

8 Megrim in Divisions VIIIc and IXa

Ecosystem aspects

The Iberian Region along the eastern Atlantic shelf (Divisions VIIIc and IXa) is an upwelling area with high productivity, especially along the Portuguese and Galician coasts; upwelling takes place during late spring and summer. The region is characterized by a large number of commercial and non-commercial fish species caught for human consumption.

The genus *Lepidorhombus* is represented in eastern Atlantic waters by two species, Megrim (*L. whiffiagonis*) and four-spot megrim (*L. boscii*). Some general ecosystem studies on megrim have been carried out in the distribution area of these stocks (Rodríguez-Marín and Olaso, 1993; Sánchez and Gil, 1995; Sanchez et al, 1998 and 2001 and Rodríguez-Marín, 2002).

Megrim (*L. whiffiagonis*) is distributed in shallow waters of both ICES Divisions (VIIIc and IXa), with its highest abundance in Division VIIIc. Four-spot megrim (*L. boscii*) is distributed in both ICES Divisions (VIIIc and IXa). Both species of megrims disappear at the mouth of the most important rivers, probably associated with the occurrence of continental run-off, which acts mainly by modifying the composition of the grounds on which megrim depend for food, and creating grounds which are more appropriate for other flatfish, such as sole, plaice or thickback sole (*Dicologlossa cuneata*), adapted to estuarine conditions (Sánchez et al., 2001).

The dependence on sediment is probably related both to the distribution of suitable prey and to the ability of flatfish to bury themselves. Burying provides some protection from predators and reduces the use of energy. The juvenile habitat is often a small and generally shallower part of the total habitat occupied by the species. For certain species nursery areas play an important role, whereas for other species no specific nursery areas are known. In general for North Atlantic flatfish the magnitude of recruitment is mainly an effect of transport to and quality of areas for larval development (van der Veer *et al.*, 1990, 2000, Beverton and Iles 1992; Bailey 1994; Wennhage and Pihl 2001).

Many flatfish species show a gradual offshore movement of juveniles as they grow. This might indicate that habitat quality for flatfish is size-dependent. Another common pattern is the annual micro- and macroscale movements and migrations between spawning, feeding, and wintering areas (e.g., Molander 1925; Aro 1989; Gibson 1997).

There is a certain bathymetric segregation between the two species of megrims. *L. boscii* has a preferential depth range of 100 to 450 m and *L. whiffiagonis* of 50 to 300 m (Sanchez et al, 1998). Previous studies on megrim species show that they generally occurred outside zones with hydrographical instabilities that foster the vertical interchange of organic matter (Sánchez and Gil, 1995). Both species appear to show a gradual expansion in their bathymetric distribution throughout their lifetimes, with the larger individuals tending to occupy shallower waters than the juveniles. Bearing in mind that the two species have similar characteristics, a certain degree of interspecific competition may be assumed (Sanchez et al, 1998).

Most flatfishes are associated with finer sediments, rather than with hard substrata. The structure of the sea bed is an important factor controlling their distribution and there is increasing evidence that flatfish species can distinguish between and select sediments on the basis of their grain size (Gibson, 1994).

Juveniles of these species feed mostly on detritivore crustaceans inhabiting deep-lying muddy bottoms. Adult *L. boscii* feeds mainly on crustaceans inhabiting muddy surfaces (Rodríguez-Marín and Olaso, 1993; Rodríguez-Marín, 2002) as opposed to *L. whiffiagonis*, which are more ichthyophagous and where rates of crustacean in diet decrease with fish size (Rodríguez-

Marín, 2002). Such seabed occurs in the Cantabrian Sea at a greater depth than in the Mediterranean, since the internal Cantabrian continental shelf has a rocky structure (Rey and Medialdea, 1989). However, recent data show a greater presence of *L. boscii*, suggesting that this species is predominant on all soft bottoms of the continental shelf. Segregation and competition between species may be the result of several niche aspects (depth, distribution, diet, etc). None of the two species represent an important part of the diet for the main fish predators in this area. However, Velasco (IEO, Santander, Spain, pers. comm.) observed that they are eventually present in stomach contents of hake, anglerfish and rays.

The spawning period of these species is short. Mature males can be found from November to March and mature females from December to March, but spawning peaks in March. In southern areas megrim spawn from January to April (BIOSDEF, 1998; study contract 95/038).

The growth rate also varies, growth is quicker in the southern area for both species but the maximum length attained is smaller than in the north. The maximum age for megrim also varies with latitude. In Subarea VII the maximum age of megrim is 14 years, this decreases to 9 years in Divisions VIIIc and IXa (BIOSDEF, 1998; Landa et. al, 1996).

Fishery description

Management of megrim is both by TAC and technical measures. The agreed combined TAC for both species in ICES Divisions VIIIc and IXa for 2004 and 2005 was 1336 t. The minimum mesh size for towed gears ranges between 40 and 90 mm depending on the catch species composition. The minimum landing size is 20 cm.

Two species of megrim are included in the landings from ICES Divisions VIIIc and IXa: megrim and four-spot megrim. The percentage of megrim (*L. whiffiagonis*) in landings of both species by weight was between 12% and 25% over the whole period.

Total estimated international landings for both species in Divisions VIIIc and IXa for 2004 were 1 140 t which is approximately the 85% of the TAC (the TAC was 1 336 t for both species combined). No landings data are available for these stocks before 1986. However, some Spanish harbours have longer landing series for both species. The Spanish survey (SP-GFS) has provided abundance indices since 1983 (Figure 8.1.1). Total landings increased sharply in 1989, and then decreased to the lowest level in 2002 (837 t). The Spanish survey indicates erratic trends for the whole series, with a sharp increase in 1988 followed by a deep decrease. The lowest value of the series was found in 2003 increasing significantly in 2004.

The *Prestige* oil spill in northwest Spanish coast (November 2002) prompted a new effort redistribution, particularly in the Galician area. Some regulation measures, such as spatial and seasonal closures, were adopted to minimize the oil spill impact on the fisheries. Regarding trawl fleets a decrease of the activity of A Coruña (15%) and Marin (14%) fleets is apparent in relation to 2002 and 2004 fishing effort.

Both species are taken as a by-catch in the mixed bottom trawl fisheries targeting “white fish”, by Portuguese and Spanish fleets, and also in small quantities by the Portuguese artisanal fleet. The majority of the catches are taken by Spanish trawlers. The decreasing catch of hake has modified the target species of some of the Spanish fleets. These fleets now focus on other species such as horse mackerel, blue whiting, or mackerel, and do not take megrim in the catch. Since the early 90’s the Spanish trawl fleet has diversified its gear, introducing a new trawl gear which targets primarily horse mackerel. This gear, named Very High Vertical Opening (VHVO) trawl, affects catches of *L. boscii* more than *L. whiffiagonis* because of the different distribution area of the two species, and the fishing area where VHVO focuses its activity. The increasing use of pair trawlers (more than 90% of total catch and where the 85% of the total retained species by weight was blue whiting) and VHVO (around 77% of the total catch spe-

cies is horse mackerel) that do not catch megrims has reduced the effort on these species in recent years.

Atlantic mackerel, anglerfish, blue whiting, horse mackerel, hake, different cephalopods and *Nephrops* account for a high percentage (around 70%) of all retained species of this multispecies trawl fishery. A great number of species are caught as by-catch. Discards are to be important, particularly for younger ages of both megrims species. Artisanal fleets catch few megrims and discards of all species in these fleets are very low. Between 30-60% of the total species caught are discarded by trawlers. Non-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 most of the species.

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

8.1.1 General

See general section for both species.

8.1.2 Data

8.1.2.1 Commercial catches and discards

The Working Group estimates of landings for the period 1986 to 2004 are given in Table 8.1.1. Portuguese landings by species were estimated as last year using the relative abundance of each species in the sampled landings. Spanish landing in 2002 was revised due to change of magnitude of landing between species in some harbours. The total estimated international landings in Divisions VIIIc and IXa for 2004 was 150 t, this figure is lower than predicted from last year's assessment (190 t at *status quo* F) and it is slightly higher than previous year landings. Landings reached a peak of 980 t in 1990 and since then landings have steadily decreased to the lowest level reached in 2002 (117 t).

For megrim, discard data are available for Spanish trawlers in 1994, 1997, 1999 to 2001 and 2003 and 2004. Annual discards of megrim are estimated to be around 14 t to 60 t along the whole series. Discards in number represent between 10-45% of the total catch. Discard data are not used in this assessment because of the lack of data in some years of the series.

8.1.2.2 Biological sampling

Annual length compositions for total landings are given in Figure 8.1.2 for the period 1986 - 2004. Length distributions were available for Spanish and Portuguese landings until 1998. Portuguese length frequency data were previously mainly based on samples from Aveiro, but due to the uncertainties of this port for 1999 - 2004, no length frequency is presented for Portuguese landings for this period. Instead, Spanish length distributions were raised to the total international landing. Nevertheless, Portuguese landings only represent the 13% of the total landings on average (Table 8.1.2). There has been a decrease in landings of fish under 15 cm in length since 1994. This change probably results from a stricter enforcement of the minimum landing size (20 cm) in Divisions VIIIc and IXa and a mesh size increase. Table 8.1.2 shows the total length distribution by area in 2004. The bulk of landings in numbers in recent years (86%) is corresponding to fish of 20-30 cm in length.

The sampling levels for both species are given in Table 1.2.

Mean lengths and mean weights in landings are shown in the table below. The revision of the Spanish landing in 2002 due to a change in the proportion between the two megrim species in the landings from some harbours has modified the values of this year. There is no obvious change in mean length, except for 1987 and 1988.

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Mean length (cm)	24.2	21.4	21.9	25.0	22.3	23.5	24.6	23.4	25.1	24.7	24.6	24.6	24.7	25.3	25.8	25.1	26.0	25.7	26.1
Mean weight (g)	127	84	91	145	105	108	129	108	124	121	120	118	119	127	134	124	137	134	137

Age compositions for 1990 - 2004 (Table 8.1.3) were based on Spanish ALKs and, as in previous years, age compositions for 1986–1989 were based on a combined ALK (survey ALK from 1986 combined with an annual ALK from 1990). This year, ALKs for 1989, 1992, 1993 1996 and 2002 were revised but only small changes in 1996 and 2002 were produced. Catch weights-at-age of the international landings (Table 8.1.4) were also used as the weights-at-age in the stock and were also revised accordingly with the age length keys.

Natural mortality was set at 0.2 and assumed constant over all ages and years, as previously. This is the same value used for *L. whiffiagonis* in Subareas VII and Divisions VIIIab. The sex combined maturity ogive (BIOSDEF, 1998) was the same as used in previous assessments, as follows:

Age	0	1	2	3 and older
Propo. mature	0	0.34	0.90	1.00

8.1.2.3 Abundance indices from surveys

Portuguese survey indices and Spanish survey (SP-GFS) indices are summarised in Table 8.1.5. Portuguese biomass and abundance indices from July and August surveys have not information since 1999 and are not presented this year. However, a new biomass and abundance indices from the Portugal Crustacean survey are included this year. This survey covers the South and South-west of the Portuguese coast with a bathymetric distribution from 100 to 750 m.

Portuguese surveys indicate low abundance and recruitment indices for the whole period except for the initial year of the Crustacean survey (1997). It should be taken in consideration that during the years 1996, 1999, 2003 and 2004 the October Portuguese survey was carried out with a different vessel than that used in the rest of the series.

The Spanish survey (SP-GFS) covers the distribution area and depth strata of this species in the Spanish waters (ICES files).

Total biomass and abundance indices of Spanish survey were higher during the period 1988 - 1990, subsequently declining to a mean lower levels, which are common through the rest of the time series.

The Spanish survey recruitment indices at ages 0 and 1 indicate an extremely weak year class in 1993, followed by better recruitments, except for the relatively low values for the 1997 and 1998 year classes. The 1999 year class was estimated to be relatively strong compared to previous years, but the 2000, 2002 and 2003 year classes were again estimated to be relatively low. Estimated recruitment for 2004 by the Spanish survey at age 0 was also at the same low level than in the previous years, though this value is not used in the assessment due to its very scarce catches at this age. The total biomass indices of Spanish survey have been very low in 2003 and 2004 (Table 8.1.5).

Catch numbers-at-age and effort data sets for the Spanish survey (SP-GFS) in Divisions VIIIc and IXa (1988 - 2004) are given in Table 8.1.6.

8.1.2.4 Commercial catch-effort data

Fishing effort and LPUE data were available for the period 1986 - 2004 for one fleet of Spanish trawlers from A Coruña (SP-CORUTR8c) fishing in Division VIIIc, and for Portuguese trawlers fishing with occurrence of megrim in landings in Division IXa for the period 1988 – 2004. The effort from the Portuguese fleet is collected when occurrence of megrim. No information from Avilés (SP-AVILESTR) fishing in Division VIIIc is available for 2004, (Table 8.1.7 and Figure 8.1.3).

Commercial fleets used in the assessment to tune the model

Before 1993 A Coruña (SP-CORUTR8c) effort was generally stable, and a decreasing trend has been observed since then. The lowest value was reached in 2003 in which the restrictions imposed to the fishing activity due to the Prestige oil spill also had influence in the observed effort value. A slight increase is observed in 2004.

A Coruña LPUE (SP-CORUTR8c) (Table 8.1.7 and Figure 8.1.3) shows a relatively high stable values (1986 – 1992) and since 1998 the LPUE has declined. The revision of landing in 2002 has modified slightly the LPUE of this fleet.

Avilés (SP-AVILESTR) effort has decreased throughout the whole period to a very low level in recent years.

Avilés LPUE (SP-AVILESTR) shows an increasing trend between 1986 and 1990, with a sharp decrease in 1991; since then, it has shown a further upward and downward fluctuation with a peak in 1997, reaching the lowest value in 2003.

Catch numbers-at-age and effort data sets for these fleets are given in table 8.1.6.

Commercial fleets not used in the assessment to tune the model

Portuguese effort of 2002 and 2003 was revised. Portuguese effort series is quite variable although a declining trend can be observed since 1990s, apart from those values reached in 1999 and 2000 when it was reduced significantly (Table 8.1.7 and Figure 8.1.3).

Portuguese LPUE, shows a sharp decrease between 1990-92, and since then it has declined with a peak in 1997-1998 and it is at lowest level in recent years.

8.1.3 Assessment

See Section 1.5 for the general approach adopted by the Working Group for the catch-at-age analysis.

8.1.3.1 Input data

For this assessment the age range considered was 1 to 7+, the same as last year. Due to the low and fluctuating catches of age 0, data from this age was not included, though (as in previous years) the data are presented in Table 8.1.3. Landings numbers-at-age and effort data sets for two commercial Spanish fleets A Coruña (SP-CORUTR8c) 1986 – 2004 and Avilés (SP-AVILESTR), 1986-2003, and one Spanish survey (SP-GFS) in Divisions VIIIc and IXa (1988-2004) were used for tuning the VPA (see table 8.1.6).

8.1.3.2 Model

Data screening

This year this stock is subject to a benchmark assessment.

A separable VPA was run to screen the landing-at-age data, generate exploratory VPAs and to analyze exploitation patterns. We have used a reference age of 4, with a terminal F set at 0.3 and a terminal S at 1.0. The results show no unusual patterns of residuals specially in recent years, although there are high values particularly for the years prior to 1991 both for younger and middle ages. A negative year effect is apparent in 2003.

In order to check for catchability trends and residuals, XSA tuning runs were carried out on individual fleets with a low shrinkage (s.e. = 1.5) and assuming q dependent on stock size. No taper time was used. Results show some high residuals at age 5 for all indices. There appear to be no evident systematic temporal trends in residuals excepting the case of age 1 from Avilés (SP-AVILESTR). Avilés (SP-AVILESTR) and Spanish survey (SP-GFS) show year effects in 2003 (ICES files). The assumption that the catchability is dependent on stock size for younger ages was tested and it was confirmed by looking at the plots of log catchability residuals versus log stock numbers for each tuning fleet, in which the adjusted lines had positive slopes until age 4 (ICES files).

Exploratory XSA runs

One initial run was made with the same settings from the previous year but including all the ages in the tuning fleets (in last year assessment the age 1 from commercial fishing fleets was not included). This option was explored because in the analysis of the assessments with individual fleets the age 1 from A Coruña, SP-CORUTR8c, and Avilés, SP-AVILESTR, did not show too high residuals. However, when using all the fleets in the assessment, these two commercial fleets showed high log catchability residuals at age 1 (ICES files). It was decided to run an updated assessment, taking out age one from the two fishing fleets indicated. The Log catchability residuals of this assessment are presented in Figure 8.1.4.

Final run

Final settings used for this year and last year's assessments are detailed below:

			2004 WG		2005 WG
Fleets	SP-CORUTR8c	90-03	2-6	90-04	2-6
	SP-AVILESTR	90-03	2-6	90-03	2-6
	SP-GFS survey	90-03	1-6	90-04	1-6
Taper			No		No
Tuning range			14		15
Ages catch dep. Stock size			1-4		1-4
q plateau			5		5
F shrinkage s.e.			1.5		1.5
year range			5		5
age range			3		3

The retrospective analysis has shown a slight trend of overestimating SSB and recruitment in recent years (Figure 8.1.5).

8.1.3.3 Assessment result

The diagnostics from the XSA final run are presented in Table 8.1.8 and Figure 8.1.4. They show rather high log q residuals at older ages for all tuning fleets and shows a negative trend in recent years and oldest ages. A negative year effect is apparent for year 2003 for commercial fleets.

Fishing mortality and population numbers from the final XSA run are given in Table 8.1.9 and 8.1.10 and the summary results are presented in Table 8.1.11 and Figure 8.1.6.

8.1.3.4 Year class strength and recruitment estimations

The 2002 year class was estimated to have 3.7 million at 1-year-old based on the information from the Spanish survey (SP-GFS) (56%) and on one commercial fleet (SP CORUNATR) fleet (23% of weight). The estimation from the last year Working Group was close to 4.0 million at one year old.

The 2003 year class was estimated to have 4.0 million fish, based only on information from the Spanish survey (SP-GFS) (72% of weight). Survivors estimates based on P shrinkages contribute 25% of the weight in the final estimation, and it is different to the Spanish survey (SP-GFS). F shrinkage makes only a small contribution to the final estimate.

Estimates of recruitment for the years 1986 to 1989, for which age compositions were based on combined ALKs, were excluded from the estimation of GM recruitment. Year classes from the period of low SSB (1991-2002) were used to estimate GM recruitment (1992-2003). 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
2001	3285	XSA	31%	56%	13%
2002	3695	XSA	56%	23%	21%
2003	4026	XSA	72%		28%
200	4302	GM ₍₉₂₋₀₃₎			

8.1.3.5 Historic trends in biomass, fishing mortality and recruitment

SSB decreased from 2 550 t in 1990 to 960 t in 1995, the lowest value in the short series. Since then, SSB has remained relatively stable at low level (Table 8.1.11 and Figure 8.1.6). SSB in 2004 is around 1 100 t.

F has declined in recent years from the high levels observed prior to 1995 (range 0.31-0.46) and the high value reached in 1998 (0.38). The lowest value in the time series was reached in 2002 (0.11), and since then fishing mortality has been at low level. Fishing mortality in 2004 ($F = 0.14$) was estimated to be slightly higher than in 2003 ($F_{2-4} = 0.13$) and in 2002. Last year's assessment estimate of F_{2003} was 0.11.

Recruitment varies substantially throughout the time-series, but shows a general decline from the high levels prior to 1991 year class. The 1993 year class is the lowest value for the time series. Since 1999 the recruitments have been at low level.

8.1.3.6 Catch Options and prognosis

Population numbers for the catch forecast were taken from the final XSA outputs. Stock size at age 1 in the years 2005 to 2007 was assumed to be GM₉₂₋₀₃ (4.3 million). The exploitation pattern used was the average of 2002-2004. The WG considered that it is appropriate to use

the unscaled F average. Mean weights in the catch and in the stock were computed as averages for 2002-2004.

8.1.3.7 Short-term projections

The input data for the short-term predictions are shown in Table 8.1.12. The management options from the catch prediction are in table 8.1.13, and Figure 8.1.7 shows the short-term forecast summary. The detailed output by age group is given in Table 8.1.14. Assuming *status quo* F, landings in 2005 and 2006 are predicted to be 153 t and 175 t respectively.

Megrim starts to contribute strongly to SSB at 2 years of age. The predicted SSB will increase to around 1 620 t in 2007.

Comparison of these predictions for 2005 - 2007 with that from last year shows slightly lower values in the estimation of SSB. This is because of the behaviour of the assessment model that shows a trend to overestimate the SSB (as it was stated in the retrospective analysis). In addition, in recent years the recruitment has been low and the fishing mortality has increased scarcely in 2004. The contributions of recent year classes, to the predicted landings in 2006 and SSB in 2007, assuming GM₉₂₋₀₃ recruitment, are presented in Table 8.1.15. The assumed GM₉₂₋₀₃ recruitment in 2004 and 2005 contributes 15% to landings in 2006 and 34 % to the predicted SSB at the beginning of 2007.

8.1.3.8 Yield and biomass per recruit analysis

The input data for the long-term predictions are shown in Table 8.1.12.

The results of the yield- and SSB-per-recruit analysis are given in Table 8.1.16. and the stock-recruitment plot is shown in Figure 8.1.12. With the *status quo* exploitation ($F = 0.13$), and assuming GM₉₂₋₀₃ recruitment of 4.3 million, the equilibrium yield would be around 250 t with a SSB of 2 058 t. $F_{status\ quo}$ is slightly lower than $F_{0.1}$, which was estimated at the same level as the last year assessment (0.15). This represents an increase of 20% comparing with the $F_{status\ quo}$. There is no evidence of reduced SSB at $F_{0.1}$ level, producing an equilibrium yield of 270 t and SSB of 1 850 t. F_{max} is not well defined for this stock (Figures 8.1.7 and 8.1.10).

The equilibrium SSB is estimated at a lower value than that obtained in the last working group (2 210 t) due to the higher value of the estimated $F_{status\ quo}$. (in last year assessment $F_{sq} = 0.11$). It should be taken into account that natural mortality (0.2) almost duplicates the value of *status quo* F and this could relatively affect the estimation of yield per recruit. $F_{status\ quo}$ is far below F_{med} (0.26).

8.1.3.9 Sensitivity and risk analysis

A sensitivity analysis was carried out to examine the contribution of different sources of uncertainty to the variance of predicted SSB and yield. The input data are presented in Table 8.1.17 and the results are shown in Figure 8.1.8. Probability profiles of expected yield and SSB are given in Figure 8.1.9.

The 50% probability of the expected *status quo* yield in 2006 and SSB in 2007 are almost equal to those predicted by short term. The approximate 90% confidence interval of the expected *status quo* yield in 2006 is 130 t - 240 t. The probability that SSB in 2007 will fall below the B_{loss} (960 t) is less than 1 %, at *status quo* F, based on the short-term predictions.

For the medium term predictions recruitment was selected by bootstrap (1992-2003 period). Considering the application of *status quo* F in the medium term predictions, the yield and the SSB are expected to increase (Figure 8.1.10), which is the consequence above all of the relatively low level of the fishing mortality and stable recruitment.

8.1.4 Biological reference points

Results from the PA software Excel add-in are shown in Figures 8.1.11 and 8.1.12.

The table below shows a summary of the reference points proposed. F_{med} was proposed by ACFM in 2000 as an interim reference point:

	ACFM 1998	WG 2000	ACFM 2000	WG 2002	ACFM 2002
F_{lim}	Not defined	Not defined		Not defined	
F_{pa}	No proposal	No proposal	Not adopted	No proposal	Not adopted
B_{lim}	900 t ($B_{loss}=B_{95}$ WG98)				
B_{pa}	1 500 t ($B_{lim} \times$ 1.64)	900 t ($B_{loss}=B_{95}$ WG98)	Not adopted	1 500 t (stock history)	Not adopted

The WGMG 2004 Report presented some fishing mortality reference points for the main ICES by using a non-parametric method CONCave Recruitment (CONCR) based on the 75% confidence limit estimated. This estimation gives a value of 0.30 close to the F_{med} value. It has to be highlighted that the estimate of F_{med} in this assessment (0.26) is lower to those obtained in other years' assessments (0.43 in WG 2002, 0.38 in WG 2003 and 0.28 in WG 2004). F_{med} is unstable because there are two distinct group of points giving low and high SSB/R relationships. At F_{med} , the level of long-term SSB is slightly lower than 1 320 t, which is above B_{loss} (960 t).

There is no new information to define reference points B_{lim} and B_{pa} for this stock. B_{loss} is now estimated at 960 t (1996), similar to last year estimation but slightly higher to those values obtained in previous assessments when it was proposed to estimate B_{pa} .

Since 1992 both high and low recruitment has been observed at low stock level. Most of the high values of stock-recruitment correspond to the initial years of the time-series, when a combined ALK was used (Figure 8.1.12). There is a narrow range of SSB and short time-series of data for this stock. Recruitment has been variable and SSB has been relatively stable.

8.1.5 Management Strategies

Discard data were not used in this assessment because of the lack of data in some years of the series. Discards in number represent between 10-45% of the total catch and they are thought to be important for younger ages.

8.1.6 Comments on the assessment

The inclusion of discards in the assessment should have influence in the perception of the state of the stock. It is therefore recommended to follow with the collection of discard data in order to get a significant number of years to be included in the assessment.

There is a lack of data on age 1-group in the landings of commercial fleets. However, the Spanish survey (SP-GFS) provides good information for this age.

Comparison of this assessment with that from last year shows similar trends for F and SSB (Fig 8.1.13).

This assessment indicates that SSB since 1990 has remained relatively stable at low level. Since 1992 both high and low recruitment has been observed at low stock level.

Megrim starts to contribute strongly to SSB at 2 years of age. Around 34% of the predicted SSB in 2006 relies on year classes for which recruitment has been assumed as GM_{92-03} .

Recent F is estimated below assumed natural mortality which has a high influence in yield per recruit results.

8.1.7 Management considerations.

There is a probability less than 1 % of SSB falling below B_{loss} at *status quo* F , based on the short-term predictions.

It is appropriate to take into account that megrim, *L. whiffiagonis*, is taken in mixed fisheries. 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. Megrim is a by-catch in the mixed fisheries that are in general directed to white fish. Therefore, the fishing mortality of megrims is in fact controlled by the restrictions imposed to the demersal mixed fisheries to preserve and to rebuild the overexploited stocks of southern hake and Nephrops.

Table. 8.1.1 Megrim (*L. whiffiagonis*) in Divisions VIIIc, IXa. Total landings (t).

Year	Spain			Portugal	Total
	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

* Revised

**Table 8.1.2 Megrim (*L. whiffiagonis*) Divisions VIIIc and IXa.
Annual length compositions of landings ('000 fish) in 2003**

Length (cm)	Div. VIIIc	Div. IXa	Total
10			
11			
12			
13			
14		0.3	0.3
15		0.1	0.1
16		0.1	0.1
17		0.2	0.2
18	0.9	0.1	1.0
19	5.6	0.2	5.8
20	40.3	1.5	41.8
21	63.4	2.3	65.7
22	86.6	3.0	89.6
23	115.7	4.0	119.7
24	125.9	4.4	130.3
25	113.3	3.9	117.2
26	104.1	3.8	108.0
27	78.0	3.2	81.3
28	67.8	3.3	71.1
29	54.4	2.7	57.2
30	43.5	1.9	45.4
31	28.3	1.4	29.7
32	21.7	1.0	22.7
33	16.1	2.3	18.3
34	15.0	0.5	15.5
35	18.0	1.3	19.3
36	10.2	0.4	10.6
37	10.9	0.5	11.3
38	4.6	0.2	4.7
39	3.3	0.1	3.4
40	1.7	0.1	1.8
41	1.9	0.1	1.9
42	2.4	0.1	2.5
43	1.0	0.1	1.0
44	0.7	0.0	0.7
45	0.8	0.0	0.9
46	0.4	0.1	0.5
47	0.9	0.1	1.0
48	0.6		0.6
49	0.2		0.2
50+	0.1	0.0	0.1
Total	1038	43	1082

Table 8.1.3 Megrin (*L. whiffiagonis*) in Divisions VIIIc and IXa. Catch numbers at age.

Catch numbers at age Numbers*10**3

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AGE																			
* 0	(15)	(0)	(0)	(0)	(8)	(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
2	1952	2303	3344	1903	2135	2352	392	1703	432	36	1486	1062	882	240	122	305	151	242	235
3	668	752	1038	678	775	801	677	312	1784	254	37	1011	1205	960	598	300	310	265	205
4	639	394	738	631	868	690	1120	526	549	620	279	76	881	693	507	244	86	175	241
5	501	289	530	501	329	643	591	357	624	241	502	362	214	442	361	220	164	80	184
6	201	80	181	190	376	141	77	102	330	69	147	305	328	105	83	160	80	54	100
+gp	194	71	130	253	558	59	68	36	119	72	81	116	149	207	161	118	37	48	71
TOTALNUM	5168	5909	8938	4916	9271	5704	3987	3555	3878	1801	2733	3014	3735	2667	1841	1387	860	993	1082
TONSLAND	659	497	817	714	977	614	516	383	479	218	329	356	446	343	253	175	117	134	149
SOPCOF %	95	95	95	99	99	100	100	100	100	101	102	100	101	101	101	101	100	101	100

* Age 0 was not used in the assessment.

Table 8.1.4 Megrin (*L. whiffiagonis*) in Divisions VIIIc and IXa. Catch weights at age (kg.).

Mean weight at age

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AGE																			
1	0.045	0.049	0.045	0.051	0.041	0.039	0.034	0.036	0.046	0.060	0.054	0.056	0.046	0.056	0.056	0.058	0.058	0.056	0.062
2	0.102	0.084	0.090	0.102	0.098	0.091	0.095	0.080	0.069	0.071	0.088	0.083	0.070	0.070	0.072	0.085	0.082	0.089	0.085
3	0.121	0.092	0.103	0.122	0.129	0.108	0.125	0.117	0.100	0.102	0.121	0.102	0.099	0.089	0.094	0.088	0.115	0.116	0.109
4	0.164	0.143	0.150	0.164	0.166	0.146	0.155	0.147	0.130	0.127	0.128	0.126	0.130	0.119	0.121	0.118	0.119	0.150	0.130
5	0.216	0.176	0.191	0.224	0.207	0.173	0.209	0.195	0.150	0.165	0.164	0.141	0.155	0.160	0.161	0.148	0.162	0.194	0.157
6	0.316	0.314	0.290	0.293	0.241	0.252	0.321	0.237	0.190	0.212	0.211	0.199	0.189	0.216	0.215	0.172	0.206	0.252	0.204
+gp	0.477	0.415	0.424	0.520	0.369	0.420	0.534	0.538	0.344	0.340	0.354	0.341	0.324	0.296	0.296	0.256	0.388	0.382	0.320
SOPCOFAC	0.949	0.950	0.949	0.994	0.986	1.002	1.000	1.003	1.001	1.006	1.020	0.998	1.008	1.007	1.010	1.007	1.001	1.0059	1.0002

Table 8.1.5 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		
	October	Crustaceans	s.e	Mean	s.e.	Crustaceans	s.e.	Mean	s.e.	Portugal (n)	Spain (n/30 min)*10			
										October				
1983				0.96	0.14	1983		14.0	2.45	1983	18.8	77.2		
1984				1.92	0.34	1984		28.0	4.57	1984	3.2	160.8		
1985				0.89	0.15	1985		9.0	1.34	1985	1.0	27.4		
1986				1.65	0.20	1986		33.0	6.22	1986	137.8	111.9		
1987				ns		1987		ns		1987	ns	ns		
1988				3.52	0.64	1988		43.0	8.82	1988	6.5	166.0		
1989				3.13	0.53	1989		42.0	7.04	1989	29.0	139.6		
1990	0.08			3.08	0.86	1990		28.0	5.50	1990	5	1.1	91.3	
1991	0.11			1.22	0.17	1991		10.0	1.67	1991	5	12.6	13.8	
1992	0.11			1.39	0.20	1992		18.0	3.35	1992	8	0.1	120.3	
1993	0.04			1.46	0.24	1993		15.0	3.23	1993	1	0.0	27.6	
1994	0.05			1.02	0.20	1994		8.0	1.87	1994	+	6.0	0.5	
1995	0.01			1.03	0.16	1995		11.0	1.86	1995	+	4.1	73.8	
*1996	+			1.64	0.22	*1996		21.0	3.60	*1996	+	4.5	112.6	
1997	+	1.4	1.0	1.79	0.25	1997	7.2	4.8	20.0	3.26	1997	+	1.5	59.1
1998	0.01	0.2	0.1	1.47	0.23	1998	1.1	0.5	14.8	2.64	1998	+	0.2	25.6
**1999	+	0.1	0.1	1.59	0.29	**1999	0.6	0.5	15.5	3.05	**1999	+	5.6	12.6
2000	+	0.1	0.0	1.80	0.35	2000	0.3	0.2	19.4	4.46	2000	+	0.5	69.2
2001	0	0.0	0.0	1.45	0.28	2001	0.1	0.0	12.8	2.77	2001	+	1.9	19.7
2002	0.04	0.1	0.0	1.26	0.24	2002	0.2	0.1	12.1	2.65	2002	+	0.8	25.3
*2003	0.01	0.1	0.1	0.82	0.16	*2003	0.2	0.1	7.2	1.26	*2003	0.05	0.5	19.1
***2004	0.01	0.1	0.1	1.08	0.20	***2004	0.3	0.1	8.4	1.39	***2004	+	1.4	18.3

+ less than 0.01

na no available

ns no survey

* Portuguese Survey used a different vessel and gear

** Portuguese Survey cover partial area only

*** Crustaceans Portuguese Survey, vessel with gear operational problems.

Table 8.1.6 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Tuning data.

FLT01: SP-CORUTR8c. 1000 Days by 100 HP (thousand)(*)									
1986	2004								
1	1	0	1						
1	7	Eff.							
39.8	137	363	150	180	154	59	34	39.8	1986
34.7	840	650	216	113	90	32	26	34.7	1987
42.2	286	909	320	301	228	80	40	42.2	1988
44.4	56	390	161	207	159	58	39	44.4	1989
44.4	98	357	216	361	153	161	162	44.4	1990
40.4	53	436	190	241	250	61	22	40.4	1991
38.9	22	92	259	562	355	46	39	38.9	1992
44.5	1	189	91	219	168	43	7	44.5	1993
39.6	0	14	208	114	167	119	25	39.6	1994
41.5	211.7	13.4	63.7	139.4	50.2	13.8	9.4	41.5	1995
35.7	9.7	246.8	9.6	66.2	130.5	39	20.6	35.7	1996
35.2	3.3	114.8	175.2	17.4	89.4	83.2	28.6	35.2	1997
32.6	1.6	49.7	138.4	172.2	48.8	100.7	45.4	32.6	1998
30.2	2.2	23.8	122.2	128.4	105.8	29.4	59.1	30.2	1999
30.1	3.7	16.6	110.8	152.8	146.3	37	43.3	30.1	2000
29.9	5.6	54.7	55	66	71	57.6	40.4	29.9	2001
21.8	3.7	23	78.3	21.7	59.1	31.1	12.3	21.8	2002
18.5	37.4	27.8	28.8	29	17.6	14.4	12.3	18.5	2003
21.1	2.9	15.8	17.9	27	25.5	19	17.8	21.1	2004
FLT02: SP-AVILESTR. 1000 Days by 100 HP (thousand) (*)									
1986	2003								
1	1	0	1						
1	7	Eff.							
10.8	272	344	285	139	121	102	61	10.8	1986
8.3	341	272	295	140	84	97	32	8.3	1987
9	1065	661	547	261	113	141	62	9.0	1988
8.1	605	372	390	183	105	126	49	8.1	1989
8.5	3147	684	162	125	33	36	51	8.5	1990
7.7	668	583	156	68	57	10	5	7.7	1991
0	0	0	0	0	0	0	0	0.0	1992
7.6	415	538	33	36	19	9	7	7.6	1993
9.6	16	148	461	114	112	43	20	9.6	1994
6.1	20.8	1.2	22.1	71.8	35.8	13.3	7.4	6.1	1995
4.5	59.1	316.6	6.3	47.2	89.6	28.1	23.2	4.5	1996
4.7	41.6	381.4	269.2	14.8	66.5	55.4	20.1	4.7	1997
5.4	9.7	187.3	227.6	141.5	31.5	42.2	23.1	5.4	1998
6.8	6.8	71.9	260.5	172.2	106.2	24.9	45.7	6.8	1999
4.5	11.2	21.2	93.3	89.7	57.1	14	20.6	4.5	2000
1.8	7.9	43	41.4	26.2	24.8	18	18.3	1.8	2001
2.7	12.5	36.2	54.8	14.8	21.3	12.3	10.8	2.7	2002
2.5	5.9	19.2	23.9	16	7.1	5.5	6.4	2.5	2003
FLT03: SP-GFS (n/30 min)									
1988	2004								
1	1	0.75	0.83						
1	7								
1	16.6	12.48	5.18	4.54	2.66	0.74	0.53	101	1988
1	13.96	11.2	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	1.3	0.71	0.27	0.04	118	1994
1	7.38	0.2	0.55	1.65	0.7	0.17	0.1	116	1995
1	11.26	6.45	0.25	1.03	1	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	4.3	4.33	2.08	0.41	0.6	0.15	114	1998
1	1.26	4.47	4.36	2.5	1.46	0.46	0.77	116	1999
1	6.92	2.46	2.84	3.42	2.14	0.7	0.39	113	2000
1	1.97	4.6	1.14	2.31	1.58	0.61	0.4	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	1.3	0.8	0.66	0.46	114	2004

Age 1 excluded in this year assessment for SP-CORUTR8c and SP-AVILESTR fleets.

Table 8.1.7 Megrim (*L. whiffiagonis*). LPUE data by fleet in Divisions VIIIc and IXa.

Year	A Coruña Trawl in VIIIc			Avilés Trawl in VIIIc			Portugal trawl in IXa		
	Landings	Effort	LPUE ¹	Landings	Effort	LPUE ¹	Landings	Effort	LPUE ²
1986	156	39.8	3.92	141	10.8	13.04			
1987	155	34.7	4.47	102	8.3	12.23			
1988	263	42.2	6.24	180	9.0	19.94	74.9	38.5	1.95
1989	196	44.4	4.41	143	8.1	17.75	92.2	44.7	2.06
1990	270	44.4	6.08	266	8.5	31.33	86.0	39.0	2.20
1991	211	40.4	5.22	102	7.7	13.28	85.5	45.0	1.90
1992	255	38.9	6.55	56	na		32.6	50.9	0.64
1993	121	44.5	2.72	67	7.6	8.76	31.7	44.2	0.72
1994	108	39.6	2.73	96	9.6	9.95	25.8	45.8	0.56
1995	28	41.5	0.67	50	6.1	8.16	21.4	37.0	0.58
1996	72	35.7	2.01	67	4.5	14.72	22.2	46.5	0.48
1997	75	35.2	2.12	83	4.7	17.70	41.5	33.4	1.24
1998	90	32.6	2.78	74	5.4	13.78	60.1	43.1	1.39
1999	73	30.2	2.40	83	6.8	12.21	4.3	25.3	0.17
2000	79	30.1	2.63	41	4.5	9.26	6.9	27.0	0.25
2001	49	29.9	1.65	24	1.8	13.01	1.3	43.1	0.03
2002*	36	21.8	1.66	21	2.7	7.78	1.0	31.2	0.03
2003*	25	18.5	1.36	13	2.5	5.06	15.3	40.5	0.38
2004	22	21.1	1.06	27	na		3.1	32.0	0.10

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

² LPUE as catch (kg) per hour.

* Revised the effort from the Portuguese trawl

Table 8.1.8 Megrin (*L. whiffiagonis*) in Divisions VIIIc and IXa. Tuning diagnostic.

Lowestoft VPA Version 3.1

18/04/2005 14:02

Extended Survivors Analysis

Megrin (*L. whiffiagonis*) in Divisions VIIIc and IXa

CPUE data from file fleet051avco.txt

Catch data for 19 years. 1986 to 2004. Ages 1 to 7.

Fleet	First year	Last year	First age	Last age	Alpha	Beta	
FLT01:SP-CORUTR8c 10		1990	2004	2	6	0	1
FLT02:SP-AVILESTR 10		1990	2004	2	6	0	1
FLT03:SP-GFS (thousa		1990	2004	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 = .00534

Final year F values

Age	1	2	3	4	5	6
Iteration 29	0.0127	0.0938	0.1232	0.2028	0.2042	0.2451
Iteration 30	0.0127	0.0935	0.1228	0.2019	0.2028	0.2427

Table 8.1.8 (Cont'd)

Regression weights										
	1	1	1	1	1	1	1	1	1	1
Fishing mortalities										
Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1	0.069	0.029	0.014	0.021	0.009	0.003	0.013	0.01	0.039	0.013
2	0.036	0.296	0.21	0.208	0.084	0.07	0.117	0.064	0.106	0.094
3	0.143	0.047	0.336	0.392	0.368	0.311	0.247	0.167	0.152	0.123
4	0.39	0.23	0.129	0.555	0.411	0.338	0.2	0.103	0.134	0.202
5	0.468	0.637	0.528	0.643	0.606	0.391	0.24	0.201	0.132	0.203
6	0.467	0.588	1.084	1.471	0.778	0.212	0.3	0.128	0.094	0.243
1										
XSA population numbers (Thousands)										
YEAR	AGE									
	1	2	3	4	5	6				
1995	8.40E+03	1.12E+03	2.11E+03	2.12E+03	7.13E+02	2.05E+02				
1996	7.78E+03	6.42E+03	8.88E+02	1.50E+03	1.18E+03	3.65E+02				
1997	6.42E+03	6.19E+03	3.91E+03	6.93E+02	9.75E+02	5.09E+02				
1998	4.10E+03	5.18E+03	4.11E+03	2.29E+03	4.99E+02	4.71E+02				
1999	2.45E+03	3.29E+03	3.45E+03	2.27E+03	1.08E+03	2.15E+02				
2000	3.75E+03	1.98E+03	2.48E+03	1.95E+03	1.23E+03	4.80E+02				
2001	3.34E+03	3.06E+03	1.51E+03	1.49E+03	1.14E+03	6.83E+02				
2002	3.28E+03	2.70E+03	2.23E+03	9.68E+02	9.95E+02	7.34E+02				
2003	3.70E+03	2.66E+03	2.07E+03	1.55E+03	7.15E+02	6.67E+02				
2004	4.03E+03	2.91E+03	1.96E+03	1.46E+03	1.11E+03	5.13E+02				
Estimated population abundance at 1st Jan 2005										
	0.00E+00	3.26E+03	2.18E+03	1.42E+03	9.79E+02	7.45E+02				
Taper weighted geometric mean of the VPA populations:										
	5.47E+03	4.20E+03	2.74E+03	1.75E+03	9.99E+02	4.59E+02				
Standard error of the weighted Log(VPA populations) :										
	0.6019	0.5488	0.4166	0.3391	0.2706	0.4178				
1										
Log catchability residuals.										
Fleet : FLT01:SP-CORUTR8c 10										
Age	1990	1991	1992	1993	1994					
1	No data for this fleet at this age									
2	0.23	0.59	0.35	-0.19	-0.68					
3	0.1	-0.11	0.4	0.02	-0.13					
4	0.11	0.13	0.29	0.17	0.13					
5	0.39	0.82	1.32	0.18	0.7					
6	0.17	0.37	0.09	0.11	0.97					

Table 8.1.8 (Cont'd)

Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1	No data for this fleet at this age									
2	0.23	0.23	-0.17	-0.4	-0.34	-0.03	0.2	0.01	0.23	-0.24
3	-0.13	-0.23	-0.06	-0.18	-0.04	0.23	0.33	0.28	-0.1	-0.38
4	-0.19	-0.11	0.11	-0.06	-0.16	0.05	-0.04	0.05	-0.23	-0.24
5	-0.62	0.06	-0.17	0.03	0.09	0.19	-0.52	-0.27	-1.02	-1.18
6	-0.66	0	0.64	1.14	0.5	-0.33	-0.19	-0.64	-1.17	-0.69

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	-5.4428	-5.4428
S.E(Log q)	0.6722	0.6496

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	0.54	2.627	7.81	0.72	15	0.35	-7.48
3	0.54	3.216	7.2	0.79	15	0.23	-6.66
4	0.4	4.634	6.87	0.82	15	0.17	-6.05

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	0.71	0.547	5.85	0.21	15	0.49	-5.44
6	1.26	-0.529	5.25	0.24	15	0.84	-5.42

Fleet : FLT02:SP-AVILESTR 10

Age	1990	1991	1992	1993	1994
1	No data for this fleet at this age				
2	-0.09	0.07	99.99	-0.2	0.14
3	-0.13	-0.29	99.99	-0.47	0.04
4	-0.07	-0.26	99.99	-0.55	0.23
5	-0.53	-0.04	99.99	-1.27	0.68
6	-0.71	-0.82	99.99	-0.73	0.33

Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1	No data for this fleet at this age									
2	-0.39	-0.05	0.02	-0.1	-0.07	0.15	0.29	0.2	0.03	99.99
3	-0.55	-0.17	0.23	0.05	0.17	0.19	0.72	0.25	-0.05	99.99
4	-0.18	0.05	0.02	0.31	0.25	0.23	0.26	0.04	-0.32	99.99
5	-0.08	0.71	0.51	0.35	0.55	0.11	0.2	-0.24	-0.96	99.99
6	0.18	0.7	1.21	1.03	0.78	-0.44	0.42	-0.52	-1.17	99.99

Table 8.1.8 (Cont'd)

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	-4.4048	-4.4048
S.E(Log q)	0.6194	0.789

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	0.35	6.92	7.16	0.91	13	0.19	-5.12
3	0.49	2.346	6.4	0.66	13	0.35	-4.88
4	0.64	1.608	5.73	0.64	13	0.28	-4.79

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	0.69	0.644	5.17	0.28	13	0.44	-4.4
6	1.79	-0.922	3.02	0.11	13	1.42	-4.38
1							

Fleet : FLT03:SP-GFS (thousa

Age	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1	-0.26	-0.3	-0.1	0.09	-0.69	-0.15	0.11	0	0.06	0.25	0.61	0.14	0.28	0.04	-0.08
2	0.03	-0.24	-0.36	0.01	-0.63	-0.36	-0.02	0.07	-0.07	0.35	0.51	0.45	0.34	-0.07	0
3	0.08	-0.54	-0.16	-0.42	0.06	-0.52	-0.15	-0.01	0.1	0.27	0.33	0.27	0.52	0.13	0.04
4	0.2	-0.03	-0.06	0.03	0.1	-0.19	-0.16	0.14	-0.08	-0.03	0.26	0.26	-0.23	-0.18	-0.02
5	0.47	0.1	0.5	-0.26	0.29	-0.13	-0.14	-0.05	-0.17	0.3	0.38	0.04	0.01	-0.69	-0.65
6	0.25	-0.43	-0.65	-0.57	-0.1	-0.3	-0.06	0.11	0.92	0.9	0.06	-0.36	-0.74	-1.35	-0.04

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	-6.2694	-6.2694
S.E(Log q)	0.3626	0.6135

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	0.46	3.693	7.87	0.78	15	0.31	-7.2
2	0.57	2.614	7.47	0.74	15	0.33	-6.91
3	0.57	2.192	7.32	0.67	15	0.32	-6.92
4	0.53	3.618	6.95	0.82	15	0.17	-6.54

Table 8.1.8 (Cont'd)

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	0.861	6.42	0.46	15	0.27
	6	1.29	-0.628	6.52	0.27	15	0.78
	1						

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 2003

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT01:SP-CORUTR8c 10	1		0	0	0	0	0
FLT02:SP-AVILESTR 10	1		0	0	0	0	0
FLT03:SP-GFS (thousa	3015	0.319		0	0	1	0.721
P shrinkage mean	4203	0.55					0.246
F shrinkage mean	2753	1.5					0.033

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
	3262	0.27	0.12	3	0.432
					0.013

1

Age 2 Catchability dependent on age and year class strength

Year class = 2002

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT01:SP-CORUTR8c 10	1700	0.367		0	0	1	0.231
FLT02:SP-AVILESTR 10	1		0	0	0	0	0
FLT03:SP-GFS (thousa	2216	0.234	0.018	0.08	0.08	2	0.557
P shrinkage mean	2744	0.42					0.197
F shrinkage mean	2300	1.5					0.015

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
	2175	0.18	0.08	5	0.477
					0.094

Age 3 Catchability dependent on age and year class strength

Year class = 2001

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT01:SP-CORUTR8c 10	1169	0.208	0.282	1.35	2	0.279	0.147
FLT02:SP-AVILESTR 10	1464	0.2	0	0	1	0.28	0.119
FLT03:SP-GFS (thousa	1550	0.192	0.102	0.53	3	0.313	0.113
P shrinkage mean	1752	0.34					0.122
F shrinkage mean	652	1.5					0.006

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
	1424	0.11	0.09	8	0.786
					0.123

Table 8.1.8 (Cont'd)

Age 4 Catchability dependent on age and year class strength

Year class = 2000

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT01:SP-CORUTR8c 10	829	0.143	0.065	0.46	3	0.333	0.233
FLT02:SP-AVILESTR 10	1124	0.176	0.108	0.62	2	0.194	0.177
FLT03:SP-GFS (thousa	1057	0.139	0.074	0.53	4	0.347	0.188
P shrinkage mean	999	0.27				0.122	0.197
F shrinkage mean	809	1.5				0.004	0.239

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F	
	979	0.08	0.05	11	0.615	0.202

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

Year class = 1999

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT01:SP-CORUTR8c 10	691	0.14	0.201	1.44	4	0.343	0.216
FLT02:SP-AVILESTR 10	809	0.152	0.197	1.3	3	0.264	0.187
FLT03:SP-GFS (thousa	758	0.132	0.217	1.65	5	0.389	0.198
F shrinkage mean	448	1.5				0.004	0.316

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F	
	745	0.08	0.11	13	1.335	0.203

1

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

Year class = 1998

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT01:SP-CORUTR8c 10	337	0.138	0.163	1.18	5	0.34	0.238
FLT02:SP-AVILESTR 10	374	0.149	0.217	1.45	4	0.264	0.217
FLT03:SP-GFS (thousa	303	0.129	0.162	1.25	6	0.392	0.261
F shrinkage mean	468	1.5				0.005	0.177

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F	
	333	0.08	0.09	16	1.175	0.243

Table 8.1.9. Megrim (*L. whiffiagonis*) Div. VIIIc and IXa. Estimates of fishing mortality at age.

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

At 18/04/2005 14:02

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age		1986	1987	1988	1989	1990	1991	1992	1993	1994
AGE										
	1	0.1334	0.2047	0.3657	0.0921	0.4875	0.2633	0.1212	0.1429	0.0317
	2	0.3328	0.5044	0.6149	0.4227	0.4018	0.5563	0.1528	0.2909	0.1698
	3	0.2504	0.2055	0.4481	0.2362	0.3034	0.257	0.3033	0.1749	0.5655
	4	0.4557	0.2294	0.3195	0.5443	0.5387	0.4869	0.694	0.4099	0.529
	5	0.8028	0.384	0.5509	0.3742	0.6174	1.0382	1.0679	0.4942	1.3247
	6	0.5073	0.2748	0.4433	0.3883	0.5378	0.5925	0.3103	0.5149	1.2791
	+gp	0.5073	0.2748	0.4433	0.3883	0.5378	0.5925	0.3103	0.5149	1.2791
0	FBAR 2- 4	0.3463	0.3131	0.4608	0.4011	0.4147	0.4334	0.3834	0.2919	0.4214

Table 8 Fishing mortality (F) at age		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	FBAR ***- **
AGE												
	1	0.0693	0.0285	0.0142	0.021	0.0091	0.0027	0.0133	0.0105	0.0393	0.0127	0.0208
	2	0.036	0.2955	0.2103	0.2084	0.0841	0.0704	0.1166	0.0639	0.1059	0.0935	0.0878
	3	0.1426	0.0472	0.3365	0.3921	0.3681	0.3106	0.2471	0.1667	0.1524	0.1228	0.1473
	4	0.3897	0.2303	0.1292	0.5546	0.4113	0.3383	0.2003	0.1033	0.1336	0.2019	0.1463
	5	0.4681	0.6374	0.5283	0.6429	0.6056	0.3911	0.24	0.201	0.132	0.2028	0.1786
	6	0.4666	0.5883	1.0835	1.4707	0.7776	0.2119	0.2999	0.1284	0.0938	0.2427	0.155
	+gp	0.4666	0.5883	1.0835	1.4707	0.7776	0.2119	0.2999	0.1284	0.0938	0.2427	
0	FBAR 2- 4	0.1895	0.191	0.2253	0.385	0.2878	0.2398	0.188	0.1113	0.1306	0.1394	

Table 8.1.10. Megrim (*L. whiffiagonis*) Div. VIIIc and IXa. Estimates of stocks numbers at age

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

At 18/04/2005 14:02

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year)		Numbers*10**3								
YEAR		1986	1987	1988	1989	1990	1991	1992	1993	1994
AGE										
	1	8967	12061	10741	9550	12116	4860	10282	4307	1417
	2	7621	6425	8047	6100	7131	6092	3058	7457	3057
	3	3333	4473	3176	3562	3273	3906	2860	2149	4565
	4	1930	2124	2982	1661	2303	1978	2474	1729	1477
	5	1003	1002	1383	1774	789	1100	995	1012	939
	6	558	368	559	653	999	349	319	280	505
	+gp	533	325	398	862	1467	144	280	98	178
0	TOTAL	23946	26778	27285	24162	28078	18430	20267	17032	12138

Table 10 Stock number at age (start of year)		Numbers*10**3										GMST 86- **	AMST 86- **	
YEAR		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005		
AGE														
	1	8403	7778	6421	4101	2446	3751	3339	3285	3695	4026	0	5701	6695
	2	1124	6419	6189	5183	3288	1984	3063	2698	2661	2909	3262	4412	4996
	3	2112	888	3911	4106	3445	2475	1514	2231	2072	1960	2175	2845	3058
	4	2123	1499	693	2287	2271	1952	1485	968	1546	1457	1424	1784	1879
	5	713	1177	975	499	1075	1233	1139	995	715	1108	979	1013	1047
	6	205	365	509	471	215	480	683	734	667	513	745	446	485
	+gp	211	199	190	208	417	927	500	338	591	362	565		
0	TOTAL	14889	18325	18888	16855	13158	12802	11723	11249	11947	12334	9151		

**Table 8.1.11. Megrin (*L. whiffiagonis*) in Divisions VIIIc and IXa.
Summary of catches and XSA results.**

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

At 18/04/2005 14:02

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 2- 4
	Age 1					
1986	8967	2548	2204	659	0.299	0.3463
1987	12061	2273	1829	497	0.2718	0.3131
1988	10741	2577	2185	817	0.3739	0.4608
1989	9550	2853	2469	714	0.2891	0.4011
1990	12116	2945	2548	977	0.3835	0.4147
1991	4860	1793	1613	614	0.3807	0.4334
1992	10282	1841	1581	516	0.3264	0.3834
1993	4307	1573	1412	383	0.2713	0.2919
1994	1417	1223	1159	479	0.4134	0.4214
1995	8403	1302	961	218	0.2268	0.1895
1996	7778	1625	1291	329	0.2548	0.191
1997	6421	1663	1374	356	0.259	0.2253
1998	4101	1489	1328	446	0.3358	0.385
1999	2446	1286	1173	343	0.2925	0.2878
2000	3751	1398	1245	253	0.2032	0.2398
2001	3339	1177	1023	175	0.1711	0.188
2002	3285	1227	1079	117	0.1084	0.1113
2003	3695	1448	1288	134	0.104	0.1306
2004	4026	1294	1105	149	0.1349	0.1394
Arith. Mean	6397	1765	1519	430	0.2684	0.2923
0 Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		

Table 8.1.12. Megrim (*L. whiffiagonis*) in Division VIIIc, IXa. Prediction with management option table: Input data

MFD version 1a

Run: wif05_no1coav_final

Time and date: 20:20 12/05/05

Fbar age range: 2-4

Age	2005	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
1		4302	0.2	0.34	0	0	0.059	0.021	0.059
2		3262	0.2	0.9	0	0	0.085	0.088	0.085
3		2175	0.2	1	0	0	0.113	0.147	0.113
4		1424	0.2	1	0	0	0.133	0.146	0.133
5		979	0.2	1	0	0	0.171	0.179	0.171
6		745	0.2	1	0	0	0.221	0.155	0.221
7		565	0.2	1	0	0	0.363	0.155	0.363

Age	2006	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
1		4302	0.2	0.34	0	0	0.059	0.021	0.059
2			0.2	0.9	0	0	0.085	0.088	0.085
3			0.2	1	0	0	0.113	0.147	0.113
4			0.2	1	0	0	0.133	0.146	0.133
5			0.2	1	0	0	0.171	0.179	0.171
6			0.2	1	0	0	0.221	0.155	0.221
7			0.2	1	0	0	0.363	0.155	0.363

Age	2007	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
1		4302	0.2	0.34	0	0	0.059	0.021	0.059
2			0.2	0.9	0	0	0.085	0.088	0.085
3			0.2	1	0	0	0.113	0.147	0.113
4			0.2	1	0	0	0.133	0.146	0.133
5			0.2	1	0	0	0.171	0.179	0.171
6			0.2	1	0	0	0.221	0.155	0.221
7			0.2	1	0	0	0.363	0.155	0.363

Input units are thousands and kg - output in tonnes

Table 8.1.13 Megrim (*L. whiffiagonis*) in Divisions VIIIc and Ixa catch forecast : management option table.

MFDP version 1a

Run: wif05_no1coav_final

w1coavMFDP Index file 19/04/05

Time and date: 20:20 12/05/05

Fbar age range: 2-4

2005						
Biomass	SSB	FMult	FBar	Landings		
1504	1309	1	0.1271	153		
2006					2007	
Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
1682	1486	0	0	0	2009	1813
.	1486	0.1	0.0127	19	1988	1792
.	1486	0.2	0.0254	37	1968	1771
.	1486	0.3	0.0381	55	1947	1751
.	1486	0.4	0.0508	73	1927	1731
.	1486	0.5	0.0636	91	1907	1711
.	1486	0.6	0.0763	108	1888	1692
.	1486	0.7	0.089	125	1869	1673
.	1486	0.8	0.1017	142	1850	1654
.	1486	0.9	0.1144	159	1831	1635
.	1486	1	0.1271	175	1813	1617
.	1486	1.1	0.1398	192	1795	1599
.	1486	1.2	0.1525	208	1777	1581
.	1486	1.3	0.1652	223	1759	1563
.	1486	1.4	0.178	239	1742	1546
.	1486	1.5	0.1907	254	1724	1529
.	1486	1.6	0.2034	270	1708	1512
.	1486	1.7	0.2161	285	1691	1495
.	1486	1.8	0.2288	299	1674	1479
.	1486	1.9	0.2415	314	1658	1463
.	1486	2	0.2542	328	1642	1447

Input units are thousands and kg - output in tonnes

Table 8.1.14 Megrin (*L. whiffiagonis*) In Divisions VIIIc and IXa.
Single option prediction: Detail Tables.

MFDP version 1a
Run: wif05_no1coav_final
Time and date: 20:20 12/05/05
Fbar age range: 2-4

Year:	2005 F multiplier:		1 Fbar:		0.1271				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0.0208	80	5	4302	252	1463	86	1463	86
2	0.0878	249	21	3262	278	2936	251	2936	251
3	0.1473	271	31	2175	246	2175	246	2175	246
4	0.1463	176	23	1424	189	1424	189	1424	189
5	0.1786	146	25	979	167	979	167	979	167
6	0.155	97	21	745	164	745	164	745	164
7	0.155	74	27	565	205	565	205	565	205
Total		1092	153	13452	1504	10286	1309	10286	1309

Year:	2006 F multiplier:		1 Fbar:		0.1271				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0.0208	80	5	4302	252	1463	86	1463	86
2	0.0878	263	22	3450	294	3105	265	3105	265
3	0.1473	304	35	2446	277	2446	277	2446	277
4	0.1463	190	25	1537	204	1537	204	1537	204
5	0.1786	150	26	1007	172	1007	172	1007	172
6	0.155	87	19	670	148	670	148	670	148
7	0.155	120	44	919	334	919	334	919	334
Total		1195	175	14331	1682	11147	1486	11147	1486

Year:	2007 F multiplier:		1 Fbar:		0.1271				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)
1	0.0208	80	5	4302	252	1463	86	1463	86
2	0.0878	263	22	3450	294	3105	265	3105	265
3	0.1473	322	36	2587	293	2587	293	2587	293
4	0.1463	214	28	1729	230	1729	230	1729	230
5	0.1786	162	28	1087	186	1087	186	1087	186
6	0.155	90	20	690	152	690	152	690	152
7	0.155	145	53	1114	405	1114	405	1114	405
Total		1276	192	14958	1813	11774	1617	11774	1617

Input units are thousands and kg - output in tonnes

Table 8.1.15 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	2001	2002	2003	2004	2005
Stock No. (thousands) of 1 year-olds	3285	3695	4026	4302	4302
Source	XSA	XSA	XSA	GM92-03	GM92-03
Status Quo F:					
% in 2005 landings	15.0	20.3	13.7	3.3	-
% in 2006	14.8	14.2	19.9	12.5	2.8
SSB					
% in 2005 SSB	14.4	18.8	19.2	6.6	-
% in 2006 SSB	11.6	13.7	18.6	17.8	5.8
% in 2007 SSB	9.4	11.5	14.2	18.1	16.4

GM : geometric mean recruitment

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

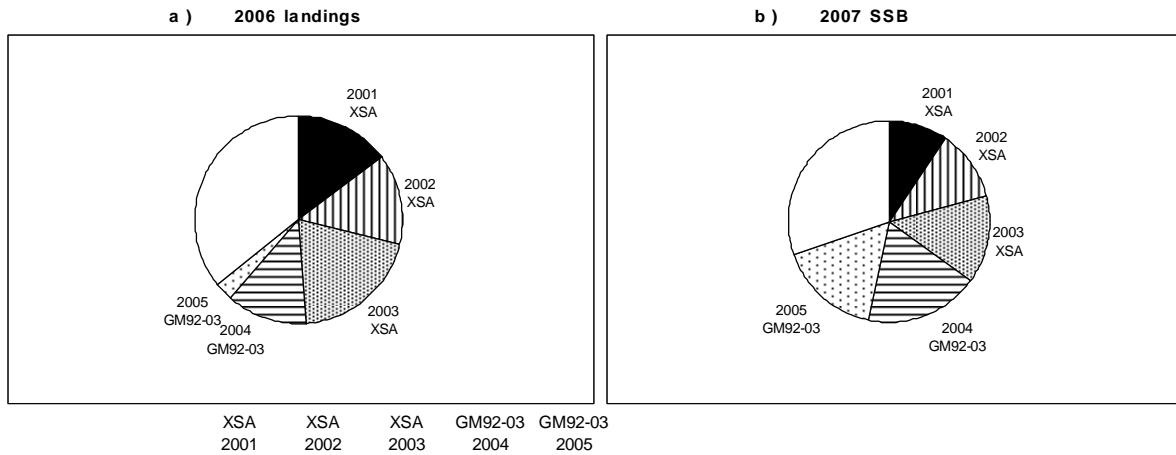


Table 8.1.16 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa, yield per recruit results.

MFYPR version 2a
 Run: wlcoav
 Time and date: 13:24 19/04/05

	FMult	Fbar	CatchNos	Yield	StockNos	Biomass	SpwnNosJan	SSBJan	SpwnNosSpwn	SSBSpwn
0.0	0.0000	0.0000	0.0000	0.0000	5.5167	1.0392	4.7748	0.9935	4.7748	0.9935
0.1	0.0127	0.0561	0.0122	5.2373	0.9495	4.4956	0.9039	4.4956	0.9039	0.9039
0.2	0.0254	0.1047	0.0220	4.9953	0.8731	4.2538	0.8274	4.2538	0.8274	0.8274
0.3	0.0381	0.1472	0.0301	4.7837	0.8072	4.0423	0.7616	4.0423	0.7616	0.7616
0.4	0.0508	0.1847	0.0367	4.5970	0.7501	3.8558	0.7045	3.8558	0.7045	0.7045
0.5	0.0636	0.2181	0.0421	4.4311	0.7002	3.6901	0.6545	3.6901	0.6545	0.6545
0.6	0.0763	0.2480	0.0466	4.2826	0.6562	3.5418	0.6106	3.5418	0.6106	0.6106
0.7	0.0890	0.2749	0.0504	4.1490	0.6173	3.4083	0.5717	3.4083	0.5717	0.5717
0.8	0.1017	0.2993	0.0535	4.0280	0.5827	3.2875	0.5371	3.2875	0.5371	0.5371
0.9	0.1144	0.3215	0.0561	3.9180	0.5518	3.1776	0.5062	3.1776	0.5062	0.5062
1.0	0.1271	0.3417	0.0582	3.8174	0.5240	3.0773	0.4785	3.0773	0.4785	0.4785
1.1	0.1398	0.3604	0.0600	3.7252	0.4990	2.9852	0.4535	2.9852	0.4535	0.4535
1.2	0.1525	0.3775	0.0615	3.6402	0.4764	2.9004	0.4309	2.9004	0.4309	0.4309
1.3	0.1652	0.3934	0.0628	3.5617	0.4558	2.8220	0.4103	2.8220	0.4103	0.4103
1.4	0.1780	0.4082	0.0638	3.4889	0.4371	2.7494	0.3916	2.7494	0.3916	0.3916
1.5	0.1907	0.4219	0.0647	3.4213	0.4200	2.6819	0.3746	2.6819	0.3746	0.3746
1.6	0.2034	0.4347	0.0654	3.3581	0.4044	2.6189	0.3589	2.6189	0.3589	0.3589
1.7	0.2161	0.4466	0.0660	3.2991	0.3900	2.5601	0.3445	2.5601	0.3445	0.3445
1.8	0.2288	0.4578	0.0665	3.2438	0.3768	2.5050	0.3313	2.5050	0.3313	0.3313
1.9	0.2415	0.4684	0.0668	3.1919	0.3646	2.4532	0.3191	2.4532	0.3191	0.3191
2.0	0.2542	0.4783	0.0671	3.1430	0.3533	2.4045	0.3078	2.4045	0.3078	0.3078

Reference point	F multiplier	Absolute F
Fbar(2-4)	1	0.1271
FMax	2.7357	0.3477
F0.1	1.2067	0.1534
F35%SPR	1.6771	0.2132

Weights in kilograms

Table 8.1.17 Megrim (*L.whiffiagonis*) Divisions VIIIc and IXa. Input data for sensitivity analysis

Name	Value	CV	Name	Value	CV
Population at age in 2005			Exploitation pattern		
N1	4301	0.56	sH1	0.021	0.74
N2	3261	0.27	sH2	0.088	0.17
N3	2175	0.18	sH3	0.147	0.26
N4	1423	0.11	sH4	0.146	0.24
N5	978	0.08	sH5	0.179	0.28
N6	745	0.11	sH6	0.155	0.43
N7	564	0.09	sH7	0.155	0.43
Weight in the catch at age			Weight in the stock at age		
WH1	0.059	0.05	WS1	0.059	0.05
WH2	0.085	0.04	WS2	0.085	0.04
WH3	0.113	0.03	WS3	0.113	0.03
WH4	0.133	0.12	WS4	0.133	0.12
WH5	0.171	0.12	WS5	0.171	0.12
WH6	0.221	0.12	WS6	0.221	0.12
WH7	0.363	0.1	WS7	0.363	0.1
Natural mortality			Maturity ogive		
M1	0.2	0.1	MT1	0.34	0.1
M2	0.2	0.1	MT2	0.9	0.1
M3	0.2	0.1	MT3	1	0.1
M4	0.2	0.1	MT4	1	0
M5	0.2	0.1	MT5	1	0
M6	0.2	0.1	MT6	1	0
M7	0.2	0.1	MT7	1	0
Recruitment in year			Effort multiplier in year		
R2006	4302	0.56	HF2005	1	0.11
R2007	4302	0.56	HF2006	1	0.11
			HF2007	1	0.11
Stock numbers in 2005 are VPA survivors. Recruitment is GM 1992-2003 from VPA			Natural mortality multiplier in year		
			K2005	1	0.1
			K2006	1	0.1
			K2007	1	0.1

Figure 8.1.1 Historical landings and abundance indices of Spanish survey of megrims (both species combined).

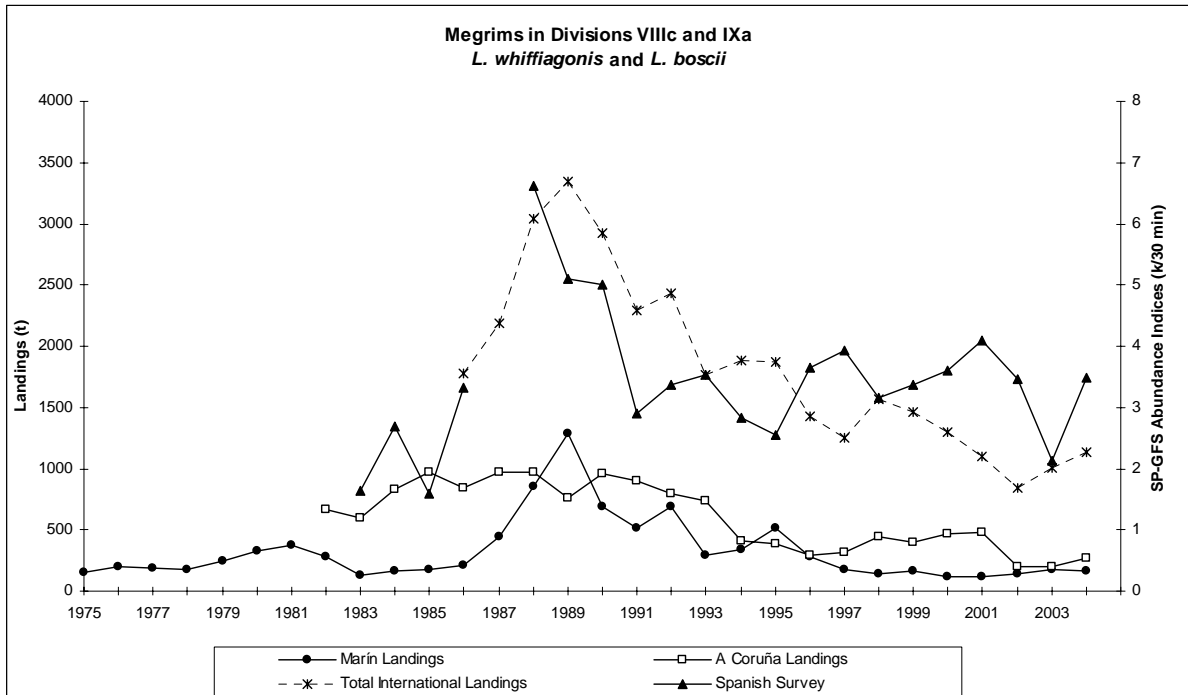
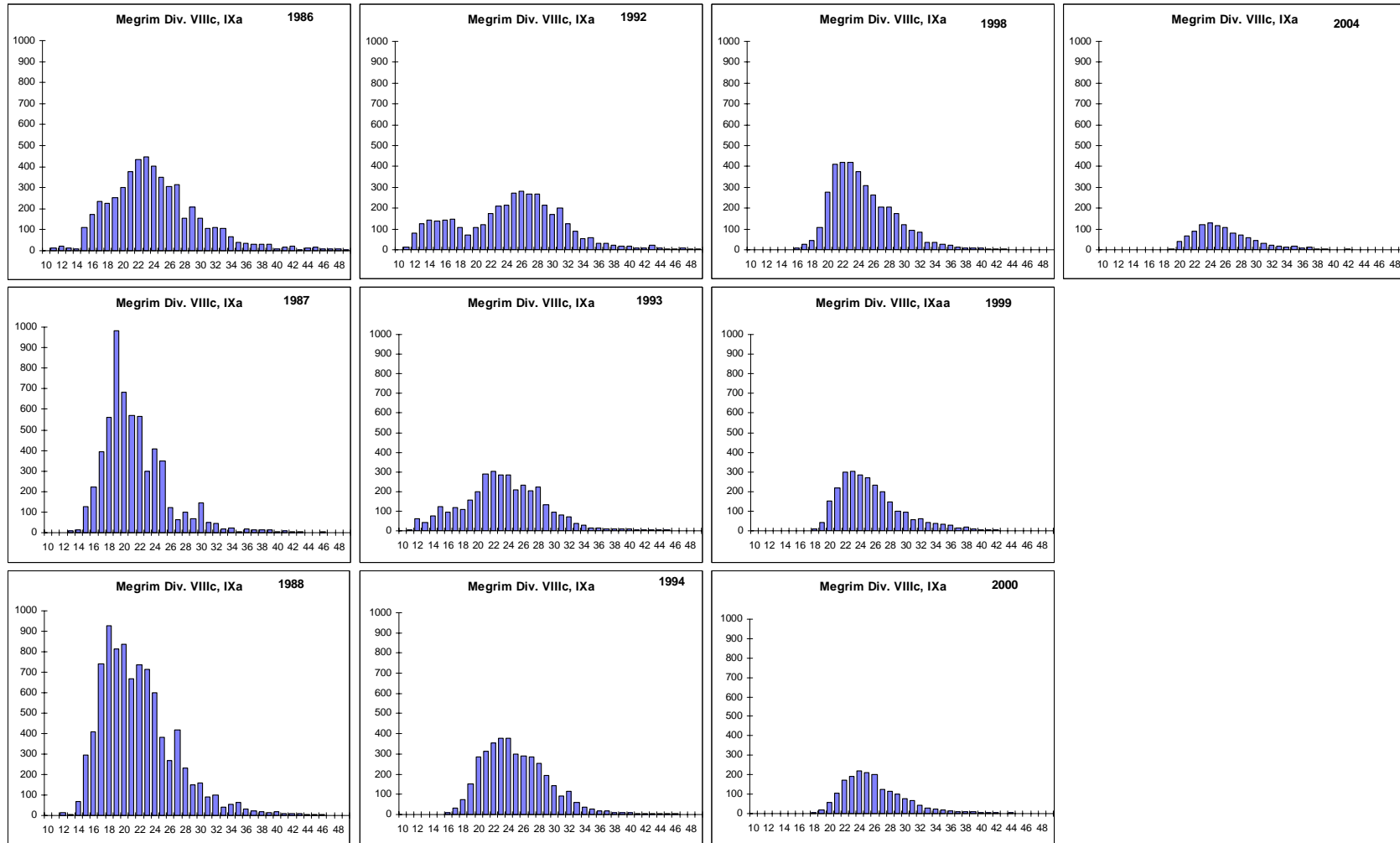


Figure 8.1.2 Megrin (*L. whiffagonis*) in Divisions VIIIc and IXa, Annual length compositions of landings ('000)



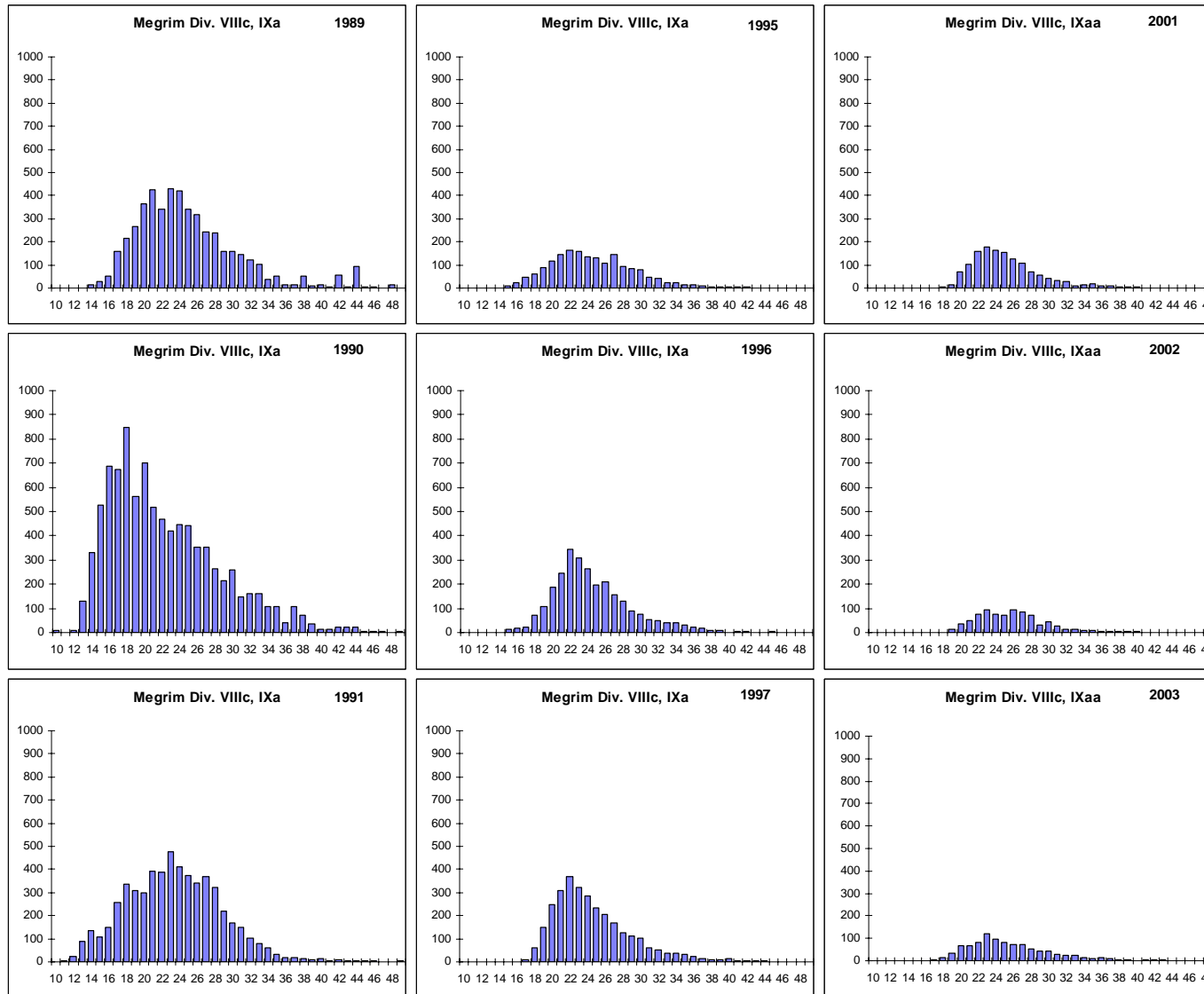


Figure 8.1.3 Megrim (*L.whiffiagonis*) in Divisions VIIIc, IXa. Landings (t), Efforts, LPUEs and Abundance Indices.

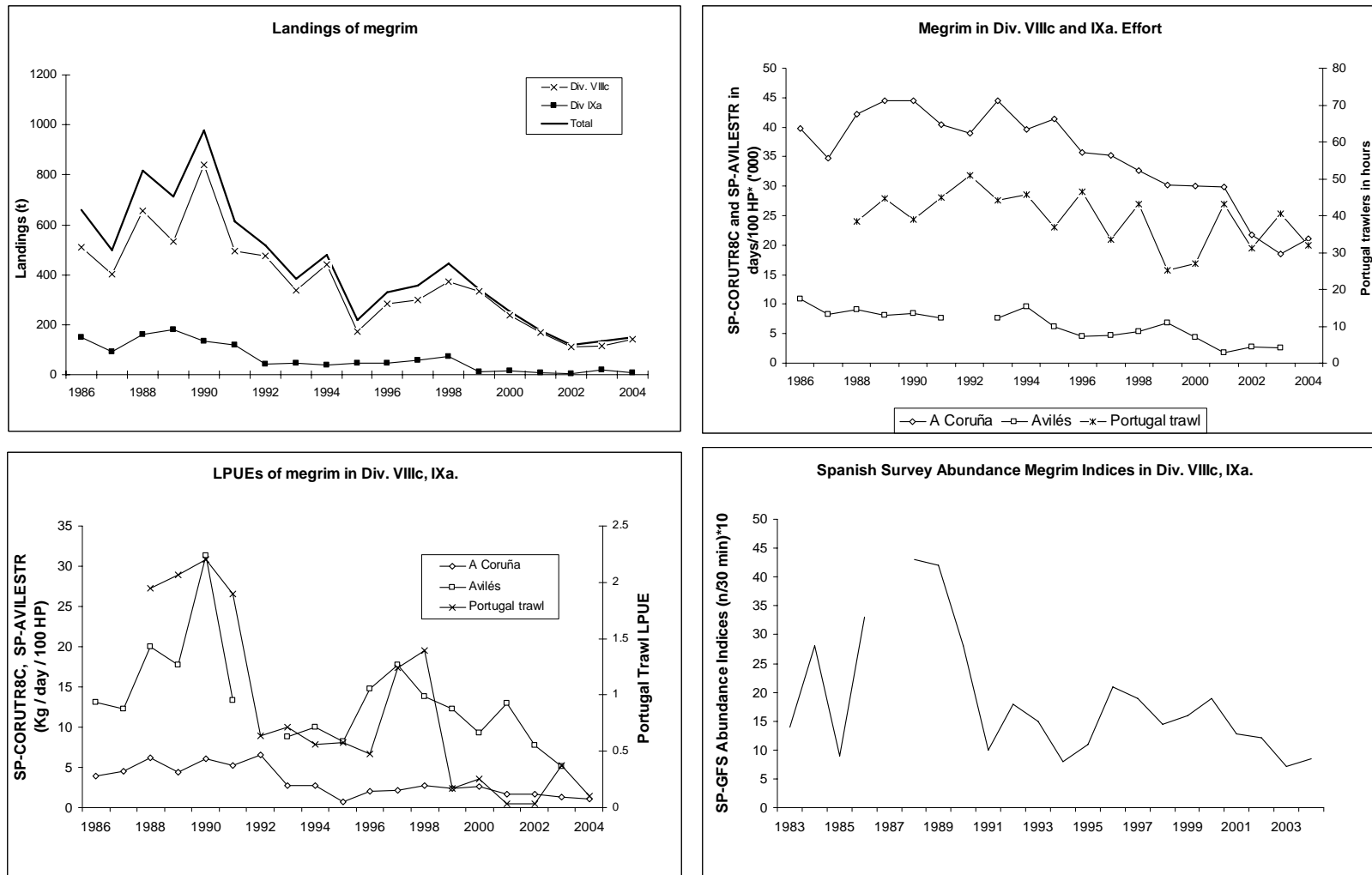


Figure 8.1.4. Megrim in Divisions VIIIc and IXa. LOG CATCHABILITY RESIDUAL PLOTS (XSA)

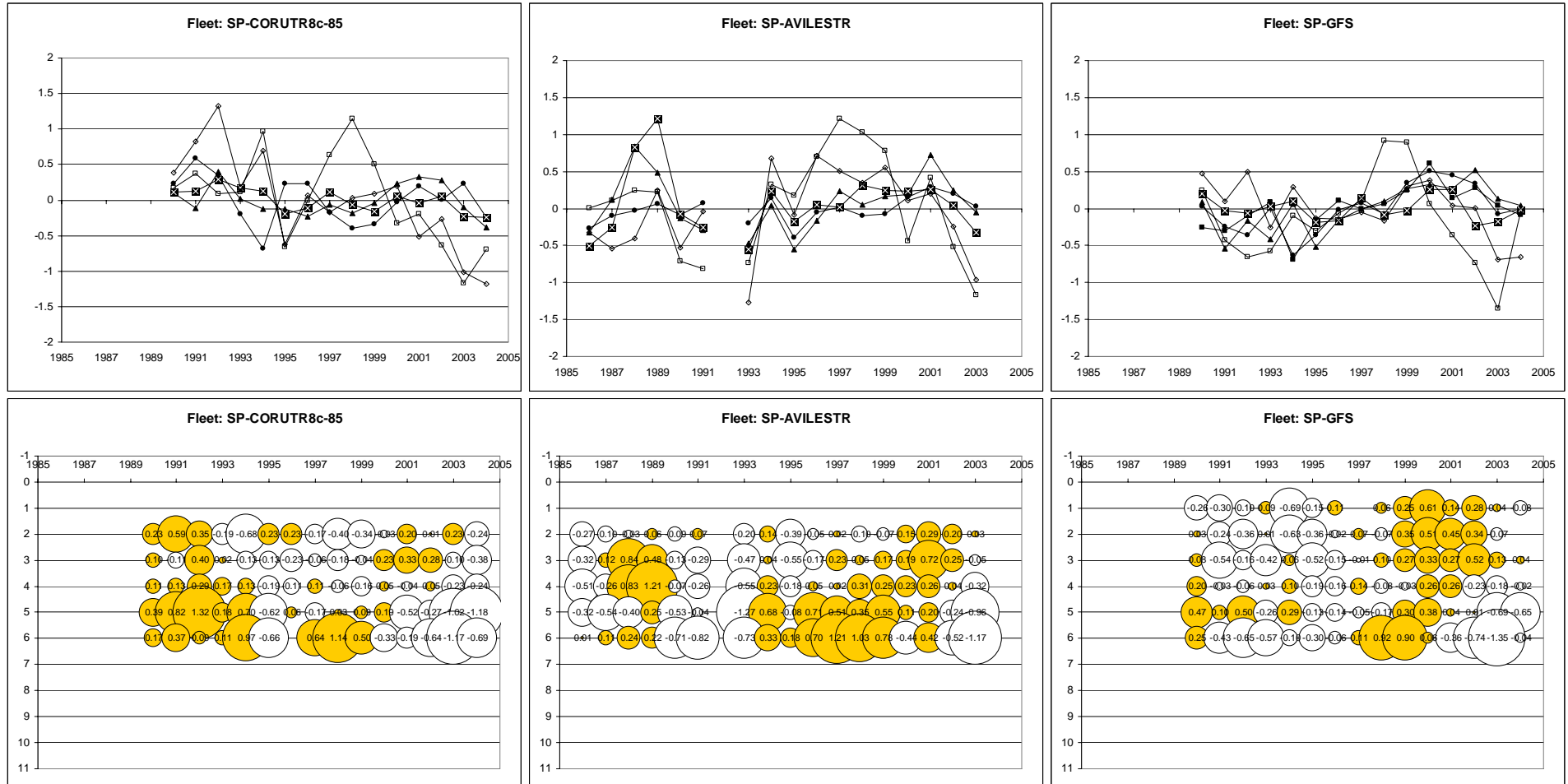
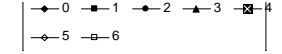


Figure 8.1.5. Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Retrospective XSA.

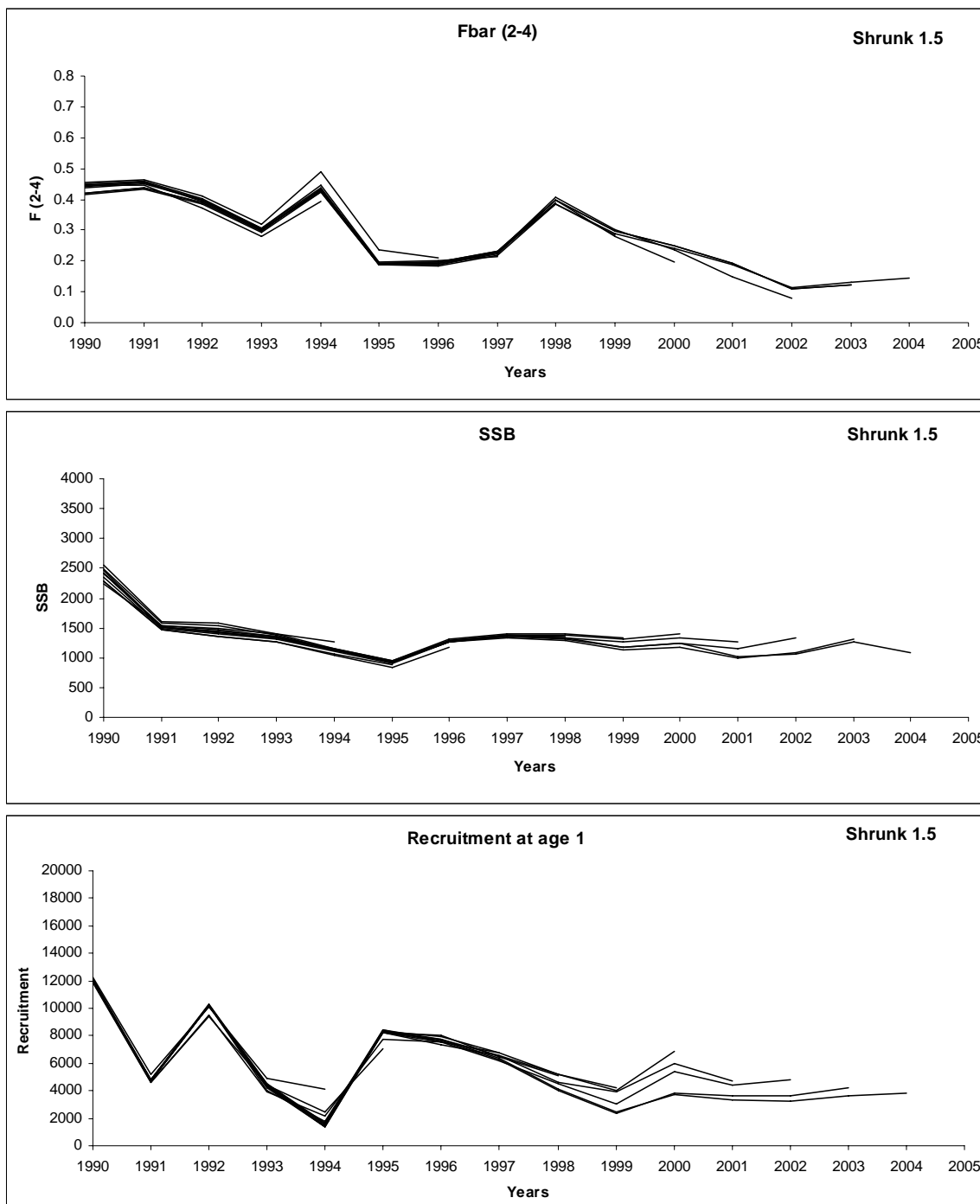


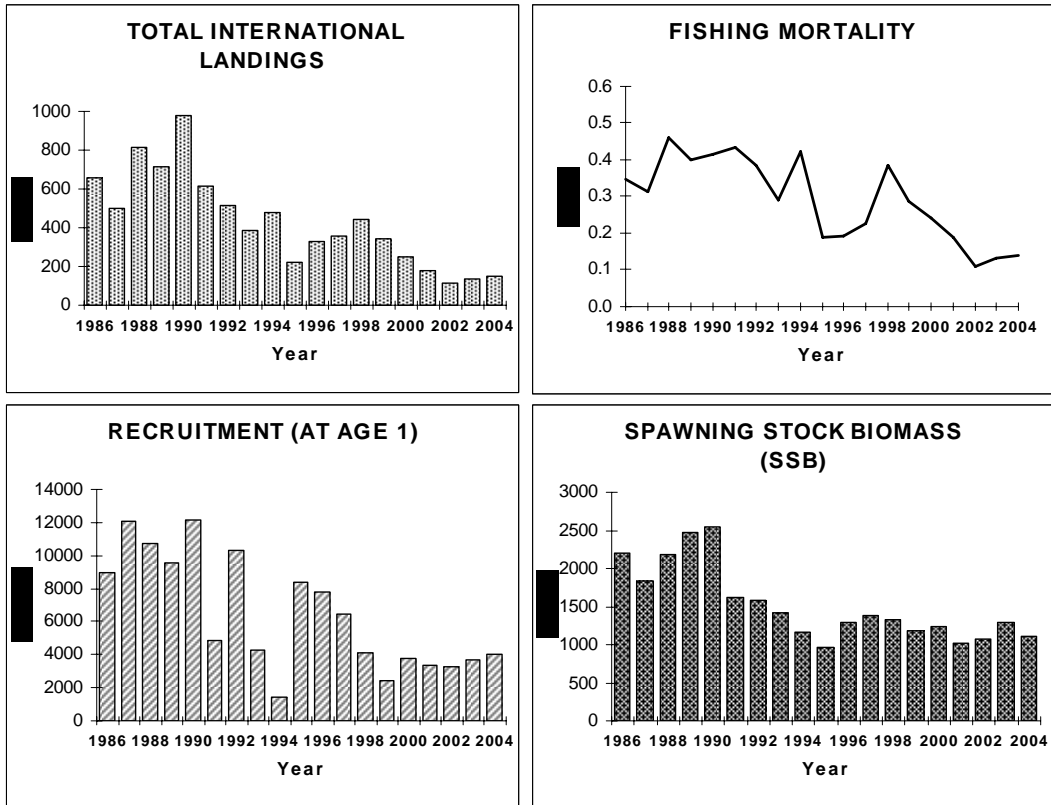
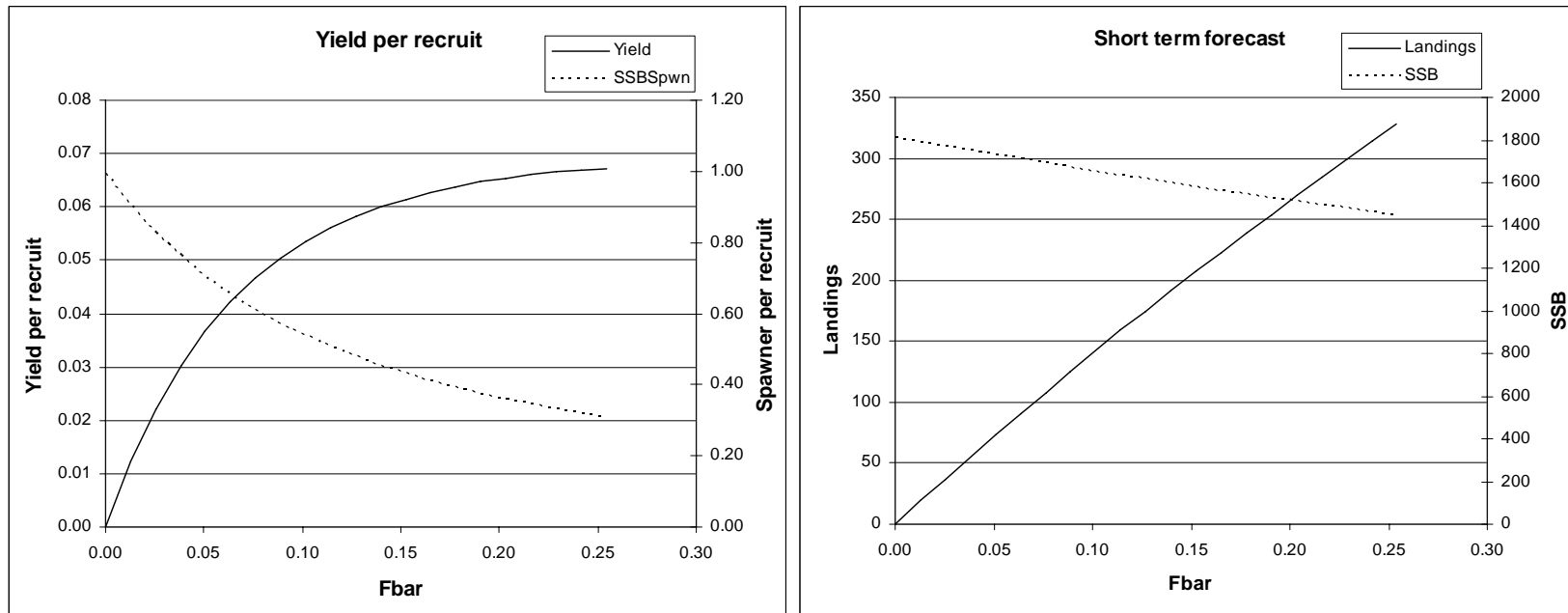
Figure 8.1.6 Megrim (*L. whiffiagonis*) in Divisions VIIIc and IXa. Stock Summary

Figure 8.1.7



MFYPR version 2a
 Run: w1coav
 Time and date: 13:24 19/04/05

Reference point	F multiplier	Absolute F
Fbar(2-4)	1.0000	0.1271
FMax	2.7357	0.3477
F0.1	1.2067	0.1534
F35%SPR	1.6771	0.2132

Weights in kilograms

MFDP version 1a
 Run: wif05_no1coav_final
 w1coavMFDP Index file 19/04/05
 Time and date: 20:20 12/05/05
 Fbar age range: 2-4

Input units are thousands and kg - output in tonnes

Figure 8.1.8. Megrim in Divisions VIIIc and IXa. Sensitivity analysis of short term forecast.

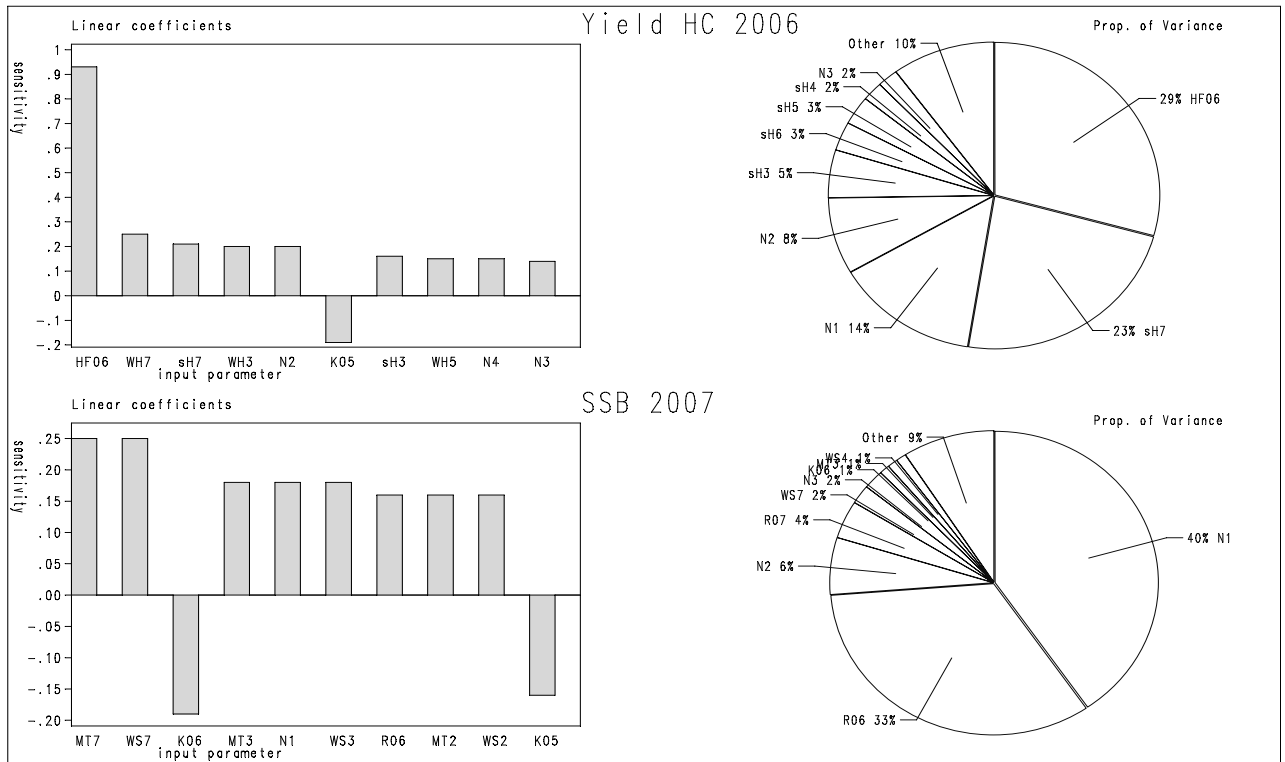


Figure 8.1.9. Megrim in Divisions VIIIc and IXa. Probability profiles for short term forecast

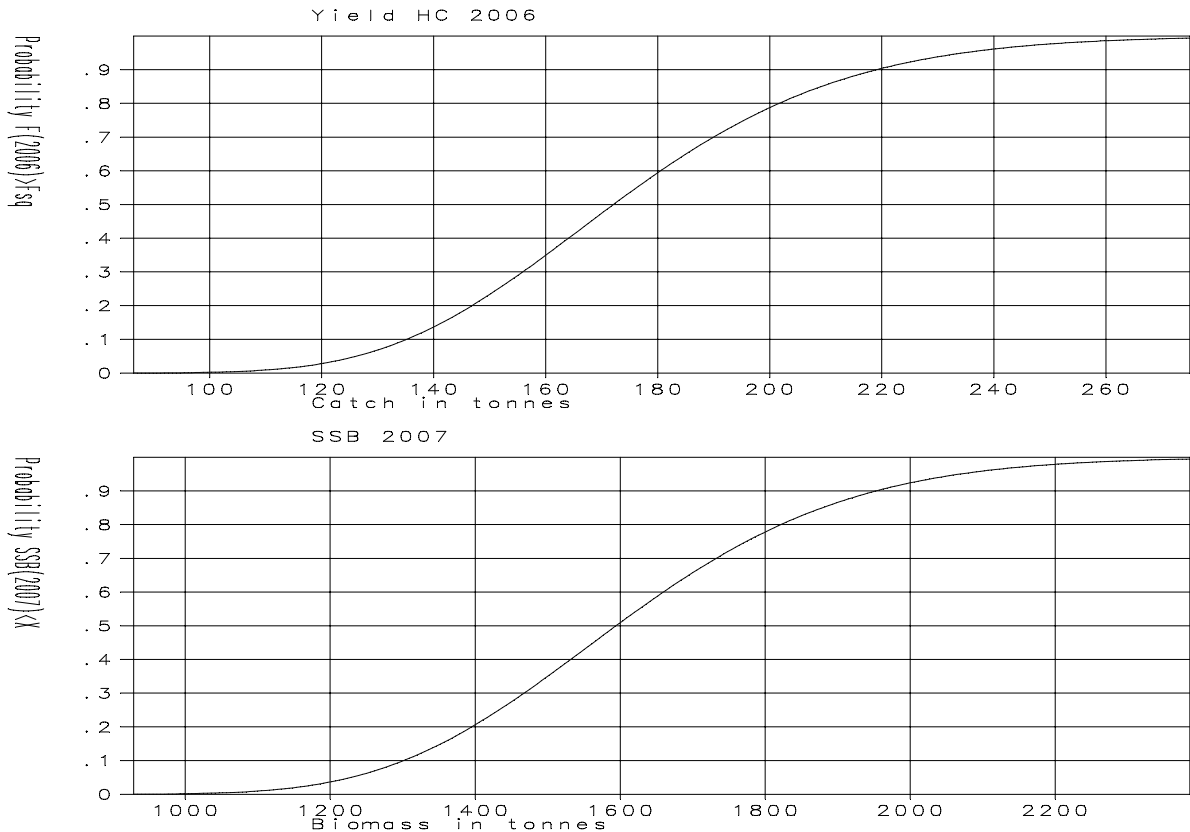
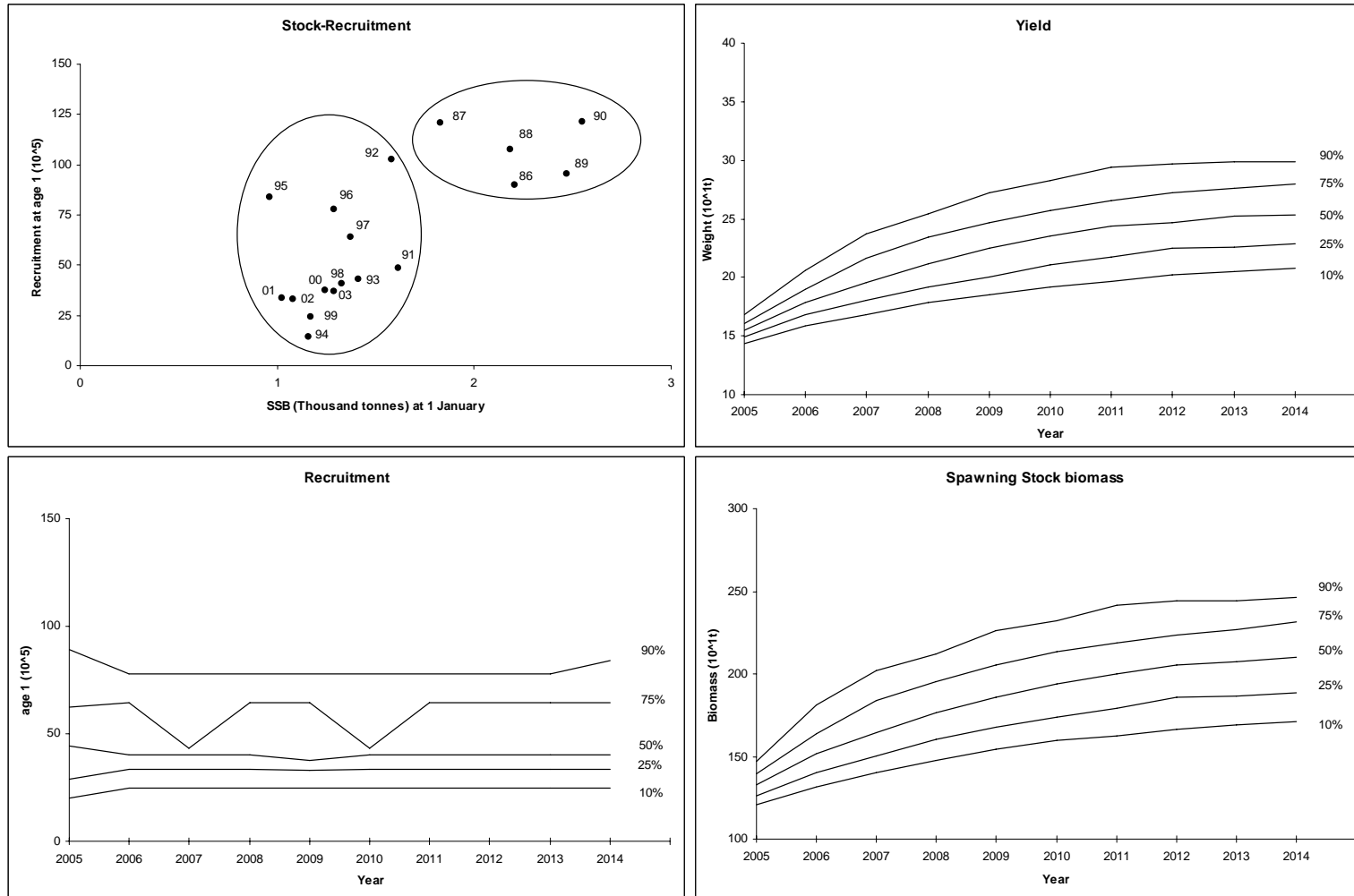
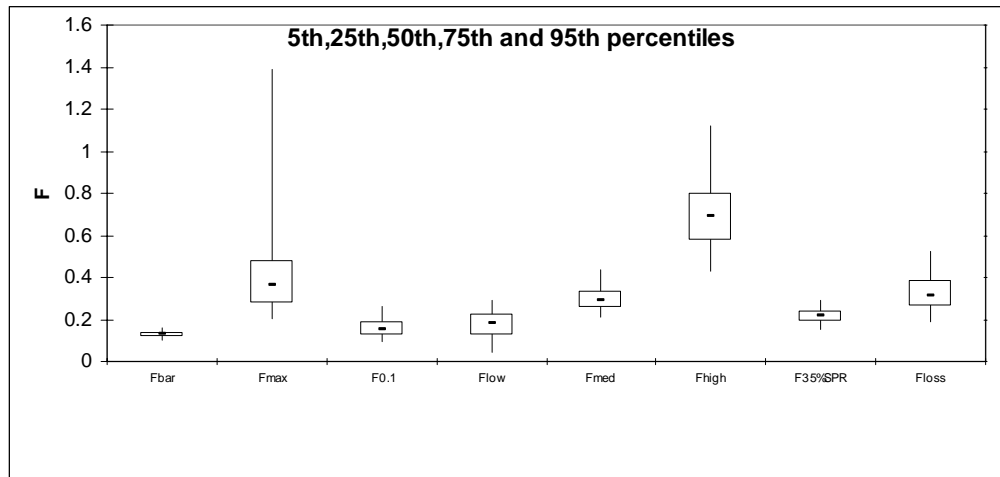


Figure 8.1.10 Megrin (*L. Whiffiagonis*) Div. VIIIc, IXa. Medium term projections. Lines show 10, 25, 50, 75 and 90 percentiles. Random stock-recruitment relationship

Four spot megrim in Divisions VIIIc and IXa. Medium term analysis, 1.00 * Fsq.





Reference point	Deterministic	Median	75th percentile	95th percentile	Hist SSB < ref pt %
MedianRecruits	4860	4860	7778	8967	
MBAL	0				0.00
Bloss	961				
SSB90%R90%Surv	1683	1656	1833	2080	73.68
SPR%ofVirgin	48.15	48.44	51.50	56.78	
VirginSPR	0.99	1.01	1.15	1.40	
SPRloss	0.27	0.27	0.30	0.36	
	Deterministic	Median	25th percentile	5th percentile	Hist F > ref pt %
FBar	0.13	0.13	0.11	0.10	94.74
Fmax	0.35	0.36	0.28	0.20	36.84
F0.1	0.15	0.15	0.13	0.10	84.21
Flow	0.10	0.18	0.12	0.04	100.00
Fmed	0.26	0.29	0.25	0.21	57.89
Fhigh	0.69	0.69	0.57	0.43	0.00
F35%SPR	0.21	0.22	0.19	0.15	68.42
Floss	0.31	0.31	0.26	0.19	47.37

For estimation of Gloss and Floss:

A LOWESS smoother with a span of 1 was used.
 Stock recruit data were log-transformed
 A point representing the origin was included in the stock recruit data.

For estimation of the stock recruitment relationship used in equilibrium calculations:

A LOWESS smoother with a span of 1 was used.
 Stock recruit data were log-transformed
 A point representing the origin was included in the stock recruit data.

Division.VIIIc IXa Megrin

Steady state selection provided as input
 FBar averaged from age 2 to 4

Number of iterations = 500
 Random number seed = -99
 Stock recruitment data Monte Carloed using residuals from the equilibrium LOWESS fit

Data source:

F:\wghmm\2005\Personal\Pablo\final_run\medium term prediction\salida_no1coav\WIF89.SEN
 F:\wghmm\2005\Personal\Pablo\final_run\medium term prediction\salida_no1coav\WIF89.SUM

FishLab DLL used

FLVB32.DLL built on Jun 14 1999 at 11:53:37
 PAsoft 4 October 1999

13/05/05 18:07:41

Figure 8.1.11 Megrin (*L. whiffiagonis*) in Divisions VIIIc and Ixa. Pasoft reference points.

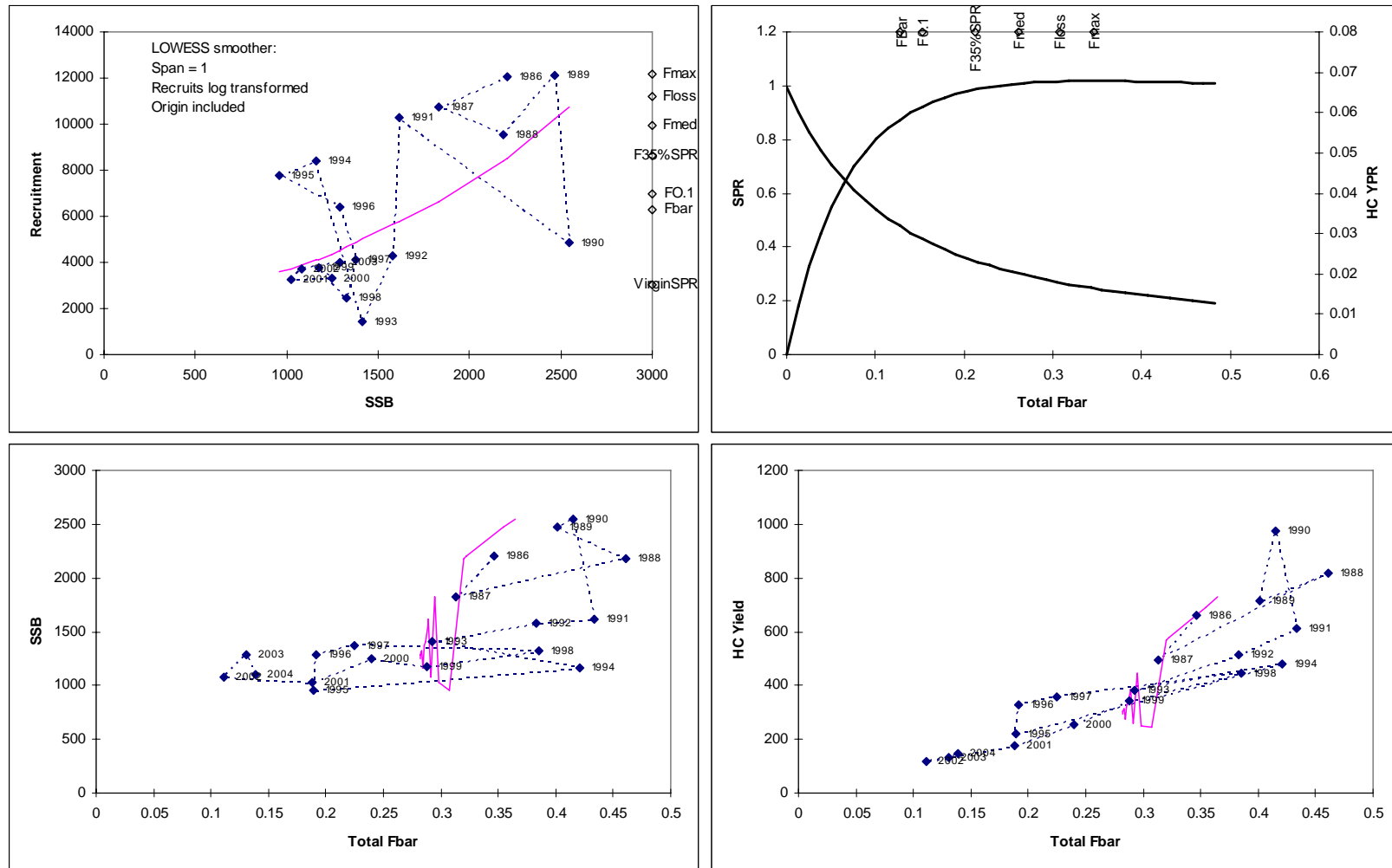
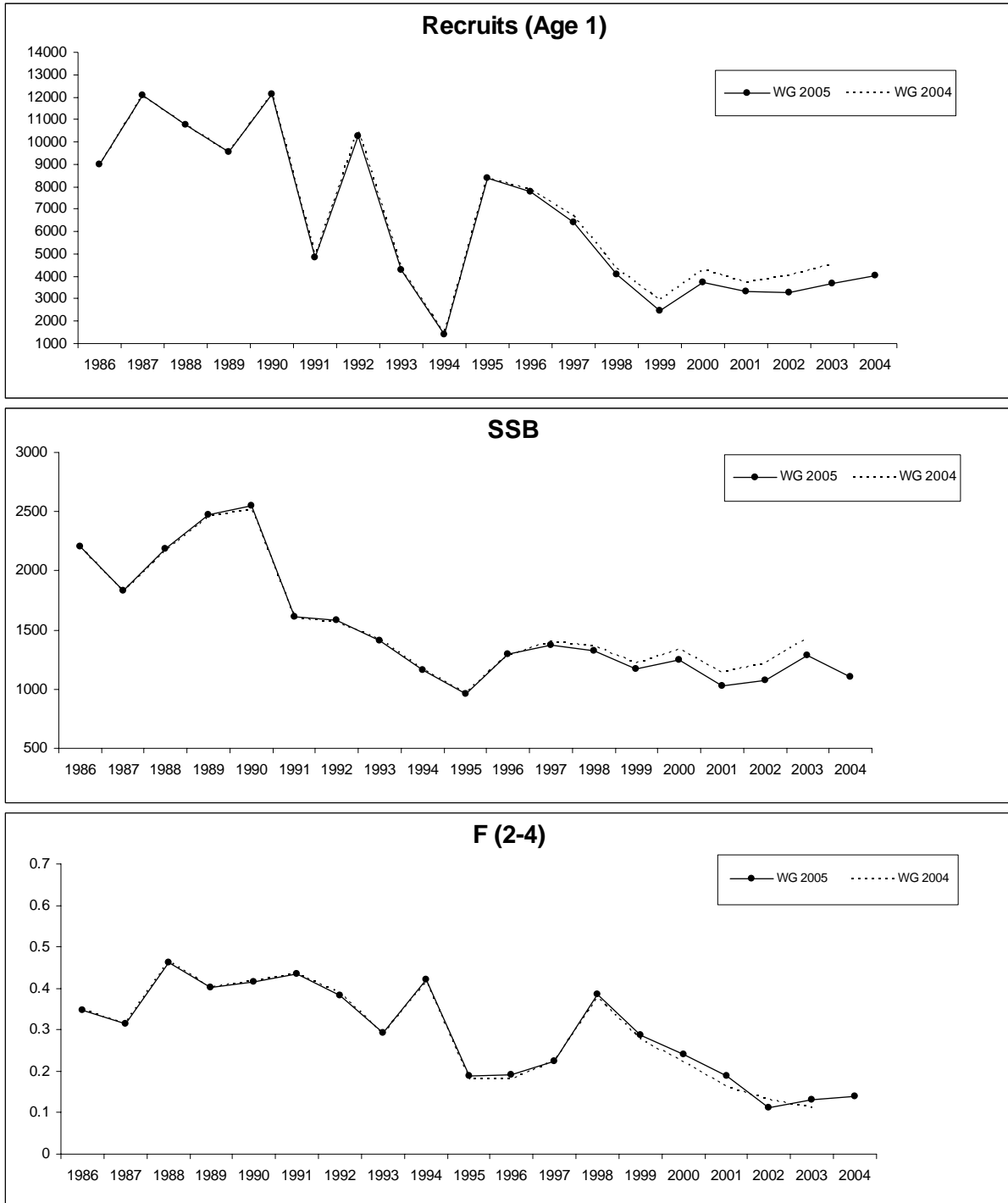


Figure 8.1.12 Megrim (*L. whiffiagonis*) in Divisions VIIIc IXa. Pasoft equilibrium plot.

Figure 8.1.13. Megrin (*L. whiffiagonis*) in Div. VIIIc, IXa. Terminal Recruits, SSB and Fs from 2004 WG XSA and 2005 WG XSA using the same setting.



8.2 Four-spot megrim (*Lepidorhombus boscii*)

8.2.1 General

See general section for both species.

8.2.2 Data

8.2.2.1 Commercial catches and discards

The estimates of four-spot megrim landings for the period 1986 to 2004 used by the WG are given in Table 8.2.1. As in previous years' assessments, Portuguese and Spanish landings were estimated using the relative abundances for the two species in the sampled landings.

Spanish landings in 2002 were revised due to change of magnitude of landing between species in some harbours. Landings reached a peak of 2 630 t in 1989 and have generally declined since then to its lowest value in 2002. The total estimated international landings in Divisions VIIIc and IXa were 990 t in 2004, 13% higher than the previous year. The recent increase of the Very High Vertical Opening nets (VHVO) as alternative gear (targeting horse mackerel) in the VHVO-Baka trawl fishery, should have reduced to lower levels the four-spot megrim catch since 2000 (see ICES files). In spite of these figures, landings in 2004 are higher to the predicted value in last year's assessment (860 t *at status quo* F).

Discard data are available for Spanish trawlers in 1994, 1997, 1999-2001 and 2003-2004. Annual discards of four-spot megrim are estimated to be around 140 t to 520 t along the whole time series. Discards in number represent between 40-60% of the total catch. Discard data are not used in this assessment due to the lack of data in some years of the series. Discard / Total Catch ratio and CV is showed in table below:

Spanish Discard/Total Catch ratio								
Year	1993	1994	1997	1999	2000	2001	2003	2004
Weight Ratio	0.27	0.30	0.28	0.24	0.33	0.13	0.21	0.30
CV	42.5	23.2	11.2	14.4	16.5	12.6	10.2	23.1
Number Ratio	0.61	0.60	0.62	0.59	0.60	0.40	0.49	0.49

8.2.2.2 Biological sampling

Annual length compositions for total landings are given in Figure 8.2.1 for the period 1986-2004. Spanish length distribution in 2002 was slightly corrected due to landing revision. Length distributions were available for Spanish and Portuguese landings, since 1986 and 1998 respectively. There has been a decrease of small fish (under 15 cm) since 1994. This change is considered to result from a stricter enforcement of the minimum landing size (20 cm) in Divisions VIIIc and IXa, as well as a mesh size increase (year 2000). Table 8.2.2 shows the length distribution by fleet and country for 2004.

The sampling levels for both species are given in Table 1.2.

The revision of the Spanish landings in 2002, due to changes in the proportion between the two species in the landings, and ALKs revision for 1995, 2000 and 2001, has modified slightly the values of these years.

Mean length and weights in landings are shown in the table below.

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Mean length (cm)	21.1	19.9	21.2	22.7	23.1	23.5	23.8	24.2	23.3	22.3	23.0	23.3	23.3	23.5	24.2	23.8	23.1	22.9	22.7
Mean weight (g)	84	69	86	105	116	118	122	128	111	96	107	112	109	113	121	114	105	101	98

Age compositions for 1990–2004 were based on Spanish annual ALK and, as in previous years, age compositions for 1986–1989 were based on a combined ALK (survey ALK for 1986 combined with an annual ALK for 1990). ALKs for 1995, 2000 and 2001 were revised and the new age composition was used. Nevertheless these have produced minor modifications.

Due to the low landings of 0-group over the all period, this age was not used in the assessment, however data are presented as previous years for the whole period (Table 8.2.3).

Weight-at-age of the international landings (Table 8.2.4) were also used as the weight-at-age in the stock. Problems detected last year in relation to weight-at-age (years 1995, 2000 and 2001) has been revised this year, nevertheless these have produced minor modifications.

Natural mortality was set at 0.2, as usual, and assumed constant over all ages and years. This value is the same value used for *L. whiffiagonis* in Subarea VII and Divisions VIIIabd. The same sex-combined maturity ogive (BIOSDEF, 1998) as the one used last year was applied to all years:

AGE	0	1	2	3	4	5+
Prop. mature	0.0	0.55	0.86	0.97	0.99	1

8.2.2.3 Abundance indices from surveys

The Portuguese and Spanish survey indices are summarised in Table 8.2.5. The August and July Portuguese surveys were not carried out since 1999 and 2002 respectively and are not presented this year. Nevertheless, new biomass and abundances indices from the Portuguese Crustacean (1997-2004) survey were available (Table 8.2.5). This survey covers the South and South-west Portuguese coast with a bathymetric distribution from 100 to 750 m. The Portuguese October survey biomass indices show the highest values in 2003 and 2004, which may be related with the different gear used in those years. The Portuguese Crustacean survey shows the highest values in 2003 and 2004.

The total biomass indices of the Spanish survey (SP-GFS) have remained stable after a maximum level in 1988, except in 2003, when one of the lowest index of the time series was obtained (Table 8.2.5). A high value was obtained again in 2004. Despite the some low recent year classes, it cannot completely explain the very low values detected in 2003 for all ages (Figure 8.2.2) which is in contradiction with the high values at all ages in 2004 (specially in deeper waters, ICES files). These low values in 2003 do not correspond with values of the catch number-at-age matrix (Table 8.2.3). Information of CPUE (k/h) from the “Spanish Discard Sampling Programme”, not used in this assessment, indicates that the 2003 fourth quarter, when the Spanish survey was carried out, had a lower catch comparing with the rest of the year (Figure 8.2.3).

Recruitment indices of SP-GFS are given in number of individuals at age 0 and 1 by 30 minutes.

The Spanish survey (SP-GFS) covers all the distribution area and depth strata of this species in the Spanish waters (ICES files). A Coruña (SP-CORUTR8c) and Avilés (SP-AVILESTR) fleets operate in different areas, covering only a small part of the distribution of the species. This may explain the difference between patterns in some years: commercial catches being mostly composed of ages 3 and 4, while the Spanish survey (SP-GFS) catches mostly ages 1 and 2.

The Spanish survey (SP-GFS) indices by age (0 to 7) for the period 1988–2004 are presented in Table 8.2.6.

8.2.2.4 Commercial catch-effort data

Catch numbers-at-age and effort data sets were available for commercial Spanish fleets SP-CORUTR8c (1986-2004) and SP-AVILESTR (1986–2003) in ICES Divisions VIIIc and IXa (Table 8.2.6).

Fishing effort and LPUE data were available for two Spanish trawl fleets, the A Coruña (SP-CORUTR8c) for the period 1986-2004 and the Avilés trawl fleet fishing in Division VIIIc (SP-AVILESTR) till 2003, and for the Portuguese trawlers (with occurrence of four-spot megrim) fishing in Division IXa for the period 1988–2004 (Table 8.2.7 and Figure 8.2.4).

Commercial fleets used in the assessment to tune the model

A Coruña trawl commercial fleet (SP-CORUTR8c) was used for tuning. The effort of this fleet has been generally stable till 1993; a decreasing trend has been observed since then. The lowest value was reached in 2003 in which the restrictions imposed to the fishing activity due to the Prestige oil spill had influence in the effort value (Figure 8.2.4). The Spanish commercial trawl LPUE series show conflicting trends until 1998, after which both give consistent pattern. A Coruña LPUE (SP-CORUTR8c) shows a general decreasing trend till 1996 and an increasing one since then to 2001, decreasing again excepting a slight increase in 2004.

Commercial fleets not used in the assessment to tune the model

The effort of Avilés trawl fleet (SP-AVILESTR) has been decreasing along the whole period to very low levels in recent years. Portuguese trawl effort shows a slightly declining trend since 1990s, apart from in 1999 and 2000 when it was reduced significantly.

The LPUE series from the Avilés trawl fleet (SP-AVILESTR) shows increasing trend till 1995 and a decreasing one since then. Portugal trawl LPUE has generally declined since 1992 with a slight increase in the last years.

8.2.3 Assessment

See Section 1.5 for the general approach adopted by the Working Group.

8.2.3.1 Input data

For this assessment the age range considered was 1 to 7+, as last year. Due to the low and irregular landings of age 0, this age was not included (as in previous assessments), though the data are presented in Table 8.2.3.

Landing-at-age and effort data for the two commercial Spanish fleets SP-CORUTR8c (1986-2004), Avilés (SP-AVILESTR) (1986-2003) and one Spanish survey (SP-GFS) in Divisions VIIIc and IXa (1988-2004) were used.

8.2.4 Model

Data screening

Results of exploratory runs not included in this report are available in the ICES files.

A separable VPA was run to screen the catch-at-age data, using a reference age of 4, with terminal F set at 0.25 and terminal S at 1.0. Results show no unusual patterns of residuals, although high values were observed in young ages, and particularly in years earlier than 1990 when combined ALKs were used. Some high residuals were also observed in recent years.

Following ACFM recommendations, the WG explored the assumption that catchability is dependent on stock size for the young ages, XSA. Results of exploratory runs (diagnostic and plot of Log catchability residuals/Log stock numbers, in ICES files) shows that a power model for ages 1 and 2, as in previous assessments, is still adequate.

Regarding to catchability trends and residuals, XSA tuning runs were carried out on individual fleets with a low shrinkage (s.e.= 1.5). No taper time weighting was used. Results show high residuals for almost all ages for the SP-AVILESTR fleet. This fleet operates in a small area and it has got an historical low catch. Furthermore, it produces high residuals with opposite trend to SP-CORUTR8c fleet. SP-AVILESTR data were again not considered in the assessment. Results also show high residuals at age 2 for the SP-CORUTR8c fleet. Low residuals at young ages were observed in the SP-GFS fleet (see ICES files). A negative year effect was observed in the 2003 for SP-GFS survey.

Exploratory XSA runs

For this year this stock is subject to a benchmark assessment.

One initial run, using the same settings than in the last assessment was carried out included only the SP-CORUTR8c and SP-GFS fleet. As in last year's assessment, age 0 was added to the abundance indices of the Spanish survey (SP-GFS) and zero values in the catch-at-age matrix at age 0 in order to have an immediate indication of incoming recruitment. Ages 1 and 2 for SP-CORUTR8c were excluded from the assessment due to the high residuals observed, specially for age 2. As in last year's assessment, the SP-CORUTR8c commercial tuning data for the most recent years (2000-2004) was excluded for the assessment since in that period the alternative use of Baka with VHVO nets has taken place in higher proportion than in the previous period. Nevertheless, the remaining information (years 1986-1999) from SP-CORUTR8c is still kept (from 3-age to older) for tuning older ages that are not well-represented in the survey. Results also show low residuals at young ages for the Spanish survey (SP-GFS). However, this fleet shows a negative year effect in 2003.

Considering the problem found in SP-GFS in 2003 (see Section 8.2.2.3) a new run was performed excluding year 2003 from the Spanish survey tuning data due to the unusual low value obtained that year. Results showing that excluding year improve the estimation for most of the ages and reduce the retrospective pattern in F and SSB.

Final XSA run

Final settings used this year and last year's configuration are detailed below:

		2004 WG		2005 WG	
Fleets	SP-CORUTR8c	86-99	3-6	86-99	3-6
	SP-GFS	88-03	0-6	88-04 2003 not included	0-6
Taper			3 over 20		3 over 20
Tuning range			18		19
Ages catch dep. Stock size			1-2		1-2
q plateau			5		5
F shrinkage se			1.5		1.5
year range			5		5
age range			3		3

The retrospective analysis has shown a trend of underestimating F and overestimating SSB in recent years (Figure 8.2.5).

8.2.4.1 Assessment results

Diagnostics from the XSA final run are presented in Table 8.2.8 and Figure 8.2.6. The survivors estimates are given by the survey and the P-shrinkage for ages 0-1, and only by the survey for ages 2-6, due to data from the commercial fleet stops 1999. The F-shrinkage has a little influence in survivor estimations.

F in 2004 ($F_{2-4} = 0.32$) was estimated to be at a high level. F_{2003} was estimated to be 0.23 in the 2004 assessment, similar to this year (0.24).

8.2.4.2 Year class strength and recruitment estimations

The 2001 year class was estimated to have 23 million 0-years-old individuals, lower than the GM over the whole period (31 million).

2002 year class was estimated to be 27 million 0-year-old individuals, higher than the 2004 assessment estimate for the same year class (22 million).

The 2003 year class was estimated at 32 million 0-year-old, being estimated to be 22 million in the 2004 assessment.

The estimate of the 2004 year class (25 million 0-year-old) is based on the survey data (58%) and P-shrinkage (42%) in a consistent way.

Estimates of recruitment for the years 1986 to 1989, when age compositions were based on combined ALKs, were excluded from the estimation of GM_{90-03} assumed for the 2005 and subsequent year classes (26 million at age 0).

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

Recruitment at age 0:

YEAR CLASS	THOUSAND	BASIS	SURVEYS	COMMERCIAL	SHRINKAGE
2002	26 804	XSA	75%	-	25%
2003	31 918	XSA	59%	-	42%
2004	25 212	XSA	58%	-	42%
2005	25 952	GM_{90-03}			

8.2.4.3 Historic trends in biomass, fishing mortality, and recruitment

SSB, Fishing mortality and population numbers from XSA run are given in Tables 8.2.9 and 8.2.10, and the results are summarized in Table 8.2.11 and Figure 8.2.7.

The SSB decreased from 7 400 t in 1988 to 4 400 t in 1997, the lowest value in the series, and has remained at a relatively low level since then. The 2004 SSB is estimated to be 4 800 t, 10% higher than the lowest value observed in 1997.

Recruitment has fluctuated around 30 million fish since 1990 to 2000, with the exception of the very weak 1993 and 1998 year classes (13 million). Since 1998 onwards recruitment has remained at average level.

Fishing mortality values show two different periods; an initial one with higher values from 1989-1995 and, (after a sharp decrease in 1996) a second period stable at a lower level. F has slightly increased in 2003 and 2004.

8.2.5 Catch options and prognosis

Population numbers for the catch forecast were taken from the final XSA output. Stock size at age 0 in years 2005-2007 was assumed to be GM_{90-03} (26 million). The exploitation pattern used was the unscaled average of 2002-2004, despite the retrospective tendency of underestimating F in recent years, due to uncertainties in the estimation given from the survey in the last years. Mean weights in the catch and in the stock were computed as averages for 2002-2004.

8.2.5.1 Short-term projections

The input data for the short-term predictions are given in Table 8.2.12.

Table 8.2.13 gives the management options from the catch prediction and Figure 8.2.8 presents the short-term yield and SSB trends. The detailed output by age group is given in Table 8.2.14. Assuming F *status quo*, landings in 2005 and 2006 are predicted to be around 940 and 1 000 t respectively.

SSB in 2006 and 2007 are predicted to be 5 800 t and 6 000 t respectively, higher than the current SSB (5 500 t) and is prompted by the moderately high recruitment used for prediction and the assumed low exploitation pattern. Four-spot megrim starts to contribute strongly to SSB at 2 years of age. Comparison of these predictions on 2005-2006 with that from last year shows similar values of the estimation of SSB.

The contributions of recent year classes to the predicted landings in 2006 and SSB in 2007 are presented in Table 8.2.15. The year classes for which GM_{90-03} recruitment is assumed contribute around 1% to landings in 2006 and around 8% and 25% to the SSB at the beginning of 2006 and 2007 respectively.

8.2.5.2 Yield and biomass per recruit analysis

The input data for predictions are given in Table 8.2.12.

The results of the yield and SSB-per-recruit analysis are given in Table 8.2.16 and Figure 8.2.8, and the stock-recruitment plot is shown in Figure 8.2.13. There is no evidence of reduced recruitment at low stock levels in the observed series.

With the *status quo* exploitation, and assuming GM_{90-03} recruitment of 26.0 million, the equilibrium yield would be around 1 050 t with a SSB of 6 300 t.

F_{max} is not well defined for this stock. *Status quo* F (0.26) is below F_{med} (0.36). The estimate of F_{med} is higher than that obtained by last year's assessment (0.30).

At F_{med} , the level of SSB consistent with long-term SSB is 4 950 t slightly higher than B_{loss} (4 400 t). Yield per recruit at F_{med} , is close to the current yield.

$F_{0.1}$ was estimated to be 0.27, much higher than the value obtained in last year's assessment (0.19), and represents an increase of 5% relative to $F_{status\ quo}$. There is no evidence of reduced SSB at this F level (Figure 8.2.13), producing an equilibrium yield of 1 060 t and SSB of 6 400 t close to the *status quo* values.

8.2.5.3 Sensitivity and risk analysis

A sensitivity analysis was carried out to examine the contribution of different sources of uncertainty to the variance of predicted SSB and yield. The input data are presented in Table 8.2.17 and the results are shown in Figure 8.2.9. Probability profiles of expected yield and SSB are given in Figure 8.2.10. The approximate 90% confidence interval of the expected *status quo* yield in 2006 is 680 – 1 450 t. The probability that SSB in 2007 will fall below the B_{loss} (4 400 t) is less than 5%.

The 50% probability of the expected $F_{status\ quo}$ yield in 2006 is around 950 t similar to value predicted from short term (1 000 t). For the same probability SSB is predicted to be at around 5 900 t for both methods.

Medium-term predictions were made for a period of 10 years (2005-2014) to estimate percentiles of the distribution of predicted yields, SSB and recruitment at *status quo* F . Table 8.2.17 shows the input data. A random bootstrapped recruitment (1990-2003 period) was used for estimating recruitment for predictions. Results are summarised in Figure 8.2.11.

Landings and SSB are initially predicted to increase gradually. The predicted increase in SSB is mostly due to the low *status quo* F and to the inclusion of the relatively high recruitments in the random bootstrap.

8.2.6 Biological reference points

Results from the PA software Excel add-in are shown in Figures 8.2.12 and 8.2.13.

The table below summarizes the history of reference point considerations.

	ACFM 1998	WG-1999	WG-2000	ACFM 2000	WG-2002	ACFM 2003	WG-2003
F_{lim}	0.25 (F_{loss} WG98)	No proposal	0.40 (F_{loss})		Not defined		
F_{pa}	0.20 ($F_{lim} e^{-1.645\sigma}$)	No proposal	0.30 ($F_{lim} e^{-1.645\sigma}$)	Not adopted	0.31 (F_{med})	Not adopted	No proposal
B_{lim}	3 400 t ($B_{loss}=B_{96}$ WG98)	4 700 t ($B_{loss}=B_{96}$ WG99) *			Not defined		
B_{pa}	5 000 t ($B_{lim} \times 1.4$)	6 500 t	4 700 t ($B_{loss}=B_{95}$)	Not adopted	5 000 t ($B_{loss}=B_{95}$)	Not adopted	No proposal

* A new maturity ogive was used.

F_{med} was proposed by ACFM in 2000 as “an interim reference point”. The current estimation of F_{med} (0.36) is quite different to the one obtained in previous assessments (around 0.30 since 2001 WG). $F_{0.1}$ (0.27) is also estimated at very different level comparing to the one obtained last year (0.19). Despite of these differences, the PA-Soft diagnostics shows no high sensitivity to the LOWESS span, unlike the previous WG and the estimate is more precise.

The WGMG 2004 reported some fishing mortality reference points for the main ICES stocks by using a nonparametric method CONCave Recruitment (CONCR) based on the 75% confidence limit estimated. This estimation gives four-spot megrim a F_{lim} value of 0.30, lower to the F_{med} value obtained in this assessment. Despite of there is no new information to define

biomass reference points B_{lim} and B_{pa} for this stock. B_{loss} is now estimated at 4 400 t (1997 biomass), slightly lower than that in previous assessments when it was proposed as a candidate to B_{pa} .

Since 1990 both high and low recruitment has been observed at low stock level (Figure 8.2.13). Recruitment has been variable while SSB has been relatively stable.

8.2.7 Management Strategies

Four-spot megrim is taken as by-catch in mixed bottom trawl fisheries, therefore HCR's applied on this stock depend on the regulation of other species.

Discard data were not used in this assessment because of the lack of data in some years of the series. Discards in number represent between 40-60% of the total catch.

8.2.8 Comments on the assessment

The lack of including discard data into assessment may modify the perception of state of this stock. Including discard obviously produces a more real picture of the fishing exploitation. Nevertheless, the most important effect of discard inclusion is probably the chance of shifts on short and medium term predictions.

As in last year's assessment, one commercial fleet (SP-CORUTR8c) and the Spanish survey (SP-GFS) were used for tuning. Inclusion of the SP-CORUTR8c fleet provides a better estimation for older ages than just the survey. Nevertheless, as in last year, the SP-CORUTR8c commercial tuning data for the most recent years was excluded from the assessment as in that period the alternative use of VHVO (targeting horse mackerel and with very few four-spot megrim catches) and Baka trawl gears has taken place in higher proportions than in the previous years.

The Spanish survey appears to provide good estimates for young and middle ages and it covers all the distribution areas of the stock. Nevertheless, year 2003 was excluded from the tuning data due to the unusual low value obtained in that year, which does not correspond with the high catches obtained from the commercial fleets. Moreover, the high index obtained by the Spanish survey in 2004, is in contradiction with those low values detected in 2003.

Comparison of this assessment with that from last year shows similar trends for F and SSB. However a shift of the estimation of F (downwards) and SSB (upwards), especially in recent years, is apparent (Figure 8.2.14). Recruitment estimation from recent period has been revised upward. The Spanish survey SP-GFS has a strong weight in the estimations for this stock. Recruitment estimations in recent years have been revised upwards.

Four-spot megrim starts to contribute strongly to SSB at 2 years of age, 25% of the predicted SSB in 2007 relies on year classes with recruitment assumed as GM_{90-03} . The GM recruitment assumed for the predictions is taken over the period 1990-2003 to avoid using data from years based on a combined ALK.

8.2.9 Management considerations

This assessment indicates that SSB decreased between 1988 and 1996, and subsequently stabilises at low levels. The probability of SSB falling below current B_{loss} (1997 SSB) at *status quo* F is very low, based on the short-term predictions.

There is no evidence of reduced recruitment at low stock levels.

As with *L. whiffiagonis*, it should be noted that four-spot megrim (*L. boscii*) is essentially caught in mixed fisheries, and management measures applied to this species may have impli-

cations 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.

8.2.10 Combined Forecast for Megrim (*L. whiffiagonis* and *L. boscii*)

Two species of megrim are included in the landings from ICES Divisions VIIIc and IXa: megrim, (*Lepidorhombus whiffiagonis*), and four-spot megrim, (*L. boscii*). Both species are taken as a by-catch in mixed bottom trawl fisheries. Figure 8.3.1 gives the predicted 2006, at *status quo* F, landings and the 2007 SSB, for both species combined, for corresponding changes in fishing mortality. Predicted 2006 landings are around 1 200 t and the 2007 SSB is 8 300 t. The equilibrium yield, for both species combined at *status quo* F level of each species, would be around 1 300 t with a SSB of 8 370 t.

Table 8.2.1. Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Total landings (t).

Year	Spain			Portugal	Total	
	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	162		991

* Revised Spanish Landing

Table 8.2.2. Four-spot megrim (*L. boschii*) in Divisions VIIIc and IXa, Length compositions of landings in 2004 ('000 fish)

Length (cm)	Spain		Portugal		Total		
	Div. VIIIc	Div. IXa	Trawler	Artisanal	Spain	Portugal	Total
10							
11							
12	4				4		4
13							
14	1	2	0		2	0	3
15		48	0	0	48	0	48
16	21	115	6	1	136	7	143
17	53	213	23	9	265	32	298
18	156	355	54	21	511	75	586
19	298	446	95	52	744	147	891
20	600	506	133	64	1105	198	1303
21	691	526	163	80	1216	242	1459
22	693	386	124	62	1079	185	1265
23	612	288	104	59	900	163	1063
24	456	204	85	46	659	131	790
25	400	155	44	78	554	122	676
26	334	107	57	30	441	87	528
27	192	70	36	27	262	63	325
28	134	47	28	15	181	42	223
29	92	32	12	7	124	19	143
30	71	18	10	3	89	13	101
31	48	14	8	3	62	11	73
32	34	7	5	1	41	6	47
33	17	6	1		24	1	25
34	16	3	0		18	0	19
35	7	1	0		8	0	9
36	2	1	0		3	0	3
37	5	1	0		5	0	5
38	1	0	0		1	0	1
39	1	0	0		1	0	1
40	1	0	0		1	0	1
41		0			0		0
42	0	0			0		0
43	0		0		0	0	0
44			0			0	0
45	0				0		0
46			0			0	0
47		0			0		0
48							
49							
50+							
Total	4939	3549	989	557	8488	1545	10033

Table 8.2.3 Four-spot megrim (*L. boscii*) in Divisions VIIIc, IXa. Catch numbers at age. Numbers*10*-3

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
AGE																			
* 0	(4)	(1)	(9)	(2)	(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	389
2	3475	11580	10092	7140	5184	3679	2667	2334	2915	2205	2136	1244	1204	1161	655	1138	2389	2802	2483
3	3690	5073	5455	5392	1885	3328	4000	2096	4515	6138	1267	2870	4236	2781	1645	1251	2361	2873	3041
4	3940	3593	4779	5909	3829	1911	5179	3799	2268	5596	3814	744	2940	3908	2782	2393	743	1476	2403
5	1132	1344	2366	3479	2311	2650	2200	1151	1612	1056	1896	1624	698	1402	1849	1870	387	499	1110
6	849	569	1161	1778	1383	1028	738	635	839	582	204	1066	829	235	785	937	236	447	275
+gp	229	141	463	630	803	479	67	278	446	280	551	443	349	488	838	357	359	142	332
TOTALNUM	13425	24583	25841	25061	16839	14235	15694	10839	12678	17278	10265	8026	10301	10013	8599	8149	6665	8606	10033
TONSLAND	1124	1688	2223	2629	1945	1682	1916	1384	1403	1652	1098	896	1123	1125	1041	931	720	876	991
SOPCOF %	100	100	100	100	100	99	103	99	100	97	100	102	100	101	101	101	100	101	101

* Age 0 was not used in the assessment

Table 8.2.4 Four-spot megrim (*L. boscii*) in Divisions VIIIc, IXa. Catch weights at age (kg).

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
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
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
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
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
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
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
+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
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	1.011

Table 8.2.5 Four-spot megrim (*L. boscai*) Divisions VIIIc, IXa.
Abundance and Recruitment indices of 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		
October	Crustacean	SE	Mean	SE	Crustacean	SE	Mean	SE	Portugal (n)	Spain (n/30 min)*10			
1983			0.67	0.13	1983		11.8	1.80	1983		9.8	57.4	
1984			0.76	0.08	1984		15.8	2.00	1984		18.0	78.3	
1985			0.71	0.11	1985		14.0	1.74	1985		1.5	74.5	
1986			1.68	0.28	1986		32.6	3.82	1986		29.9	163.6	
1987			ns	-	1987		ns	-	1987		ns	ns	
1988			3.10	0.33	1988		59.2	6.49	1988		29.0	246.4	
1989			1.97	0.28	1989		40.7	6.24	1989		84.9	166.8	
1990	0.26		1.93	0.14	1990		40.3	3.00	1990	153	4.4	190.6	
1991	0.18		1.67	0.17	1991		27.7	2.62	1991	26	25.3	92.5	
1992	0.14		1.98	0.20	1992		49.1	5.20	1992	42	23.7	350.0	
1993	0.11		2.07	0.25	1993		43.3	5.39	1993	8	3.0	213.8	
1994	0.16		1.82	0.23	1994		26.9	3.63	1994	2	34.8	29.4	
1995	0.08		1.51	0.12	1995		32.3	2.78	1995	4	19.2	195.8	
*1996	0.10		2.00	0.19	*1996		44.8	4.05	*1996	16	35.7	205.6	
1997	0.06	3.0	2.17	0.22	1997	31.6	15.5	43.5	3.84	1997	1	35.4	133.4
1998	0.04	2.7	1.80	0.20	1998	26.5	10.7	34.3	4.45	1998	+	2.7	95.7
**1999	+	0.0	1.93	0.24	**1999	1.2	1.1	29.3	3.22	**1999	+	9.4	74.6
2000	0.08	2.2	1.89	0.28	2000	20.6	8.5	33.0	4.56	2000	16	10.7	139.6
2001	0.09	1.7	2.65	0.25	2001	17.2	7.1	42.7	3.35	2001	25	5.9	169.5
2002	0.02	2.8	2.21	0.22	2002	40.6	13.7	34.6	3.33	2002	1	10.4	99.5
*2003	1.36	3.7	1.32	0.16	*2003	60.8	21.0	16.9	1.54	*2003	8	6.5	49.5
***2004	1.27	3.3	2.40	0.24	***2004	49.9	20.2	43.9	3.71	***2004	5	11.9	211.0

+ less than 0.01
na no available
ns no survey
* Portuguese Surveys used a different vessel and gear
** Portuguese Surveys cover partial area only
*** Portuguese Crustacean vessel with gear operational problems.

Table 8.2.6 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Tuning data

FLT01: SP-CORUTR8c. 1000 Days by 100 HP (thousand)(*)										
1986	2004									
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
FLT02: SP-AVILESTR. 1000 Days by 100 HP (thousand) (*)										
1986	2004									
1	1	0	1							
1	7								Eff.	
10		1.8	135.5	130.9	110.7	38.7	33.2	16.6	10.8	1986
10		7.2	149.2	151.6	195.0	105.9	48.1	7.2	8.3	1987
10		295.1	1099.8	357.0	187.9	63.0	28.7	21.0	9.0	1988
10		121.5	623.8	276.6	165.0	76.9	39.7	21.1	8.1	1989
10		963.9	1591.1	204.8	180.1	97.7	37.7	28.2	8.5	1990
10		717.4	699.1	214.8	101.5	98.9	36.5	26.0	7.7	1991
0		0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	1992
10		470.2	637.9	150.6	153.2	21.0	11.8	5.2	7.6	1993
10		26.0	670.5	642.4	175.7	81.1	33.3	19.8	9.6	1994
10		292.1	324.2	896.1	961.7	128.5	64.5	17.1	6.1	1995
10		16.4	300.7	199.2	568.4	251.1	18.0	54.5	4.5	1996
10		0.7	249.7	710.0	207.0	344.8	157.3	53.4	4.7	1997
10		0.5	120.9	474.2	347.9	74.5	91.4	23.4	5.4	1998
10		1.7	140.0	306.2	422.0	121.2	17.9	23.6	6.8	1999
10		3.3	79.6	351.0	536.0	217.7	50.9	54.6	4.5	2000
10		30.1	224.8	270.7	469.2	251.2	132.8	47.1	1.8	2001
10		4.1	260.6	348.8	155.1	84.9	30.6	37.3	2.7	2002
10		2.6	119.8	159.0	87.8	32.3	29.3	10.3	2.5	2003
0		0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	2004
FLT03: SP-GFS (n/30 min)										
1988	2003									
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

SP-AVILESTR fleets excluded from the assessment.

Table 8.2.7 Four-spot megrim (*L. boscii*). LPUE data by fleet in Divisions VIIIc, IXa.

Year	A Coruña Trawl in VIIIc			Avilés Trawl in VIIIc			Portugal trawl in IXa		
	Landings	Effort	LPUE ¹	Landings	Effort	LPUE ¹	Landings	Effort	LPUE ²
1986	682	39.8	17.1	45	10.8	4.1			
1987	811	34.7	23.4	60	8.3	7.2			
1988	706	42.2	16.7	102	9.0	11.3	146	38.5	3.8
1989	593	44.4	13.3	79	8.1	9.8	183	44.7	4.1
1990	692	44.4	15.6	142	8.5	16.8	164	39.0	4.2
1991	680	40.4	16.8	83	7.7	10.9	166	45.0	3.7
1992	542	38.9	13.9	56	na		280	50.9	5.5
1993	615	44.5	13.8	58	7.6	7.6	180	44.2	4.1
1994	303	39.6	7.7	118	9.6	12.3	146	45.8	3.2
1995	359	41.5	8.7	127	6.1	20.7	121	37.0	3.3
1996	219	35.7	6.1	64	4.5	14.1	155	46.5	3.3
1997	244	35.2	6.9	81	4.7	17.3	76	33.4	2.3
1998	355	32.6	10.9	67	5.4	12.5	83	43.1	1.9
1999	324	30.2	10.7	74	6.8	10.8	73	25.3	2.9
2000	389	30.1	12.9	54	4.5	12.1	93	27.0	3.4
2001	431	29.9	14.4	27	1.8	14.6	89	43.1	2.1
2002	234	21.8	10.7	26	2.7	9.5	97	31.2	3.1
2003	168	18.5	9.1	13	2.5	5.0	133	40.5	2.9
2004	241	21.1	11.4	27	na		102	32.0	3.2

¹ LPUE as catch (kg) per fishing day per 100 HP('000).

² LPUE as catch (kg) per hour.

Table 8.2.8 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Tuning diagnostic.

Lowestoft VPA Version 3.1

20/04/2005 13:05

Extended Survivors Analysis

Four spot megrim (*L. boscii*) Division VIIIc and IXa

CPUE data from file Fleet05.txt

Catch data for 19 years, 1986 to 2004. Ages 0 to 7.

Fleet	First year	Last year	First age	Last age	Alpha	Beta	
FLT0:SP-CORUTR8c	1986	1999	3	6	0	1	
FLT01:SP-GFS	1988	2004	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 30 iterations

Total absolute residual between iterations

29 and 30 = .01516

Final year F values

Age	0	1	2	3	4	5	6
Iteration 29	0	0.0166	0.1694	0.4137	0.3861	0.267	0.2039
Iteration 30	0	0.0166	0.1691	0.4105	0.385	0.2653	0.195

1

Regression weights

	0.751	0.82	0.877	0.921	0.954	0.976	0.99	0.997	1	1
--	-------	------	-------	-------	-------	-------	------	-------	---	---

Fishing mortalities

Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0	0	0	0	0	0	0	0	0	0	0
1	0.062	0.015	0.002	0.002	0.004	0.002	0.008	0.011	0.019	0.017
2	0.342	0.126	0.058	0.076	0.081	0.089	0.079	0.15	0.226	0.169
3	0.446	0.338	0.249	0.284	0.252	0.158	0.246	0.235	0.272	0.41
4	0.643	0.556	0.34	0.436	0.463	0.431	0.363	0.226	0.226	0.385
5	0.935	0.467	0.489	0.623	0.383	0.416	0.584	0.09	0.234	0.265
6	0.688	0.454	0.525	0.499	0.439	0.385	0.385	0.13	0.143	0.195

Table 8.2.8 (Cont'd)

XSA population numbers (Thousands)

YEAR	AGE	0.00E+00	1.00E+00	2.00E+00	3.00E+00	4.00E+00	5.00E+00	6
1995		3.70E+04	2.59E+04	8.41E+03	1.89E+04	1.30E+04	1.92E+03	1290
1996		2.72E+04	3.03E+04	1.99E+04	4.89E+03	9.89E+03	5.62E+03	618
1997		2.46E+04	2.22E+04	2.45E+04	1.44E+04	2.85E+03	4.64E+03	2880
1998		1.27E+04	2.02E+04	1.82E+04	1.89E+04	9.19E+03	1.66E+03	2330
1999		2.46E+04	1.04E+04	1.65E+04	1.38E+04	1.16E+04	4.87E+03	731
2000		2.84E+04	2.02E+04	8.46E+03	1.24E+04	8.78E+03	6.00E+03	2720
2001		23100	23300	16500	6330	8690	4670	3240
2002		26800	18900	18900	12500	4050	4950	2130
2003		31900	21900	15300	13300	8060	2650	3700
2004		2.52E+04	2.61E+04	1.76E+04	9.98E+03	8.31E+03	5.26E+03	1720

Estimated population abundance at 1st Jan 2005

0.00E+00	2.07E+04	2.11E+04	1.22E+04	5.47E+03	4.65E+03	3330
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Taper weighted geometric mean of the VPA populations:

25800	21400	17200	12200	7830	4060	1980
-------	-------	-------	-------	------	------	------

Standard error of the weighted Log(VPA populations) :

0.3317	0.3558	0.3699	0.421	0.4364	0.4233	0.5474
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1

Log catchability residuals.

FLT0:SP-CORUTR&c

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	
0	No data for this fleet at this age									
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	0.86	0.89	0.33	-0.11	-0.18	0.31	0.22	0.58	-0.47	
4	0.93	0.32	-0.04	-0.17	0.22	-0.23	0.47	0.73	0.14	
5	0.27	-0.15	-0.19	-0.28	0	0.64	0.35	0.08	0.05	
6	0.15	-0.06	0.01	0.08	0.15	0.42	0.05	0.19	0.01	

Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0	No data for this fleet at this age									
1	No data for this fleet at this age									
2	No data for this fleet at this age									
3	0.2	-0.62	-0.54	0.4	0.19	99.99	99.99	99.99	99.99	99.99
4	-0.16	-0.2	-0.74	0.16	0.07	99.99	99.99	99.99	99.99	99.99
5	0.28	-0.58	-0.28	0.29	-0.18	99.99	99.99	99.99	99.99	99.99
6	0.07	-0.27	0.08	0.15	0.12	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	-6.5494	-5.705	-5.3147	-5.3147
S.E(Log q)	0.4541	0.4152	0.351	0.1812

Regression statistics :

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	0.76	0.802	7.26	0.69	14	0.36	-6.55
4	0.71	1.314	6.66	0.8	14	0.28	-5.7
5	1.64	-1.489	3.43	0.51	14	0.53	-5.31
6	0.87	1.532	5.52	0.96	14	0.13	-5.24

1

Table 8.2.8 (Cont'd)

FLT01:SP-GFS

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994
0	99.99	99.99	-0.02	0.61	-0.31	-0.19	-0.15	0.01	0.27
1	99.99	99.99	0.15	-0.24	-0.02	-0.01	0.17	-0.1	-0.34
2	99.99	99.99	0.13	-0.16	-0.05	-0.23	-0.39	-0.04	-0.3
3	99.99	99.99	-0.22	-0.71	-0.83	-0.6	-0.31	-0.37	-0.32
4	99.99	99.99	-0.93	-0.54	-0.15	-0.51	-0.1	-0.31	0.17
5	99.99	99.99	-0.39	-0.49	0.19	-0.03	0.06	-0.53	0.08
6	99.99	99.99	-0.57	-0.69	-0.06	-1.06	-0.26	-0.2	0.13

Age	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
0	-0.17	0.43	0.53	-0.04	-0.11	-0.19	-0.27	-0.14	99.99	-0.02
1	0.09	-0.06	-0.06	-0.19	0.3	0.07	0.07	-0.09	99.99	0.11
2	-0.35	0.19	-0.08	-0.07	0.11	0.17	0.24	0.15	99.99	0.13
3	-0.44	-0.3	0.36	0.16	0.02	-0.08	0.55	0.32	99.99	0.5
4	-0.09	-0.4	0.15	0.21	-0.21	0.4	0.27	0.19	99.99	-0.02
5	0.03	0.53	0.28	0.64	-0.31	0.09	0.75	-0.89	99.99	-0.62
6	-0.2	0.56	0.35	0.39	-0.09	-0.15	0.18	-0.68	99.99	-0.87

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	-7.4137	-7.5592	-7.7752	-7.7752
SE(Log q)	0.4062	0.2908	0.525	0.4945

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	0.48	1.967	9.96	0.61	16	0.28	-9.76
1	0.7	2.015	8.04	0.83	16	0.17	-7.2
2	0.87	0.708	7.54	0.77	16	0.22	-7.22

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	1.3	-0.762	6.83	0.43	16	0.54	-7.41
4	1.37	-1.416	7.04	0.62	16	0.38	-7.56
5	1.59	-0.933	7.44	0.22	16	0.84	-7.78
6	1.16	-0.483	7.96	0.49	16	0.58	-7.9

Terminal year survivor and F summaries :

Age 0 Catchability dependent on age and year class strength

Year class = 2004

Fleet	Estim Surviv	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT0:SP-CORUTRSc	1	0	0	0	0	0	0
FLT01:SP-GFS	20261	0.3	0	0	1	0.584	0
P shrinkage mean	21416	0.36				0.416	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
20734	0.23	0.04	2	0.156	0

Table 8.2.8 (Cont'd)

Age 1 Catchability dependent on age and year class strength

Year class = 2003

Fleet	Estim Surviv	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT0:SP-CORUTR8c	1		0	0	0	0	0
FLT01:SP-GFS	23505		0.3	0	0	1	0.585
P shrinkage mean	17194		0.37				0.391
F shrinkage mean	39464		1.5				0.024

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
	21057	0.23	0.15	3	0.649

1

Age 2 Catchability dependent on age and year class strength

Year class = 2002

Fleet	Estim Surviv	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT0:SP-CORUTR8c	1		0	0	0	0	0
FLT01:SP-GFS	12132		0.212	0.138	0.65	2	0.753
P shrinkage mean	12238		0.42				0.229
F shrinkage mean	16763		1.5				0.018

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
	12227	0.19	0.07	4	0.39

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

Year class = 2001

Fleet	Estim Surviv	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT0:SP-CORUTR8c	1		0	0	0	0	0
FLT01:SP-GFS	5369		0.193	0.213	1.11	3	0.971
F shrinkage mean	10443		1.5				0.029

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
	5473	0.19	0.18	4	0.955

1

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

Year class = 2000

Fleet	Estim Surviv	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT0:SP-CORUTR8c	1		0	0	0	0	0
FLT01:SP-GFS	4639		0.154	0.069	0.45	4	0.98
F shrinkage mean	5295		1.5				0.02

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
	4651	0.15	0.06	5	0.389

Table 8.2.8 (Cont'd)

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

Year class = 1999

Fleet	Estim Surviv	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT0:SP-CORUTR8c	1		0	0	0	0	0
FLT01:SP-GFS	3356		0.158	0.144	0.91	5	0.978
F shrinkage mean	2449		1.5				0.022

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
	3333	0.16	0.13	6	0.816

1

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

Year class = 1998

Fleet	Estim Surviv	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT0:SP-CORUTR8c	1		0	0	0	0	0
FLT01:SP-GFS	1229		0.147	0.182	1.24	6	0.98
F shrinkage mean	582		1.5				0.02

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
	1211	0.15	0.17	7	1.154

Table 8.2.9 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Estimates of fishing mortality at age.

Run title : Four spot megrim (L. boscii) in Divisions VIIIc and IXa

At 27/04/2004 10:23

Terminal Fs derived using XSA (With F shrinkage)

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994
AGE									
0	0	0	0	0	0	0	0	0	0
1	0.0025	0.0578	0.0608	0.0259	0.0581	0.0775	0.0268	0.0186	0.0089
2	0.1226	0.3805	0.3874	0.4435	0.2572	0.2059	0.2567	0.0962	0.1309
3	0.2385	0.2648	0.3098	0.3692	0.1985	0.2613	0.3618	0.3298	0.2724
4	0.5216	0.3861	0.4291	0.6548	0.4900	0.3172	0.8383	0.7046	0.7265
5	0.3849	0.3358	0.4765	0.6471	0.5829	0.7648	0.7442	0.4405	0.7554
6	0.3699	0.3400	0.5466	0.8217	0.5831	0.5619	0.4954	0.4934	0.6787
+gp	0.3699	0.3400	0.5466	0.8217	0.5831	0.5619	0.4954	0.4934	0.6787
0 FBAR 2- 4	0.2942	0.3438	0.3754	0.4892	0.3152	0.2615	0.4856	0.3769	0.3766

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	FBAR 02-04
AGE											
0	0	0	0	0	0	0	0	0	0	0	0
1	0.0625	0.0146	0.0017	0.0025	0.0041	0.0025	0.0080	0.0112	0.0187	0.0166	0.0155
2	0.3424	0.1259	0.0578	0.0760	0.0811	0.0894	0.0794	0.1503	0.2263	0.1691	0.1819
3	0.4458	0.3376	0.2488	0.2844	0.2520	0.1581	0.2463	0.2351	0.2722	0.4105	0.3059
4	0.6425	0.5558	0.3397	0.4361	0.4632	0.4310	0.3630	0.2263	0.2261	0.3850	0.2791
5	0.9345	0.4667	0.4887	0.6228	0.3833	0.4162	0.5841	0.0904	0.2336	0.2653	0.1964
6	0.6885	0.4538	0.5250	0.4990	0.4391	0.3849	0.3850	0.1304	0.1433	0.1950	0.1562
+gp	0.6885	0.4538	0.5250	0.4990	0.4391	0.3849	0.3850	0.1304	0.1433	0.1950	
0 FBAR 2- 4	0.4769	0.3398	0.2154	0.2655	0.2654	0.2262	0.2296	0.2039	0.2415	0.3215	

Table 8.2.10 Four spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Estimates of stocks numbers at age

Run title : Four spot megrim (L. boscii) in Divisions VIIIc and IXa

At 27/04/2004 10:23

Terminal Fs derived using XSA (With F shrinkage)

YEAR	1986	1987	1988	1989	1990	1991	1992	1993	1994
AGE									
0	54889	34919	38682	34548	20987	43118	39905	12652	31678
1	49514	44940	28589	31670	28285	17182	35302	32672	10359
2	33272	40439	34728	22027	25266	21852	13018	28138	26255
3	19219	24097	22631	19301	11574	15995	14562	8245	20925
4	10714	12396	15138	13593	10923	7770	10085	8303	4854
5	3916	5207	6898	8070	5782	5479	4632	3571	3360
6	3035	2182	3047	3507	3459	2643	2088	1802	1882
+gp	812	537	1202	1224	1986	1218	188	781	988
0 TOTAL	175371	164716	150915	133939	108262	115257	119780	96163	100301

YEAR	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	GMST ^{86:03}	AMST ^{86:04}
AGE													
0	37044	27174	24622	12673	24633	28446	23066	26804	31918	25212	0	28386	30344
1	25936	30329	22248	20159	10375	20168	23290	18885	21945	26132	20734	24380	26465
2	8406	19949	24472	18184	16464	8460	16471	18917	15290	17635	21057	20356	22136
3	18858	4887	14400	18910	13798	12429	6334	12456	9983	13326	12227	14038	15213
4	13047	9886	2855	9193	11650	8781	8687	4054	8062	8311	5473	8805	9525
5	1922	5618	4643	1664	4866	6002	4672	4947	2647	5265	4651	4468	4779
6	1293	618	2884	2332	731	2716	3241	2133	3700	1715	3333	2114	2329
+gp	614	1654	1186	972	1504	2876	1225	3232	1171	2061	2599		
0 TOTAL	107119	100115	97310	84086	84021	89877	86986	91428	98059	96314	70073		

Table 8.2.11 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Summary of catches and XSA results.Run title : Four spot megrim (*L. boscii*) Division VIIIc and IXa

At 20/04/2005 13:06

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 2- 4
Age 0						
1986	54889	6269	5352	1124	0.21	0.2942
1987	34919	7865	6669	1688	0.2531	0.3438
1988	38682	8381	7417	2223	0.2997	0.3754
1989	34548	8272	7285	2629	0.3609	0.4892
1990	20987	7324	6643	1945	0.2928	0.3152
1991	43118	6870	6196	1682	0.2714	0.2615
1992	39905	6347	5525	1916	0.3468	0.4856
1993	12652	6283	5587	1384	0.2477	0.3769
1994	31678	5858	5291	1403	0.2651	0.3766
1995	37044	5477	4721	1652	0.3499	0.4769
1996	27174	5198	4430	1098	0.2479	0.3398
1997	24622	4988	4365	896	0.2053	0.2154
1998	12673	5447	4890	1123	0.2297	0.2655
1999	24633	5305	4828	1125	0.233	0.2654
2000	28446	5353	4786	1041	0.2175	0.2262
2001	23066	5106	4411	931	0.2111	0.2296
2002	26804	6133	5437	720	0.1324	0.2039
2003	31918	5826	5074	876	0.1726	0.2415
2004	25212	5520	4801	991	0.2064	0.3215
Arith.						
Mean	30156	6201	5458	1392	0.2502	0.3213
0 Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		

**Table 8.2.12 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa.
Prediction with management option table: Input data**

MFDP version 1a
Run: mfdp_bos05
Time and date: 18:37 11/05/2005
Fbar age range: 2-4

Age	2005	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
0		25952	0.2	0	0	0	0.003	0.000	0.003
1		20734	0.2	0.55	0	0	0.042	0.016	0.042
2		21057	0.2	0.86	0	0	0.069	0.182	0.069
3		12227	0.2	0.97	0	0	0.094	0.306	0.094
4		5473	0.2	0.99	0	0	0.121	0.279	0.121
5		4651	0.2	1	0	0	0.148	0.196	0.148
6		3333	0.2	1	0	0	0.195	0.156	0.195
7		2599	0.2	1	0	0	0.243	0.156	0.243

Age	2006	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
0		25952	0.2	0	0	0	0.003	0.000	0.003
1 .			0.2	0.55	0	0	0.042	0.016	0.042
2 .			0.2	0.86	0	0	0.069	0.182	0.069
3 .			0.2	0.97	0	0	0.094	0.306	0.094
4 .			0.2	0.99	0	0	0.121	0.279	0.121
5 .			0.2	1	0	0	0.148	0.196	0.148
6 .			0.2	1	0	0	0.195	0.156	0.195
7 .			0.2	1	0	0	0.243	0.156	0.243

Age	2007	Stock size	Natural mortality	Maturity ogive	Prop. of F bef. Spaw.	Prop. of M bef. Spaw.	Weight in Stock	Exploit pattern	Weight CWt
0		25952	0.2	0	0	0	0.003	0.000	0.003
1 .			0.2	0.55	0	0	0.042	0.016	0.042
2 .			0.2	0.86	0	0	0.069	0.182	0.069
3 .			0.2	0.97	0	0	0.094	0.306	0.094
4 .			0.2	0.99	0	0	0.121	0.279	0.121
5 .			0.2	1	0	0	0.148	0.196	0.148
6 .			0.2	1	0	0	0.195	0.156	0.195
7 .			0.2	1	0	0	0.243	0.156	0.243

Input units are thousands and kg - output in tonnes

Table 8.2.13 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa catch forecast: management option table.

MFDP version 1a
 Run: mfdp_bos05
 Four spot megrim (*L. boscii*) Division VIIIc and IXa
 Time and date: 18:37 11/05/2005
 Fbar age range: 2-4

2005				
Biomass	SSB	FMult	FBar	Landings
6199	5478	1.0000	0.2557	937

2006					2007	
Biomass	SSB	FMult	FBar	Landings	Biomass	SSB
6503	5807	0.0000	0.0000	0	7781	7074
.	5807	0.1000	0.0256	111	7655	6950
.	5807	0.2000	0.0511	220	7532	6828
.	5807	0.3000	0.0767	326	7413	6710
.	5807	0.4000	0.1023	430	7295	6594
.	5807	0.5000	0.1278	531	7181	6481
.	5807	0.6000	0.1534	631	7069	6370
.	5807	0.7000	0.1790	728	6960	6263
.	5807	0.8000	0.2045	822	6854	6157
.	5807	0.9000	0.2301	915	6749	6054
.	5807	1.0000	0.2557	1006	6648	5954
.	5807	1.1000	0.2812	1094	6548	5855
.	5807	1.2000	0.3068	1181	6451	5759
.	5807	1.3000	0.3324	1266	6356	5666
.	5807	1.4000	0.3579	1349	6264	5574
.	5807	1.5000	0.3835	1430	6173	5485
.	5807	1.6000	0.4090	1509	6084	5397
.	5807	1.7000	0.4346	1587	5998	5312
.	5807	1.8000	0.4602	1663	5913	5228
.	5807	1.9000	0.4857	1737	5831	5146
.	5807	2.0000	0.5113	1810	5750	5067

Input units are thousands and kg - output in tonnes

Table 8.2.14 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Single option prediction. Detail Tables.

MFDP version 1a
 Run: mfdp_bos05
 Time and date: 18:37 11/05/2005
 Fbar age range: 2-4

Year:	2005		F multiplier:	1	Fbar:	0.2557				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)	
0	0	0	0	25952	87	0	0	0	0	
1	0.0155	289	12	20734	864	11404	475	11404	475	
2	0.1819	3184	221	21057	1460	18109	1256	18109	1256	
3	0.3059	2936	277	12227	1153	11860	1119	11860	1119	
4	0.2791	1214	147	5473	664	5418	657	5418	657	
5	0.1964	754	112	4651	688	4651	688	4651	688	
6	0.1562	438	86	3333	651	3333	651	3333	651	
7	0.1562	342	83	2599	632	2599	632	2599	632	
Total		9156	937	96026	6199	57374	5478	57374	5478	

Year:	2006		F multiplier:	1	Fbar:	0.2557				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)	
0	0	0	0	25952	87	0	0	0	0	
1	0.0155	296	12	21248	885	11686	487	11686	487	
2	0.1819	2527	175	16714	1159	14374	997	14374	997	
3	0.3059	3451	326	14373	1356	13942	1315	13942	1315	
4	0.2791	1635	198	7372	894	7298	886	7298	886	
5	0.1964	550	81	3390	502	3390	502	3390	502	
6	0.1562	411	80	3129	611	3129	611	3129	611	
7	0.1562	546	133	4154	1009	4154	1009	4154	1009	
Total		9416	1006	96332	6503	57973	5807	57973	5807	

Year:	2007		F multiplier:	1	Fbar:	0.2557				
Age	F	CatchNos	Yield	StockNos	Biomass	SSNos(Jan)	SSB(Jan)	SSNos(ST)	SSB(ST)	
0	0	0	0	25952	87	0	0	0	0	
1	0.0155	296	12	21248	885	11686	487	11686	487	
2	0.1819	2590	180	17129	1188	14731	1021	14731	1021	
3	0.3059	2739	258	11409	1076	11066	1044	11066	1044	
4	0.2791	1922	233	8666	1051	8579	1041	8579	1041	
5	0.1964	740	110	4566	676	4566	676	4566	676	
6	0.1562	300	59	2280	445	2280	445	2280	445	
7	0.1562	670	163	5100	1239	5100	1239	5100	1239	
Total		9258	1015	96349	6648	58009	5954	58009	5954	

Input units are thousands and kg - output in tonnes

Table 8.2.15 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	2002	2003	2004	2005	2006
Stock No. (thousands) of 0 year-olds	26804	31918	25212	25952	25952
Source	XSA	XSA	XSA	GM90-03	GM90-03
Status Quo F:					
% in 2005 landings	29.5	23.6	1.3	0.0	-
% in 2006 landings	19.7	32.4	17.4	1.2	0.0
% in 2005 SSB	20.4	22.9	8.7	0.0	-
% in 2006 SSB	15.3	22.6	17.2	8.4	0.0
% in 2007 SSB	11.4	17.5	17.5	17.2	8.2

GM : geometric mean recruitment

Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa : Year-class % contribution to

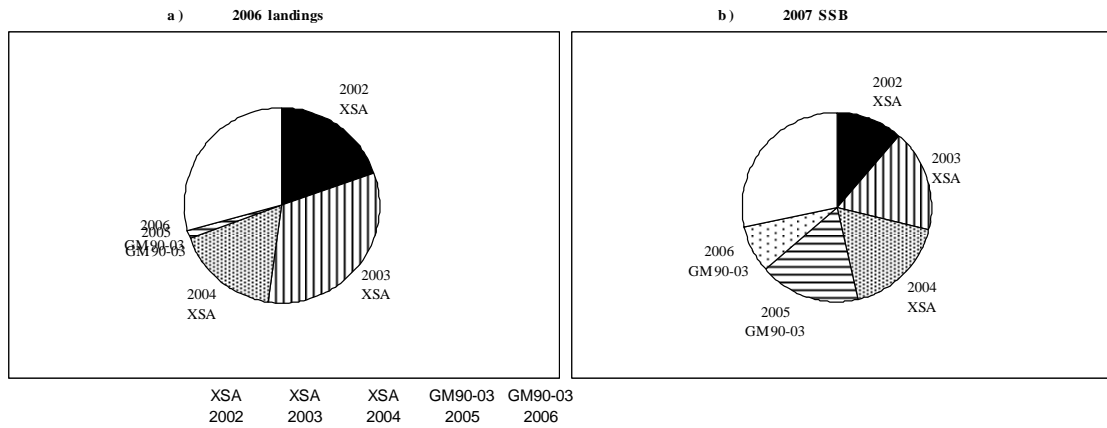


Table 8.2.16 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Yield per recruit results.

MFYPR version 2a
 Run: Mfypr_NoCa03
 Time and date: 13:48 26/04/2005
 Yield per results

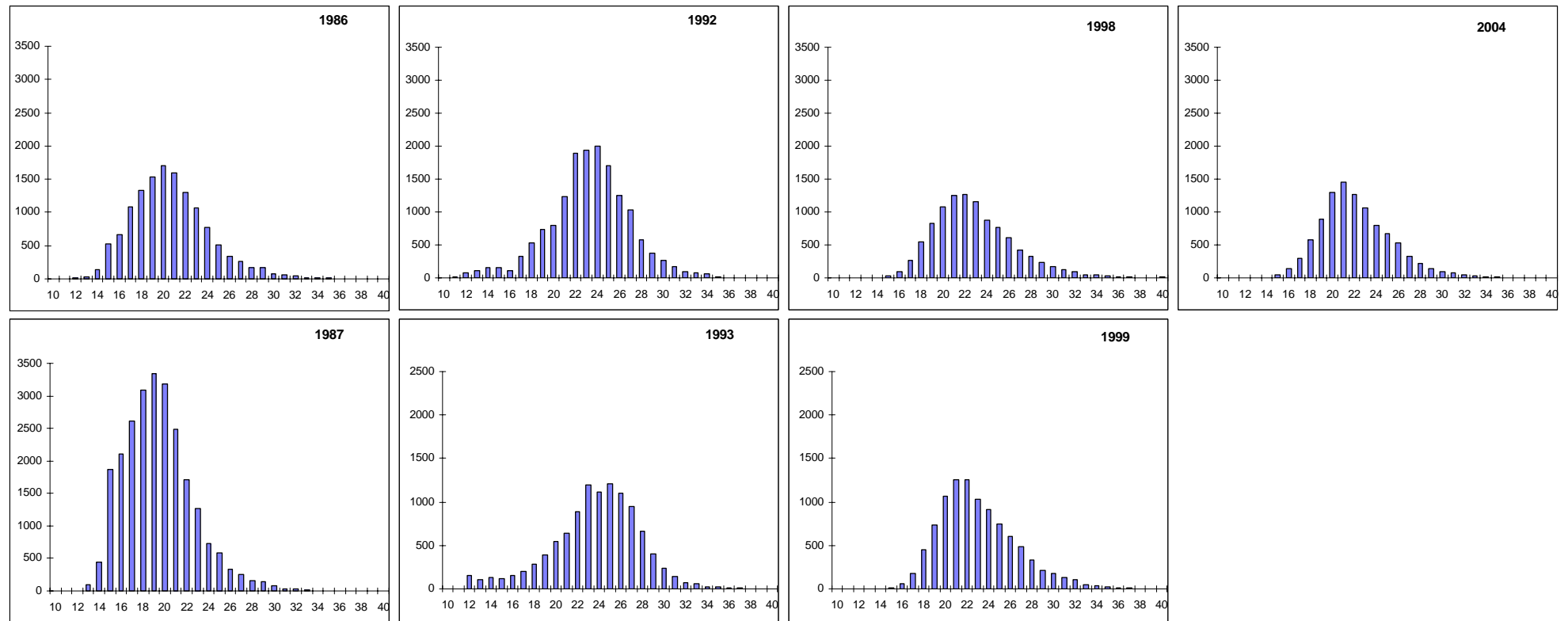
FMult	Fbar	CatchNos	Yield	StockNos	Bio mass	SpwnNos Jan	SSB Jan	SpwnNos Spwn	SSB Spwn
0.0	0	0	0	5.5167	0.6341	4.0334	0.6068	4.0334	0.6068
0.1	0.0256	0.0632	0.0090	5.2016	0.5659	3.791	0.5387	3.791	0.5387
0.2	0.0511	0.1168	0.0161	4.9349	0.5091	3.4530	0.4819	3.4530	0.4819
0.3	0.0767	0.1627	0.0218	4.7069	0.4612	3.2257	0.4341	3.2257	0.4341
0.4	0.1023	0.2022	0.0264	4.5104	0.4205	3.0298	0.3934	3.0298	0.3934
0.5	0.1278	0.2366	0.0301	4.3396	0.3857	2.8597	0.3587	2.8597	0.3587
0.6	0.1534	0.2668	0.0330	4.1903	0.3557	2.7110	0.3288	2.7110	0.3288
0.7	0.1790	0.2933	0.0355	4.0589	0.3297	2.5801	0.3029	2.5801	0.3029
0.8	0.2045	0.3168	0.0374	3.9426	0.3071	2.4644	0.2803	2.4644	0.2803
0.9	0.2301	0.3378	0.0390	3.8392	0.2873	2.3615	0.2606	2.3615	0.2606
1.0	0.2557	0.3565	0.0403	3.7467	0.2699	2.2696	0.2432	2.2696	0.2432
1.1	0.2812	0.3734	0.0413	3.6637	0.2546	2.1872	0.2279	2.1872	0.2279
1.2	0.3068	0.3886	0.0422	3.5889	0.2410	2.1129	0.2144	2.1129	0.2144
1.3	0.3324	0.4024	0.0429	3.5212	0.2288	2.0457	0.2023	2.0457	0.2023
1.4	0.3579	0.4150	0.0435	3.4597	0.2180	1.9847	0.1915	1.9847	0.1915
1.5	0.3835	0.4264	0.0439	3.4036	0.2084	1.9292	0.1819	1.9292	0.1819
1.6	0.4090	0.4369	0.0443	3.3524	0.1997	1.8784	0.1732	1.8784	0.1732
1.7	0.4346	0.4466	0.0445	3.3054	0.1918	1.8319	0.1654	1.8319	0.1654
1.8	0.4602	0.4555	0.0448	3.2622	0.1847	1.7892	0.1584	1.7892	0.1584
1.9	0.4857	0.4637	0.0449	3.2224	0.1783	1.7498	0.1520	1.7498	0.1520
2.0	0.5113	0.4713	0.0451	3.1855	0.1724	1.7134	0.1462	1.7134	0.1462

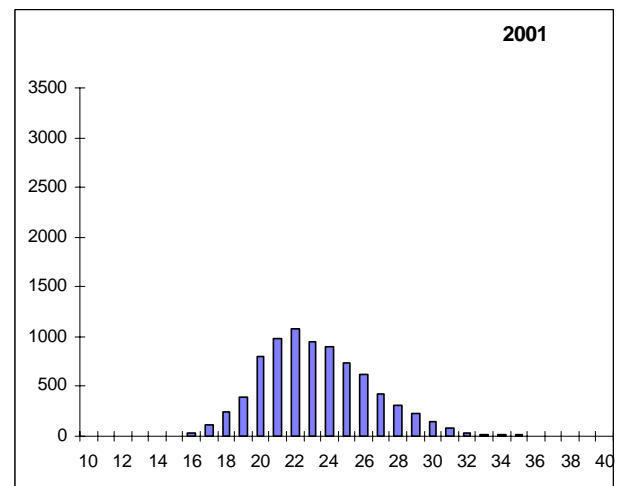
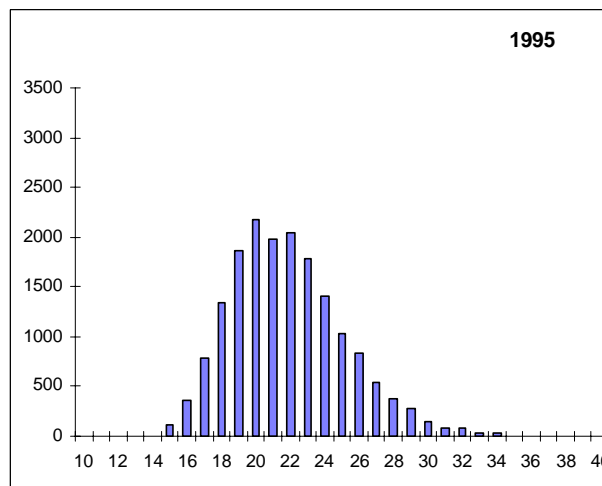
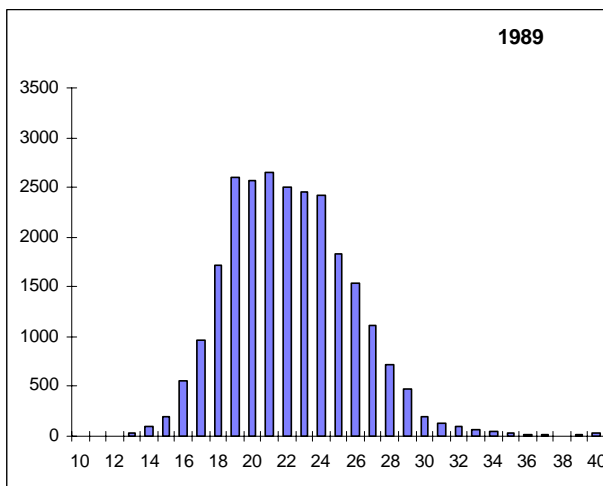
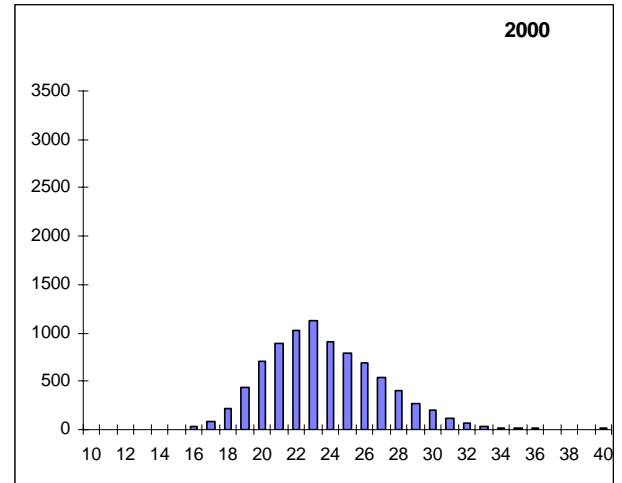
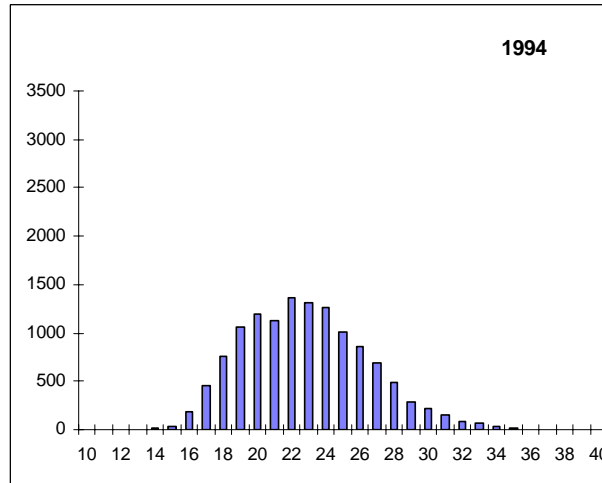
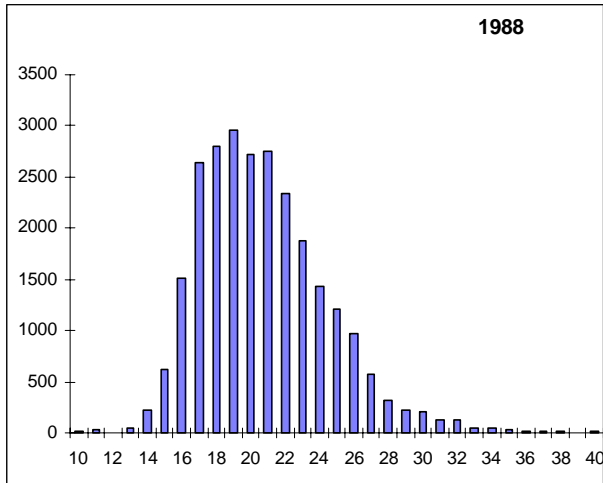
Reference point	F multiplier	Absolute F
Fbar(2-4)	1	0.2557
FMax	2.4787	0.6337
F0.1	1.0685	0.2732
F35%SPR	1.2157	0.3108

Weights in kilograms

Table 8.2.17 Four-spot megrim (*L. bosci*) in Divisions VIIIc and IXa. Input data for sensitivity analysis

Name	Value	CV	Name	Value	CV
Population at age 0 in 2005			Exploitation pattern		
N0	25951	0.37	sH0	0	0
N1	20734	0.23	sH1	0.015	0.23
N2	21057	0.23	sH2	0.182	0.28
N3	12226	0.19	sH3	0.306	0.07
N4	5472	0.19	sH4	0.279	0.12
N5	4650	0.15	sH5	0.196	0.36
N6	3333	0.16	sH6	0.156	0.04
N7	2599	0.17	sH7	0.156	0.04
Weight in the catch at age			Weight in the stock at age		
WH0	0.003	0.350	WS0	0.003	0.350
WH1	0.042	0.040	WS1	0.042	0.040
WH2	0.069	0.040	WS2	0.069	0.040
WH3	0.094	0.090	WS3	0.094	0.090
WH4	0.121	0.070	WS4	0.121	0.070
WH5	0.148	0.130	WS5	0.148	0.130
WH6	0.195	0.090	WS6	0.195	0.090
WH7	0.243	0.030	WS7	0.243	0.030
Natural mortality			Maturity ogive		
M0	0.2	0.1	MT0		
M1	0.2	0.1	MT1	0.55	0.10
M2	0.2	0.1	MT2	0.86	0.10
M3	0.2	0.1	MT3	0.97	0.10
M4	0.2	0.1	MT4	0.99	0.10
M5	0.2	0.1	MT5	1.00	0.10
M6	0.2	0.1	MT6	1.00	0.00
M7	0.2	0.1	MT7	1.00	0.00
Recruitment in year			Effort multiplier in year		
R2006	25952	0.37	HF2005	1	0.23
R2007	25952	0.37	HF2006	1	0.23
			HF2007	1	0.23
			Natural mortality multiplier in year		
Stock numbers in 2005 are VPA survivors.			K2005	1	0.1
Recruitment is GM 1990-2003 from VPA			K2006	1	0.1
			K2007	1	0.1

Figure 8.2.1 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Annual length compositions of landings ('000)



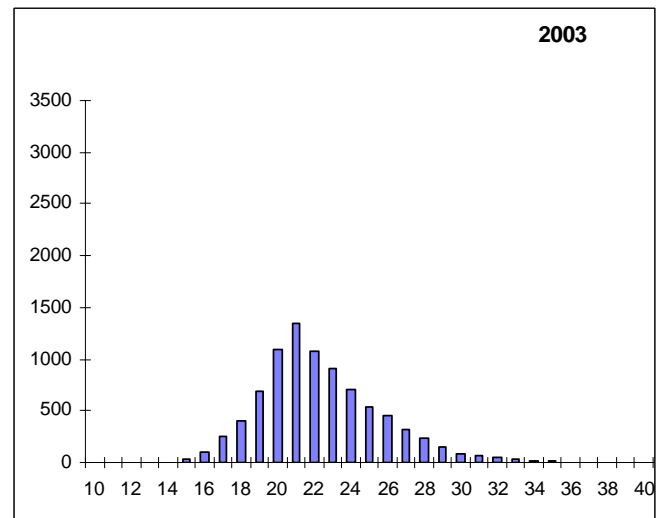
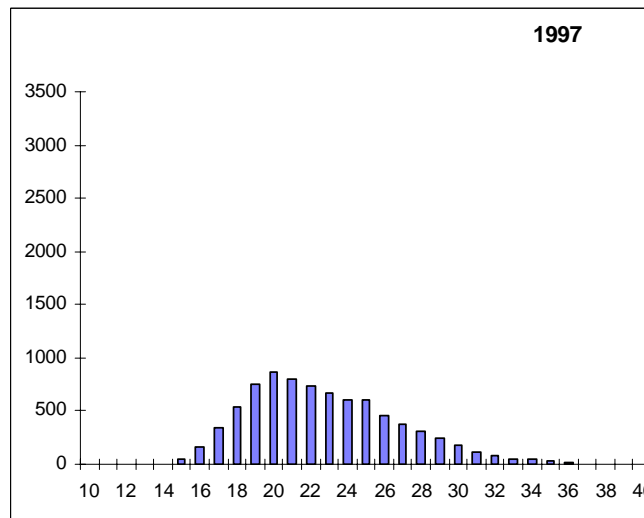
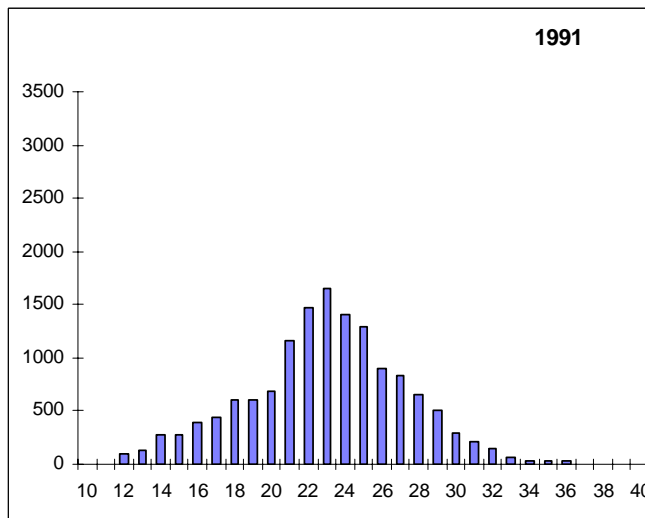
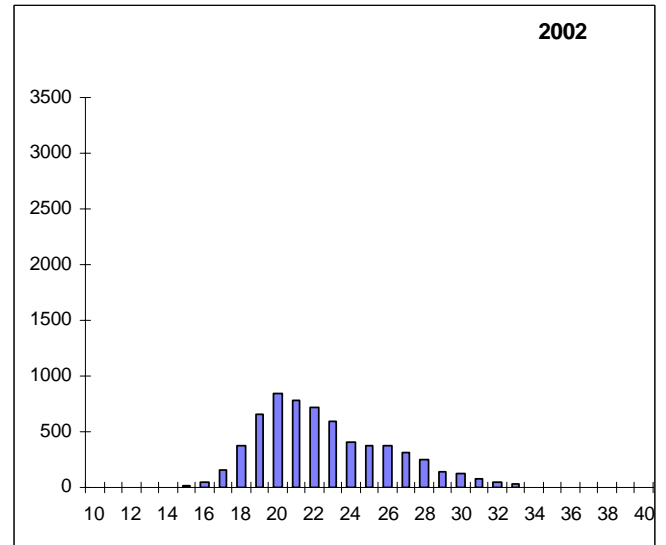
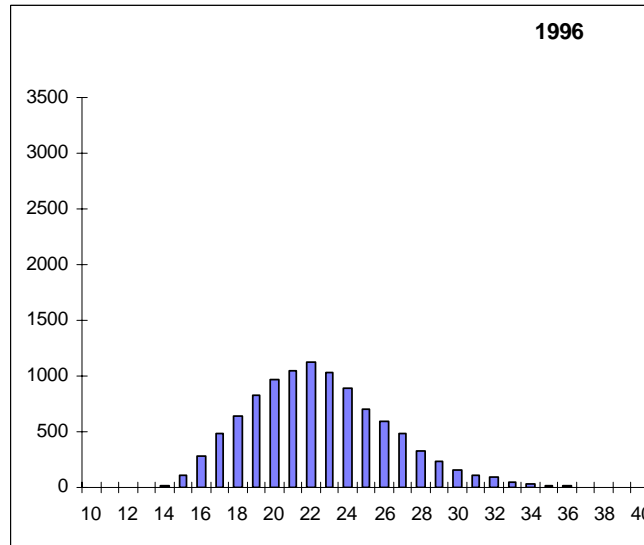
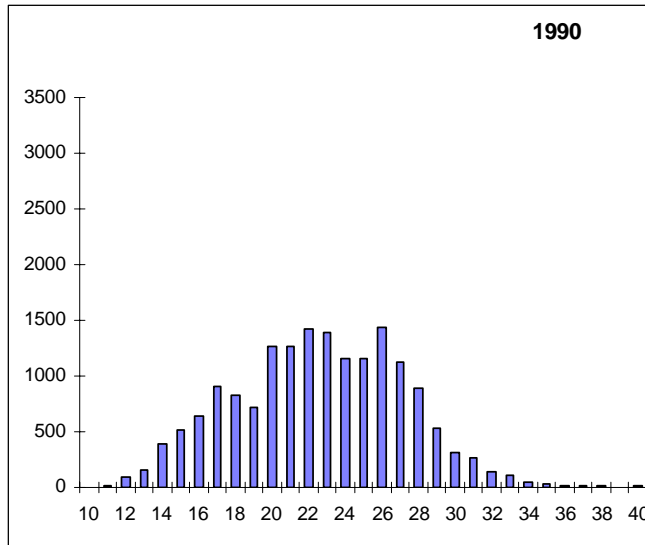


Figure 8.2.2. Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Spanish Survey age distribution

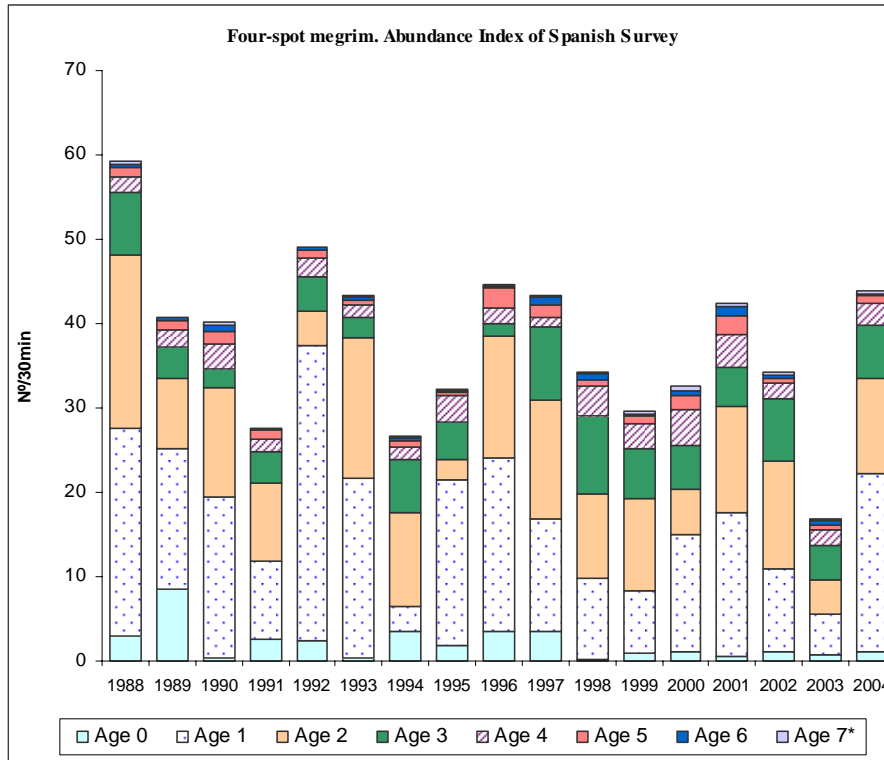
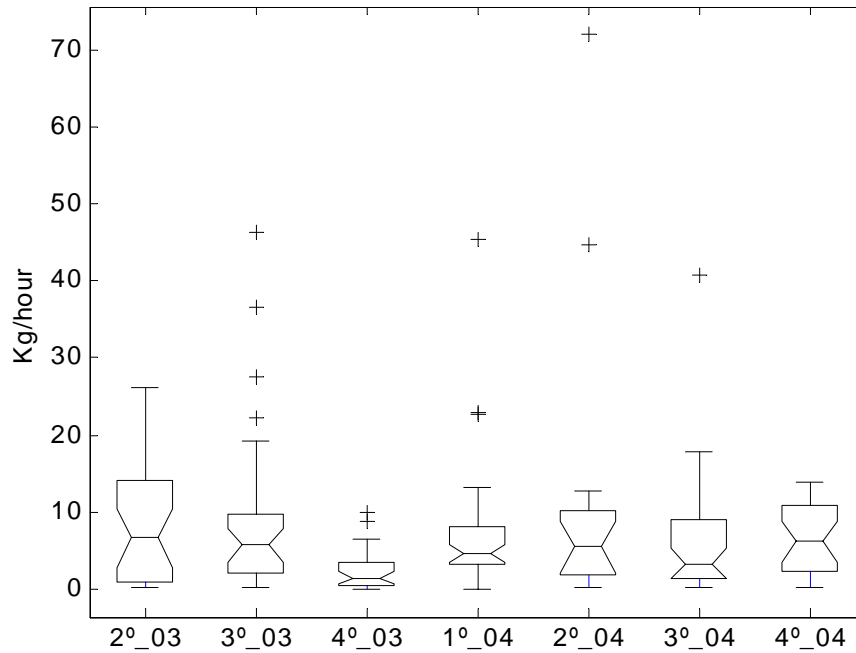


Figure 8.2.3. Notched-box plots of four-spot megrim CPUE from observers on board



* Trawl Fishery was closed on the first quarter of 2003 due to the Prestige oil spill

Figure 8.2.4 Four-spot megrim (*L.boschii*) in Divisions VIIIc and IXa. Landings (t), Efforts, LPUEs and Abundance Indices.

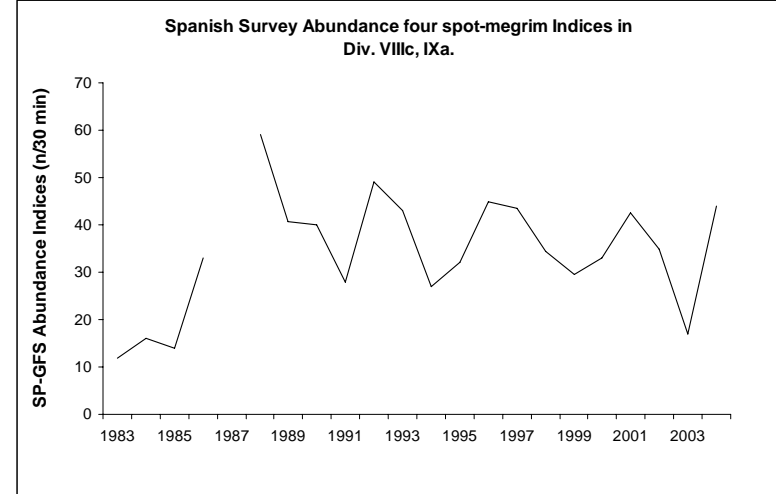
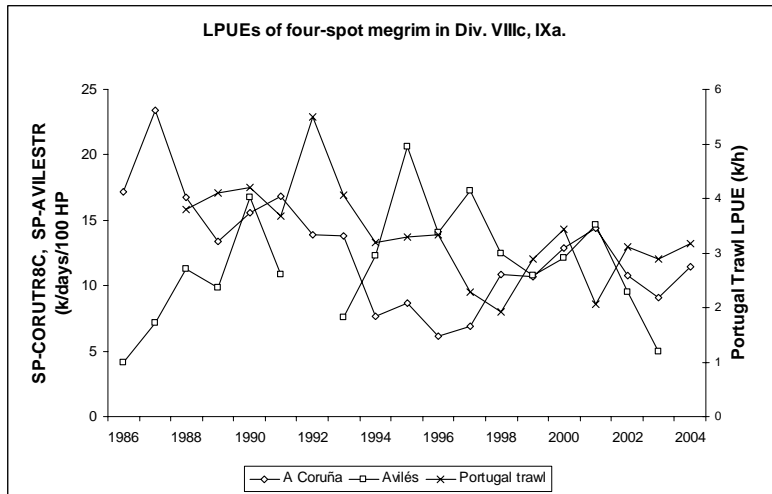
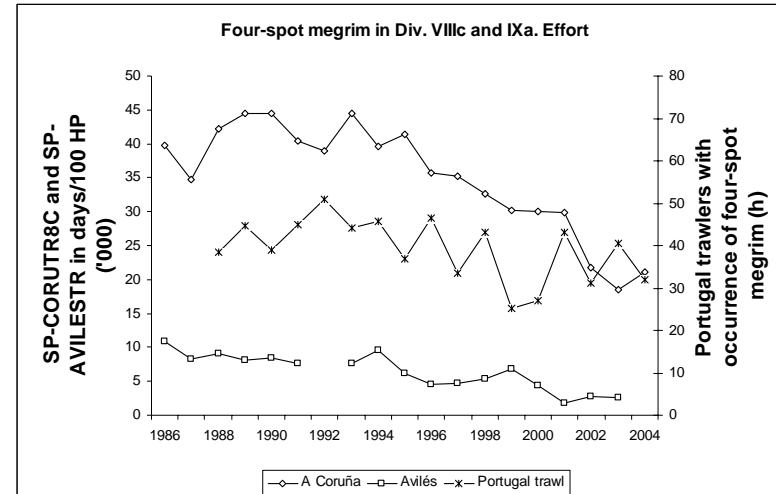
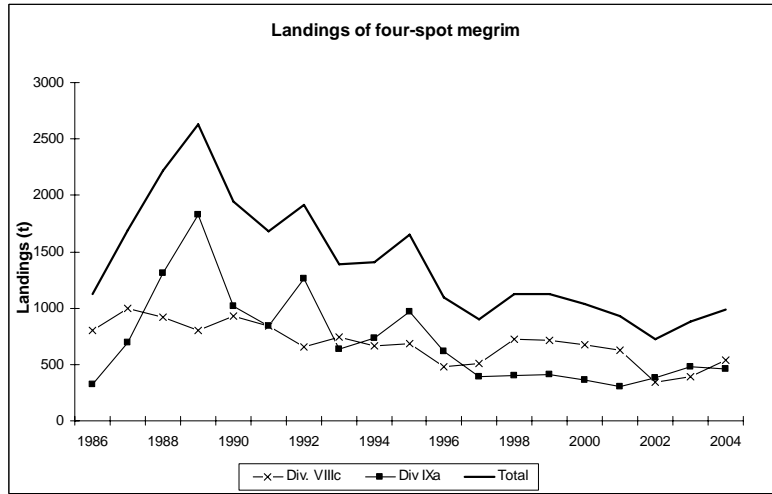


Figure 8.2.5. Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Retrospective XSA

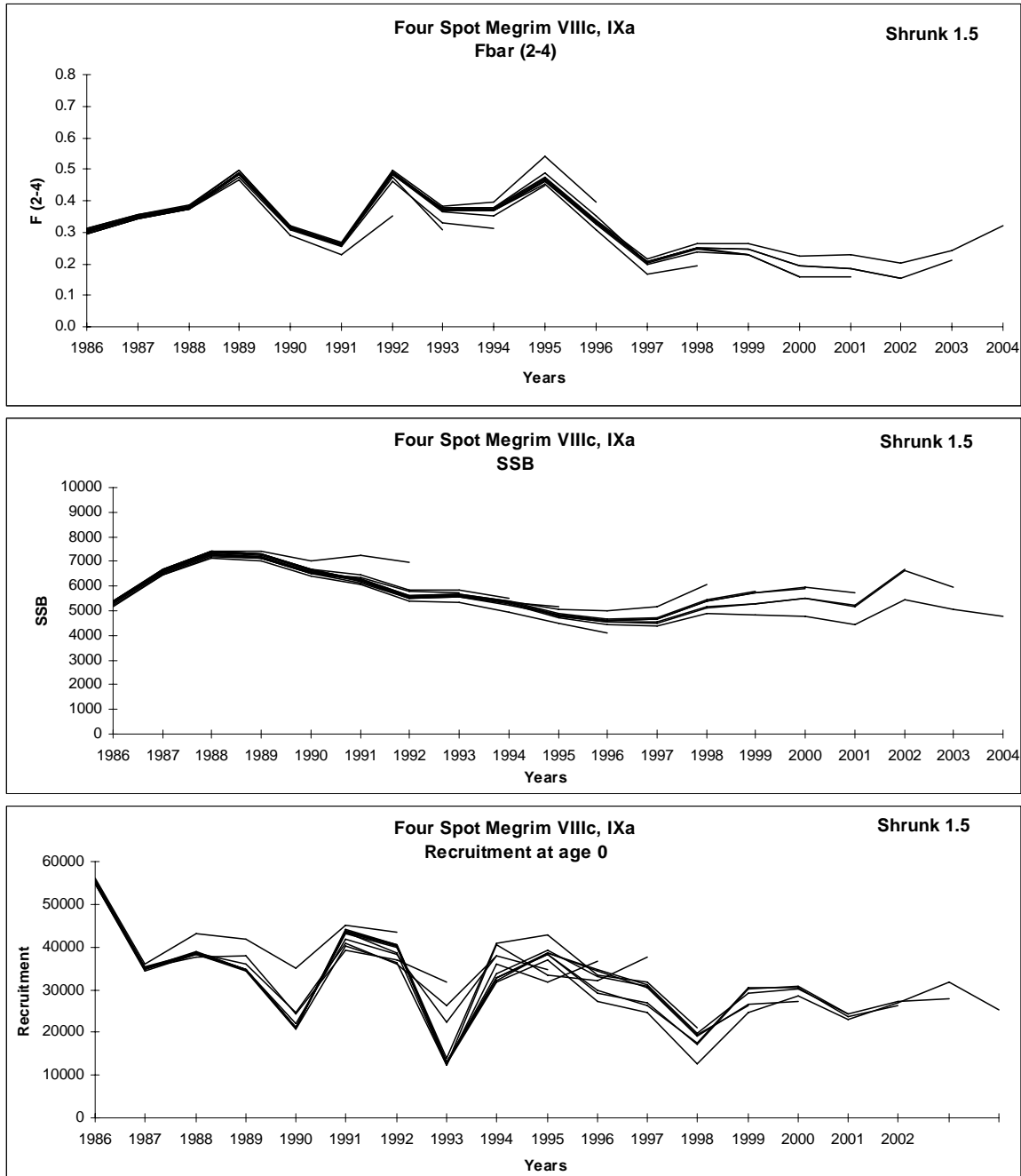


Figure 8.2.6. Four spot megrim (*L. boscii*) in Divisions VIIIc and IXa

LOG CATCHABILITY RESIDUAL PLOTS (XSA)

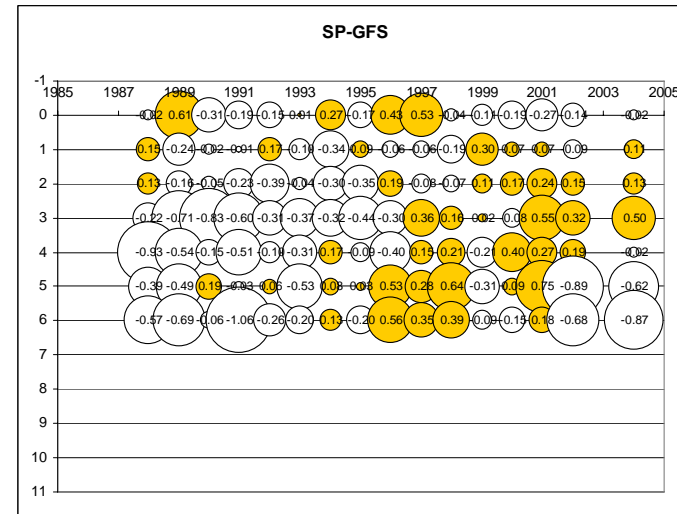
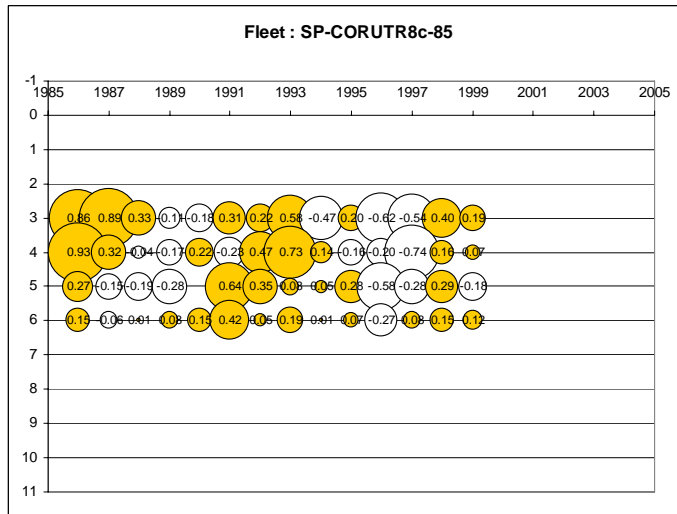
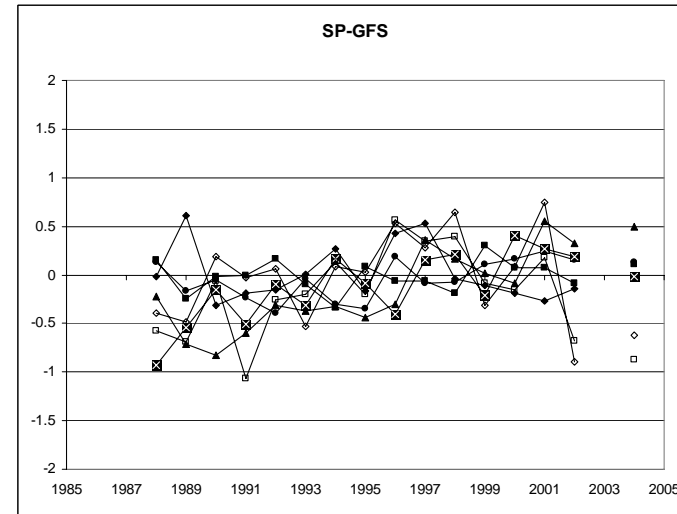
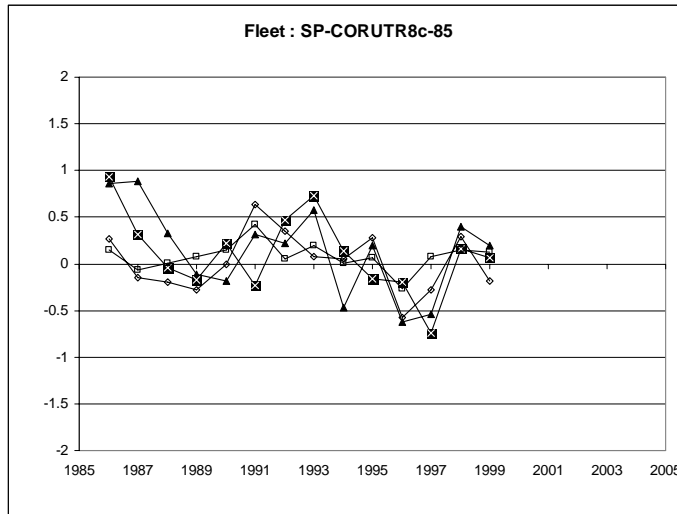
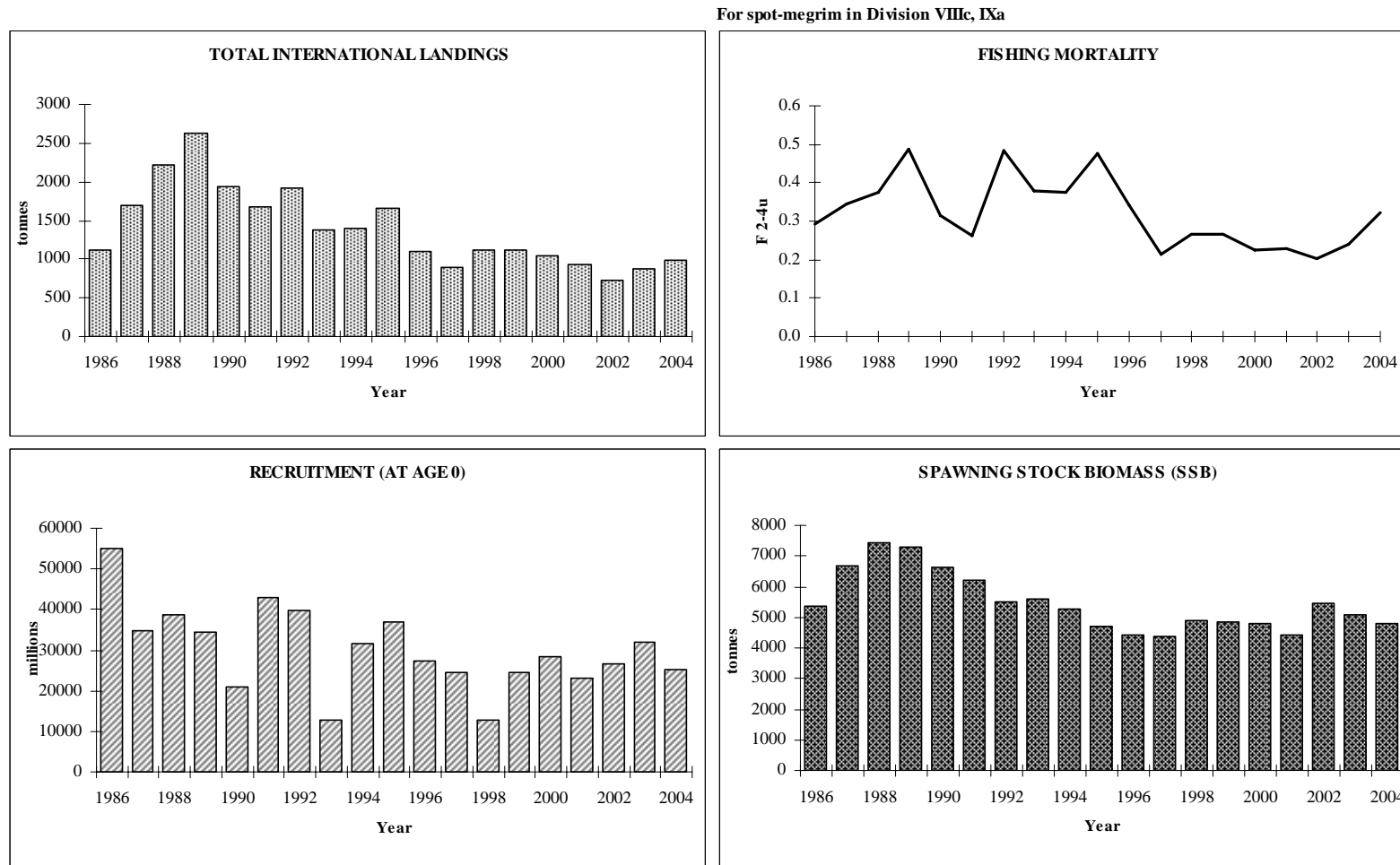
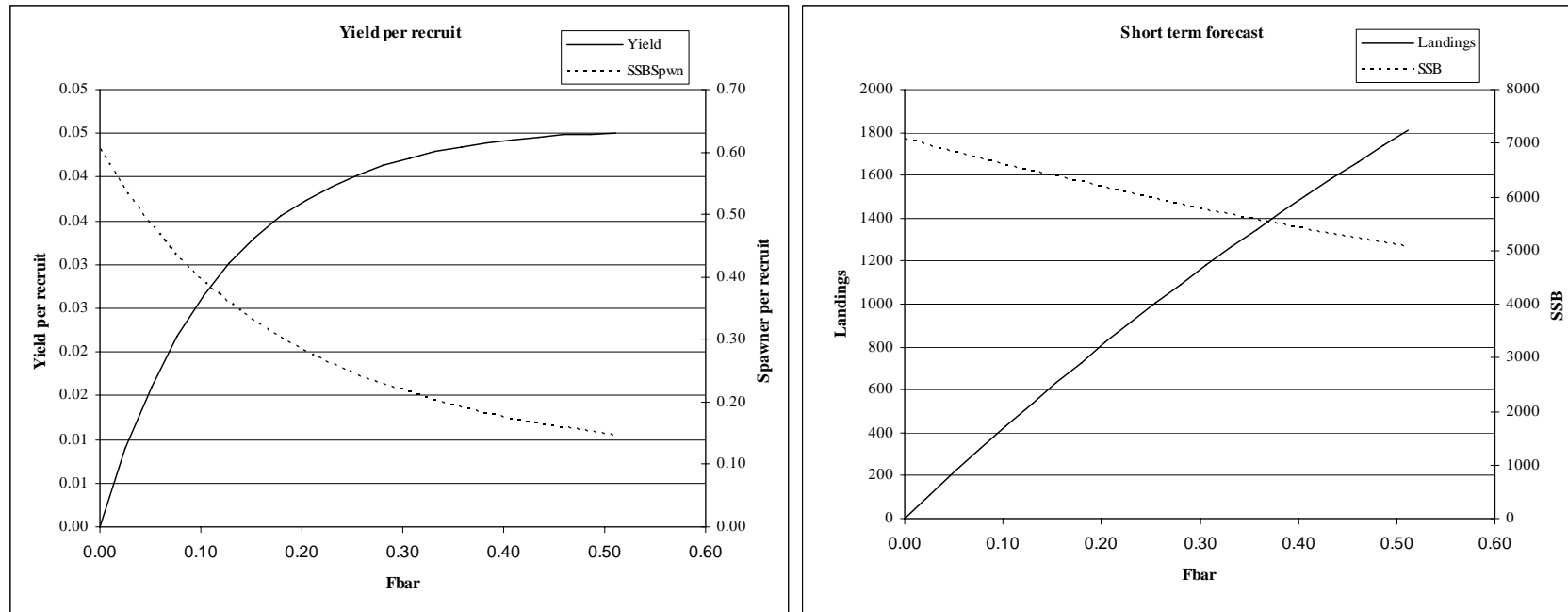


Figure 8.2.7. Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Stock Summary





MFYPR version 2a
 Run: Mfypr_NoCa03
 Time and date: 13:48 26/04/2005

Reference point	F multiplier	Absolute F
Fbar(2-4)	1.0000	0.2557
FMax	2.4787	0.6337
F0.1	1.0685	0.2732
F35%SPR	1.2157	0.3108

Weights in kilograms

MFDP version 1a
 Run: mfdp_bos05
 Four spot megrim (*L. boscii*) Division VIIIc and IXa
 Time and date: 18:37 11/05/2005
 Fbar age range: 2-4

Input units are thousands and kg - output in tonnes

Figure 8.2.8 Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Forecast summary.

Figure 8.2.9. Four-spot megrim (*L. boscii*) in Divisions VIIIc and IXa. Sensitivity analysis of short term forecast.

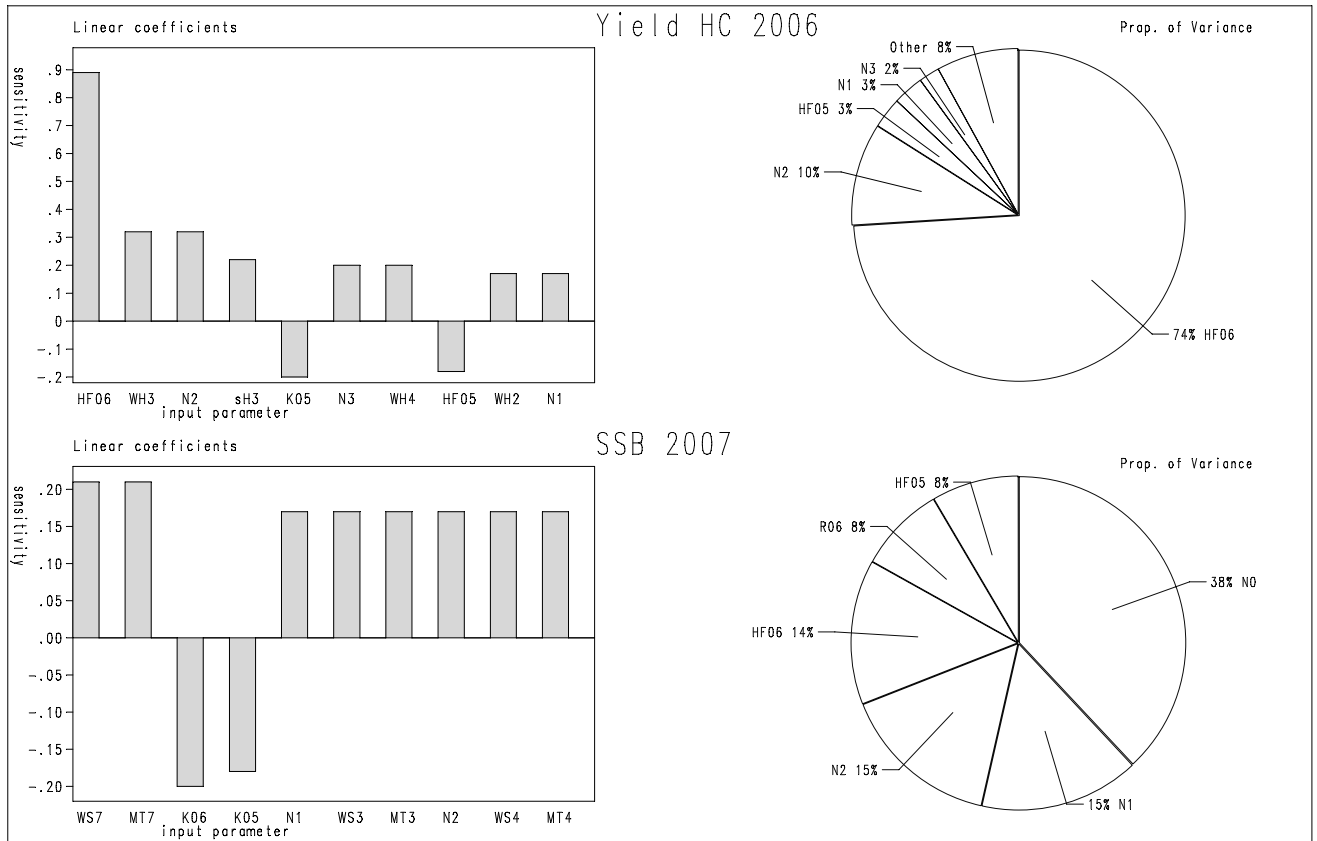


Figure 8.2.10. Four spot megrim (*L. boschii*) in Divisions VIIIc and IXa. Probability profiles for short term forecast.

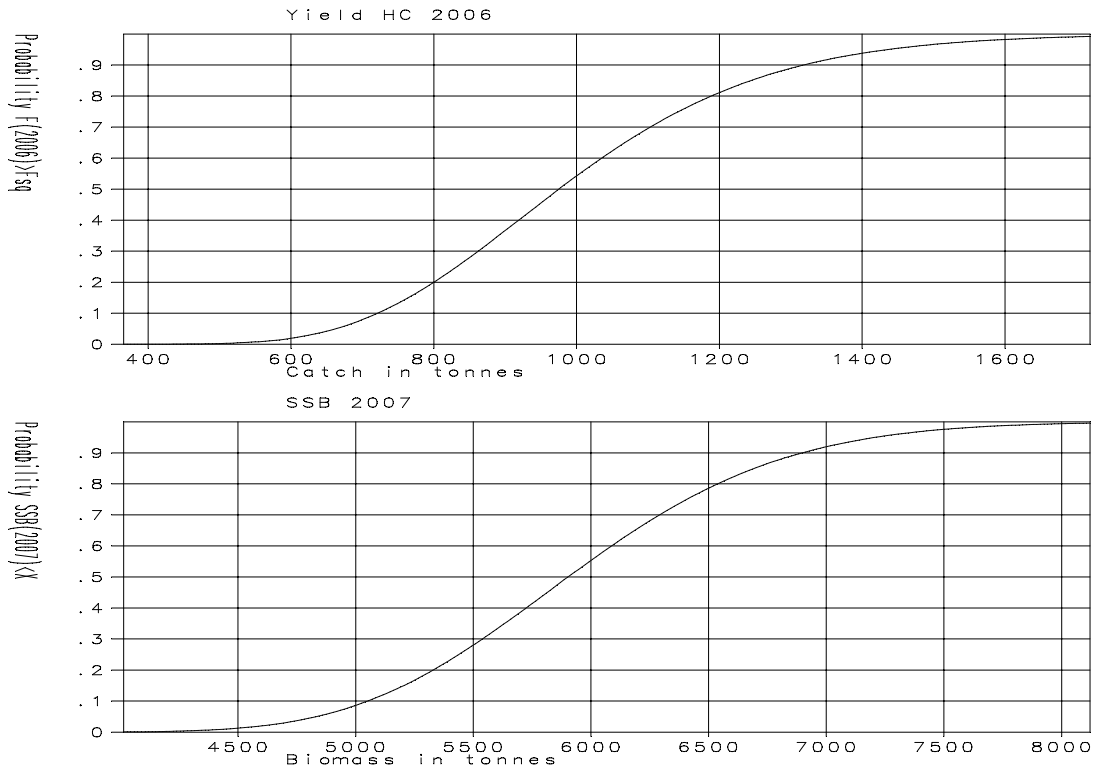


Figure 8.2.11. Four spot megrim (*L. bosci*) Div. VIIIc, IXa. Medium term projections. Lines show 10, 25, 50, 75 and 90 percentiles. Random stock-recruitment relationship

Four spot megrim in Divisions VIIIc and IXa. Medium term analysis, 1.00 * Esq.

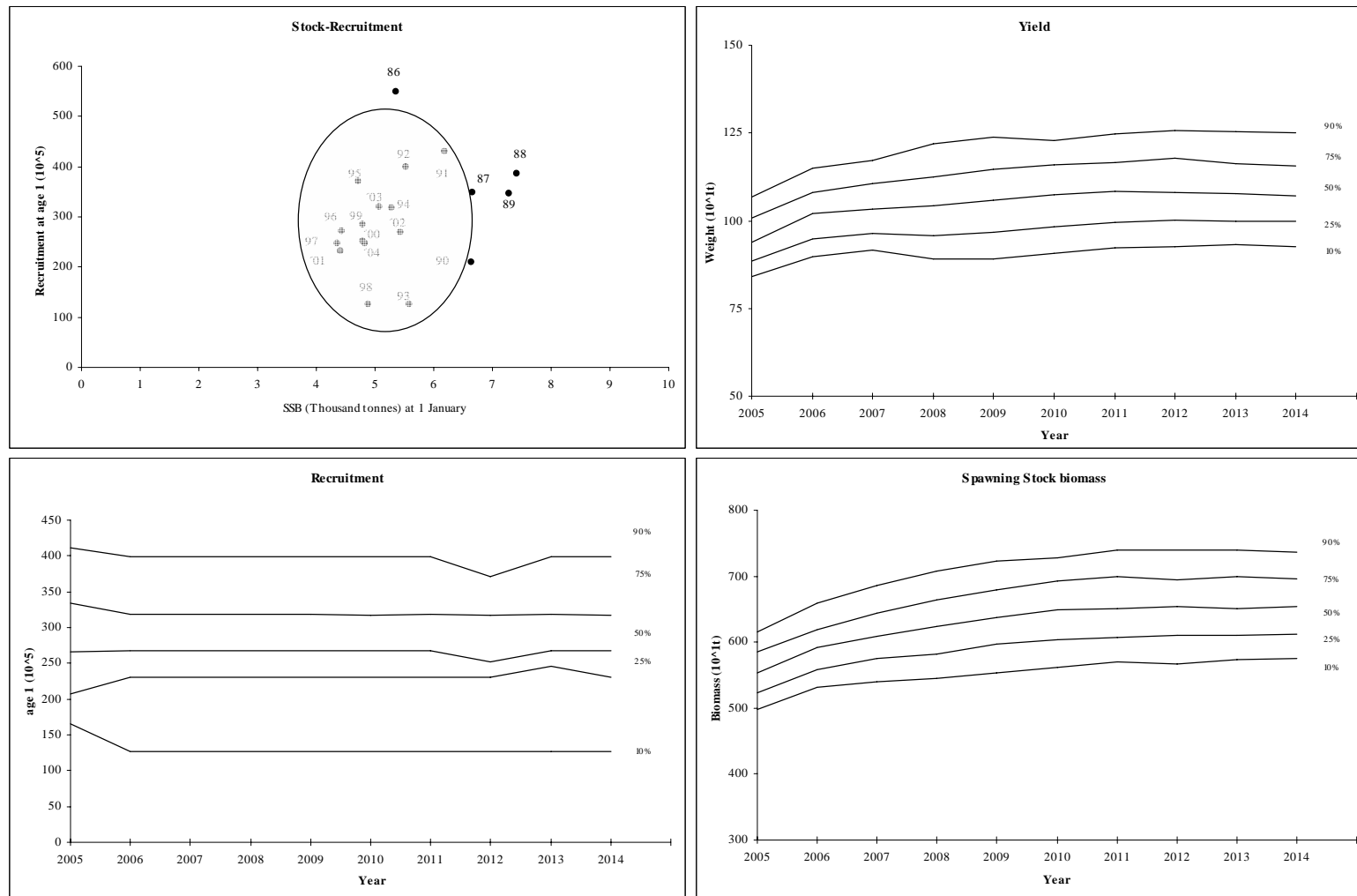
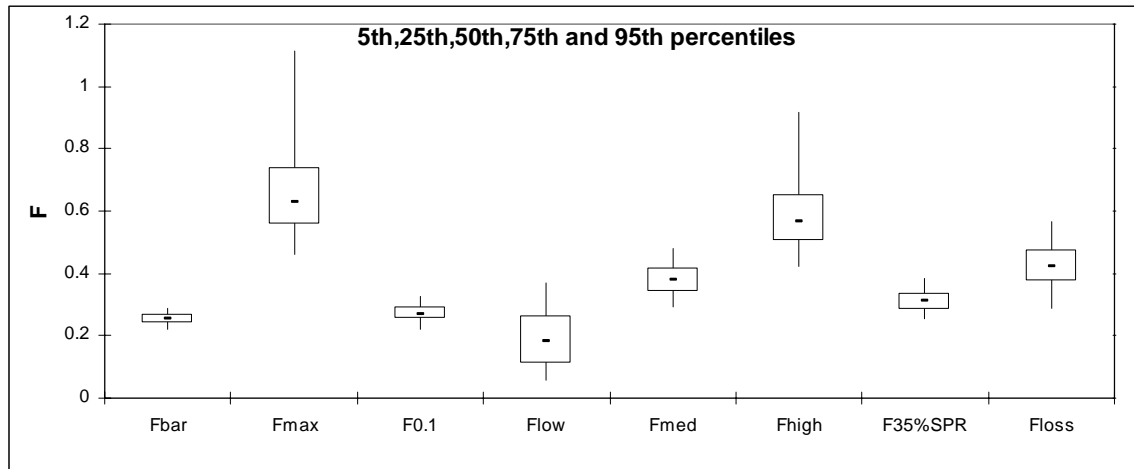


Figure 8.2.12. Four-spot megrim (*L. bosci*) in Divisions VIIIc and IXa. PASoft reference points.

Reference point	Deterministic	Median	75th percentile	95th percentile	Hist SSB < ref pt %	
MedianRecruits		28446	28446	31918	34919	
MBAL		0				0.00
Bloss		4365				
SSB90% \mathcal{R} 90% \mathcal{S} urv		5525	5507	5928	6499	63.16
SPR% \mathcal{O} fVirgin		40.10	40.28	42.66	46.37	
VirginSPR		0.61	0.61	0.69	0.83	
SPRloss		0.17	0.17	0.18	0.21	
	Deterministic	Median	25th percentile	5th percentile	Hist F > ref pt %	
FBar		0.26	0.25	0.24	0.22	73.68
Fmax		0.63	0.63	0.56	0.46	0.00
F0.1		0.27	0.27	0.25	0.22	57.89
Flow		0.15	0.18	0.11	0.06	100.00
Fmed		0.36	0.38	0.34	0.29	31.58
Fhigh		0.56	0.57	0.50	0.42	0.00
F35% \mathcal{S} PR		0.31	0.31	0.28	0.25	52.63
Floss		0.43	0.42	0.37	0.29	15.79

For estimation of Gloss and Floss:

A LOWESS smoother with a span of 1 was used.

Stock recruit data were log-transformed

A point representing the origin was included in the stock recruit data.

For estimation of the stock recruitment relationship used in equilibrium calculations:

A LOWESS smoother with a span of 1 was used.

Stock recruit data were log-transformed

A point representing the origin was included in the stock recruit data.

Div VIIIc IXa Four spot megrim

Steady state selection provided as input

FBar averaged from age 2 to 4

Number of iterations = 500

Random number seed = -99

Stock recruitment data Monte Carloed using residuals from the equilibrium LOWESS fit

Data source:

C:\aaa\WGICES\WGs\Wg05\Section8_2\Draft\2Draft\Mla_Automatic\MEDIUMTERM\Salidas_Mla\No_Ca03\BOS89.SEN

C:\aaa\WGICES\WGs\Wg05\Section8_2\Draft\2Draft\Mla_Automatic\MEDIUMTERM\Salidas_Mla\No_Ca03\BOS89.SUM

FishLab DLL used

FLVB32.DLL built on Jun 14 1999 at 11:53:37

PASoft 4 October 1999

26/04/2005 14:48:50

Figure 8.2.13. Four spot megrim (*L. boscii*) in Divisions VIIIc and IXa. PASoft equilibrium plot.

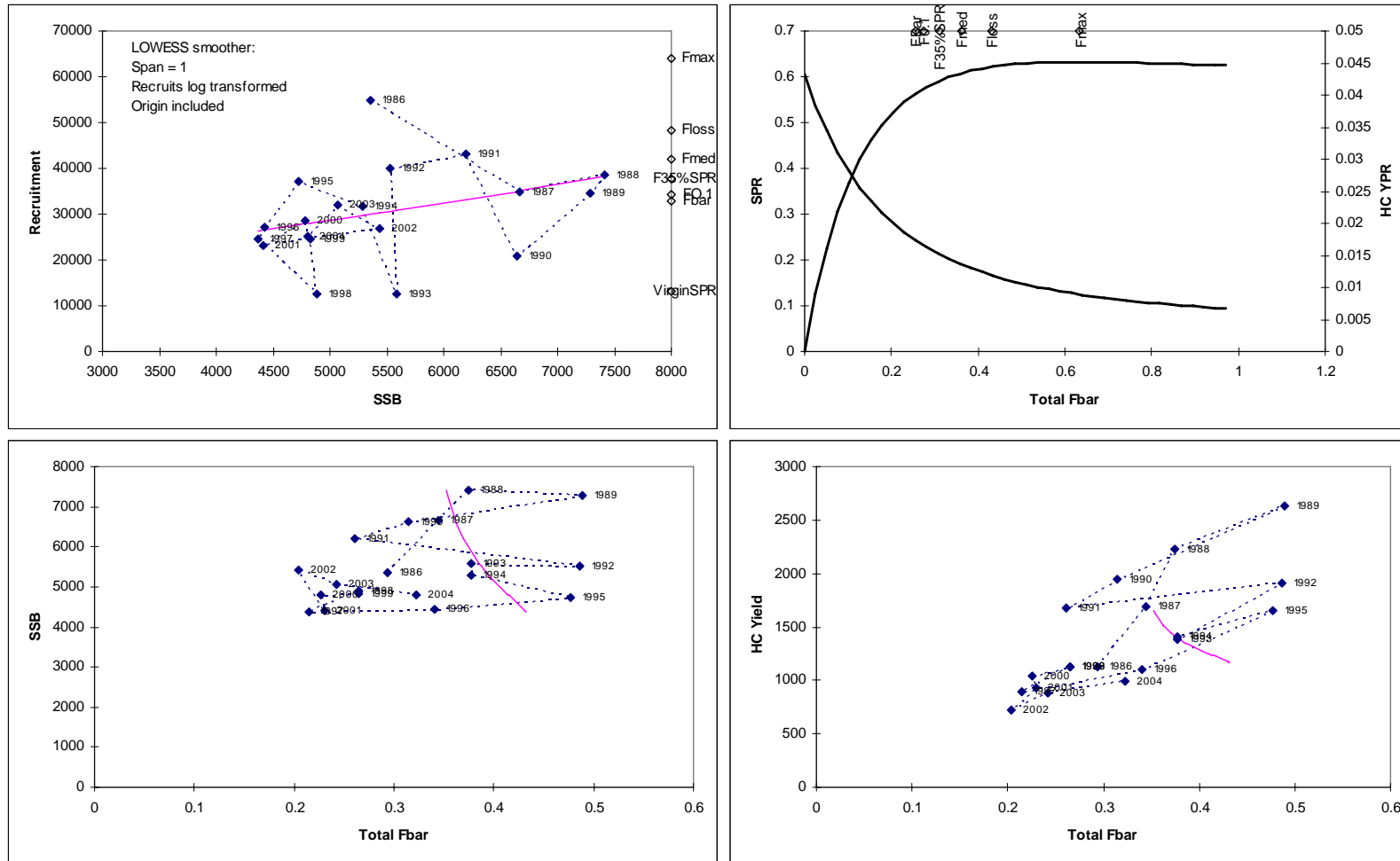
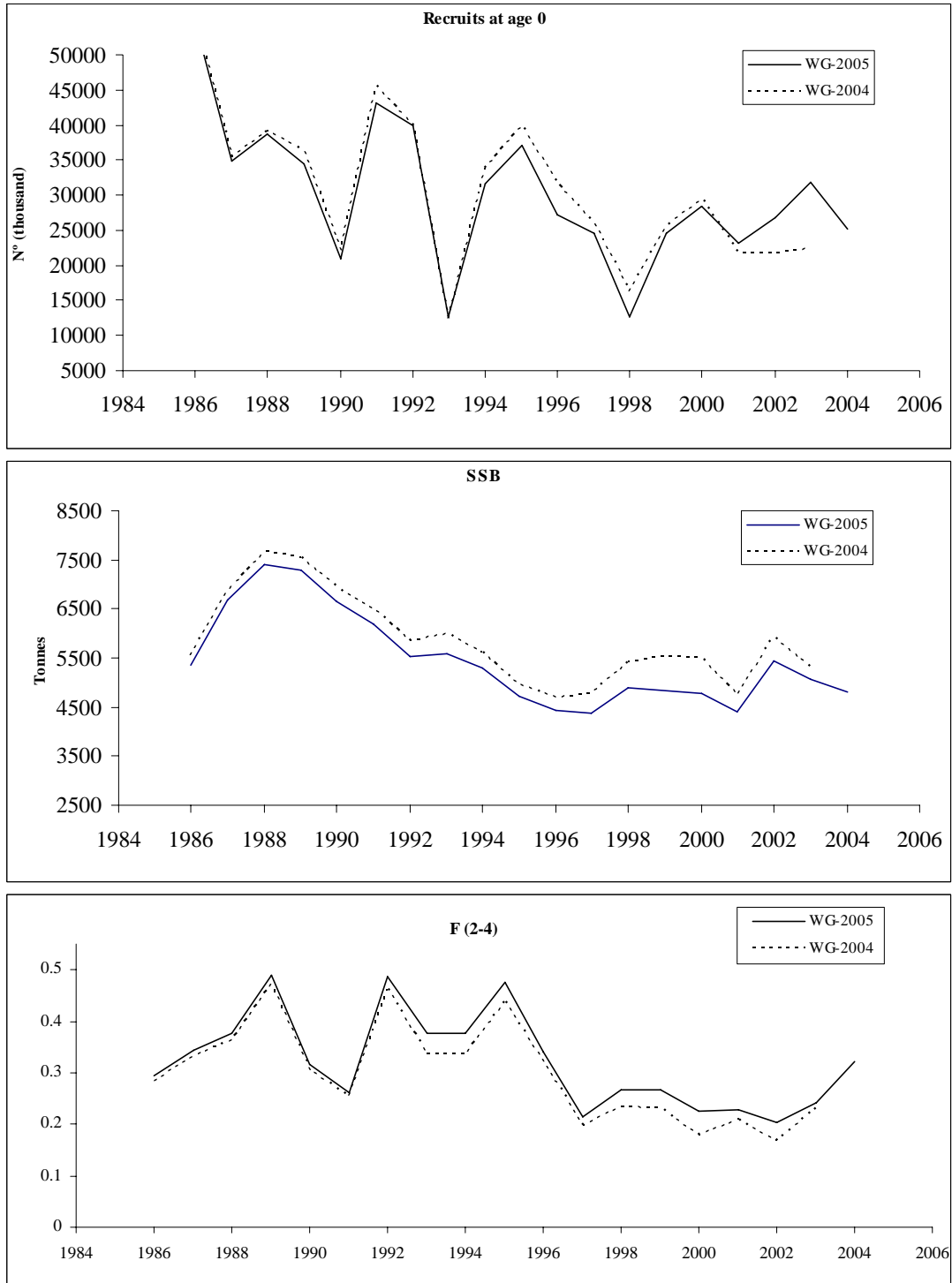


Figure 8.2.14. Four-spot megrim (*L. boscii*) Terminal Recruits, SSB and Fs from 2002 WG XSA and for this year using diferent tuning fleets.



**Figure 8.3.1. Megrim (*L. whiffiagonis* and *L. boscii*) in Divisions VIIIc and IXa.
 Combined Short Term Forecasts assuming status quo in 2004.**

