4673	51
1995	30	9.1	5501	50
1996	25	5.3	4357	30
1997	25	5.5	3685	37
1998	25	6.4	6602	24
1999	29	7.3	12800	16
2000	33	6.1	10056	20
2001**	33	8.2	11394	13
2002	34	10.5	12733	28
2003	35	9.3	9180	36
2004	33	12.6	9171	45
2005	32	11.9	7957	48
2006	30	7.7	5352	43
2007	30	7.3	5745	38
2008	30	5.8	5659	31
2009	30	3.6	5459	20
2010*	26	4.1	4762	23
* provisional; ** effort = average of years 2000 and 2002				

Table 12.2.3. - SW and S Portugal (FUs 28-29): *Nephrops* CPUEs (kg/hour) in research trawl surveys, 1994-2010.

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
ns = no survey nr = not reliable					

Table 12.2.4. - SW and S Portugal (FUs 28-29): Mean sizes (mm CL) of male and female Nephrops in Portuguese landings and surveys, 1994-2010.

Year	Landings		Demersal surveys						Crustacean surveys	
	Males	Females	Summer		Autumn		Winter		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	na	na	ns	ns	37.7	36.6

na = not available ns = no survey

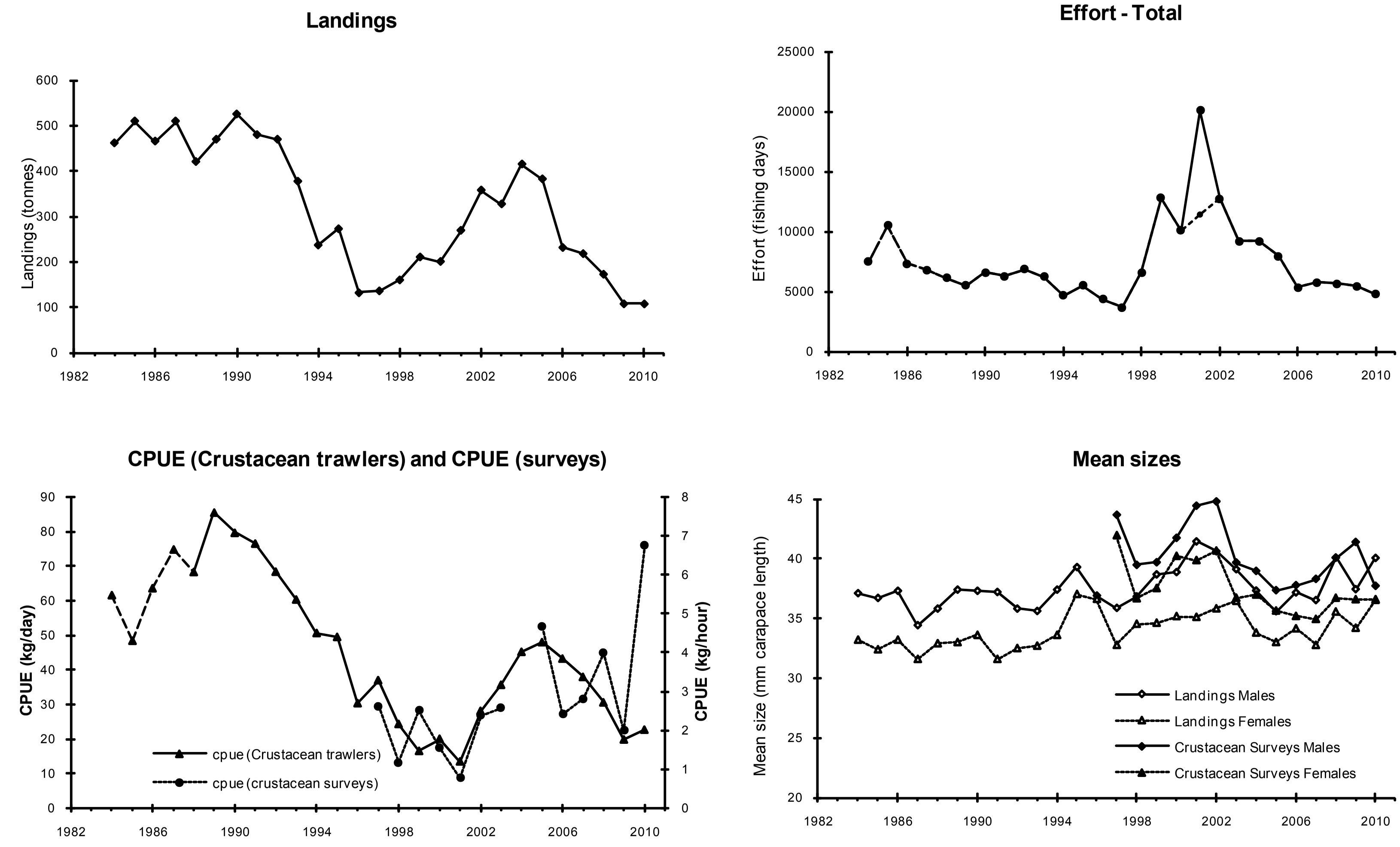


Figure 12.2.1. SW and S Portugal (FU 28+29): landings, effort, biomass indices and mean sizes of *Nephrops* in landings and surveys. Note: Values of LPUEs and effort before 1988 are less reliable.

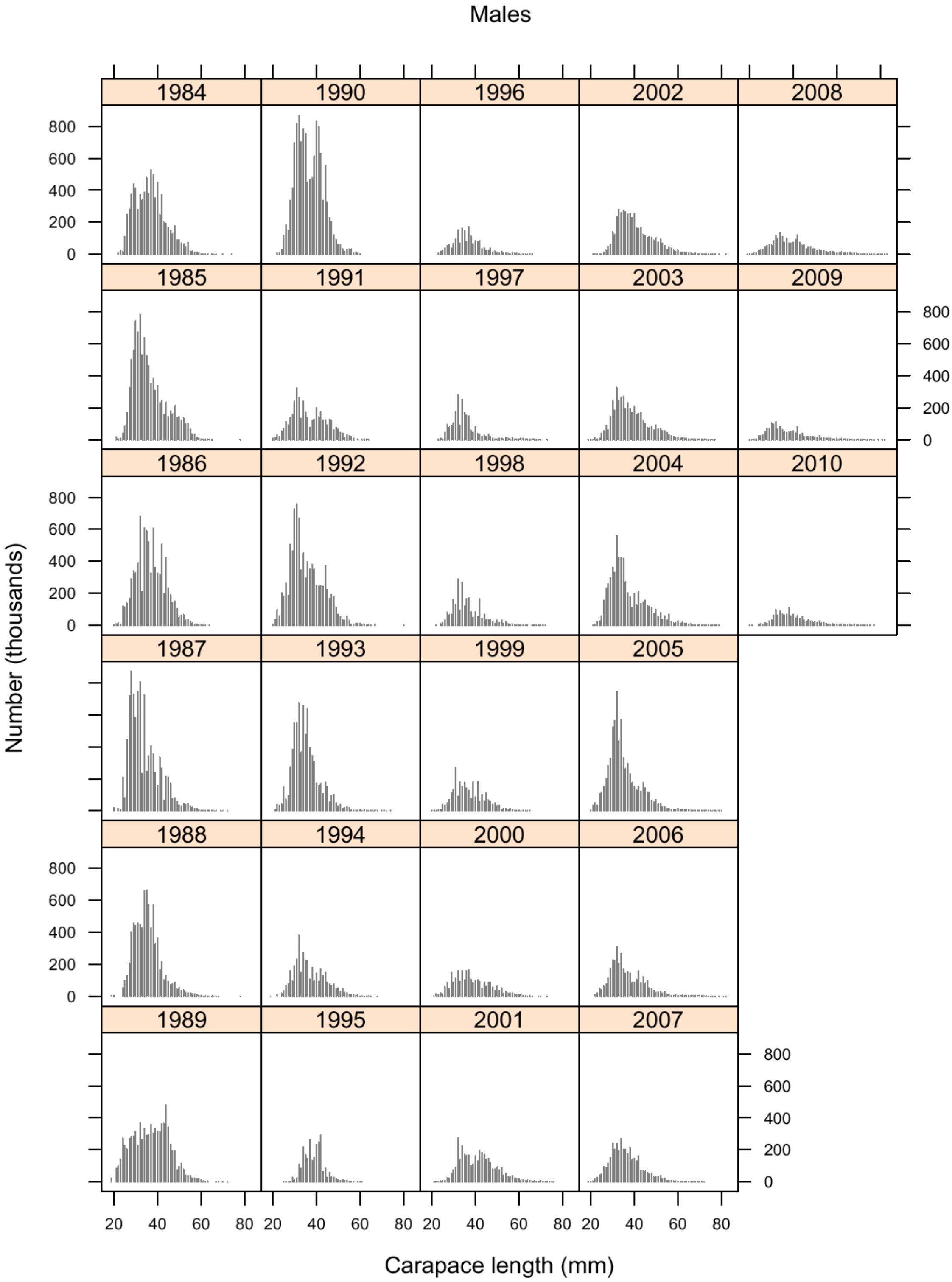


Figure 12.2.2.a. SW and S Portugal (FU 28-29) male length distributions for the period 1984-2010.

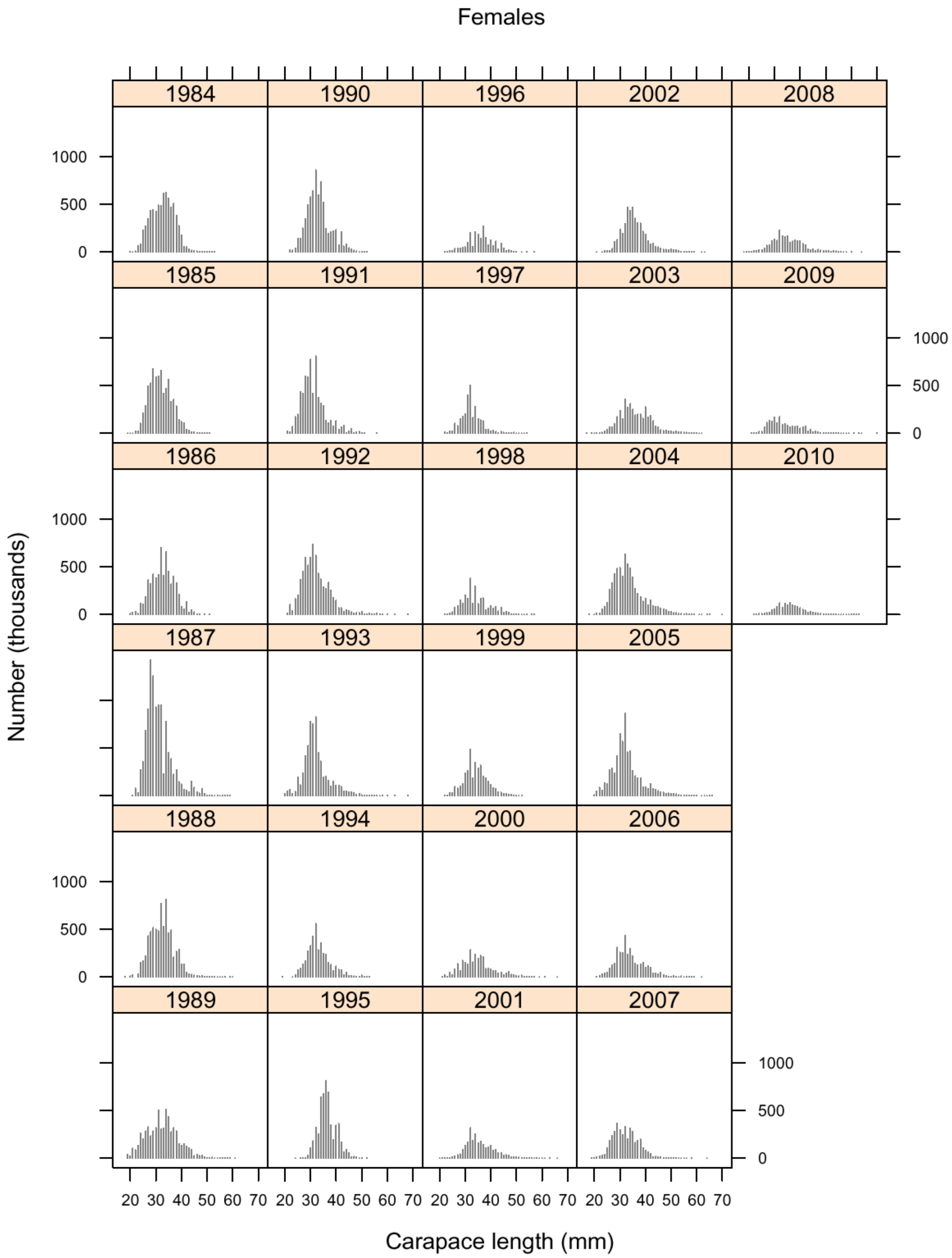


Figure 12.2.2.b. SW and S Portugal (FU 28-29) female length distributions for the period 1984-2010.

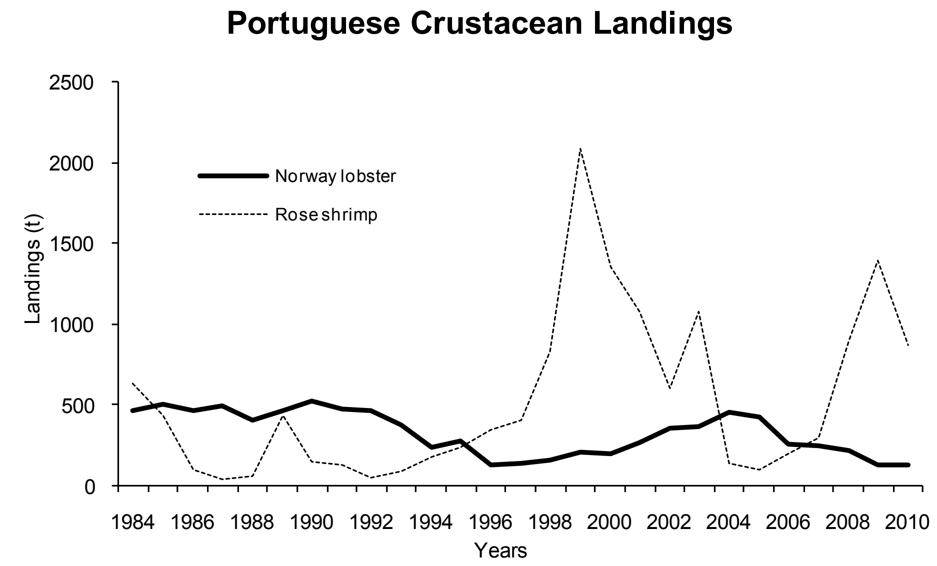


Figure 12.2.3 FUs 28-29: Portuguese Crustacean Landings in the period 1984-2010.

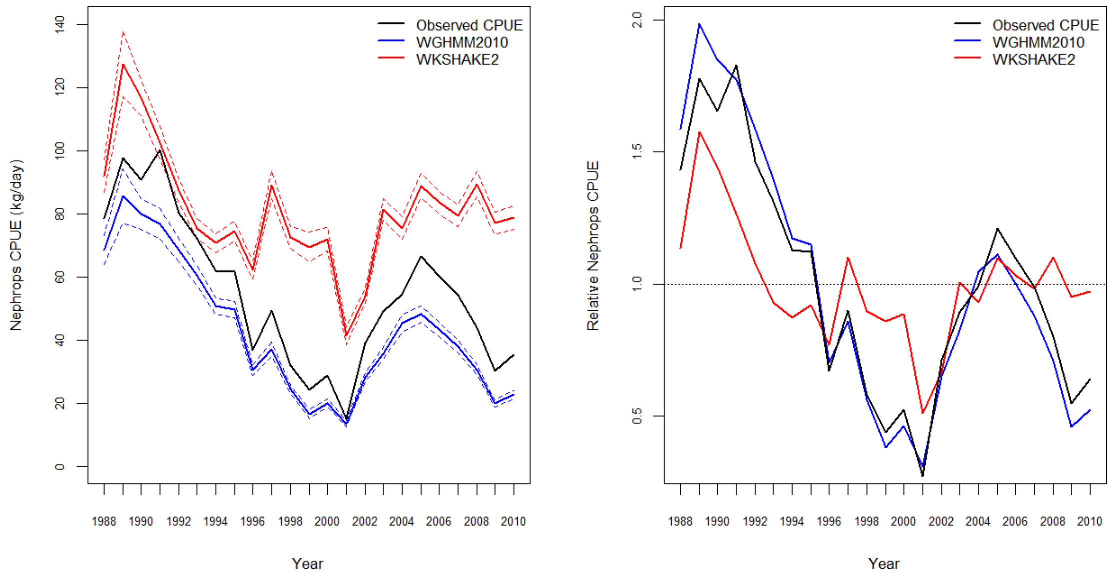


Figure 12.2.4. Comparison of *Nephrops* CPUE, estimated with different standardization methods and the observed CPUE.

12.3 *Nephrops* in FU 30 (Gulf of Cadiz)

12.3.1 General

12.3.1.1 Ecosystem aspects

See Annex L

12.3.1.2 Fishery description

See Annex L

12.3.1.3 ICES Advice for 2011 and Management applicable for 2010 and 2011

ICES Advice for 2011

The advice for these *Nephrops* stocks is biennial and valid for 2011 and 2012. MSY Approach and Precautionary Approach were given in the Advice for 2011.

The long-term trend of lpue is declining and the exploitation status is unknown. Following the ICES MSY framework, it is recommended to reduce catch from recent levels at a rate greater than the rate of the stock decrease. ICES cannot quantify the rate of reduction required. According to PA, recent lpue suggest that the stock is stable at a low level and it is recommended not to increase catch above the recent average (150 t).

To protect the stock in this Functional Unit, management should be implemented at the Functional Unit level.

Management applicable for 2010 and 2011

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.

A closed season of 21 days was established in winter 2010 (ARM/2515/2009) for the Gulf of Cadiz bottom trawl fleet by Spanish Administration in order to reduce the fishing effort. Furthermore, the latest Fishing Plan (ARM/58/2010), which is being applied since September 2010 for two years, reduces the close fishing season from 90 days to 45 days, between 24th September and 7th November 2010, plus 5 additional days to be selected by the ship owner during the duration of this Plan.

New regulations have been established since 2008 by the Regional Administration with the aim of distributing the fishing effort throughout the year by controlling the days and times when the Gulf of Cadiz bottom trawl fleet can enter or leave fishing ports. The fishing hours per day in spring and summer were increased by 3 hours from 1st May to 31st July in 2010 (Resolution 23th November 2009, BOJA nº 235) and a continued period from Monday 3 am to Thursday 9 pm during May-August has been established for 2011 (Resolution 24th September 2010, BOJA nº 209).

The TAC set for the whole Division IXa was 337 t for 2010 and 303 t for 2011.

12.3.2 Data

The sampling level for the species is given in Table 1.3.

12.3.2.1 Commercial catch and discard

The Working Group estimates of landings for FU 30 are given in Table 12.3.1. Landings were reported by Spain and also minor quantities by Portugal.

Since 2007 a significant increase in *Nephrops* landings has been observed in Ayamonte port, which is located in the mouth of the Guadiana River. Landings from this port have been taken into account from last Working Group. This port accounted for more than 30% of the total FU30 landings in last three years, becoming the most important *Nephrops* landing port of the Gulf of Cádiz, with Isla Cristina port. Previously, the landings in Ayamonte port were minimal, with the fleet landing in nearby ports. Due to this recent importance of this port, since WGHMM in 2010 their landings have been incorporated in the Gulf of Cadiz time series of landings, effort and LPUE from 2002 (Tables 12.3.1 and 12.3.4).

Along the time series, *Nephrops* landings trends in FU30 have remained unchanged after the incorporation of Ayamonte information from 2002. However, the landings levels of this port have increased particularly from 2007 although it has remained stable around 36 t in last two years (Table 12.3.1). Landings decreased from 108 t in 1994 to 49 t in 1996, the lowest value recorded. After that, there has been an increasing trend, reaching 307 t in 2003, and stabilizing around 246 t during 2005-2006, except in 2004 when a decrease of more than 50% was observed. Since 2006 landings have declined to 119 t and 106 t in 2009 and 2010, respectively.

The discarding rate of *Nephrops* in this fishery fluctuates annually but is always low (Table 12.3.2). In 2010, the percentage of discarded *Nephrops* by weight was half that of the previous year, with a value of 1.3% of discarded *Nephrops* (Table 12.3.2). Figure 12.3.2 shows the estimated length frequency distributions of the discarded and retained *Nephrops* by trip in these surveys. The mean carapace length has fluctuated along the period with no apparent trend.

12.3.2.2 Biological sampling

Figure 12.3.3 gives the annual landings length composition for males, females and both sexes combined during the period 2001-2010. The length composition of landings is bias 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 and the information is more reliable. The mean sizes for both sexes remained relatively stable after the sampling scheme was changed. From 2009 a concurrent sampling is carried out, as required by the new DCR (Reg. EC 1343/2007). A slight increase from 29.2 mm in 2008 to 31.6 mm in 2009 was observed but the mean size has remained with similar values in 2010. Mean size of males, females and sexes combined of *Nephrops* landings from 2001 to 2010 are shown in Figure 12.3.4.

12.3.2.3 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 2010 are shown in Table 12.3.3.

In the time series two different periods can be observed. From 1993 to 1998 the overall abundance index trend was decreasing, while from 1998 onwards the index has remained stable although fluctuating widely in some years (Figure 12.3.5). In 2010 the deeper strata (500-700 m) were not sampled due to a reduction in the days of the survey, as a consequence of adverse weather conditions. Therefore, only the abundance index for the strata 200-500 m is available for 2010 (Table 12.3.3). Its value is similar to the previous year. This survey is not specifically directed to *Nephrops* and the information needs to be considered with caution, as the survey is not carried out during the main *Nephrops* fishing season.

The length distributions of *Nephrops* obtained in the Spanish bottom trawl spring surveys (SPGF-cspr-WIBTS-Q1) during the period 2001-2010 are presented in Figure 12.3.6. The time series of *Nephrops* mean sizes for males, females and combined sexes obtained in these surveys are shown in Figure 12.3.7. No apparent trends are observed. Mean size ranged between 42.9 to 34.6 mm CL for males and between 34.9 to 30.6 mm CL for females.

12.3.2.4 Commercial catch– Effort data

Figure 12.3.1 shows total bottom trawl fishing effort and LPUE modified after the incorporation of the Ayamonte information from 2002. Directed effort estimates and LPUE series are shown in Figure 12.3.1 and Table 12.3.4.

The directed fishing effort trend is clearly increasing from 1994 to 2005, and after that the trend is declining to 2008 (1150 fishing days). The maximum of the series was reached in 2005 with a value of 4336 fishing days. In 2009, directed effort increased by more than 500 fishing days with respect to the previous year with only a slight decrease from 2009 to 2010 of 50 fishing days. 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 minimum value recorded (44.3 Kg/fishing days). LPUE then increased until 2008 around 60%. The incorporation of the Ayamonte data caused an increase of the directed LPUE in 2007 and 2008 (Figure 12.3.1). Since 2008 LPUE have declined to 50 Kg/fishing days in 2009 and 45.5 Kg/fishing days in 2010 (about 30% less with respect to 2008).

The overall LPUE trend is quite similar to the abundance survey index in the stratum of 200-700 m (Figure 12.3.5). 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 indicate the variability of survey data. No abundance index data are available in the deeper strata sampled by Spanish bottom trawl spring surveys (SPGF-cspr-WIBTS-Q1) in 2010 as it has been mentioned above. On the other hand, it was not possible to present the *Nephrops* abundance index of the spring survey of 2011 in this report.

12.3.3 Assessment

Given the inconsistencies in the length compositions from 2001 to 2005 and the absence of additional information, an analytical assessment of this FU was not carried out.

The results of an ASPIC model (Prager, 1994; 2004) were presented in the ICES Workshop on Iberian mixed fisheries management plan evaluation of Southern hake, *Nephrops* and anglerfish in November 2010 (ICES CM 2010/ACOM:63). These results were agreed with the conclusions of WGHMM 2010. However, the WK didn't consider that ASPIC results could be used as a basis to conduct stock projections because it was necessary to fix B1/K at 0.95 in order to achieve model convergence. This fact could influence the results strongly.

No assessment was carried out in this WG.

12.3.4 Biological reference points

There are no reference points for this stock.

12.3.5 Management considerations

Nephrops fishery is taken in mixed bottom trawl fisheries, therefore HCRs applied to other species will affect this stock.

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. However, the Gulf of Cadiz is excluded from the effort related management.

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). The first of these Fishing Plans (which started in October 2004 and lasted for 1 year) restricted the maximum number of fishing hours per day to 18, which could have an effect on *Nephrops* directed effort, because vessels may not have enough time to access the traditional *Nephrops* fishing grounds, which are deep and are located far from the coast. However, the Fishing Plans that followed from the end of 2005 onwards imposed this maximum number of fishing hours per day only as an annual average. All the Fishing Plans establish a continued period of 56 hours per week without fishing and a single landing event per vessel per day. Since the first Fishing Plan in 2004 a closed fishing season with a gradual increase in the number of days has been implemented (45, 60, and 90 days per year). The Fishing plan ARM/2515/2009, established 21 out 90 days of close fishing season in winter 2010 (from 16th January to 22nd January and from 16th February to 14th February). The latest Fishing Plan (ARM/58/2010) is being applied since September 2010 and will last for 2 years. This plan reduces the length of the closed fishing season to 45 days, between 24th September and 7th November 2010, 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. However, from 2006 to 2008, total fleet effort and *Nephrops* directed effort decreased, even though the closed seasons were established outside the main *Nephrops* fishing months. As a proxy for *Nephrops* directed effort, the set of trips for which *Nephrops* represents at least 10% of the landed weight is used. All Fishing Plans starting from the one in 2007 state that by the end of the Fishing Plan, the fishing capacity of the Gulf of Cadiz bottom trawl fleet must have been reduced by 6% on a permanent basis. 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.

New regulations were recently 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 times when the Gulf of Cadiz bottom trawl fleet can enter or leave fishing ports. Although the regulations vary between them, they generally permit a lot of flexibility during late spring and summer months (*e.g.* the 2010 Regulation establishes a continued period from Monday 3 am to Thursday 9 pm during May-August, that will be implemented in 2011), which is the main *Nephrops* fishing season, with more restricted times 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. However, the *Nephrops* directed fishing and landings decreased sharply in 2008 and remained at similarly low levels in 2009 and 2010. 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 are easier to access because they are less deep (90-380 m) and closer to the coast.

Table 12.3.1 *Nephrops* FU 30, Gulf of Cádiz:
Landings in tonnes by Functional Unit

	FU 30				
	Spain Trawl			Portugal	Total
Year	Without Ayamonte Port	Ayamonte Port	Total Spain	All gears	
1994	108		108		108
1995	131		131		131
1996	49		49		49
1997	97		97		97
1998	85		85		85
1999	120		120		120
2000	129		129		129
2001	178		178		178
2002	247	15	262		262
2003	281	22	303	4	307
2004	130	13	143	4	147
2005	232	11	243	3	246
2006	225	17	242	4	246
2007	177	34	211	4	215
2008	77	40	117	3	120
2009	81	36	117	2	119
2010	70	36	106	1	107

Table 12.3.2. *Nephrops* FU 30, Gulf of Cadiz: Mean carapace length of the discarded and retained fraction of *Nephrops*, and % of discarded (2005-2010) 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

Table 12.3.3 ***Nephrops*** **FU 30, Gulf of Cádiz:**
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	**	**		
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	0.3	4	0.37	9
2010	0.63	20	**	**		

ns = no survey

**= no sampled

Table 12.3.4 ***Nephrops*** **FU 30, 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	106	73	45.5	1603

*Landings, LPUE and fishing effort from fishing trips with at least 10% *Nephrops*.

** Ayamonte landings are included since 2002

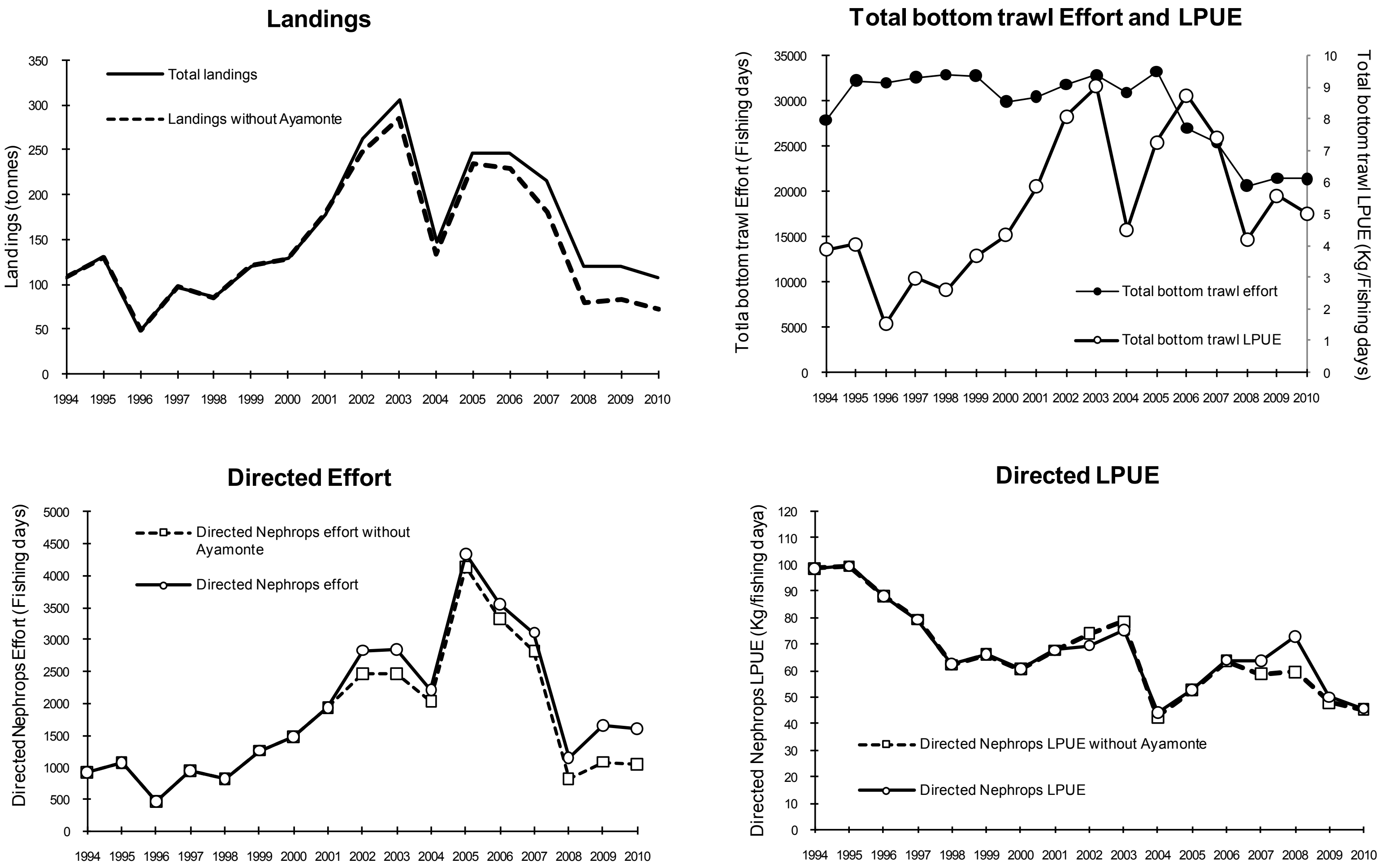


Figure 12.3.1. ***Nephrops*** **FU 30, Gulf of Cadiz: Long-term trends in landings, effort and LPUE.**

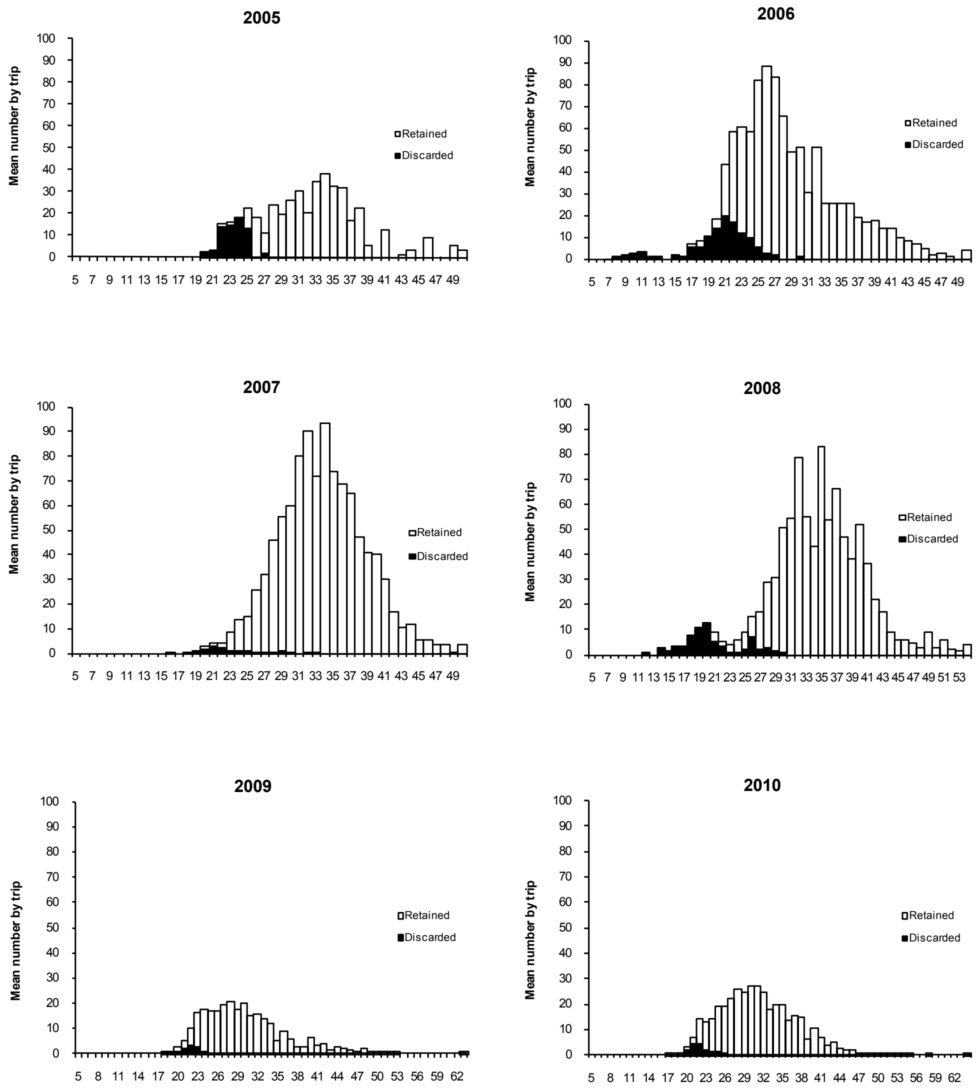


Figure 12.3.2. ***Nephrops*** **FU 30, Gulf of Cadiz: Length distribution of retained and discarded fractions** ***Nephrops*** **from discards program 2005-2010 period.**

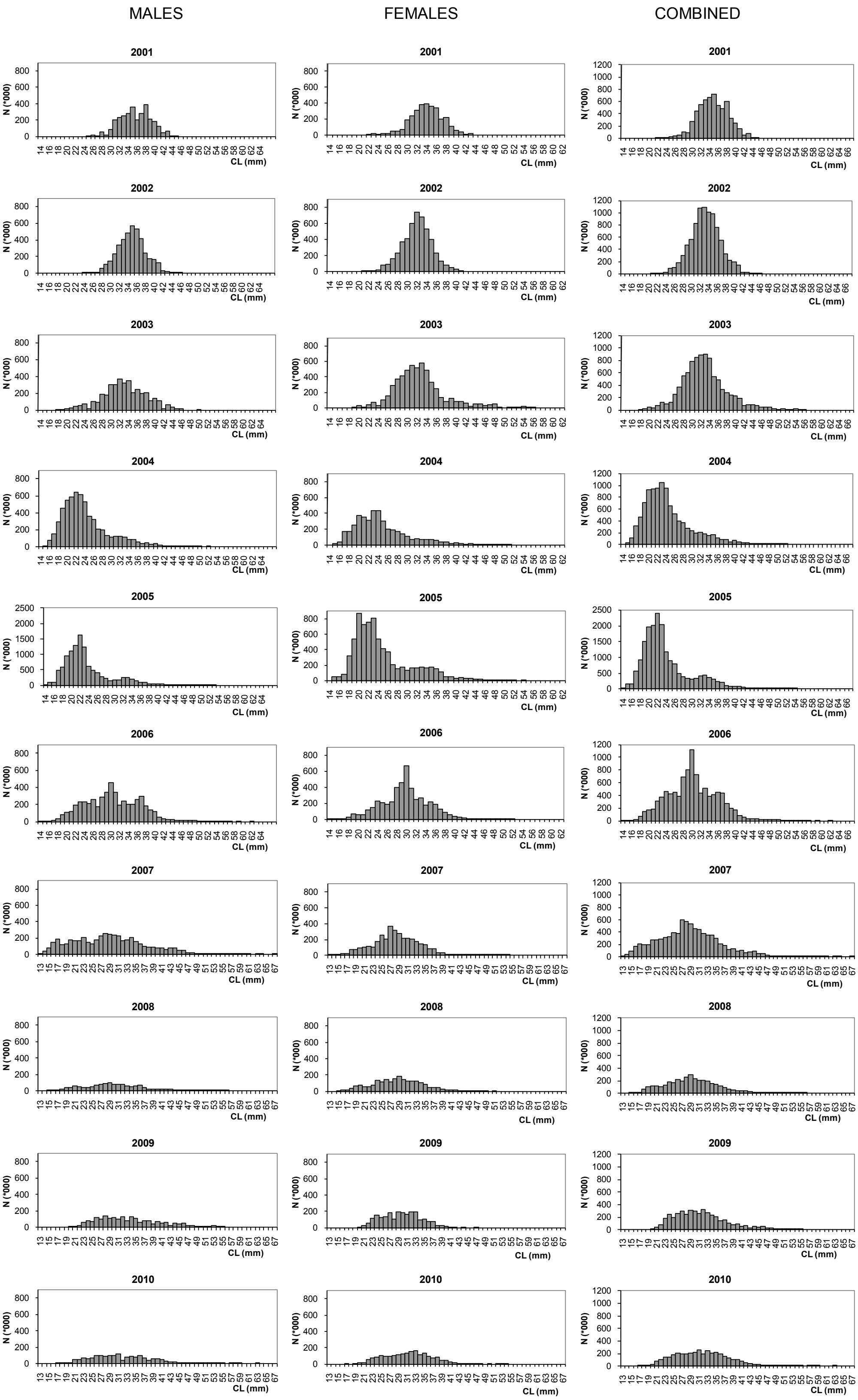


Figure 12.3.3. ***Nephrops*** **FU 30, Gulf of Cadiz: Lenght distributions of landings from 2001 to 2010.**

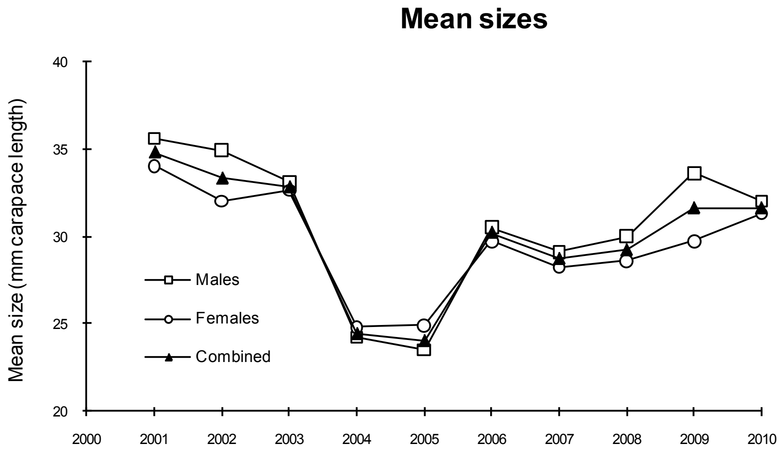


Figure 12.3.4. ***Nephrops*** **FU 30, Gulf of Cadiz: Commercial mean size trend of males, females and combined for the period 2001-2010.**

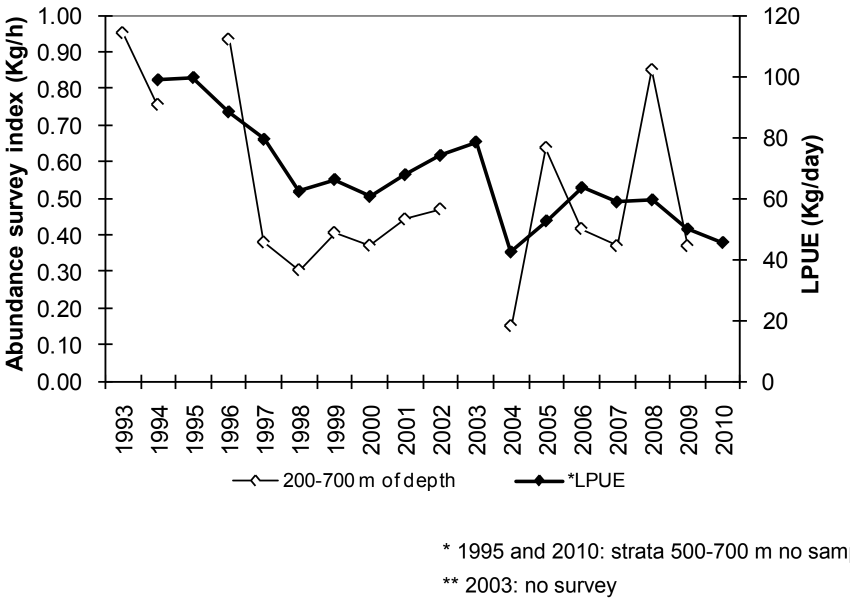


Figure 12.3.5 ***Nephrops*** **in FU 30, Gulf of Cádiz: Abundance index from Spanish bottom trawl spring surveys (SPGFS-cspr-WIBTS-Q1) and commercial *LPUE from bottom trawl fleet.**

MALES FEMALES ………… COMBINED

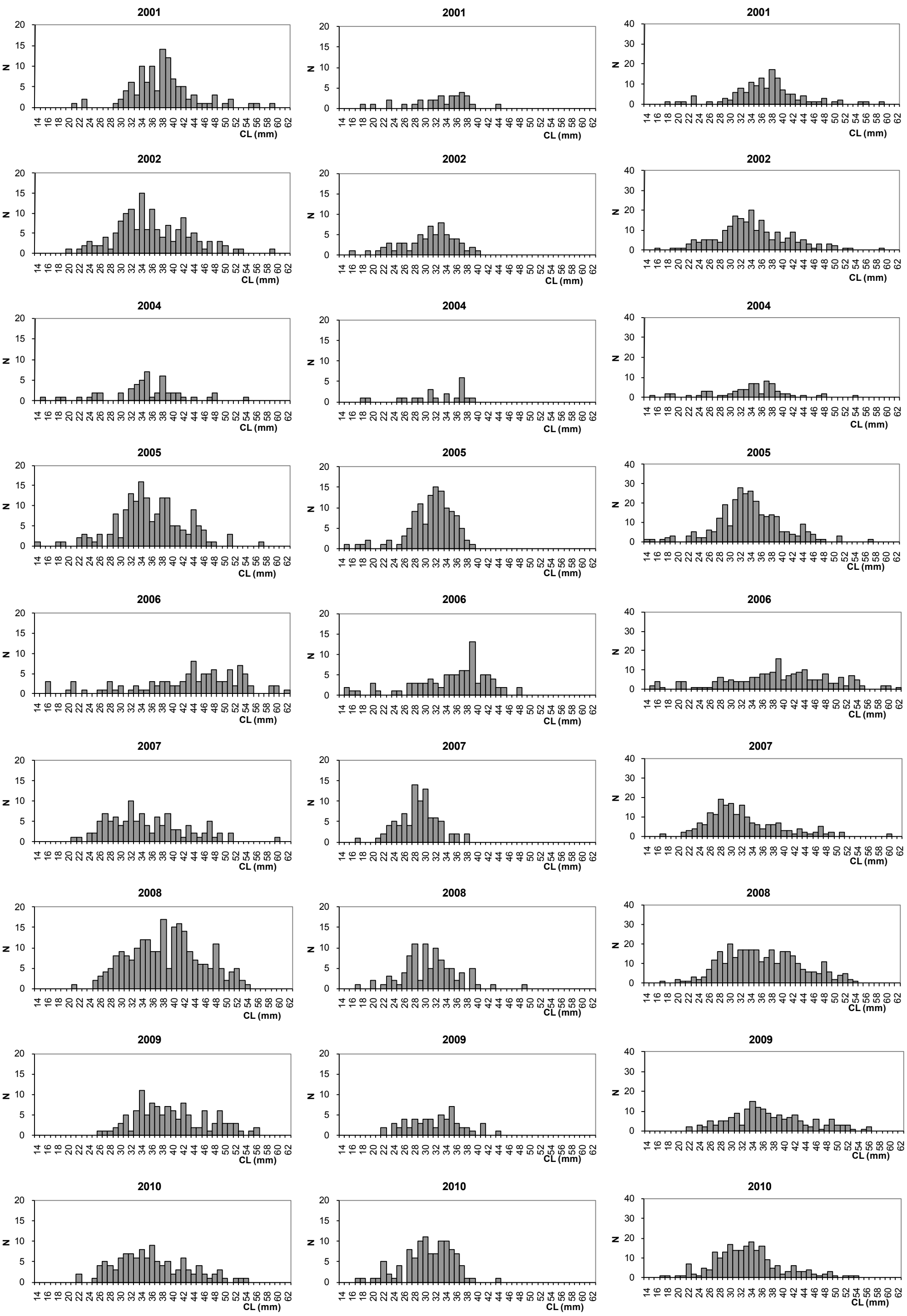


Figure 12.3.6. ***Nephrops*** **FU 30, Gulf of Cadiz: Spanish bottom trawl spring surveys (SPGFS-cspr-WIBTS-Q1) length distributions from 2001 to 2010.**

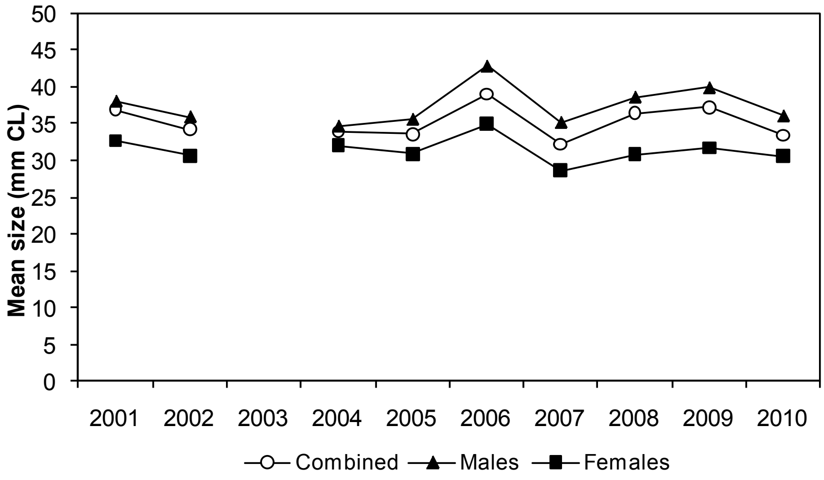


Figure 12.3.7. ***Nephrops*** **FU 30, Gulf of Cadiz: Mean size in spring bottom trawl survey (SPGFS-cspr-WIBTS-Q1) from 2001 to 2010.**

12.4 Summary for Division IXa

ICES Division IXa includes five FUs which are managed together. The TAC is set for the whole Division. In 2008, 2009 and 2010, the landings were below the TAC (-12% -29% and -26%, respectively, see Tables 12.1 and 12.2).

The northernmost stocks (FUs 26-27) continue to be at very low abundance levels. The southern stocks (FUs 28-29 and FU 30) remain low despite some increase in recent years. In these FUs, part of the multispecies fleet effort was directed to rose shrimp, reducing the pressure on *Nephrops*.

The practice of managing three distinctive *Nephrops* stocks by a joint TAC may lead to unbalanced exploitation of the individual stocks. This is particularly true for this Division where the state of the individual stocks is quite different. Fine scale management of catches and/or effort at a geographic scale that corresponds to the *Nephrops* stock distribution should be implemented.

A recovery plan for southern hake and Iberian *Nephrops* stocks was approved in December 2005 and in action since the end of January 2006. This recovery plan includes a reduction of 10% in F relative to the previous year and TAC set accordingly, within the limits of ±15% of the previous year TAC (Council Regulation (EC) No 2166/2005).

The Council Regulation (EC) No 850/98 was also amended with the introduction of two boxes, in FU 26 and the other in FU 28. These boxes are closed for *Nephrops* fishing for three and four months respectively, during the peak of the fishing season (May-August) (Council Regulation (EC) No 2166/2005).

A Portuguese regulation (Portaria no. 43, 12th January 2006) closes the crustacean fishery in FUs 28-29 in January every year. Also, a closed season of 21 days was established in the winter of 2010 (ARM/2515/2009) and another of 45 days, between September and November 2010 (ARM/58/2010) in the Gulf of Cadiz (FU30) bottom trawl fleet by Spanish Administration.

No evaluation of the impact of these closures on the *Nephrops* stocks in FUs 28–29 and FU 30 has been carried out.

New regulations have been established since 2008 by the Regional Administration with the aim of distributing the fishing effort throughout the year by controlling the days and times when the Gulf of Cadiz bottom trawl fleet can enter or leave fishing ports (Resolution 23th November 2009, BOJA nº 235)

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Annex A – List of participants

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

5 – 11 May 2011

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Annex B: Working Documents presented to WGHMM 2011

WD1: Initial investigation on using a Surplus Production on Anglerfish (*Lophius piscatorius* and *Lophius budegassa*) in the context of a Maximum Sustainable Yield advice framework. By J.C. Mahé

WD2: Sampling procedures for the proportion estimates of *Lophius piscatorius* and *Lophius budegassa* in the Spanish landings. By R. Gancedo, R. Morlán, B. Patiño and A.C. Fariña

WD3: Anglerfish (*Lophius* spp.) increasing discards in Spanish OTB fleet (VI-VII ICES). Juvenile availability or sampling artifact? By Juan Santos, Itxaso Salinas, Hortensia Araujo and Nélida Pérez

WD4: Western Anglerfish 2003–2010 (Fisheries Science Partnership 2010/11). By Lisa Readdy, Sarah Walmsley, Jon Ashworth and Peter Randall

WD5: Preliminary assessment of white anglerfish southern stock using Stock Synthesis (SS3). By Paz Sampedro and Carmen Fernández

WD6: Applying a Bayesian model incorporating discards in the assessment of the southern stock of four-spot megrim (*Lepidorhombus boscii*). By Esther Abad, Carmen Fernández and Nélida Pérez

WD7: Southern Megrim Species: Results from Spanish Discard Sampling Programme. By Pérez N., J. Santos, H. Araújo and I. Salinas

WD8: Impact of Southern hake egg production into MSY reference points; Implications for management. By Santiago Cerviño, Rosario Domínguez, Carmen Fernández, Ernesto Jardim, Sonia Mehault, Carmen Piñeiro and Fran Saborido-Rey

WD9: An example of how variables used in stock assessment can be used to quantify descriptors of the Marine Strategy Framework Directive; An AZTI internal multidisciplinary exercise of collaboration. By Ane Iriondo, Marina Santurtún and Iñaki Quincoces.

WD10: Basque coastal platform demersal ecosystem information for the implementation of European Marine Strategy Framework Directive. By Iñaki Quincoces, Ane Iriondo and Marina Santurtún

WD11: The use of VMS data for the standardization of *Nephrops* CPUE from the Portuguese Crustacean Trawl Fishery. By Cristina Silva and Manuel Afonso-Dias

WD12: Effects of using new standardized CPUE series in the Assessment of FU 28-29 *Nephrops*. By Cristina Silva and Fátima Cardador

WD13: Methodological aspects for assessment of discarded catches. Example of the *Nephrops norvegicus* stock in the Bay of Biscay. By Spyros Fifas, Marie-Joëlle Rochet, Michèle Salaun, Olivier Gaudou and Catherine Talidec.

WD14: Survival of discarded *Nephrops* in the Bay of Biscay trawl fishery. By Sonia Méhault, Fabien Morandeau and Spyros Fifas.

WD15: Revision of the assessment for Bay of Biscay *Nephrops* (FU 23-24) based on revised statistical data for 2009. By Spyros Fifas

WD16: Portuguese data provided to WGHMM for stock assessment in 2011. By Ernesto Jardim, Ricardo Alpoim, Cristina Silva, Ana Cláudia Fernandes, Corina Chaves, Marina Dias, Nuno Prista and Ana Maria Costa

WD17: Notes on the Basque fishery on Whiting (Merlangius merlangus), Plaice (*Pleuronectes platessa*), Pollack (*Pollachius pollachius*) and Sole (*Solea solea*) in the Bay of Biscay and Cantabrian waters in the last decade. By Lucia Zarauz1, Jon Ruiz, Estanis Mugerza Marina Santurtún and Iñaki Artetxe

WD18: Data availability for the UK, England and Wales component, for *Pleuronectes platessa* in ICES area 89, *Pollachius pollachius* in ICES area 89, *Solea solea* in ICES area 8c9 and *Merlangius murlangus* in ICES area 89. By L. Readdy and P. Robinson

WD19: Spanish fishery data on plaice (*Pleuronectes platessa*), pollack (*Pollachius pollachius*), sole (*Solea* spp.) and whiting (*Merlangius merlangus*) in Iberian and Bay of Biscay waters. By Jose Rodriguez, A. Celso Fariña, Francisco Velasco, Nélida Pérez and Juan José Acosta

WD20: Some information on whiting (*Merlangius merlangus*), plaice (*Pleuronectes platessa*) and Pollock (*Pollachius pollachius*) French fishery and survey indices in the Bay of Biscay (Div. VIIIa,b,d). By J.C. Mahé

WD21: Portuguese data of sole, plaice, whiting and pollock provided to WGHMM in 2011. By Ernesto Jardim, Ricardo Alpoim, Cristina Silva, Ana Cláudia Fernandes, Corina Chaves, Marina Dias, Nuno Prista and Ana Maria Costa

WD22: Some information on Irish fisheries for stocks of whiting (*Merlangius merlangus*), plaice (*Pleuronectes platessa*), pollock (*Pollachius pollachius*) and sole (*Solea solea*) in the Bay of Biscay and Iberian coast (Divisions VIIIa,b,d,e and IXa). By Eoghan Kelly.

SUMMARIES OF WDs:

WD1:

For Anglerfish in divisions VIIb-k and VIIIab, a surplus production model was used in 2000 as an attempt to assess the stock on the basis of a combined species assessment. However at the time, the data was lacking contrast and the fit were not very good whatever formulation and cpue series used.

Since then, the cpue indexes have shown a pattern of going down and up and a new survey series covering a good proportion of the area has been made available. Production model such as ASPIC are not very good at estimating absolute values of biomass but are good at estimating MSY and relative values of biomass and fishing mortality to their MSY values. Some preliminary results of ASPIC formulations are given in the context of providing elements of advice with respect to MSY target.

The results of the preliminary runs are showing that production model is a good candidate to assess the Northern Anglerfish stock considered as a whole management unit with two species combined. The results are consistent with our perception of a stock near its MSY from historical catch and survey data. However, further work is needed to investigate the use of other indices and formulation and sensitivity to initial guess of parameters.

WD2:

Two species of Anglerfish (*Lophius piscatorius* and *L. budegassa*) are caught in the northeast Atlantic, where they have a wide distribution with a great overlap, although *L. piscatorius* is the most abundant. Over the western and southern European waters anglerfish are fished on the same grounds by the same fleets, as by-catches in bottom trawl mixed and multi-gear fisheries and as target species using fixed gillnets ("rasco").

The majority of the commercial categories of the two anglerfish species are not regularly separated in the Spanish landings. Discrimination by species in landings is variable from port to port, and they are recorded together in the fishery statistics as *Lophius* spp. The separation process is mainly made during the final market stage, due to different appreciation and economic value that the species achieve in the fish market. The specific estimates in Spanish landings are obtained from their relative proportions in landed samples. This paper documents the procedures carried out for this derivation.

WD3:

An update is presented of the annual discard estimates of Anglerfish (black angler, *Lophius budegassa*, and white angler, *Lophius piscatorius*) for the Spanish bottom trawl operating in the Northeast Atlantic Ocean. Black Anglerfish discards increased sharply in the last three years and a maximum for white Anglerfish also occurred in 2010. A sampling methodology review has been carried out for 2003–2010 without detecting any shift in the protocol which could produce overestimation for recent years discards. Fishing covariates related to black Anglerfish discard data also indicates that fishing practices remain stable along the series. We detect a steady increase in the species first length of retention (L50) from 21.5cm in 2003, to a range of 23-25cm from 2004-2008 and ~28cm since 2009. We conclude that interaction between the industry adoption of a Minimum Weight Landing (500g) and the strength of recruitment indices explain the increase in amounts of Anglerfish discards.

WD4:

During the months of September and October 2010, the beam trawlers 'Billy Rowney' and 'Twilight III' carried out the eighth FSP survey of anglerfish off the SW coast of England, repeating the surveys of 2003–2009. Megrim was the most abundant of eight commercially important species caught, followed by Anglerfish (*L. piscatorius*) and lemon sole. Catch rates, combined discarded and retained, for anglerfish and hake were lower than recorded in 2009.

The index of monkfish (*L. piscatorius*) (MON) abundance has been increasing gradually over the time-series but biomass has remained fairly stable. The indices of the less common monkfish (*L. budegassa*) (WAF) abundance and biomass steadily peaked in 2008, but has been declining since then.

WD5:

A first attempt at assessment of white anglerfish southern stock using Stock Synthesis (SS3) is presented in order to evaluate its potential use as an alternative assessment model to the current surplus production model (ASPIC). Model structure, input data and provisional model settings are described in the work. Although more effort is required for tuning the model, the fit and the preliminary results seem to indicate that the Stock Synthesis can be an appropriate model to assess this stock.

WD6:

Since 2003 when the DCF started at the European level, discards data have been available by country for many stocks. Four-spot megrim is traditionally assessed with XSA (Extended Survivor Analysis) which does not include discards. For this species, discards in number are very important, being around the 60% of total catch. A Bayesian model incorporating discards was realized for the hake stock in ICES Divisions VIIIc and IXa by Fernández *et al*. (2010). This model was also designed to produce a complete time-series of discard estimates. The final run of the model is compared with results from XSA performed in the ICES working group of 2010, showing that the major differences are in fishing mortality for younger ages, being higher when incorporating discards data.

WD7:

Megrims (*Lepidorhombus whiffiagonis* and Four spot megrim, *L. boscii*) are targeted by the Spanish bottom otter trawl fleets operating in the Northeast Atlantic (ICES Divisions VIIIc and North IXa). The composition of discards estimates by this fleet is presented in this working document. Information has been obtained by sampling Spanish fleets under the "Spanish Discard Sampling Programme" carried out by the IEO. Trip was the sampling unit, being raised to different fleet levels using fishing effort and total fleet landings as auxiliary variables. It was decided to raise discards to total fleet landings as it possessed lower CV values than raising by fleet effort. Time series of discards and discard age distributions for both species from 1993-2010 are presented. Discard estimates for these species show high inter annual variation, exceeding 25% CV in almost all cases in both species but with lower values in four spot Megrim. Minimum Landing Size (MLS) and low market value for small fish are the main factors that force the fleet to discard most of individuals caught.

WD8:

One of the most important outcomes for fisheries management of the Johannesburg Summit in 2002, was the decision to "maintain or restore depleted fish stocks to levels that can produce the maximum sustainable yield (MSY) on an urgent basis and where possible by 2015". Spawning stock biomass (SSB) is one of the most frequent measures to monitor the stock status. However, recent research on reproductive potential has shown that alternative variables may improve this monitoring. In the case of hake, it is known that larger individuals produce more eggs by unit of weight, and that these eggs have better quality than those laid by small individuals. Under these circumstances, the reproductive potential studies may play an important role in the implementation of the Johannesburg agreement, since it is not only the spawning biomass but also its age or length structure that define the stock productivity and its ability to produce maximum sustainable yield. In this work we used an age-length structured population to assess the impact of different reproductive indicators (total spawning biomass, female spawning biomass and egg production) into MSY reference points. Firstly, we analyzed how these different indicators alter our perception about per recruit productivity using yield per recruit and stock per recruit length based models. Secondly, we analyzed the quality of these alternative reproductive indicators to explain and predict the recruitment using different model structures (Ricker, Beverton-Holt, etc) and bayesian inference. Thirdly, we combined per recruit models and stochastic stock-recruitment relationships to estimate the probability distributions of MSY biological reference points (MSY, Fmsy, Stockmsy, Fmax and Fcrash). Finally, a comparative statistical analysis was performed among MSY reference points considering how the factors affected them. Preliminary results suggest that Southern hake reference points are quite sensitive to biological and model assumptions. Alternative reproductive indicators could help to monitor the success of hake management guaranteeing long-term sustainability.

WD9:

An example is presented describing how the knowledge and experience of ICES assessment Working Groups experts can be used in the context of the Marine Strategy Framework Directive. The aim of this working document is to integrate the scientific and advisory work for implementing an ecosystem approach, based on qualitative descriptors, and give a coordinated and integrated assessment of sea environmental status.

WD10:

The European Marine Strategy Framework Directive (Directive 2008/56/EC), establishes a framework and common objectives for the protection and conservation of the marine environment. This Directive requires the implementation of all measures necessary to achieve the Good Environmental Status by 2020, according to 11 qualitative descriptors.

With the aim of improving the knowledge of the environmental status of the Basque coast, in relation to MSFD descriptors i, ii, iii, iv and vi a new survey named 'Cape Breton 2010' was carried out by AZTI-Tecnalia. This is a high definition IBTS-like survey that includes trawling, grab sampling and collection of oceanographic data. Biomass indices (Kg/Km^2) have been produced for all species encountered.

WD11:

The Portuguese crustacean fishery takes place off the south and southwest coasts of Portuguese continental waters (ICES Division IXa – Functional Units FU 28 and 29). The fishery is conducted by 30 trawlers, which are in average 25 meters of overall length and 411 kW of engine power. This fleet accounts for 93% of deep crustacean landings from Portuguese continental waters. There are two main target species in this fishery, the deepwater rose shrimp (*Parapenaeus longirostris*) and the Norway lobster (*Nephrops norvegicus*), sharing partly the same grounds. Although their areas of distribution overlap at depths 200–500m, rose shrimp highest yields occur at depths below 400m whereas highest catch rates of Norway lobster are between 500–600m. Due to the high market value of rose shrimp and to the fact that its fishing grounds are closer to the coast, in periods of high abundance of rose shrimp the vessels spend less effort on Norway lobster. The aim of this working document is to discuss what improvements can be introduced in the *Nephrops* CPUE standardization model using the VMS information.

WD12:

The Portuguese crustacean trawl fishery takes place off the southwest (FU 28) and south (FU29) coasts of the Portuguese continental waters (ICES Division IXa). There are two main target species in this fishery, the deepwater rose shrimp (*Parapenaeus longirostris*) and the Norway lobster (*Nephrops norvegicus*), sharing partly the same grounds. In the last two working groups, a trial to standardize the *Nephrops* CPUE (in kg/day) was carried out using General Linear Models (GLM), but the final model never explained more than 20% of the variability. Considering the behaviour of the fleet in periods of high abundance of rose shrimp, new variables related to the daily catches of this species and the proportion of *Nephrops* in the total daily catch were incorporated in the new model presented in this working document. A stock assessment with XSA was performed (for males and females) with the new series of standardized *Nephrops* CPUE to evaluate the effects on the catchability residuals and the retrospective patterns.

WD13:

The fishery for *Nephrops norvegicus* in the Bay of Biscay is exploited by about 250 French trawlers. It has been managed by a TAC since 1987 as well as a minimum landing size (MLS). This fishery discards both *Nephrops* and small hake (*Merluccius merluccius*). The quantity discarded by this fleet varies over the time series and depends on factors such as the restriction of individual quotas, the strength of recruitment, the change of MLS and modification of the selectivity according to codend mesh size. Because of the preponderance of the discarding mortality in the whole fishing for *Nephrops* fisheries, the discards were systematically included in the ICES stock assessment. A discard sampling program was occasionally carried out since the late 1980s and has been routinely carried out since 2003. The sampling design is a stratified random one using total landings as auxiliary variable. Sampling has been conducted on the *Nephrops* fleet operating in the Northern part of the Bay of Biscay only. Although this covers the main part of the fleet, it may introduce some biases in discards estimates as sorting practices may be different in the southern part of the fishery. For years with no sampling, discard levels were extrapolated as a proportion of quarterly landings; these may induce lack of contrast in recruitment indices. This working document proposes an extrapolation method by applying quarterly 'hand-sorting' curves within a given exploitation pattern (MLS, mesh size unchanged), density of probability assuming symmetry of discards vs. sizes and relationship between mean sizes of landings and discards by year.

WD14:

The *Nephrops* stock of the Bay of Biscay is exclusively exploited by French fishermen. This stock, cohabiting with hake, is targeted by a fleet of trawlers which are subject to more and more regulations to incentivize responsible and sustainable fishing practices. Discard rates in this mixed fishery remains high although it is known that discarded *Nephrops* are able to survive, grow and to reproduce. Research in 1970s concluded that 30% of discarded *Nephrops* can survive the catch process. This rate was adopted by ICES and used in the stock assessment procedures up until now. However, the fishing gears used by this fleet have changed since then and consequently the survival rates of discarded *Nephrops* were again investigated. This study shows high variability around the mean survival rates, which can partly be explained by the methods of processing of the catch on board by the various crews. As a conclusion, no single value of global survival rate of discarded *Nephrops* could be defined, but a range of 45-65% was identified. This figure is significantly higher than the 30% currently used in the stock assessment procedure.

WD15:

This working document involves a slight revision of the last year's assessment performed by ICES WGHMM. Total landings for 2009 were slightly revised (2987t against 3030t as considered in 2010), and the stock assessment was performed with the new data. This working document presents the output tables and figures. The perception for this stock was not significantly altered by the inclusion of this data.

WD16:

The objective of this working document is to compile the information transmitted to WGHMM, independently of being used in the assessment or not. It can be used for groups/tasks dealing with data issues to check the data transmitted. All information refers to the southern stocks. Portugal does not have activity on the northern parts of the stocks dealt by WGHMM. This document does not include all the tables with the data. The option taken is to plot the data making it easier to read. The data behind the plots are transmitted to the relevant stock coordinator and will be included on the main body of the report. The document starts with the description of the sampling program executed in 2010 on port sampling, on-board sampling and surveys. Afterward, a section for each species explains in detail the data collected and available by parameter in agreement with the nomenclature used by the DCF.

WD17:

Under ICES request, countries and laboratories involved in the working group assessing Hake, Monk and Megrim (WGHMM) were asked to include a number of new stocks under consideration for which Institutions might have available data. These stocks were: Plaice in the Bay of Biscay and Iberian coast (ple-89a); Pollack in the Bay of Biscay and Iberian coast (Pol-89a); Sole in the Iberian coast (sol-8c9a) and Whiting in the Bay of Biscay and Iberian coast (whg-89a)

All data to be reviewed and collated was referred to Subarea VIII (VIII abd & c) and IX a. The only exception was sole, which covers only VIIIc (i.e. not the whole of VIII) and IXa. Data to be collected was defined as: landings; discards; data from research surveys or other sources of data potentially leading to stock abundance indices and biological data.

It might be that for most of these stocks very little data are available. However, it is of interest to know if they are not available (e.g. the species does not appear in the landings (i.e. not caught by the fleet), or they are caught by the fleet but no information is collected. Thus, the identification of the lack of data is interesting, if applicable, suggesting possible improvement in the sampling.

During 2010, AZTI continued monitoring all species caught in Basque fisheries fishery in the Basque Country (Spain) in relation to the monthly landings and fishing effort by sea area and gear. In this way, compilation and updating of the basic information on species such us those required in this exercise (i.e. whiting (*Merlangius merlangius*); plaice (*Pleuronectes platessa*), pollack (*Pollachius pollachius*), sole (*Solea solea*)), is updated every year since 1994. This is, landings and landings per unit effort made by the Spanish fleets, when landed at the Basque Country ports are computed.

WD18:

There is limited activity in ICES divisions VIII and IX by UK (E&W) registered vessels. In relation to the data presented in this working document, the landings for the period 1985-1995 were mainly by Anglo Spanish vessels either landing directly to Spanish ports or overlanding catches from Welsh ports for first sale in Spain. Effort in the area then dropped to low levels until the development of a fixed net fishery targeting pollack (*Pollachius pollachius*) in 2006, landings by this fleet are split between the UK and France where the demand for pollack is higher. There is a section is dedicated to each of the four stocks outlining the data available. For all four stocks there are no data for ICES divisions VIIIc and IX from the UK, England and Wales component. For the other subdivision in area VIII three of the stocks have some landings although it is variable. Length and biological samples were taken from a scientific survey between 1983 and 2001, not all years have samples for the four stocks and the survey was discontinued in 2004.

WD19:

Following a request from ICES throughout the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim (WGHMM), countries involved in the WGHMM have been asked to provide fishery information on several fish species in geographical areas for which ICES has never provided management advice. The species concerned are plaice (*Pleuronectes platessa*), pollack (*Pollachius pollachius*), and whiting (*Merlangius merlangus*) in Bay of Biscay and Iberian waters (Subarea VIII and Division IXa) and sole (*Solea* spp.) in Iberian waters (Divisions VIIIc and IXa). These species are widely distributed in European waters, although sole is limited to the southernmost area. They are mainly caught in small scale fisheries developed on coastal waters and sporadically as by-catch in trawl fisheries.

There are no previous relevant fishery data on these species in the area. The aim of this document is to gather together available fisheries information on that species, and especially those data related to landings, discards, and information from research surveys.

WD20:

This working document presents data from French vessels operating in the Bay of Biscay over the previous decade. It should be noted that the landings figures presented here are from logbook data only and the usual quality checking procedures used to produce best estimates could not be applied due to short time notice between the request and the actual WGHMM meeting.

WD21:

The objective of this working document is to compile the information transmitted to WGHMM on the new species requested, sole, plaice, whiting and pollock. It can be used for groups/tasks dealing with data issues to check the data transmitted. The document starts with the description of the sampling programme executed in 2010 on port sampling, onboard sampling and surveys. Afterwards, a section for each species explains in detail the data collected and available by parameter in agreement with the nomenclature used by the DCF.

WD22:

Irish vessels made very small landings from these stocks with a total of 211 kg of plaice, pollack and sole from these areas declared in logbooks from 2003-2010. No landings were declared by Irish vessels during 2005, 2006, 2007 and 2010. Landings of whiting were larger in 2008 with 1,200 kg declared from Division VIIId. The vast majority (95%) of these landings were caught using bottom otter trawl (OTB) with the remainder caught using bean trawls (TBB) and dredges (DRB). There was no information available on Irish discards, survey indices or biological data of these stocks as no discard observers accompanied these fishing trips.

Annex C Stock Annex Northern Stock of Hake

Quality Handbook	Stock Annex C

Stock specific documentation of standard assessment procedures used by ICES.

Stock	Northern Stock of Hake (Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d)
Working Group:	Assessment of Southern Shelf Stocks of Hake, Monk and Megrim
Date:	May 2011
Revised by	Michel Bertignac

A. General

A.1. Stock definition

European hake (*Merluccius merluccius*) is widely distributed over the Northeast Atlantic shelf, from Norway to Mauritania, with a larger density from the British Islands to the south of Spain (Casey and Pereiro, 1995) and in the Mediterranean and Black sea. Although, as demonstrated by genetic studies (Plá and Roldán, 1994; Roldán *et al.*, 1998), there is no evidence of multiple populations in the Northeast Atlantic, ICES assumes since the end of the 1970s two different stock units: the so called Northern stock, in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d, and the Southern stock in Divisions VIIIc and IXa, along the Spanish and Portuguese coasts. The main argument for this choice was that the Cap Breton canyon (close to the border between the Southern part of Division VIIIb and the more Eastern part of Division VIIIc, i.e. approximately between the French and Spanish borders) could be considered as a geographical boundary limiting exchanges between the two populations.

Hake spawn from February through to July along the shelf edge, the main areas extending from the north of the Bay of Biscay to the south and west of Ireland (Figure 1). After a pelagic life, 0-group hakes reach the bottom in depths of more than 200 m, then moving to shallower water with a muddy seabed (75–120 m) by September. There are two major nursery areas: in the Bay of Biscay and off southern Ireland.

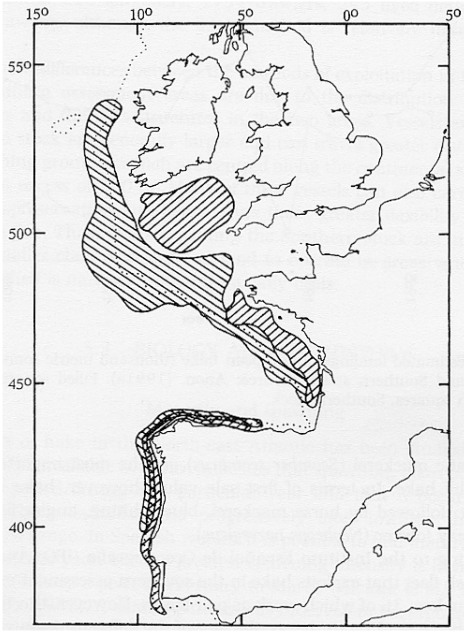

Figure 1. Main spawning and nursery areas. Spawning areas sloping downwards from left to right; Nursery areas sloping downwards from right to left. (from Casey and Pereiro, 1995)

A.2. Fishery

A set of different Fishery Units (FU) has been defined by the ICES Working Group on Fisheries Units in Sub-areas VII and VIII in 1985, in order to study the fishing activity related to demersal species (ICES, 1991a). To take into account the hake catches from other areas, a new Fishery Unit was introduced at the beginning of the nineties (FU 16: Outsiders). This Fishery Unit was created on the basis of combination between mixed areas and mixed gears (trawl, seine, longline, and gillnet). The current FU are defined as follows:

Fishery Unit	Description	Sub-area
FU1	Long-line in medium to deep water	VII
FU2	Long-line in shallow water	VII
FU3	Gillnets	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	Gillnets 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 main part of the fishery is currently conducted in six Fishery Units, three of them from Subarea VII: FU 4, FU 1 and FU 3, two from Subarea VIII: FU 13 and FU 14 and one in Subareas IIIa, IV, V and VI : FU16.

From the information reported to the Working Group, Spain accounted in recent years for the main part of the landings (around 60%) followed by France (around 25%), UK, Denmark, Ireland, Norway, Belgium, Netherlands, Germany, and Sweden contributing to the remaining.

The minimum landing size for fish caught in Subareas IV, VI, VII and VIII is set at 27 cm total length (30 cm in Division IIIa).

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 weight of marine organisms retained on board. 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.
- Two areas have been defined, one in Subarea VII and the other in Subarea VIII, where a 100 mm minimum mesh size is required for all otter trawlers, whatever the amount of hake caught.

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

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 biomass to values equal to or greater than 140 000 t. 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 in 2007, the northern hake stock has met the SSB target in the recovery plan of 140 000 t for two consecutive years (2006 and 2007). Article 3 of the recovery plan indicates that, in such a situation, a management plan should be implemented.

An annual one-month fishing activity stop has been implemented by the Spanish administration since 2004. In 2008, a specific national regulation established a 90-days stop to be distributed from August 2008 to December 2009. Independently of these regulations, some Spanish fleets stopped their activity during some weeks in June 2008 to protest against the increase of petrol prices.

In Subarea VIII, for 2006, 2007 and 2008, otter trawlers using a square mesh panel are allowed to use 70 mm mesh size in the area, mentioned above, where 100 mm minimum mesh size is required for all otter trawlers. (EC Reg. No. 51/2006; EC Reg. 41/2007).

Furthermore, there was a ban on gillnets in Divisions VIa,b and VIIb,c,j,k fishing at more than 200 m of depth (EC Reg. No 51/2006) during the first semester of 2006.

A.3. Ecosystem aspects

Although a comprehensive study on the role of hake in its ecosystem has not yet been carried out, some partial studies are available. Hake belongs to a very extended and diverse community of commercial species including megrim, anglerfish, *Nephrops*, sole, sea bass, ling, blue ling, greater forkbeard, tusk, whiting, blue whiting, *Trachurus* spp, conger, pout, cephalopods (octopus, *Loligidae*, *Ommastrephidae* and cuttlefish), and rays. The relative importance of these species in the hake fishery varies largely in relation to the different gears, sea areas, and countries involved.

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

Ecological factors or environmental conditions impacting on hake population dynamics are not taken into account at present in the assessment or in the management.

B. Data

B.1. Commercial catch

B.1.1. Landings

The Spanish landings data are based on sales notes and Owners Associations data compiled by IEO; and Basque Country sales notes and Ship Owners data compiled by AZTI. French landings data are based on logbook and auction hall sales.

From 1978 to 1989, landings in weight are available by year, gear (trawl, gillnets and longline), country (UK, France and Spain) and ICES Divisions (Division IVa + Sub-Area VI, Division VII and Divisions VIII a+b). From 1990 to present, for most of the years, landings in weight by FUs and countries are available on a quarterly basis. In 1992, only data from Spain is available by FU and on a quarterly basis (Table 1).

Table 1. Landings-in-weight (and their level of aggregation) available to the Working Group.

	1978 to 1989	1990–1991	1992	1993 to Present
By Gear, Country and ICES Divisions	X			
By FU		X	X	X
By year	X		X	
By quarter		X	X*	X

*** For Spain only**

From 1978 to 1989, length–frequency distributions are available by year, gear, country and ICES Divisions. From 1990 to present, length compositions of the landings are not available for all Fishery Units, quarters and countries. Only the main FUs/Countries are sampled. Table 2 presents, as an example, the length distributions available for 2008.

Table 2. Length–frequency distributions provided to the Working Group in 2008.

FU	France	Ireland	Spain	UK(EW)	Scotland	Danemark
01			Quarterly			
03	Quarterly		Quarterly	Quarterly		
04			Quarterly	Quarterly		
05	Quarterly			Quarterly		
06				Quarterly		
09	Quarterly					
10	Quarterly					
12	Quarterly		Quarterly			
13	Quarterly		Quarterly			
14			Quarterly			
15		Quarterly				
16			Quarterly		Quarterly	Yearly

B.1.2. Discards

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

EU countries are now required under the EU Data Collection regulation to collect data on discards.

A new sampling programme of discards in the French *Nephrops* trawlers fishery of the Bay of Biscay started in June 2002. Estimates obtained by this programme (see Table 3 below) were significantly different (by a factor 2 to 10) from previous estimates for that fishery (estimates are from 532 t in 2006 to 1597 t in 2005). Such discrepancies could be explained by changes in the sampling, changes in the discarding practices, variations in the abundance of small fish or by a combination of the three. The CVs associated with these estimates are around 20%.

Discards are available for Danish trawlers and seiners fishing in Subarea IV from 1995 to 2004 and for gillnetters from 1995 to 2008. Their values are quite variable from year to year from 100 to 800 t.

Additional information on discards was available for the Irish otter trawlers fishery in Subareas VI and VII from 1999 to 2001 and for 2004 and 2005 (values from 32 to 650 t, not raised after 2005) and for UK-EW from 2000 to 2008 (raised only to the trip level).

Estimates of discards for the Spanish trawl fleets operating in the ICES Subarea VII and Divisions VIIIabd are available for 1988, 1989, 1994, from 1999 to 2001 and from 2003 to 2008. In Subarea VII, an increase in estimated discards rate was observed from 2003 to 2008 when compared with previous years. Discards were estimated to vary from very small amounts to more than 1000 t in 2003–2005 and over 2000 t in 2008. CVs were highly variable from 20% to more than 100%. Fixed gears were also sampled in order to design the Spanish Discards Sampling Programme, but no relevant discards were observed (Pérez *et al*., 1996).

Table 3. Summary of discards data available (weight (t) in bold, numbers ('000) in italic).

Table 3.2. 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)

Fleet/metier sampled	Corresponding Fishery Units	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Spanish Trawl in VII	FU 4	NA	**137**	NA	NA	NA	**1241**	**1740**	NA	**778**	**2339**	**2033**
		NA	*800*	NA	NA	NA	*12497*	*19831*	NA	*6646*	*28615*	*16375*
French Nephrops trawl in VIIIabd	FU9	**565**	**341**	**417**	**172**	**1035**	**1359**	**1597**	**532**	**767**	**858**	NA
		9139	*7421*	*6407*	*2992*	*23676*	*39550*	*37740*	*18031*	*24277*	*18245*	NA
French trawl in VIIIabd	FU10	**211**	**169**	**100**	**142**	NA	NA	NA	NA	NA	NA	NA
		3053	*3013*	*1439*	*2253*	NA	NA	NA	NA	NA	NA	NA
Spanish trawl in VIIIabd	FU14	NA	NA	NA	NA	NA	**30**	**489**	**206**	**471**	**352**	**557**
		NA	NA	NA	NA	NA	*451*	*8475*	*3397*	*10002*	*7153*	*7530*
Irish trawl and seine in VII	FU15	**190**	**650**	**194**	NA	NA	**32**	**94**	*	*	*	NA
		1868	*892*	*1046*	NA	NA	282	*629*	*	*	*	*684*
UK (EW) trawl in IV and VII	FU16 + 4 + 5	NA	*	*	*	*	*	*	*	*	*	*
		NA	*	*	*	*	*	*	*	*	*	*
Spanish trawl in VI	FU16	NA	NA	NA	NA	NA	NA	NA	NA	NA	**6**	**31**
		NA	NA	NA	NA	NA	NA	NA	NA	NA	*11*	*36*
Danish trawl and seine	FU16	**42**	**21**	**142**	**354**	**242**	**206**	**814**	**610**	**255**	**190**	**213**
		29	*38*	*483*	*691*	*479*	*775*	NA	NA	*849*	*642*	*508*
Total Weight from sampled fleet (t)		**1008**	**1319**	**854**	**668**	**1277**	**2868**	**3920**	**738**	**2016**	**3745**	**2277**
Total Number from sampled fleets ('000)		*14090*	*12164*	*9376*	*5935*	*24155*	*53555*	*66675*	*21428*	*40925*	*54666*	*17603*

* sampled but not raised

During the 2003 assessment, the Working Group noted that, although some improvement in discard data availability had been observed (number of fleets sampled and area coverage), sampling does not cover all fleets contributing to hake catches and discard rates of several fleets are simply not known. Furthermore, when data are available, it was not possible to incorporate them into the assessment in a consistent way. As reconstructing an historical series was found problematic, discard estimates were removed from the full time-series of catch data. From 2003 to 2008, the assessment was thus conducted on landings only. After 2008 Working Group assessment, discards estimates from several sampled fleets were used in the assessment. This includes the French *Nephrops* trawl in VIIIabd discards data from 2003 to present, the Spanish trawl in VII in 1994, 1999, 2000, 2003 to present and the Spanish trawl in VIII abd from 2005 to present.

B.2. Biological

Mean weight-at-length are estimated from a fixed length–weight relationship (W(g)= 0.00513*L(cm)^3.074; ICES, 1991b).

The parameters of the time invariant logistic maturity ogive, for both sexes combined are: L_{50} = 42.85 cm and slope = - 0.2 (ICES, 2010b WD8).

Conventional tagging of European hake (de Pontual *et al.*, 2003) recently opened new avenues for a better understanding of the species biology and population dynamic which have remained controversial for decades (see e.g. Belloc, 1935; Hickling, 1933). The first tagging results provided evidence of substantial growth underestimation (by a factor ~2) due to age overestimation, (de Pontual *et al.*, 2006), thus challenging the internationally agreed age estimation method. More tagging efforts, both off the Northwest Iberian Peninsula (Piñeiro *et al.*, 2007) and the Mediterranean Sea (Mellon-Duval *et al.*, 2010), have recently proved that growth underestimation was not a regional issue. Besides, Ifremer sustained a large tagging effort in the Bay of Biscay from 2004 to 2007 which allowed confirming both the relevance of the fast growth hypothesis and the issues of the otolith-based age estimation current methodology. An ICES workshop (ICES, 2010a) confirmed that the previous internationally agreed ageing method is neither accurate nor precise and provides overestimation of age. A replacement ageing method with sufficient precision and accuracy is currently not available. Conversion from length-to-age using an age–length key and the use of an assessment model relying on a catch-at-age matrix and abundance indices at age as was done until 2008 becomes then problematic. This leads the Working Group to consider the use of a length-based stock assessment model.

In the absence of a direct estimate of natural mortality, a constant value of 0.4 was assumed for all age classes and years. It must be noted that this is a larger value than the one used in assessments conducted until 2008 where M was set to a value of 0.2. The rationale for this higher value is that if hake growths about two times faster, the hake longevity is reduced by about a half (from age ~20 to ~10), thus impacting on natural mortality (Hewitt and Hoening, 2005).

B.3. Surveys

Several research-vessel surveys cover part of the geographical distribution of the Northern hake stock (Figure 2).

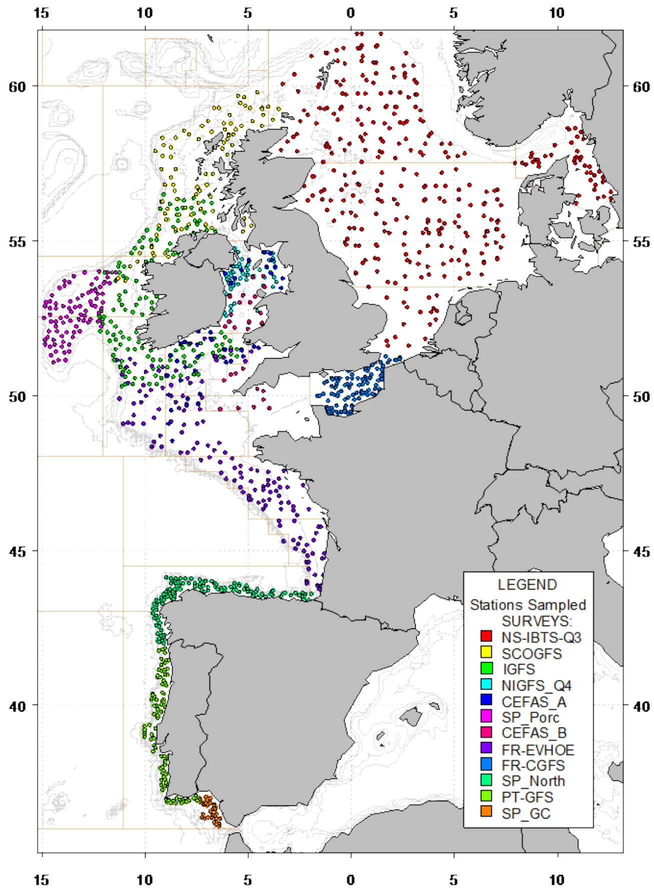

Figure 2. Map of East Atlantic groundfish surveys: stratification and trawling positions.

Abundance indices are available from the following research-vessel surveys:

Abundance indices used in the SS3 assessment:

French Evhoe groundfish survey (EVHOE-WIBTS-Q4): years 1997–present. The survey occurs in autumn. The survey uses a GOV trawl with a 20 mm codend liner. It covers the shelf of both the Bay of Biscay and the Celtic Sea.

French Ressgasc groundfish survey (RESSGASC): years 1978 to 2002. Over the years 1978–1997 the RESSGASC surveys were conducted with quarterly periodicity. They were conducted twice a year after that (in spring and autumn). Survey data prior to 1987 have been excluded, because there was a change of vessel at that time. Weather conditions encountered by RESSGASC in 2002 gives to this index a poor reliability and it was decided not to use it. The survey uses a 25 m "Vendéen type" bottom trawl. It covers the Bay of Biscay. The survey ended in 2002.

Spanish Porcupine groundfish survey (SpPGFS-WIBTS-Q4): years 2001 to present. The area covered by this survey is the Porcupine bank extending from longitude 12° W to 15° W and from latitude 51° N to 54° N, covering depths between 180 and 800 m. The cruises are carried out every year in September on board R/V "Vizconde de Eza", a stern trawler of 53 m and 1800 Kw. Numbers-at-age for this abundance index are estimated from otoliths collected during the survey.

Irish Groundfish Surveys (IGFS-WIBTS-Q4): years 2003 to present. This survey is conducted on board the *R.V. Celtic Explorer* in autumn in the west of Ireland and the Celtic sea. The survey uses GOV 36/47 (Grande Ouverture Verticale).

Abundance indices not used in the SS3 assessment:

UK WCGFS survey (UK-WCGFS): years 1988 to 2004. This survey was conducted in March in the Celtic sea. It does not include the 0-age group. Numbers-at-age for this abundance index are estimated from length compositions using a mixed distribution by statistical method. The survey ended in 2004.

B.4. Commercial cpue

Commercial cpues indices provided to the ICES Working Group are not used in the current SS3 assessment. Landings-per-unit-effort time-series are available from the following fleets:

a) Trawlers from A Coruña and Vigo fishing in Sub-area VII (SP-CORUTR7 and SP-VIGOTR7), pairtrawlers from Ondarroa and Pasajes fishing in Sub-area VIII (SP-PAIRT-ON8 and SP-PAIRT-PA8)

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

b) Ondarroa "Baka" trawlers fishing in Subareas VI, VII and Division VIIIa,b,d, Pasajes "Bou" trawlers fishing in Subarea VIII, longliners from A Coruña, Celeiro and Burela fishing in VII, longliners from Avilés in VIIIa,b,d and trawlers from Santander in VIIIa,b,d.

Lpue values of Spanish gillnetters that started to fish hake in Subareas VII and VIII in 1998 are also provided. It is to be noted that only a small number of ships are involved in the gillnet fishery which makes lpues very sensitive to small changes in the number of trips. It is also noted that for gillnetters and longliners, lpues expressed in kg/day may not be the most appropriate.

Lpue data from two French fleets (Les Sables and Lesconil) fishing in Divisions VIIIa,b,d are also available from Logbooks. Due to important reductions in the availability of logbook information in recent years for both fleets, lpue values for the years 1996 onwards have low reliability. No data have been provided for those two fleets after 2003.

B.5. Other relevant data

C. Historical stock development

Model currently used: Stock Synthesis 3 (SS3), (Methot, 2005).

Software used: Stock Synthesis V3.10, Richard Methot, NOAA Fisheries Seattle, WA.

Recent assessments and sensitivity analysis carried out.

An attempt to use a non-equilibrium surplus production model (ASPIC) was carried out in the 2004 WG (ICES, 2005) and preliminary fits of a length based stock assessment model have been presented in 2007 and 2008.

In the 1998 WG it was found that the SSB estimates for 1985–1987 were very sensitive to the q plateau options between age 5, 6, and 7 (which is the last true age). To reduce this effect, it was decided to extend the ten years window to a twelve-year period in order to tune to the longest available and well behaved fleet dataseries. In the 1999 and 2000 assessments, SSB estimates for 1985–1987 were still sensitive to the extent of the tuning period, and the longest (13 years and 14 years respectively) provided the best pattern for these years, whereas other estimates were very similar for other years. In 2001 assessment, it was decided to use the whole tuning data available and a taper time weighting to reduce the influence of the older years. At that time, this choice did not change radically the estimates of trends in F and SSB and those settings were maintained in 2002 to 2003 assessments.

In 2004, the group investigated again the influence of the taper time weighting and runs were conducted without taper and compared with the base-case run using a tricubic taper over a 20 year period. While the group agreed on the rationale behind the use of a taper to down-weight the years for which we may have less confidence, it expressed concerns over the large influence the use of this option has on the perception of the stock dynamics and the inability of the model to account, in a satisfactory manner, for uncertainty in the data.

Due to uncertainties in hake aging, in 2005, 2006 and 2007, the group also conducted a sensitivity analysis using a simulated ALK assuming a faster growth. In each of these years, several runs were thus conducted (An Update from the previous year and a Simulated ALK, see below).

In WGHMM 2007, an update runs from 2006 has been carried out and the SpPGFS-WIBTS-Q4 survey was added to the surveys used to tune the model.

WKROUND 2010 (ICES, 2010b) reviewed the uses of the Stock Synthesis assessment model.

Current assessment

The assessment is a length-based approach using the Stock Synthesis assessment model. This approach allows direct use of the quarterly length composition data and explicit modelling of a retention process that partitions total catch into discarded and retained portions.

The underlying population can be partitioned in time to include as many seasons within a year as required. This is important where temporal aspects of biology (like growth in the case of hake), or fishing activity dictate finer than annual-level representation, however all the basic input data must then be partitioned to the level of the underlying dynamics.

Recruitment is based on a Beverton–Holt function parameterized to include the equilibrium level of unexploited recruitment (R0) and the steepness (h) parameter, describing the fraction of the unexploited recruits produced at 20% of the equilibrium spawning biomass level. Annual deviations can be estimated for any portion of the modelled time period (or the whole period), and the expected recruitments are bias-corrected to reflect the level of variability (sigmaR, an input quantity) allowed in these deviations.

Growth is described through a von Bertalanffy growth curve with the distribution of lengths for a given age assumed to be normally distributed. The CV of these distributions is structured to include two parameters which can be estimated or fixed, defining the spread of lengths at a young and old age with a linear interpolation between. In addition to growth, the relationships between weight and length, fecundity and length as well as maturity-at-length are all generalized to allow parameters to be estimated or fixed, temporally invariant or not. All model parameters can vary over time either as a function of annual deviations about a mean level, user defined 'blocks' of years in which the parameters differ or a combination of the two.

All model expectations for comparison with data are generated as observations from a 'fleet', either a fishery or a survey/index of abundance. Each fleet has unique characteristics defining relative selectivity across age or size, and can be structured to remove catch or collect observations at a particular time of the year or season. All fleets may be considered completely independent, or parameters may be shared among fleets where appropriate via 'mirroring'.

A suite of selectivity curves including logistic-based shapes of up to eight parameters, power functions and nonparametric forms can be explored through relatively simple modification of the input files.

The kinds of data that model expectations can be fit to include: absolute or relative abundance, length–frequency distributions, age frequency distributions (either total or conditional by length), length-at-age, body weight, and proportion discard. Each of these can be from the retained, discarded or total removals by a specific fleet. Each source has an error distribution (either normal, lognormal or multinomial) associated with it, described by either an input sample size or standard deviation.

Input data for SS3

The overall fishery prosecuting the northern stock of hake has been categorized into 7 "fleets", 4 of which use trawl gears, whereas the remaining three use gillnet, longline and a combination of several gears (Table 4). They are based on a combination of the Fishery Units described above. For each fleet, estimates of landings in weight and length–frequency distributions are available. For some fleet only, discards in weight and length–frequency distribution are used.

Table 4. Fleets characteristics and data available for SS3 (Length–Frequency distribution (LFD) and weight of landings and discards).

Fleets	Description	FU	Landings (quarterly)	Discards (quarterly)
SPTRAWL7*	Spanish trawl in VII	04	Yearly : 1978-1989 (LFD+tonnage) Quarterly: 1990-2010(LFD+tonnage)	1994, 1999, 2000, 2003–2008 (LFD + Weight)
FRNEP8	French trawl targeting *Nephrops* in VIII	09	Yearly : 1978-1989 (tonnage) Yearly : 1985-1989 (LFD) Quarterly : 1990-2010 (LFD+tonnage)	2003–2008 (LFD + Weight)
SPTRAWL8	Spanish trawl in VIII	14	Yearly : 1978-1989 (LFD+tonnage) Quarterly: 1990-2010(LFD+tonnage)	2005–2008 (LFD + Weight)
TRAWLOTH	All other trawl	05 + 06 + 08 + 10	Yearly : 1978-1989 (LFD+tonnage) Quarterly: 1990-2010 (LFD+tonnage)	
GILLNET	Gillnet all countries	03 + 13	Yearly : 1978-1989 (LFD+tonnage) Quarterly: 1990-2010 (LFD+tonnage)	
LONGLINE	Longline all countries	01 + 02 + 12	Yearly : 1978-1989 (LFD+tonnage) Quarterly: 1990-2010 (LFD+tonnage)	
OTHERS	Everything else all countries	15 + 16 + 00	Yearly : 1978-1989 (LFD+tonnage) Quarterly: 1990-2010 (LFD+tonnage)	

*** FU04 (and consequently SPTRAWL7) landings and discards contain small amount from area VI as, in some cases, the sampling programme does not allow to make the distinction between area VII and VI.**

For the two Spanish trawl fisheries, it is thought that discarding became much more substantial starting from 1998. For the French *Nephrops* fishery, discarding is thought to have occurred already from 1990. The remaining 4 fisheries (TRAWLOTH, GILLNET, LONGLINE, OTHERS) are assumed not to discard any fish.

Several surveys provide relative abundance indices of abundance and length distributions (Table 5).

Table 5. List of surveys used in SS3.

Surveys	Area	Years	Quarter
EVHOE-WIBTS-Q4	Bay of Biscay and Celtic Sea	1997–(y*-1)	4
RESSGASC	Bay of Biscay	1990–1997 1998–2001	1, 2 ,3 and 4 2 and 4
SpPGFS-WIBTS-Q4	Porcupine Bank	2001–(y-1)	3
IGFS-WIBTS-Q4	North, West and South of Ireland	2003–(y-1)	4

* y = assessment year

No commercial fleet tuning data are used.

SS3 settings (input data and control files):

Years: 1978 to present, 1 area, 4 seasons, both sexes combined.

Length Frequency Distribution are available on a yearly basis from 1978 to 1989 and on a quarterly basis from 1990 to present. No age data are used.

Initial equilibrium catch: annual average of five years (1978–1982) for each fishery.

Variability for landings, discards and survey abundance indices are entered as standard deviation in log-scale, as follows:

> Landings (tonnes): 10% variability
>
> Discards (tonnes): 50% variability
>
> Survey abundance indices: variability externally estimated. As the latter represents only the surveys internal variability, extra variability was added (increment to CV in SS3 control file) according to how representative each survey was felt to be of stock abundance (i.e. the area coverage of the survey as compared to the spatial distribution of the stock). Surveys' CV were increased by 0.1 (EVHOE-WIBTS-Q4), 0.2 (RESSGASC, IGFS-WIBTS-Q4), 0.3 (SpPGFS-WIBTS-Q4).

Length compositions were assigned the following sampling sizes in the SS3 input data file, on the basis of how representative they were felt to be:

> Landings: 125 for all fleets, except SPTRAWL7 for which 50 was used for 1990-1997 and 200 was used from 1998 onwards
>
> Discards: 50 for SPTRAWL7 and SPTRAWL8, 80 for FRNEP8
>
> Surveys: 125

The following multipliers were subsequently applied to the latter sample sizes in the SS3 control file:

Landings and discards: 0.5 for all fleets, except LONGLINE to which a factor of 1 was applied

Surveys: 1 (EVHOE-WIBTS-Q4), 0.525 (RESSGASC, IGFS-WIBTS-Q4), 0.35 (SpPGFS-WIBTS-Q4)

M=0.4.

Von Bertalanffy growth function: Linf=130 cm, K and mean length-at-age 0.75 estimated. Same growth parameters apply to all fish (across morphs, years, etc)

Maturity ogive: length-based logistic, externally estimated and assumed constant over time

Recruitment allocation for Quarter 2 to 3 estimated with respect to Quarter 1. Quarter 2 allocation is time-varying, with annual deviates. Quarter 4 allocation set to 0.

Beverton–Holt stock–recruitment relationship: steepness h=0.999, sigma_R=0.4, R0 estimated.

Recruitment deviations starting in 1970.

F estimation method = 2 (F by fishery and quarter treated as unknown parameters)

Surveys catchabilities constant over time.

RESSGASC survey entered as 4 separate surveys (1 per quarter). Catchabilities are quarter-specific but all quarters use the same selectivity-at-length.

Selectivity only length-based (no age selectivity considered)

Selectivity-at-length uses Pattern 24 (double normal function, with 6 parameters) for fleets SPTRAWL7, FRNEP8, SPTRAWL8, GILLNET, LONGLINE and all surveys. TRAWLOTH and OTHERS use Pattern 1 (logistic function, with 2 parameters). When Pattern 24 is used, parameter P5 is not used except for SPTRAWL7 and SPTRAWL8.

Selectivity-at-length constant over all years.

Retention patterns for fisheries with discards: length-logistic with asymptotic retention = 1 in all cases, and unknown L50 and slope. For SPTRAWL7 and SPTRAWL8, two different patterns of retention over time are assumed, one for years 1978–1997 and the another one from 1998 onwards.

D. Short-term projection

- Model used: length and age-based.
- Software used: Forecast module in SS3.
- Initial stock size. Taken from the SS3 in the last assessment year.
- Natural mortality: Set to 0.4 for all ages in all years.
- Growth model: Von Bertalanffy model, with parameters estimated in the assessment model.
- Maturity-at-length: The same ogive as in the assessment is used for all years.
- Weight-at-length in the stock and in the catch: The same length–weight relationship as in the assessment model.
- Exploitation pattern: Average of the final 3 assessment years (with the possibility of scaling to final year F).
- Intermediate year assumptions: *status quo* F
- Stock–recruitment model used: Beverton–Holt Stock Recruitment relationship estimated in the assessment, with deviances chosen so that recruitment in the projection years approximately matches the geometric mean of estimated recruitment from 1990 until the final assessment year minus 2.

E. Medium-term projections

- No medium-term projections are conducted for this stock.

F. Long-term projections

- Model used: yield and biomass-per-recruit over a range of F values.
- Software used: Forecast module in SS3
- Selectivity pattern: Average of final 3 assessment years.
- Stock and catch weights-at-length: Same length–weight relationship as in the assessment model
- Maturity: Fixed maturity ogive as used in assessment

G. Biological reference points

	WG 1998	ACFM 1998	ACFM 2003	ACOM 2010
MSY $B_{trigger}$				not defined
F_{MSY}				0.24
Flim	No proposal	0.28 (= Floss WG 98)	0.35 (= Floss WG 03)	not defined
Fpa	No proposal	0.20 (= Flim*e-1.645*0.2)	0.25 (= Flim*e-1.645*0.2)	not defined
Blim	No proposal	120 000 t (~ Bloss= B94)	100 000 t (~ Bloss= B94)	not defined
Bpa	119 000 t (=Bloss= B94)	165 000 t (= Blim*e1.645*0.2)	140 000 t (= Blim*e1.645*0.2)	not defined

H. Other issues

None.

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Annex D: Anglerfish in Divisions VIIb-k and VIIIa,b,d

Quality Handbook **ANNEX: D - Anglerfish**

Stock specific documentation of standard assessment procedures used by ICES.

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

Working Group:	WGHMM, Working Group on the Assess ment of Southern Shelf Stocks of Hake, Monk and Megrim
Date:	6 May 2009
Revised by	Jean-Claude Mahé

A. General

A.1. Stock definition

ICES assumes since the end of the 1970s three different stocks for assessment and management purposes: Anglerfish in Division IIa (Norwegian Sea), Division IIIa (Kattegat and Skagerrak), Subarea IV (North Sea), and Subarea VI (West of Scotland and Rockall) (*Lophius piscatorius* and *L. budegassa*); Anglerfish in Divisions VIIb-k and VIIIa,b,d (*L. piscatorius* and *L. budegassa*) and Anglerfish in Divisions VIIIc and IXa (*L. piscatorius* and *L. budegassa*). These stock definitions apply for both anglerfish species White anglerfish (*L. piscatorius*) and Black anglerfish (*L. budegassa*). In Divisions VIIb-k and VIIIa,b,d, the two species are assessed separately but advised as a single stock since the EU gives a unique TAC for both species

A.2. Fishery

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

A.3. Ecosystem aspects

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

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

B. Data

The particularity of the data gathering processes for anglerfish species is that, except in Spain, anglerfishes are sold without any species distinction. The overall catch per species is estimated from the species ratio observed in the biological sampling.

Biological sampling is carried out by the countries contributing most catches, but assumptions about species proportion have to be made for countries reporting raw tonnages for species combined. The amount of tonnage with no biological sampling for species composition has been much reduced since the early 2000’s and in 2007 these represented less than 8% of the total *Lophius* landings. In some countries however, anglerfish are landed as tails only and conversion factors have to be used to estimate total length, which still may introduce errors.

Data are supplied from databases maintained by national Government Departments and research institutions. The figures used in assessment are considered as the best available data at the Working Group time of the year. From year to year, and before the Working Group, small revisions of data could occur. In that case, revised data are explained and incorporated into the historical data series for assessment.

Data are supplied on electronic files to a stock coordinator nominated by the ICES Hake Monk and Megrim (formerly Southern Self Demersal Stocks) Working Group, who compiles the international landings, discards and catch at age data, and maintains the time series of such data with the amendments proposed by countries.

B.1. Commercial catch

Landings data are supplied from databases maintained by national Government Departments and research institutions. Countries providing landings data by quarter and ICES Division are Spain, France, Ireland United Kingdom and Belgium.

The derivation used to compute the landings by fishery units and by species is given in the following table.

Anglerfish in Divisions VIIb-k and VIIIa,b,d - Derivation of the 2008 length compositions, by fishery unit for L. piscatorius and L. budegassa, in Divisions VIIb-k and in VIIIa,b,d.

ICES Division	Fishery unit	Country		2008
	FU 3 Fixed nets	FR	Q	FR.03.08
		EW	Y	total International length distribution species ratio available
	FU 4 Medium and deep waters non-Nephrops	IR	Q	IR.04.08
		FR	Q	FR.04.08
		SP	Q	SP.04.08
		~~EW~~	~~Q~~	~~total International LD~~
VIIb-k	FU 5 gadoid fleets	EW	Q	EW.05.08
		~~FR~~	~~Q~~	~~FR.05.08~~
	FU 6 beam-trawl	BEL	Q	total International LD
		~~EW~~	~~Q~~	~~EW.06.08~~
	FU 8 Nephrops	FR	Q	FR.08.08
	~~FU 9 Nephrops~~	~~FR~~	~~Q~~	~~FR.09.08~~
VIIIa,b	FU 10 artisanal ~~bottom-trawl~~	FR	Q	FR.10.08
	FU 14 medium and deep waters non Nephrops	FR	Q	FR.14.08
		SP	Q	SP.14.08

No discards assumed

Discards: preliminary information is available but not used due to uncertainties in adequacy of raising methodologies used.

B.2. Biological

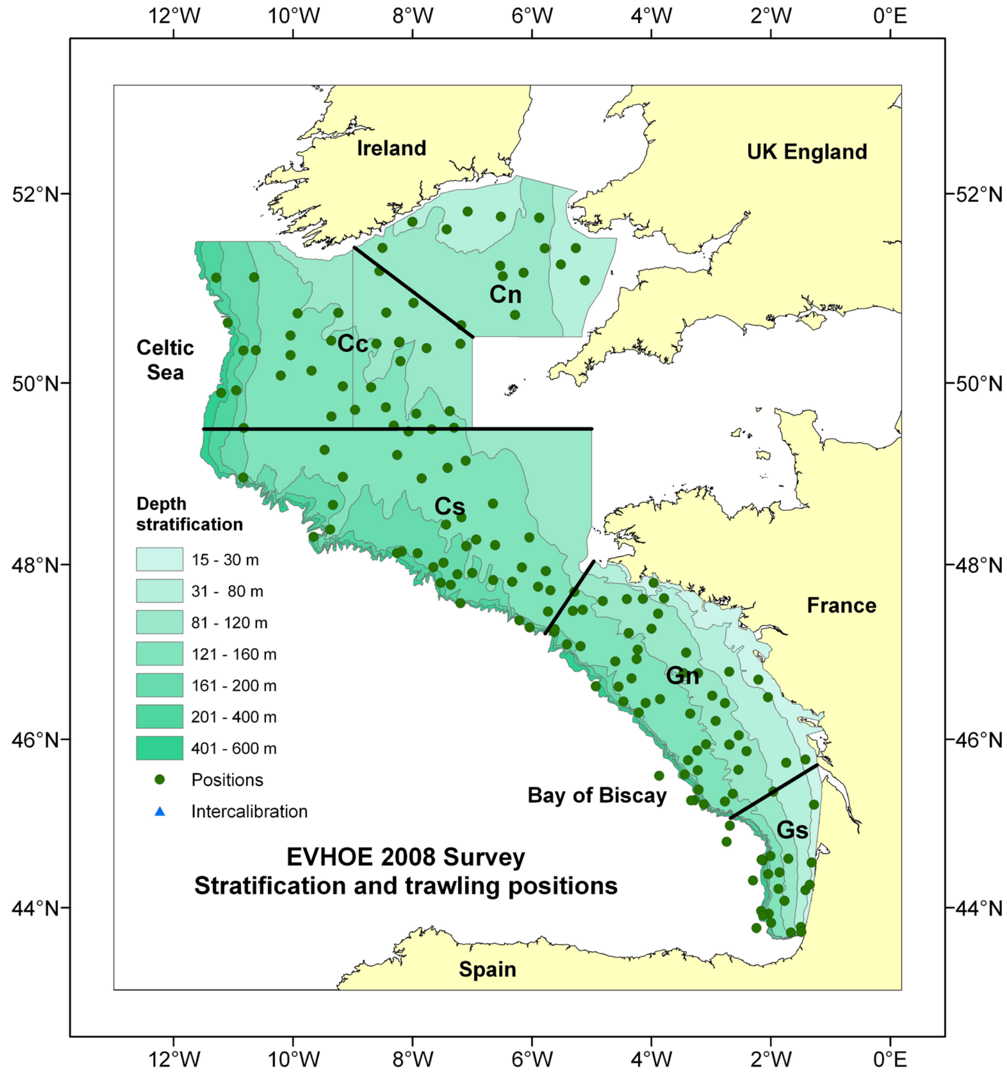
In 2007, WGHMM rejected the XSA age based assessments of both species because of data quality (increased discards not incorporated) and ageing problems clearly identified. Therefore there is no age based data used to assess the stocks. Only length distributions of landings and survey indices are used.

B.3. Surveys

For the first three surveys presented, a full description can be found on the ICES DATRAS website : http://datras.ices.dk/Home/Descriptions.aspx.

<u>The French FR-EVHOE survey</u>

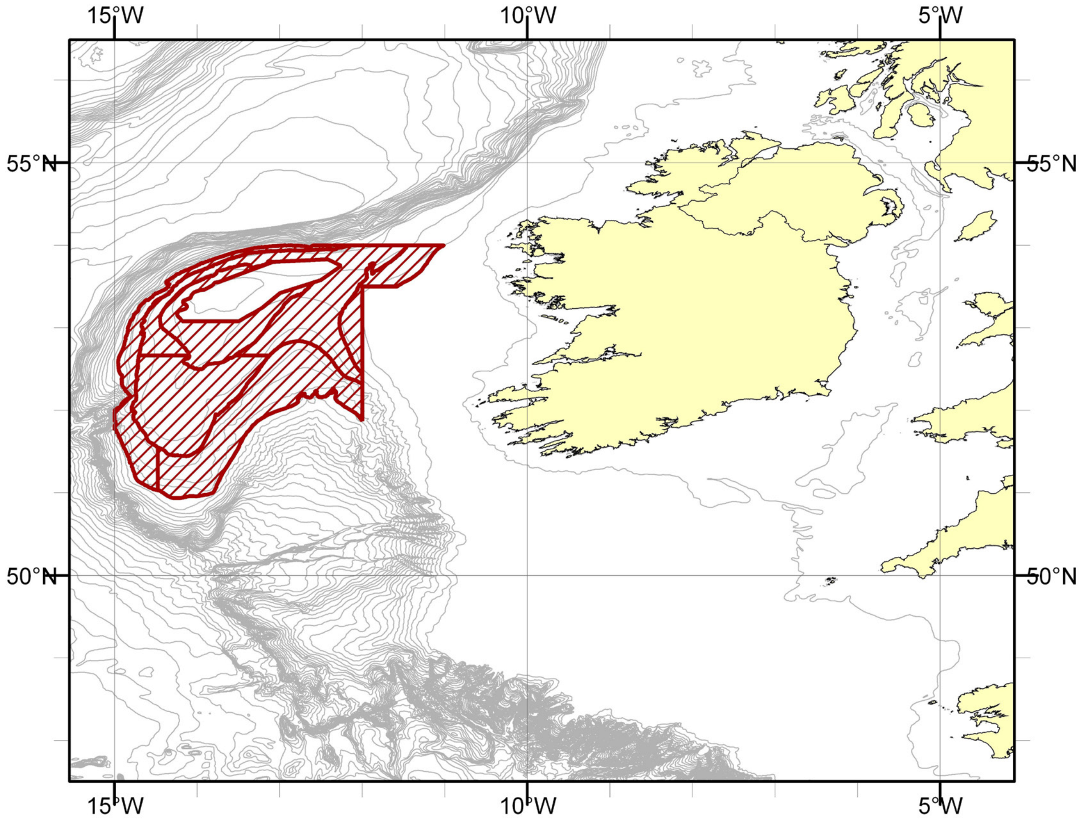
This survey covers the largest proportion of the area of stock distribution. It started in 1997.



Map of Survey Stations completed by the EVHOE Survey in 2008.

<u>**The Spanish Porcupine Groundfish Survey (SP-PGFS)**</u>

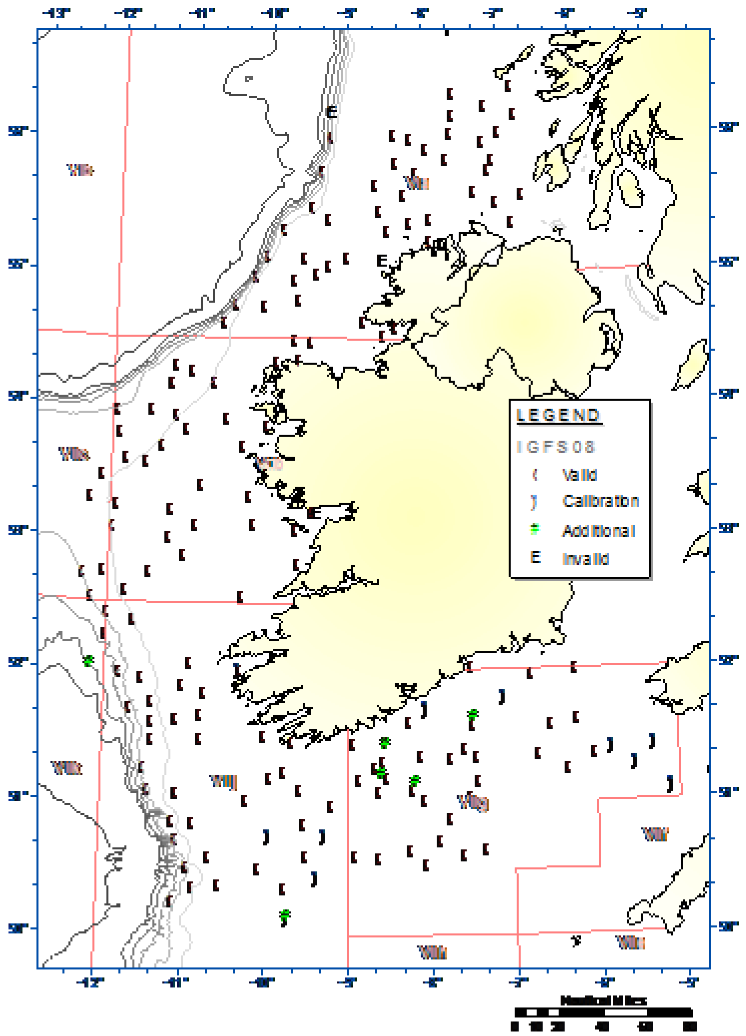
This survey was initiated in 2001 and covers the Porcupine Bank.



Map of area covered by the Porcupine Groundfish Survey.

The Irish Groundfish Survey (IR-IGFS)

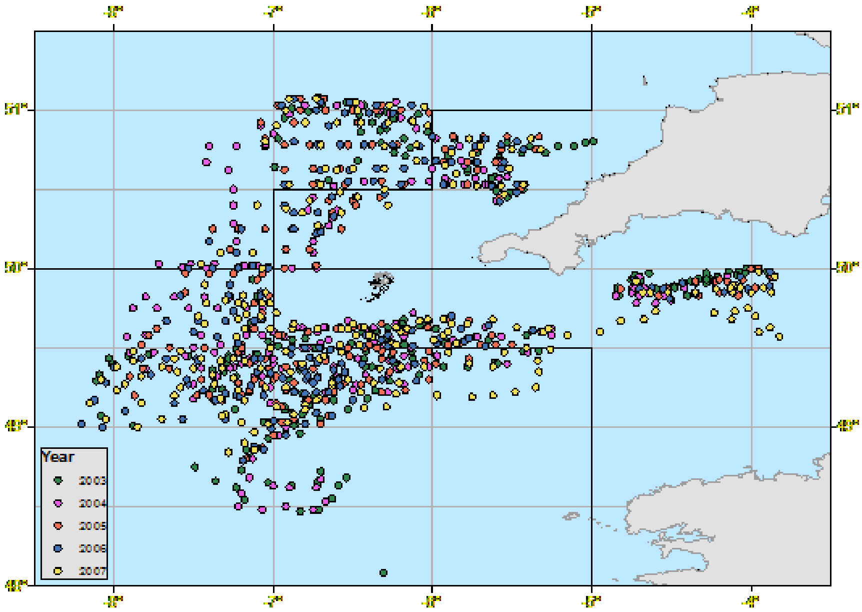
This survey was initiated in 2003 and covers areas around Ireland.



Map of Survey Stations completed by the Irish Groundfish Survey in 2008. Valid = red circles; Invalid = crosses; Intercalibration = blue squares; intercalibration and additional stations not valid for IBTS survey indices = green triangles.

<u>**The English Fisheries Science Partnership survey.**</u>

This survey covers Areas VIIe and VIIf and started in 2003.



Map of Survey Stations completed by the EW-FSP Survey in 2003 - 2007.

A full description of the survey can be found in Section 1.4 of the WGHMM2008 report.

B.4. Commercial CPUE

Effort and LPUE data are available for four Spanish trawl fleets (SP-VIGO7, SP-CORUTR7, SP-BAKON7 and SP_BAKON8). The French data for the FR-FU04 and FR-FU14 are also provided. Finally UK provides effort and LPUE data for EW-FU06.

B.5. Other relevant data

C. Historical Stock Development

In 2007, the Working Group found that the input data showed deficiencies especially as discards were known to be increasing and that ageing problem had become more obvious, consequently the WG rejected an analytical assessment. The assessments of the two species (WG 2009) are based on the analysis of LPUEs, surveys indices and length distributions.

Indicators point to the stocks being stable.

D. Short-Term Projection: NOT USED

E. Medium-Term Projections: NOT USED

F. Long-Term Projections: NOT USED

G. Biological Reference Points

There are precautionary reference points defined for these stocks. However, considering the underestimation of growth that is now obvious for both species, the reference points from earlier assessments are no longer valid. Reference points will have to be redefined based on an approved analytical assessment.

H. Other Issues

The analytical assessment was rejected in 2007 and advice was based on analysis of LPUEs, length frequencies of landings and survey data. In 2008, no new advice was delivered as the information available was considered too weak to provide any advice. The advice given for 2008 was also applicable for 2009.

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Annex E: Stock Annex Megrim in Divisions VIIb-k and VIIIa,b,d

Quality Handbook Stock Annex E

Stock specific documentation of standard assessment procedures used by ICES.

Stock:	Megrim (*Lepidorhombus whiffiagonis*) in Divi sions VIIb–k and VIIIa,b,d
Working Group:	WGHMM (Working Group on Hake Monk and Me grim from the Southern Waters)
Date:	7 May 2011
Revised by	Marina Santurtún

A. General

A.1. Stock definition

Since the end of the 1970s ICES has assumed three different stocks for assessment and management purposes: megrim in ICES Sub-area VI, megrim in Divisions VIIb-k and VIIIa,b,d and megrim in Divisions VIIIc and IXa. The stock under this Annex is called Northern Megrim and defined as megrim in Divisions VIIb-k and VIIIa,b,d.

A.2. Fishery

Megrim in the Celtic Sea, west of Ireland, and in the Bay of Biscay are caught predominantly by Spanish and French vessels, which together have reported more than 65% of the total landings, and by Irish and UK demersal trawlers.

French benthic trawlers operating in the Celtic Sea and targeting benthic and demersal species catch megrim as a by-catch.

Spanish fleets catch megrim targeting them and in mixed fisheries for hake, anglerfish, *Nephrops* and others. Otter trawlers account for the majority of Spanish landings from Subarea VII, the remainder, very low quantities, being taken by netters prosecuting a mixed fishery for anglerfish, hake and megrim on the shelf edge around the 200 m contour to the south and west of Ireland. The catches made by otter trawlers from the port of Vigo comprise around 50% of the total catches.

Most UK landings of megrim are made by beam trawlers fishing in ICES Divisions VIIe,f,g,h.

Irish megrim landings are largely made by multi-purpose vessels fishing in Divisions VIIb,c,g for gadoids as well as plaice, sole and anglerfish.

Countries	ICES area	% landings	Fisheries
Spain	Divisions VIIb,c,e–k and VIIIa,b,d	52%	Otter trawls targeting mixed groups of species (hake, anglerfish, *Nephrops* and other). Netters targeting also mixed species (anglerfish, hake and megrim)
France	Subarea VII	21 %	Benthic trawlers targeting benthic and demersal species
Ireland	Divisions VIIb,c,g	13%	Multipurpose vessels targeting gadoids, plaice, sole and anglerfish
UK	ICES Divisions VIIe,f,g,h	12%	Beam trawlers
Belgium	Divisions VIIb,c,e–k and VIIIa,b,d	1%	Beam trawlers

A.3. Ecosystem aspects

There are two megrim species in the Northeastern Atlantic: megrim (*Lepidorhombus whiffiagonis*) and four spot megrim (*Lepidorhombus boscii*).

Megrim (*L.whiffiagonis*, Walbaum, 1792) is a pleuronectiform fish distributed from the Faeroe Islands to Mauritania (from 70ºN to 26ºN) and the Mediterranean Sea, at depths ranging from 50 to 800 metres but more precisely around 100-300 metres (Aubin-Ottenheimer, 1986).

Four spot megrim (*L. boscii*, Risso 1810) is distributed from the Faeroe Islands (63ºN) to Cape Bojador and all around the Mediterranean Sea. It is found between 150-650 m, but mostly between 200-600 m.

Although, there does not appear to be evidence of multiple populations in the north-east Atlantic, since the end of the 1970s ICES has assumed three different stocks for assessment and management purposes: megrim in Sub-area VI, megrim in Divisions VIIb,c,e-k and VIIIa,b,d and megrim in Divisions VIIIc and IXa.

Spawning period of these species goes from January to March. Megrim spawning peak occurs in February (VIIIa,b,d) and March (VII) along the shelf edge. Males reach the first maturity at a lower length and age than females. For both sexes combined, fifty percent of the individuals mature at about 20 cm and about 2.5 year old (BIOS-DEF, 1998, Santurtún *et al.*, 2000). Their eggs are spherical, pelagic, with a furrow (stria) in the internal part of the membrane and with a fat globule.

Megrim is a demersal species of small-medium size with a maximum size about 60 cm. It is believed that it has a medium-large lifespan, with a maximum age of about 14 - 15 years. It lives mainly in muddy bottoms, showing a gradual expansion in bathymetric distribution throughout their lifetimes, where mature males and juveniles tend to occupy deep waters, immature females shallower waters and, during the very short period when females are mature, the dynamics remain unclear.

The Bay of Biscay and Iberian shelf are considered as a single biogeographic ecotone (a zone of transition between two different ecosystems) where southern species at the northern edge of their range meet northern species at the southern edge of their range as well as for some other Mediterranean species. Since species at the edge of their range may react faster to climate changes, this area is of particular interest in accounting for effects of climate change scenarios, for instance, in the food web models (BECAUSE, 2004)

Megrim belongs to a very extended and diverse community of commercial species and it is caught in mixed fisheries by different gears and in different sea areas. Some of the commercial species that exist in the same ecosystem are hake and anglerfish, however many other species are also found. From the northern to southern areas of the extent of the stock these species include: Octopus, *Rajidae*, *Ommastrephidae*, *Nephrops norvegicus*, *Phycis blennoides*, *Molva molva*, *Pollachius virens*, *Trisopterus* spp (mainly *Trisopterus luscus*), *Trachurus* spp, *Sepia officinalis*, Loligidae, *Micromesistius poutassou*, *Merlangius merlangus*, *Scyliorhynus canicula* and *Pollachius pollachius*.

Demersal fish prey on megrim. Megrims are very voracious predators. Prey species include flatfish, sprat, sand eels, dragonets, gobies, haddock, whiting, pout and several squid species.

Adult megrim feed on small bottom dwelling fish, cephalopods and small benthic crustaceans; juvenile megrim feed on small fish and detritivore crustaceans inhabiting deep-lying muddy bottoms (Rodriguez-Marín & Olaso, 1993).

It is believed that megrim movements are more aggregation and disaggregation movements in the same area instead of highly migratory movements between areas (Perez, pers. Comm.).

Although a comprehensive study on the role of megrim in the ecosystem of the complete sea area distribution has not been carried out, some general studies are available.

Fisheries modify ecosystems through more impacts on the target resource itself, the species associated to or dependent on it (predators or preys), on the tropic relationships within the ecosystem in which the fishery operates, and on the habitat.

At present, both the multi species aspect of the fishery and the ecological factors or environmental conditions affecting megrim population dynamics are not taken into account in assessment and management. This is due to the lack of knowledge on these issues.

B. Data

Data are supplied from databases maintained by national Government Departments and research institutions. The figures used in assessment are considered as the best available data at the Working Group time of the year. From year to year, and before the Working Group, small revisions of data could occur. In that case, revised data is explained and incorporated into the historical data series for assessment.

Data are supplied on electronic files to a stock coordinator nominated by the ICES Hake, Monk and Megrim (formerly Southern Self Demersal Stocks) Working Group, who compiles the international landings, discards and catch at age data, and maintains the time series of such data with the amendments proposed by countries.

B.1. Commercial catch

Landings data are supplied from databases maintained by national Government Departments and research institutions. Countries providing landing data by quarter and ICES Division are Spain, France, Ireland, United Kingdom and Belgium.

B.2. Discard data

In many fisheries, discards constitute a major contribution to fishing mortality in younger ages of commercial species. However, relatively few assessments in ICES stock working groups take discards into consideration. This happens mostly due to the long time series needed (not available for all the fleets involved in the exploitation of most stocks) but also to the large amount of research effort needed to obtain this kind of information (Alverson *et al*, 1994; Kulka, 1999). The knowledge of discards and their use in stock assessment may also contribute, in co-operation with the industry, to refine fishing and management strategies (Kulka, 1999).

Spain started sampling discards on board commercial vessels in 1988, more specifically the Spanish trawl fleet operating in Sub-areas VI and VII was firstly target. During 1994, discard sampling was undertaken for other fleets (long liner (EC Project: Pem/93/005)). Sampling discards continued during 1999, 2000 for IV, VII, VIII and IX (EC Project: 98/095) and in 2001, partly just for cephalopods and during the first and last quarter of the year (Bellido *et al*., 2003; Santurtun *et al*. 2004). Since 2002 and under the National Sampling Programs, Spain continues sampling discards on board commercial fleets.

Until 2003, the standard procedure used for calculation of the Spanish discards estimators was based on a haul basis as described by Trenkel (2001). However, although these procedures were applied, there was not an estimate of the error and variance in every step of the analysis. Errors were only estimated on a haul basis.

From 2003 onwards and following the recommendation of the Workshop on Discard Sampling Methodology and Raising Procedures held in Charlottenlund (Denmark) in 2003 (Anon, 2003), general guidelines on appropriate sampling strategies and methodologies were described and then, the primary sampling unit was defined as the fishing trip instead of haul.

Discard data available by country and the procedure to derivate them are summarised in Table B.2.1.

From 2000 to 2001 a reduction in the minimum legal size (MLS), from 25 to 20 cm took place.

Since using the French discards from the 1991 survey to obtain estimates for 1999 and subsequent years was considered unreliable, only the Spanish data were used for these years, applied only to the Spanish fleets. This has led to an artificial decrease in the amount of total discards, since no estimates for French fleets were available.

Some preliminary discards estimates from Ireland and United Kingdom were available to the group at the fleet and sampling level, respectively.

Table B.2.1 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)	-	-
1996	(FR91)	(SP94)	-	-
1997	(FR91)	(SP94)	-	-
1998	(FR91)	(SP94)	-	-
1999	-	**SP99**	-	-
2000	-	**SP00**	-	-
2001	-	**SP01**	-	-
2002	-	(SP01)	-	-
2003	-	**SP03**	**IR***	***UK****
2004	-	**SP04**	**IR***	-
2005	-	**SP05**	**IR***	-
2006	-	**SP06**	**IR***	***UK****
2007	-	**SP07**	**IR***	***UK****
2008	-	**SP08**	**IR***	***UK****
2009	-	**SP09**	**IR***	***UK****
2010	-	SP10	IR*	*UK**

- In bold: years where discards sampling programs provided information

- In bold and * (italics): years where discards sampling programs provided information, just at sampling level, but are not used in the derivation

- In bold and *: years where discards sampling programs provided information but are not used in the derivation

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

B.3. Biological

Quarterly/annually length/age composition data are supplied from databases maintained by national Government Departments and research institutions. These figures are used as the best available data to carry out the assessment.

France has provided quarterly length distribution by fishery unit and by sex since 1984. For 2002, 2003, 2004 and 2006 French data (length distributions, catch at age by FU and ALKs) were not available for the assessment. In 2005 and 2006, length distributions, catch at age data by quarter and sex were available. In 2007 and 2008, annual length distributions by sexes were provided. For 2010, no French data was provided to the group.

Annual length compositions of landings are available by country and fishery unit, for the period 1984-1990 by sex. Since 1991, annual length composition has been available for sexes combined for most countries except for France. Since 1999, the length compositions have been available on a quarterly or semestral basis. For Spain, data are available for sexes combined, except in 1993, when data were presented for separate sexes and on an annual basis. As in previous years, derivations were used to provide length compositions where no data other than weights of landings were available.

No ALKs were available for the period 1984–1986, and age compositions for these years were derived from a combined-sex ALK based on age readings from 1987 to 1990.

Quarterly ALKs for separate sexes were available for UK (E&W). Combined Annual ALKs were applied to their length distributions. Annual age composition of discards and semestral for landings per fleet, based on semestral ALKs for both sexes combined, were available and applied from Spain in Subarea VII and in Divisions VIIIa,b,d. Quarterly age compositions for sexes combined were available for Irish catches for Divisions VIIb,c,e-k.

The following table gives the source of length frequencies and ages for Northern Megrim:

	France		Ireland		Spain		UK	
	Length distribution	ALK	Length distribution	ALK	Length distribution	ALK	Length distribution	ALK
1984-1990	Quarter, by sex	(1984-1986) Synthetic ALKs using age reading from 1987-1990	Annual, by sex	(1984-1986) Synthetic ALKs using age reading from 1987-1990	Annual, by sex	(1984-1986) Synthetic ALKs using age reading from 1987-1990	Annual by sex	(1984-1986) Synthetic ALKs using age reading from 1987-1990
1991	Quarter, by sex	Quarter, combined	Annual, combined	Quarter, by sexes	Annual, combined	Semestral, combined	Annual, combined	Quarter, combined
1992	Quarter, by sex	Quarter, combined	Annual, combined	Quarter, by sexes	Annual, combined	Semestral, combined	Annual, combined	Quarter, combined
1993	Quarter, by sex	Quarter, combined	Annual, combined	Quarter, by sexes	Annual, by sexes	Semestral, combined	Annual, combined	Quarter, combined
1994	Quarter, by sex	Quarter, combined	Annual, combined	Quarter, by sexes	Annual, combined	Semestral, combined	Annual, combined	Quarter, combined
1995	Quarter, by sex	Quarter, combined	Annual, combined	Quarter, by sexes	Annual, combined	Semestral, combined	Annual, combined	Quarter, combined
1996	Quarter, by sex	Quarter, combined	Annual, combined	Quarter, by sexes	Annual, combined	Semestral, combined	Annual, combined	Quarter, combined
1997	Quarter, by sex	Quarter, combined	Annual, combined	Quarter, by sexes	Annual, combined	Semestral, combined	Annual, combined	Quarter, combined
1998	Quarter, by sex	Quarter, combined	Annual, combined	Quarter, by sexes	Annual, combined	Semestral, combined	Annual, combined	Quarter, combined

1999	Quarter, by sex	Quarter, combined	Quarter, combined	Quarter, combined	Semestral, combined	Semestral, combined	Quarter, combined	Quarter, by sexes
2000	Quarter, by sex	Quarter, combined	Quarter, combined	Quarter, combined	Semestral, combined	Semestral, combined	Quarter, combined	Quarter, by sexes
2001	Quarter, by sex	Quarter, combined	Quarter, combined	Quarter, combined	Semestral, combined	Semestral, combined	Quarter, combined	Quarter, by sexes
2002	NA	NA	Quarter, combined	Quarter, combined	Semestral, combined	Semestral, combined	Quarter, combined	Quarter, by sexes
2003	NA	NA	Quarter, combined	Quarter, combined	Semestral, combined	Semestral, combined	Quarter, combined	Quarter, by sexes
2004	NA	NA	Quarter, combined	Quarter, combined	Semestral, combined	Semestral, combined	Quarter, combined	Quarter, by sexes
2005	Quarter, by sex	Quarter, by sex	Quarter, combined	Quarter, combined	Semestral, combined	Semestral, combined	Quarter, combined	Quarter, by sexes
2006	Quarter, by sex	Quarter, by sex	Quarter, combined	Quarter, combined	Semestral, combined	Semestral, combined	Quarter, combined	Quarter, by sexes
2007	Annual, by sex	NA	Quarter, combined	Quarter, combined	Semestral, combined	Semestral, combined	Quarter, combined	Quarter, by sexes
2008	Annual, by sex	NA	Quarter, combined	Quarter, combined	Semestral, combined	Semestral, combined	Quarter, combined	Quarter, by sexes
2009	NA	NA	Quarter, combined	Quarter, combined	Semestral, combined	Semestral, combined	Quarter, combined	Quarter, by sexes

A fixed natural mortality of 0.2 is used for all age groups and all years both in the assessment and the forecast.

The maturity ogive, obtained by macroscopy, for sexes combined calculated for Subarea VII (BIOSDEF, 1998), has been applied every year. It is as follows:

Age	0	1	2	3	4	5	6+
Maturity	0.00	0.04	0.21	0.60	0.90	0.98	1.00

As in previous years, SSB is computed at the start of each year, and the proportions of M and F before spawning were set to zero.

B.4 Surveys

UK survey Deep Waters (UK-WCGFS-D, Depth > 180 m) and UK Survey Shallow Waters (UK-WCGFS-S, Depth < 180 m) indices for the period 1987–2004 and French EVHOE Groundfish Survey (EVHOE-WIBTS-Q4) results for the period 1997–2010 are available.

An abundance index was provided for the Spanish Porcupine groundfish survey from 2001 to 2010.

Irish Groundfish Survey is also from 2003 to 2010.

Surveys available for the assessment:

Type	Name	Year range	Age range
UK Survey Deep Water	UK-WCGFS-D	1987-2004	1-10+
UK Survey Shallow Water	UK-WCGFS-S	1987-2004	1-10+
French EVHOE Groundfish Survey	EVHOE-WIBTS-Q4	1997-2010	1-9
Spanish Porcupine Groundfish Survey	SpPGFS-WIBTS-Q4	2001-2010	0-10+
Irish Groundfish Survey	IGFS-WIBTS-Q4	2003-2010	0-10+

Surveys used in the update assessment:

Type	Name	Year range	Age range
French EVHOE Groundfish Survey	EVHOE-WIBTS-Q4	1997-2010	1-9
Spanish Porcupine Groundfish Survey	SpPGFS-WIBTS-Q4	2001-2010	0-10+
Irish Groundfish Survey	IGFS-WIBTS-Q4	2003-2010	0-10+

It must be noted that area covered by the three surveys does not overlap, just the northern component of EVHOE-WIBTS-Q4 and the southern coverage of IGFS-WIBTS-Q4.

B.5 Commercial CPUE

Commercial CPUE data from the fleet Cantábrico (SP-CANTAB7) used until year 2010 Working Group have been renamed as Baka trawlers from Ondarroa in Subarea VII (SP-BAKON7) to be consistent with the fleet name used in other stocks assessments for this same fleet.

Commercial series of fleet-disaggregated catch-at-age and associated effort data were available for three Spanish fleets in Subarea VII (A Coruña (SP-CORUTR7) and Baka trawlers from Ondarroa in Subarea VII (SP-BAKON7) from 1986 to 2010, and Vigo (SP-VIGOTR7) 1984–2010. From 1985 to 2008, LPUEs from four French trawling fleets: FR-FU04, Benthic Bay of Biscay, Gadoids Western Approaches and Nephrops Western Approaches are available. No update for the French LPUEs series has been provided to the group. Data for the Irish fleet (IR-7-OT) from 1995 to 2005 is not presented as it was removed in 2007 because of LPUE patterns in different areas and major changes in the fleet structure over time.

B.6 Other relevant data

The group reiterates the importance of incorporating estimates of discards from all main countries involved in the Northern Megrim fishery, specifically France, to detect possible recruitment processes that are not completely registered in the catch at age matrix and LPUE.

C. Historical Stock Development

Starting from 2007, no analytical assessment has been carried out. Assessment is based on discard data (Spanish data series and "preliminary" discard data from UK, and IR), catch at age data, survey indices and commercial CPUEs and LPUEs data series of the commercial fleets described in section B5.

Model used until 2006: XSA. Information on XSA options in the past is provided as background for stock coordinator and reviewers.

Software used: VPA95 Lowestoft suite

Model Options chosen (until 2006):

Age recruitment	1
Taper	Yes (tricubic) – 20
Plus group	10
Tuning range	All
Ages catch dep. Stock size	No
Q plateau	8
F shrinkage se	1.5
year range	5
age range	3

Input data types and characteristics (in 2006 XSA):

Type	Name	Year range	Age range	Variable from year to year Yes/No
Caton	Catch in tonnes	1984-2005	1-10+	Yes
Canum	Catch at age in numbers	1984-2005	1-10+	Yes
Weca	Weight at age in the commercial catch	1984-2005	1-10+	Yes
West	Weight at age of the spawning stock at spawning time.	1984-2005	1-10+	Yes
Mprop	Proportion of natural mortality before spawning	1984-2005	1-10+	NO
Fprop	Proportion of fishing mortality before spawning	1984-2005	1-10+	NO
Matprop	Proportion mature at age	1984-2005	1-10+	NO
Natmor	Natural mortality	1984-2005	1-10+	NO

Tuning data (in 2006 XSA):

Type	Name	Year range	Age range
Commercial Tuning fleet	SP – VIGOTR7	1984-2005	2-9
Commercial Tuning fleet	FR – FU04	1988-2001	4-9
Survey	UK-WCGFS-D	1993-2004	2-3
Survey	EVHOE-WIBTS-Q4	1997-2005	1-9

D. Short-term projection (until 2006):

• Model used: Age structured

• Software used: MFDP prediction with management option table and yield per recruit routines. MLA suite (WGFRANSW) used for sensitivity analysis and probability profiles.

• Initial stock size. Taken from the XSA for age 1 and older. The recruitment at age 1 in the last data year is estimated as a short-term GM (1987 onwards).

• Natural mortality: Set to 0.2 for all ages in all years.

• Maturity: The same ogive as in the assessment is used for all years.

• F and M before spawning: Set to 0 for all ages in all years.

• Weight-at-age in the stock: average stock weights for last three years.

• Weight-at-age in the catch: Average weight of the three last years.

• Exploitation pattern: Average of the three last years. Discard F's, are held constant while landings F's are varied in the management option table.

• Intermediate year assumptions: status quo F

• Stock recruitment model used: None, non-parametric bootstrap for the whole period.

• Procedures used for splitting projected catches: vectors in each of the last three years of the assessment are multiplied by the proportion landed or discarded at age to give partial Fs for landings and discards. The vectors of partial Fs are then averaged over the last three years to give the forecast values.

E. Medium-Term Projections: NOT USED

F. Long-Term Projections (until 2006):

• Model used: yield and biomass per recruit over a range of F values that may reflect fixed or variable discard F's.

• Software used: MFY or MLA

• Maturity: Fixed maturity ogive as used in assessment.

• Stock and catch weights-at-age: mean of last three years

• Exploitation pattern: mean F array from last 3 years of assessment (to reflect recent selection

patterns).

Procedures used for splitting projected catches: Catches are not split

G. Biological Reference Points

	ICES considers that:	ICES proposed that:
Limit reference points	B_{lim} is not defined.	B_{pa} be set at 55 000 t.
	F_{lim} is 0.44.	F_{pa} be set at 0.30.
Target reference points		F_y is not defined.

Technical basis:

$\mathbf{B}_{lim}$ = Not defined.	$\mathbf{B}_{pa} = \mathbf{B}_{loss}$. There is no evidence of reduced recruitment at the lowest biomass observed and $\mathbf{B}_{pa}$ was therefore set equal to the lowest observed SSB.
$\mathbf{F}_{lim} = \mathbf{F}_{loss}$.	$\mathbf{F}_{pa} = \mathbf{F}_{med}$; this implies a less than 45% probability that ($SSB_{MT} < \mathbf{B}_{pa}$).

H. Other Issues

Starting from 2007, no analytical assessment has been conducted. A benchmark workshop on this stock is planned for first quarter of 2012.

2008 Review group issues:

There is a serious shortage of basic information for this stock due to severe deficiencies in the data (lack of updates, gaps in time series, little data on discards, limited survey information). There are conflicting signals on stock trends both from surveys and LPUE data, and it will require considerable effort to provide a reliable assessment for this stock.

Data deficiencies in 2008

1) Limited discards data available: Only Spanish discard data are used. Some preliminary, not raised, discard data supplied from UK. Ireland raised discard data is provided. No French discard data are delivered.
2) Limited survey information, particularly on the strength of the incoming year classes: French EVHOE Groundfish Survey data should be provided.
3) Conflicting trends in commercial tuning data: a complete review of the commercial CPUEs from Ireland is needed. Update CPUEs of the French tuning series.
4) Segmentation on the main commercial fleets used in the assessment should be revised and, if appropriated, applied.

Data improvement in 2009:

1) Limited discards data available: French discard data is still not available. UK "preliminary" unraised data was delivered. Spain and Ireland provided raised estimations of discards.
2) Substantial improvement in survey information. The French EVHOE Groundfish Survey index series by age has been updated and revised.
3) Revision of Commercial CPUE series. The Irish Otter trawl tuning fleet has not yet been revised. French Fleets have been all updated and revised.

4) No new fleet segmentation of tuning fleet data series has been proposed and consequently no new data have been handled in.

2009 Review group issues:

- "severe deficiencies in the data" for this stock. There appears to be an on-going effort to update and revise data for this stock. The lack of discard data from all countries involved in the fishery is of particular concern, as it is likely that the international catch of this stock is underestimated. Only one country has provided discard data since 1999 (Spain) and this is the only time series incorporated in the assessment.
- Additionally, concern was expressed that survey indices conflict in their depiction of trends in biomass over time. Specifically, the Irish groundfish survey indicated much higher biomass levels in 2004-2006 than the French and Spanish groundfish surveys. Furthermore, commercial catch-effort data show different trends for the fishery in recent years. LPUE from the French fishing fleet appears to be stable since 2005, whereas the CPUE of the Spanish fleet indicates an increasing trend since 2005, with a decrease in 2008.
- This stock is targeted as part of a mixed fishery (hake, megrim, sole, cod, plaice, and *Nephrops*), but this was not noted in the 2009 report. Ecosystem information was not considered in examination of stock trends.

Data deficiencies in 2009

In 2010, quality has even decreased.

- No estimation for catches for this stock are delivered this yeas as France has not provided landing data.
- Limited discards: Lack of discards data for all countries and years continues to be a major problem for this stock. No data other than Spanish and Irish data series have been provided for the assessment. Only sampling data from United Kingdom were available.
- Commercial tuning data for four French fleets have not been been updated. The Irish Otter trawl LPUEs series has not been revised for the time of the meeting.
- No segmentation of the main commercial fleets used in the assessment has been carried out.

Improvement of 2010 data:

The above data deficiencies should be corrected for the preparation and development of a successful benchmark.

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Annex F Stock Annex Bay of Biscay Sole

Quality Handbook Stock Annex F

Stock specific documentation of standard assessment procedures used by ICES.

Stock:	Sole (division VIIIab)
Working Group:	Assessment of Hake, Monk and Megrim Stocks
Date:	WKFLAT 2011 (G. Biais and M. Lissardy)
Last updated:	WGHMM 2011 (M. Lissardy)

A General

A.1 Stock definition

The Bay of Biscay sole stock extends on shelf that lies along Atlantic French coast from the Spanish boarder to the West point of Brittany. This shelf forms a geographical unit, being narrow at its two extreme parts, particularly in the south. As sole is chiefly present at less than 150 m, this geography of the living area gives some supports to the absence or only limited exchanges with other southern or northern stocks. However, a tagging experiment carried out in 1992 on two nursery areas has shown that fish may move from southern coast of Brittany to the Iroise sea, in the West of Brittany (KoutsiKopoulos *et al*., 1993).

Several spawning grounds are known at depth from 30 to 100 m , from south to north (Arbault et *al*., 1986) :

- in the north of Cap Breton, off the Landes coast,
- between Arcachon and the Gironde estuary,
- in front of La Rochelle,
- in front of the Loire estuary,
- in several but limited areas off the southern coast of Brittany.

Nursery grounds are located in the coastal waters, in bays (Pertuis d'Antioche, Pertuis Breton, Baie de Bourgneuf) and estuaries (Gironde, Loire, Vilaine) (Le Pape et *al*., 2003a).

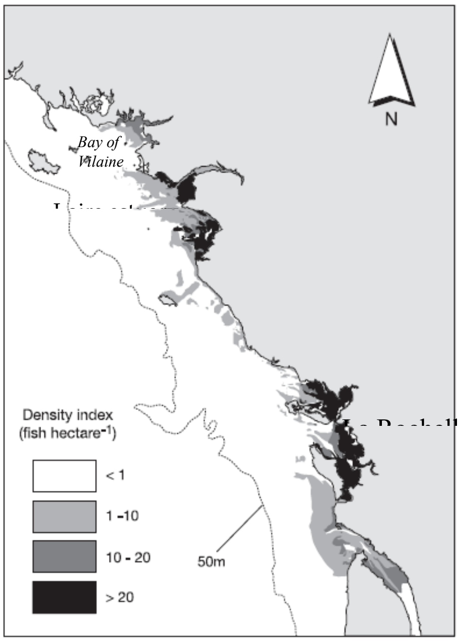


Figure 1: Fitted 0-group sole density (number of fish per hectare) in the Bay of Biscay (Le Pape et *al.*, 2003a).

A.2 Fishery

The French fleet is the major participant in the Bay of Biscay sole fishery with landings being about 90% of the total official international landings over the historical series. Most of the remaining part is usually landed by the Belgian fleet.

The fishery is largely a fixed net fishery directed on sole, particularly in the first term on the year. The other component is a French and Belgian trawl fishery. The French trawlers are otter trawlers with mixed species catches (sole, cuttlefish, squid, hake, pout, whiting….). The Belgium trawlers are beam trawlers directed at sole, but monk is an important part of its catch. The French coastal boats of these two fisheries have a larger proportion of young fish in their catch than offshore boats. These boats less than 12 m long contribute to the landings by about one third from 2000 onwards. Sole is a major resource for all these boats, given the price of this species on the market. Although the species is taken throughout the year, the catch of coastal netters is less important in autumn, those of coastal trawlers in winter and those of offshore French boats are heaviest in the first quarter.

Otter trawling predominated until the late 1980s, including a small-mesh shrimp fishery which decreased markedly in the beginning of the 1990s. The fixed fishery begun in the 1980s and it have expanded in the 1990 to account for two third to three quarters of the French landings in the beginning of 2000s. The beam trawl effort increased also rapidly and continuously in the 1990s. It has decreased after 1999 until 2004 but it has returned to its previous 2001-2002 level in 2006-2007. On the opposite, the otter trawl effort shows a decreasing trend until 1999 but it is stable since then.

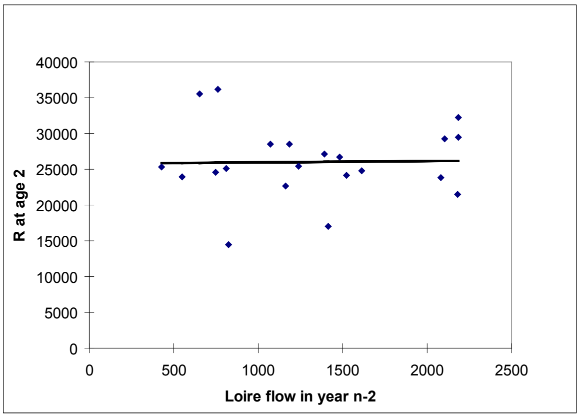
Catches have increased continuously since the beginning of the 1980s, until a maximum was reached in 1994 (7 400 t). They have decreased afterwards to 3600-4800t in 2003-2010. The year 2009 is the lower.

A.3 Ecosystem aspects

The quality and the extent of the nursery grounds have likely a major effect in the dynamic of sole recruitment. Studies in Vilaine bay showed a significant positive relationship between the fluvial discharges in winter-spring and the size of the nursery (Le Pape et *al.*, 2003b). The extent of the river plume influences both the larval supply and the size and biotic capacity of habitats in estuarine nursery grounds and determines the number of juveniles produced.

The WGSSDS looked at the possibility of such effect for the whole Bay of Biscay stock at it 2006 meeting. The relationship between recruitment and river flows was investigated using the Loire river flow in the first half of the year which is considered to be a representative index of the water discharge influences on nursery areas in the Bay of Biscay. Unfortunately, no relationship can be seen between this index and the recruitment at age 2 (Figure 2). The environmental effect is likely to be more complex at the Bay of Biscay scale.

Figure 2: relationship between recruitment at age 2 (as estimated by WGSSDS in 2006) and mean Loire flow in first half year



B. Data

B.1 Commercial Catch

B.1.1 Discards estimates

Discard data are not included in the assessment because the available discards estimates are limited and, furthermore, may be biased (see thereafter).

<u>Discards data collected within the DCF regulation framework:</u>

These observations have 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, if one considers the discards have probably been high in 2009 because the 2007 year class seems to have been above the mean according to the ORHAGO survey, and if on uses the observed ratio of discards on landings of the inshore trawler fleet in 2009, which is likely to be an overestimate because the observed trips were mainly in nursery areas, the discards of the inshore trawlers are no more than 5 % of the landings in number. Consequently, the lack of discards data does not appear to be a major problem for the quality of the assessment, notwithstanding that their estimates will increase the quality of the recruitment series.

Discards estimates of the French offshore trawlers provided by the RESSGASC surveys from 1987 to 2003:

Discards estimates of the French offshore trawlers were provided by the French trawl surveys FR-RESSGASC-S from 1987 to 2002. These surveys were carried out each quarter until 1997 and in the second and last quarter from 1998 to 2002.

In 2002, this survey was discontinued because the discards estimates that it provides were estimated to depend on the following questionable assumptions:

1) Trawls of the Gwen Drez R/S and the offshore trawlers have the same selectivity,
2) Gwen Drez R/S operate in the same area and in the same conditions than the offshore trawlers during the quarter (up to 1997) or the semester of the survey (quarter 4 year n + quarter 1 year n+1 for November survey year n; quarter 2 and 3 for may survey).

These discards estimates are been included several years in the assessments. They have represented about 1 to 3 % of the total catches from 1991 to 2003 and less than 0.5% since in 2002 and 2003. Given their low contribution to the total catch and the uncertainty due to the assumptions on which they are based, they have been no longer used in the assessment, as recommended by ACFM, since 2005.

Their estimation method may be finding in the annexes appended to the 2005 and 2006 WGSSDS reports or in the WGHMM stock annexes from 2007 to 2010 (Bay of Biscay sole stock was moved from WGSSDS to WGHMM in 2007)

B.1.2 Landing numbers at length

The quarterly French sampling for length compositions is by gear (trawl or fixed net) and boat length (below or over 12 m long). The contributions of each of these components of the French fleet to the landings are estimated by quarter from logbook data, assuming that the landings associated with logbooks are representative of the whole landings. In 2000-2002, surveys on fishing activities by month have provided a likely less biased estimate of landing split by gear than logbooks, which are filled in only by a part of the fleet (50-60% of the landings in 2000-2002). As logbooks are often recorded in the file with delay, the percentage of landings associated with logbook may be well below preceding years, particularly in the last quarter. In that case, the process is to use logbooks to get a landing split in the last year if it is close to the mean over the three preceding years otherwise the quarterly mean over the three preceding years is used.

B.1.3 Catch number at age

Age reading method

From 1984 to 2008, the ages in the French landings have been determined by reading otoliths which have been burnt and manually cut. From 1996 onwards, the ages in Belgian landings begun to be determined by reading the age on thin slices of otolith.

In 2005, the ages in French landings begun to be also determined by using this latter method which is the more commonly used for sole age reading. However, in order to estimate the effect of the change in age reading method, from 2005 to 2008 the age reading of French sampled fishes were carried out using the two methods. One otolith was burnt and the second was collected to get thin slices.

Two catch and weight at age 1984-2008 time series can thus be used to carry out two assessments, the set of data differing one from the other in the four terminal years. A comparison of these two assessments was presented to the 2010 WGHMM. It shows only limited differences in the outputs. Consequently, the French catch and weight at age were revised from 2005 onwards at the 2010 WGHMM to use the 2005-2009 data set provided by age reading on otolith slices, which is now the unique age reading method for the Bay of Biscay sole stock.

ALKs use to get catch at age estimates

Age compositions of the French landings and discards (up to 2003) are estimated using quarterly ALKs. Up to 1998, it is only FR-RESSGASC-S surveys ALKs. From the second half of the 1998 year and up to 2002, the first and third quarter ALKs are obtained from commercial landings samples. In 2003, commercial landing samples are completed by fish caught during a survey which was planned to design gear and methodology for the future survey ORHAGO aiming at a sole abundance index series in the Bay of Biscay. In 2004 and 2005, only market samples are used. From 2006 onwards, market samples are mainly used but the ORHAGO survey series provides age estimates at length for a large part of the landing length distribution in the last quarter of the year. Another survey (Langolf) can provide also some fish in the second quarter. Market samples are used to complete these ALKs for the upper part of the distribution.

Prior to 1994, the age composition of French offshore trawler catches is raised to include Belgian landings. In 1994 and 1995, FR-RESSGASC-S ALKs are applied to Belgian length distributions. From 1996 ahead, catch numbers at age of the Belgian fleet are estimated with Belgian ALKs. French and Belgian age composition are added before being raised to the total international catch except in 2001 where the Belgian age compositions were raised to the total of Belgian and Dutch landings.

B.2 Biological

Weights at Age

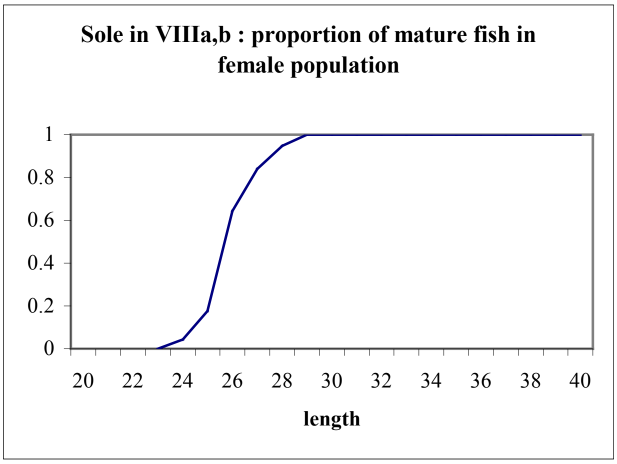
French mean weights at age are estimated using quarterly length-weight relationships in which weight are gutted weight multiplicated by the fresh/gutted transformation coefficient of French landing. This latter was changed from 1.11 to 1.04 in 2007. The French mean weights at age in catches are consequently estimated with a fresh/gutted transformation coefficient which is 1.11 up to 2006 and 1.04 from 2007 onwards.

Belgian mean weights at age are straight estimates. International mean weights at age are French-Belgian quarterly weighted mean weights.

Stock weights are set to the catch weights but always using the old fresh/gutted transformation coefficient of French landing (1.11) to have the predicted spawning biomass comparable to the biomass reference point of the management plan (B_{pa} as estimated in 2006 using mean weights in the stock which were mean weights in the catches).

Maturity ogive

In assessments up to the 2000 Working Group, a knife-edge maturity was used, assuming a full maturity at age 3.



During the 4 first months in 2000, the maturity at length and at age was observed on 296 female fish, 112 being between 24 cm and 28 cm long, which is the observed length range for maturity occurrence of sole in Bay of Biscay. The sampling was assumed to be at random within a length class of 1 cm. The maturity ogive was then estimated applying a maturity/age/length key thus obtained to the length distribution of the first quarter in 2000.

The maturity at age was so estimated to be:

Age	≤ 1	2	3	4	≥ 5
Mature	0	0.32	0.83	0.97	1

Natural Mortality

Natural mortality is assumed to be 0.1 for all age groups and all years.

B.3 Surveys

RESSGASC surveys

Quarterly RESSGASC survey series are available from 1987 to 2002 but it worth noting that these surveys were carried out to provide hake discard estimates and consequently not well designed for providing sole abundance indices. Each quarter from 1987 to 1998, and thereafter each second and fourth quarter of the year, the survey aimed to catch as commercial fishing boats in the same areas. These series were disrupted in 2003. They have been withdrawn from the assessment by the 2011 WKFLAT because they no longer contribute to the estimates of the terminal population numbers.

ORHAGO survey

The ORHAGO survey was launch in 2007. The fishing gear is a beam trawl with 40 mm codend. This survey is carried out in November-December in order to have a good catchability of sole at the age 1. The sampling plan is systematic. 50 hauls are distributed in 10' latitude by 10' longitude rectangles all over the sole habitat in the Bay of Biscay. The haul positions are kept unchanged from year to year. This beam trawl survey is coordinated by the WGBEAM to which the results are reported each year since its beginning. The inclusion of this survey in the assessment was examined by the 2011 WKFLAT who concluded that this series is not long enough to be included in the assessment in 2011 but that possibility should be examined by the WGHMM when the series is more than five years long.

B.4 Commercial CPUE

Four commercial CPUE series are used in the assessment: La Rochelle offshore trawlers (FR-ROCHELLE), Les Sables d'Olonne offshore trawlers (FR-SABLES), the Bay of Biscay offshore trawlers in the second quarter (FR-BB-OFF-Q2) and the Bay of Biscay inshore trawlers in the last quarter (FR-BB-IN-Q4).

These series are provided by boats which are selected to form homogeneous groups and to limit year to year changes in fleet compositions. The following methods were adopted:

- The La Rochelle and the Les Sables d'Olonne offshore trawler fleets are two fixed groups of fishing boats. These fleets were first included in the tuning fleets at the 2005 WGSSDS. They were formed by boats which have landed sole either in La Rochelle (or near La Rochelle) or in Les Sables and for which CPUE data (with sole and nephrops percentage in catches thresholds indicated thereafter) are available for a minimum number of years (10 from 1984 or 7 from 1995 to 2004). The criterion of skippers having declared to have looked for sole in 2003-2004 (IFREMER annual activities survey) was added to avoid inclusion of boats fishing sole sporadically. The La Rochelle vessels are 14 to 20 meters long and the Les Sables vessels are 12 to 23 meters long.
- The Bay of Biscay offshore trawler fleet in the second quarter and the Bay of Biscay inshore trawler fleet in the fourth quarter are formed by fishing boats which have caught sole in Bay of Biscay and for which CPUE data (with sole and nephrops percentage in catches thresholds indicated thereafter) are available for five years over the ten last years. Furthermore, to limit effect of changes in fishing area, the CPUE were calculated by selecting the statistical rectangles which have provided a CPUE for more than 5 years from 2000 onwards. These tuning series were first included in the tuning process at the 2011 WKFLAT. They were added to the tuning series because the decrease in number of trawlers in La Rochelle or Les Sables fleets due to the decommissioning measures or the change in gear. The inshore vessels are 10 to 12 meters long and the offshore vessels are 14 to 18 meters long.

To take into account changes in fishing areas due to change in targeting species, a minimum percentage of sole in total landing of a trip (data from 1984 to 1998) or of a day (from 1999 onwards) was selected to avoid effects of a shift in target species from sole to cephalopods in recent years. This percentage has been set to 10 % in 2005 for selecting relevant fishing periods for the La Rochelle and Les Sables tuning fleets. It resulted from the advice of fishermen given at a meeting. For defining new tuning fleets in 2011, it was necessary to reduce this percentage to 6 % for increasing the number of available data. This requirement is due to the choice to carry out the work on a more reduced time period than previously (quarter instead of year) and to pay attention to the spatial distribution of effort.

A second threshold was fixed on the percentage of nephrops in total landing (below or equal to 10%) to avoid the inclusion of trips or days during which a large part of effort is devoted to this species.

The effort is in hours. It is not corrected for horse power (H x 100 kW) because this correction is considered introducing more noise, because of the quality of the measurement of horse power, than any improvement in fleets which are constructed to be homogeneous and with limited change in composition over the time period.

Because of the decreasing on the numbers of vessels for Les Sables and the large decreasing on the fishing effort for La Rochelle for 2010, the WGHMM decision is to withdraw the 2010 CPUE value for the Les Sables and La Rochelle.

C Assessment: Data and method

Model used: XSA

Software used: Lowestoft VPA program

The XSA settings to be used were set by the WKFLAT 2011 and revised by the WGHMM are given in the following text table.

	WKFLAT 2011
Catch data range	84- last year
Catch age range	2-8+
Sables d'Olonne offshore trawlers fleets tuning fleet (FR – SABLES)	1991 - 2009 2-7
La Rochelle offshore trawlers fleets tuning fleet (FR – ROCHELLE)	1991 - 2009 2-7
Bay of Biscay offshore trawlers in the second quarter tuning fleet (FR-BB-OFF-Q2)	2000 - last year 2-6
Bay of Biscay inshore trawlers in the fourth quarter tuning fleet (FR-BB-IN-Q4)	2000 - last year 3-7
Taper	No
Ages catch dep. Stock size	No
Q plateau	6
F shrinkage se	1.5
Year range	5
age range	3
Fleet se threshold	0.2
F bar range	3-6

Historical review of changes in XSA settings (see text table thereafter):

Age range in the assessment was changed from 0-8+ to 1-8+ in 1998, and to 2-8+ in 2004. In both cases, this change is largely due to the uncertainties in discards estimates.

Because French 1999 catches were not available at the 2000 WG, the 2000 XSA was identical to the 1999 XSA.

The age range of F bar was change from 2-6 to 3-6 at the 2004 WG because the age 2 is not fully recruited. This age range was turned back to 2-6 by ACFM because its implication on reference points. The Review Group asked nevertheless to investigate changing it again to 3-6 in 2005 and ACFM accepted the change to 3-6 in 2006.

WG year XSA	1998 XSA	1999 & 2000 XSA	2001 XSA	2002 XSA	2003 XSA	2004 XSA	2005 XSA	2006 XSA	2007 XSA	2008 XSA	2009 XSA	2010 XSA	2011 XSA
Catch data range	1984-1997	1984-1998	1984-2000	1984-2001	1984-2002	1984-2003	1984-2004	1984-2005	1984-2006	1984-2007	1984-2008	1984-2009	1984-2010
Age range in catch data	1-8+	1-8+	1-8+	1-8+	1-8+	2-8+	2-8+	2-8+	2-8+	2-8+	2-8+	2-8+	2-8+
FR – SABLES	88-97 1-7	89-98 1-7	84-00 2-7	84-01 2-7	84-02 2-7	84-03 2-7	91-04 Revised 2-7	91-05 2-7	91-06 Corrected 2-7	91-07 2-7	91-08 2-7	91-09 2-7	91-09 2-7
FR – ROCHELLE	88-97 1-7	89-98 1-7	84-00 2-7	84-01 2-7	84-02 2-7	removed	95-04 Revised 2-7	91-05 corrected 2-7	91-06 corrected 2-7	91-07 2-7	91-08 2-7	91-09 2-7	91-09 2-7
FR – ROCHELLE1	Not used	Not used	Not used	Not used	Not used	84-92 2-7	Removed	Removed	Removed	Removed	Removed	Removed	Removed
FR – ROCHELLE2	Not used	Not used	Not used	Not used	Not used	93-03 2-7	Removed	Removed	Removed	Removed	Removed	Removed	Removed
FR – OTHER	Not used	Not used	Not used	Not used	Not used	Not used	95-04 2-7	Removed	**REMOVED**	**REMOVED**	**REMOVED**	**REMOVE D**	**REMOVED**
FR – RESSGASC-S	88-97 1-7	89-98 1-7	removed	removed	removed	removed	**REMOVED**	Removed	Removed	Removed	Removed	Removed	Removed
FR – RESSGASC-S 2	Not used	Not used	87-00 2-6	87-01 2-6	87-02 2-6	87-02 2-6	87-02 2-6	87-02 2-6	87-02 2-6	87-02 2-6	87-02 2-6	87-02 2-6	Removed
FR – RESSGASC-S 3	Not used	Not used	87-97 2-6	removed	removed	removed	Removed	Removed	Removed	Removed	Removed	Removed	Removed
FR – RESSGASC-S 4	Not used	Not used	87-00 1-6	87-01 1-6	87-02 1-6	87-02 2-6	87-02	87-02 2-6	87-02 2-6	87-02 2-6	87-02 2-6	87-02 2-6	Removed
FR-BB-IN-Q4	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	00-10 3-7
FR-BB-OFF-Q2	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	00-10 2-6
Taper	No	No	Yes	Yes	**YES**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**	**NO**
Tuning range	10	10	17	18	**19**	**20**	**14**	15	16	17	18	19	20
Ages catch dep. Stock size	No	No	No	No	No	No	No	No	No	No	No	No	No
Q plateau	6	6	6	6	6	6	6	6	6	6	6	6	6
F shrinkage se	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Year range	5	5	5	5	5	5	5	5	5	5	5	5	5
age range	3	3	3	3	3	3	3	3	3	3	3	3	3
Fleet se threshold	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
F bar range	2-6	2-6	2-6	2-6	2-6	3-6	2-6	3-6	3-6	3-6	3-6	3-6	3-6

D. Short term projection

Model used: Age structured deterministic projection

Software used: MFDP

Inputs

Initial stock size:

- Recruitment is the geometric mean of recruitment values XSA over 1993 to three years before the assessment year (short mean because recruitment values are lower since 1993) if the XSA last year recruitment is considered poorly estimated according to the retrospective pattern.
- Recruitment is XSA last year recruitment if this latter one is considered to be accurately estimated according to the retrospective pattern.
- Age group above recruitment is derived from the GM.

Natural mortality: Set to 0.1 for all ages in all years

Maturity: Same ogive used for all years (given in section B.2)

F and M before spawning: None

Weight at age:

- Weights at age in the landings are the unweighted means over the last 3 years 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 unweighted means over the last 3 years using the old fresh/gutted transformation coefficient of French landing (1.11). The predicted spawning biomass are consequently comparable to the precautionary biomass reference point (Bpa) set before the change in fresh/gutted transformation coefficient of the French landing.

Exploitation pattern:

- Fishing mortality at recruiting age is the arithmetic mean over the 2 years before the terminal year if the XSA recruitment estimate is overwritten by a GM.
- Fishing mortalities above recruiting age is the arithmetic mean over the 3 last years of the assessment
- Unscaled if no trend is detected,
- Scaled to the last year's Fbar if a trend is detected.

Intermediate year assumptions:

Status quo F except if there is some information about the possibility that the TAC may be limiting.

F. Yield and biomass per recruit / long term projections

Yield per recruit calculations are conducted using the same input values as those used for the short term forecasts.

G. Biological reference points

	Type	Value	Technical basis
MSY Approach	MSY $B_{trigger}$	13 000 t	B_{pa} (provisional estimate. MSY $B_{trigger}$ to be re-evaluated).
	F_{MSY}	0.26	F_{max} (as estimated by WGHMM 2010) because no stock-recruitment relationship, limited variations of recruitment, Fishing mortality pattern known with low uncertainty
Precautionary Approach	B_{lim}	Not defined	
	B_{pa}	13 000 t	The probability of reduced recruitment increases when SSB is below 13 000 t, based on the historical development of the stock.
	F_{lim}	0.58	Based on the historical response of the stock.
	F_{pa}	0.42	F_{lim} * 0.72

(unchanged since: 2010)

H. Other Issues

None

I. References

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Annex G: Stock Annex Southern Hake

Quality Handbook **ANNEX: G – Southern Hake**

Stock specific documentation of standard assessment procedures used by ICES.

Stock	Southern hake (Division VIIIc IXa)
Working Group:	WGHMM (WKROUND2010)
Date:	February 2010.(revised May 2011)
Revised by	Santiago Cerviño, Ernesto Jardim and Daniel Howell

A. General

A.1. Stock definition

Southern hake stock comprises the Atlantic coast of Iberian Peninsula corresponding with the ICES divisions VIIIc and IXa. The Northern limit is in the Spanish – French boundary and the Southern one in Gibraltar Strait. These boundaries were defined based on management considerations without biological basis.

Atlantic and Mediterranean European hake are usually considered as different stocks due to the differences in biology (i.e. growth rate or spawning season) of the populations in both areas. In the North Eastern Atlantic, there is no clear evidence of the existence of multiple hake populations, although Roldán *et al.* (1998) based on genetic studies states that "*the data (…) indicate that the population structure within the Atlantic is more complex than the discrete northern and southern stocks proposed by ICES*". It is likely that there is a degree of transfer between the Southern and Northern hake stocks, and recent studies on population genetics support that (Balado *et al*., 2003; Pita *et al*., 2010), however there is at present a lack of data to quantify the amount of migrations between stocks.

A.2. Fishery

Hake in divisions VIIIc and IXa is caught in a mixed fishery by the Spanish and Portuguese fleets (trawls, gillnetters, longliners and artisanal fleets).

The Spanish trawl fleet is quite homogeneous and uses mainly two gears, pair trawl and bottom trawl. The percentage of hake present in the landings is small as there are other important target species (i.e. anglerfishes, megrims, Norway lobster, blue whiting, horse mackerel and mackerel). During recent years there has been an increase in Spanish trawlers using a new High Vertical Opening gear towed by single vessels and targeting the pelagic species listed above. In contrast, the artisanal fleet is very heterogeneous and uses a wide variety of gears; traps, large and small gillnet, long lines, etc. The trawl fleet landings length composition, since the implementation of the minimum landing size in 1991, has a mode around 29-31 cm depending on the year. Artisanal fleets target different components of the stock depending on the gear used. Small gillnets catch smaller fish than gillnets and long lines, which target mainly large fish and have length composition with a mode above 50 cm. Hake is an important component of the catch for these fleets mainly due to the high prices that reaches in the Iberian markets.

Hake is caught by the Portuguese fleet in the trawl and artisanal mixed fisheries together with other fish species and crustaceans. These include horse mackerel, anglerfish, megrim, mackerel, Spanish mackerel, blue whiting, red shrimp (*Aristeus antennatus*), rose shrimp (*Parapenaeus longirostris*) and Norway lobster. The trawl fleet comprises two distinct components - the trawl fleet catching demersal fish (70 mm mesh size) and the trawl fleet targeting crustaceans (55 mm mesh size). The fleet targeting fish species operates along the entire Portuguese coast at depths between 100 and 200 m. The trawl fleet targeting crustaceans operates mainly in the southwest and south in deeper waters, from 100 to 750 m. The most important fishing harbours from Northern Portugal are: Matosinhos, Aveiro and Figueira Foz, from Central Portugal are: Nazaré, Lisboa and Sines and Southern Portugal are: Portimão and Vila Real Santo António. The artisanal fleet lands hake mainly in the fishing harbours of the Centre. The main fishing harbours are Póvoa do Varzim (North), Sesimbra (Centre) and Olhão (South). Landings recorded by month show that the majority of the hake landings occur from May until October for both fleets.

A.3. Ecosystem aspects

European hake presents indeterminate fecundity and asynchronous development of the oocytes (Andreu, 1956; Murua *et al*., 1998; Domínguez-Petit, 2007). It is a serial or batch spawner (Murua *et al*., 1996). Duration of spawning season at the population level may differ between areas (Pérez and Pereiro, 1985; Alheit and Pitcher, 1995; Ungaro *et al*., 2001; Domínguez-Petit, 2007); but a latitudinal gradient exists such that the latest peaks of spawning occur in higher latitudes. In general, adults breed when water temperatures reach 10º or 12ºC, changing their bathymetric distribution depending on the region they are in and the local current pattern, releasing eggs at depths from 50 to 150m (Murua *et al*., 1996; 1998; Alheit and Pitcher, 1995). In general males mature earlier than females. Size at maturity is determined by density-dependent factors like abundance or age/length population structure and density independent factors like environmental conditions or fishing pressure (Domínguez *et al*., 2008). L50 varies between areas; in the Atlantic populations is between 40-47 cm (Lucio *et al*., 2002; Piñeiro and Saínza, 2003; Domínguez-Petit, 2007) and in the Mediterranean ones between 25 and 40 cm (Alheit and Pitcher, 1995; García-Rodríguez and Esteban, 1995; Ungaro *et al*., 2001). Besides, temporal fluctuations in size at maturity within the population have been also observed what probably reflects changes in growth rate (Domínguez *et al*., 2008). Changes in maturity parameters affect stock reproductive potential, because smaller and younger females have different reproductive attributes than larger and older individuals (Solemdal, 1997; Trippel *et al*., 1997). Maternal physiological status, spawning experience (recruit or repeat spawners) or food rations during gametogenesis are all known to alter fecundity, egg and larval quality, as well as duration of the spawning season (Hislop *et al*., 1978; Kjesbu *et al*., 1991; Trippel, 1999; Marteinsdottir and Begg, 2002). Change in stock structure entails a compensatory response of age/size at maturity because depletion of large fish can be compensated by increased egg production by young fish (Trippel, 1995).

Hake recruitment indices have been related to environmental factors. High recruitments occur during intermediate oceanographic scenarios and decreasing recruitment is observed in extreme situations. In Galicia and the Cantabrian Sea, generally moderate environmental factors such as weak Poleward Currents, moderate upwelling and good mesoscale activity close to the shelf lead to strong recruitments. Hake recruitment leads to well-defined patches of juveniles, found in localized areas of the continental shelf. These concentrations vary in density according to the strength of the year-class, although they remain generally stable in size and spatial location. These authors have related the year-on-year repetition of the spatial patterns to environmental conditions. In the eastern, progressively narrowing, shelf of the Cantabrian Sea, years during which there is massive inflow of the eastward shelf-edge current produce low recruitment indices, due to larvae and pre-recruits being transported away from spawning areas to the open ocean.

In Portuguese continental waters the abundance of small individuals is higher between autumn and early spring. In the Southwest main concentrations occur at 200-300 m depth, while in the South they are mainly distributed at coastal waters. In the North of Portugal recruits are more abundant between 100-200 m water depths. These different depth-areas associations may be related with the feeding habits of the recruits, since the zooplankton biomass is relatively higher at those areas.

Hake is a highly ichthyophagous species with euphausiids although decapod prawns are an important part of its diet for smaller hake (> 20 cm). In Galicia and the Cantabrian Sea hake is one of the apex predators in the demersal community, occupying together with anglerfish one of the highest trophic levels (Velasco *et al.*, 2003). Its diet at >30 cm is mainly composed of blue whiting, while other species such as horse mackerel and clupeids are only important in shallow waters and in smaller individuals that also feed on other small fishes. Along the Portuguese coast the diet of hake is mainly composed of crustaceans (particularly decapods) and fish. The main food items include blue whiting, sardine, snipefish, decapods and mysids. Cannibalism in the diet of hake is highly variable depending on predator size, alternative prey abundance, year or season. Cannibalism in stomach content observations ranged from 0 to 30% of total volume, with mean values about 5% this values produces a high natural mortality in younger ages. An age-length assessment with GADGET taken into account cannibalism was presented in 2009 WGHMM (WD 7). Natural mortality estimation for ages 0 and 1 are substantial reaching values about 1 for age 0 and 0.5 for age 1. Projections show differences in recovery trajectories when compared with a model without cannibalism.

B. Data

B.1. Commercial catch

Landings

The landings data used in the Southern Hake assessment are based on: (i) Portuguese sales notes compiled by the National Fisheries and Aquaculture Directorate; (ii) Spanish sales notes and owners associations data compiled by IEO; and (iii) Basque Country sales notes and Ship Owners data compiled by AZTI.

All landings since 1994 were reviewed and computed by quarter. From 1982 to 1993 annual landings were split by quarters assuming the same quarter distribution than in 1994.

Landings from the Gulf of Cadiz were compiled and included on the assessment by quarter, following the same procedure as for other landings.

The length distributions of landings were also computed by quarter after 1994. For the previous period it was assumed that the existing annual length distribution was caught in the middle of the year.

Discards

A Spanish Discard Sampling Programme is being carried out in Divisions VIIIc and IXa North since 1993. The series provides information on discarded catch in weight and number and length distributions for Southern hake. Spanish sampling was carried out in 1994, 1997, 1999-2000 and 2003 onwards. The number of trips sampled by the Spanish program was distributed by three trawl fleets: Baca otter trawl, Pair trawl and HVO (High Vertical Opening) trawl. Total discards were estimated raising sampling with effort. This series was revised and computed by quarter from 2004 onwards.

The Portuguese Discard Sampling Programme started in 2003 (second semester) and is based on a quasi-random sampling of co-operative commercial vessels. Two trawl fleets are sampled in this programme: Crustacean Trawl and Fish Trawl fleets. The discards estimation method was revised to take into account fishing hours as auxiliary variable and include outlier analysis (see Southern hake WD 2).

Both series of discarded weights were rebuilt back to 1992 based on the relations between (i) discards and surveys, and (ii) discards and landings (see Southern hake WD 4), with the aim of integrating them in assessment models.

B.2. Biological

The sampling of commercial landings is carried out by the Fisheries Institutes involved in the fishery assessment (AZTI, IEO and IPIMAR) since 1982, except in the Gulf of Cadiz were length distribution are available only since 1994..

The length composition sampling design follows a multistage stratified random scheme by quarter, harbour and gear.

An international length-weight relationship for the whole period has been used since 1999 (a=0.00000659, b=3.01721).

Age information (otoliths) are collected by IEO, AZTI and IPIMAR and ages determined based on the recommendations of WKAEH (WKAEH, 2009). However, due to doubts on growth patterns and unstable ageing criteria, a von Bertalanffy growth model with t0=0, Linf=130 cm and k~0.16 (re-estimated by the model every year) is used. The growth parameters were decided based on (i) tagging data collected for the north stock in French coast (there is no information to assume a different growth (see point A.1), and (ii) k estimates by the assessment models carried out during the Benchmark WK.

Natural mortality was assumed to be 0.4 year-1, instead of the past 0.2. The rationale is that if hake growths about two times faster, the hake longevity is reduced around half (from age ~20 to ~10). Hewit and Hoening (2005) estimate a relationship among longevity and M that produces a figure around 0.4. This value was set equal for all ages.

Maturity proportions-at-length was estimated with sexes combined from IEO sampling. Data available from IPIMAR and AZTI since 2004 were not considered due to inconsistencies with the IEO data. Maturity at length used to estimate population mature biomass was estimated with a logistic function (outside GADGET model) for years 1982 to 2010. There are relevant changes in yearly maturity (Dominguez *et al*., 2007).

B.3. Surveys

The **Spanish October** groundfish (SpGFS-WIBTS-Q4) survey uses a stratified random sampling design with half hour hauls and covers the northwest area of Spain from Portugal to France during September/October since 1983 (except 1987).

Two ground fish surveys are carried out annually in the **Gulf of Cadiz - in March**, from 1994, and in **November (SPGFS-caut-WIBTS-Q4)**, from 1997. A stratified random sampling design with 5 bathymetric strata, covering depths between 15 and 700 m, is used in this area, with one hour hauls. Hake otoliths have been collected since 2000.

The **Portuguese October groundfish (PtGFS-WIBTS-Q4)** has been carried out in Portuguese continental waters since 1979 on board the RV "Noruega" and RV "Capricórnio". Recent work on calibration of these vessels showed a higher catchability of Capricórnio, in particular at lower sizes, as a consequence these years were calibrated. The main objective of this survey is to estimate hake's abundance indices to be used in stock assessment (Anon., 2008). A stratified sampling design was used from 1989 until 2004. In 2005 a new hybrid random-systematic sampling design was introduced, composed by a regular grid with a set of additional random locations (Jardim and Ribeiro Jr., 2007; Jardim and Ribeiro Jr., 2008). The tow duration was 60 minutes until 2001 and reduced to 30 minutes for the subsequent years, based on results of an experiment showing no significant differences in the mean abundance and length distribution between the two tow durations (Cardador personal communication, 2007).

The **Portuguese July groundfish** (**P-GFS-jul)** survey has not been conducted since 2002.

A new survey, the **Portuguese February groundfish (ptGFS-WIBTS-Q1)**, and has been carried out since 2005, with the aim of covering hake's spawning season.

B.4. Commercial CPUE

Effort series are collected from Portuguese logbooks and compiled by IPIMAR, and from Spanish sales notes and Owners Associations data and compiled by IEO.

Landings, LPUE and effort are available for Coruña trawl (SP-CORUTR), Coruña pair trawl (SP-CORUTRP), Vigo/Marin trawl (SP-VIMATR), Santander trawl (SP-SANTR), Cadiz Trawl and Portuguese trawl (P-TR) fleets. Tuning data table (below) shows details about these surveys as well as which of them are used in the assessment model.

The CPUE series (1989-2008) of Portuguese trawlers is standardized using a GLM model with Gamma residuals, a "log" link function and explanatory variables year, zone, engine power, metier, percentage of hake in the catch, level of total catch and level of fishing effort. A working document presented to the benchmark documents the procedure (Southern hake WD 1).

B.5. Other relevant data

Tagging data from IFREMER have been used to help estimating Bertalanffy's growth parameters.

C. Historical Stock Development

Until 2009 this stock was assessed with VPA models based on ages estimated from ALK. Since 2010, based on the decisions of the Benchmark a GADGET model was introduced.

C.1. Description of gadget

Gadget is a shorthand for the "Globally applicable Area Disaggregated General Ecosystem Toolbox", which is a statistical model of marine ecosystems. Gadget (previously known as BORMICON and Fleksibest). Gadget is an age-length structured forward-simulation model, coupled with an extensive set of data comparison and optimisation routines. Processes are generally modelled as dependent on length, but age is tracked in the models, and data can be compared on either a length and/or age scale. The model is designed as a multi-area, multi-area, multi-fleet model, capable of including predation and mixed fisheries issues, however it can also be used on a single species basis. Gadget models can be both very data- and computationally- intensive, with optimisation in particular taking a large amount of time. Worked examples, a detailed manual and further information on Gadget can be found on www.hafro.is/gadget. In addition the structure of the model is described in Begley and Howell (2004), and a formal mathematical description is given in Frøysa *et al* (2002).

Gadget is distinguished from many stock assessment models used within ICES (such as XSA) in that Gadget is a forward simulation model, and is structured be both age and length. It therefore requires direct modelling of growth within the model. An important consequence of using a forward simulation model is that the plus groups (in both age and length) should be chosen to be large enough that they contain few fish, and the exact choice of plus group does not have a significant impact on the model.

Setup of a gadget run

There is a separation of model and data within Gadget. The simulation model runs with defined functional forms and parameter values, and produces a modelled population, with modelled surveys and catches. These surveys and catches are compared against the available data to produce a weighted likelihood score. Optimisation routines then attempt to find the best set of parameter values Growth is modelled by calculating the mean growth for fish in each length group for each time step, using a parametric growth function. In the hake model a Von Bertanlanffy function has been employed to calculate this mean growth. The actual growth of fish in a given length cell is then modelled by imposing a beta-binomial distribution around this mean growth. This allows for the fish to grow by varying amounts, while preserving the calculated mean. The beta-binomial is described in Stefansson (2001). The beta-binomial distribution is constrained by the mean (which comes from the calculated mean growth), the maximum number of length cells a fish can grow in a given time step (which is set based on expert judgement about the maximum plausible growth), and a parameter β, which is estimated within the model. In addition to the spread of growth from the beta-binomial distribution, there is a minimum to this spread due by discretisation of the length distribution.

Catches

All catches within the model are calculated on length, with the fleets having size-based catchability. This imposes a size-based mortality, which can affect mean weight and length at age in the population (Kvamme 2005). A fleet (or other preditor) is modelled so that either the total catch in each area and time interval is specified, or this the catch per timestep is estimated. In the hake assessment described here the commercial catch and the discards are set (in kg per quarter), and the surveys are modelled as fleets with small total landings. The total catch for each fleet for each quarter is then allocated among the different length categories of the stock according to their abundance and the catchability of that size class in that fleet.

Likelihood Data

A significant advantage of using an age-length structured model is that the modelled output can be compared directly against a wide variety of different data sources. It is not necessary to convert length into age data before comparisons. Gadget can use various types of data that can be included in the objective function. Length distributions, age length keys, survey indices by length or age, CPUE data, mean length and/or weight at age, tagging data and stomach content data can all be used. Importantly this ability to handle length date directly means that the model can be used for stocks such as hake where age data is sparse or considered unreliable. Length data can be used directly for model comparison. The model is able to combine a wide selection of the available data by using a maximum likelihood approach to find the best fit to a weighted sum of the datsets.

Optimisation

The model has two alternative optimising algorithims linked to it, a wide area search simulated annealing Corona *et al*. (1987) and a local search Hooke and Jeeves algorithim HookeJeeves1961. Simulated annealing is more robust than Hooke and Jeeves and can find a global optima where there are multiple optima but needs about 2-3 times the order of magnitude number of iterations than the Hooke and Jeeves algorithim. The model is able to use both in a single run optimisation, attempting to utilize the strengths of both. Simulated annealing is used first to attempt to reach the general area of a solution, followed by Hooke and Jeeves to rapidly home in on the local solution. This procedure is repeated several times to attempt to avoid converging to a local optimum. The algorithms are not gradient based, and there is therefore no requirement on the likelihood surface being smooth. Consequently neither of the two algorithims returns estimates of the Hessian.

Likelihood weighting

The total objective function to be minimised is a weighted sum of the different components. Selection of the weights is based on expert knowledge about the quality of the data and the space-time coverage of each data set, and the internal variance of the data set. An internal weight based on individual adjustments of the model (var) is used to reflect the variability of the data set. This was done by optimising the model to each data set in turn, and inverting the resulting objective score to use as a weight for that data set. This has the effect of assigning high weights to low variance data sets, and low weights to low variance ones. It also normalizes the weighted contribution of the different data sets. These weights were then adjusted to account for the length of the data series, the coverage of the area inhabited by the stock, and an expert judgement about the relative quality of the different data. The final column (% weight) in the table below gives the final weighted contribution of each data set to the optimised objective function.

Finding these weights is a lengthy procedure, but it does not generally need to be repeated for each assessment. Rather, the current weights can be used for several years. The weighted contribution of the data sets in a new assessment should be computed, and compared against the previous year. Provided the relative contributions are similar then the model results should be comparable between years.

C.2. Settings for the hake assessment

Population is defined by 1cm length groups, from 1-130 cm and the year is divided into four quarters. The age range is 0 to 15 years, with the oldest age treated as a plus group. Recruitment happens in the first and second quarter. The length at recruitment is estimated and mean growth is assumed to follow the von Bertalanffy growth function with Linf=130 and k estimated by the model.

An international length-weight relationship for the whole period has been used since 1999 (a=0.00000659, b=3.01721).

Natural mortality was assumed to be 0.4 year^{-1}

The commercial landings are modelled as two fllets (1982-93 and 1994-08) with a selection pattern described by a logistic function. Cadiz data is modeled as an independent fleet from 1982-04 (andersen function, see gadget manual for more information) and added to landings fleet from 2005-08. Discards from 1992-08 follows a Andersen function. The same function was used for Spanish survey, Cádiz survey and Portuguese survey. The surveys, on the other hand is modelled as fleet with constant effort and a nonparametric selection pattern that is estimated for three 15 cm length groups.

Data used for the assessment are described below:

description	**period**	**by quarter**	**area**	**Likelihood component**
Length distribution of landings	1994-2010	YES	Iberia	Land1.ldist
Length distribution of landings	1982-1993	NO	Iberia	Land.ldist
Length distribution of landings in Cadiz	1994-2010	YES	Gulf of Cadiz	cdLand.ldist
Length distribution of Spanish GFS	1982-2010	-	North Spain	SpDem.ldist
Length distribution of Spanish GFS	1989-2010	-	Portugal	PtDem.ldist
Length distribution of Spanish GFS in Cadiz	1990-2010	-	Gulf of Cadiz	CdAut.ldist
Length distribution of discards	1994, 1998, 1999, 2004-2010	YES	Iberia	Disc.ldist
Abundace index of Spanish GFS of 4-19 cm individuals	1982-2010	-	North Spain	SpIndex15cm.1
Abundace index of Spanish GFS of 20-35 cm individuals	1982-2010	-	North Spain	SpIndex15cm.2
Abundace index of Spanish GFS of 36-51 cm individuals	1982-2010	-	North Spain	SpIndex15cm.3
Abundace index of Portuguese GFS of 4-19 cm individuals	1989-2010	-	Portugal	PtIndex15cm.1
Abundace index of Portuguese GFS of 20-35 cm individuals	1989-2010	-	Portugal	PtIndex15cm.2
Abundace index of Portuguese GFS of 36-51 cm individuals	1989-2010	-	Portugal	PtIndex15cm.3
Abundace index of Spanish	1994-2010	YES	North Spain	SpCPUE15cm.1

trawlers from A Coruña of 25-39 cm individuals				
Abundace index of Spanish trawlers from A Coruña of 40-54 cm individuals	1994-2010	YES	North Spain	SpCPUE15cm.2
Abundace index of Spanish trawlers from A Coruña of 55-70 cm individuals	1994-2010	YES	North Spain	SpCPUE15cm.3
Standardized abundace index of Portuguese trawlers of 25-39 cm individuals	1989-2010	YES	Portugal	PtCPUE15cm.1
Standardized index of Portuguese trawlers of 40-54 cm individuals	1989-2010	YES	Portugal	PtCPUE15cm.2
Standardized index of Portuguese trawlers of 55-70 cm individuals	1989-2010	YES	Portugal	PtCPUE15cm.3

Description of the likelihood components weighting procedure and relative contribution to the final total likelihood (Note that relative contribution may change from year to year depending on the new data used to fit the model):

Likelihood component	var	quarters	quality	area	Multiplicative Weight	Relative contribution
Land1.ldist	0.66	44	2	1	133.2	0.2
Land.ldist	0.91	72	3	0.9	213.9	0.32
cdLand.ldist	2.5	52	2	0.1	4.2	0.01
SpDem.ldist	0.87	27	4	0.5	62.3	0.09
PtDem.ldist	0.39	24	4	0.4	99	0.15
CdAut.ldist	0.38	10	4	0.1	10.4	0.02
Disc.ldist	1.04	36	1	0.9	31.2	0.05
SpIndex15cm.1	4.84	9	4	0.5	3.7	0.01
SpIndex15cm.2	0.98	9	4	0.5	18.3	0.03
SpIndex15cm.3	1.2	9	4	0.5	15	0.02
PtIndex15cm.1	3.75	8	4	0.4	3.4	0.01
PtIndex15cm.2	1.34	8	4	0.4	9.5	0.01
PtIndex15cm.3	0.52	8	4	0.4	24.5	0.04
SpCPUE15cm.1	2.37	5	2	0.5	2.1	<0.01
SpCPUE15cm.2	0.23	5	2	0.5	21.5	0.03
SpCPUE15cm.3	1.55	5	2	0.5	3.2	0.01
PtCPUE15cm.1	0.46	6.67	2	0.4	11.6	0.02
PtCPUE15cm.2	1.39	6.67	2	0.4	3.8	0.01
PtCPUE15cm.3	0.76	6.67	2	0.4	7	0.01

The parameters estimated are:

- The number of fish by age when simulation starts. (ages 1 to 8) .8 params
- Recruitment each year. (1982 to 2010). 29 params

- The growth rate (k) of the von Bertalanffy growth model.
- Parameter β of the beta-binomial distribution .
- The ratio between recruitment in the first and second quarter.
- The selection pattern of:
  - the commercial catches (1982-93). 2 params
  - Landings (1994-2010) . 2 params
  - Cadiz landings (1982-2004) . 3 params
  - Discards (1992-10) . 3 params
  - Spanish Survey . 3 params
  - Portugese Survey . 3 params
  - Cadiz autumn Survey . 3 params
- Catchability of :
  - Spanish Survey (3 groups from 4 cm by 15 cm) .3 params
  - Portugese Survey . (3 groups from 4 cm by 15 cm) .3 params
  - Spanish CPUE (3 groups from 25 cm by 15 cm) .3 params
  - Portugese CPUE (3 groups from 25 cm by 15 cm) .3 params

71 parameters in total

The estimation can be difficult because of some or groups of parameters are correlated and therefore the possibility of multiple optima cannot be excluded. The optimisation was started with simulated anneling to make the results less sensitive to the initial (starting) values and then the optimisation was changed to Hooke and Jeeves when the 'optimum' was approached. Multiple optimisation cycles were conducted to ensure that the model had converged to an optimum, and to provide opportunities to escape convergence to a local optimum.

The model fit were analysed with the following **diagnostics**:

- Profiled likelihood plots. To analize convergence and problematic parameters.
- Plot comparing observed and modeled proportions in fleets (catches, landings or discards). To analize how estimated population abundance and explotation pattern fits observed proportions.
- Plot for residuals in catchability models. To analyze precision and bias in abundance trends.

D. Short-Term Projection

Model used: Age-length forward projection

Software used: GADGET (script: predict.st.sh)

Initial stock size: estimates at the end of the assessment period estimated by the gadget model, with recruitment replaced by geometric mean from 1989 to Y-1, if last year recruitment estimate rejected by the group.

Maturity: arithmetic mean of last 3 years

F and M before spawning: NA

Weight at age in the stock: modelled in GADGET with VB parameters and length weight relationship

Weight at age in the catch: modelled in GADGET with VB parameters and length weight relationship

Exploitation pattern:

GADGET is a length-age based forward projection model, structured by quarter for southern hake. Two different "fleets" are used for projections, a landings fleet with a logistic selection pattern and a discards fleet with an Andersen selection pattern. Although each fleet has a constant selection pattern function, the level of exploitation can be distinct by quarter. 8 F multipliers are required for projections (2 fleets * 4 quarters), which are computed by averaging the last 3 years by quarter and fleet.

Intermediate year assumptions: If there is a trend in mean F of last 3 years the multipliers are scaled to last year's F bar (ages 1-3), so that a single scaling factor is applied to all quarters. Otherwise the multipliers are not scaled (script: multF.r).

Stock recruitment model used: geometric mean of years 89 to last year minus one.

Procedures used for splitting projected catches: driven by the selection patterns estimated by gadget for each "fleet" (landings and discards).

E. Medium-Term Projections

NA

F. Long-Term Projections

F multipliers are set in the way described for short term projections.

Model used: Age-length forward projection until 2100

Software used: GADGET (script: predict.lt.sh)

Maturity: arithmetic mean of last 3 years

F and M before spawning: NA

Weight at age in the stock: modelled in GADGET with VB parameters and length weight relationship

Weight at age in the catch: modelled in GADGET with VB parameters and length weight relationship

Exploitation pattern:

Landings: logistic selection parameters estimated by GADGET.

Discards: Andersen (asimetric) selection parameters estimated by GADGET.

Stock recruitment model used: geometric mean of years 89 to last year minus one

Procedures used for splitting projected catches: driven by different selection functions (logistic for landings, Andersen for discards) and provide by GADGET.

G. Biological Reference Points

F max = 0.24 was set as a proxy for Fmsy
No other BRPs set.

H. Other Issues and further work

It should be noted that new assessment model have been developed to avoid the reliance on age-based data. This new model is considered to be an improvement on the previous method given the problems related to age data described previously. However both are new, complex, and significantly different from the previous models. It is therefore likely that refinements and updates will be required over the coming years to both models and further consideration given to the data used. The panel (WKROUND, 2010) considers that ICES should be flexible in allowing model improvements during the Assessment Working Groups and on an inter-sessional basis. ICES should therefore ensure that resources are in place to evaluate these improvements.

In the line of previous paragraph it is worth mention that change in projection was caused by a misinterpretation regarding the way GADGET makes projections that drove to wrong results. The definition the 8 F multipliers instead of just 4 (one for each quarter) allows to a correct balance of discards and landings. Using the mean of last 3 years allows avoiding excessive weight of a unexpected data (quarter/fleet).

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Annex H: Stock Annex Southern Anglerfish (Divisions VIIIc, IXa)

Quality Handbook	**Annex H: Southern anglerfish (*L. piscato rius* and *L. budegassa*)**

Stock specific documentation of standard assessment procedures used by ICES.

Stock:	Southern anglerfish (Divisions VIIIc, IXa)
Working Group:	Working Group on the Assessment of Southern Shelf of Hake, Monk and Megrim Stocks (WGHMM)
Last Update:	WGHMM2011

A General

A.1 Stock definition

The two species of anglerfish (the white, *Lophius piscatorius,* and the black, *L. budegassa*) are North Eastern Atlantic species, however *L. budegassa* has a more southerly distribution. *L. piscatorius* is distributed from Norway (Barents Sea) to the Straits of Gibraltar (and including the Mediterranean and the Black Sea) and *L. budegassa* from the British Isles to Senegal (including the Mediterranean and the Black Sea). Anglerfish occur in a wide range of depths, from shallow waters to at least 1000 m. Information about spawning areas and seasonality is scarce, therefore the stock structure remains unclear. This lack of information is due to their particular spawning behaviour. Anglerfish eggs and larvae are rarely caught in scientific surveys.

ICES gives advice for the management of three anglerfish stocks in European waters: one stock on the Northern Shelf area, that includes anglerfish from the Northern Shelf–Division IIIa, Subarea IV and Subarea VI, and Norwegian Sea–Division IIa, and two stocks on the Southern Shelf area, the Northern stock in Divisions VIIb-k and VIIIa,b and d and the Southern stock in Divisions VIIIc and IXa. The stock under this Annex is called Southern Anglerfish and is defined as anglerfish in Divisions VIIIc and IXa. The boundaries of Northern and Southern Anglerfish stocks were establish for management purposes and they are not based on biological or genetic evidences (GESSAN, 2002; Duarte *et al*., 2004; Fariña *et al*., 2004).

Although the stock assessment is carried out separately for each species, *L. piscatorius* and *L. budegassa* are caught and landed together, due to that, the advice is given for the combined stock. There is a unique TAC for both species.

A.2 Fishery

Anglerfish in ICES Divisions VIIIc and IXa are exploited by Spanish and Portuguese vessels, the Spanish recent landings being around 90 % for both anglerfish total reported landings. International catches for this stock have increased since the beginning of the 1980s, until a maximum was reached in 1988 (10 021 t). They have decreased to 1 801 t - 1 802 t in 2001-2002. In the 2003-2009 period the catches were between 3 000 t and 4 500 t. Both species are caught on the same grounds by the same fleets and are marked together.

L. piscatorius and *L. budegassa* are caught together by Spanish and Portuguese bottom trawlers and gillnet fisheries. Spanish and Portuguese bottom trawlers are mixed fisheries. The Spanish bottom trawl fleet predominantly targets hake, megrim, Norway lobster and anglerfish. Since 2003 the alternative use of a trawl gear with HVO (High Vertical Opening) has taken place in higher proportion relative to previous years. This gear targets horse mackerel and mackerel with very few anglerfish catches. Since 1997, the Spanish landings were on average 51 % from the trawl fleet and 49 % from the gillnet fishery. The Spanish gillnet fishery can use different artisanal gears, but most catches come from "Rasco" that is a specific gear targeting anglerfish.

Anglerfish are caught by Portuguese fleets in trawl and artisanal mixed fisheries. Portuguese landings were on average, from 2000, 24 % from trawlers and 76% from artisanal fisheries. The trawl fleet has two components, the trawl fleet targeting demersal fish and trawl fleet targeting crustaceans. Since 2005, Portuguese combined species landings were TAC constrained and very low landings were registered during the 4th quarter since then.

Discarding in these stocks is considered very low, estimated data for Spanish trawl fleet (WGHMM2010).

Each year, the European Union Administration sets a combined TAC and quota for *L. piscatorius* and *L. budegassa*. There is no minimum landing size for anglerfish, but in order to ensure marketing standards a minimum landing weight of 500 g was fixed in 1996 by the Council Regulation (EC) No.2406/96.

As part of the Recovery Plan for the Southern hake and Iberian Nephrops stocks (Council Regulation (EC) No.2166/2005), in force since January of 2006, the fishing effort regulations are affecting the Spanish and Portuguese mixed trawl fisheries. As anglerfish are taken in these mixed trawl fisheries, these stocks are also affected by the recovery plan effort limitation.

A.3 Ecosystem aspects

Both anglerfish are benthic species that occur on muddy to gravelly bottoms. White anglerfish attains a maximum size of around 163 cm corresponding to a weight of approximately 51 kg, and black anglerfish attains a maximum size of around 93 cm corresponding to a weight of approximately 12 kg. Historically *Lophius piscatorius* and *L. budegassa* has been considered slow growing species, with a late maturation (Duarte *et al*., 2001). Nevertheless, new evidences from mar-recapture experiments indicate that the anglerfish growth could be faster.

The ovarian structure of anglerfish differs from most other teleosts. It consists of very long ribbons of a gelatinous matrix, within individual mature eggs floating in separate chambers (Afonso-Diaz and Hislop, 1996). The spawning of the *Lophius* species is very particular, with eggs extruded in a buoyant, gelatinous ribbon that may measure more than 10 m and contain more than a million eggs (Afonso-Dias and Hislop, 1996; Hislop *et al*., 2001 and Quincoces, 2002). Eggs and larvae drift with ocean currents and juveniles settle on the seabed when they reach a length of 5-12 cm. This particular spawning leads to highly clumped distributions of eggs and newly emerged larvae (Hislop *et al*., 2001) and favourable or unfavourable ecosystem conditions can therefore have major impacts on recruitment.

Due to their particular reproduction aspects (that shows a high parental investment in the offspring) the population dynamics of these species is expected to be highly sensitive to external biological/ecosystem factors.

Vertical displacements of immature and mature *L. piscatorius* from the seabed to the near surface have been recorded in the Northeast Atlantic (Hislop *et al*., 2001) and is suggested to be related to spawning or feeding.

Improvement of knowledge regarding growth, spawning behaviour, migratory behaviour and juvenile drift are essential to present and future assessment and management of Southern Anglerfish stocks.

B. Data

B.1 Commercial Catch

Landings data are provided by National Government and research institutions of Spain and Portugal. Quarterly landings of *L. piscatorius* and *L. budegassa* by country, gear and ICES Division are available from 1978. There were unrecorded landings in Division VIIIc between 1978 and 1979, and it was not possible to obtain the total landings in those years. For *L. piscatorius* the maximum landing of the available series was recorded in 1986 at 6 870 t. After that, a general decline to 788 t in 2001 was observed, reaching the minimum of the available series. From 2002 to 2005 landings increased reaching 3 644 t. Since 2005 landings have slowly decreased to 2 280 t in 2009.

Portuguese landings were TAC constrained since 2005. Very low landings have been registered during the 4th quarters since then. The Portuguese landings were relatively stable during the first two years, but have decreased substantially from 2006 to 2008.

After 1980, black anglerfish landings increased and reached a peak of 3 832 t in 1987. Since then, landings decreased and reached a minimum in 2002 of 770 t. From 2002 to 2007 landings increased to 1 301 t, decreasing afterwards to a new minimum in 2009 of 769 t.

Discards

Since 1994 a Spanish Discard Sampling Programme is being carried out for trawl fleets operating in the ICES Divisions VIIIc and IXa. However, the time series is not complete and years with discard data are 1994, 1997, 1999, 2000 and from 2003 to 2009. The raising procedure used to estimate discards was based on effort. The Portuguese Discard Sampling Programme started in mid 2003, with hake as the main target species, due to that the anglerfish data are not yet processed.

Discard data are not included in the input data for analytical assessment because sampling does not cover all fleets contributing to anglerfish catches and the lack of data in many years of the series.

B.2 Biological

Landing numbers at length

The quarterly Spanish and Portuguese sampling for length compositions is by port, gear (trawl or gillnet) and ICES Divisions. Length data from sampled vessels are summed and the resulting length composition is applied to the quarterly landings of the corresponding port, gear and ICES Divisions. The sampled length compositions were raised for each country and SOP corrected to total landings on a quarterly or half yearly basis (when the sampling levels by quarter were low). Spanish and Portuguese market sampling effort increased considerably from 1995 to 2008. The average lengths of trawl caught anglerfish are lower compared to the artisanal fleets.

Catch numbers at age

No catch numbers at age are provided to the Working Group. In WHMM2007, age length keys, based on *illicia* readings, were used to obtain catch number at age for each species. The exploratory analysis of estimates indicated that the biased age reading criterion does not allow following cohorts along years in either of the two species.

The biological data that are provided to the WG are the mean weight and mean length by gear, country and ICES Division. A yearly length-weight relationship, common for Spain and Portugal, are applied by species:

L. piscatorius: $W=0.0000270*L^{2.8390}$ (BIOSDEF, 1998)

L. budegassa: $W=0.0000211*L^{2.9198}$ (BIOSDEF, 1998)

Trial assessment of these stocks used a natural mortality rate of 0.15 yr^{-1}. This value was adopted for all ages and years in the absence of any direct estimates for these stocks.

B.3 Surveys

The **Spanish Groundfish Survey (SpGFS-WIBTS-Q4)** and the **Portuguese October Groundfish Survey (PtGFS-WIBTS-Q4)** series for the two anglerfish species are available from 1983, except 1987 for SpGFS-WIBTS-Q4. Due to the low level of anglerfish caught in the two surveys, these indices are not considered to reflect the change in the abundance of this species and are not employed in the stock assessment.

B.4 Commercial CPUE

Six commercial series of landing-effort are available to the WG. Four of them are Spanish fleets in the ICES Division VIIIc and two Portuguese fleets in the ICES Division IXa. The Portuguese trawl fleet was split into fish trawlers and crustacean trawlers (WD12, Duarte *et al*., 2007) according to the fleet segmentation proposed by the IBERMIX project (WD06, Castro *et al*., 2007). Due to the different distribution of the species, more southerly in the case of *L. budegassa*, the fleets employed to tune the stock assessment are different by species.

Commercial fleets used in recent assessments of L. piscatorius to tune the ASPIC model

- Coruña trawlers (SP-CORUTR8c): years 1986-2009. Data provided for Coruña trawlers comprise quarterly effort (fishing days per 100 horse power), landings and length composition of landings. This fleet represents an average of 13% of international catches of *L. piscatorius* and 13% of *L. budegassa* along the time series.

  A standardized series from 1994 to 2006 is also available for this fleet with annual effort data (in fishing days) and annual LPUE.

- Cedeira gillnet (SP-CEDGNS8c): years 1999-2009. Data provided for Cedeira gillnets comprise annual standardized effort (in soaking days), landings and length composition of landings. This fleet represents an average of 10% of international catches of *L. piscatorius* and 5% of *L. budegassa* since 1999.

Commercial fleets used in recent assessments of L. budegassa to tune the ASPIC model

- Portuguese trawlers targeting fish (PT-TRF9a): years 1989-2009. Data provided for Portuguese trawlers targeting fish comprise quarterly effort (1000 hours trawling with occurrence of anglerfish), landings and length composition of landings. This fleet represents an average of 1% of international catches of *L. piscatorius* and 3 % of *L. budegassa* along the time series.

  A standardized series from 1989 to 2008 is also available for this fleet with annual effort data (in 1000 hauls) and annual LPUE.

- Portuguese trawlers targeting crustacean (PT-TRC9a): years 1989-2009. Data provided for Portuguese trawlers targeting fish comprise quarterly effort (1000 hours trawling with occurrence of anglerfish), landings and length composition of landings. This fleet represents an average of 1% of international catches of *L. piscatorius* and 3% of *L. budegassa* along the time series.

  A standardized series from 1989 to 2008 is also available for this fleet with annual effort data (in 1000 hauls) and annual LPUE.

Other available commercial series of LPUEs that have never been employed in the analysis are:

- Avilés trawlers (SP-AVTR8c): years 1986-2003. Data provided for Avilés trawlers comprise quarterly effort (fishing days per 100 horse power), landings and length composition of landings. This fleet represents an average of 6% of international catches of *L. piscatorius* and 3% of *L. budegassa* along the time series. This commercial series has never been used as a tuning fleet in the WG. The effort series was interrupted in 2003.
- Santander trawlers (SP-SANTR8c): years 1986-2009. Data provided for Santander trawlers comprise quarterly effort (fishing days per 100 horse power), landings and length composition of landings. This fleet represents an average of 7% of international catches of *L. piscatorius* and 3% of *L. budegassa* along the time series. Effort data for 2008 was not provided to the WG. This commercial series has never been used as a tuning fleet in the WG.

C. Historical stock development: Assessment Methods and Settings

These stocks were assessed for the first time in the 1990 ICES WG meeting. Different assessment trials were performed during the subsequent 8 years but analytical assessments indicated unrealistic results. The data base (both biological and fisheries data) were improved along these years trying to apply an analytical assessment model. Since 1998 a non-equilibrium surplus production model ASPIC (Prager, 1994) was applied to each stock or to the combined stock data. These stock assessments were accepted by the ACFM and used to provide management advice. The last accepted assessment was carried out in the 2010 WG. Model input settings and data used in last assessments are summarised in the next table:

WG	2006	2007		2008	2009		2010		2011	
Assessment Model	Non-equilibrium Surplus production model (Prager, 1994a)	Non-equilibrium Surplus production model (Prager, 1994a)		No updated	Non-equilibrium Surplus production model (Prager, 1994a)		Non-equilibrium Surplus production model (Prager, 1994a)		Non-equilibrium Surplus production model (Prager, 1994a)	
Software	ASPIC (v. 5.05)	ASPIC (v. 5.16)		No updated	ASPIC (v. 5.16)	ASPIC (v. 5.24)	ASPIC (v. 5.34)	ASPIC (v. 5.34)	ASPIC (v. 5.34.9)	ASPIC (v. 5.34.9)
Stock	Combined	L.piscatorius	L.budegassa		L.piscatorius	L.budegassa	L.piscatorius	L.budegassa	L.piscatorius	L.budegassa
Catch data range	1980-2005	1980-2006	1980-2006		1980-2008	1980-2008	1980-2009	1980-2009	1980-2010	1980-2010
CPUE Series 1 (years)	SP-CORUTR8c (1986-2005)	SP-CORUTR8c (1986-2006)	PT-TRF9a (1989-2006)		SP-CORUTR8c (1986-2008)	PT-TRF9a (1989-2008)	SP-CORUTR8c (1986-2009)	PT-TRF9a (1989-2009)	SP-CORUTR8c (1986-2010)	PT-TRF9a (1989-2010)
CPUE Series 2 (years)										
Index of Biomass (years)	PT-TR9a (1989-2005)	SP-CEDGNS8c (1999-2006)	PT-TRC9a (1989-2006)		SP-CEDGNS8c (1999-2008)	PT-TRC9a (1989-2008)	SP-CEDGNS8c (1999-2009)	PT-TRC9a (1989-2009)	SP-CEDGNS8c (1999-2010)	PT-TRC9a (1989-2010)
Error Type	Condition on yield	Condition on yield	Condition on yield		Condition on yield	Condition on yield	Condition on yield	Condition on yield	Condition on yield	Condition on yield
Number of bootstrap	500	500	500		500	500	1000	1000	1000	1000
Maximum F	8.0 (y-1)	8.0 (y-1)	8.0 (y-1)		8.0 (y-1)	8.0 (y-1)	8.0 (y-1)	8.0 (y-1)	8.0 (y-1)	8.0 (y-1)
Statistical weight B1/K	1	1	1		1	1	1	1	1	1
Statistical weight for fisheries	1,1	1,1	1,1		1,1	1,1	1,1	1,1	1,1	1,1
B1-ratio (starting guess)	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	0.5
MSY (starting guess)	5000 t	5000 t	3000 t		5000 t	3000 t	5000 t	3000 t	5000 t	3000 t
K (starting guess)	100 000 t	50 000 t	20 000 t		50 000 t	20 000 t	50 000 t	20 000 t	50 000 t	20 000 t
q1 (starting guess)	1d-5	1d-5	1d-5		1d-5	1d-5	1d-5	1d-5	1d-5	1d-5
q2 (starting guess)	1d-6	1d-6	1d-4		1d-6	1d-4	1d-6	1d-4	1d-6	1d-4
Estimated parameter	All	All	All		All	All	All	All	All	All
Min and Max allowable MSY	2000 (t) -10000 (t)	2000 (t) -10000 (t)	2000 (t) -10000 (t)		2000 (t) -10000 (t)	2000 (t) -11500 (t)	2000 (t) -11500 (t)	2000 (t) -10000 (t)	2000 (t) -11500 (t)	2000 (t) -10000 (t)
Min and Max K	50000 (t) -500000 (t)	5000 (t) - 500000 (t)	5000 (t) -500000 (t)		5000 (t) - 100000 (t)	5000 (t) - 112000 (t)	5000 (t) -112000 (t)	5000 (t) -100000 (t)	5000 (t) -112000 (t)	5000 (t) -100000 (t)
Random Number Seed	1964185	1964185	1964185		1964185	1964185	1964185	1964185	1964185	1964185

D. Short term projection

See Medium term projections

E. Medium term projections

Model: ASPIC projections (Prager, 1994).

Software: ASPICP

It was assumed Fsq for the intermediate year.

Projections are performed based on ASPIC estimates. Projections are performed for the following scenarios,:

- Reduction of F in the first year from 10% to 50 %.
- F sq (status quo)
- F_{MSY}
- Zero catches
- TAC, - 15% TAC and + 15% TAC.

F. Yield and biomass per recruit / long term projections

None

G. Biological reference points

No biological reference points are defined for this stock.

H. Other Issues

None

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Annex I: Southern megrims (*L. whiffiagonis* and *L. boscii*)

Quality Handbook	**Annex H: Southern megrims (*L. whiffia gonis* and *L. boscii*)**

Stock specific documentation of standard assessment procedures used by ICES.

Stock:	Southern megrims (Divisions VIIIc, IXa)
Working Group:	Working Group on the Assessment of Southern Shelf of Hake, Monk and Megrim Stocks (WGHMM)
Last Update:	May 2011

A General

A.1 Stock definition

The genus Lepidorhombus is represented in eastern Atlantic waters by two species, megrim (*L. whiffiagonis*) and four-spot megrim (*L. boscii*). Three stocks of megrims are assessed by ICES: megrim in ICES Subareas IV and VI, megrim in Divisions VIIb-k and VIIIa,b,d and megrim in Divisions VIIIc and IXa. Although the boundaries of the stocks were established only for management purposes, recent genetic studies have proved the existence of at least two populations within the Atlantic Ocean for both species. While *L. boscii* populations match the stocks defined, *L. whiffiagonis* needs more detailed studies to refine the boundaries, although in principle would also overlap with the current structure (Danancher and García-Vázquez, 2009).

The stocks under this Annex are called Southern Megrims and include both megrim species in Divisions VIIIc and IXa. Megrim (*L. whiffiagonis*) is in both ICES Divisions (VIIIc and IXa), with its highest abundance in Division VIIIc. Four-spot megrim (*L. boscii*) is distributed in both ICES Divisions (VIIIc and IXa), being more southerly present than megrim (Sánchez *et al.*, 2002). There is a certain bathymetric segregation between the two species of megrim. *L. boscii* has a preferential depth range of 100 to 450 m and *L. whiffiagonis* of 50 to 300 m (Sanchez *et al*, 1998).

A.2 Fishery

Management of megrim is both by TAC and technical measures. The two species (*L. whiffiagonis* and *L. boscii*) are managed under a common TAC. They are caught and recorded together in the landings statistics. It is impossible to manage each species separately under a common TAC. The spatial distribution of the two stocks shows some differences that could be utilized for separate management of the two stocks.

The minimum mesh size for towed gears ranges between 55 and 70 mm, depending on catch species composition. Minimum landing size for the two species changed from 25 to 20 cm in year 2000 (Council Regulation EC 850/98).

Both megrim species are included in the landings from ICES Divisions VIIIc and IXa. The percentage of megrim (*L. whiffiagonis*) in landings of both species by weight was between 12% and 37% over the whole period for which data are available, being mostly above 20% until year 2000 and mostly below 20% since that year.

No landings data are available for these stocks before 1986, although some Spanish harbours have longer landings series. Total international landings increased sharply from 1986 to 1989, when they reached 3340 t, and then showed a continuous declining trend until their lowest level of 840 t in 2002. There has been some increase in landings since that year, being 1380 t in 2010, the maximum value of the last decade.

Both species of megrim are taken as by-catch in the mixed bottom trawl fisheries targeting "white fish" by Portuguese and Spanish fleets, and also in small quantities by the Portuguese artisanal fleet. The majority of the catches are taken by Spanish trawlers. Fishing practices of some Spanish trawl fleets have changed in recent years, now focusing more on species such as horse mackerel, blue whiting, or mackerel, and not taking megrim in the catch.

Since the early 1990´s the Spanish trawl fleet has diversified its gear, introducing a new trawl gear which targets primarily horse mackerel and does not catch megrim. This gear, named High Vertical Opening (HVO or "jurelera") trawl, affects catches of *L. boscii* more than those of *L. whiffiagonis*, because it operates mainly in the distribution area of the former species. The increasing use of pair trawlers, for which the vast majority of catch is blue whiting (and also catch mackerel as a seasonal fishery, Castro *et al*, 2011), and HVO ("jurelera") gear in trawlers, has reduced the effort on megrim species in recent years.

The Prestige oil spill in the northwest Spanish coast (November 2002) prompted a redistribution of fishing effort, particularly in the Galician area. Some regulation measures, such as spatial and seasonal closures, were adopted in order to minimise the oil spill impact on fisheries. Some trawl fleets display lower effort in 2003 in relation to later years (Abad *et al*, 2010).

Horse mackerel, Atlantic mackerel, blue whiting, anglerfish, hake, megrim, different cephalopods and *Nephrops* account for a high percentage (around 90%) of all retained species in this multispecies trawl fishery (Castro *et al*, 2011). A great number of species are caught as by-catch.

Discards are important, particularly for younger ages of both megrim species. Around 10-65% of the individuals caught are discarded by trawlers (Pérez *et al*, 2011). Lack of commercial interest, variations in market price, fish size (MLS or market size), storage capacity as well as distance to home port are the main reasons for discarding. Artisanal fleets catch few megrims and discards of all species in these fleets are very low.

Megrims have been affected by the Recovery Plan for the Southern hake and Iberian *Nephrops* stocks (Council Regulation EC 2166/2005), since January of 2006, with the fishing effort limitation measurements in the Spanish and Portuguese mixed trawl fisheries.

A.3 Ecosystem aspects

The Iberian Region along the eastern Atlantic shelf (Divisions VIIIc and IXa) is an upwelling area with high productivity, especially along the Portuguese and Galician coasts; upwelling takes place during late spring and summer (Álvarez-Salgado *et al*., 2002; Serrano *et al*., 2008). The region is characterized by a large number of commercial and non-commercial fish species caught for human consumption.

Many flatfish species show a gradual offshore movement of juveniles as they grow. This might indicate that habitat quality for flatfish is size-dependent. Another common pattern is the annual micro- and macroscale movements and migrations between spawning, feeding and wintering areas (Gibson 1994). Also, most flatfishes are associated with finer sediments, rather than with hard substrata because burying themselves provides some protection from predators and reduces the use of energy (van der Veer *et al*., 1990, 2000; Beverton and Iles 1992; Bailey 1994; Wennhage and Pihl 2001).

Previous studies on megrim species show that they generally occurred outside zones with hydrographical instabilities that foster the vertical interchange of organic matter (Sánchez and Gil, 1995) and disappear at the mouth of the most important rivers (Sánchez *et al*., 2001). Both species appear to show a gradual expansion in their bathymetric distribution throughout their lifetimes, with the larger individuals tending to occupy shallower waters than the juveniles. Bearing in mind that the two species have similar characteristics, a certain degree of interspecific competition may be assumed (Sanchez *et al*, 1998).

Juveniles of these species feed mostly on detritivore crustaceans inhabiting deep-lying muddy bottoms. Adult *L. boscii* feeds mainly on crustaceans inhabiting muddy surfaces (Rodriguez-Marín and Olaso, 1993; Rodriguez-Marín, 2002) as opposed to *L. whiffiagonis*, which are more ichthyophagous and where rates of crustacean in diet decrease with fish size (Rodriguez-Marín, 2002). None of the two species represent an important part of the diet for the main fish predators in the area. However, Velasco (IEO, Santander, Spain, pers. comm.) observed that they are occasionally present in stomach contents of hake, anglerfish and rays.

The spawning period of these species is short. Mature males can be found from November to March and mature females from December to March, but spawning peaks in March. In southern areas megrims spawn from January to April (BIOSDEF, 1998; study contract 95/038).

The growth rate also varies (Landa *et al*, 1996; Landa, 1999), growth is quicker in the southern area for both species but the maximum length attained is smaller than in the north. The maximum age for megrim also varies with latitude. In Subarea VII the maximum age of megrim is 14 years, this decreases to 12 years in Divisions VIIIc and IXa (BIOSDEF, 1998; Landa et. al, 2000). The maximum age for four-spot megrim in Divisions VIIIc and IXa is 11 years (Landa *et al*, 2002, Landa, pers. com.).

B. Data

B.1 Commercial Catch

Landings data are provided by National Government and research institutions of Spain and Portugal. The available series began in 1986.

The proportions of each megrim species in Portuguese and Spanish landings are estimated using the relative abundances of the two species of megrim in the sampled landings.

For *L. whiffiagonis*, landings present an increase for a few years at the beginning of the time series and a general declining trend since then. For *L. boscii,* landings present the same increase at the beginning of the time series; after that, they have generally declined to their lowest value in 2002 and, since then, the general trend is to increase smoothly.

Discards

Discards estimates are available for Spanish trawlers in some years.

Discards data are not yet used in this assessment due to the lack of data in some years of the series. A discarding sampling programme runs regularly since the establishment of the European Data Collection Programme in 2003. Before this year, Spanish discards data are available only for 1994, 1997, 1999 and 2000. The raising procedure used to estimate Spanish discards for the sampled years was based on effort.

B.2 Biological

Landing numbers at length

Annual length compositions of total landings for *L. whiffiagonis* and *L. boscii* are available since 1986.

For *L. whiffiagonis*, length distributions were available for both Spanish and Portuguese landings until 1998, when Portuguese length frequency data were mainly based on samples from Aveiro. Due to the uncertainties of this port since 1999, Spanish length distributions were raised to the total international landings for all subsequent years. Portuguese landings only represent 10% of the total landings on average.

For *L. boscii*, length distributions are available for Spanish and Portuguese landings since 1986 and 1998, respectively.

There has been a strong decrease in landings of fish under 15 cm in length since 1994 and under 20 cm in recent years for both species. This change probably results from stricter enforcement of the minimum landing size and a mesh size increase regulation in year 2000.

Catch numbers at age

Age compositions of landings are based on annual Spanish ALKs since 1990, whereas a survey ALK from 1986 combined with an annual ALK from 1990 was applied to years 1986-1989. Landings weights-at-age are also used as the weights-at-age in the stock. The following parameter values were used in the length-weight relationship (BIOSDEF, 1998):

	L. whiffiagonis	*L. boscii*
a	0.006488	0.00431
b	3.0114	3.1904

Natural mortality is set to 0.2 and assumed constant over all ages and years. This is the same value used for *L. whiffiagonis* in Divisions VIIb-k and VIIIabd.

The sex combined maturity ogive (BIOSDEF, 1998) is assumed constant over time, with the following proportions of fish mature at each age:

AGE	0	1	2	3	4	5+
L. whiffiagonis	0	0.34	0.90	1	1	1
L. boscii	0	0.55	0.86	0.97	0.99	1

B.3 Surveys

The Portuguese October groundfish survey (PtGFS-WIBTS-Q4) and the Portuguese Crustacean survey (PT-CTS (UWTV (FU 28-29))) and one Spanish groundfish survey (SpGFS-WIBTS-Q4) series are available since 1990, 1997 and 1983, respectively.

It should be taken into consideration that during years 1996, 1999, 2003 and 2004 the October Portuguese survey was carried out with a different vessel and gear from the one used in the rest of the series. The Crustacean survey was performed with different vessels in different years and covers a partial area; in 2004 it had many operational problems.

For these reasons and because indices from these surveys are not considered to be representative of megrim abundance, due to the very low catch rates, only the Spanish survey (SpGFS-WIBTS-Q4) is used in the assessment of the two species. The survey covers the distribution area and depth strata of these species in Spanish waters (covering both VIIIc and IXa). The survey appears to be quite good at tracking cohorts through time *for L. whiffiagonis*. For *L. boscii*, the survey signal is also clear until 2002, whereas it seems more blurred in recent years.

B.4 Commercial CPUE

LPUE and Fishing Effort data are available for the following fleets: Spanish trawlers based in A Coruña port (SP-CORUTR8c) and fishing in Division VIIIc since 1986, Spanish trawlers based in Avilés port (SP-AVILESTR) and fishing in Division VIIIc for the period 1986-2003, and Portuguese trawlers fishing in Division IXa since 1988. Effort from the Portuguese fleet is estimated from a sample of logbooks from sea trips where megrim occurred in the catch.

<u>Commercial fleets used in the assessment of *L.whiffiagonis* to tune the model</u>

- SP-CORUTR8c: This fleet contributed with data of effort (fishing days per 100 horse power), LPUE (as kg per fishing day per 100 horse power) and length composition of landings. In 2003, restrictions imposed on fishing activity due to the Prestige oil spill had an influence on effort.
- SP-AVILESTR: This fleet contributed with data of effort (fishing days per 100 horse power), LPUE (as kg per fishing day per 100 horse power) and length composition of landings. No data are available for this fleet after 2003.

<u>Commercial fleets used in the assessment of *L.boscii* to tune the model</u>

- SP-CORUTR8c: This fleet contributed with data of effort (fishing days per 100 horse power), LPUE (as kg per fishing day per 100 horse power) and length composition of landings. Due to the increased use of HVO ("jurelera") gear (which catches very little megrim) by this fleet, estimated LPUE values for recent years are not directly comparable with those from earlier years. This affects *L.boscii* more than *L.whiffiagonis* because the HVO gear is used mostly in more southern areas, where *L.whiffiagonis* abundance is very low. Hence, only LPUE values up to year 1999 from this tuning fleet are used in the assessment in the assessment of *L.boscii*.

C. Historical stock development: Assessment Methods and Settings

These stocks have been assessed with Extended Survivors Analysis (XSA), (Shepherd, 1992), since 1992.

Software used: VPA95 Lowestoft suite.

The input settings of the assessment model and data used in recent years are shown in the next table:

WG YEAR	2006		2007		2008		2009		2010	
Model	XSA		XSA		XSA		XSA		XSA	
Software	VPA95 Lowestoft suite		VPA95 Lowestoft suite		VPA95 Lowestoft suite		VPA95 Lowestoft suite		VPA95 Lowestoft suite	
Stock	*L.whiffiagonis*	*L.boscii*	*L.whiffiagonis*	*L.boscii*	*L.whiffiagonis*	*L.boscii*	*L.whiffiagonis*	*L.boscii*	*L.whiffiagonis*	*L.boscii*
Catch data range	1986-2005	1986-2005	1986-2006	1986-2006	1986-2007	1986-2007	1986-2008	1986-2008	1986-2009	1986-2009
Age range in catch data	1-7+	0-7+	1-7+	0-7+	1-7+	0-7+	1-7+	0-7+	1-7+	0-7+
SP-CORUTR8c	1990-2005 Ages 2-6	1986-1999 Ages 3-6	1990-2006 Ages 2-6	1986-1999 Ages 3-6	1990-2007 Ages 2-6	1986-1999 Ages 3-6	1990-2008 Ages 2-6	1986-1999 Ages 3-6	1990-2009 Ages 2-6	1986-1999 Ages 3-6
SP-AVILESTR	1990-2003 Ages 2-6	Not used	1990-2003 Ages 2-6	Not used	1990-2003 Ages 2-6	Not used	1990-2003 Ages 2-6	Not used	1990-2003 Ages 2-6	Not used
SpGFS-WIBTS-Q4 survey	1990-2005 Ages 1-6	1988-2005 (2003 not included) Ages 0-6	1990-2006 Ages 1-6	1988-2006 (2003 not included) Ages 0-6	1990-2007 Ages 1-6	1988-2007 (2003 not included) Ages 0-6	1990-2008 Ages 1-6	1988-2008 (2003 not included) Ages 0-6	1990-2009 Ages 1-6	1988-2009 (2003 not included) Ages 0-6
Taper	No	Tricubic over 20 years	No	Tricubic over 20 years	No	Tricubic over 20 years	No	Tricubic over 20 years	No	Tricubic over 20 years
Tuning range	16	20	17	21	18	22	19	23	20	24
Ages catch dep. stock size	1-4	0-2	1-4	0-2	1-4	0-2	1-4	0-2	1-4	0-2
Q plateau	5	5	5	5	5	5	5	5	5	5
F shrinkage s.e.	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Shrinkage year range	5	5	5	5	5	5	5	5	5	5
Shrinkage age range	3	3	3	3	3	3	3	3	3	3
Fleet s.e. threshold	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3	0.2	0.3
F bar range	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4	2-4

D. Short term projection

Common settings for *L. whiffiagonis* and *L. boscii* for deterministic short-term predictions:

- Model used: Age structured.
- Software used: MFDP prediction with management option table and yield per recruit routines.
- Natural mortality: 0.2.
- Maturity: Average maturity ogive for the last three years.
- F and M before spawning: Set to 0 for all ages in all years.
- Weight-at-age in the stock: Average stock weights for last three years.
- Weight-at-age in the catch: Average weight of the three last years.
- Exploitation pattern: Average of the three last years (normally unscaled although, when appropriately justified, it could be scaled to the final year).
- Intermediate year assumptions: status quo F

Specific settings for *L. whiffiagonis*:

- Initial stock size for projections. Taken from the XSA survivors for age 2 and older.
- Stock recruitment model used: None. Recruitment at age 1 assumed equal in all projection years (GM from 1998 to final assessment year minus 2).

Specific settings *L. boscii* for deterministic short-term predictions are:

- Initial stock size for projections. Taken from the XSA survivors for age 1 and older.
- Stock recruitment model used: None. Recruitment at age 0 assumed equal in all projection years (GM from 1990 to final assessment year minus 2).

Estimates of recruitment for years 1986 to 1989 are always excluded for these stocks because age compositions in those years are based on a combined ALK instead of annual ones. Estimates of recruitment for years 1990-1997 are excluded in *L. whiffiagonis* too because this stock has consistently displayed lower recruitment levels after 1997. The range of years may be revised by the WG in the future, if felt appropriate.

E. Medium term projections

Medium term projections are not conducted for these stocks.

F. Yield and biomass per recruit / long term projections

Yield per recruit calculations are conducted using the same input values as those used for the short term forecasts.

Model used: yield and biomass per recruit over a range of F values.

Software used: MFYPR.

G. Biological reference points

The table below shows a summary of the precautionary reference points proposed for *L. whiffiagonis* in the past. It shows that there are no precautionary reference points defined for this stock.

	ACFM 1998	WG 2000	ACFM 2000	WG 2002	ACFM 2002
Flim	Not defined	Not defined	Not defined	Not defined	Not defined
Fpa	No proposal	No proposal	Not adopted	No proposal	Not adopted
Blim	900 t (Bloss,=B95 WG98)		Not defined		
Bpa	1 500 t (Blim × 1.64)	900 t (Bloss,=B95 WG98)	Not adopted	1 500 t (stock history)	Not adopted

In the WGHMM 2010 meeting, as part of the new ICES MSY framework, possible proxies were considered for F_{msy} in the range of F_{max}, F0.1, F35% and F40%. F_{max} is not well defined for this stock, as the yield-per-recruit curve shows a very flat top. It was noted that there has been some variability in these values throughout the years. Furthermore, taking into account that the assessment of this stock and yield-per-recruit calculation ignore the fact that discards exist, a rough sensitivity exercise was conducted in WG2010 taking discards into consideration in an approximate way. The following table compares the results that were obtained from the original analysis (ignoring discards, left side of the table) and the sensitivity exercise (with some assumed landed proportions and increased F on younger ages, right side of the table):

	Original analysis			Sensitivity exercise with discards		
WG2010	Fbar	Y_p_R	SSB_p_R	Fbar	Y_p_R	SSB_p_R
Fmax	0.32	0.08	0.29	0.20	0.05	0.37
F0.1	0.14	0.07	0.48	0.13	0.05	0.50
F35%	0.21	0.07	0.38	0.19	0.05	0.38
F40%	0.17	0.07	0.43	0.16	0.05	0.43

Fmax would seem to be particularly affected by whether or not discards are taken into consideration. The F0.1, F35% and F40% values are affected to a much lesser extent.

F40%=0.17 was proposed by WGHMM 2010 as a provisional Fmsy proxy for the *L.whiffiagonis* stock. This proposal should be considered as preliminary and may be revised as further work on this stock assessment, including the incorporation of discards, takes place.

The table below summarises the history of precautionary reference points for *L. boscii* and shows that such points are not defined for this stock either.

	ACFM 1998	WG-1999	WG-2000	ACFM 2000	WG-2002	ACFM 2003	WG-2003
Flim	0.25 (Floss WG98)	No proposal	0.40 (Floss)		Not defined		
Fpa	0.20 (Flim e-1.645*σ)	No proposal	0.30 (Flim e-1.645*σ)	Not adopted	0.31 (Fmed)	Not adopted	No proposal
Blim	3 400 t (Bloss,=B96 WG98)	4 700 t (Bloss=B96 WG99)			Not defined		
Bpa	5 000 t (Blim × 1.4)	6 500 t	4 700 t (Bloss,=B95)	Not adopted	5 000 t (Bloss=B95)	Not adopted	No proposal

In previous Working Groups, reference points were not proposed because of the interannual variability detected in the relative exploitation pattern-at-age. This variability is still occurring. Nevertheless, an attempt was made during WGHMM 2010 to examine possible F_{msy} candidates for this stock. The possible proxies considered for F_{msy} were the same as for the other megrim species. There has also been some variability in the values throughout the years. Additionally, the same rough sensitive exercise to assumed discards was performed with the following results:

	Original analysis			Sensitivity exercise with discards		
WG2010	Fbar	Y_p_R	SSB_p_R	Fbar	Y_p_R	SSB_p_R
Fmax	0.39	0.05	0.16	0.21	0.03	0.21
F01	0.14	0.04	0.27	0.13	0.03	0.28
F35%	0.24	0.04	0.21	0.21	0.03	0.21
F40%	0.18	0.04	0.23	0.17	0.03	0.23

Fmax would seem to be greatly affected by whether or not discards are taken into consideration. The F0.1, F35% and F40% values are much less affected.

F40%=0.18 was proposed by WGHMM 2010 as provisional F_{msy} proxy for *L. boscii*, consistently with the choice made for *L.whiffiagonis*. This proposal should be considered preliminary and may be revised as further work on this stock assessment, including the incorporation of discards, takes place.

H. Other Issues

None.

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Annex J: Stock Annex Bay of Biscay Nephrops (FU 23-24)

Quality Handbook	**Annex J: Bay of Biscay *Nephrops* (FU 23-24)**

Stock specific documentation of standard assessment procedures used by ICES.

Stock:	Bay of Biscay *Nephrops* (Division VIIIa,b), FU 23-24, Management Area N
Working Group:	Assessment of Southern Shelf Stocks of Hake, Monk and Megrim
Created:	August 2005
Last update:	May 2010

A. General

A.1. Stock definition

Nephrops are distributed in North East Atlantic, from Iceland to South Portugal, in the North Sea and also in the Mediterranean sea, particularly in the western part. *Nephrops* live on 15–800m deep grounds, on muddy substrata. The distribution of this species is more determined by ground type and sea temperature than depth. *Nephrops* live in burrows dug in the mud. It leaves this burrow during low light periods (at dawn and dusk) to look for food. It can be caught in high quantities during this active time. *Nephrops* are sedentary. However they can move short distances if adverse factors modify its habitat, like mud disturbance by storms or other mechanical action on the sea bottom.

In the Bay of Biscay, *Nephrops* grounds correspond to muddy areas: the first one, which is the largest one, is in Division VIIIa and is called “la grande vasière”, the second one in Division VIIIb is called “vasière de la Gironde”. The overall area extends for around 12000 km² of surface.

A.2. Fishery

Nephrops in FUs 23-24 are almost exclusively exploited by French trawlers which have decreased notably throughout the recent fifteen years after conflicts of 1993-1994 and according to different decommissioning schemes.

The general features of the *Nephrops* fishery, as described in the 2003 *Nephrops* Working Group report (ICES, 2003) are still valid, but some can now be updated thanks to more precise information collected on vessel activity and economic results. These showed that:

- about 230 boats are currently involved in the Bay of Biscay *Nephrops* fishery spending an average of 193 days at sea in 2003,
- the typical Bay of Biscay trawler is 15 m long, with an engine power of 235 kW and a mean age of 19 years, (2005 data)
- the typical crew consists of three members.

In 2003, these vessels generated a total turnover of 82 million €. The contribution of *Nephrops* in the turnover is estimated to be 40% on average, but varies strongly from one boat to another. This percentage remained stable during recent years (2007 and 2008's data). For 45% of the vessels, more than half of the turnover is from *Nephrops*, and this proportion is even higher in the northern part of the fishery (Southern Brittany). 67% of the *Nephrops* trawlers and at least 64% of associated employment are concentrated in Southern Brittany. As stated, the importance of *Nephrops* fishing varies between vessels: for 72% of them it is the principal activity, 12% are part-time *Nephrops* trawlers, 10% fish for *Nephrops* between 3 and 6 months each year and for 6% of the vessels it is a marginal activity (reference to the situation in 2003). Other métiers practised by these boats are finfish directed bottom trawling (48% of the fleet) and pelagic trawling (2%).

The intensity of *Nephrops* directed fishing varies during the year: 67% of the total landings take place between April and August, and very low quantities are landed in January.

The *Nephrops* fishery is managed by TAC along with technical measures. The agreed TAC for 2008 was 4320 t whereas the ICES recommendation was 3600 t on the basis of 2006's advice as there was no ACFM review in 2007. In 2007, total nominal landings reached 3180 t. In 2009, a TAC of 4104 t was allowed whereas the ICES recommendation was 3400 t *i.e.* average landings from years 2005-2007. In 2010, the TAC was fixed at 3899 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 last year (see report WGHMM 2007).

A mesh change was implemented in 2000 and the minimum codend mesh size in the Bay of Biscay is 70 mm instead of the former 55 mm for *Nephrops*, which had replaced 50 mm mesh size in 1990-91. 100 mm mesh size is required in the *Hake* box. For 2006 and 2007, it should be noted that *Nephrops* trawlers were allowed to fish in the hake box with the current mesh size of 70 mm once they have adopted a square mesh panel of 100 mm. This derogation was maintained in 2008.

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 whole 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 and (3) an 80 mm codend mesh size.

A licence system was adopted in 2004 and, since then, there has been a cap on the number of *Nephrops* trawlers operating in the Bay of Biscay of 250. In the beginning of 2006, the French producers' organisations adopted new additional regulations such as monthly quotas which had some effects on fishing effort limitation.

A.3. Ecosystem aspects

Nephrops are omnivorous but polychetes, crustaceans, molluscs and echinoderms are its favourite prey. *Nephrops* grow by successive moults like all crustaceans, when renewing their carapace. Mating takes place just after the females moult. Eggs are fertilized when they are laid and they attach under the female abdomen. Berried *Nephrops* stay most of the time in their burrows. Egg loss is significant during incubation. When they hatch larvae are pelagic for one month, then after metamorphosis the small *Nephrops* settle on the sea bed.

In the Bay of Biscay, *Nephrops* of both sexes moult twice a year, before sexual maturity length is reached. Then when they are mature, females moult once a year, but males go on moulting twice a year.

Males are sexually mature when they are about 6.5 cm long (20 mm CL) and two years old, females when they are about 8 cm long (24 mm CL) and two and a half years old. Incubation takes 7 months in the Bay of Biscay. Egg number increase according to size (a 7-8 cm long female has a mean egg number around 650, a 9 cm long 800 eggs, a 15 cm long 4000 eggs).

The Bay of Biscay *Nephrops* fishery has a major impact on the Northern Stock of Hake, because the *Nephrops* fishing grounds are on a hake nursery. Hake discards are very important. By-catch of other species is not as large.

B. Data

B.1. Commercial catch

Nearly all the landings from FUs 23-24 are taken by French trawlers. Small landings are reported by Belgium from rectangles inside the FUs, and by Spain from rectangles outside the FUs but inside the MA.

Generally speaking, males predominate in the landings but sex ratio analysis show that since 1997 the proportion of females in the landings has slightly increased, reaching nearly 45% of the total. Changes in sex ratio can be related to discards sampling.

Discard data are available for 1987, 1991, 1998 and have been collected again since June 2002. The numbers discarded at length for the intermediate years up to 2002 were derived and discards for 2003 and 2004 have been estimated by a sample mean estimator from on board sampling programme.

Discards represent most of the catches of the 2 younger ages groups (group 1 and 2) as indicated by the available data. The average weight of discards per year on the period 1987-2004 (with derivation biases already stated) is about 1 500 tonnes.

B.2. Biological sampling and methodology

B.2.1. Generalities

Landings: French sampling plan at auction started in 1984, but only since 1987 the data can be used on quarterly basis. Since 2003, additional database of landings was also provided by sampling routinely performed onboard under the European DCR (Data Collection Regulation) aiming for discard estimates.

Discards: Discard data acquired by sampling on board are available for 1987, 1991, 1998 and since 2003 (Fig. 1). For recent years, discards have been estimated from sampling catches programme on board *Nephrops* trawlers (269 trips and 725 hauls have been sampled over period 2003-2009). Discards for sampled fishing trips are estimated by ratio estimator using the total landings as auxiliary variable (Talidec *et al.*, 2005). Discard sampling from the southern part of the fishery was carried out only once in the past (2005), thus, the poor set of available data cannot yet be included in the stock assessment.

For intermediate years up to 2002 with no sampling onboard, numbers discarded at length were derived in the following way:

- the estimates for 1987-90 from the data collected during the 1987 discard sampling programme;
- those for 1991-96 from the 1991 sampling programme; and
- those for 1997, 1999-2003 from the 1998 sampling programme.

The derivation method uses ratios at each length between discards and total numbers landed for the two sexes combined.

B.2.2. Exploratory runs based on probabilistic concepts

Applying discard data from 'sampled' to 'non-sampled' years bears the risk of inconsistency between the different data sets because it induces an inter-dependence between years and also prevents detection of any signal on recruitment strength. Hence, WG investigated additional exploratory runs based on different approaches of derivation of discards for missing years.

In order to eliminate dependence between years due to derivation of missing years from common datasets, WG carried out additional runs based on logistic derivation (*i.e.* simulation of the hand-sorting of marketable sizes) of discard length frequencies from those of landings year by year.

B.2.3. Methodology

(based on paper submitted to *ICES Journal of Marine Science*: S. Fifas, M.-J. Rochet, M. Salaün, O. Gaudou, C. Talidec in 2009; in revision and correction)

Overall scheme of this methodology is provided below. At present, this methodology is used only for exploratory runs, with the intention of using it for the main assessment after it has been tested in a benchmark.

B.2.3.1. Sampled years

The overall programme is based on a stratified random sampling. Discards are estimated for each sampled fishing trip and raised by multiplying by the total number of fishing trip in the stratum. The total number of trips is usually not known, its estimate can be done using the number of auction hall sales in the case of trips of short duration (1 day); that is the case for "Le Guilvinec" district, but not for the Southern part of the fishery. Estimates and variances are provided by haul, trip or segment (i.e. fleet or district). As there is only one sample collected during each fishing operation, the within-FO variance is estimated by assuming a fixed total sample size, only the species composition and the length frequency being variable. The variance of the observed quantity in each category is estimated by assuming a hyper-geometric distribution.

The ratio between discards and an auxiliary variable was afterwards estimated. The ratio-estimate is more accurate than the simple estimate only if the correlation of discards with the auxiliary variable is larger than half the ratio of the coefficients of variation: ϱ>CV(auxiliary var.)/(2*CV(discards)) (Cochran, 1977). Total landings were taken into account as auxiliary variable. The ratio of discards over landings by trip is calculated and is then raised using total landings.

B.2.3.2. Missing years

The integration of a set of independent variables (recruitment strength, density of probability of discards, regulations, market considerations) to extrapolate reliable discard rate from sampled to missing years was already considered by ICES. Indeed, the available common dataset (six years while the years after the MLS change *i.e.* 2006 and 2007 are excluded) reveals strong correlation for the relationship mean size of discards *vs.* mean size of landings (after log-log transformation) either on quarterly data (mainly for 2nd and 3rd quarters representing the major part of catches) or on the whole year datasets (R^2=0.96). This conclusion is valid on both separated sexes or on combined data. Even if year 1987 is removed from the regression, the R^2 remains high (0.90).

A new approach based on probabilistic concepts and on relationships between mean sizes of landings and of discards was performed by ICES. The main concepts of the derivation (back-calculation) are summarized as (Fig. 2):

1) The first step involves applying hand-sorting selection of retained catches which is explained by s-shaped (logistic) function *vs.* size. As statistically tested (Fifas *et al.*, 2006), the hand-sorting function is stable within-quarter for given parameters of the exploitation pattern (if mesh size and MLS remain constant within period). The overall time series was divided into three periods (years 1987-1990, 1988-1990 and 1992-1997).

2) The second step consists in removing undersized individuals unusual in landings which can generate unreliably extreme values of discards due to sampling problems (very high CV of landings for the extreme size classes). Hence, size classes less than a tested threshold (1% of cumulative landings) were eliminated. This calculation process retains only a part of the initial hand-sorting generated distributions of discards mainly the decreasing part of discarded individuals.

3) The third step allows the generation of missing size classes by applying a probability density function which can be symmetrical in regards to the overall symmetry of DLF of discards (Fig. 1). The whole calculation is based on multiple maximum likelihood function. Relationship as between mean sizes of landings and of discards is also included in the final fitting.

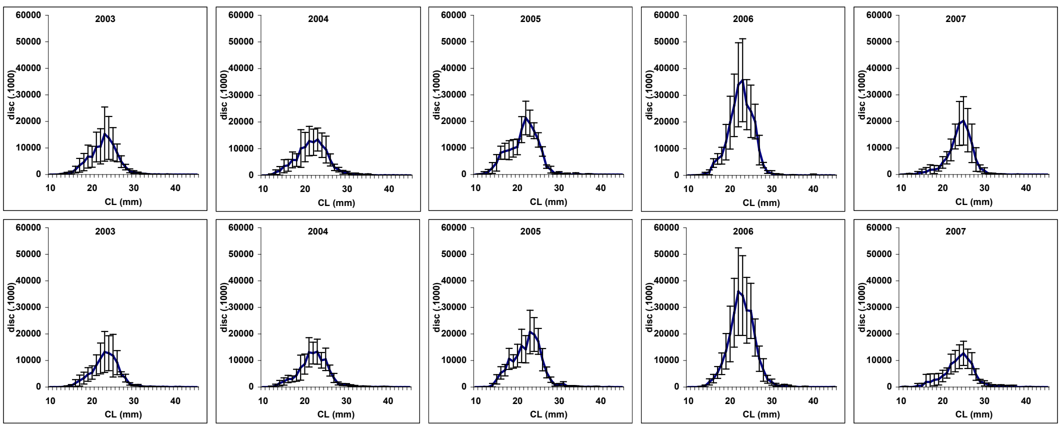

Figure 1. Years 2003-2007. Distribution of length frequencies (CL in mm) and confidence intervals (confidence level 1-α=0.95) for discards estimated by sampling. Data by sex (females above, males below).

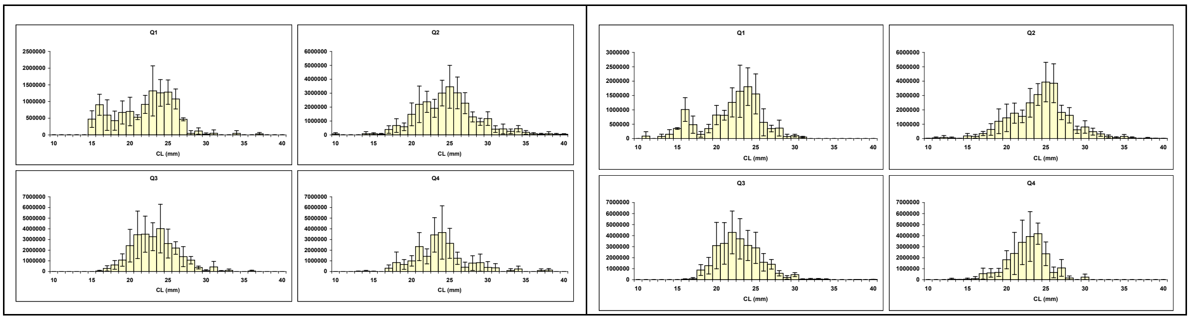

Figure 2. Distribution of length frequencies (CL in mm) for discards 2009 and confidence intervals (confidence level 1-α=0.95). Data by sex (males left, females right).

B.3. Surveys

A survey specifically designed to evaluate abundance indices of *Nephrops* in the Bay of Biscay commenced in 2006 (with the most appropriate season: 2nd quarter, hours of trawling: around dawn and dusk and fishing gear: twin trawl). In the future, this survey should provide an independent tuning dataset. These data can not currently be included as indices for the stock assessment. Nevertheless, some preliminary comparisons can be undertaken between data provided by the first four successive years (2006-2009) in order to examine recent recruitment levels.

This survey is carried out by twin trawling on the area of the Central Mud Bank of the Bay of Biscay (≈ 11680 km²). The whole area was divided to five sedimentary strata according to the mud composition of sediment and to its origin (Figure 3). The five strata are defined as:

(1) 25% mud and silt stratum (noted VV)

(2) 75% mud and silt stratum (noted VS)

(3) Lithoclastic mud<25% stratum (noted LI)

(4) Carbonated mud<25% stratum (noted CB)

(5) Calcareous mud<25% stratum (noted CL)

Using either sampling onboard for commercial vessels or VMS available data, it is possible to calculate distribution of the fishing effort for the *Nephrops* trawling fleet by stratum and by District (Table 1). The provided values are averaged on years 2003-2005. These values are used in combination with strata surfaces to allocate survey effort by stratum.

Table 1. Distribution (%) of the fishing effort of the *Nephrops* trawling fleet by sedimentary stratum and by District (GV=Le Guilvinec; CC+LO=Concarneau and Lorient; S=Southern Districts *i.e.* outside Brittany).

stratum	GV	CC+LO	S	Total
VS	4.43	4.89	2.80	12.12
VV	18.90	26.09	9.09	54.08
CL	9.10	0.00	0.00	9.10
LI	0.00	11.42	8.39	19.80
CB	3.50	0.00	1.40	4.90
	35.93	42.40	21.67	100.00

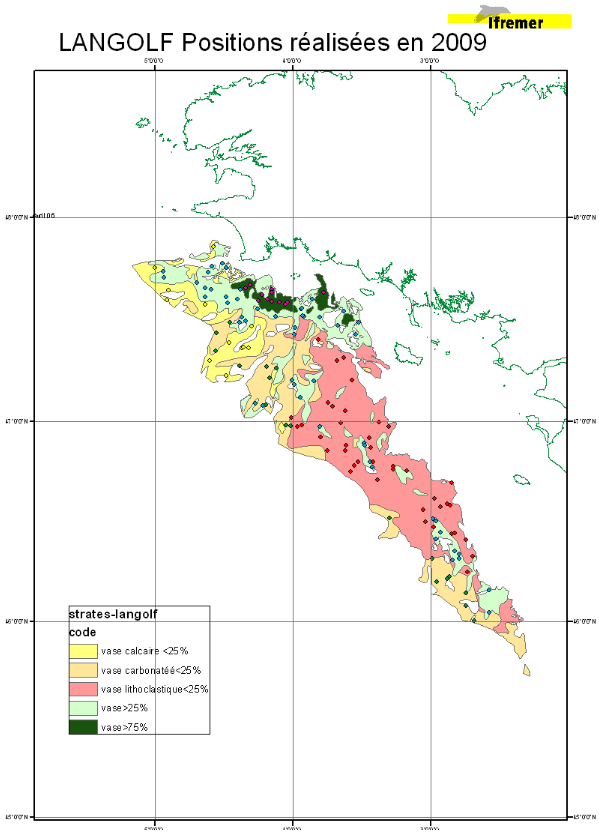

Figure 3. ***Nephrops*** **of the Bay of Biscay (FU 23-24). The Central Mud Bank, the five spatial strata and the distribution of sampling units for 2009's survey.**

B.4. Commercial CPUE

Commercial fleets used in the assessment to tune the model

The logbook regulation is not particularly well enforced in the Bay of Biscay. Very few skippers regularly fill in their logbooks (in 2003 for example, skippers of 209 out of a total of 266 *Nephrops* trawlers had filled in their logbook for at least one trip, and 108 for between one and fifty trips). Only 16% of the 2004 auction sales could be linked to logbook data.

Up to 1998, the majority of the vessels were not compelled to keep logbooks, and fishing forms were established by inquiries. Since 1999 when logbooks became compulsory for all vessels >10 m, no more inquiries have been carried out to fill in these forms, the consequence being a severe degradation in the quality of the effort data.

The available log-books cannot be considered as representative of the whole fishery, and estimates which used to be calculated in the past are no longer used (as they take into account trips with more than 10% of *Nephrops* in value). The current assessment uses the work done in 2004 to define a better effort index as follows:

The fleet which is chosen to calculate the effort index is that of the “Le Guilvinec District”, which groups four ports specialised in *Nephrops* trawling: 40% of the total *Nephrops* trawlers are from those ports. The reference period considered is the second quarter. This is the period of maximum availability of *Nephrops* (as females leave gradually burrows) and the period during which all boats target *Nephrops*, as opposed to the autumn and winter period when a (variable) proportion of the fleet prefers to target finfish for part of the trip. In the area covered by the Le Guilvinec fleets, fishing trips typically are daily, so the number of sales is equal to the number of trips[1]. The numbers of sales are available from the auction halls database. Fishing hours per trip vary seasonally: from 9 hours from April to October, to 6 hours in the remaining months. The overall effort index was then obtained by summing monthly products of fishing time by number of sales. The "Le Guilvinec District" effort series thus obtained is consistent with the data available before 1999, and is used to calculate LPUEs with landings data from the auction halls.

Because of changes in fishing gear and gear efficiency during the period, the number of hours trawling as such is not appropriate to quantify effort and to calculate LPUEs. In the 1990's, the number of boats using twin-trawls has increased together with that using rockhoppers. Gear efficiency has gone up, but its effect on fishing effort as a whole is difficult to quantify since twin-trawling is not always recorded in the fisheries statistics. An inquiry amongst fishermen has been performed in the frame of the EU project "TECTAC and data processing is in progress to build a time series on gear characteristics and other technical improvements (e.g. GPS). This should allow a better appreciation of 'real' effort.

Other available commercial fleets not used in last assessment to tune the VPA model

None

B.5. Other relevant data

B.5.1. Selectivity pattern of *Nephrops* trawls

B.5.1.1. Existing selection model

Nephrops selection data were collated by ICES WGFTFB in 1995. These have been used to produce a model relating L50 and SR [=deviation of selection=2*ln(3)/(L75-L25)] to mesh size, twine thickness and open meshes round the circumference of the codend.

$$L50 = 28.12 + 0.447 * MS - 4.87 * Ts - 0.095 * MR \qquad [9]$$

and

$$SR = 2.32 + 3.21 * Ts \qquad [10]$$

where MS is mesh size in mm, Ts is equivalent nominal single twine thickness mm and MR is number of open meshes round codend circumference. For double twine with thickness Td, it is assumed that a single twine with the same total twine cross-section is equivalent, i.e. Ts = SQRT(2 * Td * Td). The formulae for L50 and SR should be used with caution and only within the range of codend designs used to derive them. They may be derived using only hauls exhibiting length-related selection.

For the *Nephrops* trawlers of the Bay of Biscay, the selectivity parameters are given below (Table 2) [all polyethylene material; SF=selection factor=L50/MS]:

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[1] A fraction of Le Guilvinec trawlers (mainly located at the harbour of Loctudy) correspond to a different profile of exploitation from that of traditional vessels which can be used to tune XSA. The typical daily trip for this category consists on longer fishing time than the traditional one. The daily catchability for *Nephrops* is maximised around dawn and dusk. Then, this fraction of trawlers was removed from the tuning fleet.

Table 2. FU23-24 *Nephrops* stock (Bay of Biscay). Selectivity parameters (see draft report WKNEPH, Jan. 06; ICES,CM1995/B:2).

MS (mm)	55	70	80	70	80	100
thickness (mm)	4	4	4	4	4	4
double	N	Y	Y	N	N	Y
Ts	4	5.6569	5.6569	4.0000	4.0000	5.6569
nb meshes codend	100	100	100	100	100	100
L50	23.7250	22.3611	26.8311	30.4300	34.9000	35.7711
SR	15.1600	20.4785	20.4785	15.1600	15.1600	20.4785
SF	0.4314	0.3194	0.3354	0.4347	0.4363	0.3577

C. Historical Stock Development

Model used: XSA.

Software used: Lowestoft VPA suite v. 3.1 (Darby and Flatman, 1994).

Up to the 2003 assessment, tuning data were estimates of *Nephrops* directed effort based on information on the landings composition and the number of hours fished per voyage, averaged on an annual basis.

Discards for sampled fishing trips are raised by multiplying the total number of fishing trips. This total number of trips is usually not known and needs to be estimated, which can be done using the number of auction hall sales, if boats do daily trips, which is the case in the northern part of the fishery, but not in the southern part. Discards from the southern part of the fishery have not yet been sampled, so in order to obtain an estimate for the whole fishery we used the following ratio of total number of sales to number of sales in the southern part.

Then raised discards of the northern part were multiplied by this ratio. The catch sampling programme in 2005 included trips in the southern part of the fishery. So improvements in discard estimation were expected for future years. Nevertheless, the extension of the sampling design in the Southern part of the fishery could not be routinely applied every year.

Removals at length are obtained by adding up landings and “dead discards” since a discard mean survival rate of 30% is applied to discards.

The L2AGE slicing program allocates length classes into age groups, using von Bertalanffy growth parameters. The ages obtained are not absolute but relative ones (age groups). This slicing is applied to length distributions by sex and these age distributions are summed to obtain a “sex combined” age distribution.

The natural mortality both sexes combined is assumed to be 0.3 for age groups 1 and 2, then 0.25 for other age groups.

Since 2006 the WG has introduced some modifications of the maturity parameters by sex. Maturity of males is explained by the first size of functional maturity (26 mm CL on data collected in 2004; a strong yearly variability of the size of functional maturity was pointed out: Jégou, 2007). Previously, maturity of females was assumed to be knife-edged whereas now it is described by an s-shaped curve (logistic model with

L50 of 21-24 mm CL which is not significantly different to the value already used by WG *i.e.* 25 mm CL).

The growth parameters, the natural mortality and the maturity ogive by sex and combined are the following (as applied since WGHMM 2006):

Table 3. Usual input parameters (maturity, growth rate, natural mortality) for performing XSA

Males and immature females: L∞=76, K=0.14; mature females: L∞=56, K=0.11

age		1	2	3	4	5	6	7	8	9+
Size	males	10	19	26	33	38	43	48	51	54
(CL mm)	females	10	19	26	29	32	34	36	38	40
M	Males	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	females	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
	combined	0.3	0.3	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Maturity	Males	0	0	1	1	1	1	1	1	1
	females	0	0	0.5	1	1	1	1	1	1
	combined	0	0	0.75	1	1	1	1	1	1

Recruitment is assumed to occur at the 1st January and SSB is calculated at this date.

For the 2004 assessment as explained above a new tuning series was built (a) by choosing another reference fleet (the "Le Guilvinec district") and another reference period (the second quarter, which is much more indicative of the actual directedness of the fleet towards *Nephrops*) and (b) by adding a second tuning fleet covering the other ports of the Bay of Biscay, with selected *Nephrops* directed trips in the second quarter too.

This second tuning fleet has not been included since WGHMM 2005, because it is based on log book data whose quality is poor for this fishery.

So only the tuning fleet of "Le Guilvinec District" was kept to carry out the assessment. Annual age compositions were obtained by using the ratios of Quarter 2-fleet-landings to Total-quarter 2-landings.

Recent input data types and model options chosen are detailed in the following table:

Fleets	2006 XSA		2007 XSA		2008 XSA	
FR -Q2 -QGV	1987-2005	Ages 1-9+	1987-2006	Ages 1-9+	1987-2007	Ages 1-9+
Taper	Yes (3 over whole time series)		Yes (3 over whole time series)		Yes (3 over whole time series)	
Tuning range	Full		Full		Full	
Age catchability dependent of stock size	No		No		No	
q plateau	6		6		6	
F shrinkage se	1.5		1.5		1.5	
year range of shrinkage	5		5		5	
age range of shrinkage	5		5		5	

Note: no assessment was performed in 2009.

D. Short-Term Projections

Short-term projections are performed using MFDP and MFYPR procedures. In the particular case of the Bay of Biscay *Nephrops*, it is necessary to prepare data prior to the execution of the modules. Matrix containing numbers of removals by year and by age is computed using MFREP executable (available in ICES libraries) aiming to split into two matrices involving in landings and discards and the same procedure is carried out on matrix of F at age.

Apart from 2009 when no assessment was performed on the stock, short-term projections were provided on annual basis since the incorporation of the stock in the WGHMM (2005). Input for projections carried out for the five last years are commented below.

2006: In the assessment, recruitment 2005 was replaced by GM(87-04)=679 million. This GM value was input in projections for recruitments from 2006 onwards. Unscaled Fbar was calculated on years 2003-2005 (F=0.49).

2007: In the assessment, recruitment for 2005 was replaced by R2004 (=1006 million) because the WG adopted arguments for strong recruitment value for this year, but rejected the extremely high value provided by XSA. Two additional runs were also carried out with R2005 replaced either by GM(87-04)=672 million or by 90th percentile of the series 1987-2004 *i.e.* 860 million. Recruitment 2006 was replaced by GM(87-04) which was also used in projections for recruitments from 2007 onwards. The exploitation patterns for the projection are based on the unscaled average Fs-at-age in the years 2004-2006 ($F_{2\text{-}5}$=0.48). These were then split into landings and dead discards F, based on the scaled values of F discards at age estimated in 2006 because the exploitation pattern was modified due to the MLS change.

2008: In the assessment, recruitments 2006 and 2007 were replaced by GM(87-05)=683 million which was also be input in projections for recruitments from 2008 onwards. The exploitation patterns for the projection are based on the unscaled average Fs-at-age in the years 2005-2007 ($F_{2\text{-}5}$ = 0.53). As for 2007, these were then split into landings and dead discards F, based on the scaled values of F discards at age estimated in 2006 and 2007 because the exploitation pattern was modified due to the MLS change.

2010: All recruitments estimated by XSA (1987-2009) were accepted by WG, but GM for projections was calculated after excluding R2009 (=722 million) which may not represent the overall historical trend for recruitment level (even if LANGOLF signal seems to agree with relatively high recruitment for this year; the confirmation should be given in the future while this survey will be included as tuning time series). Unscaled Fbar was calculated on years 2007-2009 (F=0.43).

E. Medium-Term Projections

No analysis was carried out.

F. Biological Reference Points

There is no reference point for this stock and without any further information the Group decided not to propose any this year.

G. Other Issues

None.

H. References

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Annex K Stock Annexes *Nephrops* FU25

Quality Handbook ANNEX: K

Stock specific documentation of standard assessment procedures used by ICES.

Stock	North Galicia (Division VIIIc, FU 25).
Working Group:	WGHMM
Date:	05 May 2010
Revised by	Yolanda Vila and Luis Silva

A. General

A.1. Stock definition

Nephrops stock from FU 25 stretches along the Atlantic area off the northwest Spanish coast, located between Cap Finisterre and the Bay of Ribadeo.

A.2. Fishery

Nephrops is caught in the mixed bottom trawl fishery in the North and Northwest Iberian Atlantic. The fishery takes place throughout the year, with the highest landings in Spring and Summer. The overall decline of some bottom commercial species in the area has influenced the fishing strategies. The bottom fisheries have targeted a variety of species, including hake, anglerfish, megrim, horse mackerel and mackerel. At present, the trawl fleet comprises three main components: baca bottom trawl, high vertical opening trawl (HVO) and bottom pair trawl (STECF, 2003). Only the baca trawl catches *Nephrops*. Trawl vessels can change the gear from year to year and, consequently, the target species and fishing effort applied vary. The increasing use of pair trawlers and HVO (fishing for mackerel and horse mackerel) that do not catch *Nephrops* has reduced the fishing effort on the species in recent years.

The *Prestige* oil spill off the northwest Spanish coast (November 2002) resulted in the adoption of several temporary regulations to minimize the impact on the fisheries, such as spatial and seasonal closure for fishing fleets. The fishery remained partially closed from January to April 2003.This caused a reduction in fishing effort of the trawl fleet from November 2002 to June 2003.

Nephrops is managed by an annual TAC (applying to the whole of ICES Division VIIIc) and technical measures. European Union regulations establish 20 mm carapace length (CL) as a minimum landing size. Few animals are caught under size. Although *Nephrops* represents less than 2% of the total weight landed by the bottom trawl fishery (Fariña, 1996), the species is a very valuable component of the landings.

A recovery plan for southern hake and Atlantic Iberian *Nephrops* stocks was implemented and enforced since 2006 (EC, 2166/2005). 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.

A.3. Ecosystem aspects

This geographical area is characterized by episodic upwelling of North Atlantic Central Water during summer.

Nephrops is a burrowing species and occurs on muddy sea bed on the continental shelf and upper slope. The distribution of *Nephrops* in this area is limited to depths ranging from 90-600 m in a patch work configuration where the substrate is suitable. Its distribution is more determined by ground type and sea temperature than by depth. *Nephrops* are sedentary but they can leave their burrows in search of food and for reproduction.

After reaching sexual maturity, males molt more frequently than females, consequently growing faster. Mating takes place just after the females molt. Eggs are fertilized when they are laid and they attach under the female abdomen. 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. The emergence patterns of the *Nephrops* females during the incubation period results in a different exploitation pattern for each sex.

Nephrops are omnivorous, but polychetes, crustaceans, molluscs and echinoderms are their favourite preys. There are not reports on *Nephrops*' predators in the area.

B. Data

B.1. Commercial catch

Landings

Landings are reported only by Spain, with the data based on Spanish sales notes and Owners Associations data compiled by IEO. Fisheries statistics are believed to be reliable. However, during the periods 1998-2001 and 2004-2008 the information sources failed and landings data were obtained from the biological sampling programme, instead of directly from the sale sheets, which makes the quality of estimates more questionable.

Discard

Nephrops discards are negligible in this fishery. Generally, only soft and damaged individuals are discarded (Pérez *et al*., 1996) and the information is obtained via the onboard discard sampling programme.

B.2. Biological

Annual length compositions of the commercial landings of *Nephrops* for both males and females are available since 1980 for the A Coruña trawl fleet. The sampling data are raised to the total landings by market category and month. Starting from 2009 concurrent sampling is carried out, as required by the new DCR (Reg. EC 1343/2007). With the new sampling strategy, five fishing trips of the bottom trawl *metier* are sampled per month at the auction market in A Coruña port. Information on discards is not taken into account in the estimation of the total catch length distribution due to the low level of discards.

B.3. Surveys

Abundance indices of *Nephrops* FU 25 are derived from the Spanish groundfish survey (SPGFS-WIBTS-Q4) carried out to collect information on abundance of demersal species. The survey uses a stratified random sampling design with half hour hauls and covers the northwest area of Spain, from Portugal to France, during September/October since 1983 (except 1987). Data for 2003 are not considered reliable. The information is not taken into account because the surveys are not designed for *Nephrops*.

B.4. Commercial CPUE

Fishing effort and LPUE data are available for A Coruña trawl fleet (SP-CORUTR8c). The fishing effort corresponds to the bottom trawl fleet that fish in a mixed fishery for demersal species (not specifically directed to *Nephrops*). Fishing effort and LPUE data starting from 1999 exclude the fishing trips that operate with HVO, as this gear (which catches mostly mackerel and horse mackerel) does not catch *Nephrops.*

B.5. Other relevant data

C. Historical Stock Development

Nephrops FU 25 has been regularly assessed since 1990 (ICES, 1990). The last analytical assessment was carried out by the WGHMM in 2006 (ICES, 2006). XSA was applied, using "catch-at age" data generated by the slicing of length distributions employing the L2AGE program. This procedure, introduced in the 1991 *Nephrops* WG, uses von Bertalanffy growth parameters to determine limits between age classes. The use of slicing to convert length compositions into age compositions is controversial, especially for older age groups (3 and older). An assessment for both sexes combined was carried out, although slicing was applied by sex and the results combined to obtain a single catch-at-age matrix for both sexes.

The 2006 XSA assessment was calibrated using data from a single commercial LPUE series, where the definition of fishing effort was based on nominal effort. The results were only accepted as indicative of stock trends.

Model used (until 2006): XSA

Software used: Lowestoft VPA Suite (VPA95.exe), Retvpa02.exe

Input data types and characteristics:

Parameter	Value	Source
Discard survival	NA	Not applicable _ Few discards (<1% on
MALES		
Growth-K	0.160	(ICES, 1994)
Grouth-L(inf)	70	"
Natural mortality-M	0.2	"
Length/weight-a	0.00043	(Fariña, 1984)
Length/weight-b	3.160	"
FEMALES		
Inmature Growth		
Growth-K	0.160	(ICES, 1994)
Growth-L(inf)	70	"
Natural mortality-M	0.2	"
Size at maturity (mm CL)	28	(Fariña, 1996)
Mature Growth		
Growth-K	0.080	(ICES, 1994)
Grouth-L(inf)	60	"
Natural mortality-M	0.2	Assumed from Morizur (1982)
Length/weight-a	0.00043	(Fariña, 1984)
Length/weight-b	3.160	"

XSA run:

Males+Females	2006 WGHMM	
Tuning Fleets used SP-CORUTR-8c	Assessment Years 1982-2005	Assessment Ages 2 - 9
First age for normal catchability independent analysis	All ages independent	
First age at which q is considered independent of age	7	
Taper	Tricube over 20 yrs	
F shrinkage (SE for mean F)	1.5	
F Shrinkage	Final 5 yrs	3 oldest ages
Minimum Log SE for terminal population estimates	0.3	
Fbar (age)	4 - 7	
Recruitment Age	2	

No improvements in relation to the methodological assessment have been achieved after 2006 and the WG has not attempted any further analytical assessment for this stock. The time series of fisheries data are updated annually and LPUE series used to depict the stock trend.

D. Short-Term Projection

Not used.

E. Medium-Term Projections

Not used.

F. Long-Term Projections

Not used.

G. Biological Reference Points

There are no biological references points defined for this stock.

H. Other Issues

I. References

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Annex K Stock Annexes *Nephrops* FU31

Quality Handbook ANNEX: K

Stock specific documentation of standard assessment procedures used by ICES.

Stock	Cantabrian Sea (Division VIIIc, FU 31).
Working Group:	WGHMM
Date:	05 May 2010
Revised by	Yolanda Vila and Luis Silva

A. General

A.1. Stock definition

Nephrops stock from FU 31 extends in two main patches located in the central and in the easternmost Cantabrian Sea respectively.

A.2. Fishery

The description of these fisheries was updated and reported in STECF (2003). Mackerel and horse mackerel contribute 80% of the landed species by the baca bottom trawl fleet in the Cantabrian Sea, while hake and *Nephrops* together represent only 1% of the total landings by this fleet. Other trawl components operating in the Cantabrian Sea (namely HVO trawl and pair trawl) do not catch *Nephrops*.

Nephrops is managed in the area by an annual TAC (applying to the whole of ICES Division VIIIc) and technical measures. European Union regulations establish 20 mm carapace length (CL) as a minimum landing size. A recovery plan for southern hake and Atlantic Iberian *Nephrops* stocks was implemented and enforced since 2006 (EC, 2166/2005). 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.

A.3. Ecosystem aspects

Nephrops is a burrowing species and occurs on muddy sea bed on the continental shelf and upper slope. The distribution of *Nephrops* in this area is limited to depths ranging from 90-600 m in a patch work configuration where the substrate is suitable. It distribution is more determined by ground type and sea temperature than depth. They are sedentary but they can leave this burrow to look for food and for the reproduction.

After reaching sexual maturity, males molts more frequently than females, consequently growing faster. Mating takes place just after the females molt. Eggs are fertilized when they are laid and they attach under the female abdomen. Berried *Nephrops* stay most of the time in their burrows. Egg loss is significant during incubation. When they hatch larvae are pelagic for one month, then after metamorphosis the small *Nephrops* settle on the sea bed. The emergence patterns of the *Nephrops* females during the incubation period results in a different exploitation pattern for each sex.

Nephrops are omnivorous but polychetes, crustaceans, molluscs and echinoderms are its favourite prey. There are not reports on *Nephrops*' predators in the area.

B. Data

B.1. Commercial catch

Landings

Landings were reported only by Spain and they are available for the period 1983-2009. Data used in FU 31 are based on Spanish sales notes and Owners Associations data compiled by IEO.

Discard

Nephrops discards are negligible in this fishery.

B.2. Biological

Annual length frequencies by sex of Nephrops landings are collected by the sampling program since 1988. The sampling data of Aviles and Santander fleet are raised to the total landings by market category and month.

B.3. Surveys

Abundance indices of *Nephrops* FU 31 are derived from the Spanish groundfish survey (SPGFS-WIBTS-Q4) carried out to collect information on abundance of demersal species. The survey uses a stratified random sampling design with half hour hauls and covers the northwest area of Spain, from Portugal to France, during September/October since 1983 (except 1987). Data for 2003 are not considered reliable. The information is not taken into account due to the surveys are not designed for *Nephrops.*

B.4. Commercial CPUE

Landings per unit effort data series correspond to two bottom trawl fleets operating in the Cantabrian Sea with home ports in Aviles and Santander. No effort information for Aviles is available after 2003. In 2008 and 2009 fishing effort data are not available for Santander either.

B.5. Other relevant data

C. Historical Stock Development

At present, no assessment is carried out in this working group. The low levels of landings and fishing effort are insufficient to carry out an adequate assessment. The last analytical assessment of FU31 was conducted in 2002 (ICES, 2002).

D. Short-Term Projection

Not used.

E. Medium-Term Projections

Not used.

F. Long-Term Projections

Not used.

G. Biological Reference Points

There are no biological references points defined for this stock.

H. Other Issues

I. References

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STECF, 2003. Report of the STECF meeting on Hake Technical Measures. Lisbon, 27-31. October, 2003.

Annex L Stock Annexes Nephrops in Division IXa

Quality Handbook ANNEX: L

Stock specific documentation of standard assessment procedures used by ICES.

Stock	West Galician and North Portugal (Divi sion IXa, FU 26-27).
Working Group:	WGHMM
Date:	05 May 2010
Revised by	Yolanda Vila and Luis Silva

A. General

A.1. Stock definition

The *Nephrops* stock from FU 26 extends along the Atlantic area off the northwestern Spanish coast, south of Cape Finisterre, whereas FU 27 covers the Atlantic area off northern Portugal.

A.2. Fishery

Nephrops is caught in a mixed bottom trawl fishery, which takes place throughout the year, with the highest *Nephrops* landings in Spring and Summer. The overall decline of some bottom commercial species in the area has influenced the fishing strategies of the trawl fleets in terms of gear modalities and target species. Targeted species include hake, anglerfish, megrim, horse mackerel, mackerel and a variety of other fish and cephalopods.

The bottom trawl fleet comprises three main components: baca trawl, high vertical opening trawl (HVO) and pair trawl, each targeting different species. Only the baca trawl catches *Nephrops*. The description of these fisheries was updated and reported in STECF (2003). Trawl vessels can change gear from year to year and, consequently, target species and fishing effort applied vary. The increasing use of pair trawlers and HVO (fishing for mackerel and horse mackerel) that do not catch *Nephrops*, has reduced fishing effort on the species in recent years.

The *Prestige* oil spill off the northwest Spanish coast (November 2002) resulted in the adoption of several temporary regulations to minimize the impact on the fisheries, such as spatial and seasonal closure for fishing fleets. The fishery remained partially closed from January to April 2003, causing a reduction in fishing effort.

Nephrops is managed by an annual TAC (applying to the whole of ICES Division IXa) and technical measures. European Union regulations establish 20 mm carapace length (CL) as a minimum landing size. Few animals are caught under size. Although

Nephrops represents less than 2% of the total weight landed by the bottom trawl fishery (Fariña, 1996), the species is a very valuable component of the landings.

A Recovery Plan for southern hake and Atlantic Iberian *Nephrops* stocks was implemented and enforced since 2006 (EC 2166/2005). 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.

A.3. Ecosystem aspects

Nephrops is a burrowing species and occurs on muddy sea bed on the continental shelf and upper slope. The distribution of *Nephrops* in this area is limited to depths ranging from 90-500 m. Main patch configurations are evident in shallower waters (80-140 m) in the west coast of Galicia. The distribution of *Nephrops* is more determined by ground type and sea temperature than depth. They are sedentary but they can leave their burrows to look for food and for reproduction purposes.

After reaching sexual maturity, males molt more frequently than females, consequently growing faster. Mating takes place just after the females molt. Eggs are fertilized when they are laid and they attach under the female abdomen. Berried *Nephrops* stay most of the time in their burrows. Larvae are pelagic for one month after hatching, then after metamorphosis the small *Nephrops* settle on the sea bed. The emergence patterns of females during the incubation period results in a different exploitation pattern for each sex.

Nephrops are omnivorous but polychetes, crustaceans, molluscs and echinoderms are their favourite preys. There are not reports on *Nephrops*' predators in the area.

B. Data

B.1. Commercial catch

Landings

Landings are reported by Spain and minor quantities by Portugal. The catches are taken by Spanish fleets fishing on the Galicia (FU 26) and North Portugal (FU 27) fishing grounds and by the Portuguese artisanal fleet fishing with traps in FU 27. Prior to 1996 no distinction was made between the two FUs and, therefore, the Spanish landings for that early period are given for the two FUs together. The Spanish data used are based on Spanish sales notes and Owners Associations data compiled by IEO. Landings data are available since 1975 although landings by sex are only available from 1988 onwards.

Discard

Nephrops discards are negligible in this fishery. Generally, only soft and damaged individuals are discarded (Pérez *et al.*, 1996) and the information is obtained via the onboard discard sampling programme.

B.2. Biological

Length frequencies by sex of the *Nephrops* landings are collected monthly by the biological sampling programme since 1988. The sampling data from the Marín and Vigo fleets are raised to the total landings by market category and month. Starting from 2009 concurrent sampling is carried out, as required by the new DCR (Reg. EC

1343/2007). With the new sampling strategy, fishing trips of the bottom trawl *metier* are sampled at the auction markets of Riveira (FU 26), Marin (FU 26) and Vigo (FU 27) ports, with 3, 4 and 2 sampling events per month, respectively. Information on discards is not taken into account in the estimation of the total catch length distribution due to the low level of discards.

B.3. Surveys

Abundance indices of *Nephrops* FU 26 are derived from the Spanish groundfish survey (SPGFS-WIBTS-Q4) carried out to collect information on abundance of demersal species. The survey uses a stratified random sampling design with half hour hauls and covers the northwest area of Spain, from Portugal to France, during September/October since 1983 (except 1987). Data for 2003 are not considered reliable. The information is not taken into account due to the surveys are not designed for *Nephrops*.

B.4. Commercial CPUE

Fishing effort and an LPUE data series are available for Marín trawl fleet (SP-MATR) starting from 1994. This fleet accounts for more than 40% of the landings from these FUs. Time series of fishing effort and LPUE of the bottom trawl fleets with home ports of Muros (1984-2003), Riveira (1984-2004) and Vigo (1995-present) are also available.

B.5. Other relevant data

C. Historical Stock Development

The species has been regularly assessed since 1990 (ICES, 1990). The last analytical assessment for this FU was carried out by the WGHMM in 2006 (ICES, 2006). XSA was used with "catch-at age" data generated by slicing length distributions employing the L2AGE program. This procedure, introduced at the 1991 *Nephrops* WG, uses von Bertalanffy growth parameters to determine limits between age classes. The use of slicing to convert length compositions into age composition is controversial, especially for older age groups (3 and older). An assessment with combined sexes was carried out, although the slicing was applied for each sex separately and the resulting catch-at-age matrices by sex added up for the assessment. Prior to 2005 an assessment by sex was carried out but the WG proposed to carry out an assessment for both sexes combined, considering the advantages for management.

The 2006 assessment was calibrated using data from a single commercial LPUE series, where the definition of fishing effort was based on nominal effort. The results were accepted only as indicative of stock trends and not used for projections.

Model used (until 2006): XSA

Software used: Lowestoft VPA Suite (VPA95.exe), Retvpa02.exe

Input data types and characteristics

Parameter	Value	Source
Discards survival	NA	Not applicable-Few discards (<1% on average)
MALES		
Growth-K	0.150	(Fernandez et al., 1986)
Grouth-L(inf)	80	"
Natural mortality-M	0.2	"
Lenght/weight-a	0.00043	(Fariña, 1984)
Lenght/weight-b	3.160	"
FEMALES		
Inmature Growth		
Growth-K	0.160	(ICES, 1994)
Growth-L(inf)	70	"
Natural mortality-M	0.2	"
Size at maturity (mm CL)	26	(Fariña, 1996)
Mature Growth		
Growth-K	0.080	(ICES, 1994)
Grouth-L(inf)	65	"
Natural mortality-M	0.2	"
Lenght/weight-a	0.00043	(Fariña, 1984)
Lenght/weight-b	3.160	"

XSA run:

Males+Females	2006 WGHMM	
Tuning Fleets used SP-MATR	Assessment Years 1994-2005	Assessment Ages 2 - 9
First age for normal catchability independent analysis	All ages independent	
First age at which q is considered independent of age	6	
Taper	Tricube over 20 yrs	
F shrinkage (SE for mean F)	1.5	
F Shrinkage	Final 5 yrs	3 oldest ages
Minimum Log SE for terminal population estimates	0.3	
Fbar (age)	3 - 7	
Recruitment Age	2	

After 2006, no improvements in relation to a methodological assessment were achieved and the WG did not attempt any further analytical assessment for this stock. The time series of fisheries data are updated every year and LPUE series used to depict the stock trends.

D. Short-Term Projection

Not used.

E. Medium-Term Projections

Not used.

F. Long-Term Projections

Not used.

G. Biological Reference Points

There are no biological references points defined for this stock.

H. Other Issues

I. References

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Annex L: Stock Annex *Nephrops* in Division IXa

Quality Handbook **ANNEX: L *Nephrops* FU28-29**

Stock specific documentation of standard assessment procedures used by ICES.

Stock	Southwest and South Portugal (Division IXa, FUs 28-29)
Working Group:	WGHMM
Date:	07 May 2010 (updated)
Revised by	Cristina Silva

A. General

A.1. Stock definition

The Norway lobster (*Nephrops norvegicus*) is distributed along the continental slope off the southwest and south Portuguese coast, at depths ranging from 200 to 800 m. Its distribution is limited to muddy sediments, and requires sediment with a silt and clay content of between 10–100% to excavate its burrows, and this means that the distribution of suitable sediment defines the species distribution. Although FUs 28 and 29 are different stocklets, landings records are not differentiated and they are assessed together.

A.2. Fishery

The fishery in FUs 28 and 29 is mainly conducted by Portugal. For the last 25 years, this species has been a very important resource for the demersal trawl fisheries operating in the region. With exception of the years when the abundance of pink shrimp (*Parapenaeus longirostris*) is extremely high, *Nephrops* constitutes the main target species of the majority of the crustacean trawl fleet, and is not generally caught as by-catch of other fleets.

The Portuguese trawl fleet comprises two components, namely the trawl fleet fishing for fish and the trawl fleet fishing for crustaceans. The trawl fleet fishing for fish operates off the entire coast while the trawl fleet directed to crustaceans operates mainly in the Southwest and South Portugal, in deep waters, where crustaceans are more abundant. The fish trawlers are licensed to use a mesh size >= 65 mm and the crustacean trawlers are licensed for two different mesh sizes, 55 mm for catching shrimp and >= 70 mm for Norway lobster. Demersal fish trawlers that regularly land *Nephrops*, do in fact target this resource, which in terms of overall profit, represents a significant additional income.

The number of trawlers targeting crustaceans has been fixed at 35 since the early 1990s. However, since the late 1990s, some vessels have been replaced by new ones, better equipped and with a more powerful engine. In 2008, the number of licensed fish trawlers was 69 with an average of 645 HP, 182 GRT and 26 m of overall length, whereas the number of crustacean trawlers was 30, with an average of 562 HP, 177 GRT and 25 m of overall length.

There are two main target species in the crustacean fishery, which are the Norway lobster and the deepwater rose shrimp. These two species have a different but overlapping depth distribution. Rose shrimp occurs from 100 to 350 meters of depth whereas Norway lobster is distributed from 200 to 800 meters. The number of fishing trips directed to one species or to the other depends on the abundance of these species each year. The number of fishing trips directed to *Nephrops* increased in 2004-2005, dropping again in 2006-2009.

The fishery takes place throughout the year, with the highest landings usually being made in the spring and summer.

A Recovery Plan for the southern hake and Iberian *Nephrops* stocks has been in force since the end of January 2006 (Council Regulation (EC) No. 2166/2005). 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. In order to reduce fishing mortality on *Nephrops* stocks in this area even further, the Recovery Plan introduced a seasonal ban in the trawl and creel fishery in a box, located in FU 28, for four months in the peak of the *Nephrops* fishing season (May – August).

Every year, the TAC and the number of fishing days per vessel is regulated.

A Portuguese national regulation (Portaria no. 1142/2004, 13th September 2004) enforced a complete closure of the deepwater crustacean trawl fishery in January–February 2005 and established a ban on *Nephrops* fishing from 15 September to 15 October. The ban in September–October was already implemented in 2004. This regulation was revoked in January 2006 after the implementation of the Recovery Plan, keeping only one month of closure of the crustacean fishery in January (Portaria no. 43/2006, 12th January 2006). Although these periods do not correspond to the main fishing season for Nephrops, these measures resulted in a reduction of effort.

The minimum landing size (MLS) for *Nephrops norvegicus* is 20 mm of carapace length (CL) or 70 mm of total length (TL). Discards are negligible and are mainly related to quality (broken or soft shells).

The main by-catch species are blue whiting, hake and anglerfish.

A.3. Ecosystem aspects

The Norway lobster (*Nephrops norvegicus*) is distributed along the southwest and south Portuguese coast, at depths ranging from 200 to 800 m. Its distribution along the continental slope is patchy and high abundance areas have been clearly identified.

Differences in the length composition of catches originating from FU28 (SW Portugal) and those originating from FU29 (S Portugal) were observed during the surveys. At present there is no scientific evidence to separate these stocks and consider them two sub-populations. Further work in this area is needed to improve our knowledge about this stock.

Another topic that should be further investigated, is the possible interaction between the stocks found in FU29 and FU30 (Cadiz). Exchanges between the two populations are likely to occur since there are no known physical/geographical constraints limiting this exchange. Aiming for a better understanding of the *Nephrops* population dynamics, tagging experiments and genetic studies would provide valuable information, which would help to support the issues dealt with during the assessment working groups.

Norway lobster is a benthic species that attains a maximum size of around 80mm (CL) corresponding to a weight of approximately 400g. Lobsters spawn from August through to November off the shelf edge in deep waters. After spawning, females carry the eggs for a 3 to 4 month period after which the larvae hatch and become pelagic free swimmers. Larvae move freely in the water column for a short time period before settling into the mud grounds. Females reach the first maturity at 30 mm and males around 28 mm of carapace length (CL) (ICES, 2006).

A comprehensive study into the role of Norway lobsters in the ecosystem has not yet been carried out. It would be particularly useful to have such information, as *Nephrops* is known to be part of an extended and dynamic community of highly valuable commercial species.

B. Data

B.1. Commercial catch

Up to 1992 the estimated landings from FUs 28 and 29 have fluctuated between 450 and 530 t, with a long-term average of about 480 t. Between 1990 and 1996, the landings fell drastically to 132 t. From 1997 to 2005 landings have increased to levels observed during the early 1990s but decreased again in recent years. The value of total landings in 2009 was 122 t, the lowest value of the series.

Males are the dominant component in all landings with exception of 1995 and 1996 when total female landings exceeded male landings (ICES, 2006a). For the last eight years male to female sex-ratio has been close to 1.5:1.

A discard sampling program onboard the Portuguese crustacean trawlers started in 2004. The weight of *Nephrops* discarded in 2006-2008 was very low with high CVs. No discards were recorded in 2009.

B.2. Biological

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. The sampling data are raised to the total landings by market category, vessel and month. Information on discards is not taken into account in the estimation of the total catch length distributions due to the low level of discards and the lack of defined raising procedures. However, the length distribution of discards confirms the idea that *Nephrops* is not rejected because of its MLS (20 mm of CL) but mainly due to quality problems.

Mean weights-at-age for this stock are estimated from fixed weight-length.

A natural mortality rate of 0.3 was assumed for all age classes and years for males and immature females, with a value of 0.2 for mature females based in Morizur (1982). The lower value for mature females reflects the reduced burrow emergence while ovigerous and hence an assumed reduction in predation.

The size at maturity for females was recalculated at ICES-WKNEPH 2006 to be 30 mm being the same as used in assessments prior to 2008 (ICES, 2006). An asymmetrical log-log relationship was used to estimate the maturity ogive and L_{50}.

A segmented regression was used to estimate the size at maturity for males as the breakpoint in the growth relationship between the appendix masculina and the carapace length. The value estimated for FU 29 was 28.4 mm of CL (ICES, 2006).

Growth parameters were estimated using the Bhattacharya method and tagging experiments (Figueiredo, 1989).

Several factors were considered to potentially affect survival, including duration of the tow and season, and biological characteristics of the individuals (e.g. size, sex and ovigerous condition). Survival was only affected by season (increased mortality in warm months). A global estimate of survival of released lobsters, taking into consideration survival and proportion of the catches for each season, was 35% (Castro *et al.*, 2003)

Summary:

INPUT PARAMETERS		
Parameter	Value	Source
Discard Survival	0.35	
MALES		
Growth - K	0.200	Portuguese data (Bhattacharya method) ; tagging (ICES, 1990a)
Growth - L(inf)	70	"
Natural mortality - M	0.3	Figueiredo (1989)
Size at maturity (mm CL)	28.4	ICES (2006)
Length/weight - a	0.00028	Figueiredo (pers. comm., 1986)
Length/weight - b	3.2229	"
FEMALES		
Immature Growth		
Growth - K	0.200	Portuguese data (Bhattacharya method) ; tagging (ICES, 1990a)
Growth - L(inf)	70	"
Natural mortality - M	0.3	Figueiredo (1989)
Size at maturity (mm CL)	30	ICES (1994)
Mature Growth		
Growth - K	0.065	Portuguese data (Bhattacharya method) ; tagging (ICES, 1990a)
Growth - L(inf)	65	"
Natural mortality - M	0.2	Figueiredo (1989)
Length/weight - a	0.00056	Figueiredo (pers. comm., 1986)
Length/weight - b	3.0288	"

B.3. Surveys

The Portuguese crustacean surveys started in 1981. The surveys were carried out with the research vessels «Mestre Costeiro» and «Noruega» and the main areas covered were the southwest coast (Alentejo or FU 28) and the south coast (Algarve or FU 29). The main objectives were 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).

In 1997, a stratified sampling design was adopted, based on the design for the demersal resources. The sectors and depth strata were the same used for the groundfish surveys, from 200 to 750 meters in the southwest coast and from 100 to 750 meters in the south coast. The number of hauls in each stratum was dependent on *Nephrops* and rose shrimp abundance variance, with a minimum of 2 stations per stratum. The average total number of stations in the period 1997-2004 was 60. These surveys were carried out in May-July and had a total duration of 20 days.

Since 2005, sampling was based on a regular grid superimposed on the area of *Nephrops* distribution. This sampling procedure allows a more powerful use of data, especially considering the use of geostatistical tools. The total duration of the survey was the same (20 days) and the haul duration had to be reduced from 60 to 30 minutes in order to cover all the rectangles (77) of the grid.

Sediment samples have been collected since 2005 with the aim to study the characteristics of the *Nephrops* fishing grounds.

In 2008, the crustacean trawl survey conducted in Functional Units 28 and 29, was combined with an experimental video sampling. The collection of images was limited to 10 stations in FU 28.

A SeaCorder, composed of an MD4000 high resolution colour camera, an MP4 video recorder and a 30 Gb hard drive, was hung at the central point of the headline, pointing forward onto the sea floor with an angle of 45 degrees, approximately (ICES, 2007). A 2-beam laser pointer is attached to the SeaCorder, for measuring purposes (estimation of the width of view and *Nephrops* and burrows sizes).

The collection of video footage was routinely carried out in each trawl station was routinely carried in 2009. This methodology is being evaluated to see if the data can be used for biomass estimation, length distribution and *Nephrops* catchability by the trawl gear (ICES, 2009).

B.4. Commercial CPUE

A standardization of the CPUE series was presented to WGHMM in 2008 (Silva, C. – WD 25) and reviewed in 2009, applying the generalized linear models (GLMs). The data used for this standardization were the crustacean logbooks for the period 1988-2008. 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 variabilility, when using the CPUE in kg/day or kg/haul respectively. The CPUE series was standardised and the effort estimated correspondingly.

However some concerns related to the characteristics of the fishery remain. The main target species of this fleet are rose shrimp and Norway lobster. The vessels change their fishing objective according to the abundance of these species, which can affect the target CPUE estimation and consequently the derived effort. Further work has to be done on this subject, using only *Nephrops* targeting trips.

B.5. Other relevant data

C. Historical Stock Development

In the past, LCA assessments were carried out for males and females separately over a 3-year reference period, in which the stock was considered to be in a steady state. The steady state assumption was questioned due to the decrease of the stock and this method was abandoned (ICES, 2002).

Software used: Lba99g.exe

Age structured XSA assessments have been carried out recently for *Nephrops*, males and females separately (ICES, 2008), with two tuning fleets: the crustacean fleet and the crustacean survey. The results were considered unreliable for several reasons most importantly, growth and natural mortality assumptions and the use of age-converted groups by slicing. However, the results have been taken as indicative of stock trends.

Software used:

- For conversion of the length compositions in ages with slicing: L2AGE4.exe
- XSA: Lowestoft VPA Suite (VPA95.exe), Retvpa02.exe, FLR package

Males	2006 – 2010 WGHMM	
Tuning Fleets used (First - Last year ; Ages used)	Period	Ages
P-TR: Crustacean Trawl Fleet	1988-2005	2 - 7
P-CTS: Crustacean Trawl Survey	1997-2005	2 - 7
First age for normal catchability independent	All ages independent	
First age at which q is considered independent of	6	
Taper time weight applied?	Tricube over 20 yrs	
F shrinkage (SE for mean F)	1.5	
F Shrinkage	Final 5	3 oldest
Minimum Log SE for terminal population estimates	0.3	
Fbar (age)	2 - 7	
Recruitment Age	2	

Females	2006 – 2010 WGHMM	
Tuning Fleets used (First - Last year ; Ages used)	Period	Ages
P-TR: Crustacean Trawl Fleet	1988-2005	2 – 12
P-CTS: Crustacean Trawl Survey	1997-2005	2 – 5
First age for normal catchability independent	All ages independent	
First age at which q is considered independent of age	11	
Taper time weight applied?	Tricube over 20 yrs	
F shrinkage (SE for mean F)	1.5	
F Shrinkage	Final 5 yrs	5 oldest
Minimum Log SE for terminal population estimates	0.3	
Fbar (age)	4 – 10	
Recruitment Age	2	

Other indicators, such as CPUE from the fleet, abundance index from crustacean trawl survey and mean sizes in landings and in surveys have also been used when analysing trends.

D. Short-Term Projection

Not used

E. Medium-Term Projections

Not used

F. Long-Term Projections

Not used

G. Biological Reference Points

There are no biological reference points defined for this stock.

H. Other Issues

I. References

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Annex L: Stock Annex *Nephrops* in Division IXa

Quality Handbook	ANNEX:_L

Stock specific documentation of standard assessment procedures used by ICES.

Stock	Gulf of Cadiz (Division IXa, FU 30).
Working Group:	WGHMM
Date:	05 May 2010
Revised by	Yolanda Vila and Luis Silva

A. General

A.1. Stock definition

The *Nephrops* stock from FU30 comprises the Spanish waters of the Gulf of Cadiz, defined as the Spanish Suratlantic Region. The western limit of the stock is at the Portuguese border, on the Guadiana River estuary, whereas the eastern border is at the Gibraltar Strait. The Gibraltar Strait separates the Gulf of Cadiz from the Mediterranean Sea and is considered a natural border. On the other hand, the Guadiana River does not seem to be a real boundary for splitting possibly different populations (FUs 29 and 30). This stock limit was decided mainly on management considerations, without any clear biological basis. Possible differences and exchange rates across FUs 29 and 30 should be studied. Tagging experiments and genetic studies could provide valuable information in this respect.

Within FU 30, *Nephrops* grounds correspond to muddy and sandy areas ranging between 200 to 700 m depth. High fishing effort is particularly carried out around 500 m (Ramos et al., 1996).

A.2. Fishery

Nephrops in FU 30 is exploited mostly by Spanish trawlers. The bottom trawl fleet of the Gulf of Cadiz is characterized by the multispecifity of its landings (Sobrino, 1994; Jiménez, 2002; 2004). The fleet operates mainly from four coastal localities: Isla Cristina, Sanlúcar de Barrameda, Puerto de Santa María and Huelva. Huelva was the most important *Nephrops* landing port until 2002, but landings from Isla Cristina and Puerto de Santa María became larger than Huelva landings from that year onwards (Vila et al., 2005). Recent information from the Port of Ayamonte shows that *Nephrops* landings at this port represent 31% of the total *Nephrops* landings from the bottom trawl fleet in FU 30. Ayamonte and Isla Cristina were the main *Nephrops* landing ports in 2009. Landings are clearly seasonal with high values from April to September (Jiménez, 2002). *Nephrops* represents 1.5% of the total trawl landings from the area.

Two main *métiers* were identified among the trawlers in the past (STECF, 2003). The most common group normally fish in shallow waters (30-100 m) with a mixture of target species (sparids, cephalopods, wedge sole, hake and horse mackerel). The other group operates between 90 and 500 m of depth, targeting mainly blue whiting, shrimp, horse mackerel, hake and Norway lobster.

A fleet conversion developed by the public administration at the end of the 1990s homogenized considerably this fleet regarding its technical characteristics and fishing capacity. Jiménez et al. (2004) observed a direct relationship between the capacity of vessel mobility and the bathymetric situation of the fishing. After the fleet conversion, a larger number of vessels could access the more remote and deeper fishing grounds, resulting in an increase of *Nephrops* directed effort and landings from 2000 to 2004. At present, *Nephrops* and the others target species of the Gulf of Cádiz bottom trawl fleet are landed by a unique and highly multispecific *metier*, due to recent changes in the abundance of target species and fleet regulations (see WGHMM 2007 report Section 2).

Different Fishing Plans have been established since 2004 in order to reduce the fishing effort of the bottom trawl fleet in the Gulf of Cádiz (ORDENES APA/3423/2004, APA/2858/2005, APA/2883/2006, APA/2801/2007). The current Fishing Plan (ORDENES ARM/2515/2009, ARM/58/2010) runs from September 2009 until September 2010. The plans generally restrict daily fishing hours, establish two days per week of no fishing and a single landing event per vessel per day. The reduction of daily fishing hours has a direct effect on *Nephrops* directed effort because the trawl fleet does not have enough time to access the *Nephrops* fishing grounds, which are located far away from the fishing port. Furthermore, the plan establishes a closed fishing season of 90 days distributed in two periods. The first period took place last year between September 25-November 23 2009, and the second period was established between January 22-February 14 2010).

The effects of the closed seasons on *Nephrops* population have not yet been evaluated. However, from 2006 onwards, total fleet effort and directed effort decreased even though the closed season was established outside of the main fishing season. Since 2008, the directed fishing effort and the landings of *Nephrops* are much lower. The increment of the abundance of rose shrimp (*Parapenaeus longirostris*) has led a change in the objectives of the fishery. This fact, together with the bad weather conditions during 2008 and the remoteness of the *Nephrops* fishing grounds, probably has an influence on this reduction.

Nephrops is managed in the area by an annual TAC (applying to the whole of ICES Division IXa) and technical measures. The European Union regulations establish 20 mm carapace length (CL) as a minimum landing size. Few animals are caught under size.

For the bottom trawl fleet, the Gulf of Cadiz area has different regulations from the rest of statistical subdivisions in the North Eastern Atlantic, allowing the use of smaller mesh sizes (40 mm). Nevertheless, an increase of mesh size to 55 mm or more was indefinitely implemented in the last Fishing Plan in order to reduce discards of individuals below the minimum landing size.

There is a Recovery Plan for the southern stock of hake and Iberian stocks of *Nephrops* (EC 2166/2005). Effort limitation measures indicated in the Recovery Plan (and specifically defined in Annex IIb of the annual EC regulation setting TACs) do not affect the Gulf of Cádiz.

A.3. Ecosystem aspects

Nephrops is a burrowing species and inhabits muddy sea beds on the continental shelf and upper slopes. Its distribution is more determined by ground type and sea temperature than depth. In this area, it is distributed between 200 and 800 m of depth in a patchwork configuration where the substrate is suitable. *Nephrops* are sedentary but they can leave their burrows to look for food and for reproduction.

After reaching sexual maturity, males molt more frequently than females, consequently growing faster. Mating takes place just after the females molt. Eggs are fertilized when they are laid and they attach under the female abdomen. Berried *Nephrops* stay most of the time in their burrows. Larvae are pelagic for one month after hatching, then after metamorphosis the small *Nephrops* settle on the sea bed. The emergence pattern of the *Nephrops* females during the incubation period results in a different exploitation pattern for each sex. The spawning season occur in summer, mature females are observed in spring and summer while berried females appear starting from August (Vila et al., 2005). Females remain in their burrows during the autumn and winter.

Nephrops are omnivorous, but polychetes, crustaceans, molluscs and echinoderms are their favourite preys.

Further work in this area is needed to improve our knowledge about this stock. The information on the specific *Nephrops* biology from this area is still scarce.

A comprehensive study into the role of Norway lobsters in the ecosystem would be particularly useful since a habitat of special interest has been observed in deeper waters of the Gulf of Cádiz (OSPAR, 2004). Methane-enriched fluid expelled through a submarine mound, probably formed as a mud volcano in this area, maintains a highly sensitive ecosystem (Díaz del Río et al., 2006).

B. Data

B.1. Commercial catch

Landings

Landings are reported by Spain and also minor quantities by Portugal. Spanish data are based on sales notes and Owners Associations data compiled by IEO.

Discard

An annual Spanish Discard Sampling Programme under the EU DCR has been carried out in FU 30 since 2005. Until 2008, fishing trips in the bottom trawl *metier* were sampled by observers onboard during the *Nephrops* fishing season (Summer). The number of fishing trips sampled by year ranged between 20 and 30. Based on the new DCR, the discard sampling scheme covers the whole year since 2009 (Reg. EC 1343/2007). The 22 total annual number of sampled fishing trips in the bottom trawl *metier* was distributed among the quarters, with 5, 6, 6 and 5 sampled trips in quarters 1 to 4, respectively. The series provides information on discarded catch in weight and number and length distributions.

B.2. Biological

Annual length compositions of the commercial landings of *Nephrops* for both males and females are available since 2001. The sampling followed a multistage stratified random scheme by month in the port of Huelva for the period 2001-2005. These data were raised to the total landings from FU 30. Inconsistencies were found in this series (Silva *et al*., 2006), due to the fact that not all commercial categories were sampled before 2004. In 2006, a new sampling scheme was introduced, which included sampling in other ports (Isla Cristina, El Puerto de Santa María and Sanlúcar de Barrameda) and excluded the port of Huelva because the landings in this port have decreased. The sampling data were raised to the total landings by market category, port, month and area.

Starting from 2009 concurrent sampling is carried out, as required by the new DCR (Reg. EC 1343/2007). With the new sampling strategy, six fishing trips of the bottom trawl *metier* are sampled per month onboard vessels from the main landings ports in the Gulf of Cadiz, in order to ensure the widest geographical coverage. At least two fishing trips per month correspond to the deepest strata, where the *Nephrops* fishing grounds in this FU are located.

Information on discards is not taken into account in the estimation of the total catch length distribution due to the low level of discards.

No new information on biological parameters is available since 2004 (Vila *et al*., 2005). Carapace length (CL) and total weight (W) relationships were $W=0.0004*CL^{3.1018}$ for males, $W=0.0007*CL^{2.9657}$ for females and $W=0.0006*CL^{3.0237}$ for both sexes. Females' carapace length at first maturity was 29.4 mm. A histology study on female gonads is presently taking place, in order to compare macro and micro maturity scales. This study could improve the estimates of size at first maturity in this sex. Additionally, measurements of appendix masculine are being carried out with the aim of obtaining the size of onset of sexual maturity in males, following the methodology of McQuaid et al. (2006). Biological studies should continue in *Nephrops* from the Gulf of Cadiz.

B.3. Surveys

Two ground fish surveys are carried out annually in the Gulf of Cadiz in March (SPGF-cspr-WIBTS-Q1, since 1993) and November (SPGFS-caut-WIBTS-Q4, since 1997). A stratified random sampling design with five bathymetric strata, covering depths between 15 and 700 m, is used, with one hour hauls.

Neither of these surveys are carried out during the main fishing period of *Nephrops* (April-September). Berried females are hidden in their burrows in autumn, so only the index from the March survey is considered potentially representative of stock abundance.

B.4. Commercial CPUE

Effort data used in the Gulf of Cadiz are based on Spanish sales notes and Owners Associations data compiled by IEO.

The estimate of *Nephrops* directed effort corresponds to daily fishing trips for which *Nephrops* represent at least 10% of the total landings in weight.

B.5. Other relevant data

C. Historical Stock Development

An LCA assessment of *Nephrops* of the Gulf of Cadiz (FU 30) was attempted in 2004 for the first time, in the ICES WGNEPH (ICES 2004). The input parameters used are presented in the table below. Given the uncertainties about input parameters, this assessment was considered as preliminary. Also, the steady state assumptions required for LCA assessment are questionable due to the observed trends in landings and effort.

Model used (in 2004): LCA
Software used: Lba

Input data types and characteristics:

PARAMETERS	VALUE	SOURCE
Discard Survival	NA	Not aplicable - few discards (< 1 % on average)
MALES		
Length range (mm)	18-50	Landings (2001-2003)
Growth - K	0.160	From FU 25 k value
Growth - L(inf)	60	Lmax from Gulf of Cadiz surveys
Natural mortality - M	0.2	Fernández et al. (1986)
Length/weight - a	0.00043	Fariña (1984)
Length/weight - b	3.160	Fariña (1984)
FEMALES		
Immature Growth		
Growth - K	0.160	From FU 25 k value
Growth - L(inf)	60	L max from Gulf of Cadiz surveys
Natural mortality - M	0.2	Fernández et al. (1986)
Size at maturity	28	Average from FU 25 and FU 26-27 values
FEMALES		
Mature Growth		
Length range (mm)	18-56	Landings (2001-2003)
Growth - K	0.090	Average from FU 25 and FU 26-27
Growth - L(inf)	58	LC max from Gulf of Cadiz landings
Natural mortality - M	0.2	Fernández et al. (1986)
Length/weight - a	0.00043	Fariña (1984)
Length/weight - b	3.160	Fariña (1984)

Given the inconsistencies in the length compositions from 2001-2005 and the absence of additional information, assessment of this FU has not been carried out so far.

D. Short-Term Projection

Not used.

E. Medium-Term Projections

Not used.

F. Long-Term Projections

Not used.

G. Biological Reference Points

There are no biological references points defined for this stock.

H. Other Issues

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Annex M: ASPIC results for southern anglerfish in VIIIc and IXa

M1 – *L. piscatorius* Aspic bootstrap output

```
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                                                                                    Sunday, 15 May 2011 at 21:33:10
ASPIC -- A Surplus-Production Model Including Covariates (Ver. 5.34)
                                                                                                   BOT program mode
Author:     Michael H. Prager; NOAA Center for Coastal Fisheries and Habitat Research            LOGISTIC model mode
            101 Pivers Island Road; Beaufort, North Carolina  28516  USA                            YLD conditioning
            Mike.Prager@noaa.gov                                                                    SSE optimization

Reference:  Prager, M. H. 1994. A suite of extensions to a nonequilibrium            ASPIC User's Manual is available
            surplus-production model.  Fishery Bulletin 92: 374-389.                          gratis from the author.

CONTROL PARAMETERS (FROM INPUT FILE)          Input file: c:\...esktop\wg2011\wg\assessment\aspic_mon2011_errorced.inp
-------------------------------------------------------------------------------------------------------------------------
Operation of ASPIC:  Fit logistic (Schaefer) model by direct optimization with bootstrap.
Number of years analyzed:                       31            Number of bootstrap trials:                        1000
Number of data series:                           2            Bounds on MSY (min, max):       2.000E+03     1.150E+04
Objective function:                  Least squares            Bounds on K (min, max):         5.000E+03     1.120E+05
Relative conv. criterion (simplex):      1.000E-10            Monte Carlo search mode, trials:        1         10000
Relative conv. criterion (restart):      3.000E-08            Random number seed:                             1964185
Relative conv. criterion (effort):       1.000E-04            Identical convergences required in fitting:         10
Maximum F allowed in fitting:                8.000

PROGRAM STATUS INFORMATION (NON-BOOTSTRAPPED ANALYSIS)                                                  error code   0
-------------------------------------------------------------------------------------------------------------------------
Normal convergence

CORRELATION AMONG INPUT SERIES EXPRESSED AS CPUE (NUMBER OF PAIRWISE OBSERVATIONS BELOW)
-------------------------------------------------------------------------------------------------------------------------
                                      |
 1  Coruna                            |   1.000
                                      |      25
                                      |
 2  Cedeira                           |   0.624   1.000
                                      |      12      12
                                       --------------------------------------------------
                                              1       2

GOODNESS-OF-FIT AND WEIGHTING (NON-BOOTSTRAPPED ANALYSIS)
-------------------------------------------------------------------------------------------------------------------------
                                                     Weighted            Weighted      Current    Inv. var.    R-squared
Loss component number and title                           SSE      N          MSE       weight       weight      in CPUE

Loss(-1)  SSE in yield                              0.000E+00
Loss(0)   Penalty for B1 > K                        0.000E+00      1          N/A    1.000E+00          N/A
Loss(1)   Coruna                                    4.379E+00     25    1.904E-01    1.000E+00    8.591E-01        0.555
Loss(2)   Cedeira                                   1.265E+00     12    1.265E-01    1.000E+00    1.293E+00        0.306
.........................................................................................
TOTAL OBJECTIVE FUNCTION, MSE, RMSE:            5.64373300E+00           1.764E-01    4.200E-01
Estimated contrast index (ideal = 1.0):                0.2187           C* = (Bmax-Bmin)/K
Estimated nearness index (ideal = 1.0):                0.7719           N* = 1 - |min(B-Bmsy)|/K

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MODEL PARAMETER ESTIMATES (NON-BOOTSTRAPPED)
-------------------------------------------------------------------------------------------------------------------------
Parameter                                            Estimate     User/pgm guess     2nd guess    Estimated   User guess

B1/K      Starting relative biomass (in 1980)       2.528E-01          5.000E-01     7.075E-01            1            1
MSY       Maximum sustainable yield                 7.288E+03          5.000E+03     3.016E+03            1            1
K         Maximum population size                   5.145E+04          5.000E+04     1.809E+04            1            1
phi       Shape of production curve (Bmsy/K)        0.5000             0.5000             ----            0            1

--------- Catchability Coefficients by Data Series ---------------
q(1)      Coruna                                    2.053E-06          1.000E-05     9.500E-04            1            1
q(2)      Cedeira                                   1.357E-05          1.000E-06     9.500E-05            1            1

MANAGEMENT and DERIVED PARAMETER ESTIMATES (NON-BOOTSTRAPPED)
-------------------------------------------------------------------------------------------------------------------------
Parameter                                            Estimate              Logistic formula            General formula

MSY       Maximum sustainable yield                 7.288E+03                          ----                       ----
Bmsy      Stock biomass giving MSY                  2.572E+04                           K/2            K*n**(1/(1-n))
Fmsy      Fishing mortality rate at MSY             2.833E-01                      MSY/Bmsy                  MSY/Bmsy

n         Exponent in production function           2.0000                             ----                       ----
g         Fletcher's gamma                          4.000E+00                          ----       [n**(n/(n-1))]/[n-1]

B./Bmsy   Ratio: B(2011)/Bmsy                       2.908E-01                          ----                       ----
F./Fmsy   Ratio: F(2010)/Fmsy                       8.547E-01                          ----                       ----
Fmsy/F.   Ratio: Fmsy/F(2010)                       1.170E+00                          ----                       ----

Y.(Fmsy)  Approx. yield available at Fmsy in 2011   2.340E+03                  MSY*B./Bmsy                MSY*B./Bmsy
          ...as proportion of MSY                   3.211E-01                          ----                       ----
Ye.       Equilibrium yield available in 2011       3.622E+03           4*MSY*(B/K-(B/K)**2)      g*MSY*(B/K-(B/K)**n)
          ...as proportion of MSY                   4.970E-01                          ----                       ----

--------- Fishing effort rate at MSY in units of each CE or CC series ---------
fmsy(1)   Coruna                                    1.380E+05                   Fmsy/q( 1)                 Fmsy/q( 1)
```

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ESTIMATED POPULATION TRAJECTORY (NON-BOOTSTRAPPED)

Obs	Year or ID	Estimated total F mort	Estimated starting biomass	Estimated average biomass	Observed total yield	Model total yield	Estimated surplus production	Ratio of F mort to Fmsy	Ratio of biomass to Bmsy
1	1980	0.359	1.300E+04	1.341E+04	4.816E+03	4.816E+03	5.618E+03	1.267E+00	5.056E-01
2	1981	0.401	1.381E+04	1.390E+04	5.568E+03	5.568E+03	5.748E+03	1.414E+00	5.367E-01
3	1982	0.414	1.399E+04	1.398E+04	5.782E+03	5.782E+03	5.769E+03	1.460E+00	5.437E-01
4	1983	0.444	1.397E+04	1.377E+04	6.114E+03	6.114E+03	5.714E+03	1.567E+00	5.433E-01
5	1984	0.452	1.357E+04	1.335E+04	6.032E+03	6.032E+03	5.603E+03	1.594E+00	5.277E-01
6	1985	0.480	1.315E+04	1.279E+04	6.139E+03	6.139E+03	5.445E+03	1.694E+00	5.110E-01
7	1986	0.597	1.245E+04	1.150E+04	6.870E+03	6.870E+03	5.058E+03	2.108E+00	4.840E-01
8	1987	0.494	1.064E+04	1.042E+04	5.141E+03	5.141E+03	4.707E+03	1.742E+00	4.136E-01
9	1988	0.694	1.020E+04	9.109E+03	6.321E+03	6.321E+03	4.244E+03	2.449E+00	3.967E-01
10	1989	0.676	8.127E+03	7.390E+03	4.996E+03	4.996E+03	3.584E+03	2.386E+00	3.159E-01
11	1990	0.592	6.715E+03	6.400E+03	3.790E+03	3.790E+03	3.175E+03	2.090E+00	2.611E-01
12	1991	0.638	6.100E+03	5.705E+03	3.640E+03	3.640E+03	2.874E+03	2.252E+00	2.372E-01
13	1992	0.693	5.334E+03	4.877E+03	3.381E+03	3.381E+03	2.501E+03	2.447E+00	2.074E-01
14	1993	0.525	4.454E+03	4.439E+03	2.329E+03	2.329E+03	2.298E+03	1.852E+00	1.732E-01
15	1994	0.436	4.424E+03	4.608E+03	2.007E+03	2.007E+03	2.377E+03	1.537E+00	1.720E-01
16	1995	0.353	4.794E+03	5.193E+03	1.834E+03	1.834E+03	2.645E+03	1.247E+00	1.864E-01
17	1996	0.535	5.605E+03	5.523E+03	2.955E+03	2.955E+03	2.794E+03	1.888E+00	2.179E-01
18	1997	0.777	5.444E+03	4.781E+03	3.715E+03	3.715E+03	2.456E+03	2.742E+00	2.116E-01
19	1998	0.824	4.185E+03	3.616E+03	2.981E+03	2.981E+03	1.904E+03	2.909E+00	1.627E-01
20	1999	0.662	3.108E+03	2.916E+03	1.932E+03	1.932E+03	1.559E+03	2.338E+00	1.208E-01
21	2000	0.438	2.735E+03	2.872E+03	1.259E+03	1.259E+03	1.537E+03	1.547E+00	1.063E-01
22	2001	0.224	3.012E+03	3.524E+03	7.880E+02	7.880E+02	1.859E+03	7.891E-01	1.171E-01
23	2002	0.217	4.084E+03	4.762E+03	1.032E+03	1.032E+03	2.447E+03	7.648E-01	1.588E-01
24	2003	0.391	5.499E+03	5.819E+03	2.278E+03	2.278E+03	2.924E+03	1.382E+00	2.138E-01
25	2004	0.519	6.145E+03	6.086E+03	3.157E+03	3.157E+03	3.041E+03	1.831E+00	2.389E-01
26	2005	0.650	6.029E+03	5.608E+03	3.644E+03	3.644E+03	2.831E+03	2.293E+00	2.344E-01
27	2006	0.591	5.216E+03	5.011E+03	2.963E+03	2.963E+03	2.563E+03	2.087E+00	2.028E-01
28	2007	0.480	4.816E+03	4.896E+03	2.350E+03	2.350E+03	2.510E+03	1.694E+00	1.872E-01
29	2008	0.457	4.976E+03	5.112E+03	2.337E+03	2.337E+03	2.609E+03	1.614E+00	1.934E-01
30	2009	0.403	5.248E+03	5.530E+03	2.228E+03	2.228E+03	2.797E+03	1.422E+00	2.040E-01
31	2010	0.242	5.816E+03	6.623E+03	1.604E+03	1.604E+03	3.268E+03	8.547E-01	2.261E-01
32	2011		7.480E+03						2.908E-01

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RESULTS FOR DATA SERIES # 1 (NON-BOOTSTRAPPED) Coruna

Data type CC: CPUE-catch series Series weight: 1.000

Obs	Year	Observed CPUE	Estimated CPUE	Estim F	Observed yield	Model yield	Resid in log scale	Statist weight
1	1980	*	2.753E-02	0.3591	4.816E+03	4.816E+03	0.00000	1.000E+00
2	1981	*	2.853E-02	0.4006	5.568E+03	5.568E+03	0.00000	1.000E+00
3	1982	*	2.870E-02	0.4136	5.782E+03	5.782E+03	0.00000	1.000E+00
4	1983	*	2.826E-02	0.4441	6.114E+03	6.114E+03	0.00000	1.000E+00
5	1984	*	2.741E-02	0.4517	6.032E+03	6.032E+03	0.00000	1.000E+00
6	1985	*	2.625E-02	0.4801	6.139E+03	6.139E+03	0.00000	1.000E+00
7	1986	2.690E-02	2.361E-02	0.5973	6.870E+03	6.870E+03	-0.13044	1.000E+00
8	1987	2.740E-02	2.138E-02	0.4936	5.141E+03	5.141E+03	-0.24804	1.000E+00
9	1988	3.710E-02	1.870E-02	0.6939	6.321E+03	6.321E+03	-0.68514	1.000E+00
10	1989	2.160E-02	1.517E-02	0.6761	4.996E+03	4.996E+03	-0.35344	1.000E+00
11	1990	1.760E-02	1.314E-02	0.5922	3.790E+03	3.790E+03	-0.29247	1.000E+00
12	1991	2.140E-02	1.171E-02	0.6380	3.640E+03	3.640E+03	-0.60286	1.000E+00
13	1992	1.780E-02	1.001E-02	0.6932	3.381E+03	3.381E+03	-0.57541	1.000E+00
14	1993	8.700E-03	9.112E-03	0.5247	2.329E+03	2.329E+03	0.04628	1.000E+00
15	1994	6.200E-03	9.459E-03	0.4356	2.007E+03	2.007E+03	0.42242	1.000E+00
16	1995	6.300E-03	1.066E-02	0.3532	1.834E+03	1.834E+03	0.52590	1.000E+00
17	1996	1.160E-02	1.134E-02	0.5350	2.955E+03	2.955E+03	-0.02285	1.000E+00
18	1997	1.170E-02	9.815E-03	0.7770	3.715E+03	3.715E+03	-0.17566	1.000E+00
19	1998	4.200E-03	7.423E-03	0.8243	2.981E+03	2.981E+03	0.56953	1.000E+00
20	1999	5.400E-03	5.987E-03	0.6625	1.932E+03	1.932E+03	0.10313	1.000E+00
21	2000	2.800E-03	5.896E-03	0.4384	1.259E+03	1.259E+03	0.74461	1.000E+00
22	2001	2.800E-03	7.235E-03	0.2236	7.880E+02	7.880E+02	0.94927	1.000E+00
23	2002	6.000E-03	9.776E-03	0.2167	1.032E+03	1.032E+03	0.48816	1.000E+00
24	2003	1.230E-02	1.195E-02	0.3915	2.278E+03	2.278E+03	-0.02923	1.000E+00
25	2004	1.320E-02	1.249E-02	0.5187	3.157E+03	3.157E+03	-0.05504	1.000E+00
26	2005	1.890E-02	1.151E-02	0.6498	3.644E+03	3.644E+03	-0.49573	1.000E+00
27	2006	1.260E-02	1.029E-02	0.5913	2.963E+03	2.963E+03	-0.20283	1.000E+00
28	2007	1.050E-02	1.005E-02	0.4800	2.350E+03	2.350E+03	-0.04375	1.000E+00
29	2008	1.350E-02	1.049E-02	0.4572	2.337E+03	2.337E+03	-0.25191	1.000E+00
30	2009	1.020E-02	1.135E-02	0.4029	2.228E+03	2.228E+03	0.10701	1.000E+00
31	2010	1.110E-02	1.360E-02	0.2422	1.604E+03	1.604E+03	0.20286	1.000E+00

* Asterisk indicates missing value(s).

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RESULTS FOR DATA SERIES # 2 (NON-BOOTSTRAPPED) Cedeira

Data type I1: Abundance index (annual average) Series weight: 1.000

Obs	Year	Observed effort	Estimated effort	Estim F	Observed index	Model index	Resid in log index	Statist weight
1	1980	0.000E+00	0.000E+00	--	*	1.819E-01	0.00000	1.000E+00
2	1981	0.000E+00	0.000E+00	--	*	1.885E-01	0.00000	1.000E+00
3	1982	0.000E+00	0.000E+00	--	*	1.896E-01	0.00000	1.000E+00
4	1983	0.000E+00	0.000E+00	--	*	1.868E-01	0.00000	1.000E+00
5	1984	0.000E+00	0.000E+00	--	*	1.811E-01	0.00000	1.000E+00
6	1985	0.000E+00	0.000E+00	--	*	1.735E-01	0.00000	1.000E+00
7	1986	0.000E+00	0.000E+00	--	*	1.560E-01	0.00000	1.000E+00
8	1987	0.000E+00	0.000E+00	--	*	1.413E-01	0.00000	1.000E+00
9	1988	0.000E+00	0.000E+00	--	*	1.236E-01	0.00000	1.000E+00
10	1989	0.000E+00	0.000E+00	--	*	1.002E-01	0.00000	1.000E+00
11	1990	0.000E+00	0.000E+00	--	*	8.681E-02	0.00000	1.000E+00
12	1991	0.000E+00	0.000E+00	--	*	7.739E-02	0.00000	1.000E+00
13	1992	0.000E+00	0.000E+00	--	*	6.616E-02	0.00000	1.000E+00
14	1993	0.000E+00	0.000E+00	--	*	6.021E-02	0.00000	1.000E+00
15	1994	0.000E+00	0.000E+00	--	*	6.251E-02	0.00000	1.000E+00
16	1995	0.000E+00	0.000E+00	--	*	7.044E-02	0.00000	1.000E+00
17	1996	0.000E+00	0.000E+00	--	*	7.492E-02	0.00000	1.000E+00
18	1997	0.000E+00	0.000E+00	--	*	6.486E-02	0.00000	1.000E+00
19	1998	0.000E+00	0.000E+00	--	*	4.905E-02	0.00000	1.000E+00
20	1999	1.000E+00	1.000E+00	--	7.030E-02	3.956E-02	0.57493	1.000E+00
21	2000	1.000E+00	1.000E+00	--	3.740E-02	3.896E-02	-0.04087	1.000E+00
22	2001	1.000E+00	1.000E+00	--	4.000E-02	4.781E-02	-0.17832	1.000E+00
23	2002	1.000E+00	1.000E+00	--	5.280E-02	6.460E-02	-0.20171	1.000E+00
24	2003	1.000E+00	1.000E+00	--	5.770E-02	7.894E-02	-0.31342	1.000E+00
25	2004	1.000E+00	1.000E+00	--	6.700E-02	8.256E-02	-0.20880	1.000E+00
26	2005	1.000E+00	1.000E+00	--	1.244E-01	7.608E-02	0.49176	1.000E+00
27	2006	1.000E+00	1.000E+00	--	9.370E-02	6.798E-02	0.32092	1.000E+00
28	2007	1.000E+00	1.000E+00	--	5.070E-02	6.642E-02	-0.27001	1.000E+00
29	2008	1.000E+00	1.000E+00	--	4.400E-02	6.934E-02	-0.45490	1.000E+00
30	2009	1.000E+00	1.000E+00	--	7.950E-02	7.502E-02	0.05805	1.000E+00
31	2010	1.000E+00	1.000E+00	--	1.213E-01	8.985E-02	0.30016	1.000E+00

* Asterisk indicates missing value(s).

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ESTIMATES FROM BOOTSTRAPPED ANALYSIS

Param name	Point estimate	Estimated bias in pt estimate	Estimated relative bias	Bias-corrected approximate confidence limits 80% lower	80% upper	95% lower	95% upper	Inter-quartile range	Relative IQ range
B1/K	2.528E-01	1.559E-01	61.67%	1.203E-01	2.556E-01	1.203E-01	3.029E-01	2.774E-02	0.110
K	5.145E+04	-6.040E+03	-11.74%	4.942E+04	8.003E+04	3.825E+04	9.946E+04	9.230E+03	0.179
q(1)	2.053E-06	-1.374E-07	-6.69%	1.515E-06	2.393E-06	1.063E-06	2.543E-06	3.343E-07	0.163
q(2)	1.357E-05	-5.367E-07	-3.96%	1.065E-05	1.872E-05	7.073E-06	2.956E-05	3.530E-06	0.260
MSY	7.288E+03	-8.277E+02	-11.36%	7.225E+03	1.150E+04	6.292E+03	1.150E+04	4.200E+03	0.576
Ye(2011)	3.622E+03	-7.537E+01	-2.08%	2.752E+03	4.805E+03	2.243E+03	5.667E+03	9.845E+02	0.272
Y.(Fmsy)	2.042E+03	-6.537E+01	-3.20%	1.925E+03	2.145E+03	1.829E+03	2.243E+03	9.959E+01	0.049
Bmsy	2.572E+04	-3.020E+03	-11.74%	2.471E+04	4.001E+04	1.912E+04	4.973E+04	4.615E+03	0.179
Fmsy	2.833E-01	3.805E-02	13.43%	2.082E-01	3.150E-01	1.554E-01	3.834E-01	3.405E-02	0.120
fmsy(1)	1.380E+05	5.357E+04	38.81%	1.190E+05	1.560E+05	1.138E+05	1.742E+05	1.752E+04	0.127
fmsy(2)	2.089E+04	9.082E+03	43.48%	1.593E+04	2.495E+04	1.219E+04	2.941E+04	4.112E+03	0.197
B./Bmsy	2.908E-01	1.321E-01	45.41%	1.582E-01	3.814E-01	1.185E-11	5.516E-01	1.109E-01	0.381
F./Fmsy	8.547E-01	2.954E-02	3.46%	6.307E-01	1.253E+00	4.740E-01	1.474E+00	3.180E-01	0.372
Ye./MSY	4.970E-01	8.319E-02	16.74%	1.412E-01	6.380E-01	1.412E-01	8.076E-01	1.826E-01	0.367
q2/q1	6.608E+00	2.336E-01	3.54%	5.440E+00	8.406E+00	4.957E+00	1.039E+01	1.511E+00	0.229

INFORMATION FOR REPAST (Prager, Porch, Shertzer, & Caddy. 2003. NAJFM 23: 349-361)

Unitless limit reference point in F (Fmsy/F.): 1.170
CV of above (from bootstrap distribution): 1.701

NOTES ON BOOTSTRAPPED ESTIMATES:

- Bootstrap results were computed from 1000 trials.
- Results are conditional on bounds set on MSY and K in the input file.
- All bootstrapped intervals are approximate. The statistical literature recommends using at least 1000 trials for accurate 95% intervals. The default 80% intervals used by ASPIC should require fewer trials for equivalent accuracy. Using at least 500 trials is recommended.
- Bias estimates are typically of high variance and therefore may be misleading.

Trials replaced for lack of convergence: 0 Trials replaced for MSY out of bounds: 82
Trials replaced for q out-of-bounds: 51
Trials replaced for K out-of-bounds: 195 Residual-adjustment factor: 1.0753

Elapsed time: 0 hours, 37 minutes, 35 seconds.

M2 - *L. budegassa* Aspic bootstrap output

```
Southern Anglerfish - ank
                                                                                Friday, 06 May 2011 at 16:51:24
ASPIC -- A Surplus-Production Model Including Covariates (Ver. 5.34)
                                                                                               BOT program mode
Author:     Michael H. Prager; NOAA Center for Coastal Fisheries and Habitat Research         LOGISTIC model mode
            101 Pivers Island Road; Beaufort, North Carolina  28516  USA                      YLD conditioning
            Mike.Prager@noaa.gov                                                              SSE optimization

Reference:  Prager, M. H. 1994. A suite of extensions to a nonequilibrium           ASPIC User's Manual is available
            surplus-production model.  Fishery Bulletin 92: 374-389.                      gratis from the author.

CONTROL PARAMETERS (FROM INPUT FILE)          Input file: c:\users\ralpoim\documents\aspic534\tamboril\bot\aspic.inp
-----------------------------------------------------------------------------------------------------------------------
Operation of ASPIC:  Fit logistic (Schaefer) model by direct optimization with bootstrap.
Number of years analyzed:                  31            Number of bootstrap trials:                              1000
Number of data series:                      2            Bounds on MSY (min, max):       2.000E+03    1.000E+04
Objective function:              Least squares            Bounds on K (min, max):         5.000E+03    1.000E+05
Relative conv. criterion (simplex):   1.000E-08           Monte Carlo search mode, trials:        1        10000
Relative conv. criterion (restart):   3.000E-08           Random number seed:                              1964185
Relative conv. criterion (effort):    1.000E-04           Identical convergences required in fitting:            6
Maximum F allowed in fitting:             8.000


PROGRAM STATUS INFORMATION (NON-BOOTSTRAPPED ANALYSIS)                                                error code   0
-----------------------------------------------------------------------------------------------------------------------
Normal convergence


CORRELATION AMONG INPUT SERIES EXPRESSED AS CPUE (NUMBER OF PAIRWISE OBSERVATIONS BELOW)
-----------------------------------------------------------------------------------------------------------------------
                                       |
 1  PT.crust.tr                        |   1.000
                                       |      22
                                       |
 2  PT.fish.tr                         |   0.811   1.000
                                       |      22      22
                                       --------------------------------------------------
                                               1       2


GOODNESS-OF-FIT AND WEIGHTING (NON-BOOTSTRAPPED ANALYSIS)
-----------------------------------------------------------------------------------------------------------------------
                                                     Weighted            Weighted      Current     Inv. var.   R-squared
Loss component number and title                           SSE      N          MSE       weight        weight     in CPUE

Loss(-1)  SSE in yield                              0.000E+00
Loss(0)   Penalty for B1 > K                        0.000E+00      1          N/A    1.000E+00           N/A
Loss(1)   PT.crust.tr                               4.038E+00     22    2.019E-01    1.000E+00     1.149E+00      -0.436
Loss(2)   PT.fish.tr                                5.452E+00     22    2.726E-01    1.000E+00     8.510E-01      -0.549
.............................................................................................
TOTAL OBJECTIVE FUNCTION, MSE, RMSE:             9.49024379E+00         2.433E-01    4.933E-01
Estimated contrast index (ideal = 1.0):                0.4754           C* = (Bmax-Bmin)/K
Estimated nearness index (ideal = 1.0):                1.0000           N* = 1 - |min(B-Bmsy)|/K



MODEL PARAMETER ESTIMATES (NON-BOOTSTRAPPED)
-----------------------------------------------------------------------------------------------------------------------
Parameter                                            Estimate    User/pgm guess    2nd guess    Estimated   User guess

B1/K      Starting relative biomass (in 1980)       4.011E-01         5.000E-01    6.678E-01            1            1
MSY       Maximum sustainable yield                 2.515E+03         3.000E+03    3.600E+03            1            1
K         Maximum population size                   1.170E+04         2.000E+04    9.233E+03            1            1
phi       Shape of production curve (Bmsy/K)        0.5000            0.5000            ----            0            1

--------- Catchability Coefficients by Data Series ---------------
q(1)      PT.crust.tr                               4.649E-07         1.000E-05    9.500E-04            1            1
q(2)      PT.fish.tr                                1.117E-06         1.000E-04    9.500E-03            1            1

MANAGEMENT and DERIVED PARAMETER ESTIMATES (NON-BOOTSTRAPPED)
-----------------------------------------------------------------------------------------------------------------------
Parameter                                            Estimate             Logistic formula           General formula

MSY       Maximum sustainable yield                 2.515E+03                         ----                      ----
Bmsy      Stock biomass giving MSY                  5.850E+03                          K/2           K*n**(1/(1-n))
Fmsy      Fishing mortality rate at MSY             4.298E-01                     MSY/Bmsy                  MSY/Bmsy

n         Exponent in production function           2.0000                            ----                      ----
g         Fletcher's gamma                          4.000E+00                         ----     [n**(n/(n-1))]/[n-1]

B./Bmsy   Ratio: B(2011)/Bmsy                       9.121E-01                         ----                      ----
F./Fmsy   Ratio: F(2010)/Fmsy                       3.862E-01                         ----                      ----
Fmsy/F.   Ratio: Fmsy/F(2010)                       2.589E+00                         ----                      ----

Y.(Fmsy)  Approx. yield available at Fmsy in 2011   2.332E+03                  MSY*B./Bmsy               MSY*B./Bmsy
          ...as proportion of MSY                   9.274E-01                         ----                      ----
Ye.       Equilibrium yield available in 2011       2.495E+03          4*MSY*(B/K-(B/K)**2)      g*MSY*(B/K-(B/K)**n)
          ...as proportion of MSY                   9.923E-01                         ----                      ----

--------- Fishing effort rate at MSY in units of each CE or CC series ---------
fmsy(1)   PT.crust.tr                               9.246E+05                   Fmsy/q( 1)                Fmsy/q( 1)
```

ESTIMATED POPULATION TRAJECTORY (NON-BOOTSTRAPPED)

Obs	Year or ID	Estimated total F mort	Estimated starting biomass	Estimated average biomass	Observed total yield	Model total yield	Estimated surplus production	Ratio of F mort to Fmsy	Ratio of biomass to Bmsy
1	1980	0.433	4.693E+03	4.868E+03	2.110E+03	2.110E+03	2.443E+03	1.008E+00	8.022E-01
2	1981	0.449	5.027E+03	5.119E+03	2.300E+03	2.300E+03	2.475E+03	1.045E+00	8.592E-01
3	1982	0.450	5.202E+03	5.266E+03	2.369E+03	2.369E+03	2.489E+03	1.046E+00	8.892E-01
4	1983	0.442	5.323E+03	5.386E+03	2.379E+03	2.379E+03	2.499E+03	1.028E+00	9.098E-01
5	1984	0.335	5.442E+03	5.749E+03	1.929E+03	1.929E+03	2.512E+03	7.806E-01	9.302E-01
6	1985	0.288	6.025E+03	6.374E+03	1.833E+03	1.833E+03	2.492E+03	6.691E-01	1.030E+00
7	1986	0.386	6.684E+03	6.633E+03	2.563E+03	2.563E+03	2.470E+03	8.992E-01	1.142E+00
8	1987	0.655	6.590E+03	5.854E+03	3.832E+03	3.832E+03	2.504E+03	1.523E+00	1.126E+00
9	1988	0.816	5.262E+03	4.532E+03	3.700E+03	3.700E+03	2.376E+03	1.899E+00	8.995E-01
10	1989	0.691	3.939E+03	3.729E+03	2.578E+03	2.578E+03	2.183E+03	1.608E+00	6.733E-01
11	1990	0.685	3.545E+03	3.408E+03	2.334E+03	2.334E+03	2.076E+03	1.593E+00	6.059E-01
12	1991	0.676	3.286E+03	3.200E+03	2.163E+03	2.163E+03	1.998E+03	1.572E+00	5.617E-01
13	1992	0.698	3.122E+03	3.026E+03	2.111E+03	2.111E+03	1.928E+03	1.623E+00	5.336E-01
14	1993	0.823	2.939E+03	2.706E+03	2.227E+03	2.227E+03	1.787E+03	1.915E+00	5.024E-01
15	1994	0.614	2.499E+03	2.573E+03	1.580E+03	1.580E+03	1.725E+03	1.429E+00	4.271E-01
16	1995	0.706	2.644E+03	2.594E+03	1.831E+03	1.831E+03	1.736E+03	1.642E+00	4.519E-01
17	1996	0.625	2.548E+03	2.606E+03	1.629E+03	1.629E+03	1.741E+03	1.455E+00	4.356E-01
18	1997	0.690	2.660E+03	2.628E+03	1.813E+03	1.813E+03	1.752E+03	1.605E+00	4.547E-01
19	1998	0.891	2.599E+03	2.345E+03	2.089E+03	2.089E+03	1.610E+03	2.073E+00	4.443E-01
20	1999	1.039	2.120E+03	1.814E+03	1.885E+03	1.885E+03	1.316E+03	2.417E+00	3.624E-01
21	2000	0.992	1.551E+03	1.380E+03	1.369E+03	1.369E+03	1.046E+03	2.309E+00	2.651E-01
22	2001	0.863	1.227E+03	1.173E+03	1.013E+03	1.013E+03	9.070E+02	2.009E+00	2.097E-01
23	2002	0.642	1.122E+03	1.198E+03	7.697E+02	7.697E+02	9.245E+02	1.494E+00	1.917E-01
24	2003	0.704	1.276E+03	1.316E+03	9.256E+02	9.256E+02	1.004E+03	1.637E+00	2.182E-01
25	2004	0.697	1.354E+03	1.397E+03	9.734E+02	9.734E+02	1.057E+03	1.621E+00	2.315E-01
26	2005	0.570	1.438E+03	1.574E+03	8.970E+02	8.970E+02	1.170E+03	1.326E+00	2.459E-01
27	2006	0.641	1.712E+03	1.790E+03	1.148E+03	1.148E+03	1.303E+03	1.492E+00	2.926E-01
28	2007	0.684	1.867E+03	1.901E+03	1.301E+03	1.301E+03	1.369E+03	1.592E+00	3.191E-01
29	2008	0.426	1.935E+03	2.229E+03	9.505E+02	9.505E+02	1.549E+03	9.922E-01	3.307E-01
30	2009	0.247	2.533E+03	3.110E+03	7.693E+02	7.693E+02	1.954E+03	5.754E-01	4.330E-01
31	2010	0.166	3.718E+03	4.523E+03	7.509E+02	7.509E+02	2.369E+03	3.862E-01	6.355E-01
32	2011		5.336E+03						9.121E-01

RESULTS FOR DATA SERIES # 1 (NON-BOOTSTRAPPED) PT.crust.tr

Data type CC: CPUE-catch series Series weight: 1.000

Obs	Year	Observed CPUE	Estimated CPUE	Estim F	Observed yield	Model yield	Resid in log scale	Statist weight
1	1980	*	2.263E-03	0.4334	2.110E+03	2.110E+03	0.00000	1.000E+00
2	1981	*	2.380E-03	0.4492	2.300E+03	2.300E+03	0.00000	1.000E+00
3	1982	*	2.448E-03	0.4498	2.369E+03	2.369E+03	0.00000	1.000E+00
4	1983	*	2.504E-03	0.4417	2.379E+03	2.379E+03	0.00000	1.000E+00
5	1984	*	2.673E-03	0.3355	1.929E+03	1.929E+03	0.00000	1.000E+00
6	1985	*	2.963E-03	0.2876	1.833E+03	1.833E+03	0.00000	1.000E+00
7	1986	*	3.083E-03	0.3865	2.563E+03	2.563E+03	0.00000	1.000E+00
8	1987	*	2.721E-03	0.6545	3.832E+03	3.832E+03	0.00000	1.000E+00
9	1988	*	2.107E-03	0.8163	3.700E+03	3.700E+03	0.00000	1.000E+00
10	1989	1.170E-03	1.734E-03	0.6911	2.578E+03	2.578E+03	0.39317	1.000E+00
11	1990	1.409E-03	1.584E-03	0.6848	2.334E+03	2.334E+03	0.11756	1.000E+00
12	1991	1.222E-03	1.488E-03	0.6758	2.163E+03	2.163E+03	0.19668	1.000E+00
13	1992	1.315E-03	1.407E-03	0.6977	2.111E+03	2.111E+03	0.06738	1.000E+00
14	1993	8.535E-04	1.258E-03	0.8230	2.227E+03	2.227E+03	0.38776	1.000E+00
15	1994	6.372E-04	1.196E-03	0.6142	1.580E+03	1.580E+03	0.62967	1.000E+00
16	1995	5.824E-04	1.206E-03	0.7058	1.831E+03	1.831E+03	0.72780	1.000E+00
17	1996	7.027E-04	1.211E-03	0.6252	1.629E+03	1.629E+03	0.54443	1.000E+00
18	1997	8.791E-04	1.222E-03	0.6897	1.813E+03	1.813E+03	0.32919	1.000E+00
19	1998	1.450E-03	1.090E-03	0.8910	2.089E+03	2.089E+03	-0.28553	1.000E+00
20	1999	1.721E-03	8.434E-04	1.0390	1.885E+03	1.885E+03	-0.71344	1.000E+00
21	2000	1.559E-03	6.415E-04	0.9924	1.369E+03	1.369E+03	-0.88797	1.000E+00
22	2001	6.861E-04	5.452E-04	0.8634	1.013E+03	1.013E+03	-0.22997	1.000E+00
23	2002	7.539E-04	5.571E-04	0.6423	7.697E+02	7.697E+02	-0.30249	1.000E+00
24	2003	7.135E-04	6.116E-04	0.7035	9.256E+02	9.256E+02	-0.15412	1.000E+00
25	2004	1.074E-03	6.493E-04	0.6969	9.734E+02	9.734E+02	-0.50338	1.000E+00
26	2005	6.336E-04	7.316E-04	0.5700	8.970E+02	8.970E+02	0.14371	1.000E+00
27	2006	8.014E-04	8.320E-04	0.6414	1.148E+03	1.148E+03	0.03752	1.000E+00
28	2007	1.526E-03	8.839E-04	0.6841	1.301E+03	1.301E+03	-0.54587	1.000E+00
29	2008	1.498E-03	1.036E-03	0.4265	9.505E+02	9.505E+02	-0.36866	1.000E+00
30	2009	1.143E-03	1.446E-03	0.2473	7.693E+02	7.693E+02	0.23469	1.000E+00
31	2010	1.751E-03	2.103E-03	0.1660	7.509E+02	7.509E+02	0.18320	1.000E+00

* Asterisk indicates missing value(s).

RESULTS FOR DATA SERIES # 2 (NON-BOOTSTRAPPED) PT.fish.tr

Data type I1: Abundance index (annual average) Series weight: 1.000

Obs	Year	Observed effort	Estimated effort	Estim F	Observed index	Model index	Resid in log index	Statist weight
1	1980	0.000E+00	0.000E+00	--	*	5.435E-03	0.00000	1.000E+00
2	1981	0.000E+00	0.000E+00	--	*	5.716E-03	0.00000	1.000E+00
3	1982	0.000E+00	0.000E+00	--	*	5.880E-03	0.00000	1.000E+00
4	1983	0.000E+00	0.000E+00	--	*	6.014E-03	0.00000	1.000E+00
5	1984	0.000E+00	0.000E+00	--	*	6.419E-03	0.00000	1.000E+00
6	1985	0.000E+00	0.000E+00	--	*	7.117E-03	0.00000	1.000E+00
7	1986	0.000E+00	0.000E+00	--	*	7.406E-03	0.00000	1.000E+00
8	1987	0.000E+00	0.000E+00	--	*	6.536E-03	0.00000	1.000E+00
9	1988	0.000E+00	0.000E+00	--	*	5.060E-03	0.00000	1.000E+00
10	1989	1.000E+00	1.000E+00	--	3.514E-03	4.164E-03	-0.16968	1.000E+00
11	1990	1.000E+00	1.000E+00	--	4.288E-03	3.805E-03	0.11946	1.000E+00
12	1991	1.000E+00	1.000E+00	--	3.648E-03	3.573E-03	0.02065	1.000E+00
13	1992	1.000E+00	1.000E+00	--	3.975E-03	3.379E-03	0.16247	1.000E+00
14	1993	1.000E+00	1.000E+00	--	2.372E-03	3.021E-03	-0.24162	1.000E+00
15	1994	1.000E+00	1.000E+00	--	1.498E-03	2.873E-03	-0.65098	1.000E+00
16	1995	1.000E+00	1.000E+00	--	1.112E-03	2.896E-03	-0.95707	1.000E+00
17	1996	1.000E+00	1.000E+00	--	1.621E-03	2.909E-03	-0.58488	1.000E+00
18	1997	1.000E+00	1.000E+00	--	1.604E-03	2.935E-03	-0.60425	1.000E+00
19	1998	1.000E+00	1.000E+00	--	3.158E-03	2.618E-03	0.18755	1.000E+00
20	1999	1.000E+00	1.000E+00	--	3.853E-03	2.026E-03	0.64283	1.000E+00
21	2000	1.000E+00	1.000E+00	--	4.038E-03	1.541E-03	0.96365	1.000E+00
22	2001	1.000E+00	1.000E+00	--	2.267E-03	1.309E-03	0.54898	1.000E+00
23	2002	1.000E+00	1.000E+00	--	2.000E-03	1.338E-03	0.40179	1.000E+00
24	2003	1.000E+00	1.000E+00	--	2.174E-03	1.469E-03	0.39224	1.000E+00
25	2004	1.000E+00	1.000E+00	--	1.897E-03	1.559E-03	0.19580	1.000E+00
26	2005	1.000E+00	1.000E+00	--	1.378E-03	1.757E-03	-0.24286	1.000E+00
27	2006	1.000E+00	1.000E+00	--	1.733E-03	1.998E-03	-0.14229	1.000E+00
28	2007	1.000E+00	1.000E+00	--	3.976E-03	2.123E-03	0.62744	1.000E+00
29	2008	1.000E+00	1.000E+00	--	3.560E-03	2.488E-03	0.35803	1.000E+00
30	2009	1.000E+00	1.000E+00	--	2.652E-03	3.473E-03	-0.26945	1.000E+00
31	2010	1.000E+00	1.000E+00	--	2.372E-03	5.050E-03	-0.75578	1.000E+00

* Asterisk indicates missing value(s).

ESTIMATES FROM BOOTSTRAPPED ANALYSIS

Param name	Point estimate	Estimated bias in pt estimate	Estimated relative bias	Bias-corrected approximate confidence limits 80% lower	80% upper	95% lower	95% upper	Inter-quartile range	Relative IQ range
B1/K	4.011E-01	1.014E-05	0.00%	4.007E-01	4.017E-01	3.983E-01	4.039E-01	1.954E-04	0.000
K	1.170E+04	-2.116E+01	-0.18%	1.167E+04	1.177E+04	1.146E+04	1.204E+04	1.579E+01	0.001
q(1)	4.649E-07	1.048E-09	0.23%	4.103E-07	5.405E-07	3.776E-07	5.975E-07	7.238E-08	0.156
q(2)	1.117E-06	3.790E-07	33.95%	1.020E-06	1.233E-06	1.012E-06	1.326E-06	1.119E-07	0.100
MSY	2.515E+03	3.650E-01	0.01%	2.513E+03	2.515E+03	2.507E+03	2.521E+03	3.127E-01	0.000
Ye(2011)	2.495E+03	-7.545E+01	-3.02%	2.420E+03	2.516E+03	2.295E+03	2.524E+03	3.457E+01	0.014
Y.(Fmsy)	1.013E+03	-3.250E+00	-0.32%	9.579E+02	1.050E+03	9.282E+02	1.056E+03	4.939E+01	0.049
Bmsy	5.850E+03	-1.058E+01	-0.18%	5.833E+03	5.884E+03	5.732E+03	6.020E+03	7.893E+00	0.001
Fmsy	4.298E-01	9.691E-04	0.23%	4.273E-01	4.314E-01	4.165E-01	4.399E-01	5.871E-04	0.001
fmsy(1)	9.246E+05	1.195E+04	1.29%	7.997E+05	1.054E+06	7.297E+05	1.145E+06	1.370E+05	0.148
fmsy(2)	3.849E+05	-1.216E+04	-3.16%	3.487E+05	4.216E+05	3.254E+05	4.266E+05	3.885E+04	0.101
B./Bmsy	9.121E-01	-1.226E-02	-1.34%	7.049E-01	1.127E+00	5.871E-01	1.241E+00	2.210E-01	0.242
F./Fmsy	3.862E-01	3.491E-02	9.04%	3.043E-01	5.068E-01	2.709E-01	6.068E-01	1.028E-01	0.266
Ye./MSY	9.923E-01	-3.015E-02	-3.04%	9.628E-01	1.000E+00	9.129E-01	1.000E+00	1.369E-02	0.014
q2/q1	2.402E+00	1.031E+00	42.93%	1.928E+00	2.724E+00	1.712E+00	3.009E+00	4.110E-01	0.171

INFORMATION FOR REPAST (Prager, Porch, Shertzer, & Caddy. 2003. NAJFM 23: 349-361)

Unitless limit reference point in F (Fmsy/F.): 2.589
CV of above (from bootstrap distribution): 0.1990

NOTES ON BOOTSTRAPPED ESTIMATES:

- Bootstrap results were computed from 1000 trials.
- Results are conditional on bounds set on MSY and K in the input file.
- All bootstrapped intervals are approximate. The statistical literature recommends using at least 1000 trials for accurate 95% intervals. The default 80% intervals used by ASPIC should require fewer trials for equivalent accuracy. Using at least 500 trials is recommended.
- Bias estimates are typically of high variance and therefore may be misleading.

Trials replaced for lack of convergence: 0   Trials replaced for MSY out of bounds: 0
Trials replaced for q out-of-bounds: 251
Trials replaced for K out-of-bounds: 0   Residual-adjustment factor: 1.0622

Elapsed time: 0 hours, 9 minutes, 35 seconds.

Annex N – Benchmark Planning for 2012

Five stocks within the remit of WGHMM are scheduled to be benchmarked at the start of 2012 (as part of the benchmark workshop WKFLAT 2012). These stocks are

- *L. piscatorius* (white anglerfish) in VIIb-k and VIIIab
- *L. budegassa* (black anglerfish) in VIIb-k and VIIIab
- *L. piscatorius* (white anglerfish) in VIIIc and IXa
- *L. budegassa* (black anglerfish) in VIIIc and IXa
- *L. whiffiagonis* (megrim) in VII and VIIIabde

Additionally, the following *Nephrops* FUs are scheduled for an Inter-benchmark protocol (by correspondence) at the start of 2012. These are:

Nephrops FU 23-24 (Bay of Biscay)

Nephrops FU 28-29 (South Portugal)

Accordingly, during the WGHMM several subgroups were formed to organise the work required to take place before the benchmarks, identifying responsible scientists and dates of delivery. The result of this planning is given in the tables shown below, which also include the external scientific expertise considered necessary.

As some of the anglerfish stocks will be trying to use the Stock Synthesis model, an external expert in that model seems of high relevance. Ideally, this person should be Richard Methot or some other scientist suggested by him. An expert on production models could also be relevant for anglerfish assessments. The megrim stock will be assessed using an age-structured model, either XSA or a Bayesian model able to fill in missing discard information will be tried. So experts in either of these methodologies would also be very helpful.

Nephrops tables also indicate some potentially useful expertise, particularly in the field of CPUE standardisation in the case of FU 28-29.

The tasks required for *L. piscatorius* and *L. budegassa* in VIIb-k and VIIIab were considered to be identical, so a single table has been filled for both stocks.

Separate tables have been filled for *L. piscatorius* and *L. budegassa* in VIIIc and IXa.

For *L. whiffiagonis* is VII and VIIIabde the WG highlights the importance that someone from IFREMER takes responsibility for the tasks required from their institute in connection to the benchmark.

Due to the high amount of work that will be required from WGHMM members before these benchmarks, it is requested that WKFLAT 2012 takes place in the last week of February. Sukarrieta (Basque country, Spain) has been offered as a venue for this meeting (see WG Recommendation number 2 in Annex O).

Stock	**L. piscatorius and L. budegassa in VII VIIIabd**					
Stock coordinator	Iñaki Quincoces (L.piscatorius) Jean-Claude Mahé (L.budegassa)	iquincoces@azti.es Jean.Claude.Mahe@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?	Person in charge	Date	External expertise needed at benchmark type of expertise / proposed names
Basic data	Revised data from France for 2009 and 2010	Strong request from ICES to France providing the data	All the French data to be collected for this stock under DCF	Jean Claude Mahé*	1ST WEEK OF OCTOBER 2011	NO
Tuning series	No standardized commercial tuning data is available	Standardization of commercial tuning data by lengths	Raw data from logbooks and the length distributions for that fleet. Data should be available from member states	RUBEN ROA (BAKON7 & 8) IEO(PAZ* ESTHER*, CARMEN* VIGO fleet)	END OF OCTOBER	NO
Discards	Enforcement of laws about minimum landing weight (0.5 kg) changed totally the retention ogive and the landings length distribution.	Try to reconstruct the length distribution of specimens bellow 0.5 kg in the catch or remove the historical data of fish below 0.5 kg from the catch matrix	Discard estimates from all the involved countries	2000-2010 DISCARD DATA LD. IEO(DISCARD TEAM) 2006-2010 (FRANCE) ENGLAND RISED DATA	END OF OCTOBER.	NO

Stock	**L. piscatorius and L. budegassa in VII VIIIabd**					
Stock coordinator	Iñaki Quincoces (L.piscatorius) Jean-Claude Mahé (L.budegassa)	iquincoces@azti.es Jean.Claude.Mahe@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?	Person in charge	Date	External expertise needed at benchmark type of expertise / proposed names
Biological Parameters	Split of the landings between both species of anglerfish not known for some countries and suspect of not being correctly done some years 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	Jean Claude Mahé and Iñaki Quincoces	WHEN ALL LD AVAILABLE	NO
	Sex ratio and maturity of anglerfish only from an European project done in 1996-98	Compilation of the data collected under DCF and analysis for new sex-ratio and maturity parameters (COST)	Raw data from DCF,	Jorge Landa, Sally Songer. Jean-Claude Mahé Helen McCormick (TO PROVIDE DATA) LENGTH BASED * ANALYSIS Iñaki Quincoces	OCTOBER	NO

Stock	**L. piscatorius and L. budegassa in VII VIIIabd**					
Stock coordinator	Iñaki Quincoces (L.piscatorius) Jean-Claude Mahé (L.budegassa)	iquincoces@azti.es Jean.Claude.Mahe@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?	Person in charge	Date	External expertise needed at benchmark type of expertise / proposed names
	Growth pattern unknown or poorly known	Research on anglerfishes growth pattern. Could come from tag/recapture experiments, analysis of length distributions from surveys.	Workshop to be conducted by ICES in 2011. Results are not likely to be applicable to a benchmark in 2012 due to time constraints.	From EVHOE survey starting model for K and Linf for budegassa; from literature for piscatorius JCM*		NO
Assessment method	It depends on data available. If all the data with the needed length distributions is available a length structured model could be used. If only landings data and some tuning series are available a production model could be used.	All the above plus exploratory analysis from stock coordinators		Jean Claude Mahé, Iñaki Quincoces Carmen Fernandez, Lisa Readdy	NOVEMBER	EXPERT FOR SS3 (RICHARD METHOT) OR IF GOING FOR A DATA POOR METHOD AN EXPERT ON PRODUCTION MODELS (????)

Stock	**Southern Anglerfish (L. piscatorius)**					
Stock coordinator	Paz Sampedro	paz.sampedro@co.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?	Person in charge	Date	External expertise needed at benchmark type of expertise / proposed names
Tuning series	1.The two tuning series used in the last assessment are commercial CPUEs. No research survey series used. 2.Due to the introduction of a new fishing gear (jurelera) targeting pelagic species by the fleet SPCORUTR8C, the representativeness of its CPUE series for tuning the assessment could be affected.	1. Analysis of the time series of Spanish Grounfish Survey Index. To check wether the Survey signal is clear enough to incorporate it into the assessment as a tuning series. 2. To investigate/eliminate the effect of jurelera in this tuning series by applying appropriate standardized methods (GLM, GAMs).	1. Data are available. 2. Spanish Data Team should be asked for the availability of the detailed data (trip by trip) to use as inputs in the standardized models.	Paz Paz will check if it is possible	Completed	
Discards	Discard data are only available for one of the main fishing fleets: Spanish Trawl (1994-2009). The discards time series has some missing years (1995, 1996,1998, 2001, 2002). The length compositions of discards have large uncertainty.	To estimate the discard pattern for Spanish Trawl Fishery. To analyse the variability of the pattern along the period used in the assessment.	Part of this work is already done by the Spanish Discard Team. It is necessary to confirm with this team that no changes in the discard pattern have happened in the last three years.	Paz will check if it is possible.		

Stock	**Southern Anglerfish (L. piscatorius)**					
Stock coordinator	Paz Sampedro	paz.sampedro@co.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?	Person in charge	Date	External expertise needed at benchmark type of expertise / proposed names
Biological Parameters	1. The ageing criteria proposed in 2007 was rejected at the assessment working group (WGHMM) due to its inconsistencies. 2. An updated and reliable maturity model is needed.	1. To investigate a model of growth based on different information sources, including mark-recaptured data. 2. To investigate a maturity model, for both sexes combined, based on recent commercial samplings and survey data.	1. Information is available from published studies. 2. Information is available from DCF (Data Collection Framework).	Jorge Landa, Ricardo	Completed October	
Assessment method	Current assessment model is a production model (ASPIC) which Does not make full use of the data and information available.	To develop a size based model (using Stock Synthesis 3), where the available information requested in the previous sections would be used.	Stock Synthesis was developed by Richard Methot (NOAA Fisheries).	Paz, Carmen	For the benchmark	Richard Methot (if he is not available, then another expert scientist on Stock Synthesis, possibly suggested by Richard Methot).
Biological Reference Points	F_{MSY} from ASPIC outputs was proposed as a reference point by WGHMM in 2010. No Btrigger has been defined.	Revision of the biological reference points previously defined.	Results from new model assessment would be employed.	Paz	For the benchmark	

Stock	**Southern Anglerfish (L. budegassa)**					
Stock coordinator	Ricardo Alpoim	ralpoim@ipimar.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?	Person in charge	Date	External expertise needed at benchmark type of expertise / proposed names
Tuning series	1.The two tuning series used in the last assessment are commercial CPUEs. No research survey series used. 2.Anglerfish is not a main target species of the Portuguese surveys.	1. To investigate these tuning series by applying standardization methods. 2. Data from the Portuguese surveys are being compiled and will be presented to the WGHMM 2011. Analysis of the time series of Survey Index. To check whether the Survey signal is clear enough to be incorporated into the assessment as tuning series.	1.1. Data are available. 1.2. Spanish Data Team should be asked for the availability of the detailed data (trip by trip) to use as inputs in the standardized models.	1.Paz for Spanish tuning fleets Ricardo for Portuguese fleets 2.Ricardo will check if it is possible	October October	

Stock	**Southern Anglerfish (L. budegassa)**					
Stock coordinator	Ricardo Alpoim	ralpoim@ipimar.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?	Person in charge	Date	External expertise needed at benchmark type of expertise / proposed names
Discards	1.Discard data are only available for one of the main fishing fleets: Spanish Trawl (1994-2009). The discards time series has some missing years (1995, 1996,1998, 2001, 2002). The length compositions of discards have a large uncertainty. 2.Portuguese discard data have not been presented to the WGHMM. They are being compiled and will be presented to the WGHMM 2011.	1 .To estimate the discard pattern for Spanish Trawl Fishery. To analyse the variability of the pattern along the period used in the assessment. 2. Portuguese discard data are being compiled and will be presented to the WGHMM 2011.	1. Part of this work is already done by the Spanish Discard Team. It is necessary to confirm with this team that no changes in the discard pattern have happened in the last three years.	1.Paz will check if it is possible. 2.Ricardo will check the possible use of the data presented in the WGHMM 2011	For the benchmark	

Stock	**Southern Anglerfish (L. budegassa)**					
Stock coordinator	Ricardo Alpoim	ralpoim@ipimar.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?	Person in charge	Date	External expertise needed at benchmark type of expertise / proposed names
Biological Parameters	1. The ageing criteria proposed in 2007 was rejected at the assessment working group (WGHMM) due to its inconsistencies. 2. An updated and reliable maturity model is needed.	1. No solution available for the time being 2. To investigate a maturity model, for both sexes combined, based on recent commercial samplings and survey data (if there are any).	2. Information is available from DCF (Data Collection Framework).	Jorge Landa, Ricardo	Completed October	

Stock	**Southern Anglerfish (L. budegassa)**					
Stock coordinator	Ricardo Alpoim	ralpoim@ipimar.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?	Person in charge	Date	External expertise needed at benchmark type of expertise / proposed names
Assessment method	Current assessment model is a production model (ASPIC) which does not make full use of the data and information available.	There are no plans at this stage to develop a new assessment model for this stock. If Stock Syntehis (which is being tryied for the L.piscatorius benchmark) works well for L. piscatorius, it might be attempted for L.budegassa at some future time. New information will be available during the WGHMM 2011.		Ricardo, Paz	For the benchmark	
Biological Reference Points	F_{MSY} from ASPIC outputs was proposed as a reference point by WGHMM in 2010 . No Btrigger has been defined.	1. Revision of the biological reference points previously defined.		Ricardo	For the benchmark	

Stock	**Meg78**					
Stock coordinator	Marina Santurtun Ane Iriondo	msanturtun@azti.es; airiondo@azti.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	Deadline	Responsible person
Tuning series	LPUE data series stopped in 2006 because of patterns in different areas and major changes in the fleet structure over time. Trends in log-catchabilities residuals are still to be investigated as no Irish Otter trawl fleet was revised.	Ireland: Revised tunning fleet catches.	Yes, data should be available at Marine Institute. Analysis of Data from Marine Institute.	No needed (-RAC involvement: Basic data comes from the Irish Industry. Maybe qualitative information , as for example , technological creeping can be given by Industry.)	End of October	Colm Lordan (MI)

Stock	**Meg78**					
Stock coordinator	Marina Santurtun Ane Iriondo	msanturtun@azti.es; airiondo@azti.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	Deadline	Responsible person
	No segmentation of the main commercial fleets used in the assessment has been carried out	France: The FU04 (CPUEs and Effort)series is updated every year. However, no data of numbers at age are available since 2001. Also, maybe this Fishing Unit data is not the most appropriate level of aggregation. An effort should be made to segment FU04 to to the level 5 or 6 of the Nantes Matrix (Fishery and or Metier). The detailed segmentation is theoretically available for 2009 but reliability has to be checked by France.	France: Data should be available at IFREMER. Segmentation on the main commercial fleets used in the assessment will be revised and, if appropriated, will then be applied.	No need (- RAC involvement: Maybe RAC members could help with qualitative knowledge for further segmentation that could be carry out in this FU04 used for tuning.)	‘	
	Vigo Fleet revision of tunning series	Spain			End of October	Esther Abad*, Paz Sampedro* and Carmen Fernandez* (IEO)

Stock	**Meg78**					
Stock coordinator	Marina Santurtun Ane Iriondo	msanturtun@azti.es; airiondo@azti.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	Deadline	Responsible person
Discards	It is considered that a main problem with megrim assessment is the lack of discard data (biomass, length distributions and age composition). Underestimation of the international catch matrix occurs as some main countries (mostly France) involved in the fishery do not provide discard data. The lack of consistency of the catch series (which could cause great bias in assessment) is also a result of only one country (Spain) providing discard data since 1999 No data other than Spanish and Irish data series have been provided for the assessment in 2010. From United Kingdom only sampling data were available.	France: to provide discard data available since 1999. United Kingdom: to provide discad data raised to the total of the fleet. Methodology to be used: Application of recommendations of WS Discards (Charlotte Lund, 2003) and future WS on discards (2009)	Yes . Data should be available at IFREMER. Yes. Data should be available at CEFAS.	No need (- RAC incolvement: Basically, I think that RACs can not help much as data should be available at the Fisheries Institutes. It will be maybe good to remember the importance of a good (number of samples and sample size). This is, maybe RAC member could facilitate sampling on board to get discard data which are really important for this stock)	End of October	Lisa Readdy* (CEFAS)

Stock	**Meg78**					
Stock coordinator	Marina Santurtun Ane Iriondo	msanturtun@azti.es; airiondo@azti.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	Deadline	Responsible person
Landing	In 2010, France did not provide LANDINGS to the group.	Official deadline is October 2010. France should provide this BASIC data a.s.a.p.	Yes, landing data should be available already (by October every year) and provided by IFREMER	No need	1st week of October	Jean Claude *
Biological Parameters	France: No ALK and consequently age composition of landings and weigth at age is provided to the WGHMM routinely (Maturity Ogive: to be reviewed as for Anglers)	Strong request for providing these data for IFREMER (Member State).	I do not know about availability. Should be at IFREMER (Age data Weigth at age)	No need (- RAC incolvement: Basically, I think that RACs can not help much as data should be available or worked out at the Fisheries Institutes).	June, July End of October	Jean –Claude Mahé (IFREMER) * (Marina Santurtún *: to contact IEO (Jorge Landa) : Person to be identified in IFREMER))

Stock	**Meg78**					
Stock coordinator	Marina Santurtun Ane Iriondo	msanturtun@azti.es; airiondo@azti.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	Deadline	Responsible person
Assessment method	If discard data are not provided to the group, then experts on megrim should look for other solutions to overcome data deficiencies	If discard data are not provided, there is a need to reconstruct discards data series to fill the gaps. The solutions considered were: o Age based models – XSA after reconstructing the discard data series using selectivity functions applied to the catches distribution. o Age based models that allow for some missing discards data . Recent developments on analysis of fisheries data created the opportunity to use models that allow for missing discards data, as well as other uncertainties in the data. This situation requires previous practices to be developed in agreement, like forecasts, biological reference points, advice, etc. o Assessment without discards will be attempted although data series will be shorter due to inability to recover landing and discard data series disaggregated before 1990.	Different methodologies to be used by AZTI as Megrim Coordinator.	If XSA (Chris Darby) If Bayesian model (Andre Punt, Samu Mantyniemi, Richard Hillary).	November (decision on model)	Marina Santurtún** (possibility of checking whether we go first a Bayesian model, would depend on work load of modellers at AZTI (Leire Ibaibarriaga and Dorleta Garcia)

Stock	**Meg78**					
Stock coordinator	Marina Santurtun Ane Iriondo	msanturtun@azti.es; airiondo@azti.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	Deadline	Responsible person
Biological Reference Points	No defined	If new assessment success ➔ recalculate them		No need		

Stock	FU 23-24 Nephrops (Bay of Biscay)			
Stock coordinator	Spyros Fifas	Spyros.Fifas@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
Tuning series	There is currently only one commercial tuning fleet (GV-Q2). The aim is to add tuning time series provided by LANOLF survey, but the time series available in the beginning of 2012 will be short and cannot yet be integrated in the benchmark WG.	Compilation and addition of data (Autumn 2011) which should be collected during next survey (May 2011).	Available (end 2011)	
Discards	The routinely carried out sampling plan onboard since 2003 does not cover many previous years (13 on 24 of the overall time series). The aim is to validate probabilistic approach for discard derivation applied on the missing data.	Ready	Available	
Biological Parameters	Maturity has to be analysed on the basis of data on ogives collected on the period 2004-2010.	Compilation of data provided from samples 2009 and 2010.	Available	For ICES experts see Workshop WKNEPH January 2006.
Assessment method	Alternative methods such as CSA have to be investigated.	???		
Biological Reference Points	???			

Stock	**Nephrops FU 28-29**			
Stock coordinator	Cristina Silva	csilva@ipimar.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
Tuning series	Problem: 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*. Non-standardized CPUE series for *Nephrops* as the main cause for the retrospective pattern in the assessment. Aim: An improvement of the retrospective pattern to levels accepted in assessment of other ICES stocks.	Standardization of the commercial CPUE (taking into account the behaviour of the fleet in targeting one or the other species) to estimate *Nephrops* target effort.	Logbook data. Time series since 1988 with information on the main species caught on a daily basis will be used. Depth and fishing grounds information from VMS data, if available, will also be used.	Expertise on statistical modelling (GLM, Delta model) and CPUE standardization. Proposed name: Ruben Roa (AZTI Tecnalia)
Discards	Discarding is minimal in this fishery. Not an issue			
Biological Parameters	Growth parameters and natural mortality estimated in 1990 and not reviewed. Attempts to include a joint tagging program for several Nephrops FUs in DCF not successful due to high costs.			

Stock	Nephrops FU 28-29			
Stock coordinator	Cristina Silva	csilva@ipimar.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
Assessment method	XSA (with FLR) is currently applied separately for males and females in these FUs. Lengths are converted into ages by slicing using the growth parameters. Problem: Taking into consideration the retrospective pattern, assessment results have only been accepted as indicative of trends. Exploitation status is unknown due to the high uncertainty in point estimates for recent years. Aim: An accepted assessment, BRPs estimated and catch forecasts as basis for ICES advice.			
Biological Reference Points				

Annex O – Recommendations

Recommendation	For follow up by:
1. Most stock coordinators (which in this WG are the same as the assessment coordinators) agree to use InterCatch if all stock data are introduced by the national data submitters in InterCatch. WG members consider that it is the exclusive responsibility of national data submitters to introduce the data in InterCatch and stock coordinators in this WG will not introduce data in InterCatch when a national data submitter has not done it.	ICES Data Centre
2. The WG has planned the work to be done in advance of the scheduled 2012 benchmarks (details in Annex N). It proposes to proceed with all benchmarks planned: northern and southern anglerfishes and northern megrim. To give more time for preparation, it proposes to hold the benchmark workshop the last week of February 2012 and Sukarrieta (Basque country, Spain) is proposed as the venue.	ICES Secretariat / ACOM
3. Inter-benchmark protocols (by correspondence) for *Nephrops* FU 23-24 and *Nephrops* FU 28-29 at the start of 2012 are also proposed to proceed as planned.	ICES Secretariat / ACOM
4. Given progress shown in this WG towards improved assessment methods for southern megrims (see WD06), the WG recommends that a benchmark for these stocks be preliminarily scheduled for the start of 2013.	ICES Secretariat / ACOM
5. The WG considers that standard "ICES methodology" for discards estimation is unlikely to be appropriate for species that may have important discards but are not caught very often (eg. anglerfish or megrims) and that additional methodology and guidelines should be developed (e.g. via specific workshops) to deal with those cases.	PGCCDBS / ACOM leadership
6. Given the very high workload this WG already has and the decreasing number of participants, ToRs must be given well in advance of the meeting, so that the WG members and participating institutions can plan work and attendance. The WG considers that ToRs should be given with no less than 5 months notice.	ICES Secretariat / ACOM leadership
7. ToR list increasing year by year. This leads to a very high work load and impacts negatively on the quality of the work produced by the WG. Recommendation: ToRs should not increase (in fact, ToRs should decrease with respect to the ones WGHMM finally had in 2011).	ACOM leadership
8. New species: 4 new species were added to the WG ToRs this year. In principle, this was only to collate available that and the WG did this to the best of its ability (see Annex R). If these species were to remain in the remit of the WGHMM in future years, coordinators for them should be found, most likely outside the group of scientists currently participating in this meeting (as these scientists do not have spare capacity to work on additional species).	ACOM
9. To avoid late delivery of data, which compromises the quality of the assessments for which the WG is responsible, a deadline for data submission should be included as part of the meeting's ToRs. WG members felt that approximately 4 weeks prior to the meeting start was appropriate.	ICES Secretariat / ACOM / PGCCDBS

Annex P – Stock data problems relevant to data collection

The main data problems detected by the Working Group and for which action is required are presented in this Annex, which contains 2 tables:

- One of them contains the data problems identified by the WG this year.
- The other one indicates how PGCCDBS and the North Atlantic Regional Coordination Meeting answered to the issues raised in the "Data Problems" table filled by this WG last year and what, if any, subsequent action has followed.

Stock Data Problems Relevant to Data Collection – WGHMM 2011

Stock	Data Problem	How to be addressed in	By who
Stock name	***Data problem identification***	***Description of data problem and recommend solution***	***Who should take care of the recommended solution and who should be notified on this data issue.***
Mgw-78	*Ireland: Revised tuning fleet catches not provided since 2007*	*LPUE data series stopped in 2006 because of patterns in different areas and major changes in the fleet structure over time.*	*Ireland and ICES delegate & PGCCDBS*
Mgw-78	*France: No update of CPUEs data series are provided to the group.*	*STRONG request for providing these data to Member State.*	*France and ICES delegate & PGCCDBS*
Mgw-78	*France: No discard data (biomass, length distributions and age composition) is delivered to the WGHMM since 1998.*	*STRONG request for providing these data to Member State.*	*France and ICES delegate & PGCCDBS*
Mgw-78	*France: No ALK and consequently age composition of landing sand weight at age is provided to the WGHMM routinely.*	*STRONG request for providing these data to Member State.*	*France and ICES delegate & PGCCDBS*
Mgw-78	*United Kingdom: Discards provided to WGHMM but not used because of bad quality of the data (data is not raised).*	*Application of recommendations of WS Discards (Charlotte Lund, 2003) and future WS on discards (2009)*	*UK and PGCCDBS*
Ang-78	*United Kingdom, Spain and Ireland: Discards provided to WGHMM but not used because of bad quality of the data. (Doubts about the adequacy of raising methodology used).*	*The standard "ICES methodology" for discards estimation is unlikely to be appropriate for species that may have important discards but are not caught very often (eg. anglerfish or megrims) and that additional methodology and guidelines should be developed (e.g. via specific workshops) to deal with those cases.*	*UK, IRL, SP and PGCCDBS*

Stock	Data Problem	How to be addressed in	By who
Ang-78	*France: preliminary landings and length distribution data is delivered to the WGHMM.*	*Request for providing final data to Member State.*	*France and Ices delegate & PGCCDBS*
Ang-78	*France: No discard data is delivered to the WGHMM.*	*Strong request for providing these data to Member State.*	*France and Ices delegate & PGCCDBS*
Ang-78	*The precise methodology used for splitting catches between both Lophius species is not available to the WGHMM and no precision estimates are delivered*	*Strong request for providing these data to Member States except for Spain that has presented a WD to the Working Group.*	*PGCCDBS*
Ang-78	*Available maturity data recorded under DCF is not being delivered to WGHMM*	*Strong request for providing these data to Member States.*	*PGCCDBS*
Ang-78	*Sex-ratio data recorded under DCF is not being delivered to WGHMM*	*Strong request for providing these data to Member States.*	*PGCCDBS*
Hke-89	*France landings are unknown in recent years, except 2010.*	*Request to member state*	*France and ICES Delegate*
Sol-bisc	*Discards (obsmer) not used because of poor spatial representation*	*Improve spatial representation in sampling.*	*PGCCDBS*
General	*Doubts about reliability of discards estimates*	*The standard "ICES methodology" for discards estimation is unlikely to be appropriate for species that may have important discards but are not caught very often (eg. anglerfish or megrims) and that additional methodology and guidelines should be developed (e.g. via specific workshops) to deal with those cases.*	*PGCCDBS and ACOM*

STOCK DATA PROBLEMS RELEVANT FOR DATA COLLECTION: TABLE FILLED BY WGHMM2010, COMMENTS BY PGCCDBS 2011 AND RCM 2010 AND ACTIONS TAKEN UP TO WGHMM 2011

Stock	Data Problem	How to be addressed in	By who	PGCCDBS Comments 2011	RCM Comments 2010	Action taken up to WGHMM 2011
Stock name	***Data problem identification***	***Description of data problem and recommend solution***	***Who should take care of the recommended solution and who should be notified on this data issue.***			
Mgw-78	*Ireland: Revised tuning fleet catches not provided since 2007*	*LPUE data series stopped in 2006 because of patterns in different areas and major changes in the fleet structure over time.*	*Ireland and ICES delegate & PGCCDBS*		*RCM NA recommends Ireland to clarify the situation directly with the stock coordinator*	*IN PROGRES: Ireland compromised to deliver Irish tuning series revised by October 2011 for Benchmark in 2012.*
Mgw-78	*France: No LANDINGS are provided to the group.*	*STRONG request for providing these data to Member State.*	*France and ICES delegate & PGCCDBS*		*France should deliver the data in time, and SGRN should ensure the follow up of this recommendation.* *RCM NA was informed that the French 2009 problem affected all data, and that a revision of all the data referring to2009 should be made as soon as possible.*	*DONE: 2009 and 2010 Landing data was provided on time. Data is considered still preliminary.*
Mgw-78	*France: No update of CPUEs data series are provided to the group.*	*STRONG request for providing these data to Member State.*	*France and ICES delegate & PGCCDBS*		*See recommendation above.*	*NO ACTION: No CPUEs update of data series has been provided to the group.*
Mgw-78	*France: No discard data (biomass, length distributions and age composition) is delivered to the WGHMM since 1998.*	*STRONG request for providing these data to Member State.*	*France and ICES delegate & PGCCDBS*		*See recommendation on Mgw-78 stock above.*	*NO ACTION: No discard data has been provided to the group.*

Stock	Data Problem	How to be addressed in	By who	PGCCDBS Comments 2011	RCM Comments 2010	Action taken up to WGHMM 2011
Mgw-78	*France: No ALK and consequently age composition of landings and weight at age is provided to the WGHMM routinely.*	*Strong request for providing these data to Member State.*	*France and Ices delegate & PGCCDBS*		*RCM NA was informed that France did begin the reading of the 7 years of megrim otolith collection and that, due to the heavy workload, could not achieve the work in totality in time for the 2010 AWG. RCM NA was also informed that this task has progressed, and should be provided to the 2011 WG.*	*NO ACTION: No ALK, ages and weights by age data has been provided to the group.* *ACTION: preliminary length distribution for 2009 and 2010 have been provided to the Group but not used.*
Mgw-78	*United Kingdom: Discards provided to WGHMM but not used because of bad quality of the data (data is not raised).*	*Application of recommendations of WS Discards (Charlotte Lund, 2003) and future WS on discards (2009)*	*UK and PGCCDBS*		*UK is using COST tools to provide discards estimates. See rec below for the raising procedure.*	*NO ACTION*
Mgw-78	*WGHMM does not perceive a necessity for a maturity staging workhop for megrim (see WD 6)*		*PGCCDBS*	*Agree.*		
Ang-78	*United Kingdom, Spain and Ireland: Discards provided to WGHMM but not used because of bad quality of the data. (Doubts about the adequacy of raising methodology used).*	*Application of recommendations of WS Discards (Charlotte Lund, 2003) and future WS on discards (2009)*	*UK, IRL, SP and PGCCDBS*		*This situation is a cornerstone. Which is the correct format and standard procedure to be used for stock Assessment purposes? Should data be raised nationally or internationally? Point to be added to the RCM NS&EA demand for discussion in WGCHAIRS.*	*ONLY Spain has presented a WD about discards.*
Ang-78	*France: Neither landings nor length distribution data is delivered to the WGHMM.*	*Strong request for providing these data to Member State.*	*France and Ices delegate & PGCCDBS*		*See previous recommendation on Mgw- 78 stock above*	*DONE: 2009 and 2010 Landing data was provided on time. Data is considered still preliminary.*
Ang-78	*France: No discard data is delivered to the WGHMM.*	*Strong request for providing these data to Member State.*	*France and Ices delegate & PGCCDBS*		*See previous recommendation on Mgw-78 stock above.*	*NO ACTION: No discard data has been provided to the group.*

Stock	Data Problem	How to be addressed in	By who	PGCCDBS Comments 2011	RCM Comments 2010	Action taken up to WGHMM 2011
Ang-78	*The precise methodology used for splitting catches between both Lophius species is not available to the WGHMM and no precision estimates are delivered*	*Strong request for providing these data to Member States.*	*PGCCDBS*	*It is important that the process of splitting grouped species catches into species is thoroughly documented by national data providers and this is made available to the EGs. Data providers are strongly recommended to provide this information in order to assure/evaluate the quality of the data.*	*MS are recommended to provide a detailed explanation on the methodology for splitting the catches of Lophius to the AWG next year, and to add a section to the NP proposal 2011-2013 when a revision is being made RCM NA informs that the methodology and precision estimates are available with the COST tools, and should be estimated for next year AWG*	*Only a WD from Spain has been presented to the group.*
Ang-78	*Available maturity data recorded under DCF is not being delivered to WGHMM*	*Strong request for providing these data to Member States.*	*PGCCDBS*		*RCM NA recommends all MS to send the data collected under the DCF framework to the relevant assessment working groups, following agreed data format and codification.*	*No data received by WG*
Ang-78	*Sex-ratio data recorded under DCF is not being delivered to WGHMM*	*Strong request for providing these data to Member States.*	*PGCCDBS*		*See previous recommendation on Ang-78 stock above.*	*No data received by WG*
Ang-78	*Growth at length data recorded under DCF is not being delivered to WGHMM*	*Strong request for providing these data to Member States.*	*PGCCDBS*		*See previous recommendation on Ang-78 stock above*	*No data received by WG*

Annex Q – WGHMM Proposed ToRs for next meeting

The **Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim** [WGHMM] (Chair: TO BE CHOSEN, ???) will meet in ICES HQ, 8-14 May 2012 to:

a) Address generic ToRs for Fish Stock Assessment Working Groups (see table below).

The assessments will be carried out on the basis of the stock annex in National Laboratories, prior to the meeting. This will be coordinated as indicated in the table below.

WGHMM will report by 21 May 2012 for the attention of ACOM.

Fish Stock	Stock Name	Stocks Coordinator	Assess. Coord. 1	Assess. Coord. 2	Advice
ang-78ab	Anglerfish (*Lophius budegassa* and *L. piscatorius*) in Divisions VIIb-k and VIIIa,b	Spain/France	Spain/France	France/Spain	Advice
ang-8c9a	Anglerfish (*Lophius budegassa* and *L. piscatorius*) in Divisions VIIIc and IXa	Spain/Portugal	Spain/Portugal	Portugal/Spain	Advice
hke-nrtn	Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock);	France	France	Spain	Advice
hke-soth	Hake in Division VIIIc and IXa (Southern stock);	Spain	Spain	Portugal	Advice
mgb-8c9a	Megrim (*Lepidorhombus boscii*) in Divisions VIIIc and IXa	Spain	Spain		Advice
mgw-8c9a	Megrim (*Lepidorhombus whiffiagonis*) in Divisions VIIIc and IXa	Spain	Spain		Advice
mgw-78	Megrim (*L. whiffiagonis*) in Subarea VII & Divisions VIIIa,b,d,e	Spain	Spain		Advice
sol-bisc	Bay of Biscay sole	France	France		Advice
nep-8ab	*Nephrops* in Divisions VIIIa,b (Bay of Biscay, FU 23, 24)	France	France		Advice
nep-8c	*Nephrops* in Division VIIIc (FU 25, 31)	Spain	Spain		Advice
nep-9a	*Nephrops* in Division IXa (FU 26-30)	Spain/Portugal	Spain/Portugal	Portugal/Spain	Advice

Annex R: ToRs on New Species

During the WGCHAIRS meeting that took place in January 2011, WG chairs were given a new list of stocks/species for which collating data might be required for the 2011 assessment WG meetings. This was a long list and WG chairs were told that decisions as to which WG each stocks/species would be allocated to would come a bit later. Following this, new ToRs were added to the WGHMM assessment group in March 2011, stating that data should be collated for the following species and areas:

- Plaice in Bay of Biscay and Iberian coast (ple-89a)
- Pollack in Bay of Biscay and Iberian coast (pol-89a)
- Sole in the Iberian coast (sol-8c9a)
- Whiting in the Bay of Biscay and Iberian coast (whg-89a)

The new Generic ToR h indicates that for these stocks/species, available data should be collected and presented as far as possible. It also states that the EG report should indicate how advice for these stocks can be given in the future.

On the basis of these ToRs the WG chair requested that a person from each institution attending WGHMM (AZTI, CEFAS, IEO, IFREMER, IPIMAR, MI) prepared a Working Document with the data available at those institutes, considering 4 categories of data: (1) landings, (2) discards, (3) survey or any other data (e.g. commercial cpue) that might be useful as an abundance index and (4) biological data. These Working Documents were brought to the WGHMM meeting (WDs 17 to 22) and are incorporated in this Annex of the WG report. They are organised as follows:

AZTI: WD17, by Zarauz *et al*.; CEFAS: WD18, by Readdy *et al*.; IEO: WD19, by Rodríguez *et al*.; IFREMER: WD20, by Mahé; IPIMAR: WD21, by Jardim *et al*.; MI: WD22, by Kelly.

It is very important to keep in mind that the short time available to prepare these data and Working Documents means that:

- At least in a number of cases data could not be quality-checked as thoroughly as is normally done for the species that are regularly assessed. This has been made very clear in several of the WDs, which the WG members urge any potential users to read carefully. Hence, more time is required to quality-assure data.
- Time is also required to make sure no data are missing (e.g. from other countries typically not participating in the WGHMM assessment group – an example might be Belgium)
- Not all institutes could present time series of data for the same time period. As a general rule, the data presented (at least for commercial data) correspond to the last decade.
- There are problems with some species identification (e.g. sometimes landings are recorded as "*spp*", which can refer to several species). Sole is a particularly confusing case in this respect. Each WD generally makes very clear which species the data refer to (identifying them by their scientific name). It is necessary that ICES clarifies exactly the species for which data are being requested, indicating their scientific names to avoid misunderstandings.

- Once the above issues have been resolved, other aspects such as stock identity should be examined before considering “stock assessment” possibilities.

As a consequence of the points mentioned above, WGHMM members feel that more time and scientific work is required before assessment possibilities can be explored and advice given for these stock/species. The WG also feels that it is premature to consider delimitation of the stocks as proposed and drafted in the form of advice summary sheets (e.g. whiting, plaice and pollack in VIII and IXa).

Nevertheless, in response to the new ToRs, the WDs presented are incorporated at the end of this Annex and a short summary of the situation and issues regarding data by species and area follows.

General Issues:

The landings values presented are very preliminary and only intended to give a rough indication of the landings levels.

The WDs by IEO and IPIMAR both considered discards and concluded that they are very low for these species (the IEO data indicate non-negligible discards values only for sole, and these are presented in the IEO WD, but they are still very low). Discards were not considered in the other WDs, but given the very low level of landings of these area/species for most countries, discards may, in principle, be expected to be very low (with the possible exception of France, for which preliminary landings data indicate an important amount of landings in some cases).

Several research surveys are available that might provide abundance indices: the Spanish surveys SpGFS-WIBTS-Q4, SPGFS-cspr-WIBTS-Q1 and SPGFS-caut-WIBTS-Q4, the Portuguese survey PtGFS-WIBTS-Q4 and the French survey EVHOE-WIBTS-Q4. Section 2.2 of this WG report explains the survey acronyms and provides survey descriptions. These surveys have been examined for these species and when found relevant (*i.e.* when catching a sufficiently large amount to provide a reliable index), indices have been presented in the WDs. The potential to consider standardised CPUE series for some commercial fleets is also discussed in some WDs.

The availability of biological data has also been explored and so far found to be generally rather low, although further exploration may be required in a number of cases. The IEO WD indicates that no biological information has been collected for these species up to date under the DCR, as there was not a requirement under the Spanish National Programme Data Collection. In 2011, information in Spain is being collected for pollack, under the multiannual Community programme 2011-2013 for fishing data collection (Reg 2010/93/EU).

Area/species-specific Issues:

Plaice in Bay of Biscay and Iberian coast (ple-89a):

Species identification: This species is *Pleuronectes platessa*, however the IPIMAR WD says that because of morphological similarities with flounder (*Platichthys flesus*) they are often confounded at sales auction in Portugal and both commonly landed as plaice.

Very preliminary average annual landings (t) during last decade:

Spain (mostly from Div IXa): 20; Portugal (Div IXa): 270; France (Div VIIIabd): 110; England and Wales: 0; Ireland: 0.

Potential abundance indices:

Plaice was not present in the Spanish and Portuguese research surveys and not caught in sufficient quantities in the French survey in the Bay of Biscay.

Commercial indices were not available either but it may be possible to explore logbook data in order to produce commercial abundance indices.

Biological data: None

Pollack in Bay of Biscay and Iberian coast (pol-89a):

Species identification: This species is *Pollachius pollachius*, but the IPIMAR WD indicates that there is some mixing in Portuguese markets with whiting (*Merlangius merlangus*) due to wrong use of common names. However the information available suggests that most Portuguese landings are pollack.

Very preliminary average annual landings (t) during last decade:

Spain: 320 (mostly from Div VIIIc and IXa); Portugal: 180; France: 820 (in Div. VIIIabd); England and Wales: 40 (Div VIIIa); Ireland: 0

Potential abundance indices:

Survey indices (abundance and biomass) and bathymetric distribution are available from Spanish surveys.

Commercial indices were not available but it may be possible to explore logbook data in order to produce commercial abundance indices.

Biological data:

In 2011, Spain collected information for *Pollachius pollachius,* under the multiannual Community programme 2011-2013 for fishing data collection (Reg 2010/93/EU). UK took length samples during scientific surveys up until 2001. Currently, UK, under the DCF, is undertaking sampling from fixed net fishery although this mostly covers VIIe,h as most of area VIII landings are made into France.

Sole in the Iberian coast (sol-8c9a):

Species identification: This species is reported by most WDs as *Solea solea* although the IEO WD reports it as being composed of 3 species (*Solea spp.: Solea solea, Solea senegalensis* and *Solea lascaris*) which are landed, marketed and recorded together. IPIMAR reported a mix of species: *Solea vulgaris* and *Solea spp;* 83 % of Portuguese total landings are considered to be *Solea vulgaris.*

Very preliminary average annual landings (t) during last decade:

Spain: 250 (mostly from Div IXa); Portugal: 380 (*Solea spp.*); France: 0; England and Wales: 0; Ireland: 0

Potential abundance indices:

Survey indices (abundance and biomass) and bathymetric distribution are available from the Spanish and Portuguese surveys.

Commercial indices were not available either but it may be possible to explore logbook data in order to produce commercial abundance indices.

Biological data:

IPIMAR have length, weight, sex ratio and maturity information.

Whiting in the Bay of Biscay and Iberian coast (whg-89a):

Species identification: This species is *Merlangius merlangus*. Note however the species identification issue with pollack indicated in the IPIMAR WD.

Very preliminary average annual landings (t) during last decade:

Spain: 230 (mostly from Div VIIIabd). No landings from Division IXa have been recorded; Portugal: 30; France (Div VIIIabd): 870; England and Wales: 0; Ireland: 0

Potential abundance indices:

Biomass and abundance indices are available from the French EVHOE-WIBTS-Q4 survey for the Bay of Biscay area from 1987 to 2010, with the exclusion of 1993 and 1996. Abundance indices by age are available since 1997.

The AZTI WD presents whiting LPUE in Div. VIIIabd based on landings from the Basque country fleet, which constitute 99% of the Spanish landings in that sea area. The pair bottom trawl fleet working in Div. VIIIabd, has been selected to provide information on whiting catches (landings) per unit effort (LPUEs) and on the abundance trends in the period 1995-2010.

Biological data:

France has recorded whiting ages since 1997 from survey samples.

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for the ICES Working Group on Hake Monk and Megrim Copenhagen ,May 2011.

NOTES ON THE BASQUE FISHERY ON WHITING (*Merlangius merlangus*), PLAICE (*Pleuronectes platessa)*, POLLACK (*Pollachius pollachius*) AND SOLE (*Solea solea*) , IN THE BAY OF BISCAY AND CANTABRIAN WATERS IN THE LAST DECADE

by

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INTRODUCTION

Under ICES request, countries and laboratories involved in the working group assessing Hake, Monk and Megrim (WGHMM) were asked to include a number of new stocks under consideration for which Institutions might have available data. These stocks were: Plaice in the bay of Biscay and Iberian coast (ple-89a); Pollack in the Bay of Biscay and Iberian coast (Pol-89a); Sole in the Iberian coast (sol-8c9a) and Whiting in the Bay of Biscay and Iberian coast (whg-89a)

All data to be reviewed and collated was referred to Subarea VIII (VIII abd & c) and IX a. The only exception was sole, which covers only VIIIc (i.e. not the whole of VIII) and IXa.

Data to be collected was defined as: landings; discards; data from research surveys or other sources of data potentially leading to stock abundance indices and biological data.

It might be that for most of these stocks very little data are available. However, it is of interest to know if they are not available (e.g. the species does not appear in the landings (i.e. not caught by the fleet), or they are caught by the fleet but no information is collected. Thus, the identification of the lack of data is interesting, if applicable, suggesting possible improvement in the sampling.

During 2010, AZTI continued monitoring all species caught in Basque fisheries fishery in the Basque Country (Spain) in relation to the monthly landings and fishing effort by sea area and gear. In this way, compilation and updating of the basic information on species such us those required in this exercise (i.e. whiting (*Merlangius merlangius*); plaice (*Pleuronectes platessa)*, pollack (*Pollachius pollachius*), sole (*Solea solea*)), is updated every year since 1994. This is, landings and landings per unit effort made by the Spanish fleets, when landed at the Basque Country ports are computed.

Landings recorded in the Basque country for the above species are presented in Table 1.

Landings (t)											
ICES Area	Stocks	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
VIIIabd	Pollack	10	32	25	23	38	27	18	20	14	10
	Whiting	365	510	229	184	219	201	492	153	52	102
VIIIc	Pollack	1.6	2.8	0.4	0.2	0.7	0.5	2.4	2.3	0.3	0.8
	Sole	6.7	6.3	5.1	4.045	15.3	2.7	9.95	11.7	10.1	10.930
	Whiting	0.003	0.718	0.155	0.029		0.001	0.005	0.037	0.005	20

By ICES division, the most significant landings are whiting in VIIIabd and sole in VIIIc. This working document will be mostly focused on whiting in the Bay of Biscay. An update of whiting landings on the Basque Country ports since 2001 to 2010 are presented. Also for the Pair bottom trawl fleet operating in Div. VIIIabd -the most important fleet in relation to whiting fishery- and for that period 1995-2010, fishing effort and landings per unit effort (LPUE) values have been revised and updated.

Significant catches also occurred for sole in VIIIc. However, these data are not presented in this paper as effort data is still to be analysed.. It is to be noted that in the last 4 years an increased effort has been deployed in relation to sampling the artisanal fleet. Nowadays it can be said that there is a good coverage of sampling in relation to landings as almost all are sampled (what is sell in the Brotherhoods and landings following a direct market: small fish markets and restaurants). Sole is caught mainly in winter by trammel nets and catches reached a mean of 8-10 kg by trip. Amounts are relatively low for a trip, however price reached, especially through direct marketing the fish, is really high (> 15 €/kg). The effort deployed by the artisanal fleet is not being recorded as well as the landings and with the same frequency and accuracy that it is done for other fleets.

Thus, a simple analysis on landings and LPUE is available in this paper just for whiting. Whiting catches can be considered as by-catches of other directed or mixed demersal fisheries operated by the Basque fleet, targeting Hake, Anglerfish, Megrim and others. These demersal fisheries operate in different sea areas -ICES Subareas VI, VII and VIII- and different gears: "baka" otter bottom trawlers, pair bottom trawlers with very high vertical opening (VHVO) nets, bottom longliners, and others.

RESULTS

1. Basque fleet catches (landings) of whiting in 2001-2010 data series by metier in Division VIIIabd.

1.1. Total annual catches

In 2001-2010 data series, the Basque Country fleet annual whiting landings in Division VIIIabd amounted to 2506 T (Table2). There have been important differences between years, as shown in figure 1. Three years 2001, 2002 and 2007 have the most important landings. Then an important decrease is appreciate after 2002 and until the increase in 2007, landings were quite similar. During the last three years, important decreases have been observed in this landing.

1.2. Annual catches by fishery

Summaries of the total catches of whiting by metier from 2011 till 2010 are presented in Table 3. In this table the metiers are summarized into four: Bottom otter trawl, Pair bottom trawl, Longline, and Gillnet.

Main catches were achieved by Pair bottom trawlers (around 82%) and the rest by Bottom otter trawlers (around 16%), by Longlines (1%) and Gillnets (1%) figure 2. Gillnets metier landings are only present in 2007. As this numbers indicates this species is important for trawlers and mainly for the Pair bottom trawlers in which it could be one of the target species.

2. Seasonality of whiting catches by fishing gear

Pair bottom trawlers

In 2010, as in the past, the most part (70%) of the annual landings in area VIIIabd came from this fleet. From 2008 to 2010, the largest catches were achieved during the fourth quarter of the year, and a few ones during May and June (Figure 3). This strong seasonality can also be observed during the period 2001-2009, although from 2001 to 2007 the catches were higher, both in the second and in the fourth quarter of the year (Figs 4 and 5)

Otter bottom trawlers

In 2010, a 29% of the annual landings in area VIIIabd came from the otter bottom trawlers. Catches show a marked seasonality, being higher during the first and the fourth quarter of the year (Figure 3). This seasonal pattern can be observed during all the period of our study, from 2001 to 2010 (Figures. 4 and 5)

3. Whiting catches (landings) per unit effort

The pair bottom trawl fleet working in Div. VIIIa,b,d, has only been selected to provide information on whiting catches (landings) per unit effort (LPUEs) and on the abundance trends in the period 1995-2010. This fleet obtains the most important whiting Basque catches and its fishing effort can be quantified with accuracy along all the period. However it has to be noted that the whiting is not the main target for this metier -focused at present on hake.

The effective fishing effort of this fleet was calculated in number of fishing days, as result of multiplying the number of trips of the fleet in the sea area selected (Div. VIIIa,b,d) by the mean number of fishing days by trip in the area, season (quarter) and year:

$$\text{Effort} = \text{fishing days} = \text{trips} * (\text{mean days/trip})$$

The VHVO pair trawl fleet fishing maximum effort is appreciated in the late nineties, reaching more than 3000 fishing days in 1997. Afterwards, this effort decreased progressively during the last decade, moving until 636 days in 2009, mainly because of the severe diminishing of the number of boats of this Basque fleet (Table 3).

The whiting annual LPUEs, have remained relatively stable at low values during 1995-1999 (below 55 kg/day). Afterwards, some fluctuations are appreciable, with two peaks in 2002 and 2007, 237 Kg/day and 346 Kg/day respectively. In 2010, whiting LPUE, has been below 55 Kg/day again.

Table 2. Whiting catches landed by the Basque fleet during the period 2001-2010.

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Total	365	510	229	184	219	201	492	153	52	102	2506

Table 3. Whiting landings (Tons) by gear during the period 2001-2010

Gear	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Bottom otter trawl	37	31	44	21	62	47	85	40	14	29	410
Long line	0	1	2	2	2	2	3	4	1	0	18
Pair bottom trawl	326	474	183	161	154	152	394	108	37	73	2062
Gillnets	2	4	0	0	0	0	11	0	0	0	16
Total	365	510	229	184	219	201	492	153	52	102	2506

Table 4 Whiting landings (Kg), effective effort (fishing days = trips*(days/trip)) and LPUE (landings in kg/day) of pair bottom trawl operating in Divisions VIIIa,b,d during the period 1995-2010

	VHVO P. trawl--VIIIa,b,d		
Year	Landings (kg)	Effort (days)	LPUE (kg/days)
1995	9561	1705	6
1996	61338	2698	23
1997	159767	3042	53
1998	71919	2944	24
1999	101533	2967	34
2000	269084	2447	110
2001	326022	1740	187
2002	473591	2000	237
2003	183018	2190	84
2004	160926	2021	80
2005	154399	1359	114
2006	151969	1418	107
2007	393917	1139	346
2008	108346	791	137
2009	37277	633	59
2010	72639	1735	42

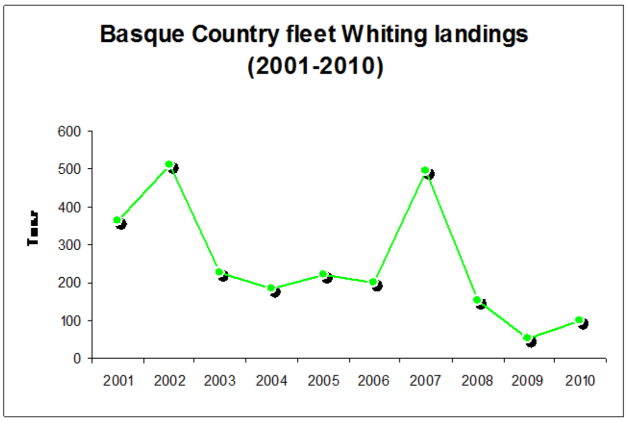

Figure 1.Basque annual Whiting landings in Division VIIIabd for the period 2001-2010

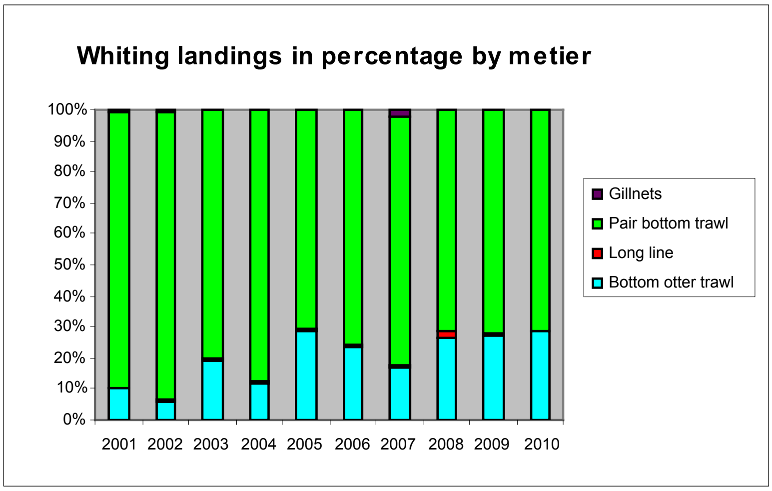

Figure 2. Whiting landings by gear in the Basque Country during the period 2001-2010.

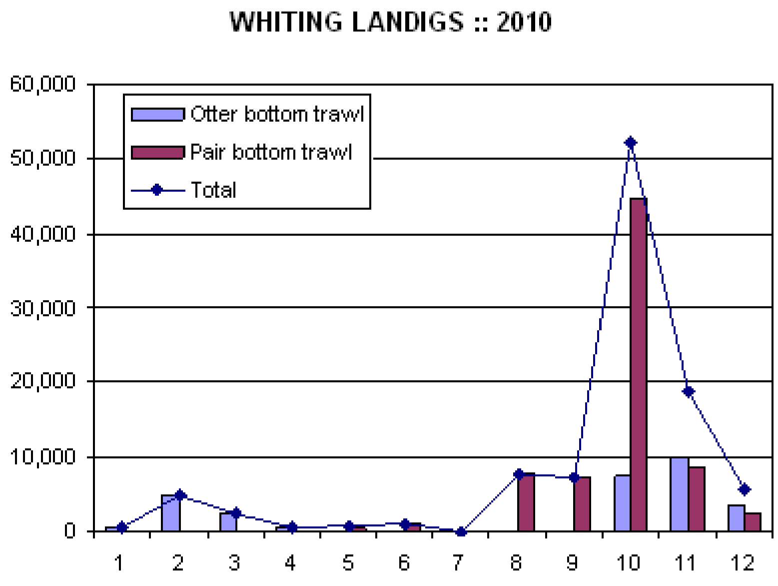

Figure 3. Monthly distribution of the landings (kg) of whiting in area VIIIabd, in 2010.

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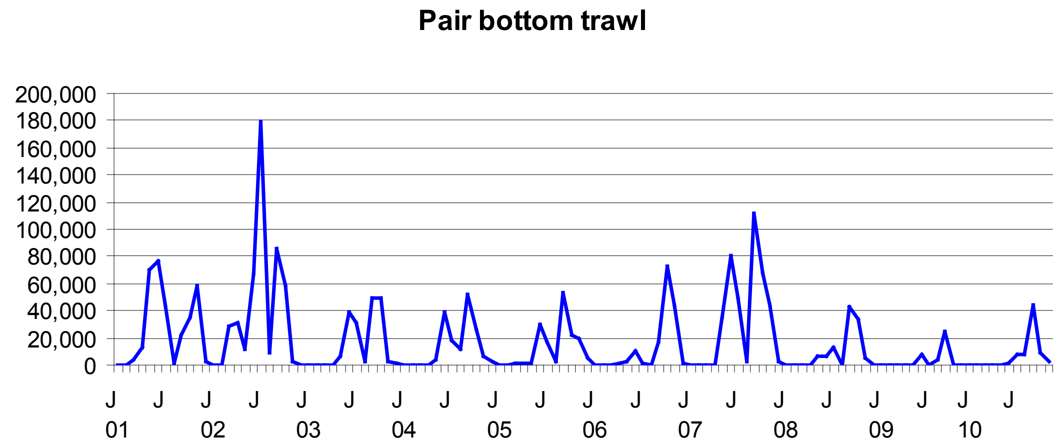


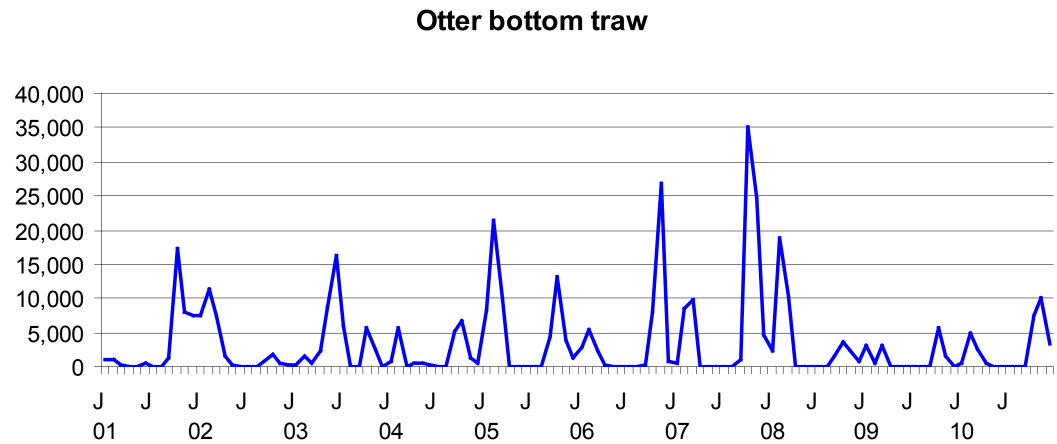
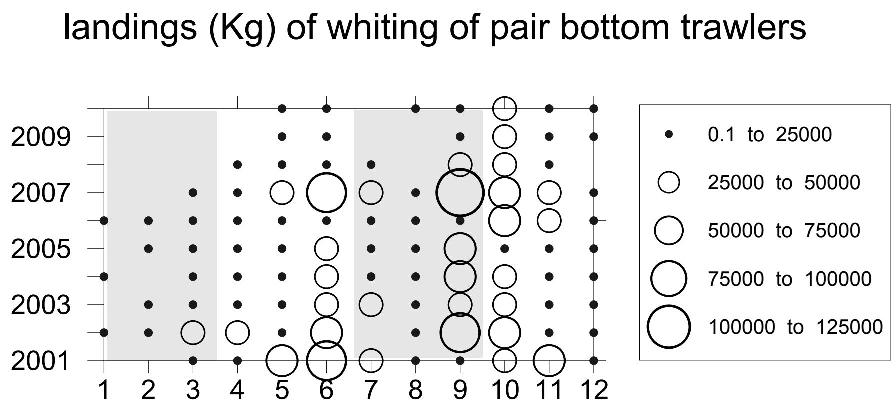


Figure 4. Time series of whiting landings (kg) by fishing gear in area VIIIabd. Only the two most important fishing gears have been considered (pair bottom trawlers and otter bottom trawlers)



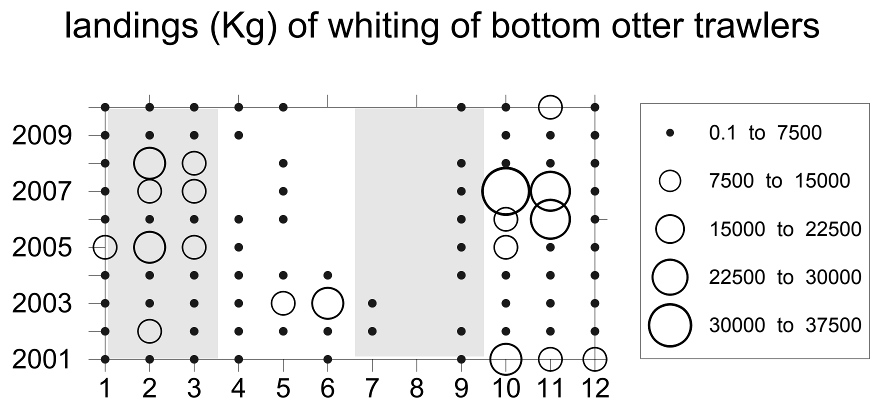


Figure5. Seasonality of whiting landings (kg) by fishing gear in area VIIIabd. Only the two most important fishing gears have been considered (pair bottom trawlers and otter bottom trawlers)

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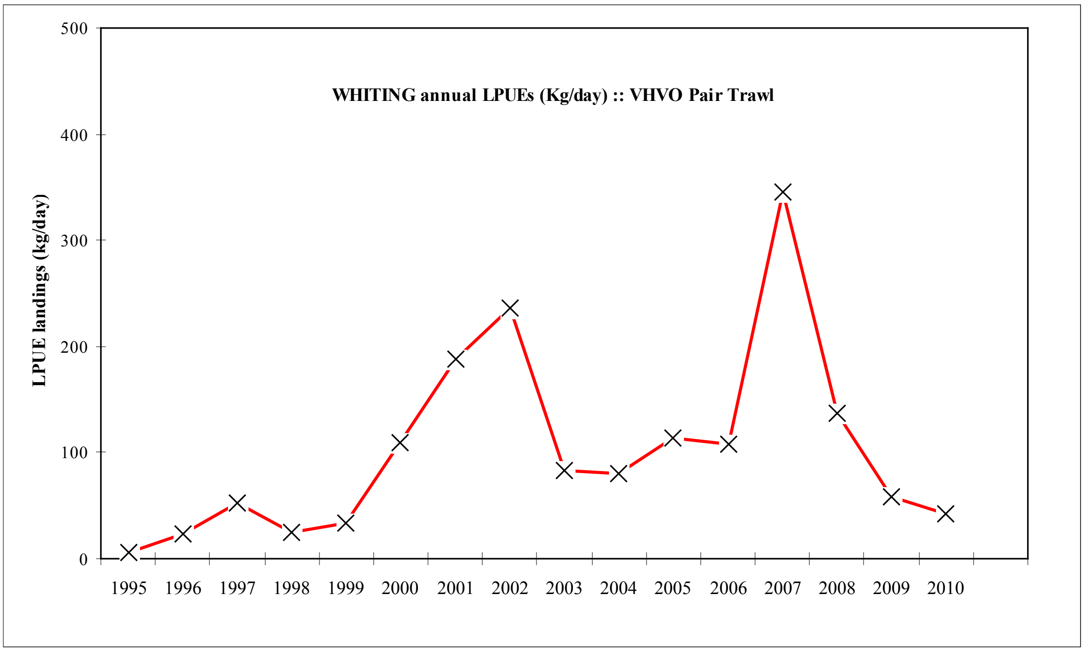

Figure 6. Whiting landings per unit effort (LPUEs in kg/day), by year, for pair bottom trawl fleet fishing in Divisions VIIIa,b,d, in the period 1995-2010.

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to be presented to the Working group on Hake, Monk and Megrim (WGHMM) 5-11 May 2011, Copenhagen.

Data availability for the UK, England and Wales component, for *Pleuronectes platessa* in ICES area 89, *Pollachius pollachius* in ICES area 89, *Solea solea* in ICES area 8c9 and *Merlangius murlangus* in ICES area 89.

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There is limited activity in ICES divisions VIII and IX by UK (E&W) registered vessels. In relation to the data presented below the landings for the period 1985 – 1995 were mainly by Anglo Spanish vessels either landing directly to Spanish ports or overlanding catches from Welsh ports for first sale in Spain. Effort in the area then dropped to low levels until the development of a fixed net fishery targeting pollack (*Pollachius pollachius)* in 2006, landings by this fleet are split between the UK and France where the demand for pollack is higher.

Each section is dedicated to one of the four stocks outlining the data available. For all four stocks there are no data for ICES divisions VIIIc and IX from the UK, England and Wales component. For the other subdivision in area VIII three of the stocks have some landings although variable. Length and biological samples where only taken from a scientific survey between 1983 and 2001, not all years have samples for the four stocks and the survey discontinued in 2004.

1 Plaice (*Pleuronectes platessa*) 89

There were no samples taken for plaice in ICES divisions VIII and IX from the landings, discards or scientific surveys. Landing for this stock are erratic and generally below 1 tonne peaking to a maximum of 1.7 tonnes in 1998. The majority of the landings are attributed to the gear group trawl, table 1.1.1, and mainly in ICES sub division VIIIb, table 1.1.2. Landings in 2010 there were recorded as zero.

Table 1.1.1 Plaice landings (kg) by year and gear grouping

Year of landing	Dredgers	Beam trawl	Bottom Trawl	Total
1985			243	243
1986			670	670
1987				
1988			815	815
1989				
1990				
1991			46	46
1992				
1993		35		35
1994				
1995		2	2	4
1996	5	96	218	319
1997			67	67
1998				
1999			97	97
2000			129	129
2001			5	5
2002				
2003				
2004				
2005				
2006				
2007			9	9
2008				
2009			19	19
2010				

Table 1.1.2 Plaice landings (kg) by year and division

Year of landing	VIIIA	VIIIB	VIIID	Total
1985	243			243
1986	670			670
1987				
1988	815			815
1989				
1990				
1991	46			46
1992				
1993			35	35
1994				
1995	2	2		4
1996		319		319
1997			67	67
1998				
1999		97		97
2000	129			129
2001	5			5
2002				
2003				
2004				
2005				
2006				
2007			9	9
2008				
2009			19	19
2010				

2 Pollack (*Pollachius pollachius*) 89

There were no samples taken for Pollack in ICES divisions VIII and IX from the landings or discards, however length samples were taken during scientific surveys up until 2001, table 2.1.1 gives the numbers at length taken. Until 2006 landings had been low and declining and mainly caught by trawl gears. In 2006 where the maximum landings was reached and peaked, in the order of 170 tonnes, the predominant gear group had then become fixed nets, table 2.1.1. In the preceding years the landings were more than halved with the most recent landings for 2010 totalling 46 tonnes. Table 2.1.2 shows that the majority of landings are recorded in ICES subdivision VIIIa. The volume of Pollack in Kg per day for fixed nets over the last five years, shown in figure 2.1.1 and 2, is generally on the decline. Under the DCF we are now undertaking sampling for the net fishery for Pollack that covers mainly area VIIeh as most of the area VIII landings are in to France.

Table 2.1.1 Pollack samples from scientific surveys by year

	Length samples			Biological samples		
Year	VIIIa	VIIIb	VIIId	VIIIa	VIIIb	VIIId
1983		1				
1985	2					
1986	1	1				
1987	1					
1989	1					
1990	1					
1991	1					
1992	2					
1993	17					
1997	169					
2001	1					

Table 2.1.2 Pollack landings (kg) by year and gear group

Year of landing	fixed nets	Long lines	Beam trawl	Bottom Trawl	Total
1985		19,504		3,759	23,263
1986				4,589	4,589
1987				1,004	1,004
1988				5,903	5,903
1989					
1990	1,802				1,802
1991		341		307	648
1992					
1993			1	262	263
1994					
1995			8	1,614	1,622
1996		9			9
1997	934	3			937
1998		5			5
1999		1			1
2000		33		6	39
2001		9			9
2002		6			6
2003		481	10	11	502
2004					
2005		5		57	62
2006	170,918				170,918
2007	61,840			1	61,841
2008	64,054				64,055
2009	40,942				40,942
2010	43,787				43,787

Table 2.1.3 Pollack landings (kg) by year and division

Year of landing	VIIIA	VIIIB	VIIID	VIIIE	Total
1985	23,263				23,263
1986	4,589				4,589
1987	1,004				1,004
1988	5,903				5,903
1989					
1990	1,802				1,802
1991	648				648
1992					
1993	262		1		263
1994					
1995	8	34		1,580	1,622
1996	9				9
1997	937				937
1998	5				5
1999	1				1
2000	33	6			39
2001	9				9
2002	6				6
2003	492		10		502
2004					
2005	5	57			62
2006	167,949		2,969		170,918
2007	61,840		1		61,841
2008	63,427		627		64,054
2009	40,942				40,942
2010	26,279		17,508		43,787

Figure 2.1.1 Pollack landings per day for the gear grouping fixed nets by ICES statistical rectangle and year, 2006 to 2010.

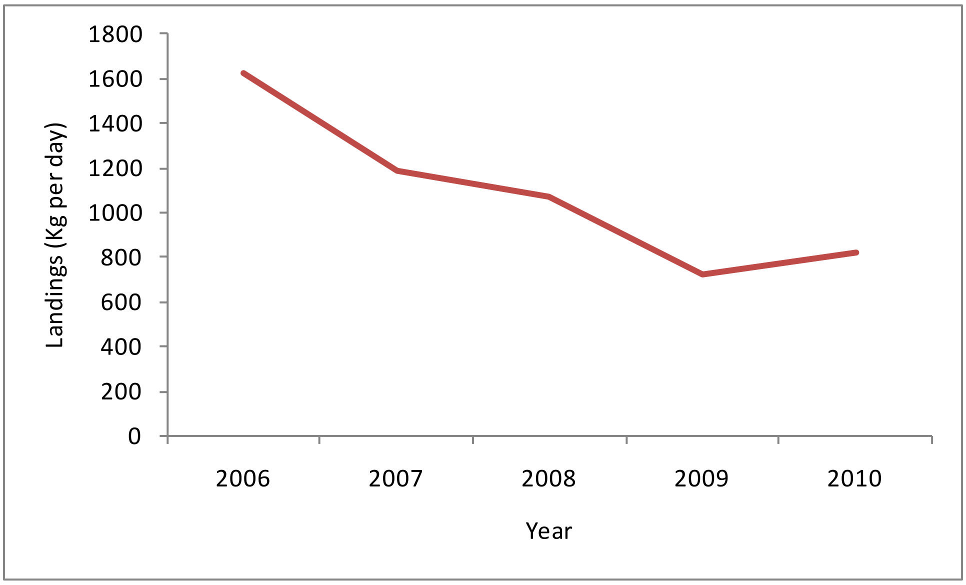

Figure 2.1.2 Pollack landings per day for the gear grouping fixed nets by year

3 Sole (Solea solea) 8c9

There are no data available for Sole in ICES Divisions VIIIc and IX from the landings or discards sampling and there are no landings recorded for this stock.

4 Whiting (*Merlangius murlangus*) 89

There were no samples taken for Whiting in ICES divisions VIII and IX from the landings or discards sampling, however length and biological samples were taken during scientific surveys, table 4.1.1 gives the numbers at length and biological samples taken. The landings for whiting are erratic and low, below 1 tonne in the last decade with zero recorded for 2010. The maximum landings recorded for this stock was in the region of 22 tonnes recorded in 1986.

Table 4.1.1 Whiting samples from scientific surveys by year

	Length samples			Biological samples		
Year	VIIIa	VIIIb	VIIId	VIIIa	VIIIb	VIIId
1983	1					
1984	4	7				
1985	5	1				
1986		1			1	
1987	14	8		6	8	
1990	29					
1991			19			
1992	2					
1996	1					

Table 4.1.2 Whiting landings (kg) by year and gear group

Year of landing	Fixed nets	Long lines	Beam trawl	Bottom Trawl	Total
1985		9,682		7,300	16,982
1986				22,428	22,428
1987				326	326
1988				3,532	3,532
1989					
1990					
1991					
1992				1,689	1,689
1993					
1994					
1995		5		14	19
1996				230	230
1997	352			286	638
1998				1,813	1,813
1999				92	92
2000		2		541	543
2001					
2002					
2003			12		12
2004					
2005					
2006	5				5
2007				4	4
2008					
2009				68	68
2010					

Table 4.1.3 Whiting landings (kg) by year and division

Year of landing	VIIIA	VIIIB	VIIID	Total
1985	16,982			16,982
1986	22,428			22,428
1987	326			326
1988	3,532			3,532
1989				
1990				
1991				
1992	1,689			1,689
1993				
1994				
1995	5	14		19
1996		230		230
1997	352		286	638
1998	122	1,369	322	1,813
1999		92		92
2000	232	311		543
2001				
2002				
2003			12	12
2004				
2005				
2006			5	5
2007				
2008			4	4
2009			68	68
2010				

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to the ICES Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim (WGHMM), Copenhagen, 5-11 May 2011

Spanish fishery data on plaice (*Pleuronectes platessa*), pollack (*Pollachius pollachius*), sole (*Solea spp.*) and whiting (*Merlangius merlangus*) in Iberian and Bay of Biscay waters

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1. INTRODUCTION

Following a request from ICES throughout the Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim (WGHMM), countries involved in the WGHMM have been asked to provide fishery information on several fish species in geographical areas for which ICES has never provided management advice. The species concerned are plaice (*Pleuronectes platessa*), pollack (*Pollachius pollachius*), and whiting (*Merlangius merlangus*) in Bay of Biscay and Iberian waters (Subarea VIII and Division IXa) and sole (*Solea spp.*) in Iberian waters (Divisions VIIIc and IXa). These species are widely distributed in European coasts, although sole is limited to the southernmost waters. They are mainly caught in small scale fisheries developed on coastal waters and sporadically as by-catch in trawl fisheries.

There are not previous relevant fishery data on these species in the area. The aim of this document is to gather together available fisheries information on that species, and specially those data related to landings, discards, and information from research surveys.

2. SOURCES OF DATA

2.1 Landings

Statistics of Spanish landings are monthly collected by the Instituto Español de Oceanografía (IEO) from different sources (i.e. daily sale reports, port statistics, fishing Associations). Fishing data are properly recorded in the IEO database according to the fishery, fishing gear, métier, fleet segment and landing port. IEO landings estimates are habitually used to the assessment of commercial species. Data prior 2000 related to the species deal with in this document are considered inconsistent and to present a homogeneous set of data, the period 2000 -2010 have been selected (Table 1). Commercial landings in Basque Country is not included in the analysis.

Total weight landings are also presented by gear (Table 2). The contributions of each of these groups of gears to the landings were estimated by IEO. Some difficulties have been found to make further detailed allocations to fishing gears. In all cases “Others” includes known gears with a minor contribution and landings from no identified gears.

Length compositions of landings have been recorded since 2009 due to the implementation of the concurrent sampling methodology, as is required in the Data Collection Framework (DCF) regarding the Common Fisheries Policy (Dec. 2008/949/EC). However, the information is irrelevant, mainly due to the low levels of sampling related with the irregular and low landings of these species.

2.2 Research surveys

Data of Pollack, sole, whiting and plaice from research surveys were extracted from the IEO survey database. These surveys are:

-Spanish groundfish survey (SP-GFS) carried out annually in the north and northwest of Spain during September/October since 1983 (except 1987) (ICES, 2010a). This series was based on a stratified random sampling methodology, using bottom trawl gear and a half hour hauls. The survey aims to collect data on distribution, relative abundance and biology of commercial fish species in the Cantabrian Sea and off Galicia waters.

Spanish Cádiz groundfish surveys –autumn and spring- (SP-GFS-caut and SP-GFS-cspr) carried out annually in the Gulf of Cadiz (in March, since 1994, and in November, from 1997) (ICES, 2010a). A stratified random sampling design with 5 bathymetric strata, covering depths between 15 and 700 m is used in this area, with one hour hauls. These surveys aim to collect data on the distribution, relative abundance, and biology of commercial fish species in the area.

Sampling design and methodology used in these surveys are detailed in ICES (2010b).Methods and temporal and spatial coverage of the surveys have been maintained identical over the time series and resulting information are consequently comparable.

2.3 Discards

Discards sampling programme has been developed by IEO in 1994, 1997, 1999-2000 and 2003 onwards. Information on discarding practices and length distributions of discarded species in Divisions VIIIc and IXa North was obtained by observers on board commercial trawl vessels. Sampling effort varies from quarter to quarter, but shows a quite stable monitoring effort (around 12 trips by quarter) (Table 3).

Discard data were raised to fishing effort to determine the total annual weight discarded by species.

2.4 Biological sampling

No biological information has been collected for these species up to date, as there was not a requirement by Spanish National Programme Data Collection. In 2011, information is being collected for *Pollachius pollachius,* under the multiannual Community programme 2011-2013 for fishing data collection (Dec 2010/93/EU).

3. RESULTS

3.1 Pollack

Annual average of pollack landings (2000-2010) was 293 t (Figure 1). Overall trend of landings during this period was slightly increasing. Landings were above 400 t in 2008 and 2010. Majority of landings come from Division VIIIc (Table 1), and this species was not recorded in IXa South (Gulf of Cádiz). Pollack is caught in small scale fisheries by a wide variety of fishing gears (different types of longline and enmeshing gears). Bottom trawlers have a minor incidence on this species.

Along the time series of SP-GFS surveys, pollack has only been caught in 1983 and regularly 2004 onwards. Abundance and biomass indices and bathymetric distribution of pollack in the Cantabrian Sea and off Galicia from survey data are given in Figures 2-4.

Regarding biological sampling, information is being collected since the beginning of 2011. Thus, little information is available.

3.2 Sole (Solea solea, Solea senegalensis, Pegusa lascaris)

Two species of *Solea* are currently found in landings from ICES Division VIIIc and IXa: *Solea solea* and *Solea senegalensis*. Sand sole *Pegusa lascaris* is also recorded in ICES Division VIIIc (*Pegusa lascaris* has a junior synonym including *Solea lascaris*). These species are landed and marketed together, and they are also recorded together in the fishery statistics. Taking into account the geographical distribution of the species, landings from Divisions VIIIc and IXa-North are made up of *Solea solea* and *Pegusa lascaris*. *S. solea* is more abundant, but information on the specific proportions in landings is lacking. In the Gulf of Cádiz (Division IXa- South) *Solea solea* and *S. senegalensis* are also landed and reported together.

Average landings (2000-2010) was 64.5 t in Division VIIIc, and 186.7 t in Division IXa (Table 1). Time series of total landings of sole show an overall decreasing trend (Figure 1). Most than a half of the total current landings are made from small scale, multispecies and multigear fisheries (compiled under the term “other gears” in Table 2).

Data on sole from research surveys (abundance and biomass indices, distribution and species proportion in the north and northwest of Spain and yields indices in the Gulf of Cádiz) are presented in Figures 5-7 and Tables 4-7. In Spanish groundfish survey majority of soles catches corresponds to *Solea solea*. In 1989 and 1993 weight of *P. lascaris* were greater than *S. solea*. Abundance indices are very low in general (<1 indiv/haul) compared to other commercial species. For the Southern IXa area, fishing yields-per-hour of both species *(Solea solea* and *Solea senegalensis)* are presented by weight and number for both research surveys series, autumn and spring, Spanish Cadiz Groundfish Survey.

Discards of sole in Divisions VIIIc and IXa were very low (Table 8). Length distribution was not presented due their low number of sole in the discard sampling.

3.3 Whiting

Spanish landings of whiting are anecdotal. Annual average of total landings during 2000-2010 period amounted 1 t. No landings from Division IXa have been recorded (Table 1). Whiting is occasionally caught by different types of gears (Table 2). Neither catches nor discards of whiting were recorded in the time series of research surveys and discarding programme.

3.4 Plaice

Mean annual landings of plaice was 21.5 tonnes for the period 1982-2008, ranging between 6.8 and 72.8 tonnes, maximum peak attained in 2005 (Figure 1). Most of the landings come from Division IXa. Only minor landings from VIIIabd were recorded in 2009 and 2010 (Table1). Small scale fisheries -representing a miscellaneous fleet characterized by multi-species/multi-gear fisheries and high variability in its activity over the time - account for the majority of the landings (96.9%) (Table 2).

Plaice was not recorded in the research surveys.

4. REFERENCES

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

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5. ACKNOWLEDGEMENTS

The authors wish to thank to technicians and observers involved in sampling and data storage of the ICES database. Special thanks to R. Gancedo, R. Morlán and B. Patiño for the compilation of fishery landings data.

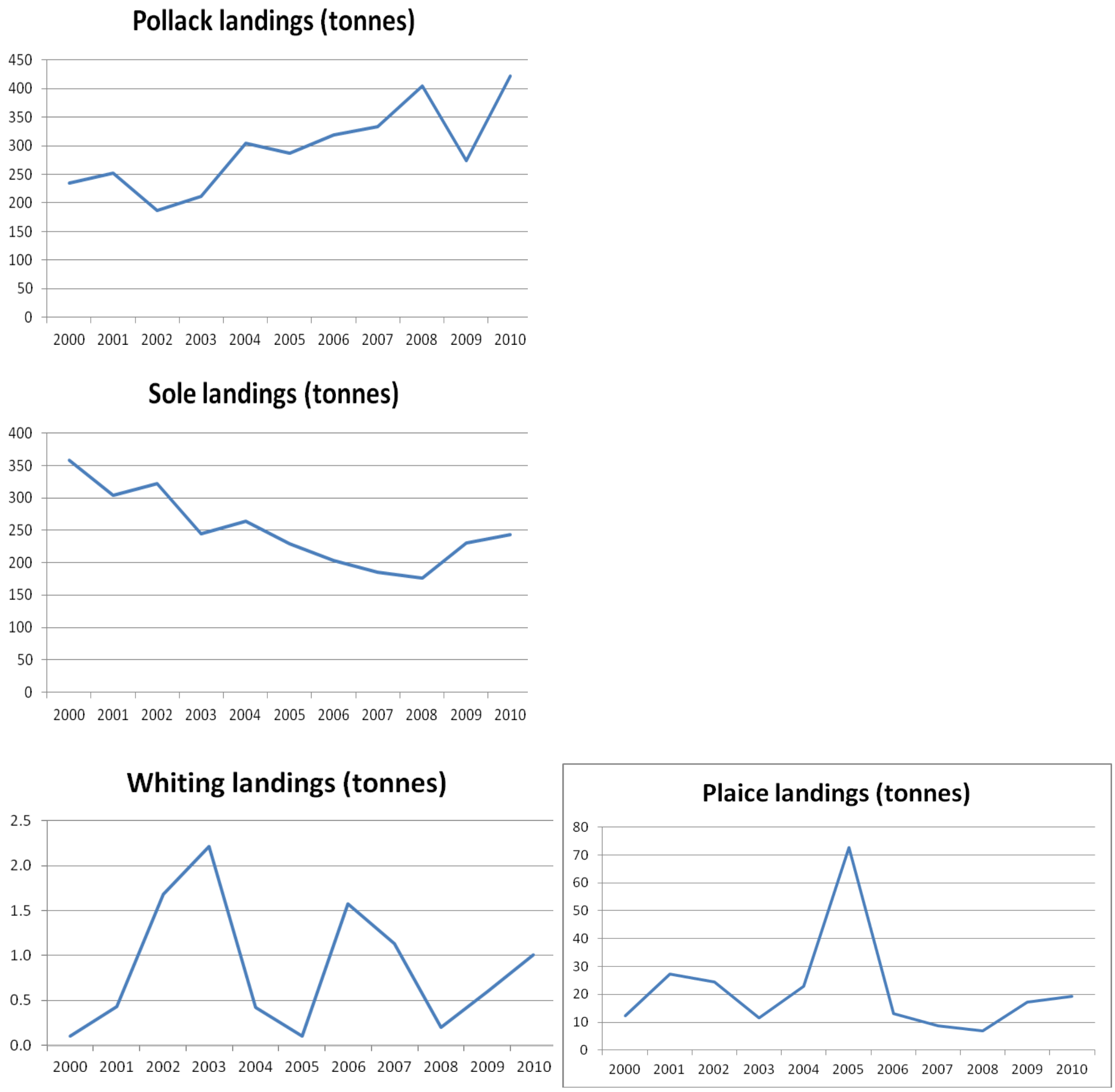

Figure 1. Pollack, sole, whiting and plaice landings in Spain, 2000-2010.

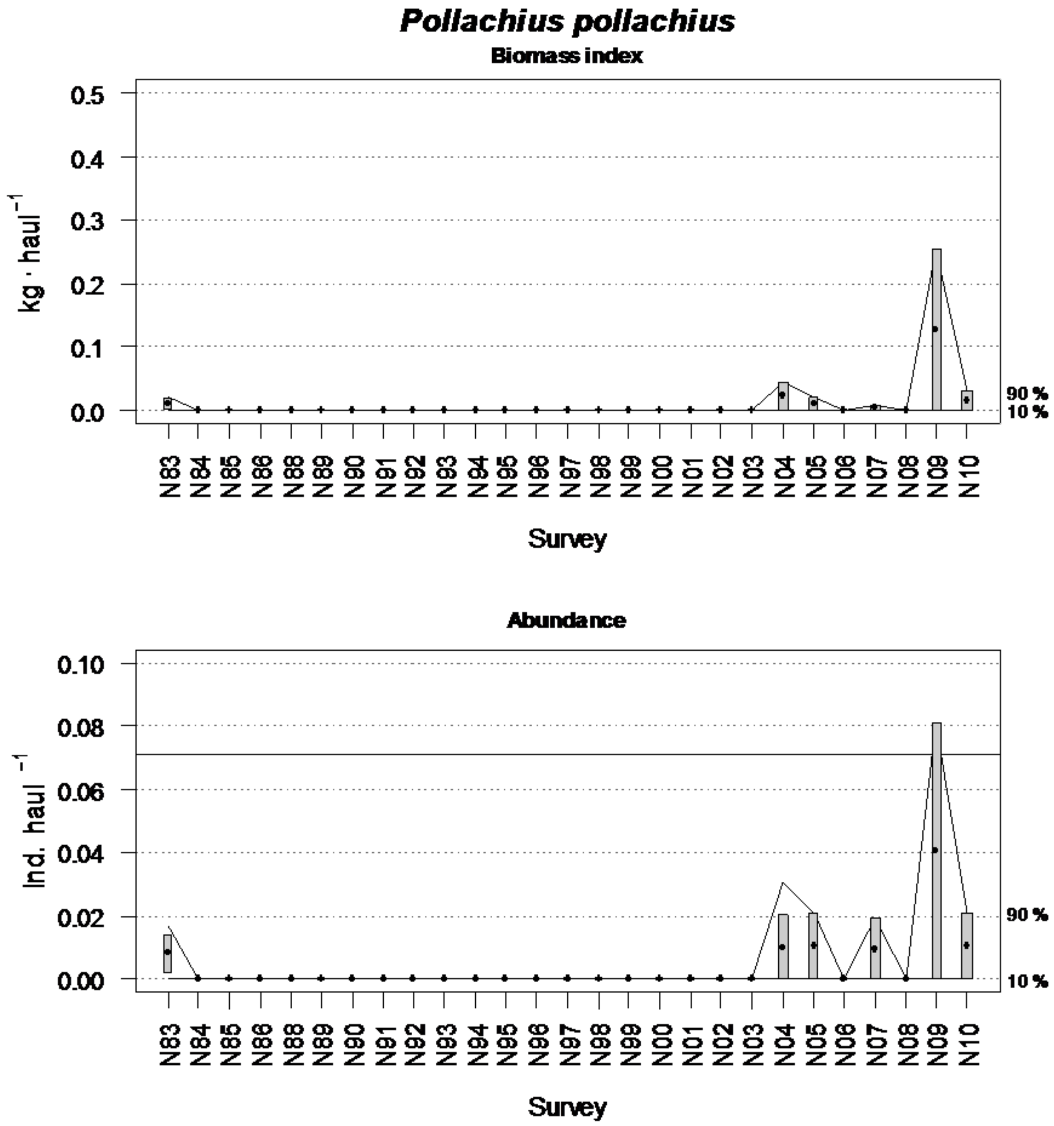

Figure 2. Biomass and abundance indices of pollack from the time series of SP-GFS, 1983-2010 (no survey in 1987)

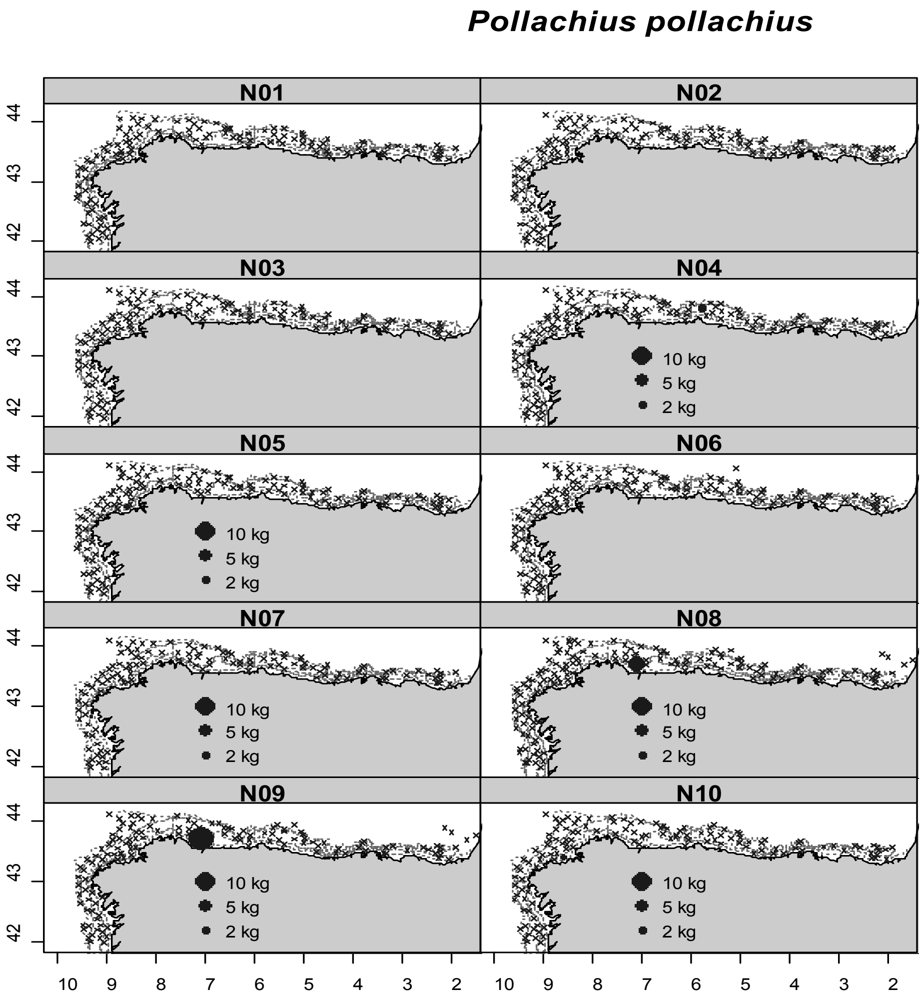

Figure 3.Geographical distribution of Pollack biomass on the north and northwest of Spain, SP-GFS data, 2001-2010.

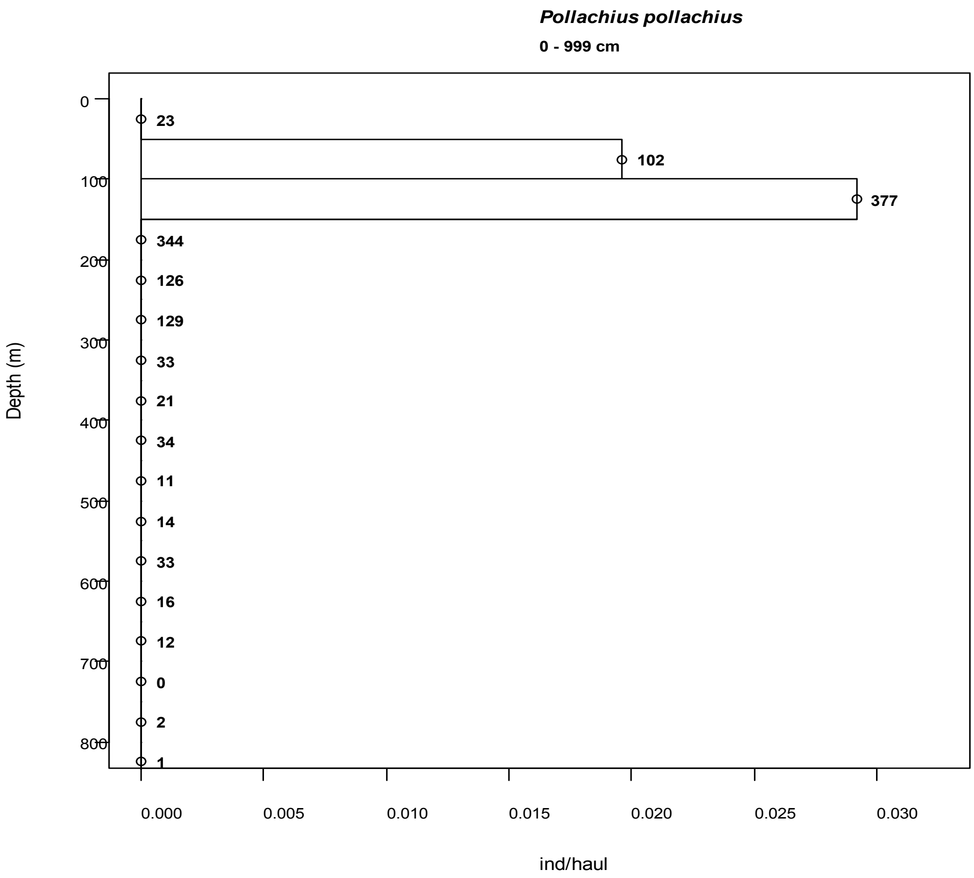

Figure 4. Bathymetric distribution of pollack on the north and northwest of Spain with the number of hauls per depth range, SP-GFS data 2001-2010.

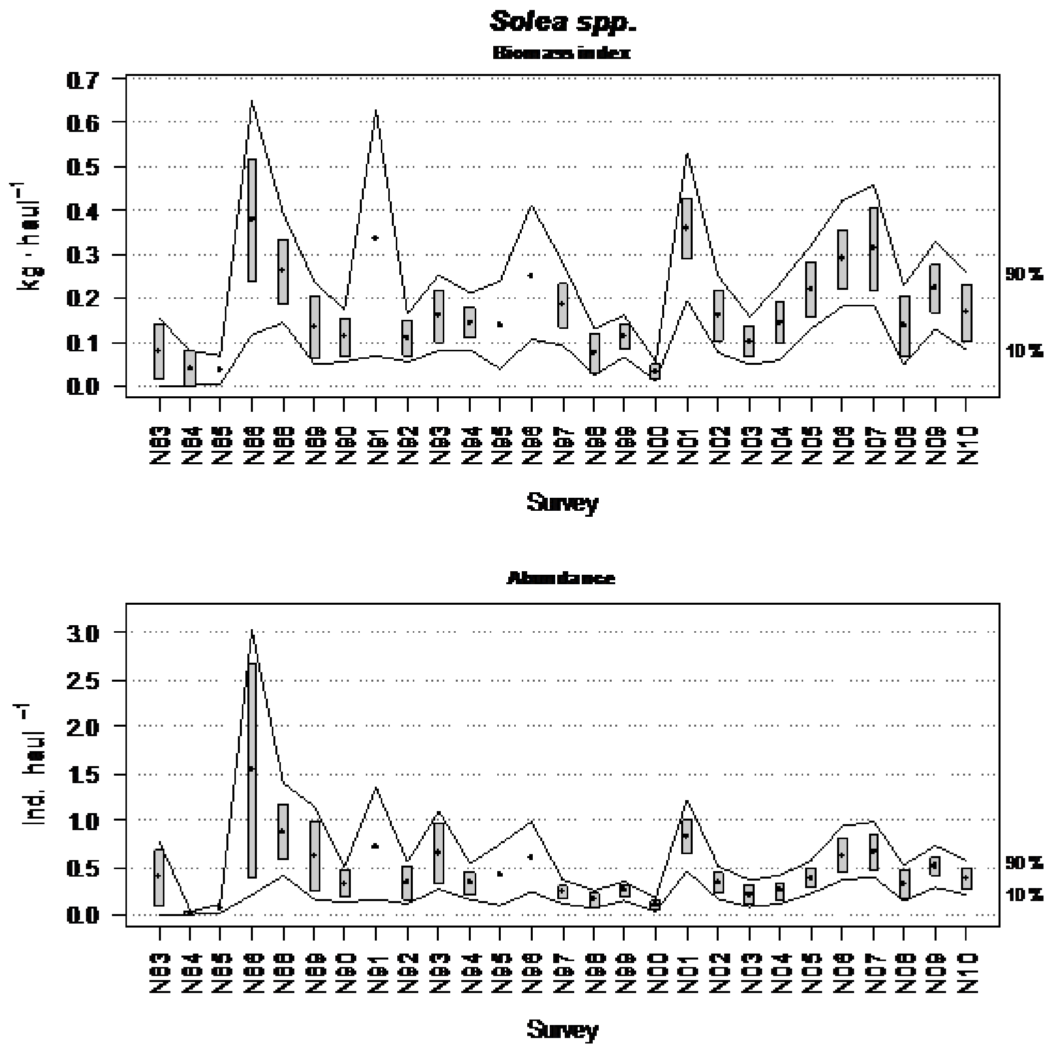

Figure 5. -Biomass and abundance indices of sole (Solea spp: Solea solea and Pegusa lascaris) on the north an northwest of Spain, from SP-GFS, 1983--2010 (no survey in 1987).

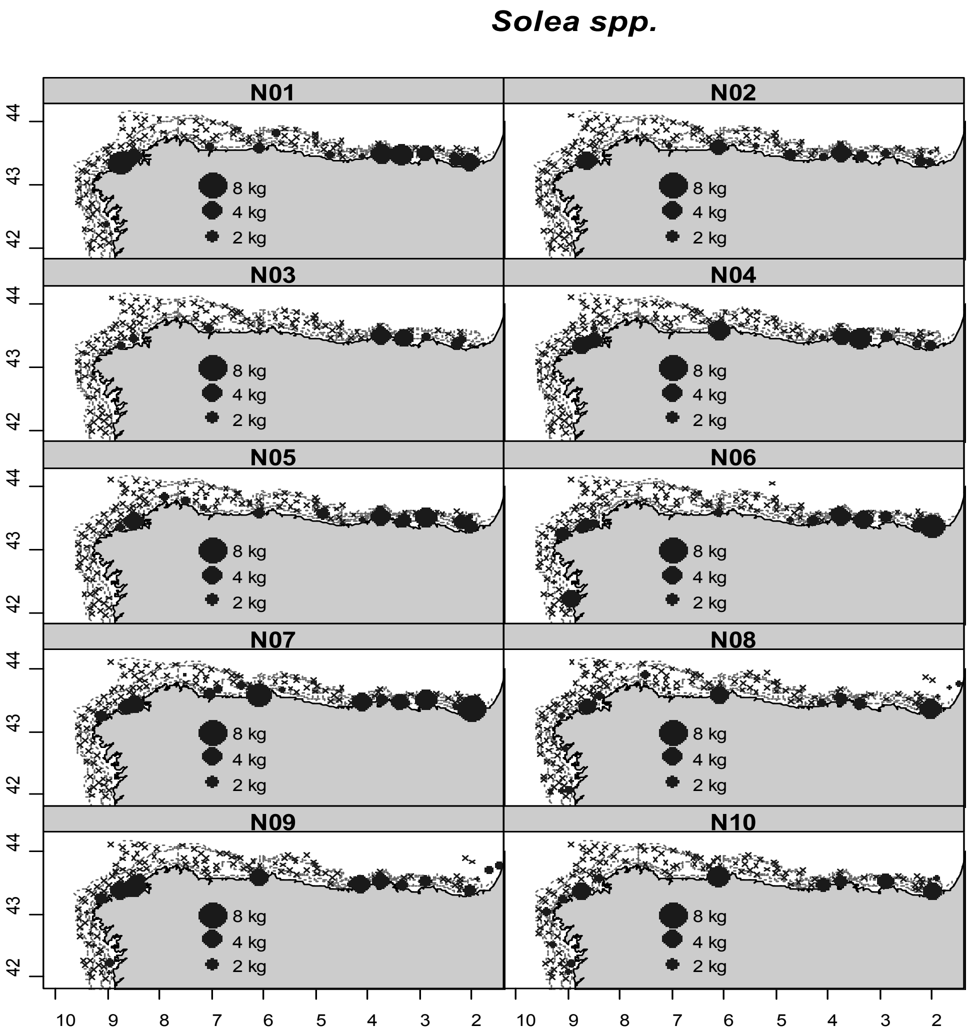

Figure 6. Geographical distribution of sole (*Solea solea* and *Pegusa lascaris*) biomass on the north and northwest of Spain, SP-GFS data 2001-2010.

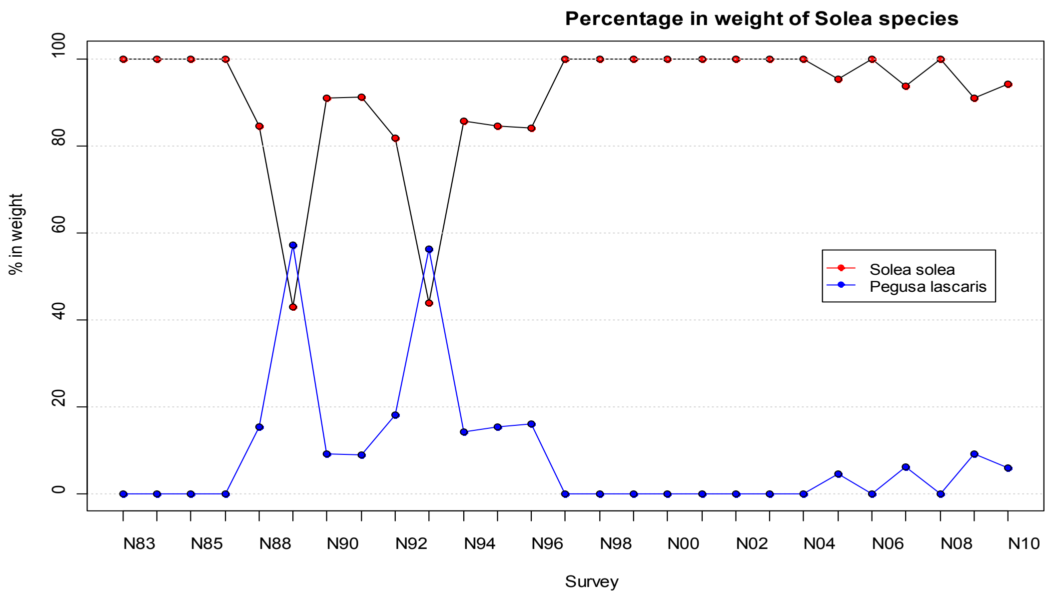

Figure 7. Percentage in weight of the two species of sole (Solea solea and Pegusa lascaris) in SP-GFS time series, 1983-2010.

Table 1. Total landings (tonnes) by specie, ICES area and year.

	Landings (tonnes) by species, ICES area and year										
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Pollack											
VIIIabd	6.6	17.7	9.1	7.3	7.9	5.8	9.6	1.4	4.4	1.9	2.4
VIIIc	134.2	151.7	122.2	119.9	189.3	184.2	202.9	224.1	276.8	192.1	347.8
IXa	94.6	83.5	55.8	84.0	107.7	97.6	106.9	107.5	123.6	79.7	72.0
Sole											
VIIIc	76.9	47.9	64.7	40.4	77.5	81.8	51.2	55.7	62.1	78.8	72.2
IXa	281.7	256.0	257.1	204.9	186.9	147.4	152.5	129.7	114.6	152.0	171.7
Whiting											
VIIIabd	0.1	0.3	1.7	1.7	0.1	-	0.1	0.4	0.1	0.4	0.6
VIIIc	-	0.1	-	0.5	0.4	0.1	1.5	0.7	0.1	0.2	0.4
Plaice											
VIIIabd	-	-	-	-	-	-	-	-	-	0.1	0.3
VIIIc	2.3	3.5	4.8	1.1	2.5	2.1	1.6	1.6	1.3	2.2	2.0
IXa	10.0	23.8	19.6	10.4	20.4	70.7	11.5	7.2	5.5	14.9	16.9

Table 2. Landings by specie and fishing gears during the period 200-2010.

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Pollack											
Longlines	38.1	30.6	25.7	30.5	47.3	90.1	47.6	72.2	146.9	100.7	167.3
Gillnets	37.0	52.8	27.5	34.9	36.1	36.2	29.0	50.9	95.4	75.9	161.5
Others	160.2	169.4	133.9	145.7	221.5	161.4	242.8	210.0	162.5	97.0	93.3
Sole											
Bottom otter trawl	201.2	189.7	215.3	175.7	133.2	111.9	97.8	68.3	53.4	77.1	107.9
Others	157.4	114.2	106.5	69.6	131.2	117.3	105.9	117.1	123.3	153.7	136.0
Whiting											
Bottom otter trawl	0.1	0.2	0.3	1.2	-	-	0.1	0.7	0.1	0.4	0.8
Longlines	-	0.1	1.1	0.6	0.1	-	-	0.4	-	-	0.1
Others	-	0.1	0.2	0.4	0.3	0.1	1.5	-	0.1	0.2	0.1
Plaice											
Small scale	11.7	26.3	23.7	11.2	22.1	72.3	12.8	7.8	6.0	16.7	18.3
Bottom otter trawl	-	1.0	0.7	0.3	0.2	0.4	0.2	0.8	0.8	0.3	0.3
Others	0.6	-	-	-	0.4	0.1	0.1	0.2	0.1	0.2	0.6

Table 3. Discards sampling level. Trips sampled onboard by quarter during the period 1994-2010.

Year	Quarter	Trips	Year	Quarter	Trips
1994	1	10	2005	1	13
	2	15		2	5
	3	16		3	10
	4	12		4	5
1997	1	19	2006	1	8
	2	15		2	6
	3	16		3	6
	4	16		4	4
1999	1		2007	1	8
	2			2	8
	3	27		3	8
	4	17		4	13
2000	1	22	2008	1	11
	2	22		2	11
	3	25		3	10
	4	17		4	2
2003	1		2009	1	4
	2	8		2	11
	3	8		3	8
	4	6		4	10
2004	1	8	2010	1	16
	2	4		2	37
	3	7		3	27
	4	7		4	20

Table 4. SP-GFS-caut (autumn) time series of fishing yields-per-hour of *Solea solea* in the Gulf of Cádiz.

Year	Yield, weight (g/h)	Yield, number (Ind/h)	SmdWeight	SmdNum
1997	73.10	0.22	8.58	0.02
1998	38.25	0.21	3.23	0.02
1999	74.05	0.14	5.31	0.01
2000	36.04	0.08	4.95	0.01
2001	91.08	0.17	6.31	0.01
2002	72.97	0.10	7.05	0.01
2003	9.26	0.05	1.00	0.01
2004	18.21	0.05	2.42	0.01
2005	14.10	0.02	2.18	0.00
2006	24.26	0.07	3.25	0.01
2007	2.09	0.03	0.34	0.00
2008	101.22	0.13	7.07	0.01
2009	51.60	0.09	4.16	0.01
2010	43.41	0.09	4.20	0.01

Table 5. SP-GFS-caut (autumn) time series of fishing yields-per-hour of *Solea senegalensis* in the Gulf of Cádiz.

Year	Yield, weight (g/h)	Yield, number (Ind/h)	SmdWeight	SmdNum
1997	41.62	0.14	5.82	0.02
1998	15.81	0.03	2.71	0.01
1999	27.00	0.09	2.94	0.01
2000	0.00	0.00	-	-
2001	38.11	0.07	3.55	0.01
2002	2.28	0.01	0.37	0.00
2003	8.24	0.02	1.29	0.00
2004	6.52	0.01	1.03	0.00
2005	10.32	0.02	1.59	0.00
2006	38.13	0.08	4.89	0.01
2007	23.38	0.03	3.84	0.00
2008	0.00	0.00	-	-
2009	3.36	0.01	0.51	0.00
2010	10.42	0.06	0.99	0.01

Table 6. SP-GFS-cspr (spring) time series of fishing yields-per-hour of *Solea solea* in the Gulf of Cádiz.

Year	Yield, weight (g/h)	Yield, number (Ind/h)	SmdWeight	SmdNum
1993	236.44	1.28	14.93	0.09
1994	15.38	0.04	2.81	0.01
1995	69.69	0.18	5.63	0.01
1996	157.06	0.28	9.59	0.01
1997	32.34	0.16	3.66	0.02
1998	98.49	0.48	7.37	0.04
1999	0.00	0.00	-	-
2000	24.42	0.10	2.33	0.01
2001	23.18	0.05	2.60	0.01
2002	0.74	0.02	0.12	0.00
2003	-	-	-	-
2004	7.49	0.06	0.72	0.01
2005	22.28	0.09	2.36	0.01
2006	80.88	0.41	4.36	0.02
2007	35.50	0.25	3.94	0.04
2008	45.55	0.10	4.38	0.01
2009	62.72	0.10	9.92	0.02
2010	85.67	0.20	12.90	0.02

Table 7. SP-GFS-cspr (spring) time series of fishing yields-per-hour of *Solea senegalensis* in the Gulf of Cádiz.

Year	Yield, weight (g/h)	Yield, number (Ind/h)	SmdWeight	SmdNum
1993	0.00	0.00	-	-
1994	0.00	0.00	-	-
1995	0.00	0.00	-	-
1996	19.54	0.06	1.79	0.01
1997	17.51	0.06	2.10	0.01
1998	35.96	0.05	5.48	0.01
1999	0.00	0.00	-	-
2000	0.00	0.00	-	-
2001	0.00	0.00	-	-
2002	0.00	0.00	-	-
2003	-	-	-	-
2004	0.00	0.00	-	-
2005	5.15	0.01	0.81	0.00
2006	0.00	0.00	-	-
2007	19.69	0.12	3.08	0.02
2008	28.87	0.49	2.78	0.05
2009	0.00	0.00	-	-
2010	113.21	0.36	9.39	0.03

Table 8. Discards of *Solea solea* in Divisions VIIIc and IXa.

Year	kg
1994	0
1997	973
1999	0
2000	0
2003	0
2004	0
2005	1006
2006	0
2007	0
2008	311
2009	300
2010	0

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to be presented at the ICES 2011 ICES Working Group on the Assessment of Southern Hake, Monk and Megrim (WGHMM). 05-11 May 2011, Copenhagen.

Some information on whiting (*Merlangius merlangus*), plaice (*Pleuronectes platessa*) and Pollock (*Pollachius pollachius*) French fishery and survey indices

In the Bay of Biscay (Div. VIIIa,b,d).

by

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Important note : Landings figures presented are from logbook data only and the usual procedure used to produce best estimates could not be applied due to short time notice between the request and the actual WGHMM meeting.

Plaice (*Pleuronectes platessa*)

France has landed about 100 t annually on average since 1999, mostly from trawling and to a lesser extent nets (table 1 and figure 1). Landings have increased from 2003 to 2006 and declined after.

Table 1 : Landings of plaice (*Pleuronectes platessa*) by France by gear type from 1999 to 2008 from areas VIIIa,b,d.

Gear	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Trawl	70	73	50	50	46	67	87	109	109	66
Other	3	1	2	0	1	3	2	2	2	1
Nets	31	10	15	22	25	34	41	64	43	42
Lines	1	0	0		0	0	0	0	0	0
Total	106	85	67	73	73	105	130	175	154	109

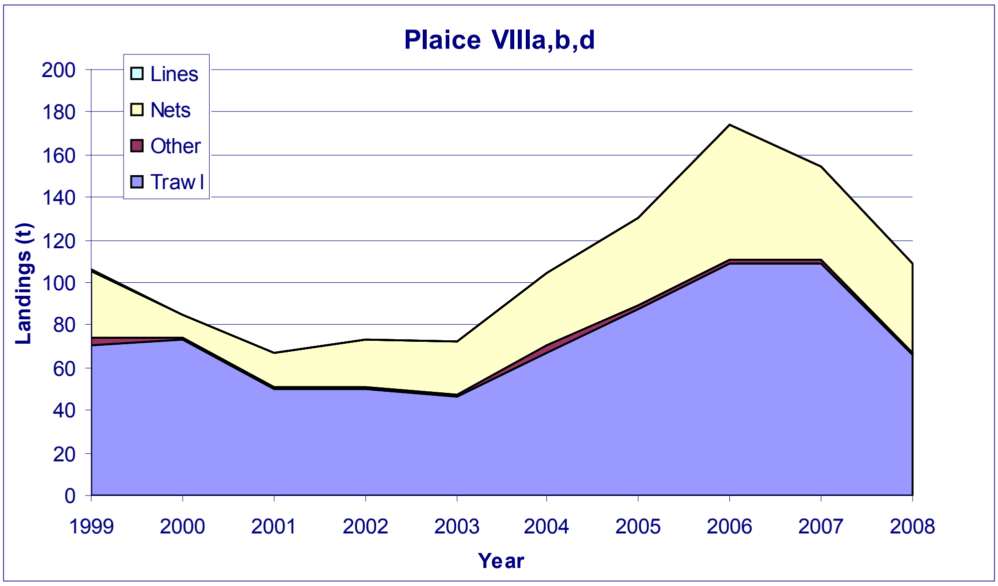

Figure 1 : Landings of plaice (*Pleuronectes platessa*) by France by gear type from 1999 to 2008 from areas VIIIa,b,d.

Pollack (*Pollachius pollachius*)

France landings have steadily increased from 1998 to 2010 from 540 t to 1100 t, mostly coming from net fisheries (table 1 and figure 1).

Table 2 : Landings of pollack (*Pollachius pollachius*) by France by gear type from 1999 to 2008 from areas VIIIa,b,d.

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Trawl	203	255	173	202	151	205	294	311	263	224
Other	5	5	5	3	4	6	11	19	12	5
Nets	260	264	358	570	542	378	498	565	557	679
Lines	73	20	36	65	57	95	92	133	138	217
Total	541	544	572	840	755	683	895	1027	970	1126

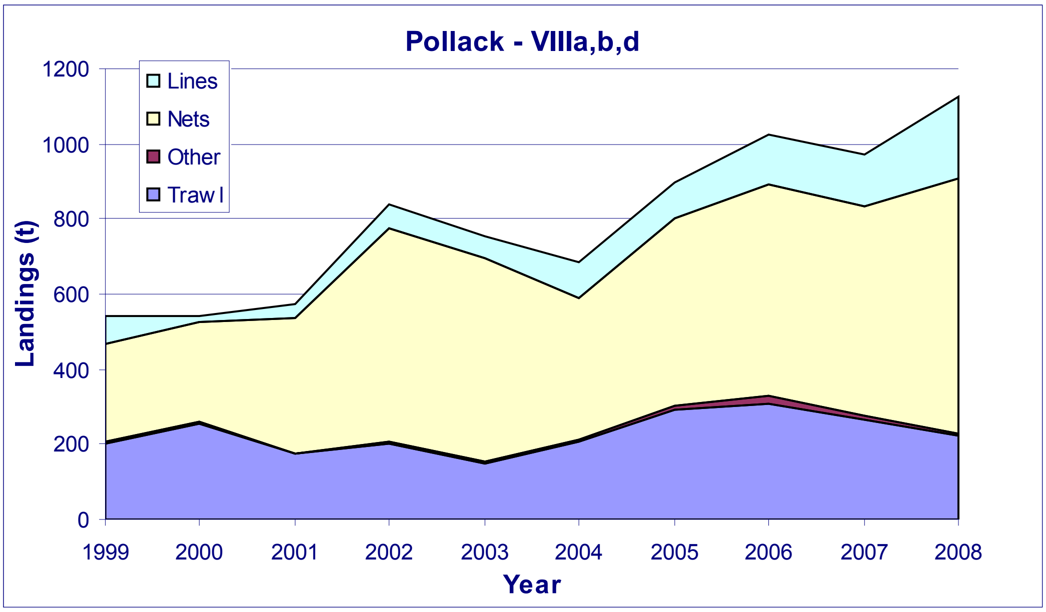

Figure 2 : Landings of pollack (*Pollachius pollachius*) by France by gear type from 1999 to 2008 from areas VIIIa,b,d.

Whiting (*Merlangius merlangius*)

French landings have increased from 550 t in 1999 to 2007to a maximum of 1300t in 2007 and dropped to 800t in 2008 table 3 and figure 3). The fishery is mostly a trawl fishery.

Table 3 : Landings of whiting (*Merlangius merlangius*) by France by gear type from 1999 to 2008 from areas VIIIa,b,d.

Gear	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Trawl	220	335	637	493	355	425	598	474	528	306
Other	110	163	156	255	247	87	166	124	228	79
Nets	46	45	69	135	109	86	122	179	146	162
Lines	172	21	28	7	13	105	149	201	370	253
Total	547	564	891	891	724	703	1035	979	1272	800

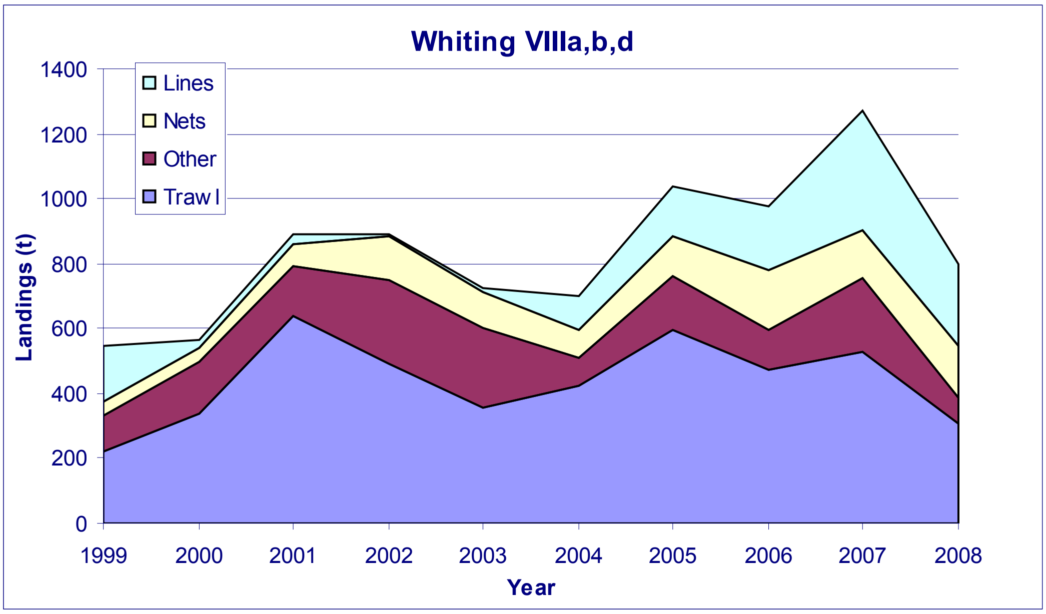

Figure 3 : Landings of whiting (*Merlangius merlangius*) by France by gear type from 1999 to 2008 from areas VIIIa,b,d.

Biomass and abundance indices from the French EVHOE survey are also available for the Bay of Biscay area from 1987 to 2010 with the exclusion of 1993 and 1996 (figure 4). Biomass has shown some increase from 2003 to 2010, an early (1987 – 1992) period of higher values and inter-annual variation with no trend from 1994 to 2003. Abundances indices roughly follow the same picture.

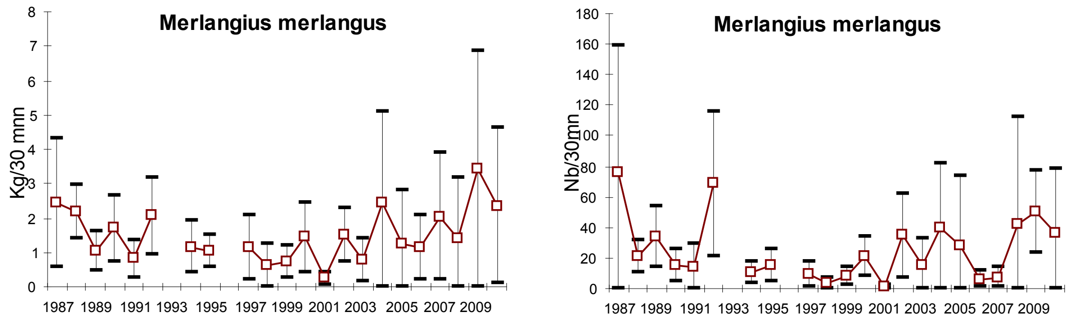

Figure 4 : Whiting biomass and abundance indices from the FR-EVHOE survey in the Bay of Biscay area (div VIIIa,b,d).

Abundance indices at age are available since 1997 and up to 2010 (figure 5). Age 0 dominates the catches in most years. Cohort tracking is not obvious except for 2005-2007.

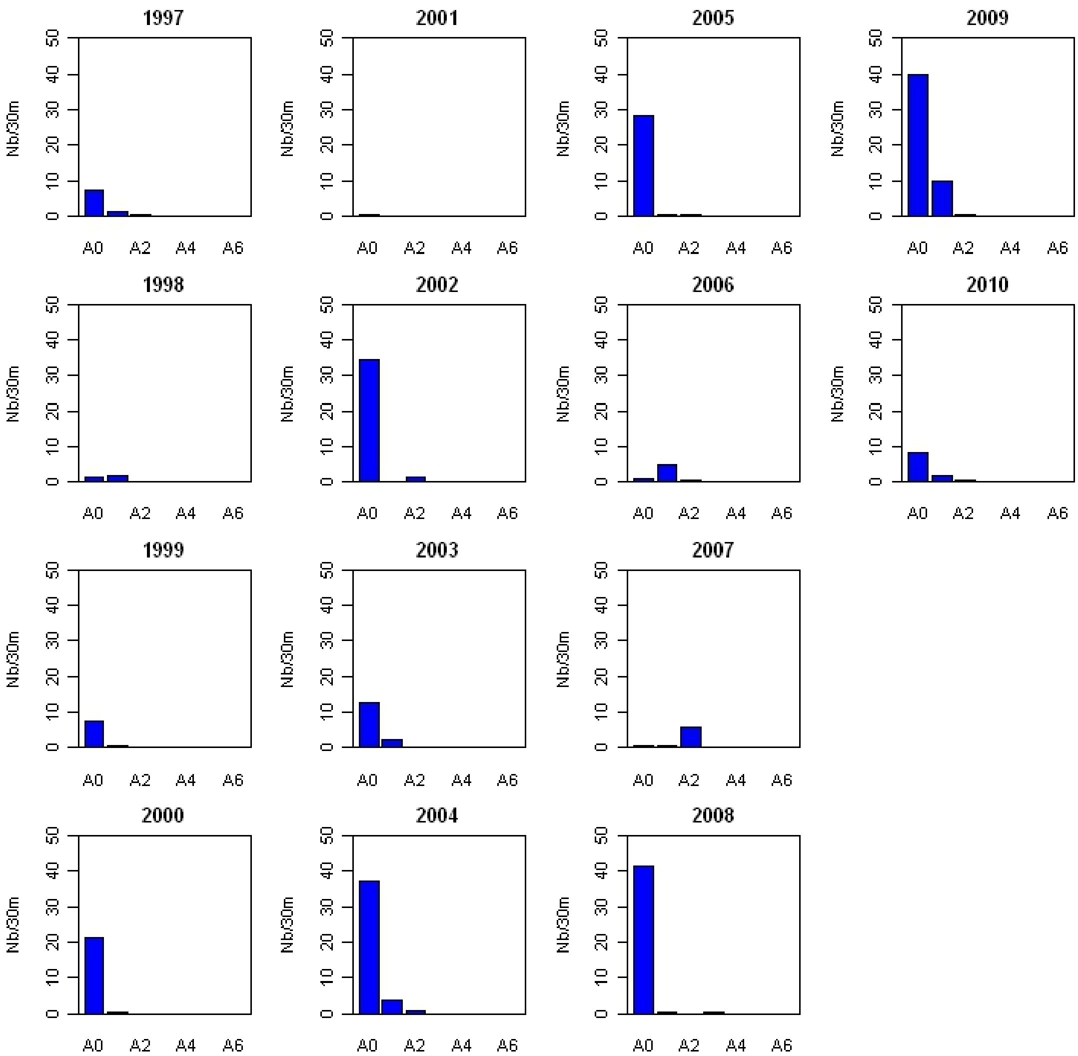

Figure 5 : Whiting abundance indices at age from the FR-EVHOE survey in the Bay of Biscay area (div VIIIa,b,d).

Portuguese data of sole, plaice, whiting and pollock provided to WGHMM in 2011

May 8, 2011

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1 Introduction

The objective of this working document is to compile the information transmitted to WGHMM on the new species requested, sole, plaice, whiting and pollock. It can be used for groups/tasks dealing with data issues to check the data transmitted.

The document starts with the description of the sampling programme executed in 2010 on port sampling, on-board sampling and surveys. Afterwards, a section for each species explains in detail the data collected and available by parameter in agreement with the numenclature used by the DCF.

1.1 Port sampling

The number of trips sampled on port by specie in 2010 is shown in Table 1. Note that after 2009 the sampling unit changed from "species landed by trip" to "trip". So the number of sampels by species depends on the species being present on the landings, while before there was an active search for the species target by the sampling programme. This shift resulted in a decrease on the number of samples collected by species.

Table 1: Sampling effort (number of trips) of port sampling for length frequencies by species and metier in 2010.

Metier	PLE	WHG	POL	SOL
FPO_MOL_>=29_0_0		1		1
GNS_DEF_60-79_0_0	2	1		2
GNS_DEF_60/FPO_MOL	1	1	1	
GNS_DEF_60/GNS_80		1		1
GNS_DEF_60/GTR/FPO				2
GNS_DEF_60/GTR_>=100	2		1	9
GNS_DEF_80-99_0_0	1	3	1	9
GNS_DEF_80/FPO_MOL			2	1
GNS_DEF_80/GTR/FPO		1		
GNS_DEF_80/GTR_>=100			1	
GNS_DEF_>=100_0_0				1
GTR_>=100/FPO_MOL	11		2	24
GTR_DEF_>=100_0_0	16	13	1	47
LLS_DEF_0_0_0			2	
OTB_DEF_65-69_0_0	1		3	50
PS_SPF_>=16_0_0				1
TBB_CRU_>=20_0_0	4			9
Total	38	21	14	157

1.2 On-board sampling

The Portuguese onboard sampling programme, included in the EU DCR/NP, is based on a quasi-random sampling of co-operative commercial vessels of a fleet segment between 12 and 40 meters. Two different trawl fleets are sampled: a Crustacean fleet (OTB_CRU) that operates cod-end mesh sizes 55-59mm and >70mm, and a Demersal Fish fleet (OTB_DEF) that operates cod-end mesh size 65-69mm. Sampling levels for 2004-2010 periods are presented in Table 2.

Data used in the estimation of discards comes from the onboard sampling programme of both trawl fleets. Information on effort (in hours and in days) for each fleet is also used in the estimation of discards and was provided by the Portuguese Administration (DGPA).

Table 2: Discard sampling levels of the Portuguese onboard sampling programme per fleet (2004-2010).

	Sampling levels					
	Trips		Sampled Hauls		Hours fished	
Year/Fleet	OTB_CRU	OTB_DEF	OTB_CRU	OTB_DEF	OTB_CRU	OTB_DEF
2004	17	24	111	125	479	315
2005	15	39	74	159	372	349
2006	7	42	30	194	133	376
2007	12	38	73	162	260	287
2008	12	34	66	128	267	250
2009	16	38	84	135	299	264
2010	16	31	103	116	372	192

The frequency of occurrence of discards from each working group species in the sampled hauls is displayed in Table 3 for OTB_DEF and Table 4 for OTB_CRU. Discards of *P.platessa* (PLE), *P.pollachius* (POL), *S.vulgaris* (SOL), and *M.merlangus* (WHG) were considered too low to be estimated with the standard methods.

Table 3: Frequency of occurrence (%) of species in the sampled hauls of the OTB_DEF fleet (2004-2010).

	Species			
	PLE	POL	SOL	WHG
2004	0	0	0	0
2005	0	0	1	0
2006	0	0	0	0
2007	0	0	0	1
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0

Table 4: Frequency of occurrence (%) of species in the sampled hauls of the OTB_CRU fleet (2004-2010).

	Species			
	PLE	POL	SOL	WHG
2004	0	0	0	0
2005	0	0	0	0
2006	0	0	0	0
2007	0	0	0	0
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0

2 *P.platessa*

2.1 Metier related variables

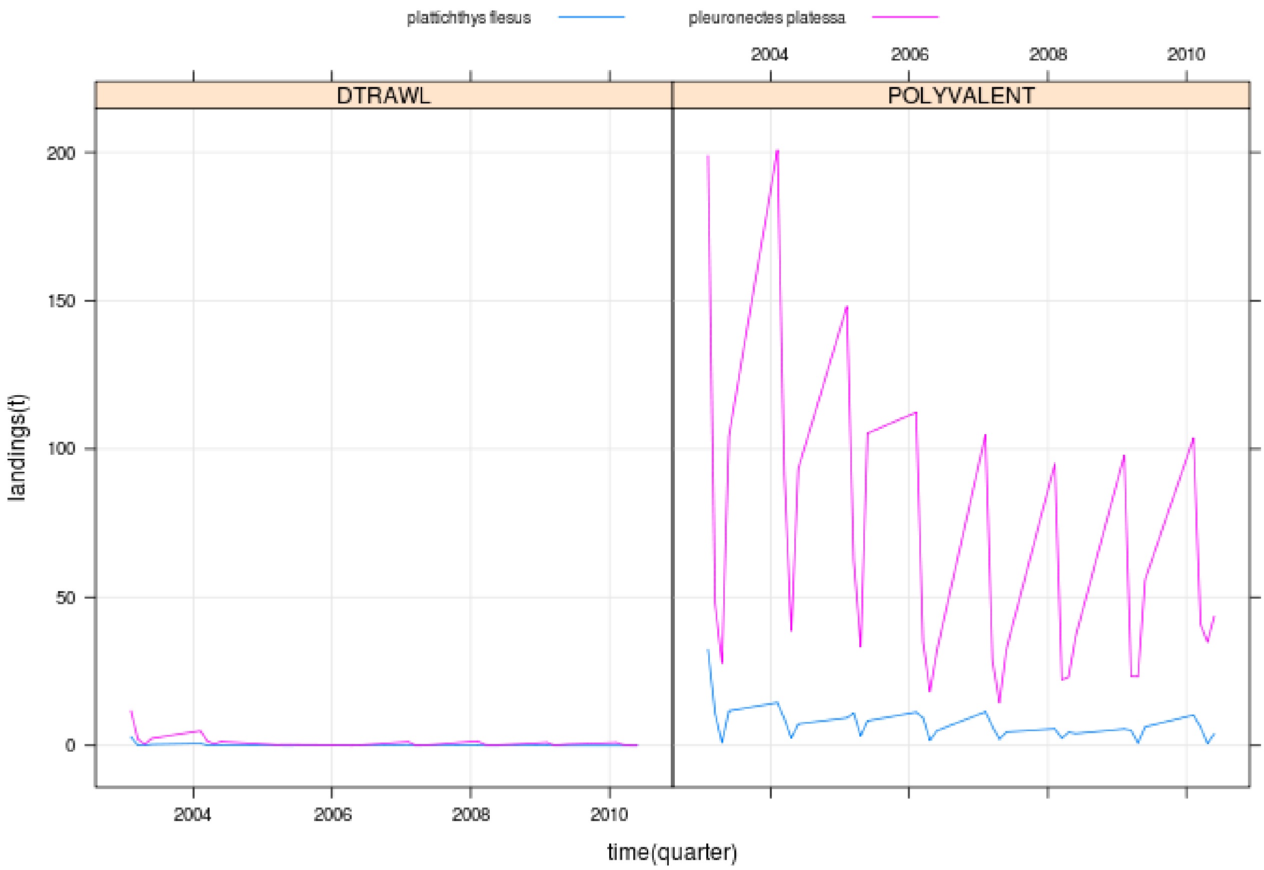
Morphological similarity between Flounder (*Platichthys flesus*) and plaice (*Pleuronectes platessa*) turns difficult the identification among species, particularly over sales auction. Thus, both species are commonly landed as plaice. Especially in juvenile stages fin-ray counts must be used to differentiate between the species. Species misclassification can generate errors in defining stocks in terms of management.

2.1.1 Landings

Table 5: Landings (ton) of plaice grouped by fleet.

	P.flesus		*P.platessa*		
	DTRAWL	POLYVALENT	DTRAWL	POLYVALENT	PSEINERS
2003	3.4	56.0	16.5	379.1	0.1
2004	1.0	33.3	8.4	423.8	0.3
2005	0.1	31.8	1.2	349.0	0.0
2006	0.0	27.4	0.3	197.7	0.0
2007	0.4	24.5	1.7	180.4	0.0
2008	0.2	16.6	2.1	177.0	0.0
2009	0.1	17.9	1.9	200.2	0.0
2010	0.0	21.2	1.3	223.1	0.0

Figure 1: Landings of plaice in 2010 grouped by fleet.



2.1.2 Discards

No discards of PLE were registered in the sampled hauls, so discards of this species can be assumed null or negligible.

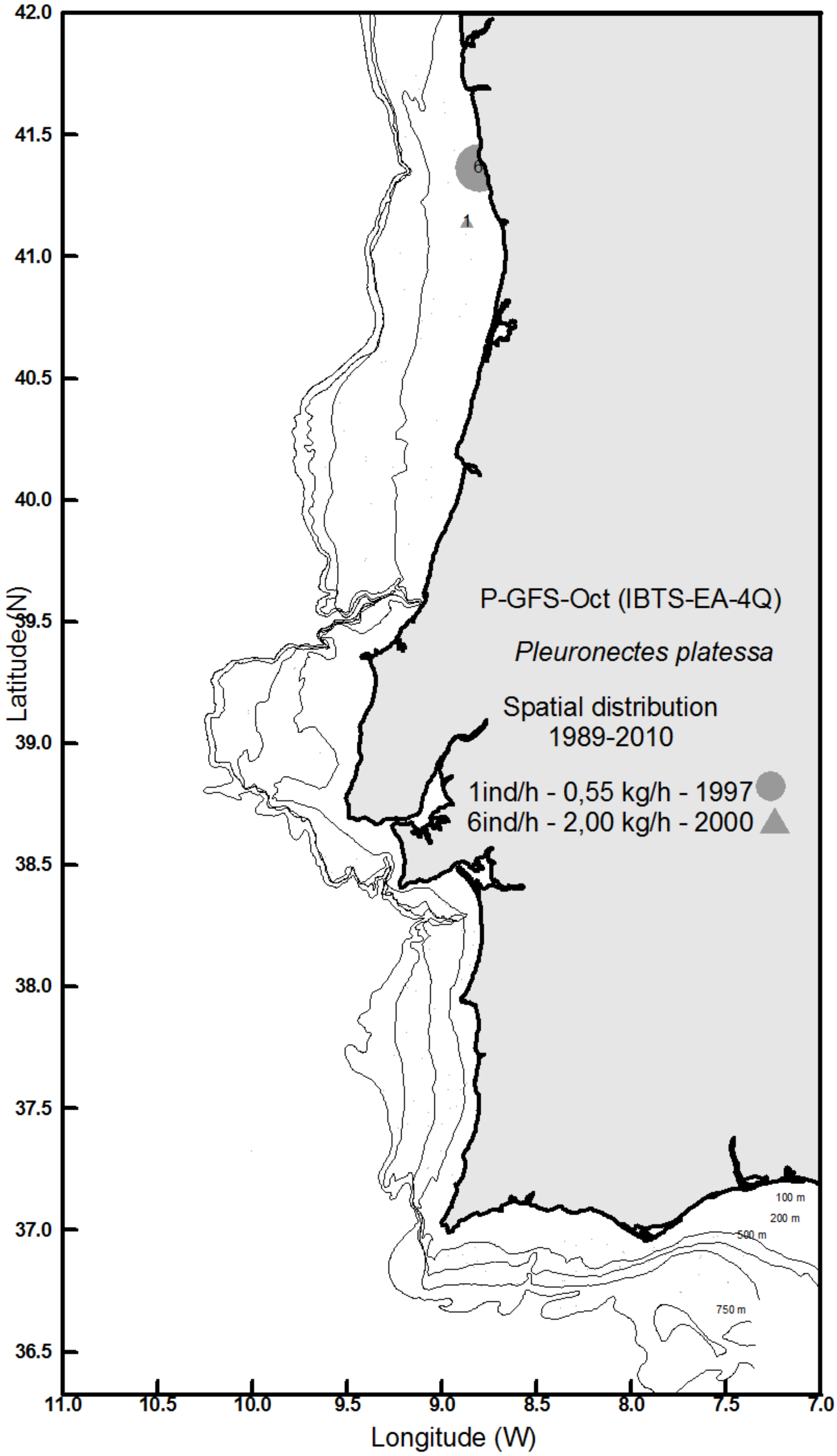
2.2 Stock related variables

There is no information to compute biological parameters.

2.3 Surveys

This species is not caught by the Autumn BTS. The information about the surveys observations and localtion are presented in Figure 2.

Figure 2: Observations of plaice by the Portuguese Bottom Trawl Survey (1989-2010)



2.4 CPUE

No CPUE was computed but it should be possible to explore the logbooks data set.

2.5 Comments on data deficiencies and aggregation

There is a problem of mixed landings that has to be tackled before using this information on assessment.

This species is not present on the Bottom Trawl Surveys.

The possibility of having a abundance index will have to use information from the commercial fleet.

3 *P.pollachius and M.merlangus*

3.1 Metier related variables

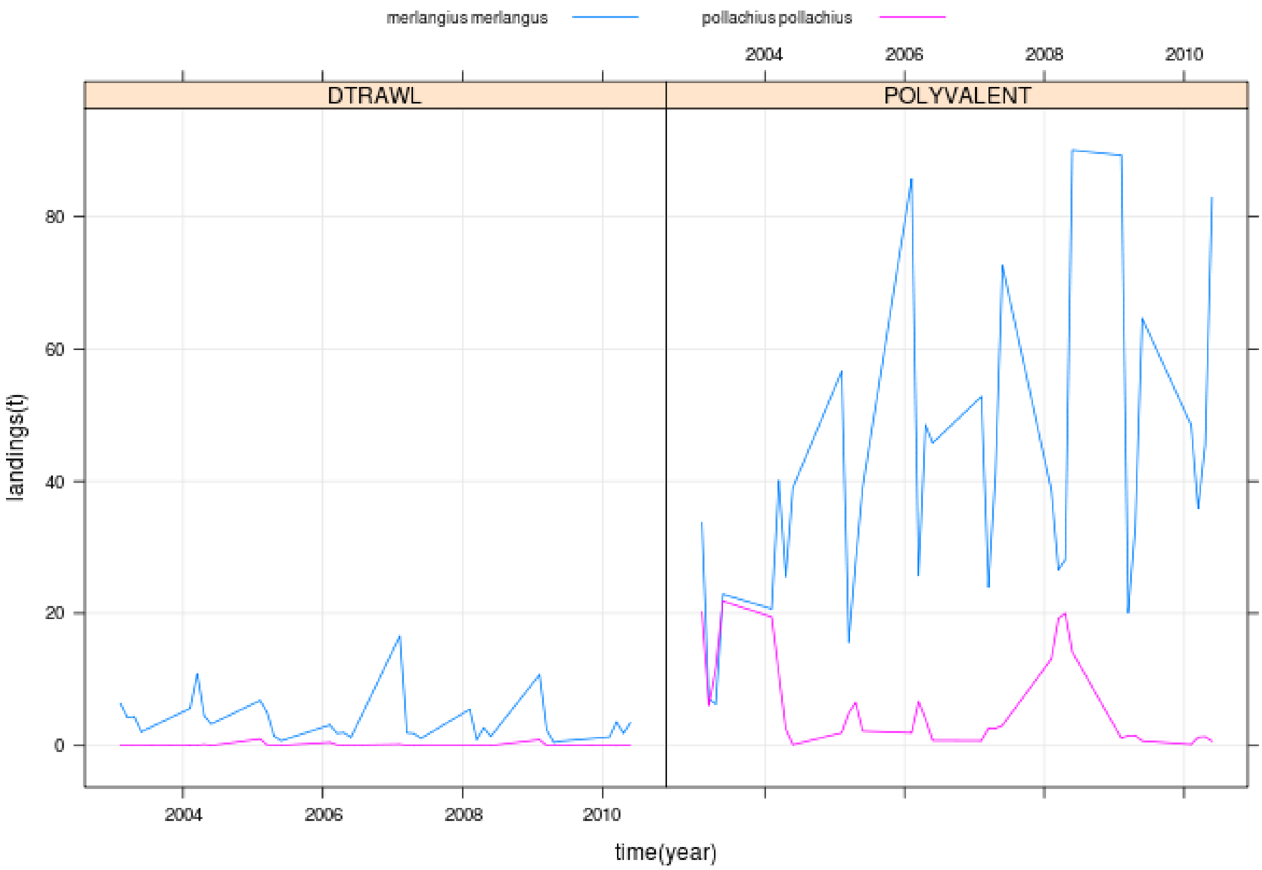
3.1.1 Landings

There are some mixing between the two species on the auction markets due to mis-usage of common names. However, the information available suggests that most landings are pollock.

Table 6: Landings (ton) of whiting and pollock grouped by fleet.

	M.merlangus			*P.pollachius*		
	DTRAWL	POLYVALENT	PSEINERS	DTRAWL	POLYVALENT	PSEINERS
2003	0.1	60.0	0.0	17.1	70.0	0.7
2004	0.3	33.0	0.1	24.3	125.3	0.1
2005	1.2	15.5	0.0	14.0	139.3	0.0
2006	0.7	13.4	0.0	8.1	205.8	0.1
2007	0.3	9.0	0.5	21.4	190.6	1.2
2008	0.1	66.5	NA	10.5	183.4	0.2
2009	1.0	4.8	NA	14.3	207.1	0.0
2010	0.2	3.4	NA	10.2	212.9	0.0

Figure 3: Landings of pollock and whiting grouped by fleet.



3.1.2 Discards

No discards of pollock or whiting were registered in the sampled hauls. With regards to whiting, in OTB_DEF the annual frequency of occurrence was very low (0 to 1%), while in OTB_CRU no discards were registered. Consequently, discards of pollock and whiting can be assumed null or negligible.

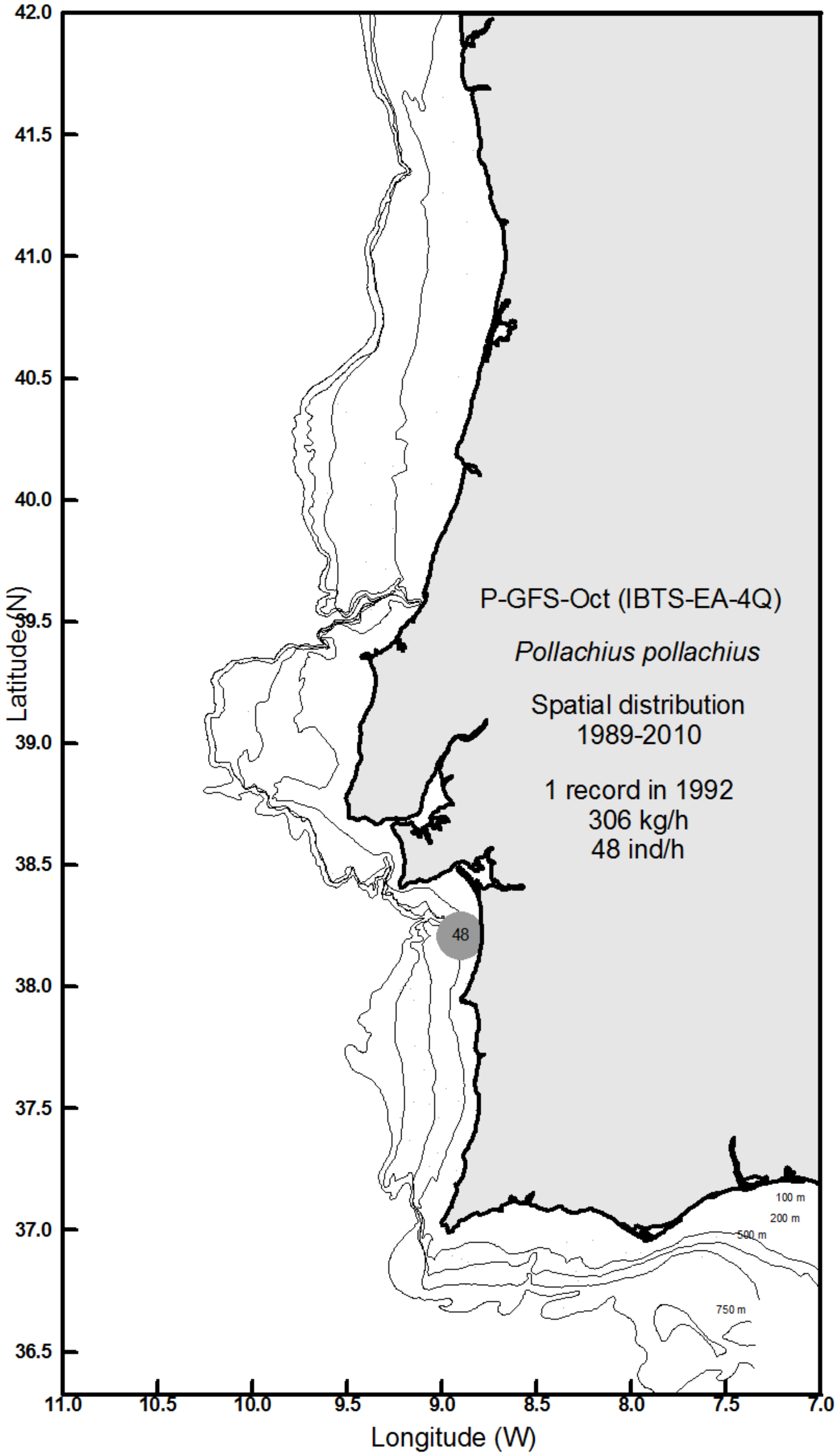
3.2 Stock related variables

There is no information to compute biological parameters.

3.3 Surveys

No observations of whiting were recorded by the Portuguese BTS, while pollock was seldom observed (Figure 4).

Figure 4: Observations of pollock by the Portuguese Bottom Trawl Survey (1989-2010)



3.4 CPUE

No CPUE was computed but it should be possible to explore the logbooks data set.

3.5 Comments on data deficiencies and aggregation

There is a problem of mixed landings that has to be tackled before using this information on assessment.

This species is not present on the Bottom Trawl Surveys.

The possibility of having a abundance index will have to use information from the commercial fleet.

4 *S.vulgaris*

4.1 Metier related variables

4.1.1 Landings

Table 7: Landings (ton) of sole grouped by fleet.

	S.vulgaris			*Solea spp.*		
	DTRAWL	POLYVALENT	PSEINERS	DTRAWL	POLYVALENT	PSEINERS
2003	2.8	219.8	0.0	53.1	776.7	4.4
2004	3.7	284.1	0.3	38.8	907.0	4.4
2005	11.1	542.2	1.4	22.6	796.2	6.0
2006	17.6	547.5	10.0	7.8	329.9	5.1
2007	33.3	497.3	5.5	3.2	131.0	0.1
2008	36.7	557.9	2.4	1.5	149.8	0.0
2009	33.9	634.0	3.6	0.5	111.0	NA
2010	34.4	727.8	7.1	0.1	154.8	NA

Figure 5: Landings of sole grouped by fleet.

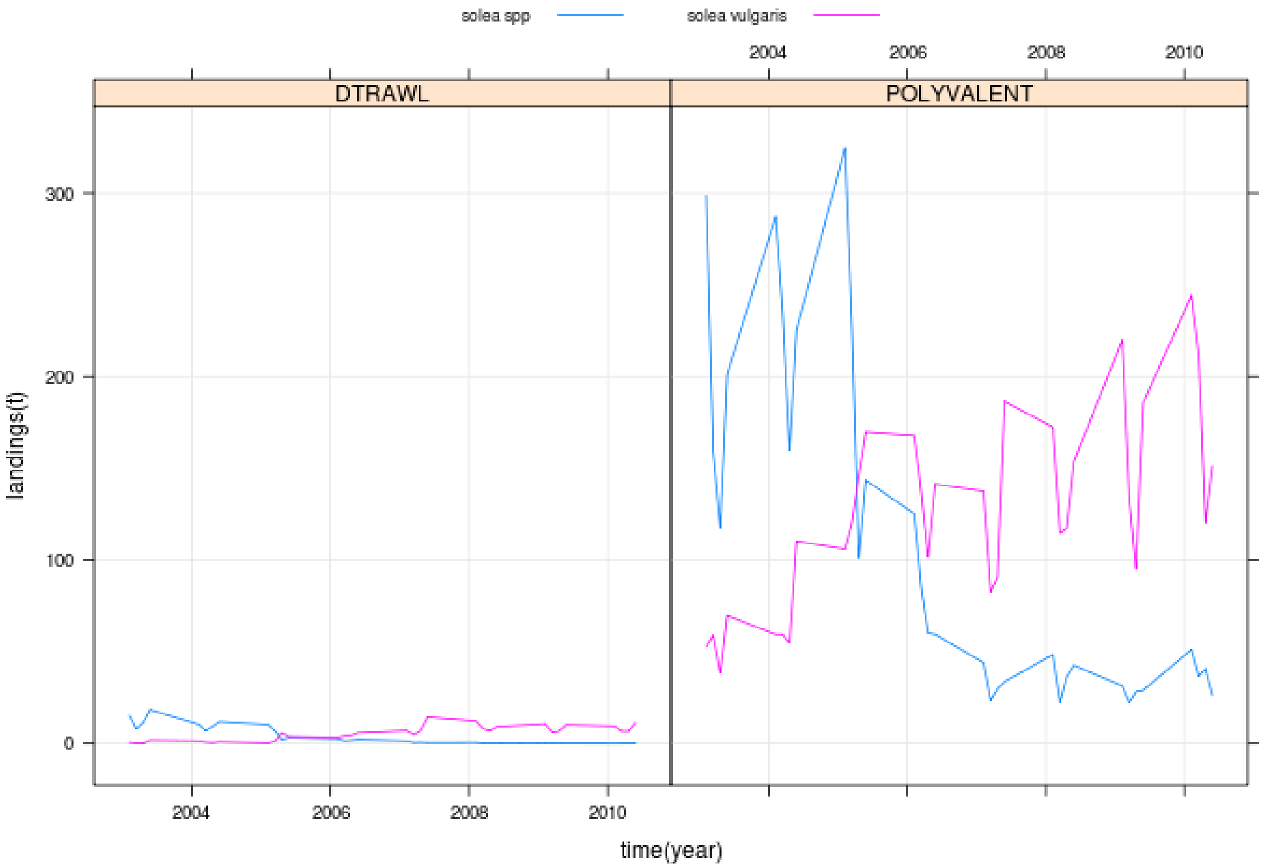
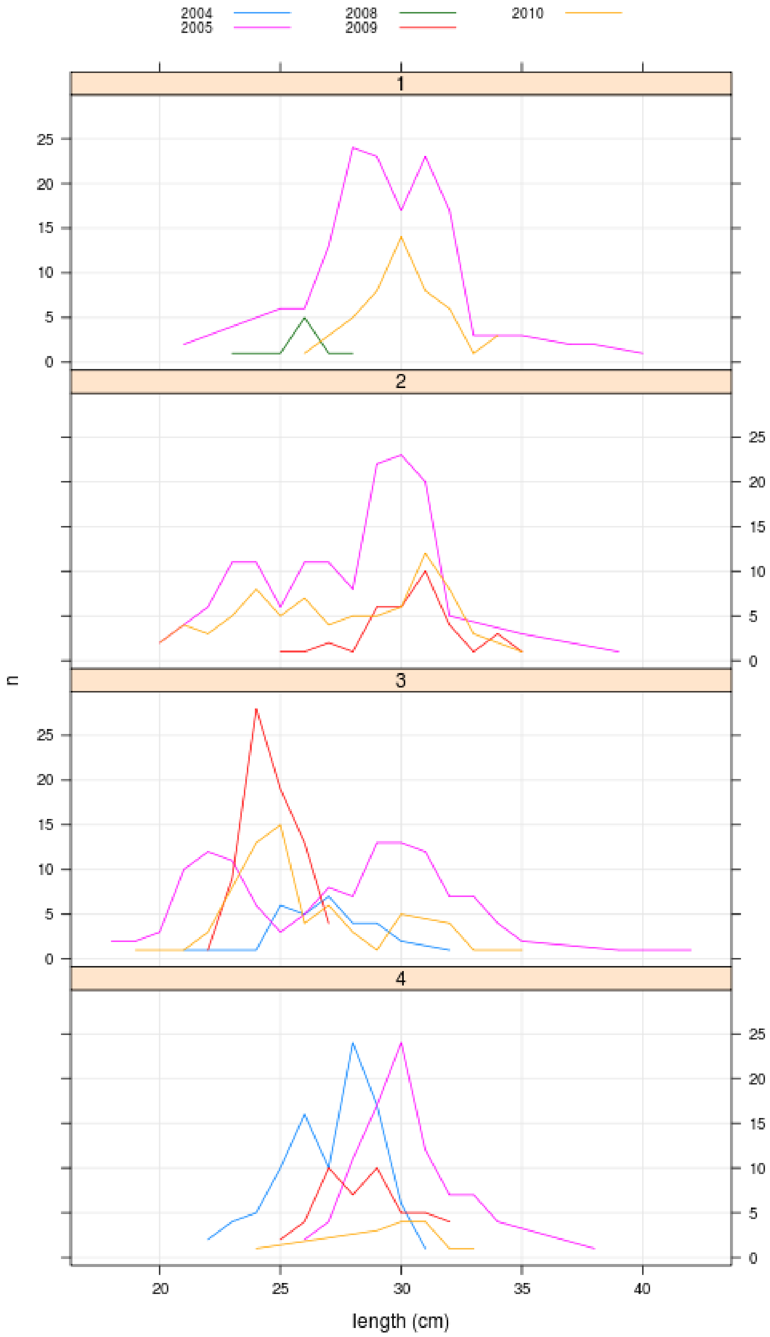


Figure 6: Observed lenght frequencies of sole landings between 2004 and 2010. The length frequencies are not raised to the total landings. All observations were carried out on the trammel nets fleet (GTR_DEF_>=100_0_0)



4.1.2 Discards

In OTB_DEF annual frequency of occurrence was very low (0 to 1%). In OTB_CRU, no discards of SOL were registered in the sampled hauls. Consequently, discards of SOL can be assumed null or negligible.

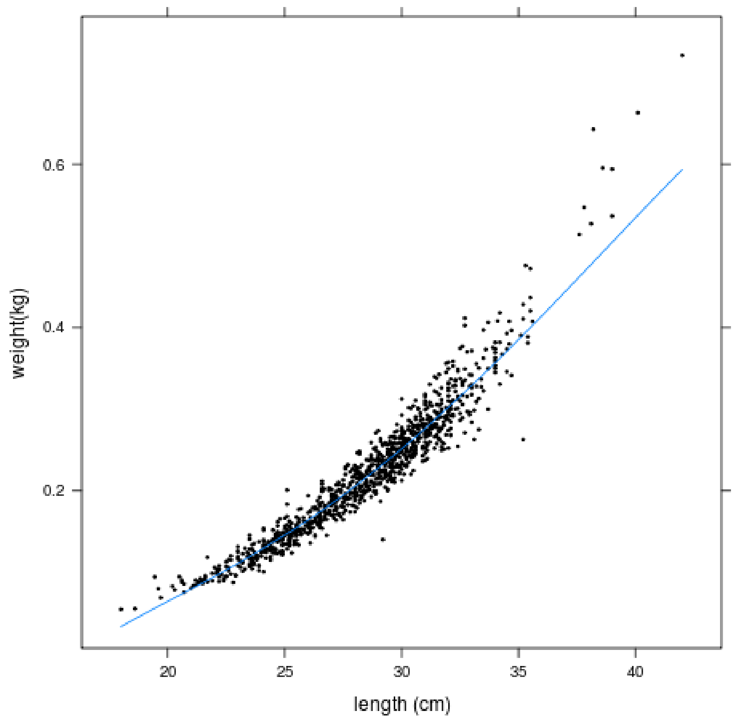
4.2 Stock related variables

4.2.1 Growth

There is no information to compute growth parameters or ALK.

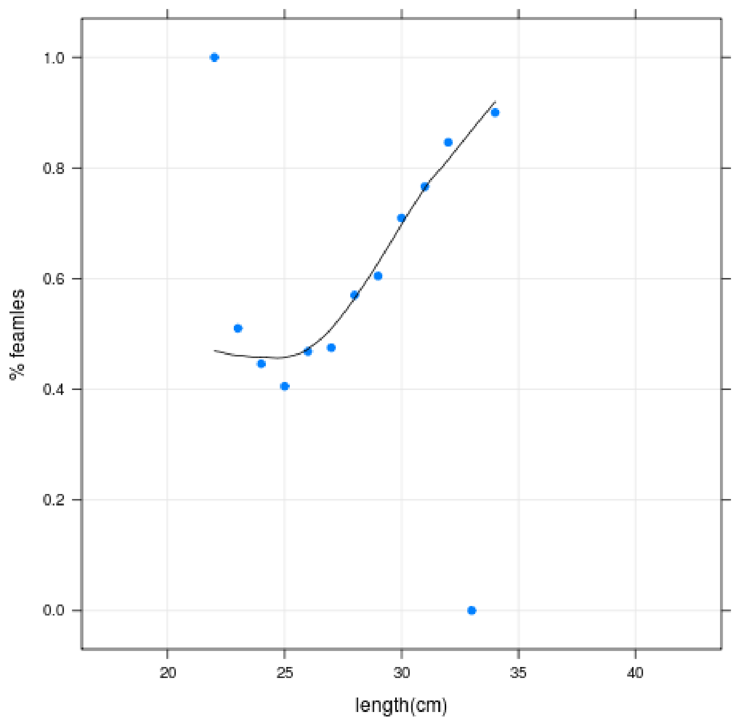
4.2.2 Length-Weight relationship

Figure 7: Length-weight information for soel. Line in black represents lowess smoother.



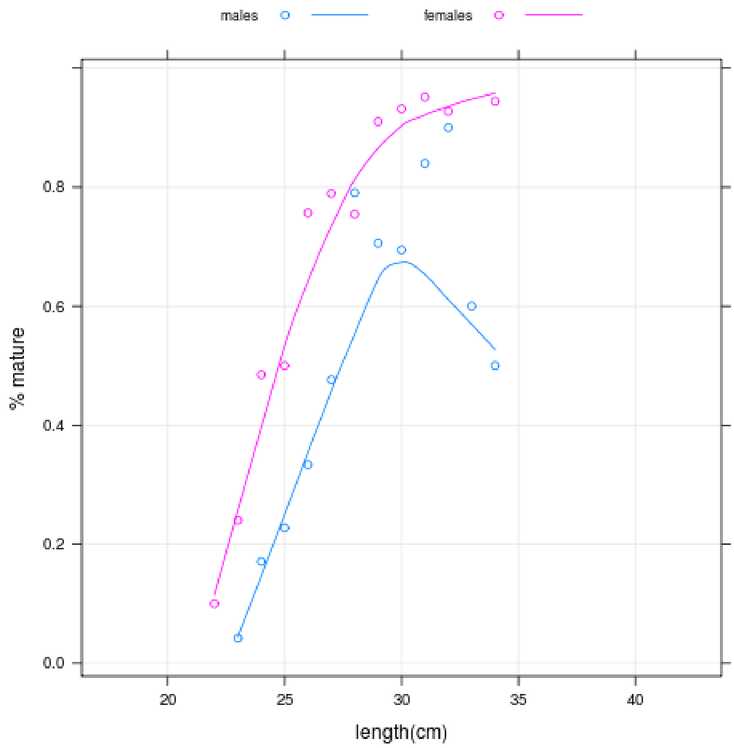
4.2.3 Sex ratio

Figure 8: Sex ratio information for sole. Line in black represents lowess smoother.



4.2.4 Reproduction

Figure 9: Sole's % mature by sex



4.3 Surveys

4.3.1 Spatial distribution

Figure 10: Spatial distribution of sole along the Portuguese continental coast between 1989 and 2010

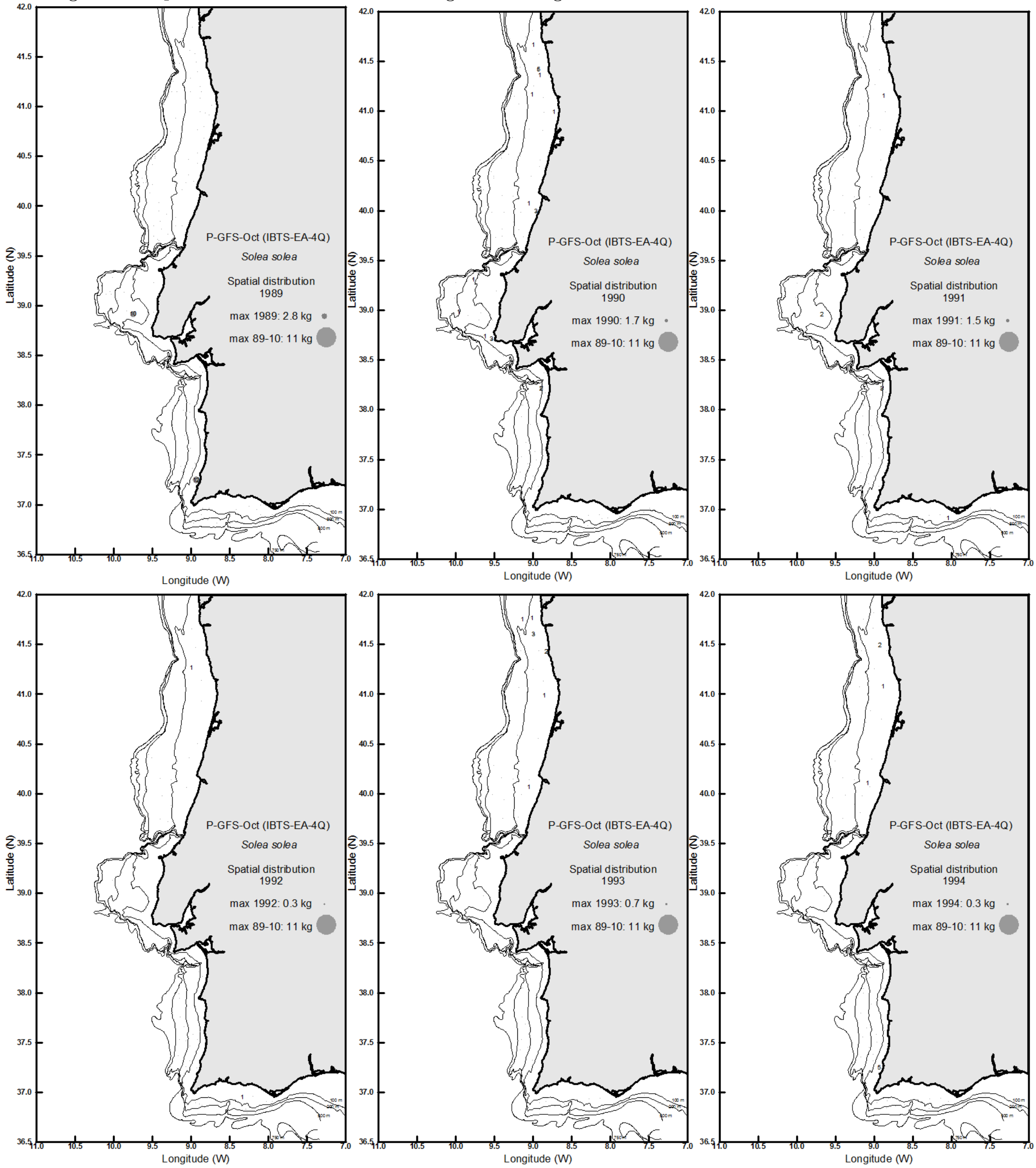


Figure 11: Spatial distribution of sole along the Portuguese continental coast between 1989 and 2010 (cont.)

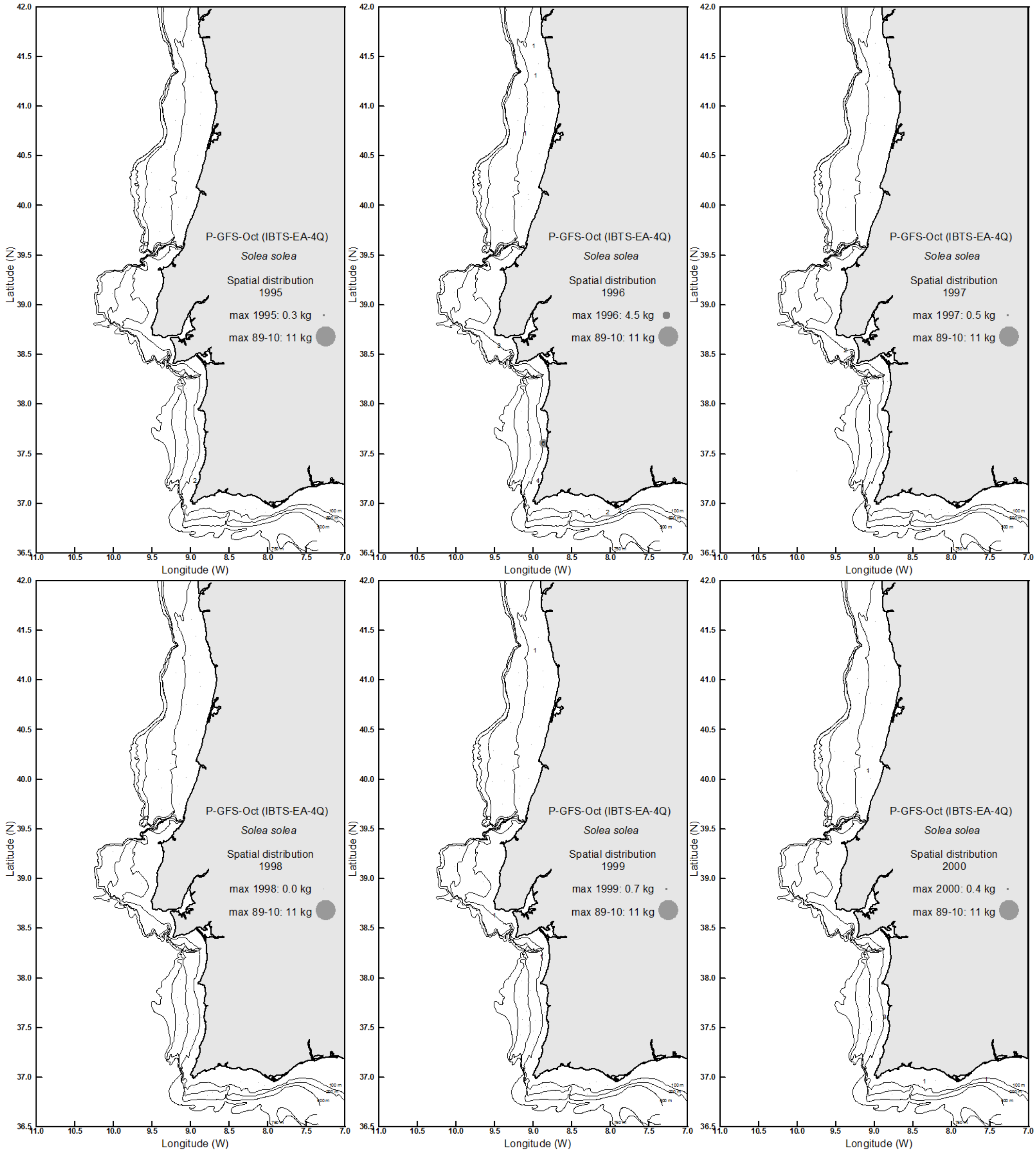


Figure 12: Spatial distribution of sole along the Portuguese continental coast between 1989 and 2010 (cont.)

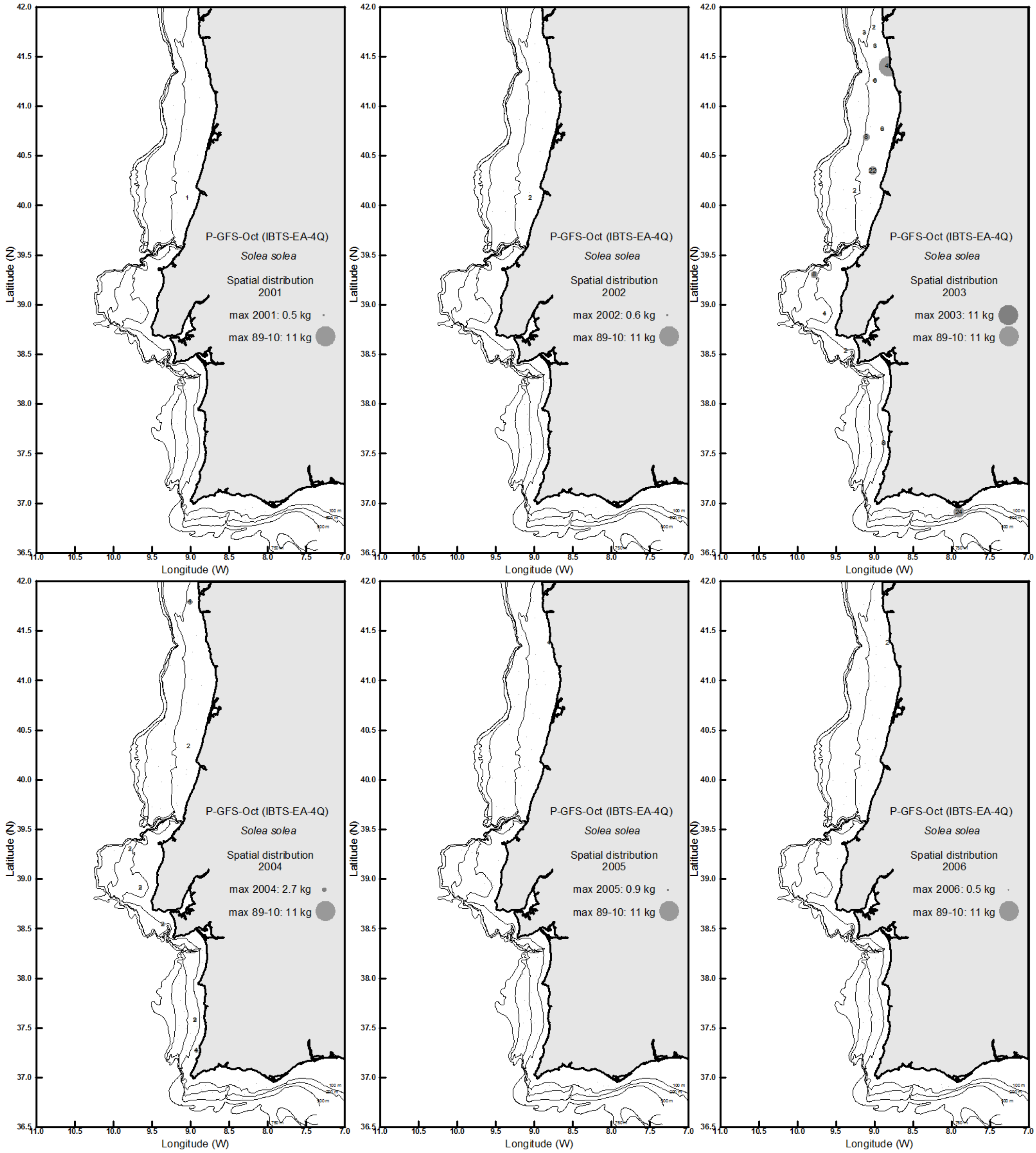
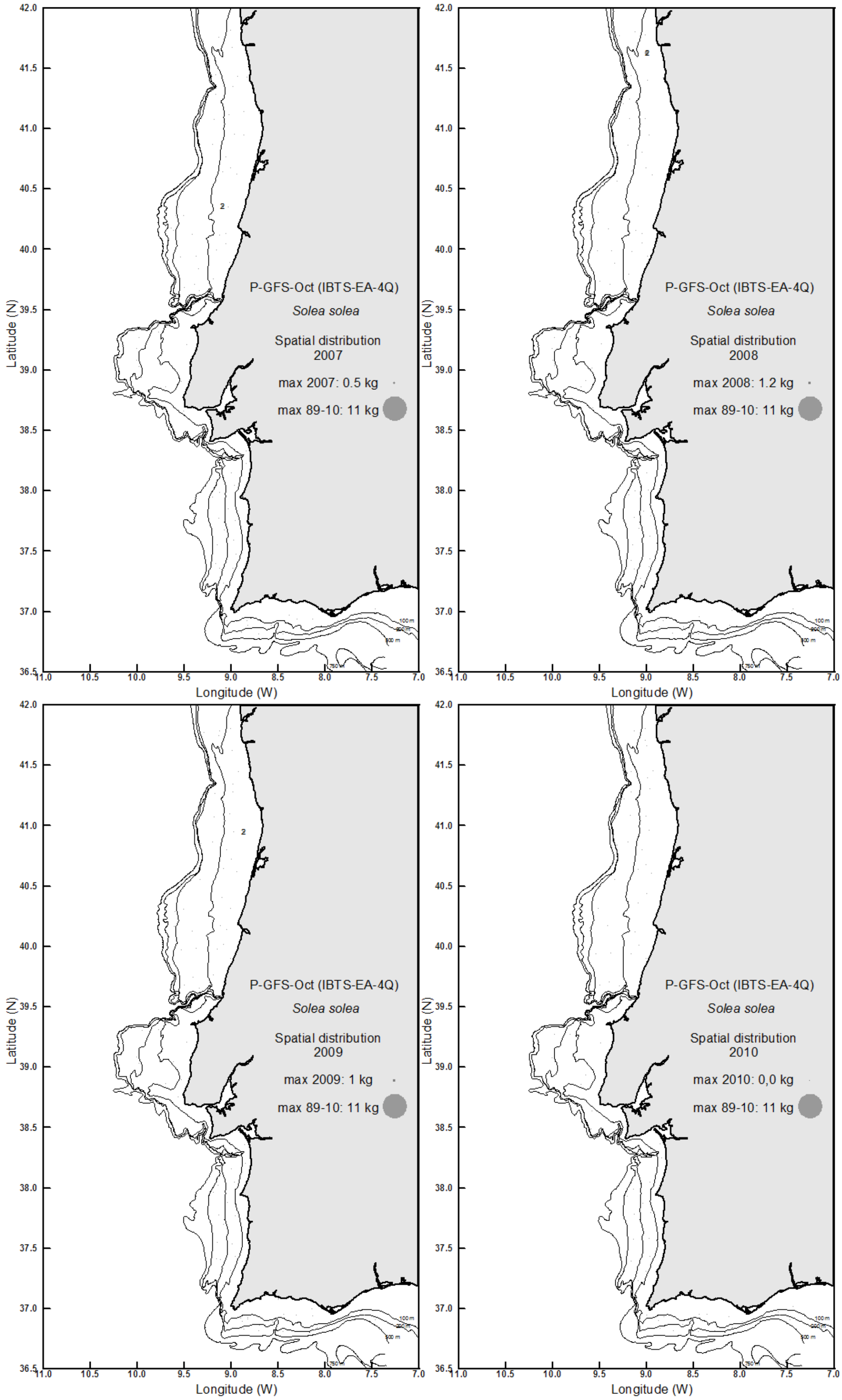
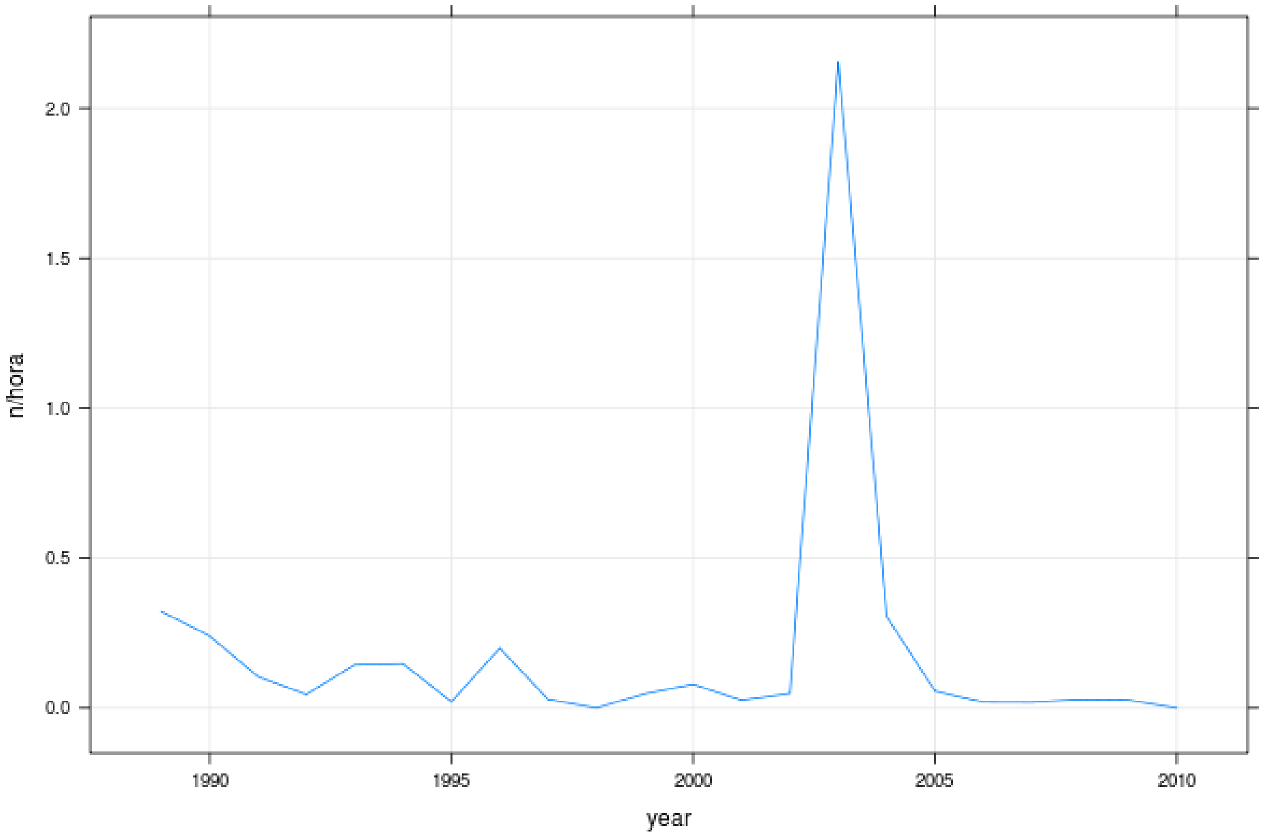


Figure 13: Spatial distribution of sole along the Portuguese continental coast between 1989 and 2010 (cont.)



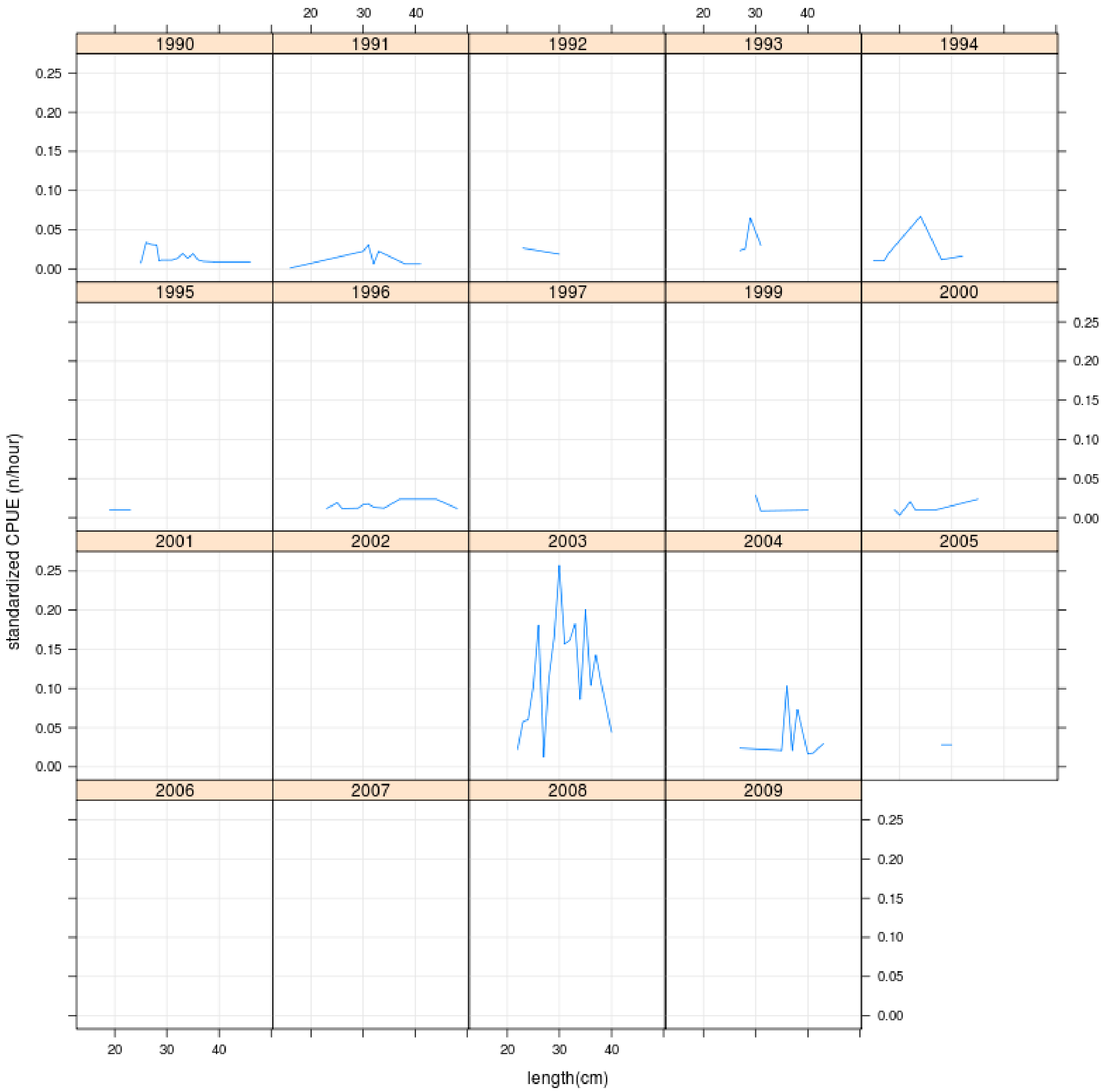
4.3.2 Survey abundance indices

Figure 14: Sole abundance indices in number of individuals per hour along the Portuguese continental coast.



4.3.3 Length & age distribution

Figure 15: Length distribution of sole's abundance along the Portuguese continental coast.



4.4 CPUE

No CPUE was computed but it should be possible to explore the logbooks data set.

4.5 Comments on data deficiencies and aggregation

There is a problem of mixed landings that has to be tackled before using this information on assessment.

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to be presented at the ICES 2011 ICES Working Group on the Assessment of Southern Hake, Monk and Megrim (WGHMM). 05-11 May 2011, Copenhagen.

Some information on Irish fisheries for stocks of whiting (*Merlangius merlangus*), plaice (*Pleuronectes platessa*), pollock (*Pollachius pollachius*) and sole (*Solea solea*) in the Bay of Biscay and Iberian coast (Divisions VIIIa,b,d,e and IXa)

by

Eoghan Kelly

Marine institute, Galway, Ireland.

Landings

Irish vessels made very small landings from these stocks with a total of 211 kg of plaice, pollack and sole from these areas declared in logbooks from 2003-2010 (Table 1). No landings were declared by Irish vessels during 2005, 2006, 2007 and 2010. These landings were located in Division VIIId,e and IXa and the figures are low as Irish vessels do not usually operate in these areas. Landings of whiting were larger in 2008 with 1,200 kg declared from Division VIIId. The vast majority (95%) of these landings were caught using bottom otter trawl (OTB) with the remainder caught using bean trawls (TBB) and dredges (DRB).

Table 1: Summary of Irish landings (kg) of plaice, pollack sole and whiting in Areas VIII and IX

Year	Quarter	Division	Plaice	Pollack	Sole	Whiting	Grand Total
2003	Q2	IXa	-	-	35	95	130
		VIIIe	-	-	18	-	18
2004	Q1	VIIId	-	-	21	-	21
2008	Q2	VIIId	-	100	-	1200	1300
2009	Q3	IXa	28	-	9	-	37
Total			28	100	83	1295	1506

Discards

There was no information available on Irish discards of these stocks as no discard observers accompanied these fishing trips.

Survey or stock abundance indices

There was no Irish survey or stock abundance indices available for these stocks as the Irish Ground Fish Survey does not extend into these areas.

Biological data

There was no biological data available from Irish vessels for these landings as no sampling was carried out on the landings.

Annex S – New ToRs on Marine Strategy Framework Directive and Coastal and Marine Spatial Planning

In March 2011, all ICES EG chairs received a letter from the SCICOM and ACOM presidents informing them about the relevance of the joint SCICOM/ACOM "MSFD Steering Group" and the Strategic Initiative on Area Based Science and Management. The importance that these initiatives for ICES and their cross-cutting nature was highlighted in the letter and, in relation to these points, a number of ToRs were added to all ICES EGs to make them aware of these initiatives as well as to try and identify aspects of their work that may be of relevance for the progress of these initiatives. The new ToRs correspond to Generic ToRs i-m. Because of the limited time available and the extremely high work load of WGHMM (including the 4 new species discussed in Annex R and assess progress of 5 stocks scheduled to be benchmarked at the start of 2012 and 2 more that will have an Inter-benchmark protocol at the same time -- see Annex N), and the fact that WGHMM attendance decreased this year, only a limited amount of work could be done on the MSFD and CMSP new ToRs. This Annex describes what the WGHMM meeting did in connection with them.

A plenary 2 hour session took place on the first day of the meeting structured as follows:

The WG chair introduced the new ToRs and explained how they had arisen, then briefly provided background on the MSFD and gave the general presentation prepared by ICES to Expert Groups on the MSFD.

A group discussion followed on the possibilities of the WG providing something in relation to the MSFD ToRs. It seems clear that assessment working groups could contribute more directly towards Descriptor 3 (Exploited populations of fish and shellfish) of the MSFD, but this is exactly the descriptor that appears to be already rather developed in the Commission Decision on Criteria and Methodological Standards of September 2010 (2010/477/EU). It was less immediately obvious what assessment working groups could contribute to the other descriptors in which ICES also appears to have an interest (1. Biodiversity; 4. Food webs; 6. Sea floor integrity) and, therefore, the WG members decided that it was not realistic to attempt to do any additional work within WGHMM itself. However, it was noted that some WG members have participated in a scientific publication, which illustrates how an assessment of Good Environmental Status might be done, applied to the Basque country region. The WG members participating in this publication prepared a short WD (WD09) with the aim of contributing towards the new ToRs on MSFD. WD09 is included at the end of this annex and makes reference to the scientific publication.

This was followed by another presentation from a WG member that is involved in the Area Based Science and Management Initiative and was local host to the workshop on Coastal and Marine Spatial Planning in Lisbon mentioned in the new Generic ToR k. The presentation provided background and progress to date on this initiative and a brief overview of the workshop and the recommendations that emerged from it. The presentation also provided suggestions of what WGHMM could contribute towards the new ToRs, highlighting in particular: (1) to suggest likely scenarios for pressures (mainly fishing activity); (2) to identify what indicators are available for assessment purposes and to suggest indicators when missing; (3) to prepare maps of spawning, fishery activity, etc.

Again a group discussion followed. The conclusions were that, even though several WG members have experience in the abovementioned issues, there was no time to tackle these aspects within WGHMM in any detail and that it was more realistic that those scientists could provide their contributions by participating in other meetings or workshops rather than through WGHMM itself. The relevance of introducing spatial and ecosystem aspects in stock assessments was highlighted as an important objective and WGHMM is already using some stock assessment models (like Stock Synthesis or Gadget) that permit, *e.g.*, the incorporation of different spatial areas with movement between them, separate fish by sex, consider different growth patterns and, in the case of Gadget, predator-prey interactions. However, the assessments currently performed by this WG with those models do not yet incorporate these features, as doing so is complex, both in terms of methodological skills and data needs. Until this happens, it is unlikely that this group can produce maps of *e.g.* spawning or recruitment areas, different from those coming originating directly from surveys, which should generally be better known to survey working groups (such as IBTSWG). WGHMM noted that the type of "more unique" knowledge it possessed in this area was probably in relation to fishing activity and, therefore, it was decided to provide a list of documents publicly available and known to WG members. This list compiled during the meeting follows:

Abad E., A. Punzón, I. Preciado and R. Somavilla. 2008. Using GAMs to identify factors that affect *Eledone cirrhosa* CPUE of North Spanish bottom trawlers. Poster presented at the *XV Simpósio Ibérico de Estudos de Biologia Marinha*, Funchal, Madeira, Portugal, 9-13 September 2008.

Abad E., A. Punzón, J. Castro and J. Landa. 2007. Geographical distribution and seasonality of métiers targeting Monkfish in Northern Spain. Poster presented at the *ICES Annual Science Conference*, Helsinki (Finland), 17-21 September de 2007.

Abad, E., J. M. Bellido, A. Punzón, N. Pérez and M. A. Ámez.2005. Analysis of the trawl fleet spatial distribution during and post Prestige oil spill by GIS simulations and real data. Cantabrian and Spanish northwestern fisheries. Poster presented at the *ICES Annual Science Conference*, Aberdeen (UK), 20-24 September de 2005.

Abad, E, J. M. Bellido, A. Punzón. 2010. Transfer of fishing effort between areas and fishery units in Spanish fisheries as side effects of the prestige oil spill management measures. Ocean and Coastal management, 53: 107-113.

Castro, J., Punzón, A., Pierce, G.J., Marín, M. y Abad, E. 2010. Identification of métiers of the Northern Spanish coastal bottom pair trawl fleet by using the partitioning method CLARA. *Fisheries Research*, 102: 184-190.

Castro, J., Marín, M., Pierce, G.J. y Punzón, A. 2011. Identification of métiers of the Spanish set-longline fleet operating in non-Spanish European waters. *Fisheries Research*, 107: 100-111.

Castro, J., Marín, M., Costas, G., Abad, E., Punzón, A., Pereiro, J. y Vázquez, A. 2011. *ATLAS de las flotas de pesca españolas de aguas europeas atlánticas*. Temas de Oceanografía, nº 4. Instituto Español de Oceanografía. Ministerio de Ciencia e Innovación. 215 pp.

Iriondo A., Quincoces I., Santurtun, M., and Gonzalez, I. 2006. Northern hake landings per unit effort and abundance indices of Basque fleets operating in Sub-areas VI, VII and divisions VIIIa,b,d, in the period 1993-2005. Working Document presented at the WGHMM in Bilbao (España).

Iriondo, A., Prellezo, R., Santurtún, M., García, D., Quincoces, I. Mugerza, E. 2010. A multivariate approach for metier definition: A case study of Basque Country trawlers. *Revista de Investigación Marina*, 17(6): 139-148.

Lucio, P., Artetxe, A. and Santurtún, M. 2000. Deep-sea Fisheries in the Basque Country (Spain) in 1998-1999. Working document presented in the ICES Study Group on the Biology and Assessment of Deep-Sea Fisheries Resources. Copenhagen 4-10 February 2000

Lucio, P., Diez, G., Iriondo, A., Santurtun, M., Prellezo, R., Artetxe, A., and Quincoces, I. 2004. The deep-sea fisheries in the Basque country (Spain) in 2002-2003. Working document for the ICES Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources Copenhagen (Denmark). 18-24 February. 2004.

Lucio, P., Iriondo, A., Santurtún, M., Quincoces, I. and Artetxe, I. 2003. Notes on the spatial distribution of the Northern Hake catches by the Basque fleets in Sub-areas VI, VII and Divisions VIIIa,b,d in 1998-2002. Working Document for the ICES Working Group on Hake, Monkfish and Megrim. Copenhagen,14-23 May, 2003

Lucio, P., Quincoces, I., Iriondo, I., Santurtún, M. and Artetxe, I. 2003. Revision and update of the Northern Hake and Anglerfish landings per unit effort and abundance indices of the Basque fleets in Sub-areas VI, VII and Divisions VIIIa,b,d for the period 1993-2002. Working Document for the ICES Working Group on Hake, Monkfish and Megrim. Copenhagen,14-23 May, 2003.

Lucio, P., Santurtún, M., and Artetxe, I. 2002. Overview on the Basque Sea bass (*Dicentrarchus labrax*) fishery in the Northeast Atlantic waters during the period 1994-2000. Working Document for ICES Study Group on Sea bass. (Brest. France), 12-15 March 2002.

Lucio, P., Santurtún, M., Quincoces, I., Díez, G., Artetxe, I., and Iriondo, A. 2002. Overview on the Deep-sea fisheries in the Basque Country (Spain) in 1999-2001. Working Document for ICES Working Group on the Biology and Assessment of Deep-Sea Fisheries Resources. (Horta (Azores. Portugal), 4-10 April 2002.

Lucio, P., Santurtún, M, Quincoces, I., Iriondo, I. and Artetxe, I. 2003. The Basque Fishery on Sea Bass (*Dicentrarchus labrax*) in the Northeastern Atlantic waters in 2001-2002. Working Document for the ICES Study Group on Sea Bass. Lowestoft (England.UK), 18-22 August, 2003.

Lucio, P., Santurtún, M., Quincoces, I., Iriondo, I., Artetxe, I. and Iriondo, A. 2003. Remarks on the spatial and length distribution of the Northern Hake landings, and accompanying species composition of the Basque (Spanish) fleets in the North-Atlantic, in 1996-2002. Working Document for the STECF Subgroup on Hake Technical Measures. Lisbon 27-31 October 2003.

Lucio, P., Santurtún, M., Quincoces, I. and Artetxe, I. 2001. Changes in the fishing activity and in the target species, and evolution of the fishing effort and the northern Hake catches per unit effort of some Basque fleets operating in Sub-areas VI, VII and Divisions VIII,b,d, in 1993-2000. Working Document for the ICES Working Group on Assessment of Southern Shelf Demersal Stocks. Copenhagen 4-13 September, 2001.

Marchal, P., Andersen, B., Bromley, D., Iriondo, A., Mahévas, S., Quirijns, F., Rackham, B., Santurtun, M., Tien, N., Ulrich, C. 2006. Improving the definition of fishing effort for important European fleets by accounting for the skipper effect. *Canadian Journal of Fisheries and Aquatic Sciences*, 63(3), 510-533.

Prellezo, R., Lazkano, I., Santurtun, M. and Iriondo, A. 2009. A Qualitative and Quantitative Analysis of Selection of Fishing Area by Basque Trawlers. *Fisheries Research*, 97.1-2.

Punzón, A., Trujillo, V., Castro, J., Perez, N., Bellido, J.M., Abad, E, Villamor, B. Abaunza, P. and Velasco, F. 2008. Closed area management taken after the 'Prestige' oil spill: effects on industrial fisheries. *JMBA2 - Biodiversity Records*, 10 pp.

Santurtún, M. Sagarminaga, Y., Lucio, P., Galparsoro I., Quincoces & Iriondo, A. 2004. Interannual trends in catches of squid (*Loligo* spp.) in the Bay of Biscay (ICES Div. VIIIa, b, d) during 2000 in relation to oceanographic features. ICES CM 2004/CC. Poster presented at the ICES Annual Scientific Conference in Vigo, September 2004.

Working Document

for the ICES Working Group on Hake Monk and Megrim Copenhagen, May 2011.

AN EXAMPLE OF HOW VARIABLES USED IN STOCK ASSESSMENT CAN BE USED TO QUANTIFY DESCRIPTORS OF THE MARINE STRATEGY FRAMEWORK DIRECTIVE.

AN AZTI INTERNAL MULTIDISCIPLINARY EXERCISE OF COLABORATION.

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Abstract

An example of how the knowledge and experience of the assessment Working Groups experts is used in the context of the Marine Strategy Framework Directive is presented. The aim is to integrate the scientific and advisory work for implementing an ecosystem approach based on qualitative descriptors, and give a coordinated and integrated assessment of sea environmental status.

Introduction

In 2011, ICES Working Group on Hake Monk and Megrim was invited, as other expert Groups to contribute with its knowledge to the recently created groups jointly by ACOM and SCICOM, the Marine Strategy Directive Framework Steering Group (MSFDSG) and the Strategic Initiative on Area Based Science and Management (SIASM). It is clear that the MSFD is cross-cutting and will have implications for most of ICES work. Also it is in the aim of ICES to better integrate its scientific and advisory work to meet the challenges of implementing an ecosystem approach. AZTI, as an active participant of this Group of Assessment Experts, carried out an internal exercise of cataloguing the Good Environmental Status (GES) of the Basque Coast. This work entitle Implementation of the European Marine Strategy Framework Directive: A methodological approach for the assessment of environmental status, from the Basque Country (Bay of Biscay) by Borja *et al*. (2011) has been recently published. We, AZTI members of the WGHMM, want to provide with this exercise, an example for helping identifying and describing the work streams of our own assessment working groups with relevance to the GES Descriptors with particular emphasis on linkages that could be made between fish stock and ecosystem/environmental monitoring and assessments.

Also, in the present work we partly cover two of the new proposed ToRs to this Assessment Group defined by ICES as:

- • Identify elements of the expert groups' work that may help determine status for the 11 Descriptors set out in the Commission Decision (available at http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:232:0014:0024:EN:PDF;

- • Provide views on what good environmental status (GES) might be for those descriptors, including methods that could be used to determine status.

Material and Methods

Work deployed during assessment working groups is one of the best compilations deployed annually in relation to data and knowledge on population dynamics and fishing activity. This knowledge is most of the time used for giving first advice in managing stocks. Parameter calculated in that, define the current status of the most important stocks species commercially exploited in Europe through a series of indicators. These indicators are traditionally used to state population status in relation to some reference points (fishing mortality, recruitment and spawning stock biomass levels).

To undertake the ecosystem based approach and to determine the environmental status, the MSFD proposes the use of 11 qualitative descriptors (Cardoso et al., 2010; European Commission, 2010). A summary of those descriptors is found in Borja et al (2011). These descriptors summarize the way in which the whole system functions. Some of the descriptors could be calculated based on the routinely work deployed at the assessment working groups.. Thus, the following descriptors in red were chosen as those in which data and population dynamics can be straight applied:

Qualitative descriptors	References
1. Biological diversity is maintained and the quality and occurrence of habitats and the distribution and abundance of species are in line with prevailing physiographic, geographic and climatic conditions	Cochrane et al. (2010)
2. Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystems	Olenin et al. (2010)
3. Populations of exploited fish and shellfish are within safe biological limits, exhibiting a population age and size distribution indicative of a healthy stock	**Piet et al. (2010)**
4. All elements of the marine food webs occur at normal abundance and diversity and levels capable of ensuring the long-term abundance of the species	**Rogers et al. (2010)**
5. Human-induced eutrophication is minimised, especially adverse effects	Ferreira et al. (2010)
6. Seafloor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems are not adversely affected	**Rice et al. (2010)**
7. Permanent alteration of hydrographical conditions does not adversely affect marine ecosystems	
8. Concentrations of contaminants are at levels not giving rise to pollution effects	Law et al. (2010)
9. Contaminants in fish and other seafood for human consumption do not exceed levels established by legislation or other standards	Swartenbroux et al. (2010)
10. Properties and quantities of marine litter do not cause harm to the coastal and marine environment	Galgani et al. (2010)
11. Introduction of energy, including underwater noise, is at levels that do not adversely affect the marine environment	Tasker et al. (2010)

Specifically, the following set of indicators by descriptor (in red colour) were identified as easily to be delivered through work deployed through the work of the assessment working group.

Descriptor	Aspect	Indicator
3: Exploited fish and shellfish	3.1 Level of pressure of the fishing activity	**3.1.1 Fishing mortality (F)***
		3.1.2 Catch/biomass ratio
	3.2 Reproductive capacity of the stock	**3.2.1 Spawning stock biomass (SSB)***
		3.2.2 Biomass indices
	3.3 Population age and size distribution	**3.3.1 Proportion of fish larger than the mean size of first sexual maturation***
		3.3.2 Mean maximum length across all species found in research vessel surveys
		3.3.3 95% percentile of the fish length distribution observed in research vessel surveys
		3.3.4 Size at first sexual maturation*
4: Food webs	4.1 Productivity of key species or trophic groups	**4.1.1 Performance of key predator species using their production per unit Biomass***
	4.2 Proportion of selected species at the top of food webs	**4.2.1 Large fish (by weight)***
	4.3 Abundance/distribution of key trophic groups/ species	**4.3.1 Abundance trends of functionally important selected groups/species***

Descriptor	Aspect	Indicator
6: Seafloor integrity	6.1 Physical damage, having regard to substrate characteristics	**6.1.1 Type, abundance, biomass and areal extent of relevant biogenic Substrate***
		6.1.2 Extent of the seabed significantly affected by human activities for the different substrate types*
	6.2 Condition of benthic community	**6.2.1 Presence of particularly sensitive and/or tolerant species***
		6.2.2 Multi-metric indices assessing benthic community condition and functionality, such as species diversity and richness, proportion of opportunistic to sensitive species*
		6.2.3 Proportion of biomass or number of individuals in the macrobenthos above specified length/size
		6.2.4 Parameters describing the characteristics of the size spectrum of the benthic community

Results

In Borja *et al.* (2011) population indicators of main commercially-exploited fish in ICES Division VIIIc were revised in relation to the level of pressure of the fishing activity. Fishing mortality is one of the traditionally precautionary limits in commercial fiac assessment. Spawning stock biomass and population age and size distribution are used also as indicators, to measure the health of the stock. These population variables are annually and routine calculated at the assessment WG. In this analysis, twelve of the higher commercial value stocks of the Bay of Biscay, over a period of 80 years, were studied.

Results of the revision are presented in the following Table 1.

Table 1. Indicators used in the assessment of qualitative descriptor 3 (exploited find), for 12 stocks within the southern part of the Bay of Biscay. Key: F: fishing mortality; SSB: spawning stock biomass; MSY: maximum.

		Engraulis encrasicolus	*Lophius budegassa*	*Lophius piscatorius*	*Lepidorhombus boscii*	*Lepidorhombus whiffiagonis*	*Merluccius merluccius*	*Sardina pilchardus*	*Trachurus trachurus*	*Scomber scombrus*	*Micromesistius poutassou*	*Thunnus alalunga*	*Thunnus thynnus*
Fishing mortality (F) (primary indicator) for all species, except for *E. encrasicolus*, which is Catch/biomass ratio (secondary indicators)	2005	0.068	0.554	0.601	0.281	0.214	0.690	0.194	0.066	0.285	0.478	0.159	0.342
	2006	0.065	0.598	0.543	0.331	0.343	0.780	0.170	0.046	0.234	0.411	0.166	0.297
	2007	0.004	0.603	0.442	0.248	0.265	0.810	0.184	0.050	0.263	0.436	0.131	0.345
	2008	-	0.352	0.424	0.226	0.206	0.750	0.267	0.065	0.236	0.476	0.129	0.311
	2009	-	0.198	0.380	0.272	0.098	0.740	0.266	0.087	0.233	0.399	0.129	0.208
	Reference F	Undefined	F msy = 0.44	F msy = 0.26	Fmsy= 0.18	Fmsy=0.17	Fmsy =0.26; Fpa = 0.4	Undefined	Undefined	Fmsy=0.22; Fpa= 0.23	Fmsy=0.18; Fpa= 0.32	Fmsy (2007) = 0.442	Fmsy=0.09 (HR) Fmsy=0.15 (LR)
	> F reference		3	5	5	4	5			5	5	0	5
	< F reference		2	0	0	1	0			0	0	5	0
Spawning Stock Biomass (SSB) (primary indicator)	2005	17110	1492	6523	4316	848	11100	369000	2356290	2290881	6210258	169151	36092
	2006	27190	1779	5707	4896	861	12700	586000	2251270	2409602	5932354	173444	39079
	2007	37080	2066	5164	5020	756	15200	566000	1955010	2540759	4631475	188885	39006
	2008	27235	2296	5436	5326	728	16000	420000	2095550	2709395	3255375	200863	34571
	2009	22000	3157	5707	4716	728	20100	316000	2276680	2978321	2097420	200806	33399
	Reference SSB	MSY & Bpa= 33000 t	MSY & Bpa= ND	MSY & Bpa= ND	MSY & Bpa= ND	MSY & Bpa= ND	MSY & Bpa= ND	MSY & Bpa= ND	MSY & Bpa= ND	MSY= 2.2 t, Bpa= 2.3 t	MSY= 2.25 t, Bpa= 2.25 t		
	> SSB reference	1	-	-	-	-	-	-	-	5	4		
	< SSB reference	4	-	-	-	-	-	-	-	0	1		
Proportion of fish larger than the mean size of first sexual maturation (primary indicator)	2005	100%	57%	61%	100%	32%	8%		42%	77%	100%		
	2006	100%	20%	44%	100%	40%	9%		44%	65%	-		
	2007	Fishery is closed	17%	55%	100%	44%	18%		62%	73%	100%		
	2008	Fishery is closed	75%	61%	100%	43%	19%		37%	74%	100%		
	2009	Fishery is closed	62%	57%	100%	55%	29%		34%	88%	93%		
Size at first sexual maturation (secondary indicator)		9.2 cm (range 4-12.5 cm)	M&F: 44.7 cm	M&F: 61.84 cm	17 cm	26.6 cm	M&F: 43.68 cm	14.8 cm	23.9 cm	28.6 cm	15 cm	85 cm	97-110 cm

Also, data available from the International Council for the Exploration of the Sea (ICES), for bottom trawl surveys (http://datras.ices.dk/Data_products/EUIndicator.aspx), corresponding to the EVHOE (Evaluation Halieutique de l'Ouest de l'Europe) survey undertaken within the framework of the International Bottom Trawl Survey (IBTS), was used to calculate the proportion of large fish present. Results are not presented here as the relevance for this short communication is the readily data availability from ICES data bases.

Conclusions

Assessment working group experts are owner of a large knowledge on population dynamics and manage data of fisheries and stocks highly useful for other purposes than stock assessment. Ecological status could be the next step to be undertaken under the ecosystem based approach. It is worth to mention that in the MSFD and moving towards a Marine Spatial Planning, fishing activity is still one of the main activities affecting the status of the ecosystems. Thus, there is a need of taking into account all knowledge deployed by assessment experts and put effort in offering useful data to experts working on these issues. Also, the experience gain after years of work of assessment scientist in relation to bridging management with advice should be considered.

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Annex T – InterCatch use in WGHMM 2011

This template was provided by ICES Secretariat for assessment WGs to record their InterCatch use and, when InterCatch is not being used, to explain the reasons why it has not been done. The following paragraph was given to the WG by ICES Secretariat and WG members have filled the required table and provided comments below.

"All stock coordinators should make sure that catch data are imported into Inter-Catch and use InterCatch, following the Generic Terms of Reference. InterCatch is the standardised documentation system for stock assessment expert groups and a part of the ICES Quality Assurance Program. Therefore it is suggested that stock coordinators request national data submitters to import catch data into InterCatch over the internet in the InterCatch format to ease the stock coordinators work. If stock coordinators have not used, tested and compared the output from InterCatch with the so far used system, it is suggested that it is done in 2011. Stock coordinators should verify that InterCatch fulfils the needs of their stocks and gives the expected output. Hereby the stock coordinator can also approve InterCatch as the system, which can be used in the future."

Table of Use and Acceptance of InterCatch				
Stock code for each stock of the expert group	InterCatch used as the: 'Only tool' 'In parallel with another tool' 'Partly used' 'Not used'	If InterCatch have not been used what is the reason? Is there a reason why InterCatch cannot be used? Please specify it shortly. For a more detailed description please write it in the 'The use of InterCatch' section.	Discrepancy between output from InterCatch and the so far used tool: Non or insignificant Small and acceptable significant and not acceptable Comparison not made	Acceptance test. InterCatch has been fully tested with at full data set, and the discrepancy between the output from InterCatch and the so far used system is acceptable. Therefore InterCatch can be used in the future.
hke-nrth	Partly used	Partly used because not all countries upload data into intercatch	Comparison not made	InterCatch has not been tested
Hke-south	Not used	South hake data are currently in a PostgreSQL data base allowing multiples utilities to deal with data input for the GADGET model.	Comparison not made	InterCatch has not been tested
Sol-bisc	Not used	Data not uploaded to InterCatch	Comparison not made	InterCatch has not been tested
Meg-78	Partly used	Partly used because not all countries upload data into intercatch	Comparison not made	InterCatch has not been tested

Ang-78	Partly used	Partly used because not all countries upload data into intercatch	Comparison not made	InterCatch has not been tested
Mgw-8c9a	Not used	No country upload data into intercatch	Comparison not made	InterCatch has not been tested
Mgb-8c9a	Not used	No country upload data into intercatch	Comparison not made	InterCatch has not been tested
Nep8c (FU25,31)	Not used	No country upload data into intercatch	Comparison not made	InterCatch has not been tested
Neph9a (FU26-30)	Not used	No country upload data into intercatch	Comparison not made	InterCatch has not been tested
Anb- 8c9a	Not used	No country upload data into intercatch	Comparison not made	InterCatch has not been tested
Anp- 8c9a	Not used	No country upload data into intercatch	Comparison not made	InterCatch has not been tested
Nep8ab (FU 23-24)	Not used	Data not uploaded to InterCatch	Comparison not made	InterCatch has not been tested

Comments from the WGHMM 2011 meeting:

The WG agreed this year to define common "InterCatch fleets" (which essentially correspond to Level 5 DCF métiers) to facilitate the use of InterCatch in future years and to promote consistency between countries and stocks. The proposal for InterCatch fleets is presented in Section 2.1 of this report, explaining how the proposed InterCatch fleets relate to the fishery units traditionally used for data submission to this WG and to the Level 6 DCF métiers. WG members will check with their national institutes whether there may be any problems using the InterCatch fleets proposed by this WG and, if any problems are detected, these will be communicated to the WG chair by the end of July 2011, who will circulate them among WG members so that amendments to the InterCatch fleets can be made by WGHMM by mid-September 2011.

Most stock coordinators (which in the case of this WG are the same as the assessment coordinators) agreed to use InterCatch if all stock data are introduced by the national data submitters in InterCatch. WG members consider that it is the exclusive responsibility of national data submitters to introduce the data in InterCatch and stock coordinators in this WG will not introduce data in InterCatch when a national data submitter has not done it.

Annex U – Review Group Technical Minutes

Bay of Biscay and Iberian Seas Review Group, 23-31 May 2011 (by correspondence)

Reviewers:	Thomas Brunel Netherlands (chair)
	Cecilie Kvamme, Norway
	Romas Statkus, Lithuania
Chair: WG:	Carmen Fernandez, Spain
Secretariat:	Cristina Morgado, ICES

General

The review group acknowledged the intense effort expended by the working group to produce the report. The report was generally well written, well structured and well presented. Stock annexes were presented for all the stocks.

Many of the assessments did not include discards data (southern anglerfish and megrim, sole). Some stocks have a high discarding rate (e.g. southern four-spot megrim) and not including the discards greatly compromises the quality of the assessment. The WG is concerned about this problem and investigates alternative ways (e.g. a new Bayesian assessment model) to better include the available discards data.

In some cases, the assessments suffer from a lack of tuning series. Survey information is lacking for Bay of Biscay sole and for the northern part of the Northern hake stock distribution. For Bay of Biscay sole the 2 main commercial LPUE tuning series were interrupted last year, due to a declining activity of the fleets, while commercial LPUE used in the assessment of Southern anglerfish (L. *budegassa*) are not representative of the entire stock distribution.

Notwithstanding these minor issues the review group found that the WGHMM 2011 report was of high quality. The input data appeared to be correct and suitable. No major faults were noticed in the assessments, and no substantial deviations from the stock annex were found. The review group considers that this report provides the necessary information for giving advice for the exploitation of these stocks.

The Review Group considered the following stocks:

- Anglerfish (*Lophius piscatorius* and *Lophius budegassa*) in Divisions VIIIc and IXa
- Hake in Division IIIa, Subareas IV, VI and VII and Divisions VIIIa,b,d (Northern stock);
- Hake in Division VIIIc and IXa (Southern stock);
- Megrim (*Lepidorhombus boscii*) in Divisions VIIIc and IXa
- Bay of Biscay sole
- *Nephrops* in Divisions VIIIa,b (Bay of Biscay, FU 23, 24)
- *Nephrops* in Division VIIIc (FU 25, 31)
- *Nephrops* in Division IXa (FU 26-30)

The review group was also asked to give its opinion on the Annex R: ToRs on New species (presenting the data available in the different institutes on plaice, Pollack and whiting in 8-9a and sole in 8c9a). The RG didn't have any specific comment to report on this annex.

Anglerfish (Lophius piscatorius and Lophius budegassa) in Divisions VIIIc and IXa:

1) Assessment type: update
2) Assessment: analytical
3) Forecast: Medium term forecast presented (11 scenarios, 10 years)
4)) Assessment model: ASPIC non equilibrium surplus production model (one for each species) – tuning by landings and 2 commercial fleet indices (LPUE) for each assessment (different fleets used for each species, Spanish (Div. VIIIc) for L. *piscatorius* and Portuguese (Div. IXa) for L. *budegassa*).
5) Consistency: Update assessment, done according to stock annex. Consistent model formulation and data inputs.
6) Stock status: No PA reference points for the stocks. L. piscatorius: below BMSY for the last 15 years (around 25%), after a decrease of the last 5 years F is estimated to below FMSY (85%) in 2010. L. *budegassa*: B increasing and F decreasing steadily over last 10 years. F below FMSY since 2008, B almost at BMSY (91%) in 2010.
7) Man. Plan.: None (but caught in mixed fisheries and recovery plans are in place for hake and *Nephrops* in the same area).

General comments

The report presents an update assessment for both anglerfish stocks. The assessments are done according to the method and data presented in the stock annex. This section is clearly presented and well explained, and provides adequate results for the formulation of advice.

Some technical problems were found in the application of the ASPIC model for the 2 species, more discussion on the quality of the assessment would be welcome (c.f. technical comments). Alternative assessment methods will be explored in a benchmark assessment in 2012.

Advice sheet

General

Since both species are in 2010 exploited below Fmsy, the statement made in the previous advices in the section MSY approach, 3rd and 4th paragraphs should be changed: 1) according to the ICES MSY framework, F should be increased of 17% (not decreased as stated in this paragraph) and L. *piscatorius* is still in poor condition, but no longer fished at F above Fmsy. The paragraph should say that both species are exploited at F below Fmsy, that L. *budegassa* is at a biomass level close to Bmsy, and that therefore the choice of the F for the 2 species is based on objective of the rebuilding of L. *piscatorius* at Bmsy.

L. budegassa

I would make a stronger statement in section "quality considerations", by replacing "uncertainty" by "concern"[1].

[1] Addressed before the ADGBBI

Technical comments

Stock annex

Section A.3 Ecosystem aspects: conclusions regarding the high dependency of recruitment success and of stock dynamics on environmental and ecosystem factors only speculative and not based on any study results.

Section C : table of model settings and input data :

- Why are the LPUE time series SP-CEDGNS8c and PT-TRC9a treated as index of biomass and not as CPUE?
- What is the meaning of the notation 1d-5 (example) for the catchability parameters? Is it 1e-5 d^{-1} ?

WG report

L. piscatorius

The assessment gives a relatively good fit to the LPUE time series (R^2 0.555 and 0.306), which is an improvement compared to last year for F2. This assessment give identical time series for B/Bmsy and F/Fmsy to the 2010 assessment, and parameters estimates are only marginally revised.

However, the bias values for many parameters (table 8.1.8) have increased a lot compared to last year's assessment (e.g. for Bmsy and Fmsy, from around 1% in last year's assessment to more than 10% this year). Moreover, the uncertainty on the parameters (IQ range) is also substantially higher in this assessment (e.g. for Bmsy and Fmsy, relative IQ range of 17.90% and 12% v.s. from around 1% in last year's assessment).

The shape of the 80% CIs for B/Bmsy on figure 8.1.5 is also very different this year : for most of the time series, the mean value is very close to the upper limit of the CI whereas last year the CI was more or less symmetrical around the mean value. Also : B1/K point estimate 0.25 close to 80% CI upper limit (0.26) and K estimate 51 540t close to 80% CI lower estimate (49 420t).

All these points were not mentioned in the WG report and should be discussed. There was no revision of the input data, except the inclusion of the 2010 data, and the assessment was run using the same settings.

Table 8.1.7 : value 1 missing for statistical weight for F2

Table 8.1.9: it would make more sense to compare B2010/Bmsy for the 2010 and 2011 assessment than comparing B2010/Bmsy and B2011/Bmsy, since they correspond to two different states of the stock (same for F).

L. budegassa

The assessment presented is very consistent with last year's assessment (except for some revisions in B2010/Bmsy and F2010/Fmsy on figure 8.2.6). Values for bias and IQ ranges presented in table 8.2.8 are generally quite low.

However, the model still has negative R^2 for the 2 LPUE series, which is a matter of concern. During the next benchmark, it should be investigated whether the lack of fit can be solved by modifying the model settings, or if it due to a conflicting signals in the LPUE time series and the landing series, in which case, alternative time series could be tested (LPUE series are representative only of Portugal, while the stock extends also to areas off the Spanish coast).

Table 8.2.9 : same remark as for table 8.1.9.

Conclusions

These assessments have been performed correctly according to the stock annex. Concerns about the bias and precision of the assessment results (L. pisc.) and about the poor model fit to the LPUE time series should be dealt with during the 2012 benchmark. This provides information for the provision of advice.

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

1) **Assessment type :** update (stock benchmarked in 2010), stock on observation list
2) **Assessment**: Accepted
3) **Forecast**: Accepted
4) **Assessment model**: Stock Synthesis 3 (Methot, 2009) length-based, tuned by 4 surveys (RESSGASC, EVHOE, SP-GFS and IGFS). Discards included (but only for some fleets).
5) **Consistency**: assessment rejected last year (first application of benchmark model, rejected based on poor data for 2009 and too short time series), this assessment was accepted after improvement of the 2009 data and extension of the time series back to 1978 instead of 1990.
6) **Stock status**: F above Fmsy (0.24) despite substantial decrease in the recent years. Strong increase in SSB (2010 value is the highest of the time series), no biomass reference point available. High recruitments in 2006-2008, signs of very low recruitments since then.
7) **Man. Plan.**: recovery plan agreed by EU in 2004 : SSB above 140 000t to be achieved by limiting fishing mortality to 0.25 and allowing a maximum change in TAC between years of 15%.

Plan is not evaluated by ICES. This plan was based on the former assessment, for which the order of magnitude of F and SSB were different from the new assessment.

General comments

This assessment was clearly presented and well explained.

This assessment is the first accepted update assessment since the benchmark in 2010. Last year's assessment was rejected due to poor quality of French data for 2009, and because the time series was too short to have enough contrast in the data, and too little information was available on the larger individuals of the stock. This year, the 2009 data problem was solved, and the time series were extended back in time of 12 additional years.

These changes in the input data only resulted in marginal changes in the assessment results (i.e. recent values of F, SSB and R time series and reference points). There was a significant reduction of the retrospective problems that were observed in the benchmark assessment. The previous assessment gave the perception of a stock showing a sudden increase at the end of the time series, which was hard to believe given that SSB was relatively flat for the earlier part of the time series. With the extension of the modelled period to 1978, it appears that the levels of SSB and F observed in the recent years are similar to the levels at the beginning of the time series, which gives more confidence in the assessment results.

Despite a recent spectacular increase in SSB, there are signs of recent bad recruitments (estimated in the assessment and detected in the surveys). At the same time, last year the TAC was overshot by more than 30%.

The most important parts of the distribution area are covered by the surveys included in the assessment (Bay of Biscay, Celtic Sea, Porcupine bank, West of Ireland). Could also other surveys be included in the assessment? E.g. what about the IBTS survey in the North Sea or surveys West of Scotland?

Discards can be substantial, and is only estimated for some fleets. The estimates amount to ~10% of landings in weight, i.e. even more in numbers.

Advice sheet

Good. All information in agreement with the WG report, except some discrepancies between the table 3.6 of the report (catch option table, status quo scenarios) and the outlook for 2012 in the advice sheet.

P43 : quality consideration :

- 1 change the phrasing "assessment is based on an assessment model using length data" for e.g. "assessment is carried out using a length-based model"[2]
- 2 "this provides a clearer perspective of the historical development of the stock", but the figure 9.4.1.2 doesn't show the earliest part of the time series (1978-1995).

Figure 9.4.1.4 – It could be useful to have the assumed Beverton-Holt stock-recruitment relationship in this figure (without the assumed CV).

Technical comments

Input data appear to be correct and suitable.

- *Stock annex*

Mostly well written and easy to understand, but some improvements could be done to the section "Description of the SS3 settings".

Figure 2 – it is difficult to link the figure legend to the text below describing the surveys.

P 436-437: the model makes the assumption that the biological parameters of Northern hake are constant. Though it might be a reasonable assumption for the parameters of the length-weight relationship and of the maturity (at length) ogive, it is a strong assumption to make for growth (which can be affected by environmental effects and/or density dependence). In a future benchmark, the possibility to estimate annual (or year class)-specific growth parameters should be investigated.

In a future benchmark, it may be useful to evaluate the sensibility of the output of SS3 to the assumption made on natural mortality. The choice of a value of M=0.4 was made after finding that hake grow twice faster as previously assumed, therefore M value should be the double of the previously assumed M=0.2. Besides, the value M=0.4 gave a better model fit than the values 0.2 and 0.3.

The 0.4 value comes from the Hewitt and Hoenig (2005, reference missing) relationship implying direct proportionality between M and longevity. But from other natural mortality models (based on the link between M and K and Linf), the relationship between M and K is not proportional. As an example Pauly's (1980) model applied with K=0.117 and Linf=130 cm (as in the WGMHH 2011) and an average temperature of 14°C gives an M=0.28. The value M=0.4 seems a bit high if we compare to the M used for the assessment of other ICES stocks with similar K values.

[2] Addressed before the ADGBBI

What was the choice of a Beverton and Holt stock-recruitment model based on?

How are the different choices of selection pattern done – a justification of these choices could be useful in the stock annex.

The description of the SS3 settings from "Length compositions …." and onward is not detailed enough to fully understand what's been used. Some descriptions are unclear, sometimes units are missing (e.g. Landings: 125 for all fleets …., does this mean 125 individuals per quarter, or something else?), and for the functions / relationships / ogives used it would be very useful if the equations were given, as well as the parameter estimates. It should also be indicated whether parameters are estimated within the assessment run, estimated annually outside the assessment model, or kept fixed.

Table 5 - * missing for y in line 3 and 4?

G. Biological reference points – Table – Justify content according to headers.

- *WG report*

On p 28 after 1st § : since the poor quality of the French data for 2009 was the main reason for rejecting the assessment last year, it should be mentioned that the quality of the French data for the year 2009 and 2010 has improved and that this data can know be included in the assessment.

P 31 short term projections : given the uncertainty on last estimated recruitment, why did the WG decide to include the recruitment for the assessment year and the year before in the GM?

P32 (last 2 §) : the inclusion of 12 more years of data has improved our perception of the historical development of the stock. But has it resulted in a reduced uncertainty in the estimated SSB and F compared to previous assessment? Adding the confidence intervals on fig. 3.8 would help to compare the precision of the estimates from this assessment with the results of the benchmark.

P33 (first §) comments on the assessment (the interpretation of the recent trend in SSB) : "the sharp increase in SSB in recent years is the direct consequence of a series of good recruitments in 2006-2008" I would add "combined with a relatively low fishing mortality". Indeed, the even higher recruitments observed in 1985-1990, didn't result in an increase of SSB (it actually decreased) because of the high and increasing level of F[3].

It is not clear how high K contributes to the increase of SSB.

Increase in LPUE is not a feature observed for all fleets.

P 33 : management considerations :

There should be a warning that the assessment indicates that the most recent recruitments (even if the estimates are quite uncertain) have been low. The abundance indices from EVHOE and IGFS also show low values in 2009 and 2010. Concurrently, there was a large overshooting of the quota in 2010[4].

Table 3.1 p 34 : define the *. It would be nice to have the landings divided into IIIa, IV, VI, VII and VIII (separate columns), especially since the surveys only covers parts of the distribution area of this stock. If the landings were clearly separated by area,

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[3] Addressed in section 3.6
[4] Addressed in section 3.7

changes in landings ratio by area could give a signal if there were changes in stock distribution. In this table, it is not clear where the landings from IIIa + IVb,c are included (improve the foot notes). In the advice sheet it is said that: "An important increase in landings has occurred in the northern part of the distribution area (Div IIIa, and Subareas IV and VI)."

Figure 3.1 – The 3 first surveys should have been put in the same figure for easier comparison of trends, with a separate y-axis for the SpPGFS. The 4th figure, the RESSGASC survey, looks very strange – according to the text, it should comprise the years 1978-2002, and for the period 1978-97 it should be a quarterly survey, whereas for 98-02 it should be done twice a year. I don't get this to match the figure, and the figure should be improved.

F3.3b – it is very difficult to read this figure because of the low resolution. In the legend it's said that it shows LPUE and effort, but to me it only looks like LPUE only.

F3.6 – the headers are confusing. It would be better to give time periods and explain colours in the figure legend. Red and green are also difficult to separate for colour-blinds. It would also be useful to divide this figure into commercial fleets (a) and surveys (b). Do none of the surveys catch large hake (> 60-70 cm) or are there no large individuals in the stock?

F.3.8-10 – low resolution.

Figure 3.11. Complete the caption : "red line : 2011 assessment, black line : 2010 benchmark assessment"[5]

Conclusions

The extension of the time period covered by the data gives a better view on the stocks historical dynamics and provides elements of explanation of the recent increase of the stock.

The assessment was conducted with no deviation from the stock annex and the main data problem was solved. The review group therefore considers that this assessment provides information for the provision of advice.

<u>Future benchmark suggestions:</u>

Include more available surveys.

For some of the fleets, no discard has been assumed. Is this justified?

Estimate cannibalism mortality in the assessment model

The trends in SSB, fishing mortality and catches seem similar for southern and northern hake. Trying to do a combined assessment for the two stocks / look at stock identity might be interesting in a future benchmark.

[5] Addressed in the report

Hake in Division VIIIc and IXa (Southern stock)

1) **Assessment type:** update (based on benchmark assessment, WKROUND 2010)
2) **Assessment**: Analytical assessment (Gadget)
3) **Forecast**: Presented
4) **Assessment model**: Gadget (length-age based) – tuning by 2 commercial indices (SP-CORUTR; P-TR) + 3 surveys (Sp-GFS-WIBTS-Q4; SPGFS-caut-WIBTS-Q4; PtGFS-WIBTS-Q4)
5) **Consistency**: Second application of this model for advice. Past year's assessment was reviewed in December 2010 after detecting an error in the predictions.
6) **Stock status**: Existing PA reference points are no longer valid. No biomass reference points are defined for this stock, but F has been above the proposed Fmsy proxy (Fmax) and F_{pa} for the entire time series. Suggested Fmsy-candidate = Fmax = 0.24. F_{pa} = 0.40. R uncertain, seem to be high recent years.
7) **Man. Plan.**: A recovery plan agreed by EU in 2005, and enforced since 2006. SSB above 35 000 t by 2016 and to reduce fishing mortality to 0.27. The main elements in the plan are a 10% annual reduction in F and a 15% constraint on TAC change between years. Plan is **not** evaluated by ICES.

General comments

This assessment is clearly presented and mostly well explained. The stock was benchmarked in 2010 and the benchmark assessment has been updated with the last available data according to the stock annex for the stock.

The discard is quite high, mostly ranging from 20 to 30% in weight (1992-2010).

The stock has a history of catches > TAC > ICES advice. For example: Catches 2010 = 17.3 kt >> TAC 2010 = 9.3 kt >> advice 2010 < 4.9 kt. The catches were at the same level as the estimated spawning stock biomass in 2010 (18.7 kt).

MLS = 27 cm is quite low, as compared to when hake reach maturity (L50(mat) = 40-47 cm for Atlantic populations).

As for the Northern hake assessment, the natural mortality value of 0.4 used is based on Hewitt and Hoenig (2005) model $M=4.22/t_{max}$, were t_{max} is the apparent longevity, here assumed to be 10 years. However, this value of M=0.4 seems quite high compared to values from other models (e.g. Pauly's (1980) model gives M=0.28, using average temperature of 14°c) and compared to the M values used for other ICES stocks with similar K values (e.g. North Sea cod M=0.2, for K= 0.21 and Linf=128cm).

Technical comments

Input data broadly appear to be correct and suitable.

Page 141 §9 (technical measures): some information about the range of minimum mesh size used could be useful. Are minimum mesh sizes set according to MLS?

7.2.2: Table 1.3: There are no ages from Spain. Does Spain collect otoliths, or has this sampling stopped? Probably the number of stars in the leftmost column should have been 5, i.e. otoliths are sampled, but not read. In any case, it will be useful to continue otolith sampling for potential future use – if age reading methods for hake improve. A general comment on the sampling level compared to the required EU DCR level would also be useful.

Page 142 §8, maturity ogive: Give the equation and parameter estimates here – this is useful for comparison with northern hake estimates.

Page 143 §1, Figure 7.3: Comment that only the surveys used for tuning the assessment model are shown in the figure.

Page 143 §4 2nd sentence: don't agree that "all show the same increasing pattern in recent years with high values in ….."

Page 143 §7, Figure 7.4: A comment on what causes the very high LPUE values the last two years for the "A Coruña Pair Trawl" could be useful.

Page 145: Improve headers to make them self explainable, or add a table legend

Page 145 §1: A table showing the estimated parameters would be useful for comparisons between assessments.

Page 145 §1: the selection patterns are estimated for catches (1982-1993), landings (1994-2010) and discards (1992-2010) (+ Cadiz landings), with the same selection pattern throughout the period. However, the MLS was introduced in 1992 – wouldn't it thus be more natural to split between catches for the period 1982-1991 and landings for the period 1992-2010?

Tables – general comments: use the same number of significant numbers when natural (e.g. T7.1), remove green triangles and justify numbers and headers equally (or use lines to separate columns).

T7.2 – Spain – length compositions are provisional – this should be commented in the table legend. SOP / NW a bit low for Port-Trawl and Port-Art?

T7.6 – Header: Change Mort(1-3) into F(1-3). Or is this total mortality?

T7.7 – Headers: Change BIO into TSB which is more self-explaining[6]

Figure 7.2 – Five more information in the figure legend. It is confusing with the shifting starting point and way of reading the figures (F7.1: 1982 – from left to right, F7.2: 2010 – from right to left). And why is also 1980 and 1981 included here? Is the maturity ogive shifting from year to year? If not, it would be better to show one general figure for all years, marking e.g. L50. If it is shifting from year to year, it would probably be better to show the estimated annual values in a table, as it is difficult to see the changes from this figure.

F7.4 – One figure is missing part of the year labels at the x-axis

F7.5 – The short names should be explained in the figure legend, and the figures should be grouped according to "themes" and reordered according to year to improve readability, perhaps with a short explanation (e.g. recruitment, survey, fishery, growth etc.) to the right of the figure. 58 parameters are shown here, whereas in the text it is said that 71 parameters were estimated – where are the rest?

F7.7 – Legends: indicate time period for all of the curves, or none. Land94-08 should be changed into Land 94-10. Figure legend should include some more information

[6] Addressed in the report

about which parameters are fixed and which are estimated. Are all the selection parameters estimated?

F7.10 – are all these runs Gadget assessments? Explain in figure legend.

F7.11 – explanation of light blue vertical line is missing.

F7.12 – difficult to read the explanation belonging to the two first vertical lines.

Stock annex

A justification of the choice of the different selection curves would be useful (e.g. logistic vs Andersen function)

In the first table in C.2 there are some errors:

Line 3 – period should be 1982-2004 (according to text)

Line 5 – should be Portuguese

Abundance misspelled (lines 8-17) or missing (18-19)

Format of line 18

In the likelihood table legend, an explanation of how the Multiplicative weight was calculated would be useful (= (q*qual*area)/var).

Advice

Page 1: Stock status figure: Is the lower, left figure really total mortality?[7] Isn't it fishing mortality?

F7.4.1.2: Is it the change in M and growth alone that causes the increase in R and decrease in F, or is this also influenced by the choice of assessment model?

Additional considerations: 1st § "The model estimates for the first few years are not considered reliable because of ……" – here it would be useful if the time period (these first few years)[8] was indicated. Is it the years that are outliers in figure 7.4.1.4 (82-88) – if so, this should also be described in the figure legend of 7.4.1.4.[9]

T7.4.1.1: TAC 2011 (= 10 695 t) is missing[10]

T7.4.1.3: Change tn into t, and Mort into F. The explanation of * is missing.[11]

Conclusions

The assessment has been performed correctly and this is a clear, mostly well described and accepted stock assessment. The RG feels it is a good basis for the provision of advice.

Suggestions for future benchmarks:

Estimate cannibalism mortality in the assessment model

The trends in SSB, fishing mortality and catches seem similar for southern and northern hake. Trying to do a combined assessment for the two stocks / look at stock identity might be interesting in a future benchmark.

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[7] Inserted a remark in the advice sheet
[8] Inserted a remark in the advice sheet
[9] Inserted a remark in the advice sheet
[10] Addressed in the advice sheet
[11] Addressed in the advice sheet

Megrim (Lepidorhombus boscii and L. whiffiagonis) in Di-visions VIIIc and IXa

1) Assessment type: update
2) Assessment: analytical
3) Forecast: presented
4) Assessment model: XSA (one for each species) – tuning by 2 (L. *whiffiagonis*) and 1 (L. boscii) commercial LPUE series (SP-CORUTR8c and SPE-CIES-AVILESTR) + 1 survey (SP-GFS)
5) Consistency: same assessment method as the previous years
6) Stock status: No PA reference points. L. *boscii* above proposed Fmsy value, L. *whiffiagonis* below proposed Fmsy in the last 2 years.
7) Management Plan.: None (but caught in mixed fisheries and recovery plans are in place for hake and *Nephrops* in the same area).

General comments

This section is well explained and the data and results are well presented.

The assessments were update assessments, done as laid out in the stock annex. First presentation of the stock annex for these stocks which presents clearly the data and method used for the assessment and the projections.

The RG appreciated the data screening done prior to running the assessment which provides preliminary information on the dynamics of the stock and its exploitation.

An attempt to apply a Bayesian model (Fernandez et al. 2010) allowing the incorporation of the existing discards data was presented in a WD (L. *boscii*). It gives a slightly different view of the state and dynamics of the stock than the assessment presented in the report :

- Values of SSB are in a similar range but the decreasing trend is less pronounced,
- Recruitment appears to be higher and exhibits higher variability
- F is higher (essential due to age 2) and less variable

The review group considers that this model could provide an interesting alternative to XSA for the assessment of this stock, and that it should be tested further during the next benchmark for this stock.

Advice sheet

Good

Section "biology" should specify "southern megrim stock" instead of "megrim" [12](same for four-spot megrim).

[12] Addressed in the advice sheet

Technical comments

L. whiffiagonis

Retrospective problems on SSB and F (though less pronounced for the least retrospective year)

Some temporal pattern in the residuals for the survey (prevalence of negative residuals until 1996, then prevalence of positive residuals until 2002).

No convergence of XSA is still a matter of concern.

The SSB is expected to increase by 2013 to levels observed 1995-2000 but this prediction is highly dependent on the good 2010 recruitment estimate (which is uncertain) and on the assumption of recruitment in 2011 and 2012 equal to GM98-08, which is twice the value of recruitment observed in 2008 and 2009.

This new assessment gives a different perception of the biological reference point than the 2010 assessment. BRP values are usually slightly revised at each assessment, but the change between the 2011 and 2010 assessments is larger than what was previously observed. Is it related to the relatively high 2010 recruitment? I agree that the Fmsy value should be kept for the moment at the value proposed in 2010.

Table 9.1.3 : legend should say length distribution in the landings in 2010.

L. boscii

As for L. *whiffiagonis*, some temporal pattern in the residuals for the survey (prevalence of negative residuals until 1996, then prevalence of positive residuals until 2002), and some year effect (e.g. in 1998).

Conclusions

Given the high proportion of discards, efforts to develop an assessment method able to deal with the available discard data are encouraged by the RG.

The assessments are well presented and correctly performed. Despite some minor concerns about the assessments (except for the discards problem), the RG views it appropriate for providing advice.

Sole in Divisions VIIIa,b (Bay of Biscay)

1) **Assessment type:** update (based on benchmark assessment 2011, WKFLAT 2011)
2) **Assessment**: age analytical (XSA)
3) **Forecast**: presented
4) **Assessment model**: XSA – tuning by 4 CPUE fleets: 2 from 1991 to 2009 (FR-SABLES and FR-ROCHELLE) and 2 since 2000 (FR-BB-IN-Q4 and FR-BB-OFF-Q2). No survey fleets used for tuning.
5) **Consistency**: Consistent with benchmark assessment 2011, updated with 2010 data for the 2 new CPUE fleets, but not for the old ones. As compared with last year's assessment, 2 new CPUE fleets were added, and the 2 survey fleets having data up to 2002 only (i.e. discontinued) were left out.
6) **Stock status**: Biomass fluctuating somewhat below Bpa (= MSY Btrigger) for last 12 years, currently estimated to be slightly above it (2011). Fpa has been slightly below / around Fpa for the last 5 years. Recruitment for this stock is uncertain but the 2010 estimate from XSA is very low (around 6 000) as compared to the assumed GM level (22 000).
7) **Man. Plan.**: Multi-annual plan agreed 2006: SSB above 13 000 t by 2008. The main elements in the plan are a 10% annual reduction in F and a 15% constraint on TAC change between years. In 2009, ICES estimated that this objective had been reached. Plan is **not** evaluated by ICES. First phase biomass target for 2008 has been reached and the plan should enter its second phase, requiring a choice of long term target as well as on the rules to reach it.

General comments

This was generally easy to follow and clearly described.

The WG took the decision to exclude from the assessment the 2010 values for La Rochelle and Les Sables tuning fleets because they now represent a too low fishing effort. This is in agreement with the decision of the benchmark assessment to exclude this series when they become no longer relevant. This decision is supported by the comparison of retrospective plots when assessment is carried out with and without 2010 for these two series : not including that year reduces significantly the retrospective problems on SSB and F, with no effect for R. The RG agrees with this decision of the WG.

There is some confusion about the use of catch and landings, as well as CPUE and LPUE, throughout the text / figures and tables for this stock, also in the stock annex. The most correct would be to use landings and LPUE throughout– as there is no estimate of discards included in the assessment. Discards are assumed to be low.

Year classes for which GM93-08 recruitment has been assumed (2008 to 2011) contribute 61% of the 2012 landings and 67.5% of the 2013 SSB! Perhaps predictions with a lower recruitment also should be tried out, to get knowledge about what could happen if R is lower than now assumed.

The order of tables and figures is strange – they do not appear in the same order as in the text. E.g. the figures come in the order 6.4, .5, .1, .2.

XSA did not converge after 30 iterations. This was also the case last year.

The absence of survey indices is of concern as it results in a large uncertainty on the estimates of recent recruitments (they depend only on fishery related information). The inclusion of the ORHEGO survey will hopefully improve the situation in a near future.

Comments from last year's RGBBI (2010) that still apply:

The practice of using different fresh / gutted transformation coefficients for catch and stock to be able to compare with the estimated PA values for SSB seems a bit odd, as I guess it would be possible to estimate new PA reference points for SSB.

Discards assumed to be low in recent years for the most important fleets. This needs more justification.

XSA didn't converge. Have any runs been done to test the sensitivity to the number of iterations run? The total absolute residual between the last two iterations seems small enough though. **Please look at the methods working group 2009 report, where they discuss convergence in XSA.**

This stock shows only small fluctuations over time, not surprising given the lack of contrast in the CPUE series that it is fitted to.

Technical comments

Input data broadly appear to be correct and suitable.

Report stock section:

Sec 6.2.1 §3: Figure 6.1a should be changed into **Table** 6.1a.[13]

Sec 6.2.2 §2: A general comment on the sampling level compared to the required EU DCR level would be useful.

Sec 6.2.2 §4-5. Start with the text lines (add them in one §), and remove the references to Tables and Figures. Then add a line saying something like: "The catch numbers at age are shown in Table 6.4 and Figures 6.5ab, and the mean catch weights at age in Table 6.5."[14]

Sec 6.2.4 §3: In the reference to Figure 6.1, also refer to Table 6.2a.[15]

Sec 6.3.2 Final XSA run, Table: 2011 XSA column, 5th line – according to stock annex this should be 3-7 instead of 3-8.[16]

Sec 6.3.2 Final XSA run, §2: The description in this § is not completely correct and should be revised.

Sec 6.3.3.2 §2: ", a decreasing trend is observed again until 2008," should be changed into ", stabilized at around 0.4,"[17]

Sec 6.3.3.2 §4: "Since 2004 the series is increasing," should be changed into "Since 2004 the series is **fluctuating**,"[18]

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[13] Addressed in the report
[14] Addressed in the report
[15] Addressed in the report
[16] Addressed in the report
[17] Addressed in the report
[18] Addressed in the report

Sec 6.3.4.2: "Long-term equilibrium landings and SSB (…) are estimated to be 4800 t and 14 900 t respectively". Cannot find this information anywhere. Rephrase to make clearer, or add a reference to where this information can be found.

Sec 6.3.6: What would the SSB estimates be if the low 2010 R estimate of Age 2 from the 2008 year class was used? What if the number of Age 2 recruits will be low (e.g. as 2010 estimate = 6000 instead of 22 000) from 2010 and onwards? On the other side, Figure 6.3 shows that if the old LPUE data series include 2010 data, the R estimate would be about the same level as before. Does this mean that a continued use of these old CPUE data series should be recommended?

Tables – general comment: justify numbers and headers equally (or use lines to separate columns).

Table 6.1a: A comment on the sometimes large difference between official landings and the WG landings could be useful. ** is not used in the table but explained below – should it be used for the 2010 data?

T6.2a: Header – change CPUE into LPUE. The table is not referred to in the text.

T6.3: Mention that MLS = 24 cm in the table legend.[19]

T6.6: remove "and survey catch" from the table legend.[20] According to the stock annex, FR-BB-IN-Q4 age 8 should not be marked as bold here (only ages 3-7).

T6.7 page 1: FR-SABLES and FR-ROCHELLE should have "Last year" as 2009. (But there is no data for these fleets in 2010 as can be seen from the log catchability residuals in page 2-3)

Figure 6.1: Change CPUE into LPUE[21]

F6.4ab – the figure legends turn black when printed.

F6.5a – the figure legend turns black when printed.

F6.8 – explain the u in F(3-6, u) in the figure legend, or remove the u.

Stock annex:

Should say something about spawning time here (it is mentioned in the advice).

<u>Advice</u>

Stock status – it seems like R of age 2 is given like GM for 2010 and 2011 – if so, this should be indicated by a different colour, as well as commented in the figure legend.[22]

Additional considerations – Comparison with previous assessment: Here it is said that "There is no major revision in data or in methodologies in the 2011 …… compared to …. 2010." (assessment) . The RGBBI does not agree with this – concerning tuning fleets, 2 survey fleets have been left out, the 2 old CPUE fleets have not been updated with 2010 data, and 2 new CPUE fleets have been added. This is a considerable change.[23]

Conclusions

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[19] Addressed in the report
[20] Addressed in the report
[21] Addressed in the report
[22] Addressed in the advice
[23] Addressed in the advice

Good assessment. Done as laid out in the annex. Clearly explained and presented.

The assessment has been performed correctly, but the large influence of the GM assumption for recruitment and the lack of any survey to tune the assessment is disturbing. The decision about leaving out 2010 data for the old CPUE fleets also seems to influence the recruitment estimate for 2010 (Figure 6.3), which is very low as compared to the recruitment time series. However, this is replaced by a GM estimate.

Future benchmark suggestions:

Estimate and include discards.

Add the ORHEGO survey time series when this is long enough

Why not updating the maturity ogive, using the maturity-length relationship from the 2000 sampling, but with annual values for the age length keys and for the length composition of each year. This would reflect the changes in maturity at age that could result from changes in growth (though it makes the assumption that the maturity length relationship is fixed in time).

Nephrops in divisions VIIIa,b (Bay of Biscay, FU 23-24)

1) **Assessment type:** **SALY**
2) **Assessment**: no new assessment
3) **Forecast**: no new forecast
4) **Assessment model**: XSA with slicing of length distribution of catch (combined sexes including discards) + tuning by 1 LPUE fleet
5) **Consistency**: last year's assessment was done following the same approach that 2 years before.
6) **Stock status**: No agreed biological reference points. Conclude that spawning biomass has been relatively stable over the entire period (between 8 000 and 10 000 t). The fishing mortality (0.4) is probably well above candidate FMSY of 0.17. Large retrospective pattern.
7) **Man. Plan.**: No specific management objectives are known to ICES. TAC does not limit the fishery. In light of the EU policy paper on fisheries management (12 May 2009, COM(2009) 224) this stock is classified under category 6. As the TAC was not constraining for landings over the years 2006-2009, that implies a TAC in 2011 based on reduction up to 15% of the averaged landings over recent years in order to reach Fmax proxy up to 2015.

General comments

As the advice is the same as last year, there was no new assessment or prediction presented this year. The report is basically the same as last year, with updated figures for the 2010 data.

Nephrops in divisions VIIIc (FU 25,31)

1) Assessment type: SALY
2) Assessment: no new assessment
3) Forecast:no new forecast
4) Assessment model: analysis of trends in LPUE
5) Consistency: last year's assessment was done following the same approach that 2 years before.
6) Stock status: very low state of the stock (for the two functional units).
7) Man. Plan.: TAC does not limit the fishery. A recovery plan has been agreed by the EC in 2006 (Council Regulation (EC) 2166/2005). 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. ICES has not evaluated the current recovery plan for Nephrops in relation to the precautionary approach or the MSY framework. Since 2006 there has been an annual reduction of fishing days by 10% in response to the recovery plan which has also not been evaluated by ICES.

General comments

As the advice is the same as last year, there was no new assessment or prediction presented this year. The report is basically the same as last year, with updated figures for the 2010 data.

In sections ecosystem aspects and section fisheries description change "sea" for "see" (both for FU25 and FU31)[24].

In section 11.1.1.3,

- 2nd paragraph : I don't understand the sentence "according to the precautionary approach, the new data available do not change the perception of FU 25 status "[25]
- last paragraph : "TACs of 101t and 91t were set for 2010 and 2011 respectively", but in section 11.1.5 (and 11.3 summary for the whole stock) "TAC in 2010 was 91t : which are the right figures for TAC in 2010 and 2011?[26]

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[24] Corrected in the report.
[25] Corrected in the report: "The new data (landings and lpue) available do not change the perception of FU 25 status, and give no reason to change the advice given in 2008".
[26] Corrected in the report section 11.3: "TAC in 2011 was 91t".

Nephrops in divisions IXa (FU 26-30)

1) Assessment type: SALY

2) Assessment: no new assessment

3) Forecast:no new forecast

4) Assessment model:

5) FU 26 and 27: analysis of LPUE trends (no discard estimates). FU 28 and 29: XSA with slicing of length distributions of landings (separate sexes, no discards as negligible) + tuning by 1 LPUE fleet and 1 survey fleet. FU 30: trends in LPUE and survey.

6) **Consistency: last year's assessment was done following the same approach** that 2 years before.

7) Stock status: No agreed biological reference points. FU 26 and 27 stocks are at an extremely low level. Increase in mean sizes and previous assessment (2006) indicate that the stocks suffer a progressive recruitment failure. FU 28 and 29 large retrospective pattern makes comment on current state of stock biomass and recruitment difficult but F appears more robust and suggests a decline in fishing mortality over the last 5 years. FU 30 – the trends in the time series are difficult to interpret and the review group find it difficult to justify the statement of stock stability in recent years.

8) Man. Plan.: TAC is spread over all function units and does not limit any of the fisheries. A recovery plan has been agreed by the EC in 2006 (Council Regulation (EC) 2166/2005). 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. ICES has not evaluated the current recovery plan for *Nephrops* in relation to the precautionary approach or the MSY framework. Seasonal closed boxes in FU 28, closed seasons in FU30 plus other regional limitations on fishing effort

General comments

<u>FU 26-27 :</u>

As the advice is the same as last year, there was no new assessment or prediction presented this year. The report is basically the same as last year, with updated figures for the 2010 data.

In sections 12.1.1.1 ecosystem aspects and section 12.1.1.2 fisheries description change "sea" for "see"[27].

In section 12.1.2, 2nd paragraph : I don't understand the sentence "according to the precautionary approach, the new data available do not change the perception of FU 26-27 status "[28]

<u>FU 28-29 :</u>

[27] Corrected in the report.

[28] Corrected in the report: "The new data (landings and lpue) available do not change the perception of FU 26-27 status, and give no reason to change the previous advice of zero catch".

As the advice is the same as last year, there was no new assessment or prediction presented this year. The report by large is the same as last year, with updated figures for the 2010 data. Some sections were rewritten to deleted obsolete information.

Survey in 2010 suggests that the stock has increased.

Two new methods for CPUE standardization using GLM are presented. They explain a larger proportion of the variance in the data than the GLM model previously applied, but give similar perception of the temporal variation in stock abundance.

The results of an analysis of the sensibility of the Fmsy proxies to the choice of the time window considered for the computation of the yield per recruits was presented. The values of the biological reference point were modified in the light of this new analysis.

FU 30

As the advice is the same as last year, there was no new assessment or prediction presented this year. The report by large is the same as last year, with updated figures for the 2010 data. Some sections were rewritten to deleted obsolete information.

Section 12.3.3 reports that an attempt to apply the ASPIC model was made, which results were in agreement with the conclusion of the WGHMM 2010.

In this section :

- rephrase "these results were agreed with the conclusions of WGHMM 2010"
- replace "because it was necessary to fix B/K at 0.95" by, "as assumptions had to be made on some parameter values"

References

Fernández, C., Cerviño, S., Pérez, N., and Jardim, E. 2010. Stock assessment and projections incorporating discard estimates in some years: an application to the hake stock in ICES Divisions VIIIc and IXa. – ICES Journal of Marine Science, 67: 1185–1197

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Annex V – Technical Minutes from RGCS1, 2011

Review of ICES **Working Group on Hake, Monk and Megrim [WGHMM] Report 2011,** 05 - 20 May 2011

Reviewers:	Asgeir Aglen (chair), Rick Officer, Rainer Oberst
Chair:	WG: Carmen Fernandez, Spain
Secretariat:	Cristina Morgado, Diane Lindemann

Review process

The Review Group considered the following stocks:

- ang-78ab
- mgw-78

Anglerfish (*Lophius piscatorius and Lophius budegassa*) in Divisions VIIb-k and VIIIa,b,d (report section 4)

1) **Assessment type: SALY**
2) **Assessment**: No analytical assessment is presented.
3) **Forecast**: Not presented
4) **Assessment model**: None presented
5) **Consistency**: No analytical assessment has been conducted on this stock since 2006.
6) **Stock status**: Uncertain
7) **Man. Plan.**: No management plan is in place for this stock.

General comments

Issues noted last year by the Review Group have not yet been addressed. A benchmark assessment for this stock is scheduled for 2012. Addressing the difficulties precluding an analytical assessment for this stock will require a substantial amount of work in advance of the next benchmark assessment.

Technical comments

An evaluation of the relative quality of the different tuning fleets (e.g. internal consistency of age compositions, presence of year effects, differences in trends related to different spatio-temporal patterns) should be provided. This is described for one series in the text but should be conducted in a consistent manner for all tuning series. Screening of these data using models such as SURBA would be worthwhile.

A similar analysis should also be conducted on the catch-at-age data prior to its incorporation in a stock assessment model. Anglerfish are very difficult to age. Consequently the ability to track cohorts of Anglerfish in this area may prove to be poor.

Conclusions

Should ageing and data difficulties continue to preclude an age-structured assessment in this area then the development of alternative methods of stock assessment is strongly encouraged (e.g. the length-based approach previously adopted for Northern shelf anglerfish). Development of survey-based methods to indicate the relative status of the stock should also be encouraged.

There is currently no accepted analytical basis for management advice. The status of the stock in relation to MSY and PA indicators is unknown.

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

1) **Assessment type: SALY**
2) **Assessment**: No analytical assessment is presented.
3) **Forecast**: Not presented
4) **Assessment model**: None presented
5) **Consistency**: No analytical assessment has been conducted on this stock since 2006.
6) **Stock status**: Uncertain
7) **Man. Plan.**: No management plan is in place for this stock.

General comments

An age-structured analytical assessment was conducted until 2006. The stock annex should explicitly explain why this assessment approach was discontinued.

The Stock Annex provides very useful ecosystem information

Technical comments:

The stock annex indicates that the age-length keys provided by Spain are "semestral" and combined by sex. However, the WG report suggests that the Spanish ALKs are presented for yearly aggregations of data. Given the dominance of the Spanish landings, the problems in ageing megrim in other seas, and the difficulties in tracking cohorts, it would be preferable to used temporally dis-aggregated ageing data. The WG should ascertain and consistently report the level of dis-aggreation of these data.

Last year's review group noted that no evaluation was provided of the relative quality of the different tuning fleets (e.g. internal consistency of age compositions, presence of year effects, differences in trends related to different spatio-temporal patterns). The WG has undertaken to complete analysis at the next benchmark assessment.

A similar analysis should also be conducted on the catch-at-age data prior to its incorporation in a stock assessment model. Megrim in other areas are difficult to age. Consequently the ability to track cohorts of Megrim in this area may also be poor.

Conclusions:

Should ageing and sampling difficulties also preclude an age-structured assessment in this area then the development of alternative methods of stock assessment is strongly encouraged (e.g. the preliminary Bayesian biomass-dynamic surplus production model proposed for Northern shelf megrim).

There is currently no accepted analytical basis for management advice. The status of the stock in relation to MSY and PA indicators is unknown. The WG's contention that the "stock appears stable at the present level of fishing" is not substantiated.