7 Sprat in Subdivisions 22–32 (update assessment)

As in previous years sprat in the Baltic Subdivisions 22–32 was assessed as a single unit.

7.1 The Fishery

Sprat catches in 2011 were 263,789 t, which is 23% less than in 2010 and 50% less than the record high value of 529,400 t in 1997. In 2011 the TAC of 288,766 t set for EU was utilized in 85%. The largest decrease in catches was observed for Germany (57%), Denmark (28%), Latvia (27%) and Estonia (27%). Catches by Lithuania increased slightly compared to 2010.

The spatial distribution (by Subdivision) of sprat catches was similar to previous years. Sub-divisions 26 and 28 dominated in the catches (32% and 24%, respectively). Another important area was Subdivision 29 with a 16% share in the sprat catch. Landings by country and Subdivision are presented in Tables 7.1–7.2. Table 7.3 contains landings, catch numbers, and weight at age by subdivision and quarter.

7.1.1 Unallocated landings

No information on unallocated catches was presented to the group. It is expected, however, that misreporting of catches occurs, as the estimates of species composition of the clupeids catches are imprecise in some mixed pelagic fisheries.

7.1.2 Discards

In most countries discards are probably small because undersized and lower quality fish can be used for production of fish meal and feeding in animal farms. In fisheries directed for human consumption, however, young fish (0 and 1 age groups) are discarded with higher rates in years when strong year classes recruit to the fishery. Recruitment to the fishery takes place in the 4th (age 0) and 1st (age 1) quarters. The amount of discarding of these age-groups is unknown. However, the collection of sprat discards data is in progress (EU Regulation) and the data should be available for future WG meetings.

7.1.3 Effort and CPUE data

No new fishing effort and CPUE data were provided to the group in this year. Russia has previously provided the data on fishing effort and CPUE for Subdivision 26 in 1995-2010 (Table 7.4). These data indicate increase in CPUE in 1995-2001 and fluctuations without clear trend since then, although during the last four years the CPUE has been rather stable. Available effort and CPUE data are restricted to only some regions and years, and are not considered representative for the entire stock and therefore were not applied in the assessment.

7.2 Biological composition of the catch

7.2.1 Age composition

All countries provided age distributions of their major catches (landed in their waters) by quarter and Subdivision. Catches for which the age composition was missing represented about 13% of the total. Almost all German catches (92%) were taken out-

side the German waters and these were only partly sampled (33% of total catches). The unsampled catches were distributed to ages according to overall age composition in a given Subdivision and quarter using "Allocation scheme" with CATON values as weighting keys in InterCatch. There were no samples corresponding to the catches (34.7 tonnes) taken from SD 22 in the 3rd quarter, therefore ages in the catches were estimated using the sampling data from the 4th quarter in SD 22. In the same way, ages in the unsampled catches in SD 27 from the 3rd quarter were distributed based on the samples from the 4th quarter in SD 27. A large part of the sprat catches is taken as part of the fish meal fishery. In some fisheries the catch species composition is not very precise. Moreover, sprat age composition in the catches is not well known. The estimated catch at age in numbers is presented in Table 7.3 and 7.6 and the age composition of the catches is shown in Figure 7.1. The consistency of the catch at age estimates was checked in bubbles-plot (Figure 7.2). The correlation between catch at a given age and the catch of the same generation 1 year later is high and exceeds 0.9 in most cases.

7.2.2 Quality of catch and biological data

In all countries around the Baltic Sea fish catch statistics are based on log-book data. In some countries, such as Denmark and Poland, these data are supplemented by data collected in regional Marine Offices. In Denmark, Sweden, Finland, and to a lesser degree in Poland, much of the sprat catch is taken in industrial fisheries where large by-catches of other fish species (mostly herring) may occur. The species composition of these catches is not accurately known, and can create errors in annual sprat catch statistics.

The landings and sampling activity for 2011 by quarter, ICES Subdivision, and country is presented in Table 7.5. These data show that generally in 2011 the sampling activity by Subdivision exceeded the levels indicated in the EC regulation No. 1639/2001, i.e. at least 1 sample per 2,000 t. of catch, 100 length measurements and 50 age readings per sample. On average number of samples was 3.6 times higher than indicated in the directive, and 473 length measurement and 125 age readings were recorded per 2,000 t catch.

7.3 Mean weight-at-age

Almost all countries presented rather extensive data on weight at age in the catch by quarter and subdivision. Mean weights at age in the catch were obtained as averages weighted by catch in numbers. The weights at age have decreased by about 40% in 1992–1998 (Figure 7.3). Since 1999 the weights have fluctuated without a clear trend. Mean weights in the stock were assumed the same as mean weights in the catch (Table 7.7). The consistency of the weight at age estimates was explored in 2005 and it was considered satisfactory.

7.4 Natural mortality

As in previous years the natural mortalities used varied between years and ages as an effect of cod predation. The estimates until 2005 were based on the updated MSVPA from 2006. In 2010 new estimates of predation mortality (covering 1974-2008) were provided from SMS model. However, SMS estimates differ from MSVPA values in the historical part (1974-1986) and produce a marked increase in total M (M2 included) in recent years. The preferred approach would be to test implementation of SMS estimates of M2 within next benchmark sprat assessment, which is expected to

take part in 2013. However, with the marked increase in cod stock in recent years keeping a constant M would be not justified. Thus the estimates of sprat M for 2006-2011 were obtained from the regression of M against cod SSB fitted to data from 1974-2005 (Figure 7.4). The residual natural mortality was taken as 0.2. Final estimates of M are given in Table 7.8.

7.5 Maturity at age

The maturity estimates were kept unchanged from previous years and constant throughout the time series (Table 7.9). In 2002 the WG was provided with rather extensive maturity data by the Study Group on Herring and Sprat Maturity. These data were analysed using GLM approach and year dependent estimates were obtained (ICES 2002/ACFM:17). These estimates at age 1 varied markedly from year to year but the WG felt that it was necessary to continue sampling and perform more extensive analysis of the data. Thus the maturities were averaged over years in 2002 assessment. As new data or new analyses of the old data have not been provided since then, the maturities were kept the same as in last year assessment.

7.6 Catch-at-age analysis

7.6.1 Tuning fleets

As in previous years three tuning data sets were available: from International Acoustic Surveys in autumn in 1991–2011 covering Subdivisions 24-29, from International Acoustic Surveys in May in 2001–2011 covering Subdivisions 24-26 and 28, and Acoustic Surveys covering age 0 sprat in Subdivisions 26+28 in 1993–2011 (Tables 7.12–7.14). The survey data were corrected for area coverage (WGBIFS Report 2012).

The internal consistency of survey at age estimates was checked on graphs (Figures 7.5-7.6). The correlation between CPUE at given age and the CPUE of the same generation 1 year later is high ranging between 0.7-0.9. The abundance of sprat at age 0 was used only from Acoustic Surveys in the SD 26+28 because this survey has used a trawl-net with a 6mm mesh size (bar length) in the cod-end. Other countries were using trawl-nets with a 10mm mesh size (bar length) in the cod-end. Therefore the estimation of the abundance of sprat at age 0 is much more precise in the Acoustic Surveys in SD 26+28 than in other subdivisions.

7.6.2 XSA runs

The input data for the catch at age analysis are presented in Tables 7.6–7.14. In 2005 the WG performed a benchmark assessment of the sprat stock, and this year assessment was an update one. Thus the settings for the parameterisation of XSA were the same as in the benchmark assessment (see Annex 11: sprat Quality Handbook) :

- tricubic time weighting,
- catchability dependent on year class strength at age 1 (only for this age group the slopes of regressions were significantly different from 1),
- catchability independent of age for ages 5 and older,
- the SE of the F shrinkage mean equal 0.75.

As in 2007-2011, the only difference of this year's assessment compared to assessments before 2007 was the additional tuning fleet available (May Acoustic Survey), whose performance was tested during the 2007 WG meeting.

Table 7.15 contains the diagnostic of the run. The log q residuals are presented in Figures 7.7a and 7.7b. The data are moderately noisy for international fleet (SE of log q = 0.4-0.6). The log q residuals from the May survey are lower with a SE's range of 0.3-0.45. The residuals from acoustic survey on age 0 (shifted to represent age 1) are rather low (regression SE of 0.3). The correlations between XSA estimates and survey indices are high (R^2 mostly at level of 0.7-0.9).

The May survey had the highest influence on survivor estimates (ca. 40 – 55% weight except for age 1). The weight of estimates resulting from shrinkage is low (weight below 10%). The May and October survey estimates of survivors are very consistent at ages 1, 2, 3 – consistency is somewhat lower at other ages.

Retrospective analysis (Figure 7.8) shows quite scattered estimates (especially for F) , with a tendency to overestimates F and underestimate SSB. However, estimates of SSB for recent years are rather consistent. The average F estimates, *i.e.* F(3-5), are most noisy as they are base on Fs from 3 ages only. In addition, recruitment of sprat is very variable which easily can lead to overestimation of F for weak year classes when they neighbour strong year classes, due to possible misspecification of age readings from these strong generations. The retrospective analysis shows consistent estimates of recruitment.

The fishing mortalities, stock numbers and summary tables are presented in Tables 7.16-7.18. Fish stock summary plots are presented in Figures 7.9 and 7.10.

7.7 Recruitment estimates

The acoustic estimates on age-0 sprat in Subdivisions 26 + 28 (shifted to represent age 1) and XSA estimates were analysed using the RCT3 program (Tables 7.19 and 7.20, Fig. 7.11). The R^2 between XSA numbers and acoustic indices is high, generally at range of 0.65-0.75. Estimates are mainly determined by survey (weight of 60 - 70%). The 2011 year class was estimated 10% above the average at 98 billion.

7.8 Historical stock trends

In the 1990s the SSB exceeded 1 million t, being record high in 1996-1997 (above 1.7 million t). These values were several times higher than the SSB estimates of 200,000–250,000 t in the early 1980s. Since 1997 the SSB has decreased, and after 2000 it has fluctuated mostly in range of 0.9-1.1 million tons. The estimate of SSB for 2011 is 809 thousand tons. Weight-at-age has decreased since the early 1990s, and has remained low since then. This is likely due to density-dependent effects. Autumn acoustic surveys show that the stock has been mainly concentrated in Subdivisions 27-29 and 32 after the early 1990s (Casini et al. 2011, WGBIFS 2011).

7.9 Short-term forecast and management options

The RCT3 program estimate of the 2011 year class at age 1 was used in the predictions. The 2012 and 2013 year classes were assumed as geometric mean of the recruitment at age 1 in 1991-2010 (period of recruitment fluctuations without clear trend, the 2010 value is well estimated in the assessment). The natural mortalities were assumed at 2011 level (increase in cod biomass), while mean weights at age were taken as averages of the 2009–2011 values. The fishing pattern was smoothed as the average F at age in 2009–2011 and was scaled to the final year (decline in F observed in three recent years). Input data for catch prediction are presented in Table 7.21.

The *status quo* catches for 2012 and 2013 are predicted to be 230,000 and 234,000 t, respectively. The SSB in 2014 is predicted to be at the level of 840,000 t (Table 7.22).

Yield per recruit (based on input to short-term prediction) and short-term forecast for sprat in SD 22-32 are presented in Figure 7.12.

In Figure 7.13 the sensitivity of the projection to the assumed strength (GM) of the 2012 and 2013 year classes and the estimate of 2011 year class is presented. The assumed level of the 2012-2013 year classes contributes by 16% to the predicted catch in 2013 and by 44% to SSB in 2014.

7.10 Reference points

The PA software (CEFAS, Lowestoft) was used to estimate biological reference points (Figure 7.14). As the input to the program the three years averages of mean weights and natural mortalities were taken. The estimated $\mathbf{F}_{med}$ (used by ACFM as a basis for $\mathbf{F}_{pa}$= 0.4) changed substantially (similarly as last year) and is now 0.14. In Figure 7.15 the equilibrium SSB and yield as well as the observed stock and yield trajectory are presented. The biological reference points derived based on the replacement lines depend on the natural mortality, weight at age, and maturity data used. In recent years the natural mortalities increased markedly but the weights at age were still low. The increase in M had a large impact on estimate of F_{med} (estimate obtained in 2009 was 0.27). To obtain meaningful results the PA software should be used with the data covering periods with similar weights and mortality at age. This was not possible, however, as these periods in case of sprat do not cover continuous set of years. Thus estimates of F_{med}, F_{loss}, F_{low} and F_{high} are doubtful.

Last year the F_{msy} was estimated at 0.32 – 0.35 using independently deterministic long-term predictions and a stochastic model. Following these analyses the F_{msy} was adopted at 0.35 and there was no reason to revise this value at current meeting. The F_{msy} depends strongly on cod predation and weight-at-ages, thus the estimate may change when cod biomass and mean weights change.

7.11 Quality of assessment

The major problem for this stock is the combined catch data for clupeids. In the mixed fishery for herring and sprat the reported quantities landed by each species are imprecise. These uncertainties could influence the estimates of absolute stock size and fishing mortality. The retrospective plots show quite large deviations of estimates for certain years. In case of fishing mortality the deviations are to some extent caused by F_{bar} based on three values only (F at age 3-5), that is sensitive to bias in F-at-age, occurring especially for weak year classes neighbouring a strong year class.

The predicted SSB for the year following the prediction year is very sensitive to the assumed (GM) year class strength. The assumed year classes constitute usually 40-55% of the predicted SSB.

The sprat in Subdivisions 22–32, now being assessed as one unit, was previously considered to be composed of three stock components: sprat in Subdivisions 22–25, 26+28, and 27+29–32. An analysis of the impact of merging components on stock assessment has not been conducted since the early 1990s.

The inputs to the assessments are catch-at-age data and age-structured stock estimates from the acoustic surveys. The survey estimates of stock numbers are inter-

nally consistent and the same applies to catch at age numbers (Figures 7.2 and 7.5-7.6).

German landings were corrected after the end of the EG, and amount to 11.5 thousand tonnes (7.7 thousand tonnes were used in the assessment). This was due to an error in landings from SD 28, likely due to the way Intercatch handle SD 28 (SD 28.1 is treated as Gulf of Riga, while SD 28.2 as Central Baltic herring). The corrected total landings for Baltic sprat amount to 268 thousand tonnes (1.5 % difference from the values used in the assessment). This was considered by the EG as negligible for the assessment outputs.

7.12 Comparison with previous assessment

The comparison between the results of 2011 and 2012 assessments is presented in the text table below. The XSA settings were the same in both years.

CATEGORY	PARAMETER	ASSESSMENT 2011	ASSESSMENT 2012	DIFF. (+/-) %
Data input	Maturity ogives	age 1 - 17%, age 2 - 93%	age 1 - 17%, age 2 - 93%	No
	Natural mortality	M in 2006-2010 estimated from regression of historical M against cod SSB	M in 2006-2011 estimated from regression of historical M against cod SSB	Small (5-10% for 2010 estimate, up to 0.01)
XSA input	Catchability dependent on year class strength	Age<2	Age<2	No
	Catchability independent on age	Age >=5	Age >=5	No
	SE of the F shrinkage mean	0.75	0.75	No
	Time weighting	Tricubic, 20 years	Tricubic, 20 years	No
	Tuning data	International acoustic autumn International Acoustic May	International acoustic autumn International Acoustic May	No
		Acoustic on age 0	Acoustic on age 0	No
XSA results	SSB 2010 (million t)	0.89	1.06	19%
	TSB 2010 (million t)	1.5	1.6	7%
	F(3-5) 2010	0.41	0.34	-17%
	Recruitment (age 1) in 2010	56 billions	42 billions	-25%

7.13 Management considerations

There are no explicit management objectives for this stock. As in previous years, sprat in Baltic Subdivisions 22–32 was assessed as a single unit, and this procedure shows relatively good assessment quality.

Sprat in Subdivisions 22-32 is the largest stock assessed by this WG and was considered as at risk of being exploited unsustainably. This year, the estimate of F_{pa} is doubtful (F_{med} changed to 0.14), so F cannot be related to precautionary limits, although the rate of exploitation is probably higher than any candidate for F_{pa}. The spawning stock biomass has been low in the first half of 1980s. In the beginning of

1990s the stock started to increase rapidly and in 1996-1997 it reached the maximum observed spawning stock biomass of 1.7 million tonnes. The stock size increased due to the combination of strong recruitments and decline in natural mortality (effect of low cod biomass). Next stock declined and since 2001 the spawning biomass has been fluctuating at range of 0.8 – 1.2 million t. After 2000 fishing mortality increased to 0.4-0.5, but declined in 2010-2011 following marked decline of the catches. In 2013-2014 the stock is predicted to increase by about 10% if it is exploited at $F_{sq.}$ None of the three year classes in row (2009 – 2011) is strong; only the 2011y-c is estimated slightly above average. The marked part of the sprat catches is taken in a mixed sprat-herring fishery, and the species composition of these catches is imprecise in some fishing areas /periods.

Table 7.1 Sprat landings in Subdivisions 22-32 (thousand tonnes)

Year	Denmark	Finland	German Dem. Rep.	Germany Fed. Rep.	Poland	Sweden	USSR	Total
1977	7.2	6.7	17.2	0.8	38.8	0.4	109.7	180.8
1978	10.8	6.1	13.7	0.8	24.7	0.8	75.5	132.4
1979	5.5	7.1	4.0	0.7	12.4	2.2	45.1	77.1
1980	4.7	6.2	0.1	0.5	12.7	2.8	31.4	58.1
1981	8.4	6.0	0.1	0.6	8.9	1.6	23.9	49.3
1982	6.7	4.5	1.0	0.6	14.2	2.8	18.9	48.7
1983	6.2	3.4	2.7	0.6	7.1	3.6	13.7	37.3
1984	3.2	2.4	2.8	0.7	9.3	8.4	25.9	52.5
1985	4.1	3.0	2.0	0.9	18.5	7.1	34.0	69.5
1986	6.0	3.2	2.5	0.5	23.7	3.5	36.5	75.8
1987	2.6	2.8	1.3	1.1	32.0	3.5	44.9	88.2
1988	2.0	3.0	1.2	0.3	22.2	7.3	44.2	80.3
1989	5.2	2.8	1.2	0.6	18.6	3.5	54.0	85.8
1990	0.8	2.7	0.5	0.8	13.3	7.5	60.0	85.6
1991	10.0	1.6		0.7	22.5	8.7	59.7*	103.2

Year	Denmark	Estonia	Finland	Germany**	Latvia	Lithuania	Poland	Russia	Sweden	Total
1992	24.3	4.1	1.8	0.6	17.4	3.3	28.3	8.1	54.2	142.1
1993	18.4	5.8	1.7	0.6	12.6	3.3	31.8	11.2	92.7	178.1
1994	60.6	9.6	1.9	0.3	20.1	2.3	41.2	17.6	135.2	288.8
1995	64.1	13.1	5.2	0.2	24.4	2.9	44.2	14.8	143.7	312.6
1996	109.1	21.1	17.4	0.2	34.2	10.2	72.4	18.2	158.2	441.0
1997	137.4	38.9	24.4	0.4	49.3	4.8	99.9	22.4	151.9	529.4
1998	91.8	32.3	25.7	4.6	44.9	4.5	55.1	20.9	191.1	470.8
1999	90.2	33.2	18.9	0.2	42.8	2.3	66.3	31.5	137.3	422.6
2000	51.5	39.4	20.2	0.0	46.2	1.7	79.2	30.4	120.6	389.1
2001	39.7	37.5	15.4	0.8	42.8	3.0	85.8	32.0	85.4	342.2
2002	42.0	41.3	17.2	1.0	47.5	2.8	81.2	32.9	77.3	343.2
2003	32.0	29.2	9.0	18.0	41.7	2.2	84.1	28.7	63.4	308.3
2004	44.3	30.2	16.6	28.5	52.4	1.6	96.7	25.1	78.3	373.7
2005	46.5	49.8	17.9	29.0	64.7	8.6	71.4	29.7	87.8	405.2
2006	42.1	46.8	19.0	30.8	54.6	7.5	54.3	28.2	68.7	352.1
2007	37.6	51.0	24.6	30.8	60.5	20.3	58.7	24.8	80.7	388.9
2008	45.9	48.6	24.3	30.4	57.2	18.7	53.3	21.0	81.1	380.5
2009	59.7	47.3	23.1	26.3	49.5	18.8	81.9	25.2	75.3	407.1
2010	43.6	47.9	24.4	17.8	45.9	9.2	56.7	25.6	70.4	341.5
2011	31.4	35.0	15.8	7.7	33.1	9.9	55.3	19.5	56.2	263.8

* Sum of landings by Estonia, Latvia, Lithuania, and Russia.

**German landing values were adjusted after the end of the EG.

The correct landings amount to 11.5 thousand tonnes.

Table 7.2 **Sprat landings in the Baltic Sea by country and Subdivision (thousand tonnes).** 1/2

Year 2000

Country	Total	22	24	25	26	27	28	29	30	31	32
Denmark	**51.5**	9.4	0.8	41.2[1)]	-	-	-	-	-	-	-
Estonia	**39.4**	-	-	-	-	-	6.1	13.9	-	-	19.4
Finland	**20.2**	-	-	-	-	-	-	3.6	4.8	0	11.9
Germany	**0**	0		-	-	-	-	-	-	-	-
Latvia	**46.2**	-	-	2.6	7.3	-	36.3	-	-	-	-
Lithuania	**1.7**	-	-	-	1.7	-	-	-	-	-	-
Poland	**79.2**	-	0.8	40.5	37.9	-	-	-	-	-	-
Russia	**30.4**	-	-	-	28.3	-	2	-	-	-	-
Sweden	**120.6**	-	2.1	31.7	13.2	31.5	23.9	18.1	-	-	-
Total	**389.1**	**9.5**	**3.7**	**116**	**88.4**	**31.5**	**68.3**	**35.5**	**4.8**	**0**	**31.4**

[1)] Danish landings in Subdivision 25 include landings in Subdivision 22 and 24.

Year 2001

Country	Total	22	24	25	26	27	28	29	30	31	32
Denmark	**39.7**	-	-	39.7	-	-	-	-	-	-	-
Estonia	**37.5**	-	-	-	-	-	6.3	16.1	-	-	15.1
Finland	**15.4**	-	-	-	-	-	-	4.5	3.2	0.001	7.6
Germany	**0.8**	0.02	0.8	-	-	-	-	-	-	-	-
Latvia	**42.8**	-	-	1.1	7	-	34.7	-	-	-	-
Lithuania	**3**	-	-	-	3	-	-	-	-	-	-
Poland	**85.8**	-	0.4	46.3	39.1	-	-	-	-	-	-
Russia	**32**	-	-	-	29.6	-	2.3	-	-	-	-
Sweden	**85.4**	-	1	2.9	4.8	27.8	30.2	18.1	-	-	0.5
Total	**342.2**	**0.02**	**2.1**	**90**	**83.5**	**27.8**	**73.5**	**38.7**	**3.2**	**0.001**	**23.2**

Year 2002

Country	Total	22	24	25	26	27	28	29	30	31	32
Denmark	**42.0**	4.7	1.0	22.5	7.7	0.7	4.6	0.9	-	-	-
Estonia	**41.3**	-	-	-	-	-	7.7	17.0	-	-	16.6
Finland	**17.2**	-	0.8	2.3	0.004	0.1	0.001	3.7	4.8	-	5.5
Germany	**1.0**	0.03	-	0.1	0.4	0.1	0.1	0.2	-	-	-
Latvia	**47.5**	-	-	1.4	4.5	-	41.7	0.0	-	-	-
Lithuania	**2.8**	-	-	0.0	2.8	-	-	-	-	-	-
Poland	**81.2**	-	0.04	39.7	41.5	-	-	-	-	-	-
Russia	**32.9**	-	-	-	29.9	-	2.9	-	-	-	-
Sweden	**77.3**	-	3.0	13.3	5.6	27.2	19.9	8.3	-	-	-
Total	**343.2**	**4.8**	**4.8**	**79.3**	**92.4**	**28.1**	**76.8**	**30.1**	**4.8**	**0.0**	**22.1**

Year 2003

Country	Total	22	24	25	26	27	28	29	30	31	32
Denmark	**32.0**	8.2	0.7	10.4	8.9	1.8	1.7	0.3	-	-	-
Estonia	**29.2**	-	-	-	-	-	11.1	11.6	-	-	6.5
Finland	**9.0**	-	0.03	0.4	0.04	0.2	0.1	4.6	1.5	0.001	2.0
Germany	**18.0**	0.2	0.5	0.8	3.0	9.5	2.8	1.1	-	-	-
Latvia	**41.7**	-	-	0.8	7.8	-	33.2	-	-	-	-
Lithuania	**2.2**	-	-	-	2.2	-	-	-	-	-	-
Poland	**84.1**	-	0.03	26.7	57.4	-	-	-	-	-	-
Russia	**28.7**	-	-	0.0	27.2	-	1.4	-	-	-	-
Sweden	**63.4**	-	2.1	5.5	8.6	24.1	19.3	3.8	-	-	-
Total	**308.3**	**8.3**	**3.5**	**44.6**	**115.1**	**35.6**	**69.6**	**21.5**	**1.5**	**0.001**	**8.5**

Year 2004

Country	Total	22	24	25	26	27	28	29	30	31	32
Denmark	**44.3**	16.0	5.5	16.8	0.5	0.5	3.9	1.1	-	-	-
Estonia	**30.2**	-	-	-	-	-	8.9	10.1	-	-	11.1
Finland	**16.6**	-	0.5	2.5	0.003	0.1	0.03	9.3	3.0	0.003	1.1
Germany	**28.5**	0.8	0.9	1.4	6.0	8.2	6.8	4.4	-	-	-
Latvia	**52.4**	-	-	2.3	7.5	0.2	42.4	0.0	-	-	-
Lithuania	**1.6**	-	-	-	1.6	-	-	-	-	-	-
Poland	**96.7**	-	1.4	33.6	61.6	0.04	0.02	-	-	-	-
Russia	**25.1**	-	-	-	23.9	-	1.2	-	-	-	-
Sweden	**78.3**	-	1.4	9.2	7.6	25.8	22.3	12.0	-	-	-
Total	**373.7**	**16.8**	**9.7**	**65.8**	**108.8**	**34.8**	**85.6**	**36.9**	**3.0**	**0.003**	**12.2**

Year 2005

Country	Total	22	24	25	26	27	28	29	30	31	32
Denmark	**46.5**	17.6	2.1	11.1	5.4	0.3	10.0	-	-	-	-
Estonia	**49.8**	-	-	-	-	-	7.1	16.6	-	-	26.0
Finland	**17.9**	-	0.1	0.6	0.6	0.1	0.3	9.0	3.2	0.005	4.0
Germany	**29.0**	1.2	0.1	0.4	4.3	10.2	6.8	6.1	-	-	-
Latvia	**64.7**	-	-	1.2	7.3	0.4	55.8	-	-	-	-
Lithuania	**8.6**	-	-	-	8.6	-	-	-	-	-	-
Poland	**71.4**	-	2.0	23.5	45.6	0.2	0.1	-	-	-	-
Russia	**29.7**	-	-	-	29.7	-	-	-	-	-	0.1
Sweden	**87.8**	-	0.7	11.1	10.3	25.1	24.5	16.2	-	-	-
Total	**405.2**	**18.8**	**5.0**	**47.9**	**111.7**	**36.2**	**104.5**	**47.9**	**3.2**	**0.005**	**30.2**

Table 7.2 continued 2/2

Year 2006

Country	Total	22	24	25	26	27	28	29	30	31	32
Denmark	**42.1**	19.4	1.7	6.9	9.9	0.3	2.6	1.2	-	-	-
Estonia	**46.8**	-	-	0.1	-	0.3	5.5	19.2	-	-	21.6
Finland	**19.0**	-	0.2	0.5	1.1	1.9	2.0	6.8	3.5	0.007	3.0
Germany	**30.8**	1.2	0.01	1.3	8.2	12.0	4.6	3.4	-	-	-
Latvia	**54.6**	-	-	1.1	6.0	-	47.5	-	-	-	-
Lithuania	**7.5**	-	-	-	7.5	-	-	-	-	-	-
Poland	**54.3**	-	0.8	16.7	36.8	-	-	-	-	-	-
Russia	**28.2**	-	-	-	27.9	-	-	-	-	-	0.3
Sweden	**68.7**	0.0	0.7	4.6	25.3	13.7	16.6	7.6	0.0	0.0	0.2
Total	**352.1**	**20.5**	**3.4**	**31.3**	**122.8**	**28.3**	**78.9**	**38.3**	**3.5**	**0.007**	**25.1**

Year 2007

Country	Total	22	24	25	26	27	28	29	30	31	32
Denmark	**37.6**	9.6	0.7	6.4	17.0	-	3.0	0.8	-	-	-
Estonia	**51.0**	-	-	2.2	0.8	0.1	4.3	15.3	-	-	28.3
Finland	**24.6**	0.0	0.0	1.9	4.2	0.3	2.6	4.5	7.2	0.002	3.8
Germany	**30.8**	0.8	0.46	1.8	12.2	5.8	4.8	4.9	-	-	-
Latvia	**60.5**	-	-	5.1	7.4	1.4	46.5	-	-	-	-
Lithuania	**20.3**	-	-	1.7	11.8	-	3.6	3.2	-	-	-
Poland	**58.7**	-	0.8	21.4	36.4	0.04	0.06	-	-	-	-
Russia	**24.8**	-	-	-	24.8	-	-	-	-	-	-
Sweden	**80.7**	-	1.8	10.0	30.8	11.0	14.9	11.9	0.1	-	0.2
Total	**388.9**	**10.4**	**3.8**	**50.5**	**145.4**	**18.7**	**79.8**	**40.6**	**7.3**	**0.002**	**32.4**

Year 2008

Country	Total	22	24	25	26	27	28	29	30	31	32
Denmark	**45.9**	5.6	1.0	5.6	4.0	7.1	13.2	0.3	-	-	9.2
Estonia	**48.6**	-	-	0.3	0.0	-	5.3	15.6	-	-	27.3
Finland	**24.3**	-	-	2.1	2.1	0.2	2.3	8.6	5.2	0.0002	3.8
Germany	**30.4**	1.3	0.07	1.8	6.0	4.0	13.7	3.6	-	-	-
Latvia	**57.2**	-	-	2.1	6.3	0.2	48.6	0.005	-	-	-
Lithuania	**18.7**	-	0.01	5.5	6.0	0.7	4.6	1.8	-	-	-
Poland	**53.3**	-	3.9	25.4	23.8	0.02	0.15	-	-	-	-
Russia	**21.0**	-	-	-	21.0	-	-	-	-	-	-
Sweden	**81.1**	-	2.0	13.3	13.2	9.1	27.4	15.4	0.00005	-	0.7
Total	**380.5**	**6.9**	**7.1**	**56.0**	**82.4**	**21.4**	**115.2**	**45.3**	**5.2**	**0.0002**	**41.0**

Year 2009

Country	Total	22	23	24	25	26	27	28	29	30	31	32
Denmark	**59.7**	3.8	0.5	0.7	9.7	14.3	0.3	22.1	8.3	-	-	-
Estonia	**47.3**	-	-	-	0.6	-	-	2.5	13.7	-	-	30.5
Finland	**23.1**	-	-	-	0.0	2.7	0.3	2.9	7.7	4.4	0.0001	5.2
Germany	**26.3**	1.4	-	0.24	1.9	3.7	6.2	9.0	4.0	-	-	-
Latvia	**49.5**	-	-	0.0	6.0	5.0	0.5	38.0	0.008	-	-	-
Lithuania	**18.8**	-	-	0.45	3.3	6.4	0.5	7.2	0.9	-	-	-
Poland	**81.9**	-	0.3	2.1	25.4	33.9	6.60	8.40	5.2	-	-	-
Russia	**25.2**	-	-	-	-	25.2	-	-	-	-	-	-
Sweden	**75.3**	-	-	2.4	7.9	13.5	10.5	28.2	12.6	0.0014	-	0.2
Total	**407.1**	**5.2**	**0.9**	**5.9**	**54.8**	**104.6**	**24.9**	**118.3**	**52.3**	**4.4**	**0.0001**	**35.9**

Year 2010

Country	Total	22	23	24	25	26	27	28	29	30	31	32
Denmark	**43.6**	8.0	-	0.7	5.2	12.3	2.4	9.6	5.3	-	-	-
Estonia	**47.9**	-	-	-	-	-	-	2.6	16.9	-	-	28.3
Finland	**24.4**	-	-	-	-	1.9	0.3	5.3	6.8	3.3	0.002	6.9
Germany	**17.8**	1.8	-	0.05	1.3	4.7	2.8	4.5	2.7	-	-	-
Latvia	**45.9**	-	-	-	5.2	5.0	-	35.7	-	-	-	-
Lithuania	**9.2**	-	-	-	0.03	4.6	-	4.6	-	-	-	-
Poland	**56.7**	-	0.02	0.1	14.3	32.8	6.1	2.9	0.6	-	-	-
Russia	**25.6**	-	-	-	-	25.6	-	-	-	-	-	-
Sweden	**70.4**	-	-	1.6	5.3	8.8	22.5	19.9	12.2	0.003	-	-
Total	**341.5**	**9.8**	**0.02**	**2.5**	**31.2**	**95.7**	**34.1**	**85.0**	**44.5**	**3.3**	**0.002**	**35.2**

Year 2011

Country	Total	22	23	24	25	26	27	28	29	30	31	32
Denmark	**31.4**	7.1	-	0.4	2.4	4.0	0.1	8.9	8.1	-	-	0.3
Estonia	**35.0**	-	-	-	0.2	0.2	0.042	2.5	11.9	-	-	20.2
Finland	**15.8**	-	-	-	-	0.6	0.3	1.2	4.5	3.5	-	5.7
Germany*	**7.7**	1.2	-	0.061	0.4	2.8	0.011	-	3.3	-	-	-
Latvia	**33.1**	-	-	0.003	2.1	4.2	0.1	26.6	-	-	-	-
Lithuania	**9.9**	-	-	0.021	1.8	5.8	0.053	1.7	0.6	-	-	-
Poland	**55.3**	-	-	0.7	9.5	38.0	0.2	6.0	1.0	-	-	-
Russia	**19.5**	-	-	-	-	19.5	-	-	-	-	-	-
Sweden	**56.2**	-	-	1.2	5.9	8.9	11.0	15.4	11.9	0.077	-	1.8
Total	**263.8**	**8.3**	**0.00**	**2.4**	**22.3**	**83.8**	**11.8**	**62.4**	**41.2**	**3.6**	**0.000**	**28.0**

***German landing values were adjusted after the end of the WG. The correct landings amount to 11.5 thousand tonnes.**

Table 7.3 SPRAT in SD 22-32. Catch in numbers and weight at age by quarter and Sub-division in 2011

Sub-division 22

	Numbers (milions)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.000	0.000	0.048	2.126	2.174	0	0	1.8	1.8
1	3138.274	150.425	3.575	160.009	3452.283	1.5	4.2	8.2	8.2
2	30.453	0.000	0.176	7.878	38.506	10	0	9.4	9.3
3	57.172	1.981	0.027	1.211	60.391	8.4	7.5	19.6	19.6
4	25.929	0.000	0.000	0.000	25.929	9.8	0	0	0
5	18.601	0.000	0.000	0.000	18.601	9.1	0	0	0
6	0.000	0.000	0.000	0.000	0.000	0	0	0	0
7	0.000	0.000	0.000	0.000	0.000	0	0	0	0
8	0.000	0.000	0.000	0.000	0.000	0	0	0	0
9	0.000	0.000	0.000	0.000	0.000	0	0	0	0
10	0.000	0.000	0.000	0.000	0.000	0	0	0	0
Sum	3270.4	152.4	3.8	171.2	3597.9				
SOP	5915.6	646.6	31.6	1412.9	8006.7				
Catch	5978.9	762.0	34.7	1554.5	8330.2				

Sub-division 23

	Numbers (milions)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.000	0.000	0.000	0.000	0.000	0	0.0	0.0	0.0
1	0.000	0.000	0.000	0.000	0.000	0	0.0	0.0	0.0
2	0.000	0.000	0.000	0.000	0.000	0	0.0	0.0	0.0
3	0.000	0.000	0.000	0.000	0.000	0	0.0	0.0	0.0
4	0.000	0.000	0.000	0.000	0.000	0	0.0	0.0	0.0
5	0.000	0.000	0.000	0.000	0.000	0	0.0	0.0	0.0
6	0.000	0.000	0.000	0.000	0.000	0	0.0	0.0	0.0
7	0.000	0.000	0.000	0.000	0.000	0	0.0	0.0	0.0
8	0.000	0.000	0.000	0.000	0.000	0	0.0	0.0	0.0
9	0.000	0.000	0.000	0.000	0.000	0	0.0	0.0	0.0
10	0.000	0.000	0.000	0.000	0.000	0	0.0	0.0	0.0
Sum	0.0	0.0	0.0	0.0	0.0				
SOP	0.0	0.0	0.0	0.0	0.0				
Catch	0.0				0.0				

Sub-division 24

	Numbers (milions)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.000	0.000	0.000	0.113	0.113	0.0	0.0	0.0	5.7
1	194.471	14.388	0.164	6.531	215.554	4.2	5.5	10.4	13.0
2	14.189	5.465	0.511	8.471	28.636	10.8	14.1	13.6	15.3
3	10.850	14.434	0.661	16.653	42.599	14.6	15.5	14.2	16.1
4	4.173	4.796	0.454	3.490	12.913	12.9	17.6	15.4	17.5
5	1.669	1.487	0.136	4.352	7.645	18.2	17.7	15.5	17.0
6	0.000	0.442	0.052	0.870	1.364	0.0	19.1	16.3	17.0
7	0.000	0.786	0.097	0.004	0.887	0.0	21.0	16.6	15.8
8	0.000	0.000	0.000	0.000	0.000	0.0	0.0	0.0	0.0
9	0.000	0.000	0.000	0.000	0.000	0.0	0.0	0.0	0.0
10	0.000	0.000	0.000	0.000	0.000	0.0	0.0	0.0	0.0
Sum	225.4	41.8	2.1	40.5	309.7				
SOP	1212.6	515.6	29.6	633.2	2391.0				
Catch	1210.5	516.2	29.6	632.2	2388.5				

Table 7.3 continued

Sub-division 25

	Numbers (milions)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.000	0.000	0.445	19.228	19.673	0.0	0.0	4.6	5.0
1	227.024	31.964	6.930	24.080	289.998	3.3	4.9	11.9	11.7
2	140.888	150.051	7.993	15.345	314.278	9.3	10.4	15.0	13.5
3	244.920	612.793	18.413	22.052	898.178	11.1	11.4	15.4	15.3
4	93.757	172.463	9.107	6.412	281.739	13.6	12.4	16.7	16.5
5	61.406	80.730	9.048	4.276	155.459	14.1	13.7	16.2	16.5
6	12.146	12.501	1.476	0.774	26.897	15.2	13.6	16.7	16.0
7	15.253	7.144	0.989	0.392	23.779	16.2	13.6	17.2	18.8
8	4.923	14.541	1.148	0.942	21.554	15.5	13.9	16.1	14.4
9	0.941	0.946	0.164	0.078	2.130	17.0	13.0	19.0	14.0
10	1.846	0.473	0.000	0.157	2.476	14.9	15.0	0.0	18.0
Sum	803.1	1083.6	55.7	93.7	2036.2				
SOP	7470.5	12436.2	849.9	1136.0	21892.7				
Catch	7831.1	12482.8	849.7	1137.8	22301.3				

Sub-division 26

	Numbers (milions)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.000	0.000	178.171	441.511	619.682	0	0.0	3.5	4.2
1	847.084	728.429	125.267	216.705	1917.485	3.7	5.6	9.6	9.7
2	850.278	902.809	208.187	100.527	2061.801	8.9	9.2	11.1	11.2
3	1809.796	1310.319	98.353	152.974	3371.443	10	9.7	12.3	12.7
4	453.425	193.329	7.885	17.924	672.563	11.5	10.8	12.8	14.1
5	326.621	123.904	16.216	26.325	493.066	11.9	11.3	13.3	13.6
6	89.477	52.290	5.716	1.807	149.290	12.8	11.8	14.0	14.5
7	37.258	21.359	0.516	2.379	61.512	13	12.3	13.6	16.1
8	35.322	4.282	2.169	0.906	42.679	13.3	12.0	13.9	19.5
9	5.586	22.468	0.203	0.000	28.257	15	12.6	13.3	0.0
10	0.588	2.592	0.068	0.000	3.248	17.8	11.2	13.8	0.0
Sum	4455.4	3361.8	642.8	961.1	9421.0				
SOP	40094.5	29826.5	5784.2	7718.0	83423.2				
Catch	40588.6	29746.5	5775.1	7695.5	83805.6				

Sub-division 27

	Numbers (milions)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.0	0.0	0.01	24.3	24.3	0.0	0.0	3.1	3.1
1	9.3	21.3	0.00	1.3	31.9	4.4	3.8	10.1	10.1
2	68.9	15.7	0.00	0.6	85.1	8.0	8.0	11.3	11.3
3	551.1	106.6	0.01	11.9	669.6	9.6	8.9	10.9	10.9
4	130.3	17.3	0.00	1.7	149.3	10.8	10.4	10.8	10.8
5	91.2	14.9	0.00	2.1	108.2	12.1	10.2	11.9	11.9
6	29.8	6.4	0.00	0.8	37.0	12.1	10.3	13.5	13.5
7	33.5	5.6	0.00	0.8	39.9	11.8	11.5	11.5	11.5
8	33.5	5.6	0.00	0.9	40.1	11.9	11.4	12.0	12.0
9	14.9	2.0	0.00	0.2	17.1	11.1	12.2	12.0	12.0
10	5.6	1.6	0.00	0.2	7.4	12.7	12.2	13.0	13.0
Sum	968.2	197.1	0.0	44.6	1210.0				
SOP	9785.6	1726.5	0.2	302.0	11814.3				
Catch	9780.8	1727.8	0.2	301.6	11810.3				

Table 7.3 continued

Sub-division 28

	Numbers (milions)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.000	0.000	2.094	90.834	92.928	0.000	0.000	3.500	3.700
1	188.085	210.713	115.395	258.538	772.732	3.100	3.800	8.000	8.800
2	336.733	257.158	37.577	214.601	846.069	8.100	8.600	9.600	10.400
3	1874.171	1137.759	192.492	496.694	3701.116	9.100	9.000	10.200	11.400
4	376.499	231.911	32.014	73.496	713.921	10.000	9.700	10.000	11.800
5	144.590	86.235	24.116	58.960	313.901	10.600	10.500	11.100	12.400
6	40.330	44.538	3.094	31.925	119.888	11.000	11.000	12.200	12.400
7	45.308	14.411	1.747	10.382	71.848	10.000	10.500	14.400	13.100
8	34.640	37.521	7.319	22.023	101.502	11.100	10.600	11.100	12.400
9	0.000	0.000	0.000	0.963	0.963	0.000	0.000	0.000	14.000
10	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sum	3040.4	2020.2	415.8	1258.4	6734.9				
SOP	26944.4	17446.1	3986.6	12922.2	61299.3				
Catch	27686.4	17514.6	3994.3	13159.8	62355.1				

Sub-division 29

	Numbers (milions)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.000	0.000	16.427	305.867	322.294	0.0	0.0	2.6	2.9
1	418.055	99.080	5.672	344.761	867.567	3.1	2.9	8.3	8.3
2	462.825	19.661	2.035	157.831	642.353	7.6	6.9	10.5	9.7
3	1690.153	75.228	18.410	545.431	2329.222	8.3	7.7	10.1	10.0
4	307.504	36.606	3.856	133.707	481.673	9.5	8.5	11.9	10.5
5	150.447	18.248	1.948	47.981	218.624	9.3	8.8	11.7	10.6
6	53.160	6.468	1.182	34.216	95.027	10.1	9.6	10.8	10.8
7	58.483	11.134	0.207	11.596	81.420	10.3	8.6	11.5	11.9
8	29.111	14.577	3.291	36.697	83.676	10.3	8.9	9.8	10.7
9	0.000	0.000	0.000	1.954	1.954	0.0	0.0	0.0	10.0
10	0.000	0.000	0.000	3.908	3.908	0.0	0.0	0.0	11.5
Sum	3169.7	281.0	53.0	1623.9	5127.7				
SOP	24601.3	1761.6	413.2	13611.0	40387.0				
Catch	25408.3	1764.2	413.5	13609.4	41195.3				

Sub-division 30

	Numbers (milions)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.000	0.000	0.000	5.313	0.899	0.0	0.0	0.0	4.4
1	1.400	0.408	0.631	6.167	6.013	3.9	4.6	8.5	9.9
2	2.445	1.736	1.292	1.818	63.765	9.9	9.4	10.6	12.0
3	3.866	6.444	1.459	15.755	19.953	10.7	10.8	12.4	12.4
4	3.138	4.949	2.217	19.448	15.057	13.2	11.9	13.7	13.6
5	4.679	6.211	2.599	9.513	5.156	12.8	12.4	13.5	15.8
6	1.619	0.058	0.564	3.781	17.485	13.3	7.0	12.0	14.0
7	3.589	5.401	3.792	8.979	49.627	12.5	13.3	14.4	15.7
8	17.435	18.847	4.641	82.507	85.179	14.6	14.4	15.7	16.5
9	0.000	0.000	0.000	0.000	0.000	0.0	0.0	0.0	0.0
10	0.000	0.000	0.000	0.000	0.000	0.0	0.0	0.0	0.0
Sum	38.2	44.1	17.2	153.3	263.1				
SOP	493.3	567.3	236.8	2271.7	3569.1				
Catch	493.0	567.0	237.0	2268.0	3565.0				

Table 7.3 continued

Sub-division 31

	Numbers (milions)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.000	0.000	0.000	0.000	0.000	0.0	0.0	0.0	0.0
1	0.000	0.000	0.000	0.000	0.000	0.0	0.0	9.7	0.0
2	0.000	0.000	0.000	0.000	0.000	0.0	0.0	11.6	0.0
3	0.000	0.000	0.000	0.000	0.000	0.0	0.0	12.6	0.0
4	0.000	0.000	0.000	0.000	0.000	0.0	0.0	12.9	0.0
5	0.000	0.000	0.000	0.000	0.000	0.0	0.0	13.9	0.0
6	0.000	0.000	0.000	0.000	0.000	0.0	0.0	14.5	0.0
7	0.000	0.000	0.000	0.000	0.000	0.0	0.0	14.6	0.0
8	0.000	0.000	0.000	0.000	0.000	0.0	0.0	15.3	0.0
9	0.000	0.000	0.000	0.000	0.000	0.0	0.0	0.0	0.0
10	0.000	0.000	0.000	0.000	0.000	0.0	0.0	0.0	0.0
Sum	0.0	0.0	0.0	0.0	0.0				
SOP	0.0	0.0	0.0	0.0	0.0				
Catch	0.0	0.0	0.0	0.0	0.0				

Sub-division 32

	Numbers (milions)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.000	0.000	9.457	107.503	116.961	0.0	0.0	2.8	2.8
1	495.011	156.612	61.446	484.095	1197.166	3.1	2.7	7.3	7.8
2	102.177	44.785	18.850	144.752	310.565	7.8	6.6	9.2	9.2
3	479.890	248.785	82.907	567.497	1379.079	8.3	7.5	9.9	10.0
4	103.397	134.768	13.673	73.013	324.851	9.6	8.3	9.7	10.8
5	42.330	50.472	5.519	18.092	116.413	9.9	9.0	11.6	10.8
6	20.250	34.323	5.895	37.510	97.978	9.6	9.0	9.5	10.4
7	42.158	16.381	1.678	11.765	71.982	9.7	8.9	10.8	10.3
8	18.335	39.711	10.316	9.730	78.092	10.2	9.8	10.8	10.5
9	0.000	0.000	0.000	0.000	0.000	0.0	0.0	0.0	0.0
10	0.000	0.000	0.000	0.000	0.000	0.0	0.0	0.0	0.0
Sum	1303.5	725.8	209.7	1454.0	3693.1				
SOP	8516.6	5001.0	1851.4	12681.0	28050.1				
Catch	8543.9	5011.0	1849.6	12633.4	28037.9				

Sub-divisions 22-32

	Numbers (milions)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.000	0.000	206.654	996.780	1203.434	0.0	0.0	3.4	3.6
1	5518.715	1413.341	319.081	1502.203	8753.340	2.3	4.6	8.6	8.5
2	2008.881	1397.354	276.621	651.788	4334.644	8.4	9.1	10.9	10.2
3	6721.953	3514.348	412.727	1830.127	12479.155	9.2	9.6	10.9	10.8
4	1498.159	796.120	69.206	329.183	2692.668	10.6	10.3	11.4	11.4
5	841.579	382.170	59.583	171.571	1454.903	11.2	11.2	12.7	12.3
6	246.773	157.057	17.980	111.637	533.446	11.7	11.0	12.2	11.4
7	235.563	82.248	9.028	46.249	373.088	11.2	11.0	13.9	12.8
8	173.280	135.111	28.884	153.746	491.020	12.0	11.1	12.0	14.1
9	21.423	25.426	0.367	3.184	50.400	12.4	12.6	15.8	11.4
10	8.020	4.675	0.068	4.253	17.016	13.6	11.9	13.8	11.8
Sum	17274.3	7907.8	1400.2	5800.7	32383.1				
SOP	125034.5	69927.3	13183.5	52688.0	260833.3				
Catch	127521.4	70092.1	13183.8	52992.1	263789.3				

Table 7.4 SPRAT in SD 22-32. Fishing effort and CPUE data

Year	Russia - Sub-division 26			
	Type of vessels			
	*)SRTM (51 m length, 1100 hp)		MRTK (27 m length, 300 hp)	
	Effort	CPUE,	Effort	CPUE,
	[h]	[kg/h]	[h]	[kg/h]
1995	8907	647	8760	601
1996	12129	620	7810	953
1997	17140	470	10691	746
1998	13469	646	9986	782
1999	13898	869	15967	965
2000	14417	766	13501	1031
2001	12837	937	12912	1282
2002	11789	884	18979	1012
2003	5869	958	14128	1285
2004	2973	895	14751	1394
2005	1696	1323	21908	1115
2006	877	1362	16592	1406
2007			16032	1303
2008			14428	1306
2009			17966	1258
2010			14179	1276

*) - vessels withdrawn from exploitation in 2007

Table 7.5 Sprat in Sub-divisions 22-32. Samples of commercial catches by quarter, country and Sub-division for 2011 available to the Working Group.

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Sub-division 22	Country	Quarter	Landings in tons	Number of samples	Number of fish measured	Number of fish aged
	Denmark	1	5,015.2	5	491	160
		2	593.9	2	272	92
		3	34.7			
		4	1,487.3	4	421	212
		Total	7,131.1	11	1184	464
	Germany	1	963.7			
		2	168.2			
		3				
		4	67.2	1	280	58
		Total	1,199.1	1	280	58
	Total	1	5,978.9	5	491	160
		2	762.0	2	272	92
		3	34.7			
		4	1,554.5	5	701	270
		Total	8,330.2	12	1464	522
Sub-division 23+24	Country	Quarter	Landings in tons	Number of samples	Number of fish measured	Number of fish aged
	Denmark	1	38.4			
		2	1.7			
		3	15.6			
		4	369.9			
		Total	425.7	0	0	0
	Finland	1				
		2				
		3				
		4				
		Total	0.0	0	0	0
	Germany	1	25.1	3	270	92
		2	33.9			
		3				
		4	1.8	1	325	88
		Total	60.8	4	595	180
	Latvia	1				
		2	3.0			
		3				
		4				
		Total	3.0	0	0	0
	Lithuania	1				
		2	21.0			
		3				
		4				
		Total	21.0	0	0	0
	Poland	1	122.0			
		2	372.6	3	520	138
		3	4.0	1	177	73
		4	189.9			
		Total	688.5	4	697	211
	Sweden	1	1,025.0			
		2	84.0			
		3	10.0			
		4	70.5	2	300	297
		Total	1,189.5	2	300	297
	Total	1	1,210.5	3	270	92
		2	516.2	3	520	138
		3	29.6	1	177	73
		4	632.2	3	625	385
		Total	2,388.5	10	1592	688

cont. 2/6

Table 7.5 Sprat in Sub-divisions 22-32. Samples of commercial catches by quarter, country and Sub-division for 2011 available to the Working Group.

Sub-division 25	Country	Quarter	Landings in tons	Number of samples	Number of fish measured	Number of fish aged
	Denmark	1	1,958.1	10	1172	514
		2	231.2	6	688	193
		3	3.1			
		4	198.1	6	618	314
		Total	2,390.5	22	2478	1021
	Estonia	1	194.1			
		2				
		3				
		4				
		Total	194.1	0	0	0
	Finland	1				
		2				
		3				
		4				
		Total	0.0	0	0	0
	Germany	1				
		2	351.1	2	234	105
		3				
		4				
		Total	351.1	2	234	105
	Latvia	1	700.0			
		2	1,282.0			
		3				
		4	138.0			
		Total	2,120.0	0	0	0
	Lithuania	1	196.8			
		2	1,646.7			
		3				
		4				
		Total	1,843.4	0	0	0
	Poland	1	2,323.8	18	3063	572
		2	6,861.9	12	2601	276
		3	22.5	14	2877	402
		4	313.1	12	2293	277
		Total	9,521.3	56	10834	1527
	Sweden	1	2,458.4	4	503	492
		2	2,109.9	6	525	509
		3	824.1	6	341	327
		4	488.5	6	481	471
		Total	5,880.9	22	1850	1799
	Total	1	7,831.1	32	4738	1578
		2	12,482.8	26	4048	1083
		3	849.7	20	3218	729
		4	1,137.8	24	3392	1062
		Total	22,301.3	102	15396	4452

cont. 3/6

Table 7.5 Sprat in Sub-divisions 22-32. Samples of commercial catches by quarter, country and Sub-division for 2011 available to the Working Group.

Sub-division 26	Country	Quarter	Landings in tons	Number of samples	Number of fish measured	Number of fish aged
	Denmark	1	3,993.8	14	1428	598
		2	0.0	4	446	226
		3				
		4				
		Total	3,993.8	18	1874	824
	Estonia	1	155.9			
		2				
		3				
		4				
		Total	155.9	0	0	0
	Finland	1	623.0			
		2				
		3				
		4				
		Total	623.0	0	0	0
	Germany	1	1,952.9			
		2	838.0			
		3				
		4				
		Total	2,790.8	0	0	0
	Latvia	1	1,592.0	2	1584	188
		2	2,023.0	2	361	158
		3	216.0	3	614	267
		4	335.0	1	206	96
		Total	4,166.0	8	2765	709
	Lithuania	1	2,500.9	4	1320	500
		2	3,200.7	4	782	500
		3	97.2	1	257	150
		4				
		Total	5,798.9	9	2359	1150
	Poland	1	11,662.1	28	5876	784
		2	19,940.2	14	3148	435
		3	2,959.3	3	615	120
		4	3,402.8	15	3003	336
		Total	37,964.4	60	12642	1675
	Russia	1	9,476.9	19	3847	262
		2	3,522.1	26	5250	522
		3	2,502.6	3	709	213
		4	3,957.7	19	3714	376
		Total	19,459.3	67	13520	1373
	Sweden	1	8,631.1	0	0	0
		2	222.5	0	0	0
		3				
		4				
		Total	8,853.6	0	0	0
	Total	1	40,588.6	67	14055	2332
		2	29,746.5	50	9987	1841
		3	5,775.1	10	2195	750
		4	7,695.5	35	6923	808
		Total	83,805.6	162	33160	5731

cont. 4/6

Table 7.5 Sprat in Sub-divisions 22-32. Samples of commercial catches by quarter, country and Sub-division for 2011 available to the Working Group.

Sub-division 27	Country	Quarter	Landings in tons	Number of samples	Number of fish measured	aged
	Denmark	1	133.1			
		2				
		3				
		4				
		Total	133.1	0	0	0
	Estonia	1	41.5			
		2				
		3				
		4				
		Total	41.5	0	0	0
	Finland	1	262.0			
		2	8.0			
		3				
		4				
		Total	270.0	0	0	0
	Germany	1	10.7			
		2				
		3				
		4				
		Total	10.7	0	0	0
	Latvia	1				
		2	117.0			
		3				
		4	2.0			
		Total	119.0	0	0	0
	Lithuania	1				
		2	53.0			
		3				
		4				
		Total	53.0	0	0	0
	Poland	1	55.3			
		2	105.6			
		3				
		4				
		Total	160.9	0	0	0
	Sweden	1	9,278.2	10	525	520
		2	1,444.2	4	499	490
		3	0.2	0	0	0
		4	299.6	4	241	237
		Total	11,022.1	18	1265	1247
	Total	1	9,780.8	10	525	520
		2	1,727.8	4	499	490
		3	0.2	0	0	0
		4	301.6	4	241	237
		Total	11,810.3	18	1265	1247
Sub-division 28	Country	Quarter	Landings in tons	Number of samples	Number of fish measured	aged
	Denmark	1	5,843.5	12	1064	302
		2	729.3	1	118	48
		3				
		4	2,294.7	3	329	143
		Total	8,867.5	16	1511	493
	Estonia	1	877.6	1	209	103
		2	507.3	6	681	343
		3	81.6	1	142	59
		4	1,005.0	5	517	242
		Total	2,471.4	13	1549	747
	Finland	1	1,241.0			
		2				
		3				
		4				
		Total	1,241.0	0	0	0
	Germany	1				
		2				
		3				
		4				
		Total	0.0	0	0	0
	Latvia	1	7,419.0	4	843	330
		2	8,590.0	8	1728	678
		3	3,624.0	4	983	352
		4	7,014.0	5	1011	449
		Total	26,647.0	21	4565	1809
	Lithuania	1	297.0			
		2	265.0			
		3	97.7			
		4	991.9			
		Total	1,651.6	0	0	0
	Poland	1	1,205.1	3	722	71
		2	4,803.0	4	1027	62
		3				
		4	20.0			
		Total	6,028.1	7	1749	133
	Russia	1				
		2				
		3				
		4				
		Total	0.0	0	0	0
	Sweden	1	10,803.3	2	321	315
		2	2,619.9			
		3	191.0			
		4	1,834.2	2	175	170
		Total	15,448.4	4	496	485
	Total	1	27,686.4	22	3159	1121
		2	17,514.6	19	3554	1131
		3	3,994.3	5	1125	411
		4	13,159.8	15	2032	1004
		Total	62,355.1	61	9870	3667

cont. 5/6

Table 7.5 Sprat in Sub-divisions 22-32. Samples of commercial catches by quarter, country and Sub-division for 2011 available to the Working Group.

Sub-division 29	Country	Quarter	Landings in tons	Number of samples	Number of fish measured	aged
	Denmark	1	7128.2	4	416	218
		2				
		3				
		4	966.7			
		Total	8094.9	4	416	218
	Estonia	1	5540.7	3	572	252
		2	1708.2	2	523	208
		3	113.5			
		4	4549.0	7	1533	309
		Total	11911.4	12	2628	769
	Finland	1	1320.0			
		2	56.0	4	323	81
		3	300.0	4	922	106
		4	2789.0	4	966	97
		Total	4465.0	12	2211	284
	Germany	1	2646.0			
		2				
		3				
		4	639.1			
		Total	3285.1	0	0	0
	Latvia	1				
		2				
		3				
		4				
		Total	0.0	0	0	0
	Lithuania	1				
		2				
		3				
		4	570.0			
		Total	570.0	0	0	0
	Poland	1	967.8	6	1306	131
		2				
		3				
		4				
		Total	967.8	6	1306	131
	Sweden	1	7805.5	3	520	499
		2				
		3				
		4	4095.5	2	300	297
		Total	11901.0	5	820	796
	Total	1	25408.3	16	2814	1100
		2	1764.2	6	846	289
		3	413.5	4	922	106
		4	13609.4	13	2799	703
		Total	41195.3	39	7381	2198
Sub-division 30	Country	Quarter	Landings in tons	Number of samples	Number of fish measured	aged
	Finland	1	420.0	11	736	125
		2	567.0	11	756	89
		3	237.0	8	963	67
		4	2264.0	10	1493	106
		Total	3488.0	40	3948	387
	Sweden	1	73.0			
		2				
		3				
		4	4.0			
		Total	77.0	0	0	0
	Total	1	493.0	11	736	125
		2	567.0	11	756	89
		3	237.0	8	963	67
		4	2268.0	10	1493	106
		Total	3565.0	40	3948	387
Sub-division 31	Country	Quarter	Landings in tons	Number of samples	Number of fish measured	aged
	Finland	1				
		2				
		3				
		4				
		Total	0.0	0	0	0

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Table 7.5 Sprat in Sub-divisions 22-32. Samples of commercial catches by quarter, country and Sub-division for 2011 available to the Working Group.

Sub-division 32	Country	Quarter	Landings in tons	Number of samples	Number of fish measured	Number of fish aged
	Denmark	1				
		2				
		3				
		4	330.9			
		Total	330.9	0	0	0
	Estonia	1	7,548.9	8	1342	603
		2	4,239.0	5	964	385
		3	480.6	5	647	384
		4	7,933.5	8	1342	603
		Total	20,202.0	26	4295	1975
	Finland	1	995.0	3	684	154
		2	772.0	2	111	64
		3	1,369.0	3	908	94
		4	2,544.0	3	684	154
		Total	5,680.0	11	2387	466
	Sweden	1				
		2				
		3				
		4	1,825.0			
		Total	1,825.0	0	0	0
	Total	1	8,543.9	11	2026	757
		2	5,011.0	7	1075	449
		3	1,849.6	8	1555	478
		4	12,633.4	11	2026	757
		Total	28,037.9	37	6682	2441
Sub-divisions 22-32	**Total**	**Quarter**	**Landings in tons**	**Number of samples**	**Number of fish measured**	**Number of fish aged**
		1	**127,521.4**	**177**	**28814**	**7785**
		2	**70,092.1**	**128**	**21557**	**5602**
		3	**13,183.8**	**56**	**10155**	**2614**
		4	**52,992.1**	**120**	**20232**	**5332**
		Total	**263,789.3**	**481**	**80758**	**21333**

Table 7.6 SPRAT in SD 22-32. Catch in Numbers (Thousands)

CANUM: Catch in numbers (Total International Catch) (Thousands)

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1974	2615000	6172000	3618000	1940000	1929000	933000	1213000	278000
1975	628000	2032000	5678000	2387000	790000	878000	247000	546000
1976	4682000	818000	2106000	3510000	1040000	350000	548000	422000
1977	2371000	8399000	997000	1907000	1739000	364000	140000	399000
1978	500000	3325000	4936000	480000	817000	683000	73000	189000
1979	1340000	597000	1037000	2291000	188000	150000	335000	125000
1980	369000	1476000	378000	500000	1357000	72000	67000	235000
1981	2303000	920000	405000	94000	88000	527000	13000	99000
1982	363000	2460000	425000	225000	64000	57000	231000	51000
1983	1852000	297000	531000	107000	47000	12000	18000	148000
1984	1005000	2393000	388000	447000	77000	38000	9000	83000
1985	566000	1703000	2521000	447000	271000	30000	19000	65000
1986	495000	1142000	1425000	2099000	340000	188000	16000	50000
1987	779000	394000	1320000	1833000	1805000	227000	149000	73000
1988	78067	2695775	730495	1148801	762480	760343	64666	141159
1989	2101849	290021	1771932	403652	739242	390255	398382	137139
1990	1049000	3171000	346000	952000	188000	316000	112000	200000
1991	1043547	2649359	2438646	406536	568611	106181	160259	152226
1992	1782000	2939000	3040000	1643000	444000	311000	121000	163000
1993	1832200	5685200	3243700	1898100	883700	267100	244400	256688
1994	1079000	8169000	8176000	3525000	2201000	779000	193000	208000
1995	6373200	2341300	6643300	6636100	3366400	1901800	626600	409200
1996	8388700	27674900	4704100	6517100	3323000	1499200	690100	403400
1997	1717800	23181900	23395000	6343200	4107900	1650800	682700	279100
1998	11017500	3802500	17687600	19617500	2658600	1777800	1468100	489100
1999	2081600	19901300	5832000	9972000	8835500	1180100	686700	515400
2000	10534600	2948125	14716398	2870128	4284070	4076601	707496	760552
2001	2775600	11557200	2670400	9252400	1998800	2651400	2263500	522500
2002	6648000	5429000	10781000	3835000	4308000	998000	880000	1340000
2003	9366111	7108722	4805394	5067481	2396044	1902532	833054	1383341
2004	23263510	13094317	5447560	3086404	3245594	1333956	1143154	1364306
2005	2842586	30967900	11254006	2933589	1868255	842965	658605	615157
2006	10851128	3265522	21097242	6832239	1380358	613632	405085	529977
2007	13796000	11968000	3706000	13723000	3855000	623000	301000	539000
2008	6390863	15479241	6684347	2936620	5718800	2255393	299070	362477
2009	21145000	8891000	10181000	3905000	1795000	2837000	1008000	353000
2010	4584000	21493000	5363000	4234000	1239000	881000	994000	511000
2011	8753340	4334644	12479155	2692668	1454903	533446	373088	558435

Table 7.7 SPRAT in SD 22-32.
Mean weight in the Catch and in the Stock (Kilograms)
WECA (=WEST): Mean weight in Catch (Kilograms)

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1974	0.0066	0.0105	0.0122	0.0134	0.0139	0.0154	0.0141	0.0143
1975	0.0068	0.0112	0.0124	0.0134	0.0147	0.0143	0.0157	0.0135
1976	0.0069	0.0107	0.0127	0.0135	0.0145	0.0161	0.0147	0.0143
1977	0.0054	0.0110	0.0134	0.0140	0.0144	0.0159	0.0159	0.0158
1978	0.0051	0.0109	0.0125	0.0131	0.0141	0.0152	0.0158	0.0151
1979	0.0055	0.0127	0.0130	0.0137	0.0151	0.0158	0.0156	0.0162
1980	0.0078	0.0113	0.0143	0.0141	0.0143	0.0167	0.0158	0.0160
1981	0.0063	0.0141	0.0161	0.0180	0.0165	0.0159	0.0168	0.0161
1982	0.0088	0.0117	0.0160	0.0162	0.0167	0.0164	0.0163	0.0173
1983	0.0092	0.0145	0.0162	0.0171	0.0169	0.0170	0.0169	0.0168
1984	0.0097	0.0111	0.0146	0.0153	0.0158	0.0163	0.0169	0.0172
1985	0.0091	0.0113	0.0127	0.0140	0.0160	0.0171	0.0171	0.0158
1986	0.0079	0.0121	0.0129	0.0140	0.0148	0.0161	0.0170	0.0167
1987	0.0085	0.0117	0.0133	0.0145	0.0152	0.0164	0.0170	0.0176
1988	0.0056	0.0103	0.0122	0.0142	0.0152	0.0153	0.0166	0.0170
1989	0.0097	0.0136	0.0145	0.0158	0.0169	0.0173	0.0175	0.0181
1990	0.0104	0.0126	0.0149	0.0160	0.0175	0.0177	0.0184	0.0181
1991	0.0090	0.0129	0.0143	0.0158	0.0166	0.0175	0.0169	0.0169
1992	0.0087	0.0121	0.0147	0.0154	0.0173	0.0172	0.0181	0.0184
1993	0.0066	0.0111	0.0138	0.0146	0.0150	0.0162	0.0166	0.0166
1994	0.0080	0.0098	0.0121	0.0140	0.0145	0.0152	0.0155	0.0159
1995	0.0065	0.0106	0.0110	0.0126	0.0137	0.0141	0.0143	0.0145
1996	0.0043	0.0075	0.0103	0.0111	0.0124	0.0128	0.0127	0.0129
1997	0.0067	0.0074	0.0085	0.0101	0.0117	0.0124	0.0125	0.0127
1998	0.0046	0.0076	0.0083	0.0089	0.0104	0.0106	0.0108	0.0118
1999	0.0040	0.0078	0.0092	0.0091	0.0092	0.0106	0.0112	0.0110
2000	0.0062	0.0102	0.0100	0.0108	0.0113	0.0117	0.0128	0.0134
2001	0.0063	0.0093	0.0114	0.0108	0.0116	0.0113	0.0110	0.0118
2002	0.0069	0.0097	0.0102	0.0109	0.0111	0.0111	0.0115	0.0117
2003	0.0050	0.0099	0.0108	0.0109	0.0114	0.0111	0.0107	0.0108
2004	0.0044	0.0076	0.0105	0.0112	0.0111	0.0114	0.0111	0.0113
2005	0.0047	0.0069	0.0081	0.0107	0.0112	0.0116	0.0110	0.0113
2006	0.0049	0.0078	0.0082	0.0089	0.0108	0.0112	0.0111	0.0114
2007	0.0056	0.0077	0.0091	0.0092	0.0094	0.0109	0.0113	0.0110
2008	0.0068	0.0092	0.0098	0.0105	0.0103	0.0102	0.0112	0.0122
2009	0.0050	0.0092	0.0105	0.0109	0.0114	0.0108	0.0110	0.0120
2010	0.0052	0.0080	0.0099	0.0107	0.0110	0.0112	0.0108	0.0114
2011	0.0040	0.0091	0.0096	0.0107	0.0114	0.0114	0.0114	0.0124

Table 7.8 SPRAT in SD 22-32. Natural Mortality
NATMOR: Natural Mortality

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1974	0.96	0.57	0.45	0.45	0.50	0.46	0.56	0.56
1975	1.39	0.76	0.57	0.55	0.63	0.59	0.73	0.73
1976	0.88	0.55	0.43	0.42	0.48	0.46	0.56	0.56
1977	0.77	0.50	0.41	0.40	0.44	0.43	0.52	0.52
1978	1.05	0.67	0.54	0.51	0.57	0.55	0.68	0.68
1979	1.17	0.80	0.65	0.59	0.67	0.68	0.86	0.86
1980	1.26	0.84	0.68	0.60	0.68	0.73	0.92	0.92
1981	1.02	0.71	0.58	0.53	0.60	0.61	0.78	0.78
1982	1.20	0.83	0.68	0.61	0.69	0.71	0.91	0.91
1983	1.06	0.78	0.63	0.59	0.69	0.69	0.88	0.88
1984	0.85	0.65	0.55	0.50	0.56	0.59	0.74	0.74
1985	0.74	0.55	0.46	0.43	0.48	0.50	0.62	0.62
1986	0.64	0.45	0.39	0.37	0.40	0.40	0.48	0.48
1987	0.53	0.40	0.35	0.34	0.36	0.36	0.42	0.42
1988	0.57	0.44	0.38	0.36	0.39	0.40	0.47	0.47
1989	0.47	0.37	0.33	0.31	0.34	0.35	0.41	0.41
1990	0.38	0.31	0.28	0.27	0.29	0.29	0.33	0.33
1991	0.32	0.27	0.25	0.24	0.25	0.25	0.28	0.28
1992	0.34	0.26	0.25	0.24	0.25	0.25	0.26	0.26
1993	0.36	0.29	0.27	0.26	0.28	0.26	0.29	0.29
1994	0.35	0.29	0.27	0.26	0.27	0.27	0.29	0.29
1995	0.33	0.28	0.26	0.26	0.27	0.27	0.30	0.30
1996	0.31	0.27	0.25	0.25	0.26	0.26	0.29	0.29
1997	0.35	0.28	0.26	0.26	0.27	0.28	0.31	0.31
1998	0.39	0.31	0.27	0.27	0.29	0.28	0.32	0.32
1999	0.41	0.32	0.28	0.28	0.29	0.29	0.33	0.33
2000	0.41	0.32	0.29	0.28	0.30	0.30	0.33	0.33
2001	0.39	0.31	0.27	0.27	0.29	0.29	0.31	0.31
2002	0.40	0.32	0.29	0.28	0.30	0.30	0.33	0.33
2003	0.30	0.26	0.24	0.24	0.25	0.25	0.26	0.26
2004	0.30	0.26	0.24	0.24	0.25	0.24	0.26	0.26
2005	0.33	0.27	0.25	0.24	0.25	0.25	0.27	0.27
2006	0.33	0.27	0.25	0.24	0.26	0.25	0.27	0.27
2007	0.35	0.29	0.26	0.26	0.27	0.27	0.29	0.29
2008	0.36	0.30	0.27	0.27	0.28	0.28	0.30	0.30
2009	0.43	0.36	0.32	0.32	0.34	0.33	0.36	0.36
2010	0.45	0.37	0.34	0.33	0.35	0.35	0.38	0.38
2011	0.45	0.37	0.34	0.33	0.35	0.35	0.38	0.38

Table 7.9 **SPRAT in SD 22-32. Proportion Mature at Spawning Time**
MATPROP: Proportion of Mature at Spawning Time

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1974-2011	0.170	0.930	1.0	1.0	1.0	1.0	1.0	1.0

Table 7.10 **SPRAT in SD 22-32. Proportion of M before Spawning**
MPROP: Proportion of M before Spawning

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1974-2011	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4

Table 7.11 **SPRAT in SD 22-32. Proportion of F before Spawning**
FPROP: Proportion of F before Spawning

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1974-2011	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4

Table 7.12 SPRAT in SD 22-32. Tuning Fleet
Acoustic Survey in SD 26+28

Fleet 03. Acoustic on age 0 in SD 26+28 shifted to represent age 1

Year	Fish. Effort	Age 1
1994	1	2221
1995	1	38555
1996	1	27810
1997	1	3287
1998	1	39334
1999	1	682
2000	1	22249
2001	1	3466
2002	1	6410
2003	1	31780
2004	1	61462
2005	1	2074
2006	1	18202
2007	1	23831
2008	1	3144
2009	1	53263
2010	1	6363
2011	1	8669

Table 7.13 SPRAT in SD 22-32. Tuning Fleet/InternationalAcoustic Survey in October (SD 24-29)

Fleet 01. International Acoustic Survey corrected by area surveyed (Catch: Millions)

Year	Fish. Effort	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1991	1	46989	40690	43970	2637	8953	1806	1936	3072
1992	1	37345	27356	24438	9433	1945	2452	717	563
1993	1	-11	-11	-11	-11	-11	-11	-11	-11
1994	1	12557	45137	43656	17478	12051	5149	1034	1579
1995	1	-11	-11	-11	-11	-11	-11	-11	-11
1996	1	71379	133914	21098	23648	12968	6493	3770	1341
1997	1	-11	-11	-11	-11	-11	-11	-11	-11
1998	1	102572	22213	56369	37065	8201	4856	1675	1064
1999	1	4904	91316	16083	36201	39247	5296	3364	1787
2000	1	59895	5321	51166	5753	14282	16174	1599	2760
2001	1	12224	36403	6973	30796	4064	9749	6477	2449
2002	1	31811	14641	37845	5831	19258	2656	5167	4419
2003	1	100928	32803	24306	23675	8099	13435	4867	8747
2004	1	121935	47843	11895	8053	4995	2472	2454	3640
2005	1	7200	126586	49268	10179	5197	3051	2392	3348
2006	1	37280	12054	105751	33052	8168	4692	2167	3031
2007	1	52489	22128	8331	26627	9980	1105	479	1610
2008	1	29422	45772	20500	5407	19177	5765	1267	1942
2009	1	78186	25771	21329	6728	4751	7197	2070	1407
2010	1	11769	52258	10916	6781	1737	1995	2621	1195
2011	1	20865	11819	44250	10126	6868	2671	1850	2858

Table 7.14 SPRAT in SD 22-32. Tuning Fleet/InternationalAcoustic Survey in SD 24-28 excl. 27

Fleet 02. International Acoustic Survey in May corrected by area surveyed (Catch: Millions)

Year	Fish. Effort	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
2001	1	8322	36412	13010	37889	5449	4804	4717	630
2002	1	27439	19133	37184	19104	14974	2547	3711	2685
2003	1	27313	16662	8514	15855	5668	7364	1720	3769
2004	1	139812	68118	16020	11115	13050	3296	8068	6572
2005	1	4402	91314	23823	7313	3593	2827	1873	2308
2006	1	13783	8242	78851	21526	5847	2008	1570	2016
2007	1	53027	29438	6506	36976	7692	1292	540	720
2008	1	9163	41157	20519	5706	21703	4320	777	1538
2009	1	40705	27209	36819	10775	6506	14494	5469	1009
2010	1	9432	59855	15427	16098	5129	1682	5628	1308
2011	1	18647	6941	67502	17020	10796	4147	2442	3490

Table 7.15 SPRAT in SD 22-32. Output from XSA.

Lowestoft VPA Version 3.1
15/04/2012 13:54
Extended Survivors Analysis
Sprat 22 32
CPUE data from file d:\SprDat11\FL2intAge0c.txt
Catch data for 38 years. 1974 to 2011. Ages 1 to 8.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
FLT01: International	1991	2011	1	7	0.75	0.85
FLT02: Intenational	2001	2011	1	7	0.35	0.42
FLT03: Latvian/Russian	1994	2011	1	1	0	0.01

Time series weights :
Tapered time weighting applied
Power = 3 over 20 years

Catchability analysis :
Catchability dependent on stock size for ages < 2
Regression type = C
Minimum of 5 points used for regression
Survivor estimates shrunk to the population mean for ages < 2
Catchability independent of age for ages >= 5

Terminal population estimation :
Survivor estimates shrunk towards the mean F
of the final 5 years or the 3 oldest ages.
S.E. of the mean to which the estimates are shrunk = .750
Minimum standard error for population
estimates derived from each fleet = .300

Prior weighting not applied

Tuning had not converged after 40 iterations

Total absolute residual between iterations
39 and 40 = .00180

Final year F values

Age		1	2	3	4	5	6	7		
Iteration	39	0.1581	0.2556	0.3238	0.3083	0.23	0.2785	0.4894		
Iteration	40	0.1581	0.2549	0.3243	0.3085	0.23	0.2784	0.4891		
Regression weights	0.751	0.82	0.877	0.921	0.954	0.976	0.99	0.997	1	1

Fishing mortalities

Age	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
1	0.165	0.106	0.136	0.082	0.188	0.163	0.115	0.153	0.147	0.158
2	0.236	0.31	0.231	0.299	0.142	0.372	0.323	0.278	0.289	0.255
3	0.462	0.373	0.442	0.339	0.368	0.257	0.404	0.418	0.321	0.324
4	0.375	0.445	0.461	0.478	0.375	0.467	0.36	0.496	0.355	0.308
5	0.355	0.462	0.615	0.603	0.463	0.403	0.393	0.445	0.335	0.23
6	0.363	0.285	0.541	0.333	0.429	0.425	0.482	0.391	0.491	0.278
7	0.317	0.659	0.295	0.612	0.282	0.422	0.412	0.48	0.273	0.489

XSA population numbers (Millions)

	AGE						
YEAR	1	2	3	4	5	6	7
2002	53500	30300	33700	14100	16700	3810	3820
2003	109000	30400	17400	15900	7330	8700	1960
2004	212000	72400	17200	9420	8010	3600	5090
2005	42500	137000	44400	8700	4680	3370	1650
2006	74800	28200	77700	24600	4240	1990	1880
2007	109000	44600	18600	41900	13300	2060	1010
2008	70500	65200	23000	11100	20300	6780	1030
2009	185000	43900	35000	11700	5930	10300	3170
2010	42100	103000	23200	16700	5180	2700	5030
2011	75000	23200	53400	12000	8440	2610	1170

Estimated population abundance at 1st Jan 2012

0	40800	12400	27500	6320	4720	1390

Taper weighted geometric mean of the VPA populations:

83400	52100	32400	17000	9000	4490	2380

Standard error of the weighted Log(VPA populations) :

0.5546	0.5906	0.5401	0.5469	0.5647	0.6244	0.6377

continued Table 7.15 SPRAT in SD 22-32. Output from XSA: Diagnostics (2/4)

Log catchability residuals.

Fleet : FLT01:	**International**										
Age	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	
1	99.99	-0.07	99.99	-0.38	99.99	-0.22	99.99	0.00	-0.75	0.20	
2	99.99	0.05	99.99	0.19	99.99	0.23	99.99	-0.07	0.39	-1.39	
3	99.99	0.16	99.99	0.21	99.99	-0.25	99.99	0.17	-0.16	0.09	
4	99.99	0.14	99.99	0.17	99.99	0.29	99.99	-0.17	0.43	-0.61	
5	99.99	-0.25	99.99	0.22	99.99	0.01	99.99	-0.02	0.43	0.01	
6	99.99	-0.08	99.99	0.37	99.99	0.39	99.99	0.00	0.17	0.24	
7	99.99	-0.08	99.99	0.15	99.99	0.43	99.99	-0.69	0.31	-0.32	

Age	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
1	-0.09	0.46	0.40	-0.13	-0.32	0.20	0.04	0.09	-0.20	0.09	-0.12
2	0.06	-0.19	0.63	0.07	0.47	-0.43	-0.08	0.24	0.07	-0.06	-0.08
3	-1.03	0.48	0.58	-0.06	0.34	0.56	-0.63	0.18	-0.15	-0.46	0.10
4	0.23	-0.61	0.70	0.16	0.49	0.54	-0.12	-0.46	-0.15	-0.60	0.10
5	-0.49	0.25	0.25	-0.20	0.37	0.82	-0.17	0.07	-0.01	-0.96	-0.16
6	0.37	-0.25	0.45	-0.17	-0.05	0.98	-0.48	0.03	-0.20	-0.05	0.11
7	0.07	0.40	1.23	-0.70	0.66	0.16	-0.59	0.36	-0.17	-0.55	0.74

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

Age	2	3	4	5	6	7
Mean Log q	-0.0939	0.2402	0.2459	0.4169	0.4169	0.4169
S.E(Log q)	0.4349	0.4632	0.453	0.4467	0.3895	0.6044

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	0.63	2.235	4.5	0.79	17	0.29	-0.54

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

Age	**Slope**	**t-value**	**Intercept**	**RSquare**	**No Pts**	**Reg s.e**	**Mean Q**
2	0.77	1.42	2.62	0.79	17.00	0.32	-0.09
3	0.70	1.63	2.89	0.76	17.00	0.30	0.24
4	0.93	0.28	0.43	0.64	17.00	0.44	0.25
5	0.96	0.15	-0.06	0.64	17.00	0.45	0.42
6	0.98	0.08	-0.35	0.74	17.00	0.39	0.49
7	1.59	-1.37	-5.37	0.36	17.00	0.91	0.51

Fleet : FLT02: Intenational											
Age	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**
1	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-0.06	0.64
2	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	0.09	0.12
3	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-0.31	0.42
4	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	0.18	0.33
5	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-0.31	-0.12
6	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-0.50	-0.41
7	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-0.41	-0.04

Age	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
1	-0.11	0.29	-0.36	-0.16	0.34	-0.37	-0.34	0.19	0.06
2	-0.02	0.49	0.18	-0.71	0.20	0.14	0.13	0.07	-0.60
3	-0.45	0.22	-0.36	0.28	-0.82	0.18	0.37	-0.12	0.52
4	0.03	0.21	-0.12	-0.12	-0.07	-0.65	0.00	0.00	0.37
5	-0.24	0.56	-0.20	0.34	-0.55	0.07	0.13	-0.01	0.21
6	-0.22	-0.05	-0.21	0.01	-0.46	-0.42	0.35	-0.41	0.44
7	-0.04	0.41	0.21	-0.23	-0.61	-0.27	0.61	0.10	0.81

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

Age	**2**	**3**	**4**	**5**	**6**	**7**
Mean Log q	-0.3642	-0.0306	0.227	0.2606	0.2606	0.2606
S.E(Log q)	0.3626	0.4375	0.2864	0.3179	0.3732	0.4525

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	0.65	1.705	4.75	0.75	11	0.34	-1.21

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

Age	**Slope**	**t-value**	**Intercept**	**RSquare**	**No Pts**	**Reg s.e**	**Mean Q**
2	0.71	2.33	3.35	0.89	11	0.21	-0.36
3	0.69	1.74	3.23	0.80	11	0.27	-0.03
4	0.98	0.08	-0.08	0.77	11	0.30	0.23
5	1.18	-0.74	-1.94	0.68	11	0.39	0.26
6	0.98	0.13	0.10	0.77	11	0.35	0.11
7	0.92	0.38	0.31	0.74	11	0.43	0.33

continued Table 7.15 SPRAT in SD 22-32. Output from XSA: Diagnostics (3/4)

Fleet : FLT03: Latvian/Russian

Age	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
1	99.99	99.99	-0.51	-0.45	-0.18	-0.18	-0.07	-0.93	0.15	-0.03	0.18
2	No data for this fleet at this age										
3	No data for this fleet at this age										
4	No data for this fleet at this age										
5	No data for this fleet at this age										
6	No data for this fleet at this age										
7	No data for this fleet at this age										

Age	2003	2004	2005	2006	2007	2008	2009	2010	2011
1	0.27	-0.07	-0.16	0.37	0.12	-0.46	0	0.41	-0.01
2	No data for this fleet at this age								
3	No data for this fleet at this age								
4	No data for this fleet at this age								
5	No data for this fleet at this age								
6	No data for this fleet at this age								
7	No data for this fleet at this age								

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	0.5	2.758	6.66	0.75	18	0.33	-2.03

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength
Year class = 2010

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT01:International	36236	0.309	0	0	1	0.328	0.176
FLT02: Intenational	43383	0.361	0	0	1	0.241	0.149
FLT03: Latvian/Russian	40467	0.347	0	0	1	0.26	0.159
P shrinkage mean	52061	0.59				0.105	0.126
F shrinkage mean	41650	0.75				0.065	0.155

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
40830	0.18	0.06	5	0.316	0.158

Age 2 Catchability constant w.r.t. time and dependent on age
Year class = 2009

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT01:International	12761	0.262	0.082	0.31	2	0.371	0.249
FLT02: Intenational	9933	0.266	0.396	1.49	2	0.368	0.309
FLT03: Latvian/Russi	18761	0.35	0	0	1	0.197	0.176
F shrinkage mean	10963	0.75				0.064	0.284

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
12433	0.16	0.15	6	0.934	0.255

Age 3 Catchability constant w.r.t. time and dependent on age
Year class = 2008

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT01:International	25583	0.234	0.09	0.39	3	0.395	0.345
FLT02: Intenational	29972	0.234	0.245	1.05	3	0.405	0.301
FLT03: Latvian/Russian	27491	0.369	0	0	1	0.131	0.324
F shrinkage mean	24471	0.75				0.068	0.358

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
27454	0.15	0.09	8	0.622	0.324

Age 4 Catchability constant w.r.t. time and dependent on age
Year class = 2007

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT01: International	6181	0.213	0.129	0.61	4	0.355	0.314
FLT02: Intenational	7214	0.191	0.163	0.85	4	0.503	0.275
FLT03: Latvian/Russian	4003	0.362	0	0	1	0.086	0.451
F shrinkage mean	4429	0.75				0.056	0.416

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
6317	0.13	0.1	10	0.762	0.308

continued Table 7.15 SPRAT in SD 22-32. Output from XSA: Diagnostics

Age 5 Catchability constant w.r.t. time and dependent on age
Year class = 2006

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT01: International	3989	0.212	0.132	0.62	5	0.34	0.267
FLT02: Intenational	5531	0.177	0.064	0.36	5	0.553	0.2
FLT03: Latvian/Russian	5351	0.357	0	0	1	0.053	0.206
F shrinkage mean	2386	0.75				0.053	0.413

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
4724	0.13	0.09	12	0.674	0.23

Age 6 Catchability constant w.r.t. time and age (fixed at the value for age) 5
Year class = 2005

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT01: International	1197	0.209	0.197	0.94	6	0.375	0.318
FLT02: Intenational	1614	0.173	0.093	0.54	6	0.535	0.245
FLT03: Latvian/Russian	2009	0.358	0	0	1	0.032	0.201
F shrinkage mean	787	0.750				0.058	0.450

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
1394	0.13	0.1	14	0.803	0.278

Age 7 Catchability constant w.r.t. time and age (fixed at the value for age) 5
Year class = 2004

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT01: International	479	0.205	0.176	0.86	7	0.358	0.497
FLT02: Intenational	449	0.172	0.239	1.39	7	0.525	0.523
FLT03: Latvian/Russian	417	0.386	0	0	1	0.033	0.554
F shrinkage mean	971	0.75				0.084	0.276

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
489	0.13	0.14	16	1.055	0.489

Table 7.16 SPRAT IN SD 22-32. Output from XSA. Fishing mortality (F) at age

Run title : Sprat 22-32
At 15/04/2012 13:55
Terminal Fs derived using XSA
(With Fshrinkage)

Table 8 Fishing mortality (F) at age

YEAR	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Age 1	0.0517	0.034	0.0368	0.0889	0.0517	0.0736	0.0311	0.059	0.0156	0.0207	0.0285	0.02	0.0454
Age 2	0.1048	0.1026	0.1264	0.1441	0.3116	0.174	0.261	0.2365	0.1787	0.0352	0.0657	0.1039	0.0769
Age 3	0.3008	0.198	0.2269	0.3085	0.1663	0.2493	0.2907	0.1821	0.2836	0.0917	0.0955	0.1331	0.1585
Age 4	0.3719	0.4809	0.2511	0.4297	0.3224	0.1598	0.2944	0.1668	0.2246	0.1693	0.1535	0.2087	0.1979
Age 5	0.2693	0.3781	0.5984	0.2452	0.4676	0.3131	0.2153	0.1163	0.2581	0.1062	0.2692	0.1794	0.3111
Age 6	0.5173	0.2778	0.4324	0.6014	0.1973	0.2288	0.3335	0.1958	0.167	0.1166	0.1885	0.2287	0.2378
Age 7	0.3961	0.3933	0.4388	0.4357	0.3398	0.2439	0.2951	0.1649	0.2266	0.1359	0.2103	0.2106	0.2533
Age 8+	0.3961	0.3933	0.4388	0.4357	0.3398	0.2439	0.2951	0.1649	0.2266	0.1359	0.2103	0.2106	0.2533
FBAR 3-5	0.314	0.3523	0.3588	0.3278	0.3188	0.2407	0.2668	0.1551	0.2554	0.1224	0.1727	0.1738	0.2225

YEAR	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Age 1	0.0301	0.0076	0.0678	0.026	0.0232	0.0235	0.0254	0.0208	0.0311	0.0633	0.038	0.0816	0.0499
Age 2	0.0642	0.1883	0.0463	0.1699	0.0965	0.0925	0.1099	0.1728	0.0647	0.2049	0.2775	0.1271	0.2472
Age 3	0.1483	0.2003	0.2232	0.0815	0.2088	0.1634	0.1501	0.2498	0.2256	0.1924	0.2884	0.3876	0.3272
Age 4	0.3832	0.2212	0.1904	0.2002	0.1387	0.2229	0.1544	0.2606	0.357	0.3862	0.4606	0.4548	0.433
Age 5	0.3163	0.328	0.2562	0.1412	0.1885	0.2325	0.1915	0.2908	0.4629	0.3266	0.4868	0.3898	0.4204
Age 6	0.4405	0.2601	0.3392	0.1876	0.1188	0.1573	0.227	0.2808	0.4812	0.4181	0.2895	0.4421	0.3323
Age 7	0.3865	0.2745	0.2656	0.1779	0.1496	0.2056	0.1925	0.2778	0.4262	0.3519	0.3776	0.5158	0.3445
Age 8+	0.3865	0.2745	0.2656	0.1779	0.1496	0.2056	0.1925	0.2778	0.4262	0.3519	0.3776	0.5158	0.3445
FBAR 3-5	0.2826	0.2499	0.2233	0.141	0.1787	0.2063	0.1653	0.2671	0.3485	0.3017	0.4119	0.4108	0.3935

YEAR	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	FBAR 09-11
Age 1	0.1348	0.0726	0.1646	0.1055	0.1362	0.0821	0.1876	0.1635	0.1149	0.1530	0.1466	0.1581	0.1525
Age 2	0.1103	0.2574	0.2358	0.3095	0.2305	0.2988	0.1424	0.3716	0.3227	0.2780	0.2885	0.2549	0.2738
Age 3	0.3303	0.1529	0.4616	0.3731	0.4416	0.3390	0.3677	0.2566	0.4043	0.4178	0.3207	0.3243	0.3543
Age 4	0.2904	0.3939	0.3747	0.4453	0.4608	0.4782	0.3754	0.4668	0.3597	0.4959	0.3545	0.3085	0.3863
Age 5	0.3727	0.3741	0.3552	0.4623	0.6146	0.6027	0.4626	0.4031	0.3927	0.4447	0.3351	0.2300	0.3366
Age 6	0.3913	0.4705	0.3627	0.2850	0.5414	0.3328	0.4293	0.4248	0.4818	0.3911	0.4912	0.2784	0.3869
Age 7	0.3887	0.4475	0.3174	0.6593	0.2952	0.6124	0.2824	0.4221	0.4122	0.4797	0.2733	0.4891	0.4141
Age 8+	0.3887	0.4475	0.3174	0.6593	0.2952	0.6124	0.2824	0.4221	0.4122	0.4797	0.2733	0.4891	
FBAR 3-5	0.3311	0.3070	0.3972	0.4269	0.5057	0.4733	0.4019	0.3755	0.3856	0.4528	0.3368	0.2876	

Table 7.17 SPRAT IN SD 22-32. Output from XSA. Stock number at age (Numbers*10-6)**

Run title : Sprat 22-32
At 15/04/2012 13:55
Terminal Fs derived using XSA
(With Fshrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-6

YEAR	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
Age 1	83816	37663	201070	40979	16778	33913	22657	66951	42748	153429	54684	41317	15351	34276
Age 2	82525	30474	9067	80385	17360	5575	9779	6230	22759	12676	52066	22716	19322	7735
Age 3	17440	42028	12862	4610	42215	6505	2105	3252	2418	8300	5610	25452	11812	11408
Age 4	7822	8231	19498	6668	2247	20833	2647	797	1518	923	4033	2942	14064	6825
Age 5	10493	3439	2936	9966	2909	978	9842	1082	397	659	432	2098	1553	7970
Age 6	2908	4862	1255	999	5023	1031	366	4020	529	154	297	188	1085	763
Age 7	4907	1094	2041	514	356	2379	415	126	1796	220	69	136	91	573
Age 8+	1090	2311	1521	1422	887	846	1376	928	377	1734	611	454	279	275
TOTAL	211000	130103	250250	145543	87775	72059	49187	83387	72541	178094	117802	95304	63558	69826

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Age 1	13738	40580	49467	53405	90834	87483	62302	245321	159806	54861	170889	52482	102519	48171
Age 2	19577	7711	23701	32961	37890	63149	59505	42998	170964	110025	37218	106636	33133	59454
Age 3	4862	10445	5085	14668	22848	26635	42335	37459	30462	106330	63001	24040	60475	21548
Age 4	6931	2722	6007	3542	9271	15111	17498	25174	23049	19572	61443	32640	13099	32522
Age 5	3311	3876	1650	3754	2426	5835	9985	10397	13583	12200	9521	29764	15999	7405
Age 6	4053	1615	2135	1072	2421	1497	3642	5699	4996	7556	5724	4824	14628	8165
Age 7	343	2095	811	1324	741	1611	920	2099	2689	2536	4275	2780	2589	7327
Age 8+	728	710	1434	1250	992	1683	981	1350	1552	1022	1399	2055	2745	1667
TOTAL	53545	69752	90290	111976	167422	203005	197167	370497	407100	314101	353471	255221	245188	186259

YEAR	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	GMST 74-11	AMST 74-11
Age 1	53488	108657	212273	42534	74805	108969	70507	184832	42094	74977	0	63221	81488
Age 2	30330	30411	72433	137233	28168	44579	65208	43853	103180	23180	40830	32204	45439
Age 3	33709	17398	17206	44352	77703	18649	23004	34984	23169	53407	12433	17317	25923
Age 4	14116	15897	9424	8703	24610	41897	11125	11721	16728	11966	27454	9081	14031
Age 5	16743	7335	8011	4676	4244	13299	20255	5927	5184	8436	6317	4725	7360
Age 6	3812	8695	3598	3375	1993	2060	6784	10336	2704	2613	4724	2285	3671
Age 7	3817	1965	5093	1647	1884	1011	1028	3167	5026	1166	1394	1116	1846
Age 8+	5735	3207	6022	1512	2443	1785	1228	1088	2546	1708	1205		
TOTAL	161750	193565	334060	244031	215851	232250	199140	295908	200631	177453	94357		

Table 7.18 Sprat in SD 22-32. Output from XSA. Stock summary.

Table 16 Summary (without SOP correction) **Run title : Sprat 22-32**
Terminal Fs derived using XSA (With F shrinkage) **At 15/04/2012 13:55**

	RECRUITS Age 1	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 3- 5
1974	83816	2013	1106	242	0.2185	0.3140
1975	37663	1397	820	201	0.2457	0.3523
1976	201070	2026	636	195	0.3065	0.3588
1977	40979	1451	916	181	0.1974	0.3278
1978	16778	968	643	132	0.2058	0.3188
1979	33913	709	388	77	0.1986	0.2407
1980	22657	530	251	58	0.2319	0.2668
1981	66951	675	223	49	0.2207	0.1551
1982	42748	757	282	49	0.1727	0.2554
1983	153429	1792	423	37	0.0881	0.1224
1984	54684	1275	594	53	0.0885	0.1727
1985	41317	1043	553	70	0.1257	0.1738
1986	15351	751	506	76	0.1497	0.2225
1987	34276	781	420	88	0.2102	0.2826
1988	13738	567	380	80	0.2113	0.2499
1989	40580	836	404	86	0.2125	0.2233
1990	49467	1093	538	86	0.1592	0.1410
1991	53405	1296	741	103	0.1394	0.1787
1992	90834	1843	986	142	0.1442	0.2063
1993	87483	2033	1275	178	0.1397	0.1653
1994	62302	2069	1323	289	0.2183	0.2671
1995	245321	3052	1394	313	0.2246	0.3485
1996	159806	2826	1772	441	0.2489	0.3017
1997	54861	2564	1747	529	0.3030	0.4119
1998	170889	2361	1308	471	0.3598	0.4108
1999	52482	1939	1330	421	0.3168	0.3935
2000	102519	2142	1256	389	0.3097	0.3311
2001	48171	1732	1137	342	0.3009	0.3070
2002	53488	1500	903	343	0.3800	0.3972
2003	108657	1441	760	308	0.4059	0.4269
2004	212273	2025	964	374	0.3876	0.5057
2005	42534	1726	1177	405	0.3444	0.4733
2006	74805	1559	983	352	0.3581	0.4019
2007	108969	1687	892	388	0.4356	0.3755
2008	70507	1726	996	381	0.3822	0.3856
2009	184832	2050	949	407	0.4292	0.4528
2010	42094	1623	1061	342	0.3220	0.3368
2011	74977	1312	809	264	0.3262	0.2876
Arith. Mean	80280	1557	864	235	0.2558	0.3038
Units	(Millions)	(Thousand tonnes)	(Thousand tonnes)	(Thousand tonnes)		

Table 7.19 Sprat in SD 22-32. Input Data for RCT3 analysis.

Sprat 22-32: Acoustic on age 0 in Sub-div. 26+28

Yearclass	VPA	Acoustic Age 0
1973	83816	-11
1974	37663	-11
1975	201070	-11
1976	40979	-11
1977	16778	-11
1978	33913	-11
1979	22657	-11
1980	66951	-11
1981	42748	-11
1982	153429	-11
1983	54684	-11
1984	41317	-11
1985	15351	-11
1986	34276	-11
1987	13738	-11
1988	40580	-11
1989	49467	-11
1990	53405	-11
1991	90834	32738
1992	87483	39847
1993	62302	2221
1994	245321	38555
1995	159806	27810
1996	54861	3285
1997	170889	39334
1998	52482	682
1999	102519	22249
2000	48171	3466
2001	53488	6410
2002	108657	31780
2003	212273	61462
2004	42534	2074
2005	74805	18202
2006	108969	23831
2007	70507	3144
2008	184832	53263
2009	42094	6363
2010	74977	8669
2011	-11	17553

Table 7.20 Sprat in SD 22-32. Output from RCT3 analysis.

Analysis by RCT3 ver3.1 of data from file recspr1l.txt
Sprat 22-32: YFS data from Latvian-Russian acoustic on age 0

Data for 1 surveys over 39 years: 1973-2011
Regression type=C
Tapered time weighting applied
power = 3 over 20 years
Survey weighting not applied
Final estimates shrunk towards mean
Minimum S.E for any survey taken as 0.2
Minimum of 3 points used for regression
Forecast/Hindcast variance correction used.

Yearclass = 2000

			Regression			Prediction			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	0.44	7.39	0.44	0.64	9	8.15	10.97	0.554	0.633
					VPA Mean =		11.22	0.727	0.367

Yearclass = 2001

			Regression			Prediction			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	0.46	7.2	0.43	0.664	10	8.77	11.22	0.517	0.641
					VPA Mean =		11.22	0.691	0.359

Yearclass = 2002

			Regression			Prediction			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	0.48	6.93	0.44	0.651	11	10.37	11.96	0.535	0.596
					VPA Mean =		11.23	0.649	0.404

Yearclass = 2003

			Regression			Prediction			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	0.47	7.02	0.42	0.656	12	11.03	12.22	0.519	0.578
					VPA Mean =		11.29	0.607	0.422

Yearclass = 2004

			Regression			Prediction			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	0.47	7	0.39	0.707	13	7.64	10.63	0.485	0.622
					VPA Mean =		11.39	0.622	0.378

Yearclass = 2005

			Regression			Prediction			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	0.47	7.05	0.37	0.752	14	9.81	11.66	0.424	0.681
					VPA Mean =		11.35	0.619	0.319

Yearclass = 2006

			Regression			Prediction			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	0.48	6.95	0.37	0.73	15	10.08	11.75	0.433	0.649
					VPA Mean =		11.35	0.588	0.351

Yearclass = 2007

			Regression			Prediction			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	0.47	6.99	0.35	0.743	16	8.05	10.78	0.412	0.653
					VPA Mean =		11.37	0.564	0.347

Yearclass = 2008

			Regression			Prediction			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	0.46	7.14	0.34	0.741	17	10.88	12.12	0.406	0.641
					VPA Mean =		11.35	0.542	0.359

Yearclass = 2009

			Regression			Prediction			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	0.46	7.14	0.31	0.779	18	8.76	11.14	0.361	0.708
					VPA Mean =		11.41	0.562	0.292

Yearclass = 2010

			Regression			Prediction			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	0.5	6.69	0.35	0.746	19	9.07	11.23	0.405	0.672
					VPA Mean =		11.35	0.579	0.328

Yearclass = 2011

			Regression			Prediction			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	0.5	6.66	0.33	0.752	20	9.77	11.57	0.383	0.678
					VPA Mean =		11.33	0.555	0.322

Year Class	Weighted Average Prediction RCT3	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
2000	63652	11.06	0.44	0.12	0.07	48172	10.78
2001	74490	11.22	0.41	0.00	0.00	53488	10.89
2002	115940	11.66	0.41	0.36	0.75	108658	11.60
2003	136868	11.83	0.39	0.46	1.37	212274	12.27
2004	55009	10.92	0.38	0.37	0.94	42535	10.66
2005	104840	11.56	0.35	0.14	0.16	74806	11.22
2006	110405	11.61	0.35	0.19	0.30	108970	11.60
2007	59052	10.99	0.33	0.28	0.72	70508	11.16
2008	139060	11.84	0.32	0.37	1.26	184832	12.13
2009	74637	11.22	0.30	0.12	0.17	42094	10.65
2010	78062	11.27	0.33	0.06	0.03	74977	11.22
2011	97951	11.49	0.31	0.11	0.12		

Table 7.21 Sprat in SD 22-32. Input data for short-term prediction.

MFDP version 1a
Run: Sprat Pr 2012 Status Quo
Time and date: 12:30 2012-04-16
Fbar age range: 3-5

2012

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
1	97951	0.45	0.17	0.4	0.4	0.0047	0.122	0.0047
2	40830	0.37	0.93	0.4	0.4	0.0088	0.219	0.0088
3	12433	0.34	1	0.4	0.4	0.0100	0.284	0.0100
4	27454	0.33	1	0.4	0.4	0.0108	0.309	0.0108
5	6317	0.35	1	0.4	0.4	0.0113	0.270	0.0113
6	4724	0.35	1	0.4	0.4	0.0111	0.310	0.0111
7	1394	0.38	1	0.4	0.4	0.0111	0.332	0.0111
8	1205	0.38	1	0.4	0.4	0.0119	0.332	0.0119

2013

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
1	86812	0.45	0.17	0.4	0.4	0.0047	0.122	0.0047
2	.	0.37	0.93	0.4	0.4	0.0088	0.219	0.0088
3	.	0.34	1	0.4	0.4	0.0100	0.284	0.0100
4	.	0.33	1	0.4	0.4	0.0108	0.309	0.0108
5	.	0.35	1	0.4	0.4	0.0113	0.270	0.0113
6	.	0.35	1	0.4	0.4	0.0111	0.310	0.0111
7	.	0.38	1	0.4	0.4	0.0111	0.332	0.0111
8	.	0.38	1	0.4	0.4	0.0119	0.332	0.0119

2014

Age	N	M	Mat	PF	PM	SWt	Sel	CWt
1	86812	0.45	0.17	0.4	0.4	0.0047	0.122	0.0047
2	.	0.37	0.93	0.4	0.4	0.0088	0.219	0.0088
3	.	0.34	1	0.4	0.4	0.0100	0.284	0.0100
4	.	0.33	1	0.4	0.4	0.0108	0.309	0.0108
5	.	0.35	1	0.4	0.4	0.0113	0.270	0.0113
6	.	0.35	1	0.4	0.4	0.0111	0.310	0.0111
7	.	0.38	1	0.4	0.4	0.0111	0.332	0.0111
8	.	0.38	1	0.4	0.4	0.0119	0.332	0.0119

Input units are millions and kg - output in kilotonnes

M =	Natural mortality
MAT =	Maturity ogive
PF =	Proportion of F before spawning
PM =	Proportion of M before spawning
SWT =	Weight in stock (kg)
Sel =	Exploit. Pattern
CWT =	Weight in catch (kg)

N_{2012} Age 1:	RCT3 estimate (Table 7.20)
N_{2012} Age 2-8+:	Survivors estimates from XSA (Table 7.16)
$N_{2013\text{-}2014}$ Age 1:	Geometric mean from XSA-estimates at age 1 for the years 1991-2010
Natural Mortality (M):	2011
Weight in the Catch/Stock (CWt/SWt):	Average for 2009-2011
Expoitation pattern (Sel):	Average for 2009-2011 scaled to 2011

Table 7.22 Sprat in SD 22-32. Output from short-term prediction with management option table for *status quo* fishery in 2012

MFDP version 1a
Run: Sprat Pr 2012 Status Quo
Sprat
Time and date: 12:30 2012-04-16
Fbar age range: 3-5

2012 Biomass	SSB	FMult	FBar	Landings
1395	770	1.0000	0.2876	230

2013 Biomass	SSB	FMult	FBar	Landings	2014 Biomass	SSB
1437	919	0.0	0.000	0	1676	1128
.	910	0.1	0.029	26	1651	1094
.	901	0.2	0.058	51	1626	1062
.	892	0.3	0.086	76	1601	1031
.	883	0.4	0.115	100	1578	1001
.	874	0.5	0.144	124	1554	972
.	866	0.6	0.173	147	1532	944
.	857	0.7	0.201	169	1509	916
.	849	0.8	0.230	191	1488	890
.	840	0.9	0.259	213	1466	865
.	832	1.0	0.288	234	1445	840
.	824	1.1	0.316	255	1425	816
.	816	1.2	0.345	275	1405	793
.	808	1.3	0.374	295	1386	770
.	800	1.4	0.403	314	1367	749
.	792	1.5	0.431	333	1348	728
.	784	1.6	0.460	352	1330	707
.	776	1.7	0.489	370	1312	688
.	769	1.8	0.518	388	1295	669
.	761	1.9	0.546	405	1278	650
.	754	2.0	0.575	422	1261	632

Input units are millions and kg - output in kilotonnes

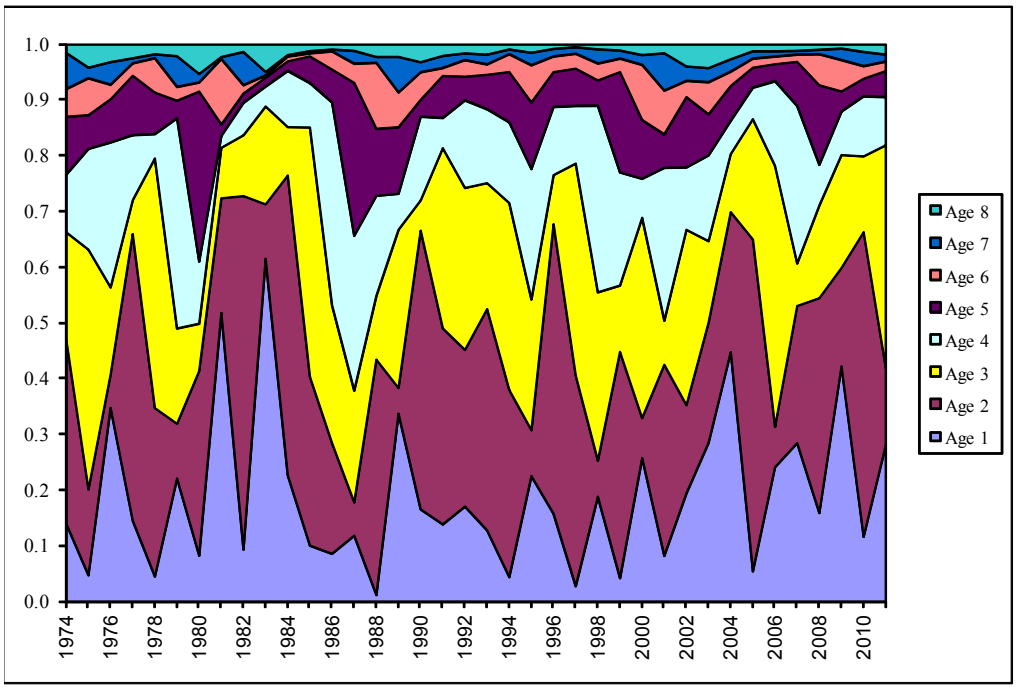


Figure 7.1 Sprat in SD 22-32. Relative catch-at-age in numbers.

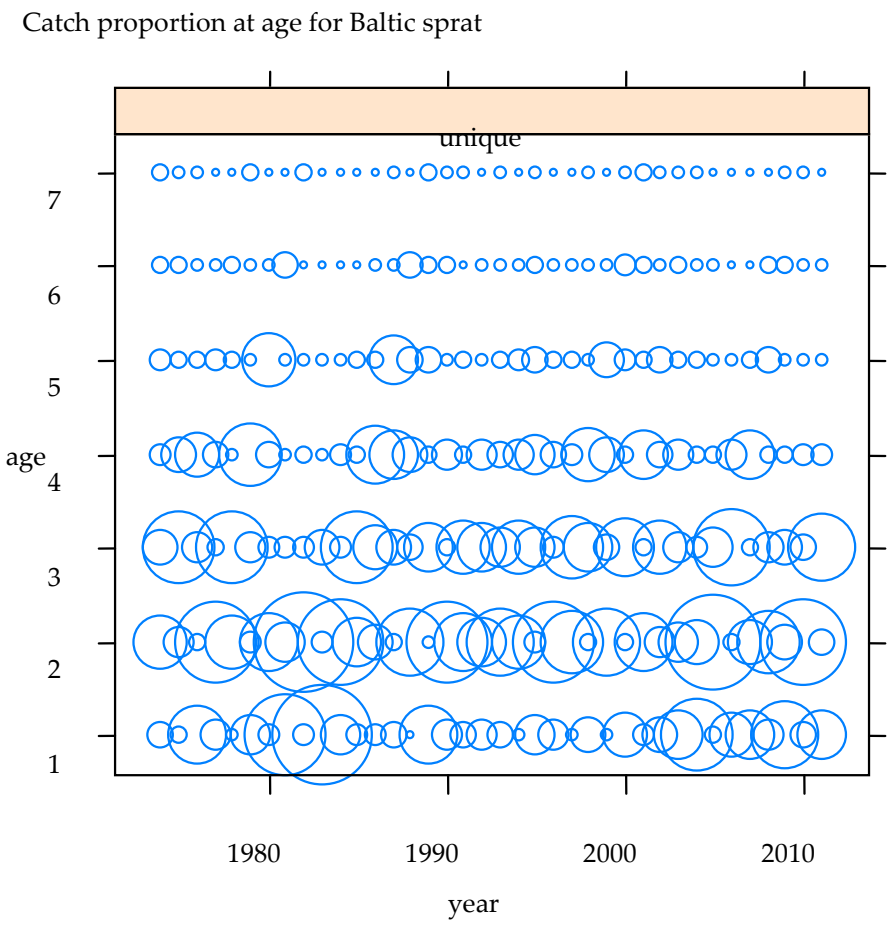


Figure 7.2 Sprat in SD 22-32. CANUM consistency check.

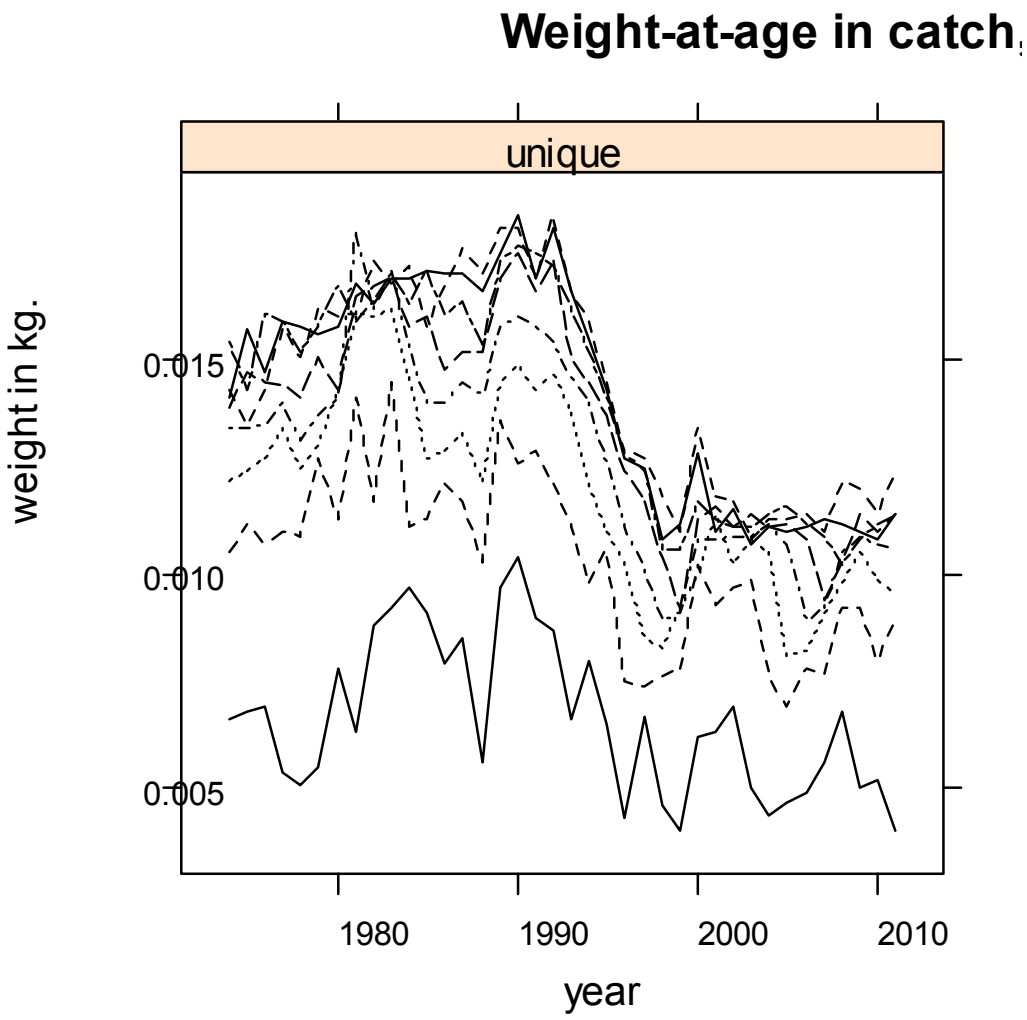


Figure 7.3 Sprat in SD 22-32. Mean weight-at-age in the catches.

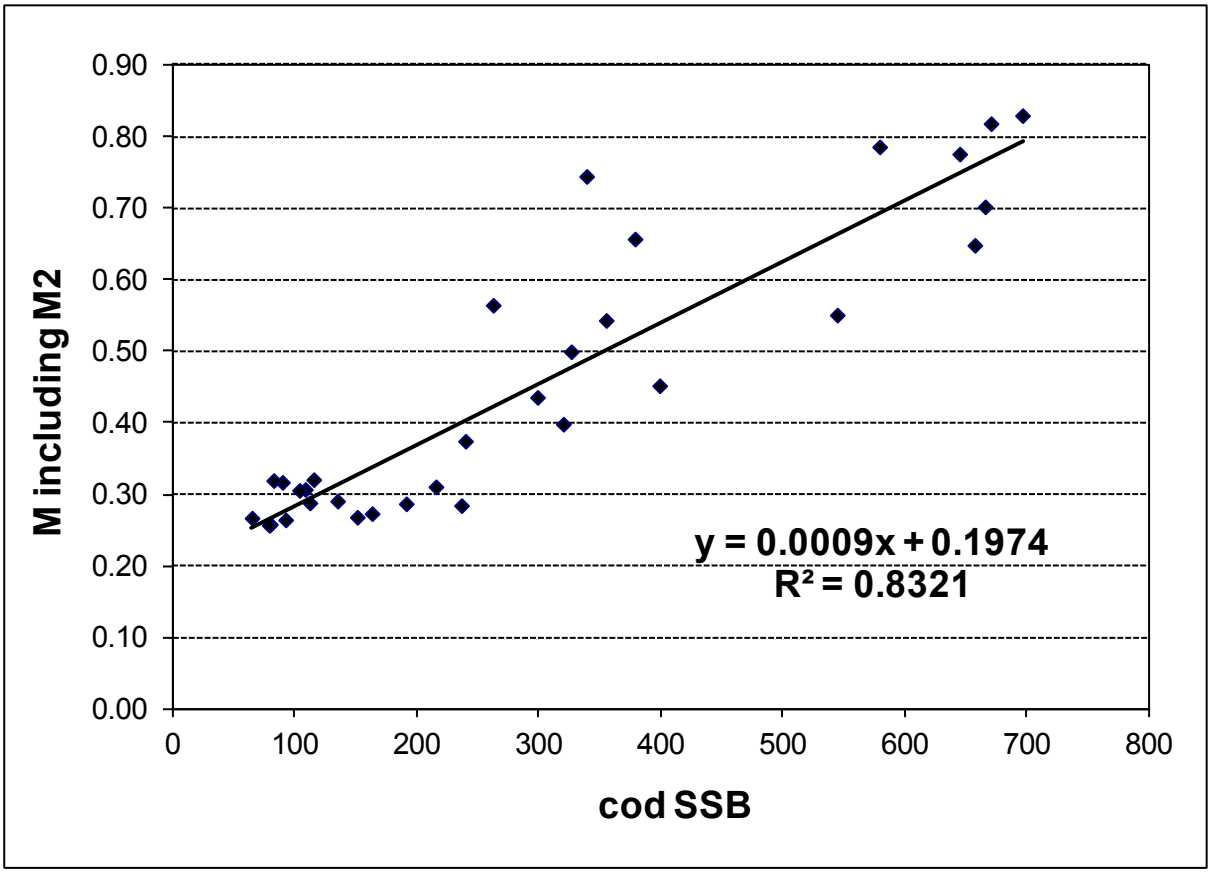


Figure 7.4. Regression of sprat M versus cod SSB.

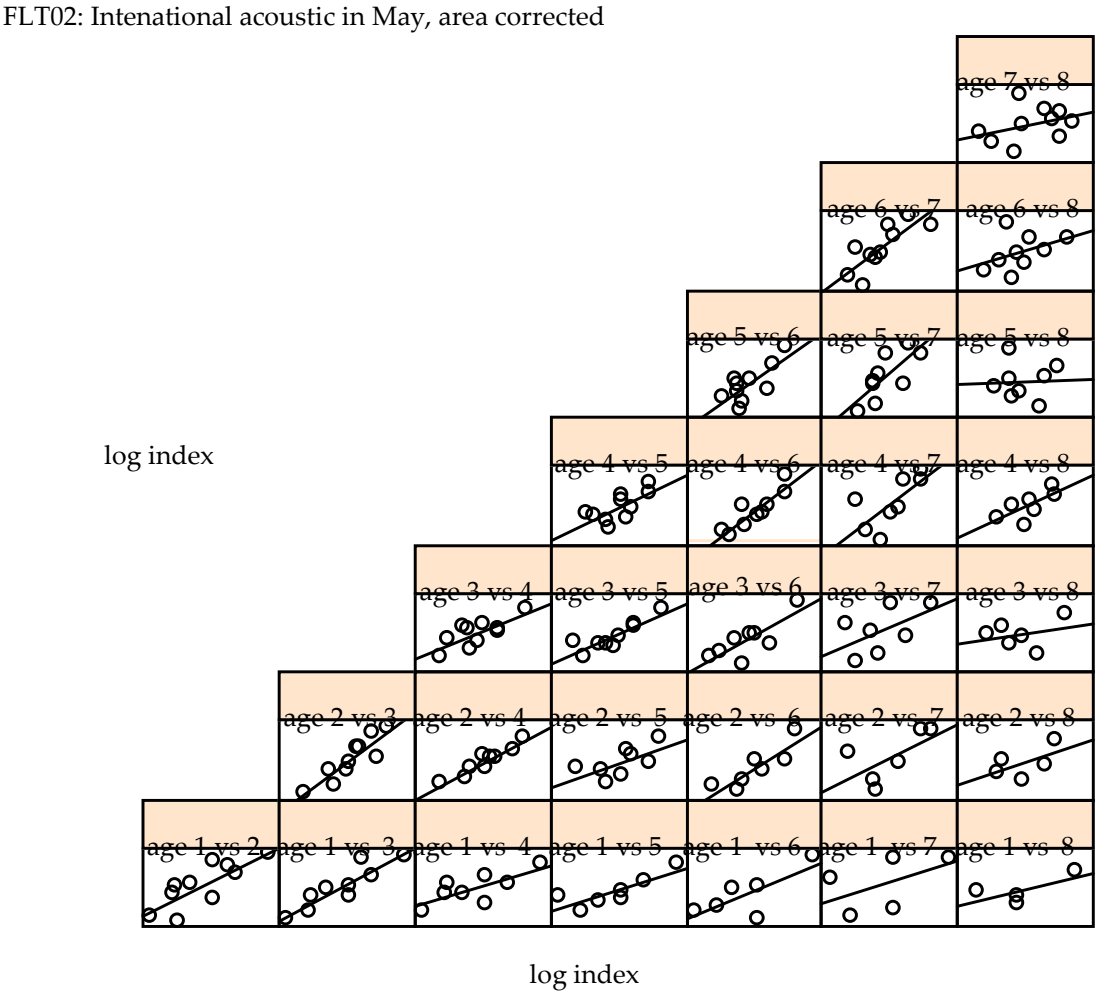


Figure 7.5 Sprat in SD 22-32. Check for consistency in May acoustic survey estimates.

FLT01: International acoustic in October, area corrected

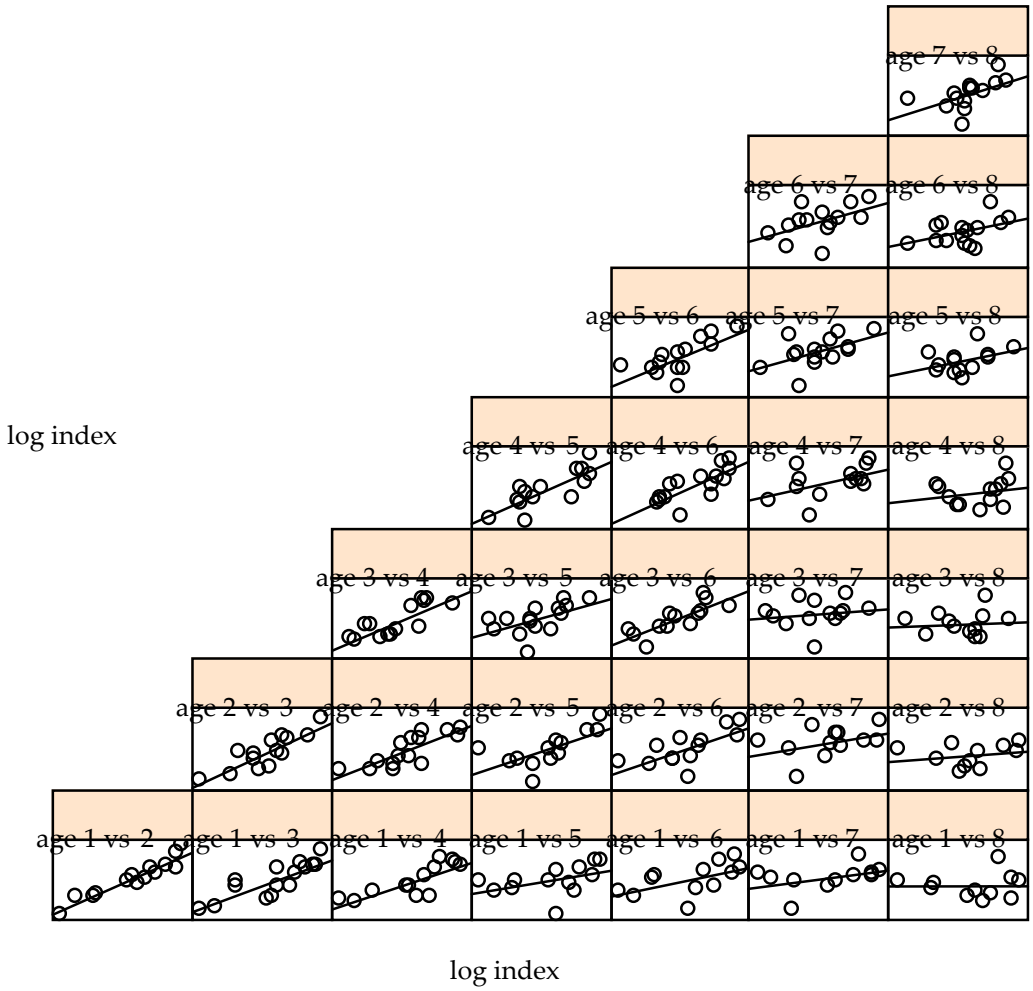
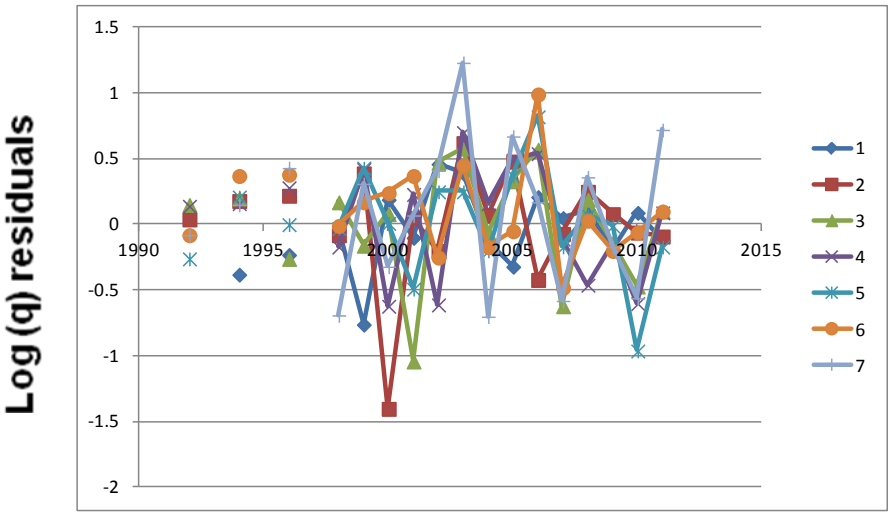
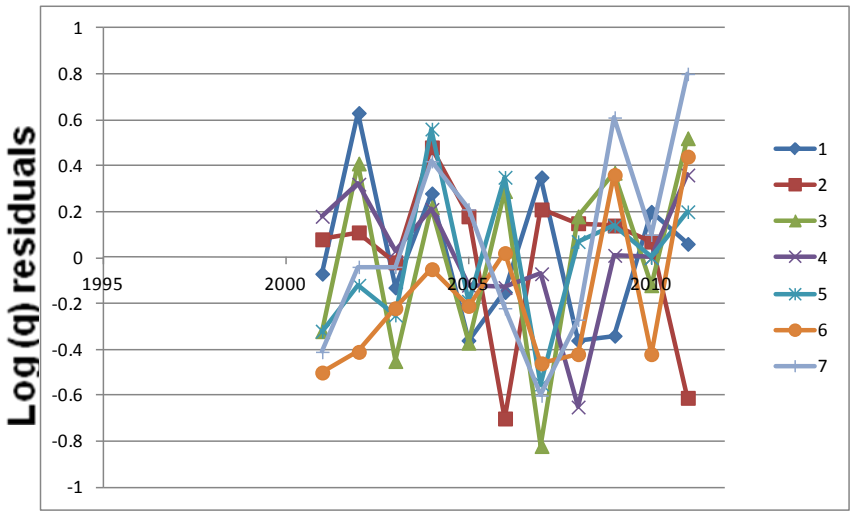


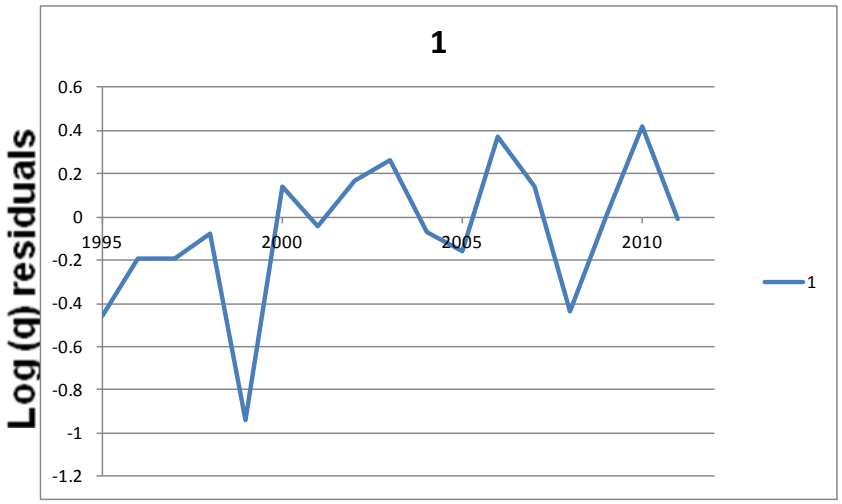
Figure 7.6 Sprat in SD 22-32. Check for consistency in October acoustic survey estimates.



(October survey – FLT01)



(May survey – FLT02)



(Survey on age 0, October-FLT03)

Figure 7.7a Sprat in SD 22-32. Log catchability residuals by fleet.

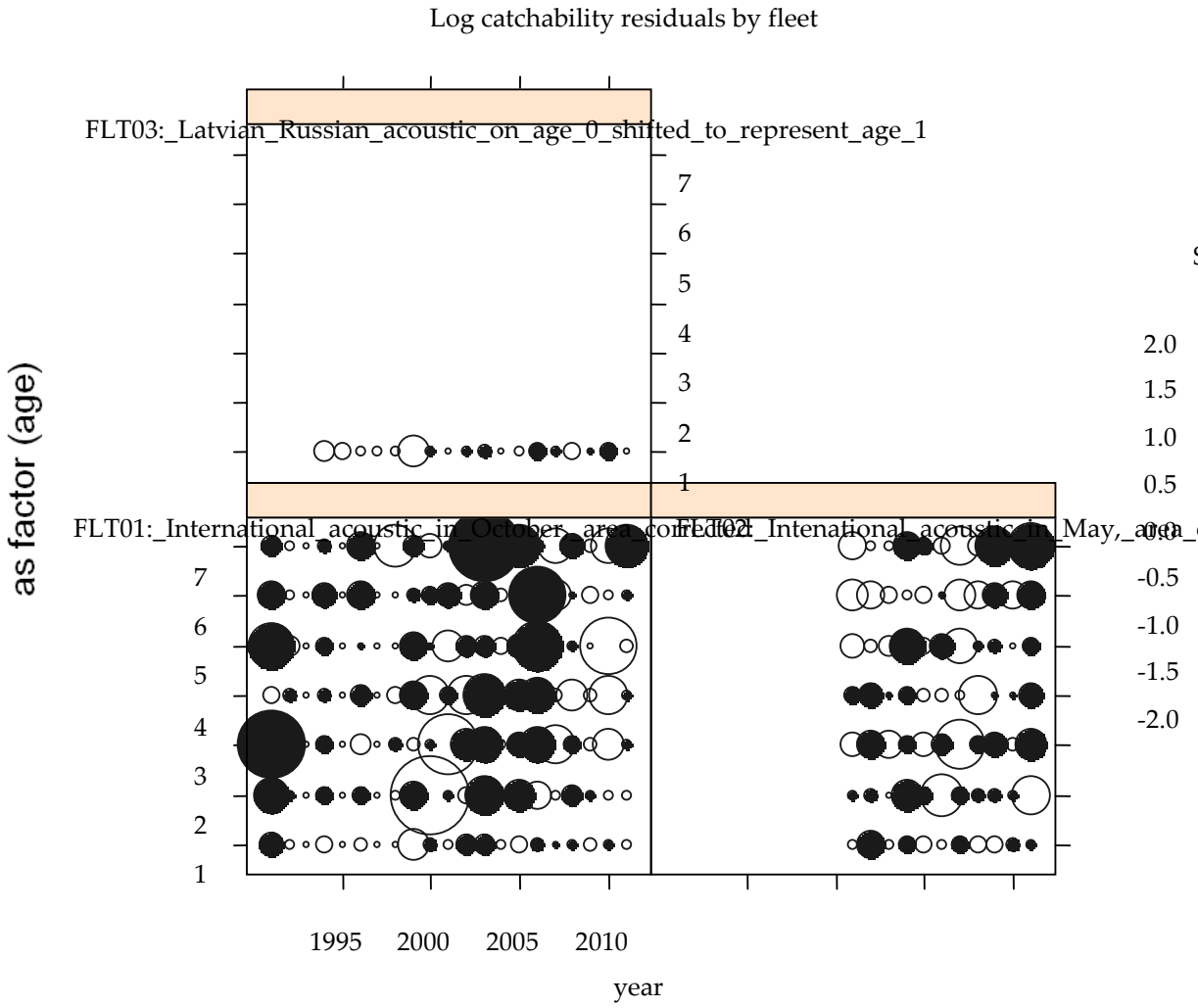


Figure 7.7b Sprat In SD 22-32. Log catchability residuals by fleet.

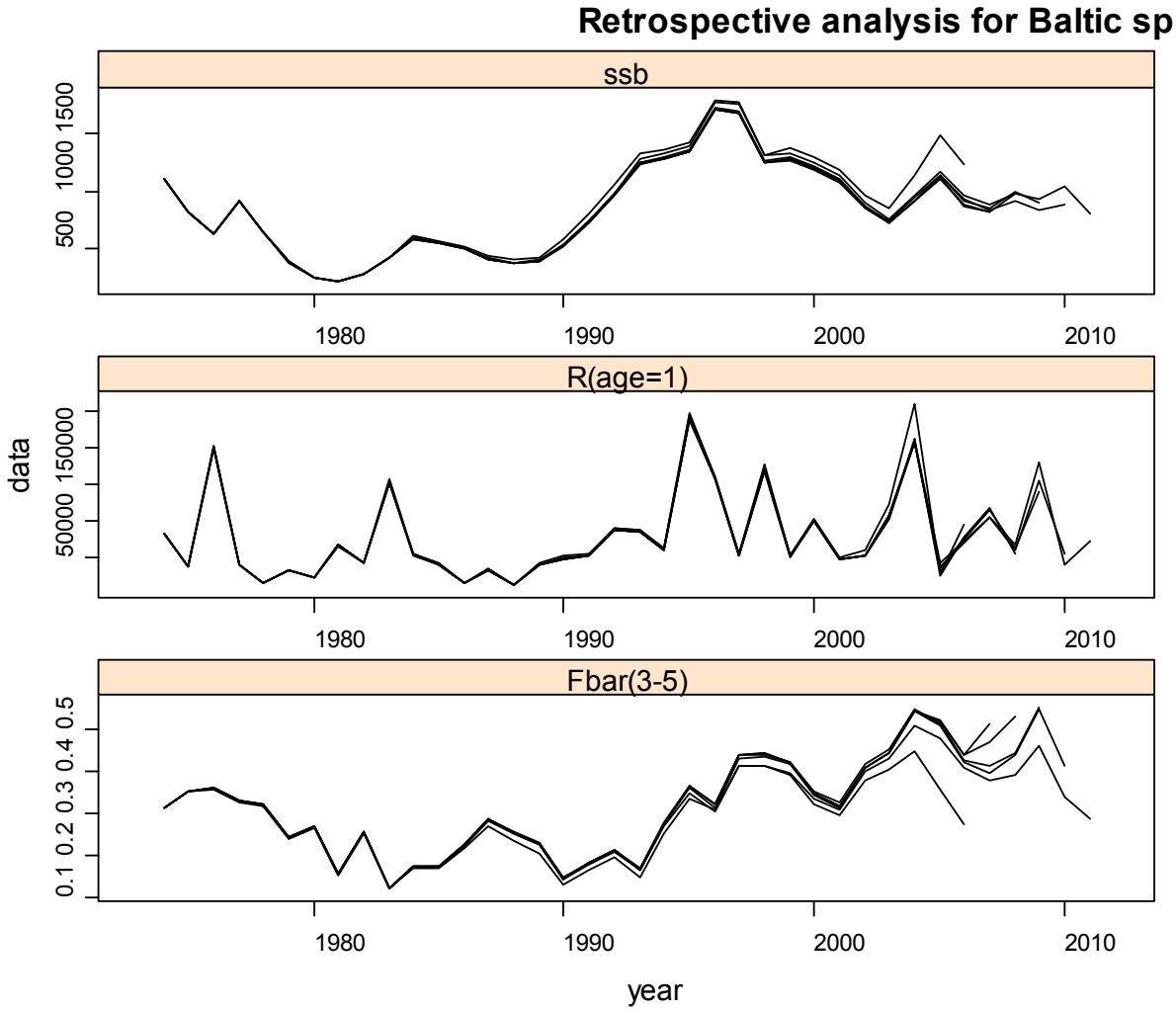


Figure 7.8 Sprat in SD 22-32. Retrospective analysis.

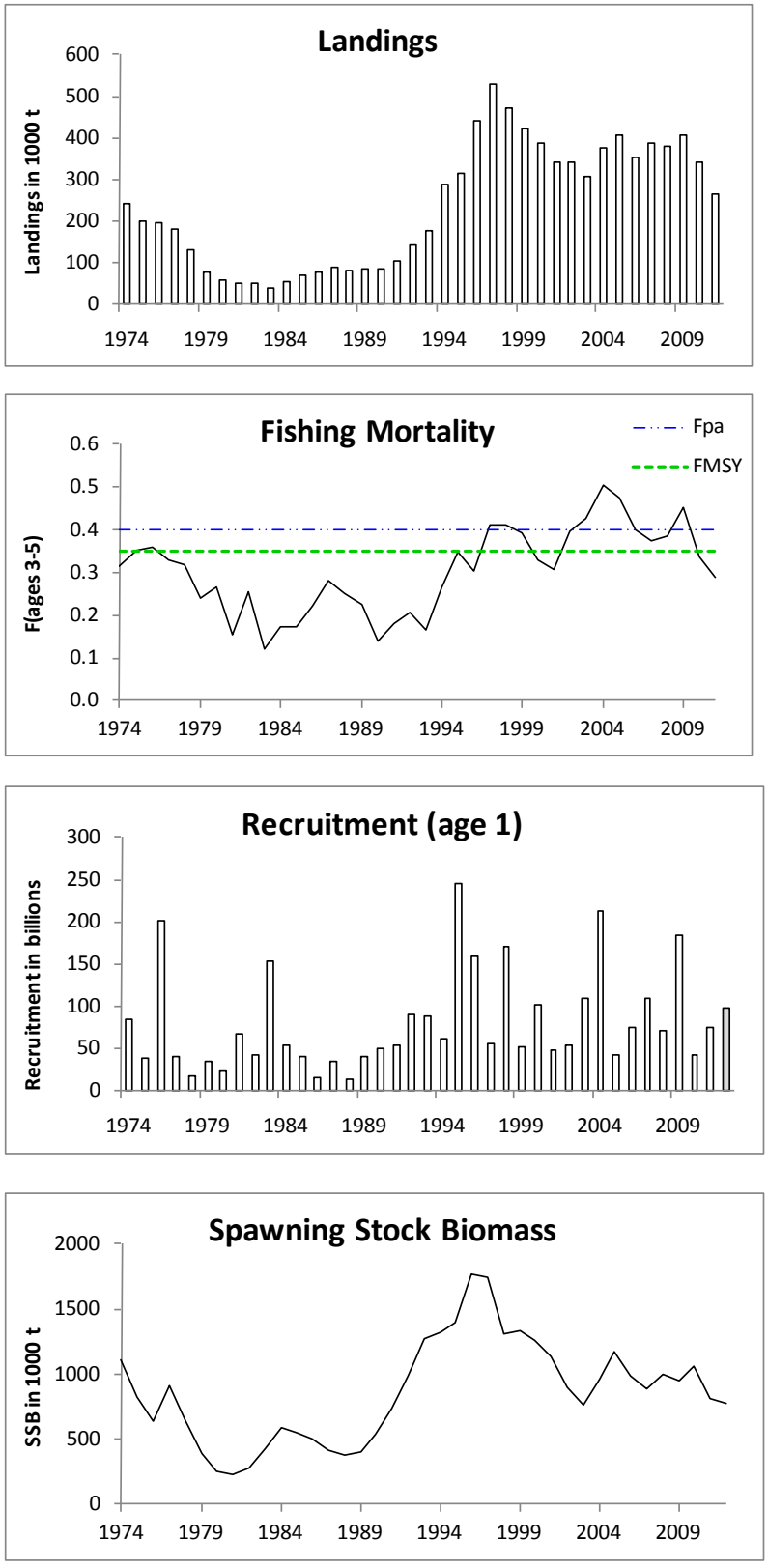
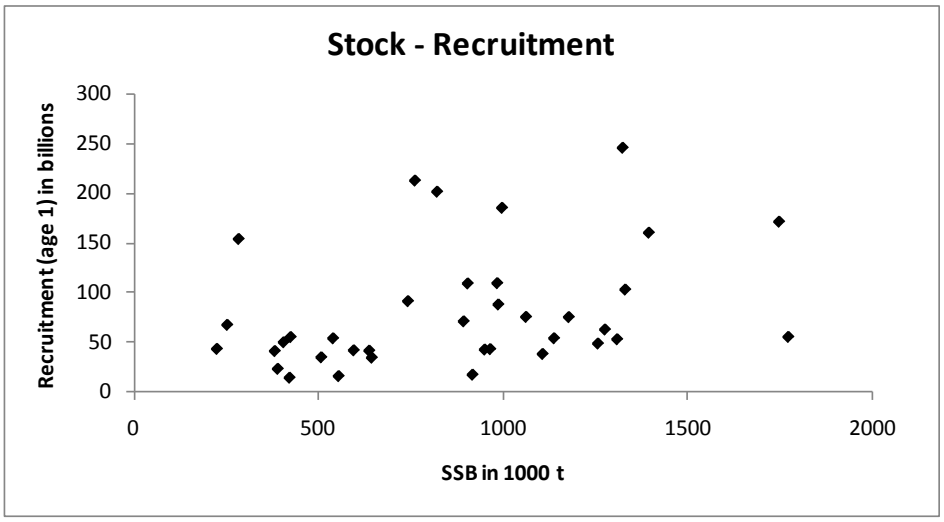
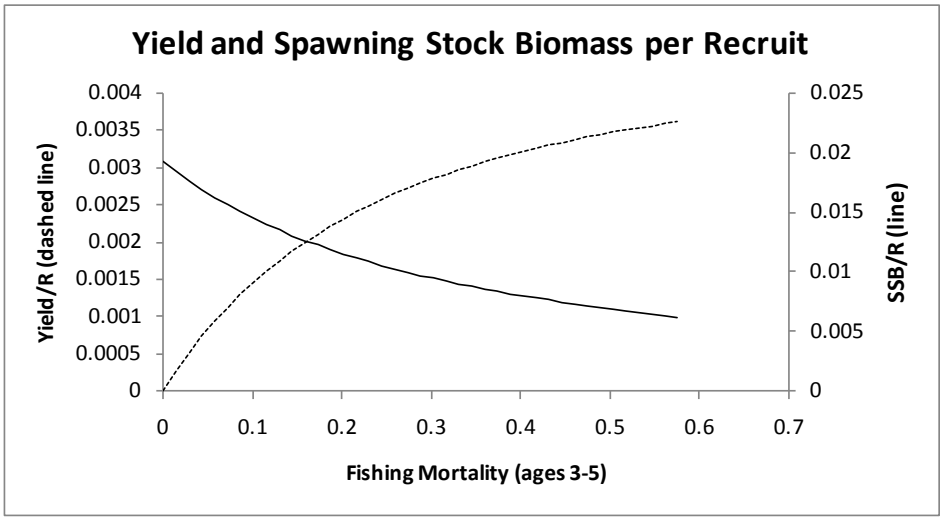


Figure 7.9 Sprat in SD 22-32. Summary sheet plots: landings, fishing mortality, recruitment (age 1) and spawning stock biomass.





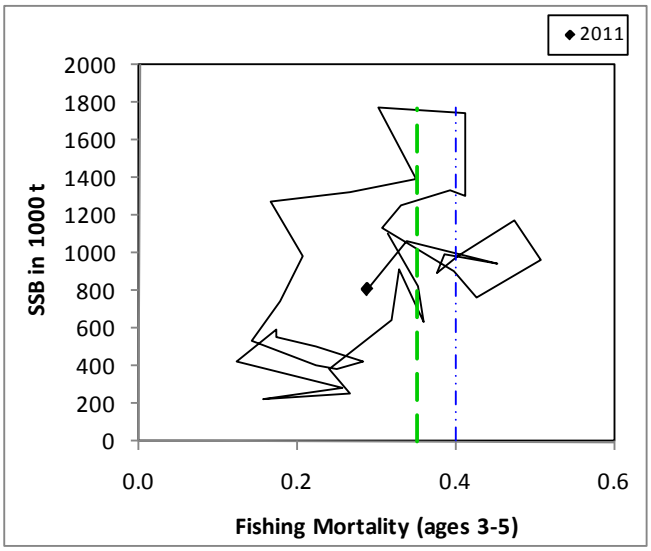


Figure 7.10 Sprat in SD 22-32. Summary sheet plots: stock recruitment, yield, and spawning biomass per recruit and precautionary approach plot.

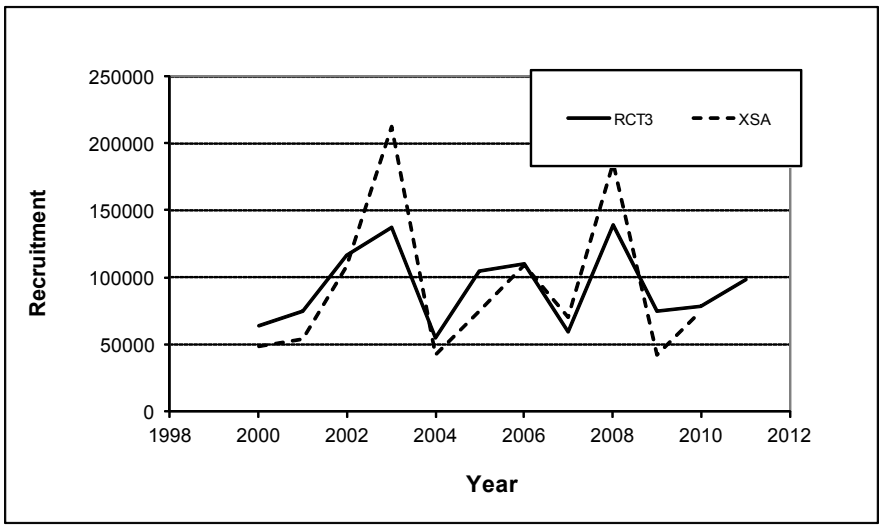
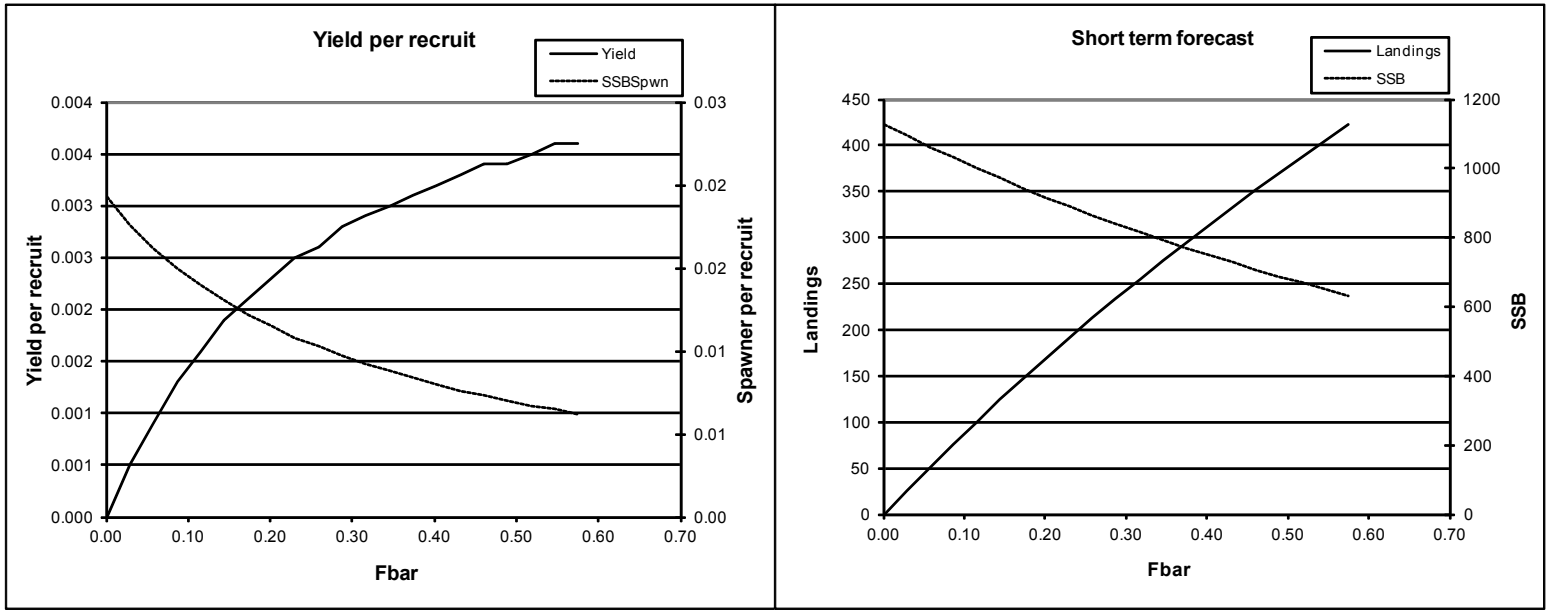


Figure 7.11 Sprat in SD 22-32. Comparison of recruitment estimates from RCT3 and XSA.



MFYPR version 2a
Run: Sprat Pr 2012 Status Quo
Time and date: 12:36 2012-04-16

Reference point	F multiplier	Absolute F
Fbar(3-5)	1.0000	0.2876
FMax	8.3431	2.3995
F0.1	1.8551	0.5335
F35%SPR	1.7941	0.5160

Weights in kilograms

MFDP version 1a
Run: Sprat Pr 2012 Status Quo
Sprat
Time and date: 12:30 2012-04-16
Fbar age range: 3-5

Input units are millions and kg - output in kilotonnes

Figure 7.12 Sprat in SD 22-32. Yield-per-recruit and short-term forecast.

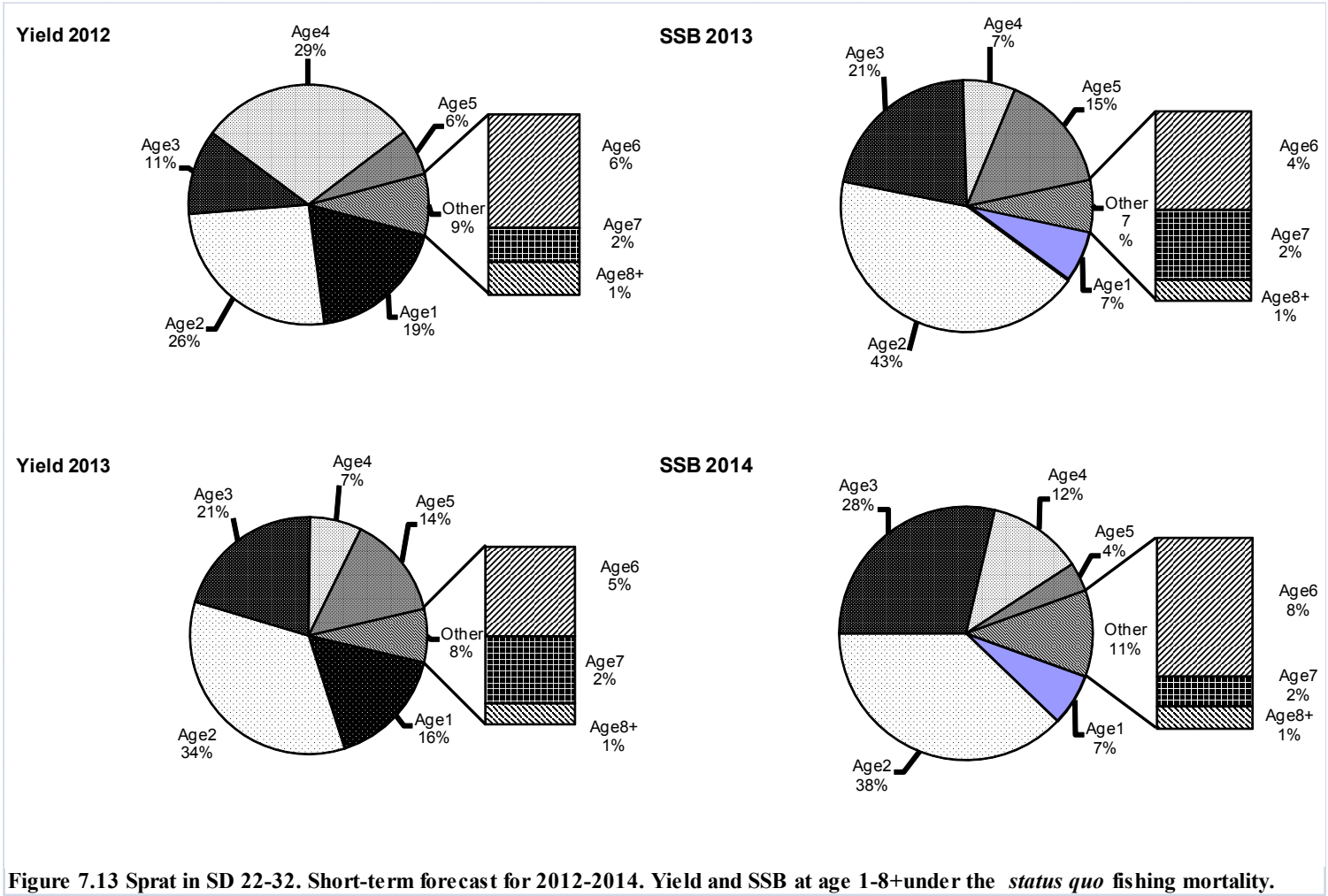
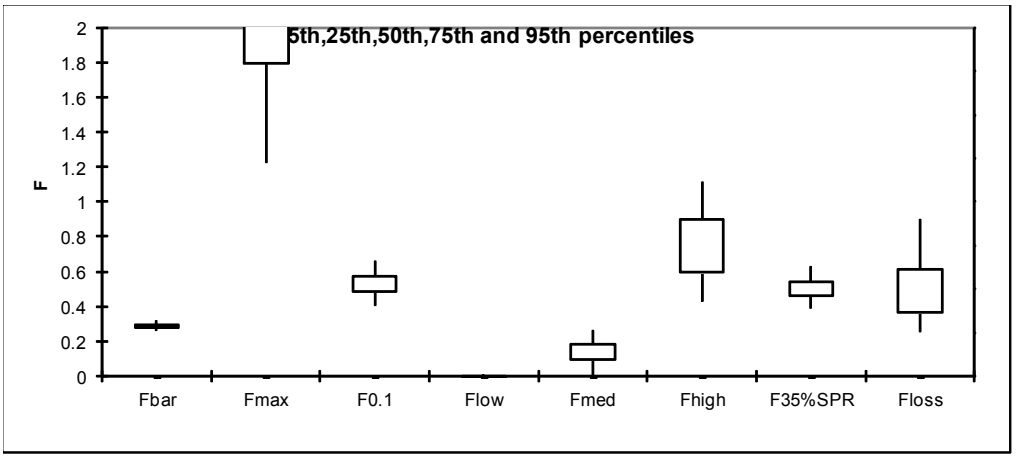


Figure 7.13 Sprat in SD 22-32. Short-term forecast for 2012-2014. Yield and SSB at age 1-8+under the *status quo* fishing mortality.



Reference point	Deterministic	Median	75th percentile	95th percentile	Hist SSB < ref pt %
MedianRecruits	54773	54773	64626	74891	
MBAL	0				0.00
Bloss	223				
SSB90%R90%Surv	841	811	912	1041	47.37
SPR%ofVirgin	49.92	49.66	51.83	55.16	
VirginSPR	0.02	0.02	0.02	0.02	
SPRloss	0.01	0.01	0.01	0.01	

	Deterministic	Median	25th percentile	5th percentile	Hist F > ref pt %
FBar	0.29	0.29	0.28	0.27	55.26
Fmax	11785.24	2.31	1.80	1.23	0.00
F0.1	0.52	0.53	0.49	0.41	0.00
Flow	0.00	0.00	0.00	0.00	100.00
Fmed	0.14	0.13	0.09	0.01	94.74
Fhigh	0.77	0.75	0.60	0.43	0.00
F35%SPR	0.50	0.51	0.46	0.39	2.63
Floss	0.56	0.48	0.37	0.25	0.00

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.
Sprat 22 32
Steady state selection averaged over 3 years.
FBar averaged from age 3 to 5
Number of iterations = 100
Random number seed = -99
Stock recruitment data Monte Carloed using residuals from the equilibrium LOWESS fit
Data source:
C:\2012.darbagrupa\sprPAinp.
FishLab DLL used
FLVB32.DLL built on Jun 14 1999 at 11:53:37
PASoft 4 October 1999
17/04/2012 12:31:32

Figure 7.14 Sprat in SD 22-32. PA reference points.

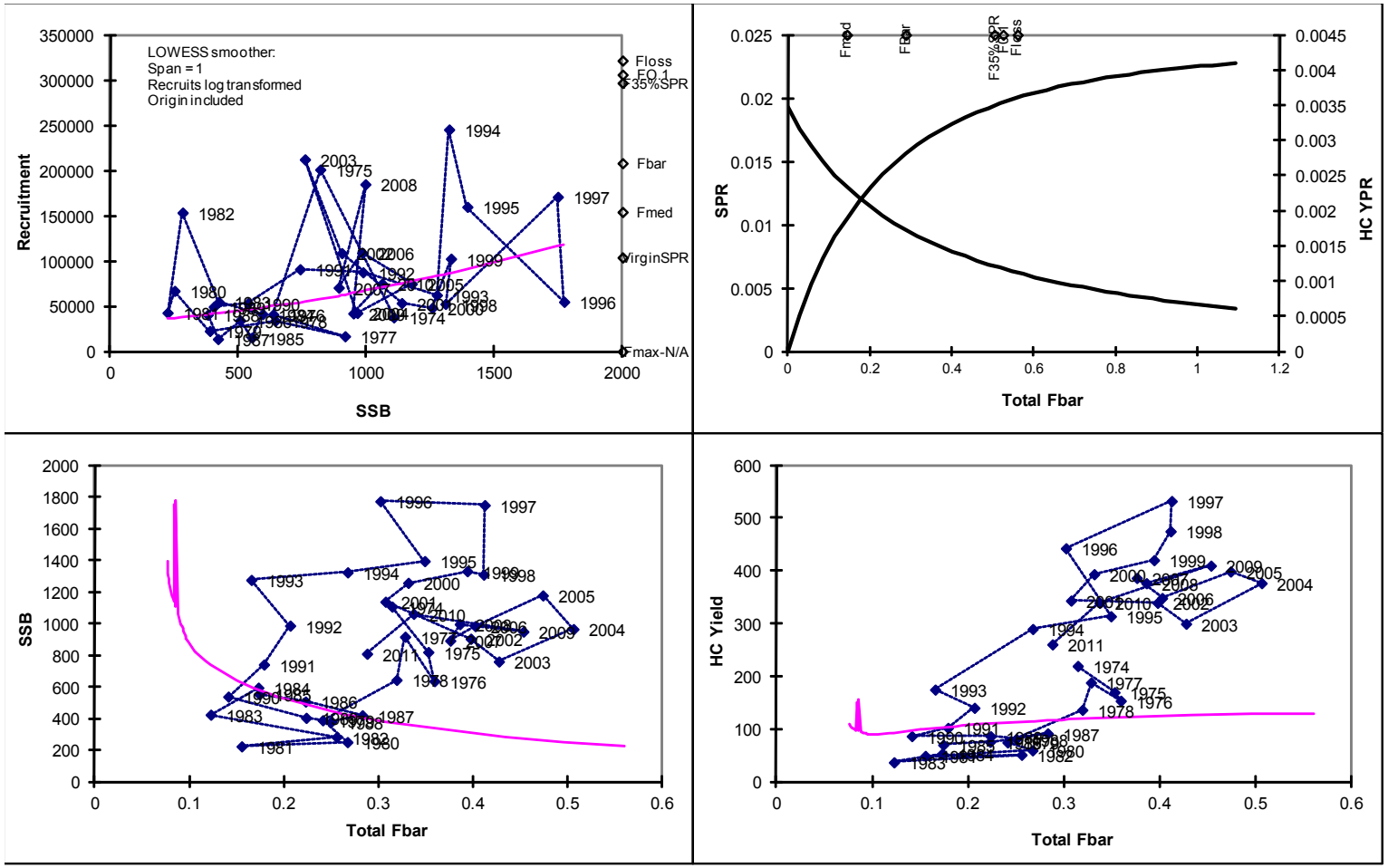


Figure 7.15 **Sprat in SD 22-32. PA graphs for present natural mortality and weights.**