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6 SOLE IN DIVISION IIIA (KATTEGAT AND SKAGERRAK)

6.1 Catch Trends

The officially reported landings by area and country for 1997 are given in Table 6.1 and the historical landings for the stock are given in Table 6.2 and Figure 6.1. The fishery fluctuated between 200 and 500 t annually prior to the mid-1980s. Landings increased to a maximum of 1400 t in 1993 and since then have decreased almost every year to the 1997 level of 814 t. Kattegat is the most important area accounting for 70–80% of the annual catches. Denmark takes more than 95% of the total catch.

Sole has been the single most important species in recent years in the Danish Kattegat fisheries and accounts for about 25% of the total value of the human consumption fisheries. The importance of sole is more limited in Skagerrak where it accounts for less than 5% of the total value of the Danish human consumption fisheries. For both Kattegat and Skagerrak the major part of the sole catches is taken in the mixed species trawl fishery using mesh sizes 70 - 105 mm and with gill nets using mesh sizes of 90–120 mm.

Traditionally the sole fishery has been regulated by catch quota constraints with a TAC set autonomously by EU for 1994–1997 at 1,995 t. In 1997 the fishery was regulated either based on half-month rations or through an experimental effort regulation. This programme has been operated since 1994.

6.2 Unallocated Landings

For the period 1991–1993 the official catch statistics are disputable with a very significant amounts of sole assumed landed without being properly recorded. For Kattegat, where most of the sole catches in 1994–1997 were taken under the effort regime the official statistics are assumed fairly accurate as there is no catch constraints.

6.3 Discards

Danish discard sampling at sea is carried out within EU programmes that began in 1995 in both Kattegat and Skagerrak. Results indicate that the amount of sole discarding is very limited. Discard levels are believed to be only a few percent when measured relative to the sole landings.

6.4 Effort and CPUE Data

Effort and fleet data from a recent study of demersal fisheries in the Kattegat (Hovgaard *et al.* 1998) were presented to the working group for tuning purposes. Since a large majority of sole in Division IIIA are captured in the Kattegat by Danish vessels, it was assumed that these effort data represented the major trends in effort allocation to the sole fishery in both the Kattegat and Skagerrak by all countries participating in the fishery.

There are 3 Danish fleets which capture most of the landed sole. These fleets are the gill net fleet (90-119 mm mesh size) and two trawler fleets (70-89 mm and 90-104 mm mesh sizes). Effort from these fleets have been standardized by Hovgaard *et al.* (1998) on an annual basis. Their data show that effort has increased or remained stable since 1987 (Figure 6.2).

6.5 Age Composition

Only Denmark provided statistics on catches in numbers broken down by age groups (Table 6.3). The age structure of the Danish catch was assumed to apply to the total international catch (Table 6.4).

6.6 Mean Weight at Age

Data on mean weight at age were derived by using the same sample allocation as used in the computation of catch-at-age. The mean weight is shown in Table 6.5 for the period 1984–1997. The difference in weight at age between recent years are mainly related to sampling problems.

The mean weight at age of the stock was assumed to be equal to the mean weight at age in the catch. The same assumption was made in last year's assessment.

6.7 Maturity Ogive

No new information relating to maturity ogives were available. The present assessment uses the same ogive as in the 1996 assessment (knife edge maturity at age 4).

6.8 Natural Mortality

The natural mortality was set to 0.1 per year as was done in previous assessments.

6.9 Catch at Age Analysis

In last year's report, the age of full recruitment and total mortality were estimated by a catch curve analysis. This analysis was based on catches from the year classes 1983 to 1991 (age 4–10) and suggested that sole are not fully recruited to the fishery until after age 4, and that average total mortality was ~ 0.56 per year.

In previous years, sole were assessed using a separable VPA. This method was necessary because effort data for tuning purposes were not available. However, the availability of the new effort and fleet data (Table 6.6) enabled an extended survivors analysis (XSA). Exploratory runs were made with the gill net fleet and both trawler fleets. These showed that the small-meshed trawler fleet was not contributing substantially to the tuning. This fleet was discarded in subsequent runs. A new run showed that the log residuals of the age-specific catchabilities from the gill net fleet for the older age groups were rather high especially for the first year (1987) for which effort data were available. This year was removed and the XSA re-run.

The final run log catchability plot is shown in Figure 6.3. These show that catchabilities were lower for the trawler fleet than for the gill net fleet and that the standard errors were usually 0.25-0.5 for the age-groups (3-5) represented most frequently in the catches (Table 6.7). This level of variability in the log residuals was considered to be acceptable. The trawler fleet contributed more to the overall tuning than the gill net fleet for all age groups except for age 2. There appears to be some large negative residuals during the years 1992-1994. This is probably to the lower reliability of the catch data during this period.

The IBTS February survey is another potential source of tuning information. The survey indices (no/hr) for the 2-group are presented in Figure 6.4. Although the survey does not provide age disaggregated abundance estimates, the abundance of sole between 15–22 cm has conventionally been used by the Working Group as a proxy for the recruiting age 2 group. An exploratory run conducted with the survey as a tuning fleet showed that it contributed only a small amount of tuning information. As a result, it was not used in further tuning attempts.

The final stock estimates and fishing mortalities as obtained using the gill net and large mesh trawler fleets are shown in Tables 6.8, 6.9 and 6.10. These indicate that recruitment in 1997 decreased for the third year in a row. The low recruitment in 1997 was also seen in the low survey index, and there is a statistically significant relationship between the XSA and survey estimates of recruit abundance (Fig. 6.5).

Spawning stock biomass continues to be high, and fishing mortality (F_{BAR} = 0.16) on age groups 4-8 is estimated to be lower than in the early 1990's (Figure 6.6).

The retrospective analysis showed that most years produced the same trends as those observed with this assessment (Figure 6.7). The year 1994 appears to deviate from the other years because it has a lower recruitment and SSB, and higher fishing mortality, although the time trends are similar. 1994 may be different because the catch data are less reliable for this year.

6.10 Recruitment Estimates

Recruitment (numbers of 2 year olds) for 1998 is estimated to be 2.7 million. This estimate was derived from the geometric mean of the abundance of 2 year olds in 1995, 1996 and 1997 as determined by catch-at-age analysis (see below).

There is some evidence of a statistically significant Ricker relationship between spawning stock biomass and recruitment (Figure 6.8). Based on this relationship and given the spawning stock in 1996 (6300 t), the recruitment for 1998 could

be 3.0 million, which is close to the value given above. For additional discussion and the fitted model of the stock - recruitment relationship, see "Biological Reference Points".

6.11 Historical Stock Trends

The SSB increased from 760 t in 1984 to a level of ~6,000 t in 1993–1997 (Figure 6.6). Recruitment has averaged ~6 million and shows a series of above-average recruitment for the year classes 1987–1991. Recruitment peaked in 1992 (~13 million) and has decreased almost every year since then to its lowest level on record in 1997. The period of good recruitment coincides with a row of winters with above normal temperatures which is believed to favour good survival. Mean fishing mortality (ages 4 - 8) during the period is 0.31, and has gradually decreased from 0.60 in 1987 to 0.15 in 1997 (Figure 6.6). However, standardized fishing effort in the Kattegat has remained stable or slightly increased during the same time period (Figure 6.2).

6.12 Short-Term Forecast and Management Options

The input to the forecast is given in Table 6.11. The weight at age used is the average for the years 1995–1997. The exploitation pattern is the average fishing mortality for 1995–1997 scaled to the level observed in the same time period. Age 2 abundance in 1998–2000 is the geometric mean for 1995–1997. Natural mortality was assumed to be 0.1 as was also used in the catch-at-age analysis.

The forecast shows that maintaining the 1995-1997 level of fishing mortality will lead to yields of about 850 and 750 t in 1998 and 1999, respectively (Table 6.12, Figure 6.9). These yields are similar to the landings in 1997 (814 t: Table 6.1).

6.13 Long-Term Forecast (Yield per Recruit)

The input for the yield per recruit analysis is given in Table 6.13 and the results are presented in Table 6.14 and Figure 6.9. The yield per recruit curve is distinctively flat topped with yields for F(4–8) above 0.5 found at 0.2 kg per recruit.

6.14 Medium-Term Projections

The Study Group on Management Strategies for Baltic Fish Stocks (SGBFS; ICES 1998) used a spreadsheet macro program for producing medium term projections. This program was made available to the Working Group and was modified for application to sole in Division IIIA. The program allows the user to include stochastic variations in several input parameters.

The medium term projections used the same maturity ogive and natural mortality rates as was used in the catch-at-age analysis. A Ricker stock-recruitment relationship with random variation generated recruitment estimates from spawning stock biomass values. Weights-at-age were drawn randomly from mean and standard deviations based on those in the catch.

The results of the simulations are shown in Figures 6.10, 6.11, 6.12 and Table 6.15. The outputs should be considered tentative because of the uncertainties associated with the stock-recruitment relationship. These medium term projections are the first to be made for this stock.

6.15 Biological Reference Points

Biological reference points were determined according to guidelines given by the Study Group on the Precautionary Approach to Fishery Management (SGPAFM; ICES 1998). The following reference points were considered for sole in division IIIA:

B_{LIM} : the biomass at which there is a high probability of recruitment failure, or the biomass below which stock dynamics are unknown.

B_{PA} : the biomass below which the stock is regarded as potentially depleted or overfished.

F_{LIM}: the level of fishing mortality which should be avoided with high probability due to possible stock collapse or unknown stock dynamics.

F_{PA}: the upper limit of fishing mortality used by ACFM when providing advice. In the specific case of Baltic stocks, the Study Group on Fisheries Management Strategies for Baltic Fish Stocks recommends that F_{PA} be the level of F for which there is less than 10% probability that SSB fall below B_{LIM}.

Based on the observed time series of spawning stock biomasses, the following tentative biomass reference points have been determined:

$B_{LIM} = B_{LOSS} = 764$ t
$B_{PA} = 1060$ t

The relation between stock and recruitment is shown in Figure 6.8 and has been fitted by a Ricker curve (parameters fitted on the log scale). The fitted relationship is $R = 9.76*SSB(e^{-0.000476*SSB})$. However, the curve is based on a short-time series, covers different environmental periods (generally warmer after 1987 than before) that might affect sole survival (see ICES 1997) and explains a low amount of the observed variance ($R^2 = 32\%$). In addition, other variables (e. g., oxygen conditions in benthic habitats, eutrophication) could also affect recruitment for a given level of spawning stock biomass. Since the time series is rather short, it is possible that most of the high recruitments (despite low SSB) may have occurred in years when environmental conditions were favourable for survival, and that most of the years with bad recruitment (despite high SSB) occurred in years when environmental conditions were bad. While this possibility needs to be investigated in more detail, such a pattern could produce the apparent Ricker relationship between spawning stock biomass and recruitment.

As a result, the biological reference points, shape of the fitted S-R relationship and interpretations based on it (including the medium term projections presented above) should be treated with caution. The mortality reference points given below are therefore somewhat uncertain and could perhaps be improved in future.

F_{med} was estimated to be 0.41 based on the yield per recruit analysis. When $F_{bar} = 0.223$ (= 1.4**status quo*), the medium term projections showed that there was less than 5% probability that the spawning stock biomass would fall below B_{PA} (see below "Biological Reference Points" below for definition) within the next 10 years (Figure 6.10). This result suggests that $F_{PA} > 0.223$.

6.16 Comments to the Assessment

This is the first year that sole in Division IIIA has been assessed using an extended survivors analysis. Previous assessments have used a separable VPA because effort data were not available.

The change in assessment methodology has had two important consequences. First, the spawning stock biomass in recent years is now estimated to be about twice as high as estimated in last year's assessment which was conducted with separable VPA. Second, fishing mortality rates are now estimated to be about 50-65% less than those estimated in last year's assessment. The apparently large differences in spawning biomass and fishing mortality are confined to the years since 1990.

The finding that recruit abundances measured by the February IBTS survey are correlated with those derived from XSA suggests that the survey might be able to provide additional estimates of recruitment. In future, this survey, as well as the newly established bi-annual Danish survey of the Kattegat with *RV Havfisken* may be useful for tunings in coming years.

The assessment for sole is now accompanied for the first time by medium term projections.

Despite these improvements, there still are some serious limitations to a quality sole assessment in Division IIIA. First, catch statistics are unreliable especially for 1991–1993. This situation has improved in recent years because a Danish management regime based on effort regulation is expected to remove the incentive for nonreporting and misreporting of sole catches.

Secondly, the effort data made available to the Working Group showed that although both fishing effort and spawning stock biomass have remained stable or has increased slightly during the 1990's, yields have decreased during the same period. The apparent contradiction between the yield and effort trends is unclear and needs to be investigated.

Thirdly, the stock-recruitment relationship is uncertain. If reasons for the variability associated with this relationship could be identified, it might be possible to develop more reliable models, medium term projections and biological reference points.

Table 6.1. Sole landings in Division IIIA by country and quarter for 1997

Sole Landings in Kattegat in 1997

Country	Quarter								Yearly Total	
	1		2		3		4			
	Tonnes	Nos.	Tonnes	Nos.	Tonnes	Nos.	Tonnes	Nos.	Tonnes	Nos.
Denmark	99	281	85	288	137	483	239	833	560	1885
Germany	1.4		0		0		0.8		2.2	
Sweden	5.4		11.1		15.6		7.9		40	
Total	105.8		96.1		152.6		247.7		602.2	

Sole Landings in Skagerrak in 1997

Country	Quarter								Yearly Total	
	1		2		3		4			
	Tonnes	Nos.	Tonnes	Nos.	Tonnes	Nos.	Tonnes	Nos.	Tonnes	Nos.
Denmark	34	67	95	215	19	38	52	126	200	446
Germany	0		0		0		0		0	
Sweden	3.3		4.5		1.3		3		12.1	
Total	37.3		99.5		20.3		55		212.1	

Sole Landings in Division IIIA (Kattegat and Skagerrak) in 1997

Country	Quarter								Yearly Total	
	1		2		3		4			
	Tonnes	Nos.	Tonnes	Nos.	Tonnes	Nos.	Tonnes	Nos.	Tonnes	Nos.
Denmark	133	348	180	503	156	521	291	959	760	2331
Germany	1.4		0		0		0.8		2.2	
Sweden	8.7		15.6		16.9		10.9		52.1	
Total	143.1		195.6		172.9		302.7		814.3	

Table 6.2. Historical landings of sole in Division IIIA.

Year	Landings (t)
1952	266
1953	249
1954	254
1955	223
1956	255
1957	347
1958	317
1959	296
1960	401
1961	430
1962	414
1963	365
1964	421
1965	374
1966	332
1967	455
1968	306
1969	268
1970	183
1971	283
1972	370
1973	325
1974	436
1975	468
1976	435
1977	513
1978	495
1979	373
1980	324
1981	282
1982	212
1983	276
1984	337
1985	397
1986	643
1987	722
1988	706
1989	824
1990	1050
1991	1011
1992	1294
1993	1439
1994	1198
1995	1297
1996	1059
1997	816

Table 6.3 Number of sole aged by Denmark in 1997 in the Kattegat and Skagerrak.

Quarter	Kattegat	Skagerrak	Total
1	269	201	470
2	283	169	452
3	238	103	341
4	370	224	594
Total	1160	697	1857

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Table 6.4 Sole in Kattegat and Skagerrak
Catch in numbers (thousands) by year and age.

Year	2	3	4	5	6	7	8	9	10	11+
1984	64	638	240	117	31	33	40	84	60	31
1985	786	594	190	55	60	16	8	29	30	10
1986	258	1255	671	210	33	36	33	29	18	16
1987	391	857	1018	434	174	64	31	6	17	64
1988	516	1035	897	484	129	37	23	8	14	38
1989	863	613	847	592	404	83	30	16	7	29
1990	1209	1300	651	564	310	167	27	13	5	13
1991	530	1301	928	334	345	302	180	47	13	16
1992	506	1178	939	493	320	178	166	122	57	60
1993	523	1804	1251	826	418	117	137	83	44	30
1994	127	1037	1451	752	444	152	45	15	29	15
1995	272	622	1359	1226	600	385	142	50	28	26
1996	316	1015	537	691	440	232	148	80	48	75
1997	54	251	440	365	505	360	262	138	65	60

Table 6.5 Sole weight-at-age (kg) in the catch and in the stock (Kattegat and Skagerrak)

Year	Age 2	3	4	5	6	7	8	9	10	11+
1984	0.183	0.213	0.257	0.294	0.297	0.28	0.321	0.323	0.365	0.415
1985	0.174	0.234	0.283	0.291	0.335	0.292	0.279	0.32	0.357	0.415
1986	0.165	0.231	0.287	0.297	0.409	0.267	0.262	0.365	0.369	0.415
1987	0.16	0.194	0.245	0.274	0.319	0.36	0.417	0.357	0.311	0.415
1988	0.159	0.197	0.235	0.251	0.335	0.348	0.363	0.336	0.304	0.415
1989	0.176	0.221	0.255	0.266	0.271	0.352	0.3	0.364	0.285	0.415
1990	0.18	0.228	0.251	0.308	0.333	0.4	0.547	0.752	0.498	0.415
1991	0.174	0.229	0.275	0.292	0.346	0.309	0.386	0.502	0.493	0.513
1992	0.213	0.252	0.336	0.412	0.43	0.491	0.566	0.568	0.688	0.61
1993	0.178	0.224	0.274	0.328	0.374	0.403	0.388	0.406	0.507	0.508
1994	0.174	0.229	0.28	0.342	0.388	0.445	0.448	0.342	0.4	0.439
1995	0.187	0.2	0.248	0.291	0.351	0.382	0.432	0.426	0.384	0.339
1996	0.176	0.218	0.267	0.307	0.339	0.404	0.457	0.67	0.697	0.624
1997	0.198	0.272	0.296	0.308	0.345	0.359	0.364	0.362	0.364	0.357

Table 6.6. Tuning fleets used in XSA analysis.

Sole in the Kattegat and Skagerrak (Fishing Area IIIA) (run name XSABRM09)

FLT05: Gill-net 90-120mm (Catch: Unknown) (Effort: Unknown)

1987	1997									
1	1	0	1							
2	10									
	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
	2794	27124	81104	53249	27663	5782	715	699	105	379
	3060	89232	47074	58519	37938	26153	3527	1150	773	137
	2361	34628	26613	17082	11605	7927	2787	707	258	76
	2628	66906	150208	63518	21529	18745	23403	12264	1783	188
	3609	69216	125603	47830	12146	3544	1269	1244	739	340
	8120	99506	227680	87787	46316	18395	5095	7405	3188	1539
	13343	49150	422247	425131	138599	69538	10838	8602	3224	6470
	9466	54117	294464	508499	385290	128551	74189	12112	10351	4627
	9605	75080	363262	177874	260630	168337	80118	44813	25249	5856
	8357	19831	80416	124014	102434	131470	92922	66758	43975	21701

FLT03: Trawl 90-104 mm (Catch: Unknown) (Effort: Unknown)

1987	1997									
1	1	0	1							
2	10									
	2659	14127	24823	26300	10704	4273	1443	956	198	216
	2228	16016	32631	35604	17673	4888	1855	937	334	469
	3999	57686	29385	52189	37785	29828	4772	2434	957	410
	3421	47070	51846	26555	30772	16371	12109	1837	467	378
	5021	107207	267138	147705	61703	68950	58326	33066	4888	409
	6881	225020	354924	203408	73894	23519	23652	30511	24916	5947
	6534	164725	395734	243444	164937	67879	18991	30012	15647	5842
	6484	25531	325524	563274	199931	125291	13031	2981	1298	8954
	4951	109499	125465	243432	226774	112865	67302	20291	4329	5321
	5533	98953	194600	120557	153484	100400	34730	28671	9377	5993
	6024	17900	78149	115451	83176	106256	79339	64700	27237	14158

Table 6.7 XSA output for sole in Division IIIA.

Lowestoft VPA Version 3.1

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Extended Survivors Analysis

Sole in IIIa (run: XSABRM09/X09)

CPUE data from file /users/fish/ifad/ifapwork/wgbfas/sol_kask/FLEET.X09

Catch data for 14 years. 1984 to 1997. Ages 2 to 11.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
FLT05: Gill-net 90-1	1987	1997	2	10	0	1
FLT03: Trawl 90-104	1987	1997	2	10	0	1

Time series weights :

Tapered time weighting applied
Power = 3 over 20 years

Catchability analysis :

Catchability independent of stock size for all ages

Catchability independent of age for ages >= 7

Terminal population estimation :

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

S.E. of the mean to which the estimates are shrunk = .500

Minimum standard error for population
estimates derived from each fleet = .300

Prior weighting not applied

Tuning converged after 44 iterations

1

Regression weights

0.751	0.82	0.877	0.921	0.954	0.976	0.99	0.997	1	1

Fishing mortalities

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
2	0.146	0.146	0.153	0.063	0.044	0.058	0.03	0.053	0.112	0.05
3	0.299	0.232	0.304	0.218	0.174	0.194	0.141	0.178	0.255	0.11
4	0.336	0.379	0.365	0.328	0.217	0.252	0.212	0.248	0.206	0.15
5	0.306	0.344	0.414	0.287	0.259	0.268	0.211	0.248	0.172	0.189
6	0.276	0.401	0.271	0.426	0.435	0.325	0.202	0.233	0.119	0.165

7	0.343	0.256	0.255	0.408	0.361	0.248	0.167	0.241	0.119	0.121
8	0.412	0.457	0.111	0.425	0.366	0.462	0.128	0.208	0.123	0.171
9	0.29	0.497	0.325	0.255	0.505	0.28	0.074	0.183	0.156	0.145
10	0.359	0.393	0.252	0.553	0.494	0.304	0.133	0.172	0.24	0.164

1

XSA population numbers (Thousands)

	AGE								
YEAR	2	3	4	5	6	7	8	9	10
1988	3.99E+03	4.21E+03	#######	#######	######	#######	#######	3.34E+01	4.88E+01
1989	6.67E+03	3.12E+03	#######	#######	######	#######	#######	4.29E+01	2.26E+01
1990	8.97E+03	5.22E+03	#######	#######	######	#######	#######	4.92E+01	2.36E+01
1991	9.13E+03	6.97E+03	#######	#######	######	#######	#######	2.19E+02	3.22E+01
1992	1.24E+04	7.76E+03	#######	#######	######	#######	#######	3.23E+02	1.54E+02
1993	9.70E+03	1.07E+04	#######	#######	######	#######	#######	3.58E+02	1.77E+02
1994	4.56E+03	8.28E+03	#######	#######	######	#######	#######	2.22E+02	2.45E+02
1995	5.52E+03	4.00E+03	#######	#######	######	#######	#######	3.14E+02	1.86E+02
1996	3.12E+03	4.74E+03	#######	#######	######	#######	#######	5.83E+02	2.37E+02
1997	1.16E+03	2.53E+03	#######	#######	######	#######	#######	1.08E+03	4.51E+02

Estimated population abundance at 1st Jan 1998

0.00E+00	1.00E+03	#######	#######	######	#######	#######	1.33E+03	8.42E+02

Taper weighted geometric mean of the VPA populations:

5.31E+03	4.88E+03	#######	#######	######	#######	#######	1.81E+02	1.01E+02

Standard error of the weighted Log(VPA populations) :

0.6503	0.4906	0.6332	0.8289	1.0171	1.1289	1.1167	1.1023	1.0339

1

Log catchability residuals.

Fleet : FLT05: Gill-net 90-1

Age	1987
2	99.99
3	99.99
4	99.99
5	99.99
6	99.99
7	99.99
8	99.99
9	99.99
10	99.99

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
2	0.34	0.93	-0.05	0.44	-0.16	-0.35	-0.81	-0.56	0.36	0.12
3	0.41	0.04	-0.75	0.55	-0.08	-0.61	-0.26	0.47	0.54	-0.27
4	0.28	0.46	-0.29	0.46	-0.57	-0.91	-0.15	0.6	0.28	-0.06
5	0.33	0.47	-0.22	0.45	-0.94	-0.89	-0.43	0.6	0.41	0.34
6	0.16	0.81	-0.25	0.85	-1.04	-0.76	-0.47	0.33	0.23	0.31
7	-0.07	0.33	-0.35	1.55	-1.28	-0.65	-1.05	0.65	0.52	0.38
8	0.56	0.81	-0.73	1.46	-1.21	0.19	-0.33	-0.31	0.42	0.72
9	-0.63	1.12	0.07	0.37	-1.1	-0.66	-0.76	0.45	0.7	0.77

10	0.31	-0.02	-0.45	0.17	-1.14	-0.67	-0.14	0.16	0.18	0.94

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

Age	2	3	4	5	6	7	8	9	10
Mean Log q	-6.2417	-5.1939	-5.2254	-5.404	-5.582	-5.9734	-5.9734	-5.9734	-5.9734
S.E(Log q)	0.5187	0.4804	0.4994	0.5943	0.6356	0.872	0.8173	0.7693	0.5946

Regression statistics :

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
2	1.08	-0.275	6.06	0.62	10	0.59	-6.24
3	1.38	-0.746	3.92	0.35	10	0.68	-5.19
4	1.42	-0.697	3.91	0.27	10	0.73	-5.23
5	1.02	-0.046	5.35	0.38	10	0.65	-5.4
6	0.89	0.327	5.78	0.56	10	0.6	-5.58
7	0.77	0.892	6.17	0.67	10	0.68	-5.97
8	1.03	-0.111	5.82	0.6	10	0.88	-5.83
9	0.94	0.242	5.91	0.71	10	0.77	-5.94
10	0.91	0.523	5.91	0.81	10	0.56	-6.04
1							

Fleet : FLT03: Trawl 90-104

Age	1987
2	-0.76
3	-0.85
4	-0.6
5	-0.33
6	0.08
7	-0.05
8	0.29
9	-1.38
10	-0.45

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
2	-0.19	-0.01	-0.35	0.03	0.14	0.14	-0.98	0.57	0.95	0.11
3	-0.29	-0.71	-0.46	0.46	0.3	0.15	0.19	0.26	0.45	0.01
4	-0.19	-0.21	-0.5	0.37	-0.05	0.04	0.56	0.22	0.15	-0.1
5	-0.35	-0.26	-0.07	0.4	-0.23	0.15	0.2	0.27	-0.02	0.01
6	-0.38	0.07	-0.49	0.91	-0.39	0.16	0.25	0.25	-0.34	-0.18
7	0.34	-0.4	-0.01	1.05	0.24	0.12	-0.91	0.44	-0.53	-0.21
8	0.32	0.53	-0.91	1.04	0.58	1.04	-1.43	0.09	-0.24	0.25
9	-0.01	0.3	-0.47	-0.04	1	0.39	-1.71	-0.54	-0.51	-0.14
10	-0.02	0.05	0.02	-0.46	0.31	0.12	0.15	0.19	-0.01	0.08

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

Age	2	3	4	5	6	7	8	9	10
Mean Log q	-6.01	-5.1822	-4.9358	-4.953	-4.985	-5.2098	-5.2098	-5.2098	-5.2098
S.E(Log q)	0.5533	0.4432	0.3431	0.2484	0.4129	0.5431	0.7921	0.8278	0.2368

Regression statistics :

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
2	1.1	-0.326	5.75	0.57	11	0.64	-6.01
3	0.71	1.265	6.15	0.71	11	0.31	-5.18
4	0.63	2.654	6.17	0.87	11	0.17	-4.94
5	0.83	1.298	5.43	0.89	11	0.2	-4.95
6	1.01	-0.073	4.95	0.76	11	0.44	-4.99
7	1.1	-0.469	5.06	0.74	11	0.62	-5.21
8	1.04	-0.17	5.04	0.64	11	0.86	-5.08
9	0.94	0.263	5.47	0.71	11	0.77	-5.48
10	0.89	1.881	5.13	0.97	11	0.19	-5.2
1							

Terminal year survivor and F summaries :

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

Year class = 1995

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT05: Gill-net 90-1	1130	0.546	0	0	1	0.319	0.044
FLT03: Trawl 90-104	1122	0.58	0	0	1	0.282	0.045
F shrinkage mean	837	0.5				0.399	0.06

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
1000	0.31	0.13	3	0.426	0.05

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

Year class = 1994

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT05: Gill-net 90-1	2046	0.372	0.312	0.84	2	0.37	0.11
FLT03: Trawl 90-104	2921	0.363	0.451	1.24	2	0.39	0.079
F shrinkage mean	1148	0.5				0.239	0.189

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
2047	0.23	0.26	5	1.141	0.11

1

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

Year class = 1993

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT05: Gill-net 90-1	2595	0.306	0.3	0.98	3	0.334	0.15
FLT03: Trawl 90-104	3023	0.258	0.208	0.81	3	0.495	0.13
F shrinkage mean	1639	0.5				0.171	0.227

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
2588	0.18	0.16	7	0.884	0.15

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

Year class = 1992

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT05: Gill-net 90-1	1868	0.277	0.281	1.01	4	0.275	0.17
FLT03: Trawl 90-104	1667	0.197	0.181	0.92	4	0.597	0.189
F shrinkage mean	1327	0.5				0.128	0.232

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
1670	0.15	0.13	9	0.843	0.189

1

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

Year class = 1991

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT05: Gill-net 90-1	3173	0.261	0.186	0.71	5	0.273	0.141
FLT03: Trawl 90-104	2763	0.182	0.074	0.41	5	0.608	0.16
F shrinkage mean	1597	0.5				0.12	0.263

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
2686	0.14	0.1	11	0.68	0.165

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

Year class = 1990

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT05: Gill-net 90-1	2762	0.256	0.18	0.7	6	0.268	0.117
FLT03: Trawl 90-104	2999	0.176	0.143	0.81	6	0.612	0.108
F shrinkage mean	1338	0.5				0.12	0.228

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
2664	0.14	0.12	13	0.868	0.121

Age 8 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1989

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT05: Gill-net 90-1	1386	0.255	0.226	0.89	7	0.275	0.165
FLT03: Trawl 90-104	1459	0.176	0.106	0.6	7	0.586	0.158
F shrinkage mean	847	0.5				0.138	0.258

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
1334	0.14	0.11	15	0.758	0.171

Age 9 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1988

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT05: Gill-net 90-1	891	0.259	0.23	0.89	8	0.291	0.137
FLT03: Trawl 90-104	952	0.179	0.086	0.48	8	0.556	0.129
F shrinkage mean	484	0.5				0.153	0.24

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
842	0.15	0.11	17	0.77	0.145

Age 10 Catchability constant w.r.t. time and age (fixed at the value for age) 7

Year class = 1987

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT05: Gill-net 90-1	394	0.266	0.281	1.06	9	0.242	0.146
FLT03: Trawl 90-104	327	0.173	0.113	0.65	9	0.631	0.173
F shrinkage mean	360	0.5				0.127	0.158

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
347	0.14	0.11	19	0.787	0.164

1

Table 6.8. Fishing mortalities by age and year for sole in Division IIIA.

Run title : Sole in IIIa (run: XSABRM09/X09)

At 20-Apr-98 11:08:25

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age				
YEAR	1984	1985	1986	1987
AGE				
2	0.0221	0.1431	0.0525	0.0847
3	0.5399	0.2607	0.3167	0.2203
4	0.6044	0.2686	0.4649	0.4065
5	0.4614	0.236	0.4723	0.5501
6	0.2062	0.4039	0.1942	0.8048
7	0.3172	0.14	0.4005	0.6152
8	0.3465	0.1054	0.4193	0.6324
9	0.4553	0.4031	0.5891	0.1106
10	0.3583	0.2583	0.4164	0.7336
+gp	0.3583	0.2583	0.4164	0.7336
FBAR 4- 8	0.3871	0.2308	0.3902	0.6018

Table 8 Fishing mortality (F) at age											
YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	FBAR 95-97
AGE											
2	0.1462	0.1461	0.1527	0.063	0.0439	0.0583	0.0297	0.0532	0.1124	0.0501	0.0719
3	0.2993	0.2315	0.3037	0.2184	0.1739	0.1943	0.1412	0.1784	0.2551	0.1103	0.1813
4	0.3356	0.3792	0.3649	0.3285	0.2166	0.2523	0.2116	0.2479	0.2063	0.1499	0.2014
5	0.3059	0.3437	0.4144	0.2873	0.2592	0.268	0.2115	0.2485	0.1721	0.1889	0.2031
6	0.2757	0.4007	0.271	0.4264	0.4345	0.3246	0.2016	0.2328	0.1186	0.1645	0.172
7	0.3432	0.2558	0.2551	0.4082	0.3613	0.2484	0.1674	0.2409	0.1188	0.1209	0.1602
8	0.4119	0.4572	0.1107	0.4248	0.3656	0.4623	0.1276	0.2084	0.123	0.1713	0.1676
9	0.2898	0.4974	0.3252	0.2552	0.505	0.2796	0.0738	0.1829	0.1558	0.1448	0.1612
10	0.3588	0.3932	0.2518	0.5528	0.4937	0.3036	0.133	0.1719	0.2395	0.1642	0.1919
+gp	0.3588	0.3932	0.2518	0.5528	0.4937	0.3036	0.133	0.1719	0.2395	0.1642	
0 FBAR 4-1	0.3345	0.3673	0.2832	0.375	0.3274	0.3111	0.1839	0.2357	0.1478	0.1591	

Table 6.9. Stock numbers by age and year for sole in Division IIIA.

Run title : Sole in IIIa (run: XSABRM09/X09)

At 20-Apr-98 11:08:25

Terminal Fs derived using XSA (With F shrinkage)

Table 10	Stock number at age (start of year)				Numbers*10**-3				
YEAR	1984	1985	1986	1987	1988	1989	1990	1991	1992
AGE									
2	3075	6198	5307	5060	3989	6674	8974	9130	12399
3	1608	2721	4860	4556	4207	3118	5218	6970	7757
4	556	848	1897	3204	3308	2822	2238	3484	5069
5	333	275	586	1078	1931	2140	1748	1406	2270
6	175	190	197	331	563	1287	1373	1045	955
7	128	129	115	146	134	387	780	947	617
8	144	84	101	70	72	86	271	547	570
9	241	92	68	60	33	43	49	219	323
10	209	139	56	34	49	23	24	32	154
+gp	108	46	49	129	132	93	61	39	161
0 TOTA	6576	10721	13236	14669	14416	16671	20735	23820	30275

Table 10	Stock number at age (start of year)				Numbers*10**-3			
YEAR	1993	1994	1995	1996	1997	1998	GMST 84-95	AMST 84-95
AGE								
2	9701	4556	5523	3124	1162	0	6224	6715
3	10737	8280	4001	4739	2526	1000	4737	5336
4	5898	8000	6506	3029	3322	2047	2879	3653
5	3694	4147	5858	4594	2230	2588	1490	2122
6	1585	2556	3037	4134	3500	1670	739	1108
7	559	1037	1891	2177	3322	2686	373	572
8	389	395	793	1345	1750	2664	205	293
9	358	222	314	583	1076	1334	123	169
10	177	245	186	237	451	842	79	111
+gp	120	126	173	369	416	666		
0 TOTA	33219	29564	28283	24331	19755	15498		

Table 6.10. Stock summary table for sole in Division IIIA.

Run title : Sole in IIIa (run: XSABRM09/X09)

At 20-Apr-98 11:08:25

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS Age 2	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 4-8
1984	3075	1479	764	337	0.441	0.3871
1985	6198	2258	1047	397	0.3793	0.2308
1986	5307	2920	1757	643	0.3659	0.3902
1987	5060	3047	1917	722	0.3765	0.6018
1988	3989	3067	2127	706	0.3319	0.3345
1989	6674	3724	2219	824	0.3713	0.3673
1990	8974	4896	2870	1050	0.3659	0.2832
1991	9130	5579	3505	1011	0.2885	0.375
1992	12399	8658	5354	1294	0.2417	0.3274
1993	9701	8225	5798	1439	0.2482	0.3111
1994	4556	8206	6740	1198	0.1777	0.1839
1995	5523	7546	5839	1297	0.2221	0.2357
1996	3124	7484	6333	1059	0.1672	0.1478
1997	1162	6327	5600	816	0.1457	0.1591
Arith. Mean	6062	5244	3705	914	0.2945	0.3096
0 Units	(Thousan	(Tonnes)	(Tonnes)	(Tonnes)		
1						

Table 6.11

The SAS System 14:26 Wednesday, April 29, 1998

Sole in the Kattegat and Skagerrak (Fishing Area IIIa)

Prediction with management option table: Input data

Year: 1998								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
2	2716.000	0.1000	0.0000	0.0000	0.0000	0.187	0.0719	0.187
3	1000.000	0.1000	0.0000	0.0000	0.0000	0.230	0.1813	0.230
4	2047.000	0.1000	1.0000	0.0000	0.0000	0.270	0.2014	0.270
5	2588.000	0.1000	1.0000	0.0000	0.0000	0.302	0.2031	0.302
6	1670.000	0.1000	1.0000	0.0000	0.0000	0.345	0.1720	0.345
7	2686.000	0.1000	1.0000	0.0000	0.0000	0.382	0.1602	0.382
8	2664.000	0.1000	1.0000	0.0000	0.0000	0.418	0.1676	0.418
9	1334.000	0.1000	1.0000	0.0000	0.0000	0.486	0.1612	0.486
10	842.000	0.1000	1.0000	0.0000	0.0000	0.482	0.1919	0.482
11+	666.000	0.1000	1.0000	0.0000	0.0000	0.440	.	0.440
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1999								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
2	2716.000	0.1000	0.0000	0.0000	0.0000	0.187	0.0719	0.187
3	.	0.1000	0.0000	0.0000	0.0000	0.230	0.1813	0.230
4	.	0.1000	1.0000	0.0000	0.0000	0.270	0.2014	0.270
5	.	0.1000	1.0000	0.0000	0.0000	0.302	0.2031	0.302
6	.	0.1000	1.0000	0.0000	0.0000	0.345	0.1720	0.345
7	.	0.1000	1.0000	0.0000	0.0000	0.382	0.1602	0.382
8	.	0.1000	1.0000	0.0000	0.0000	0.418	0.1676	0.418
9	.	0.1000	1.0000	0.0000	0.0000	0.486	0.1612	0.486
10	.	0.1000	1.0000	0.0000	0.0000	0.482	0.1919	0.482
11+	.	0.1000	1.0000	0.0000	0.0000	0.440	.	0.440
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 2000								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
2	2716.000	0.1000	0.0000	0.0000	0.0000	0.187	0.0719	0.187
3	.	0.1000	0.0000	0.0000	0.0000	0.230	0.1813	0.230
4	.	0.1000	1.0000	0.0000	0.0000	0.270	0.2014	0.270
5	.	0.1000	1.0000	0.0000	0.0000	0.302	0.2031	0.302
6	.	0.1000	1.0000	0.0000	0.0000	0.345	0.1720	0.345
7	.	0.1000	1.0000	0.0000	0.0000	0.382	0.1602	0.382
8	.	0.1000	1.0000	0.0000	0.0000	0.418	0.1676	0.418
9	.	0.1000	1.0000	0.0000	0.0000	0.486	0.1612	0.486
10	.	0.1000	1.0000	0.0000	0.0000	0.482	0.1919	0.482
11+	.	0.1000	1.0000	0.0000	0.0000	0.440	.	0.440
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANBRM02
Date and time: 22APR98:09:12

Table 6.12

The SAS System 14:26 Wednesday, April 29, 1998

Sole in the Kattegat and Skagerrak (Fishing Area IIIa)

Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	0.1809	6134	5103	858	0.0000	0.0000	5191	4157	0	5251	4178
.	.	.	.	.	0.1000	0.0181	.	4157	81	5175	4106
.	.	.	.	.	0.2000	0.0362	.	4157	160	5101	4036
.	.	.	.	.	0.3000	0.0543	.	4157	238	5027	3966
.	.	.	.	.	0.4000	0.0723	.	4157	315	4955	3898
.	.	.	.	.	0.5000	0.0904	.	4157	391	4884	3831
.	.	.	.	.	0.6000	0.1085	.	4157	465	4814	3765
.	.	.	.	.	0.7000	0.1266	.	4157	538	4746	3700
.	.	.	.	.	0.8000	0.1447	.	4157	610	4678	3637
.	.	.	.	.	0.9000	0.1628	.	4157	681	4612	3574
.	.	.	.	.	1.0000	0.1809	.	4157	750	4547	3513
.	.	.	.	.	1.1000	0.1989	.	4157	818	4483	3452
.	.	.	.	.	1.2000	0.2170	.	4157	886	4419	3393
.	.	.	.	.	1.3000	0.2351	.	4157	952	4357	3335
.	.	.	.	.	1.4000	0.2532	.	4157	1017	4296	3277
.	.	.	.	.	1.5000	0.2713	.	4157	1080	4236	3221
.	.	.	.	.	1.6000	0.2894	.	4157	1143	4178	3166
.	.	.	.	.	1.7000	0.3075	.	4157	1205	4120	3111
.	.	.	.	.	1.8000	0.3255	.	4157	1266	4062	3058
.	.	.	.	.	1.9000	0.3436	.	4157	1325	4006	3005
.	.	.	.	.	2.0000	0.3617	.	4157	1384	3951	2954
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANBRM02
Date and time : 22APR98:09:12
Computation of ref. F: Simple mean, age 4 - 8
Basis for 1998 : F factors

Table 6.13

The SAS System 14:26 Wednesday, April 29, 1998

Sole in the Kattegat and Skagerrak (Fishing Area IIIa)

Yield per recruit: Input data

Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
2	1.000	0.1000	0.0000	0.0000	0.0000	0.187	0.0719	0.187
3	.	0.1000	0.0000	0.0000	0.0000	0.230	0.1813	0.230
4	.	0.1000	1.0000	0.0000	0.0000	0.270	0.2014	0.270
5	.	0.1000	1.0000	0.0000	0.0000	0.302	0.2031	0.302
6	.	0.1000	1.0000	0.0000	0.0000	0.345	0.1720	0.345
7	.	0.1000	1.0000	0.0000	0.0000	0.382	0.1602	0.382
8	.	0.1000	1.0000	0.0000	0.0000	0.418	0.1676	0.418
9	.	0.1000	1.0000	0.0000	0.0000	0.486	0.1612	0.486
10	.	0.1000	1.0000	0.0000	0.0000	0.482	0.1919	0.482
11+	.	0.1000	1.0000	0.0000	0.0000	0.440	.	0.440
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDBRM02
Date and time: 21APR98:17:45

Table 6.14

The SAS System 14:26 Wednesday, April 29, 1998

Sole in the Kattegat and Skagerrak (Fishing Area IIIa)

Yield per recruit: Summary table

						1 January		Spawning time	
F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0.000	0.000	6.236	1989.910	4.331	1594.798	4.331	1594.798
0.2000	0.0362	0.171	55.197	5.638	1751.447	3.746	1359.305	3.746	1359.305
0.4000	0.0723	0.304	95.730	5.134	1553.514	3.255	1164.301	3.255	1164.301
0.6000	0.1085	0.408	125.428	4.709	1388.522	2.842	1002.197	2.842	1002.197
0.8000	0.1447	0.489	147.126	4.348	1250.380	2.494	866.901	2.494	866.901
1.0000	0.1809	0.554	162.920	4.040	1134.189	2.198	753.515	2.198	753.515
1.2000	0.2170	0.605	174.362	3.776	1035.999	1.946	658.089	1.946	658.089
1.4000	0.2532	0.646	182.596	3.548	952.618	1.730	577.435	1.730	577.435
1.6000	0.2894	0.680	188.471	3.350	881.464	1.544	508.967	1.544	508.967
1.8000	0.3255	0.707	192.613	3.178	820.438	1.383	450.590	1.383	450.590
2.0000	0.3617	0.730	195.484	3.028	767.833	1.244	400.595	1.244	400.595
2.2000	0.3979	0.749	197.426	2.895	722.256	1.123	357.591	1.123	357.591
2.4000	0.4341	0.765	198.690	2.778	682.564	1.017	320.436	1.017	320.436
2.6000	0.4702	0.778	199.461	2.674	647.824	0.923	288.196	0.923	288.196
2.8000	0.5064	0.790	199.878	2.581	617.263	0.841	260.100	0.841	260.100
3.0000	0.5426	0.800	200.039	2.497	590.246	0.768	235.512	0.768	235.512
3.2000	0.5788	0.809	200.019	2.422	566.245	0.703	213.906	0.703	213.906
3.4000	0.6149	0.817	199.871	2.354	544.823	0.646	194.844	0.646	194.844
3.6000	0.6511	0.824	199.636	2.292	525.613	0.594	177.961	0.594	177.961
3.8000	0.6873	0.831	199.342	2.236	508.311	0.547	162.953	0.547	162.953
4.0000	0.7234	0.836	199.009	2.184	492.660	0.505	149.563	0.505	149.563
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDBRM02
Date and time : 21APR98:17:45
Computation of ref. F: Simple mean, age 4 - 8
F-0.1 factor : 1.4462
F-max factor : 3.0711
F-0.1 reference F : 0.2616
F-max reference F : 0.5554
Recruitment : Single recruit

Table 6.15. Projected medium term spawning stock biomasses (t) for sole in Division IIIA assuming three different levels of fishing mortality.

F(4-8) 0.096
(0.6*status quo fishing mortality)

Percentile	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	5524	4972	4598	4183	4047	4001	4003	4041	4149	4472
0.10	5713	5057	4837	4394	4257	4151	4109	4308	4539	4844
0.25	5952	5301	5137	4760	4558	4540	4644	4972	4986	5346
0.50	6304	5673	5475	5141	4902	5039	5205	5448	5752	5956
0.75	6669	6099	5919	5595	5235	5471	5799	6049	6279	6751
0.90	7119	6491	6218	5888	5644	6000	6266	6843	6991	7339
0.95	7258	6671	6328	6105	5805	6268	6736	7153	7400	7782

F(4-8) 0.1591
Status quo fishing mortality (1995-1997)

Percentile	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	5484	4451	3786	3462	3016	3039	3066	3310	3604	3818
0.10	5658	4658	4082	3549	3185	3142	3253	3560	3752	4023
0.25	5934	4943	4387	3775	3396	3390	3630	3906	4113	4665
0.50	6251	5265	4685	4063	3694	3857	4138	4463	4905	5300
0.75	6589	5553	5093	4428	4034	4339	4541	5306	5811	5913
0.90	6928	5873	5327	4784	4391	4879	5350	6074	6533	6610
0.95	7191	6014	5450	4947	4557	5248	5830	6952	7089	7084

F(4-8) 0.223
1.4*status quo fishing mortality

Percentile	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	5436	4204	3350	2745	2103	2198	2436	2561	2826	3062
0.1	5673	4369	3567	2871	2251	2349	2641	2729	3091	3398
0.25	5933	4694	3846	3075	2482	2538	2932	3301	3502	3794
0.5	6228	4969	4115	3308	2742	2933	3417	3892	4297	4327
0.75	6615	5205	4400	3586	2979	3444	4015	4806	5101	5289
0.9	6980	5493	4631	3835	3248	4023	4776	5647	6251	6129
0.95	7183	5623	4771	3918	3446	4265	5101	6746	6730	6641

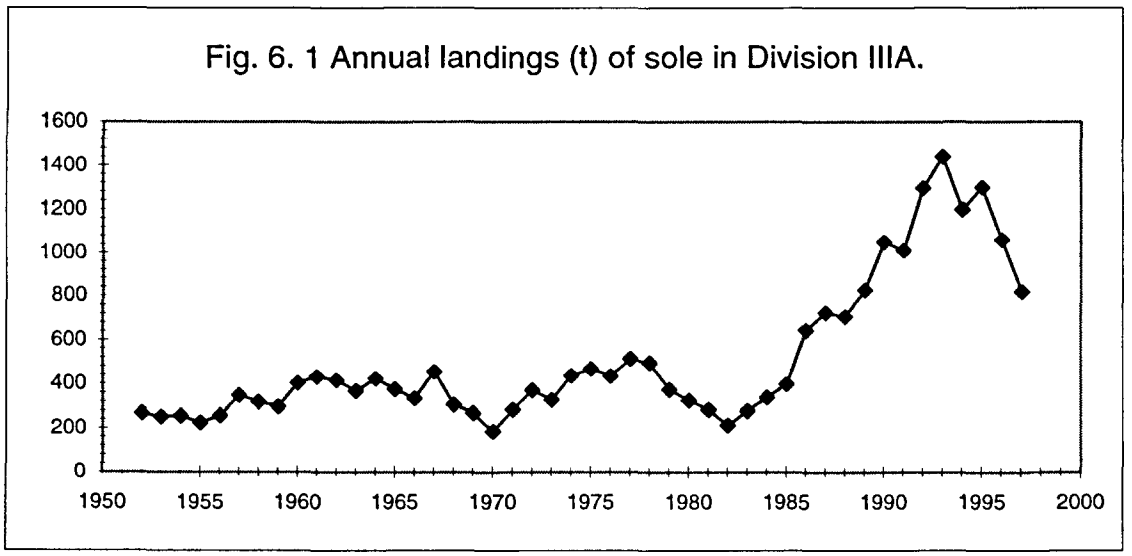


Figure 6.2. Standardised fishing effort for sole in the Kattegat.
("All fleets" include fleets additional to those indicated on the figure.)

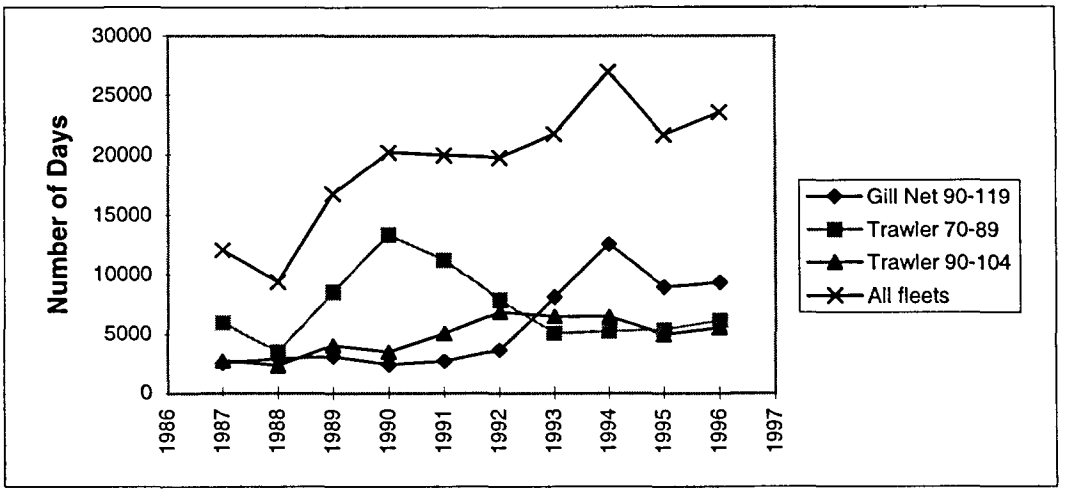


Figure 6.3 Residual catchabilities for two tuning fleets used in XSA for sole in Division IIIA.

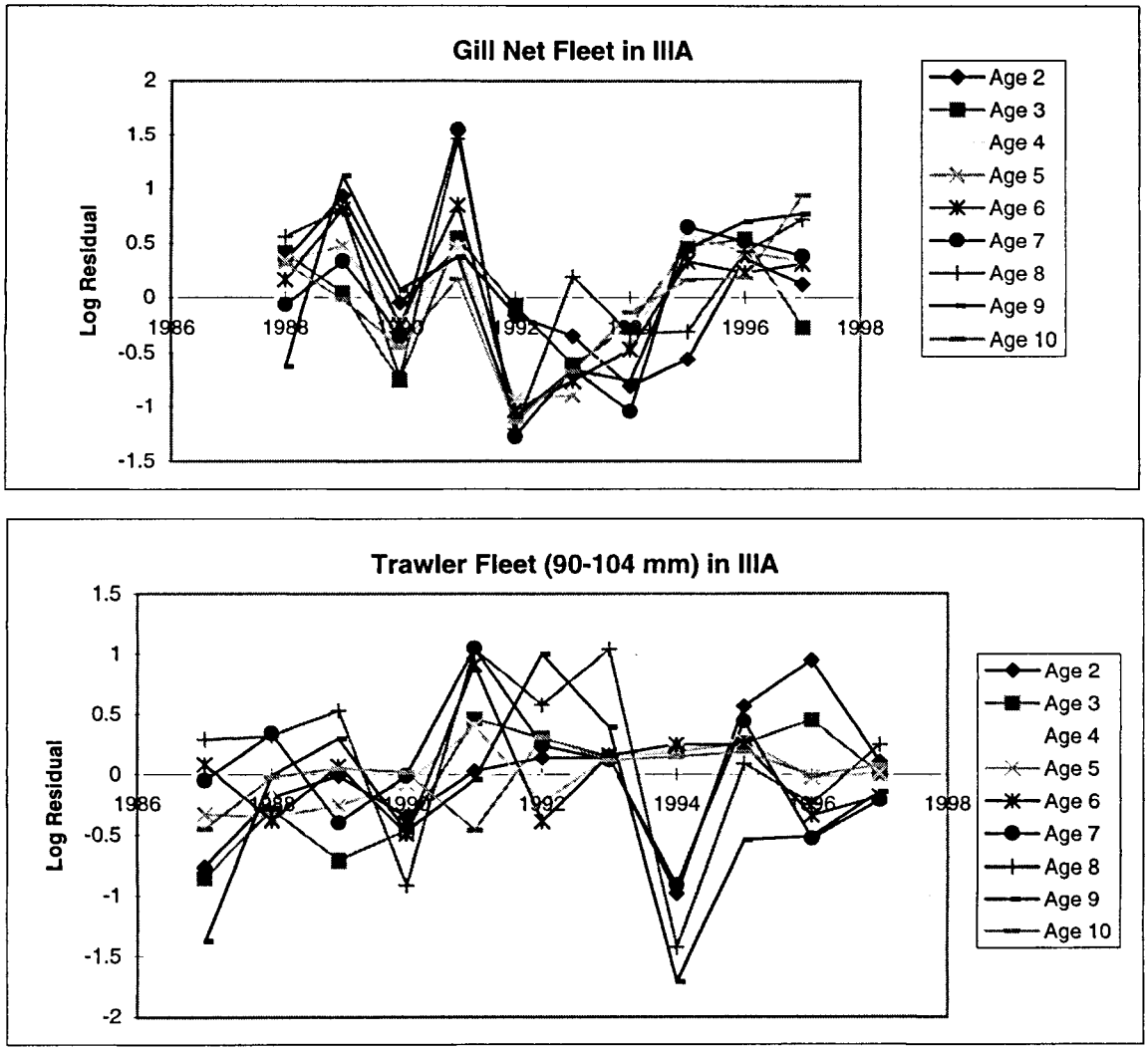


Figure 6.4. Abundances of 2-group sole recorded by IBTS surveys conducted in Kattegat and Skagerrak during February.
See 1997 WG report for raw data.

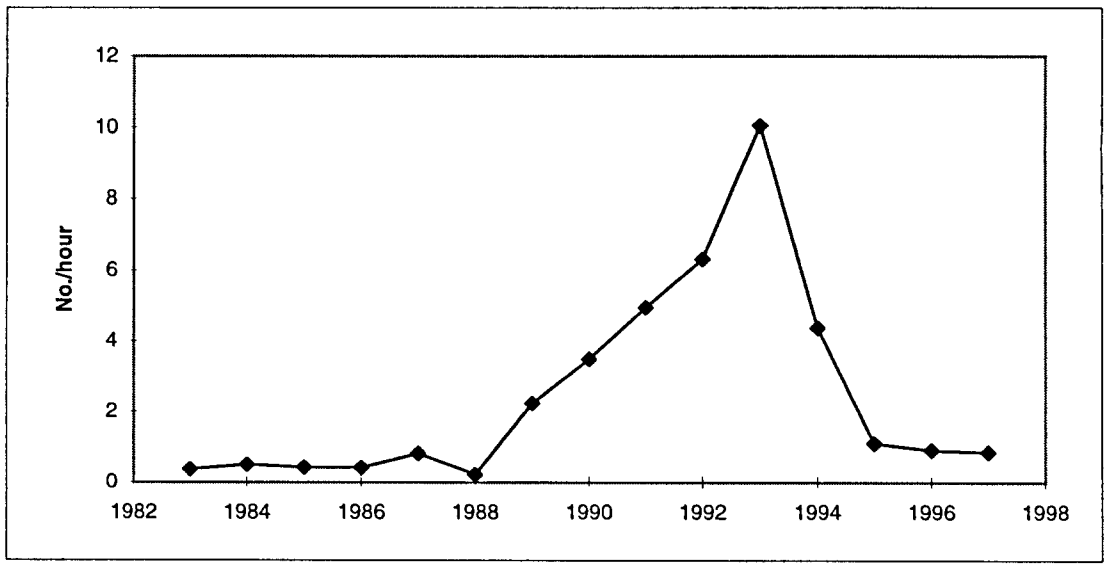
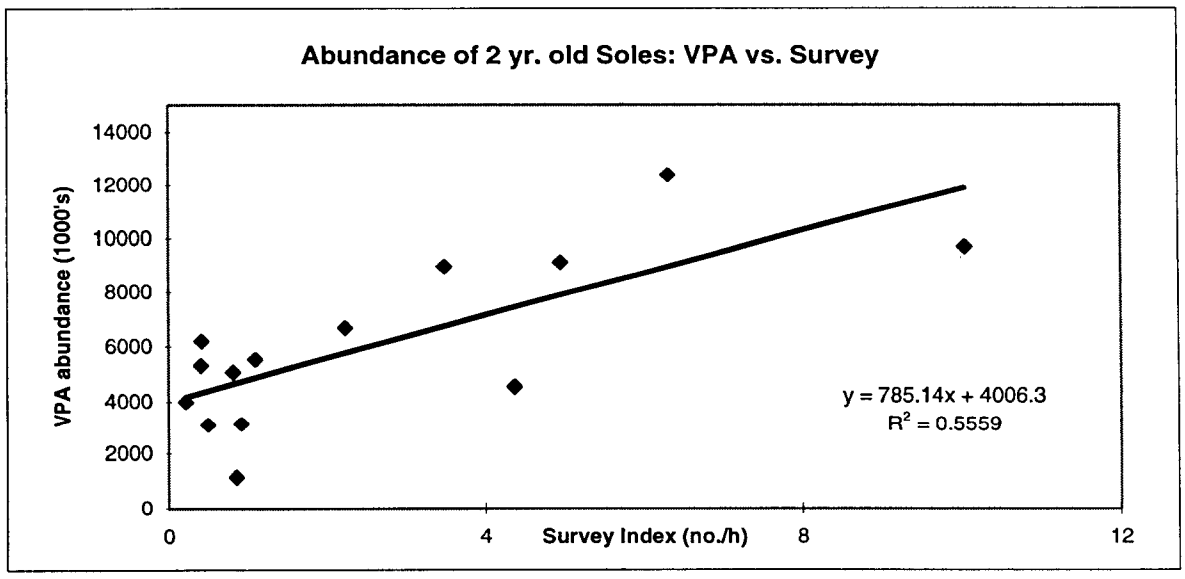
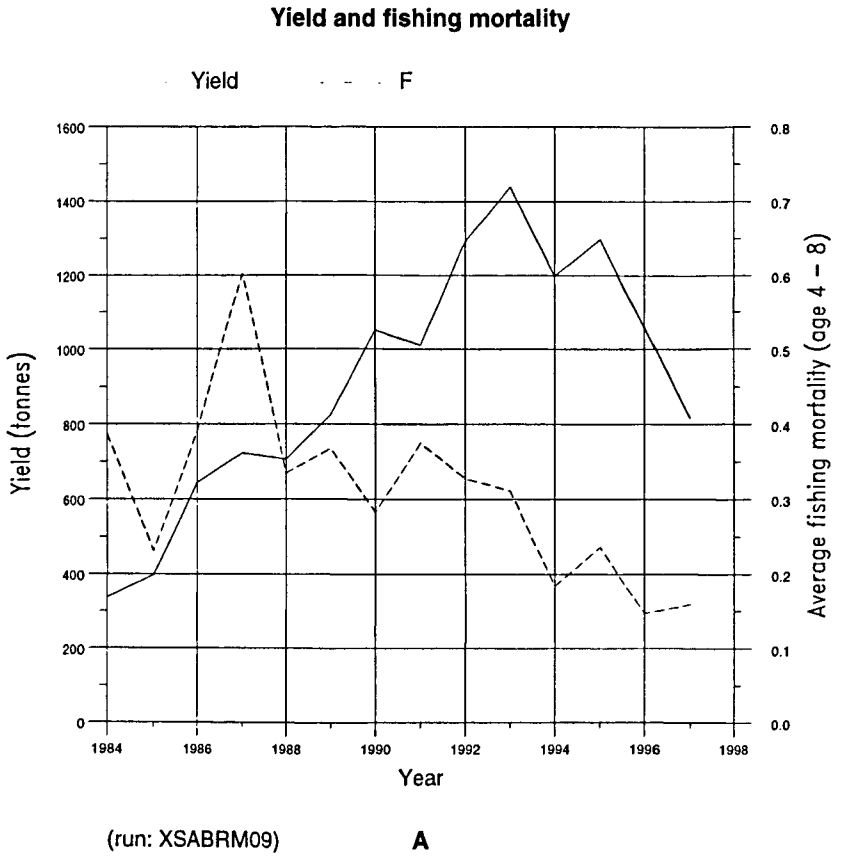


Figure 6.5. Comparison of abundances of 2-group soles estimated by XSA and measured by research surveys in February.
The relation is statistically significant (P = 0.002).



Fish Stock Summary
Sole in the Kattegat and Skagerrak (Fishing Area IIIa)
20-4-1998



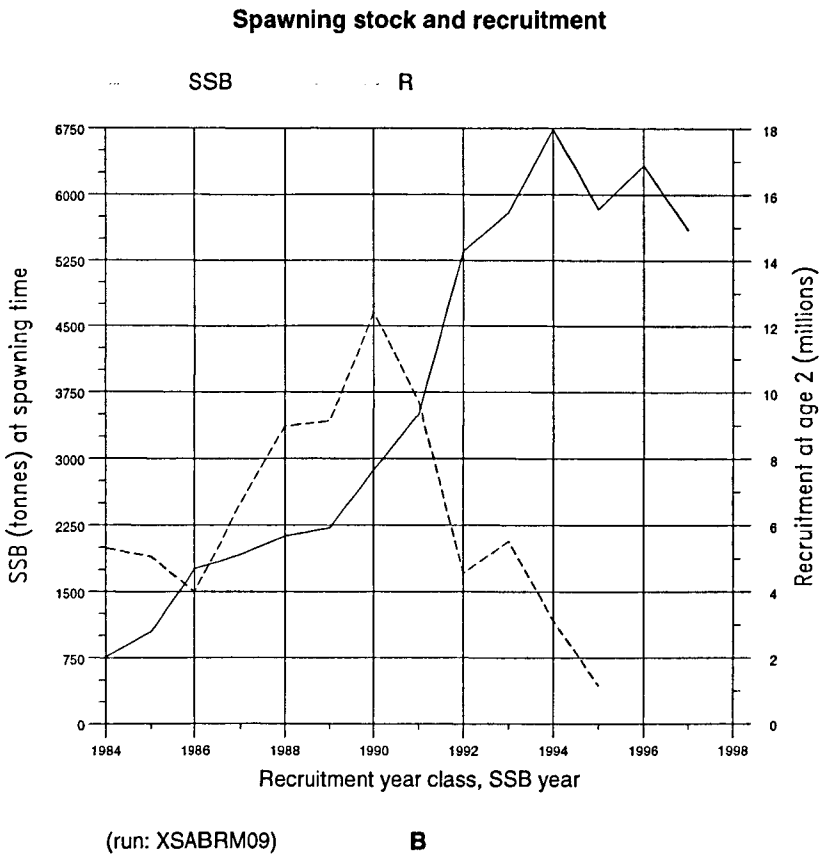
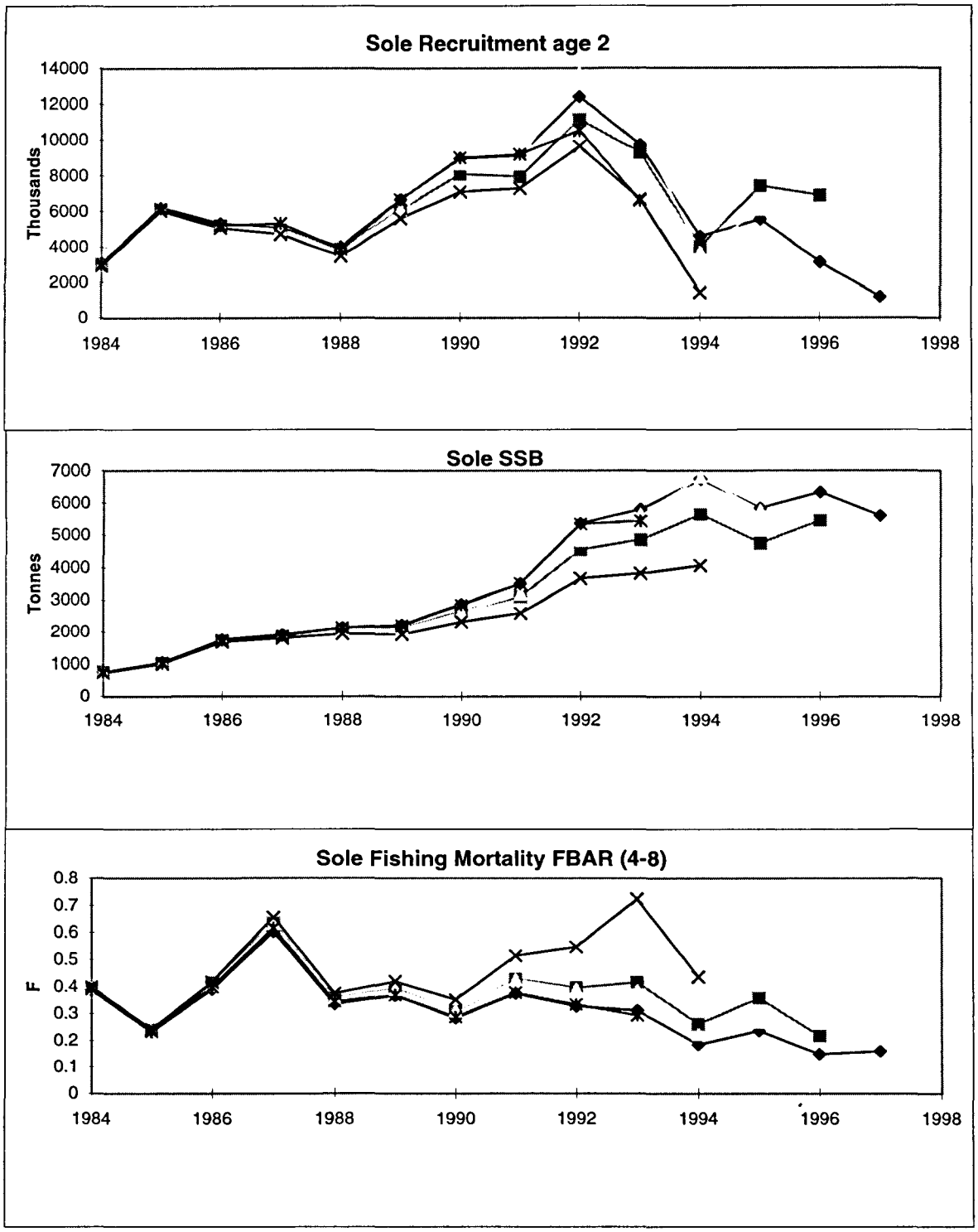


Figure 6.6

Figure 6.7. Retrospective XSA analyses of sole in Division IIIA.



o:\acfm\wgreps\wgbfas\reports\1998\F6-7.xls

Sole in the Kattegat and Skagerrak (Fishing Area IIIa)
20-4-1998

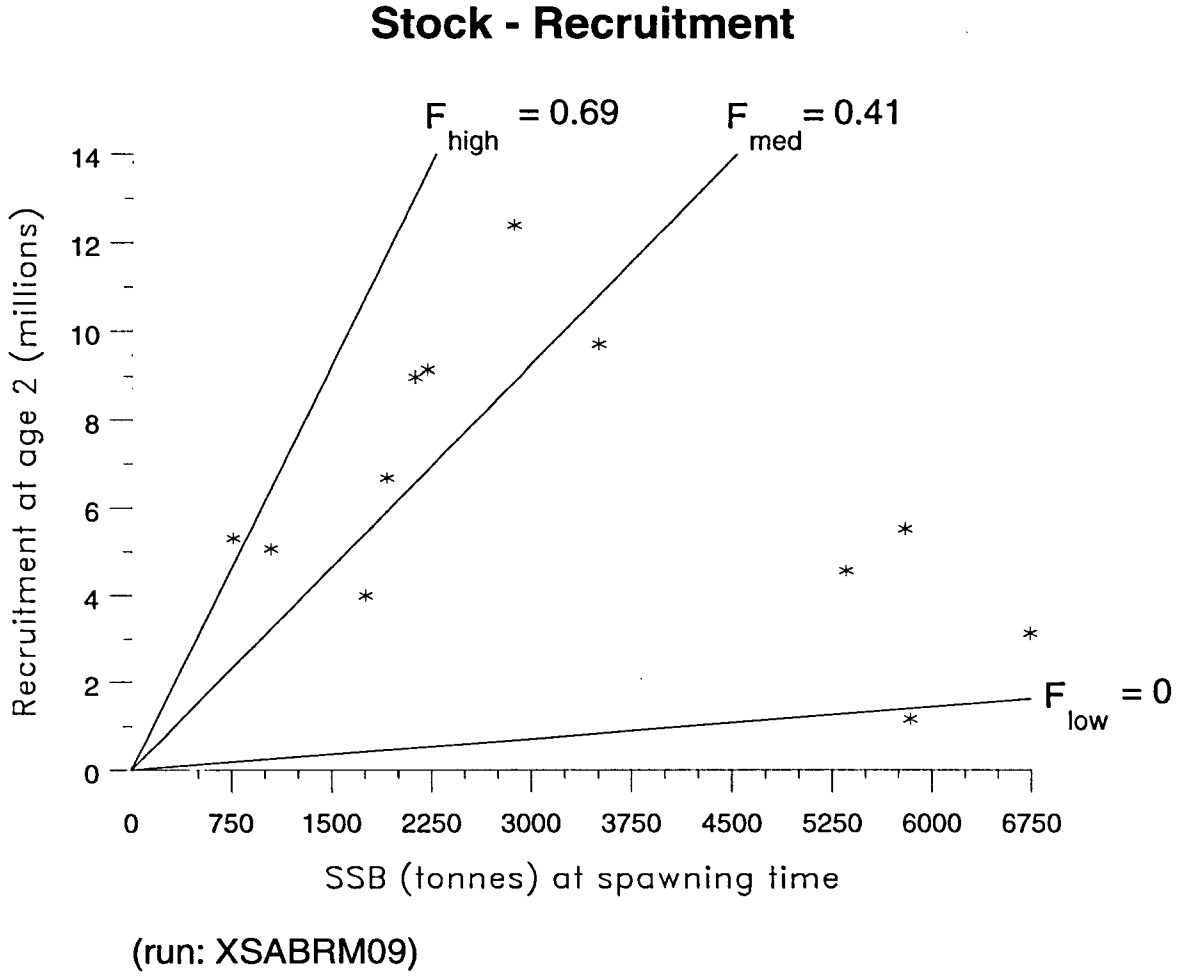
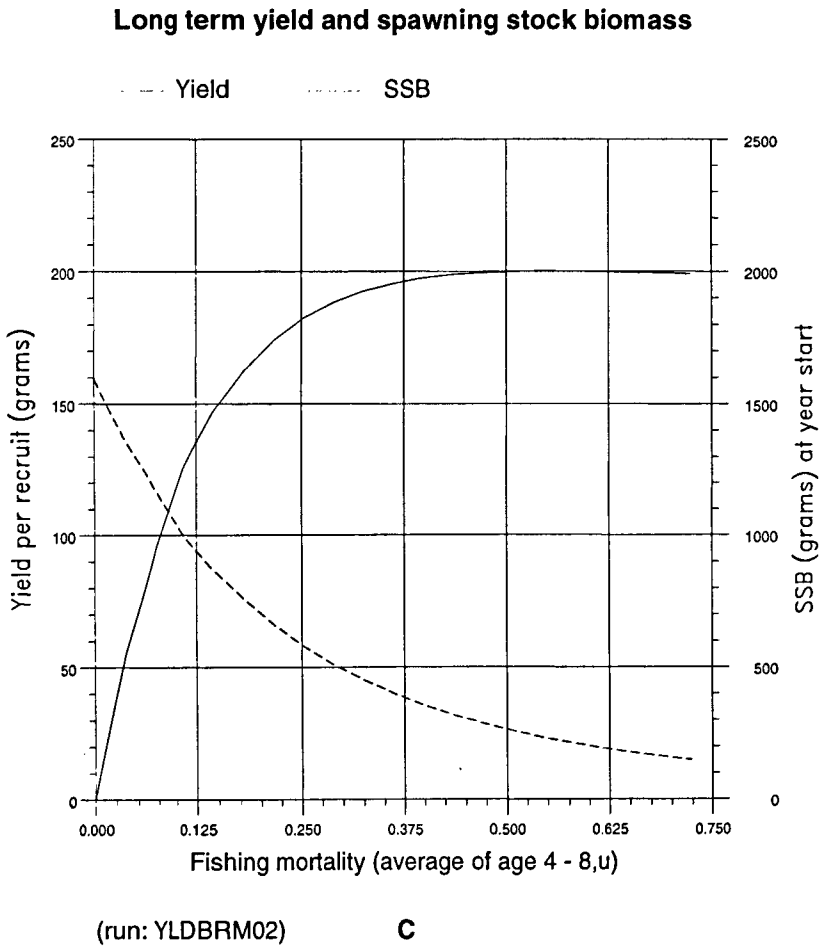


Figure 6.8

Fish Stock Summary
Sole in the Kattegat and Skagerrak (Fishing Area IIIa)
21-4-1998



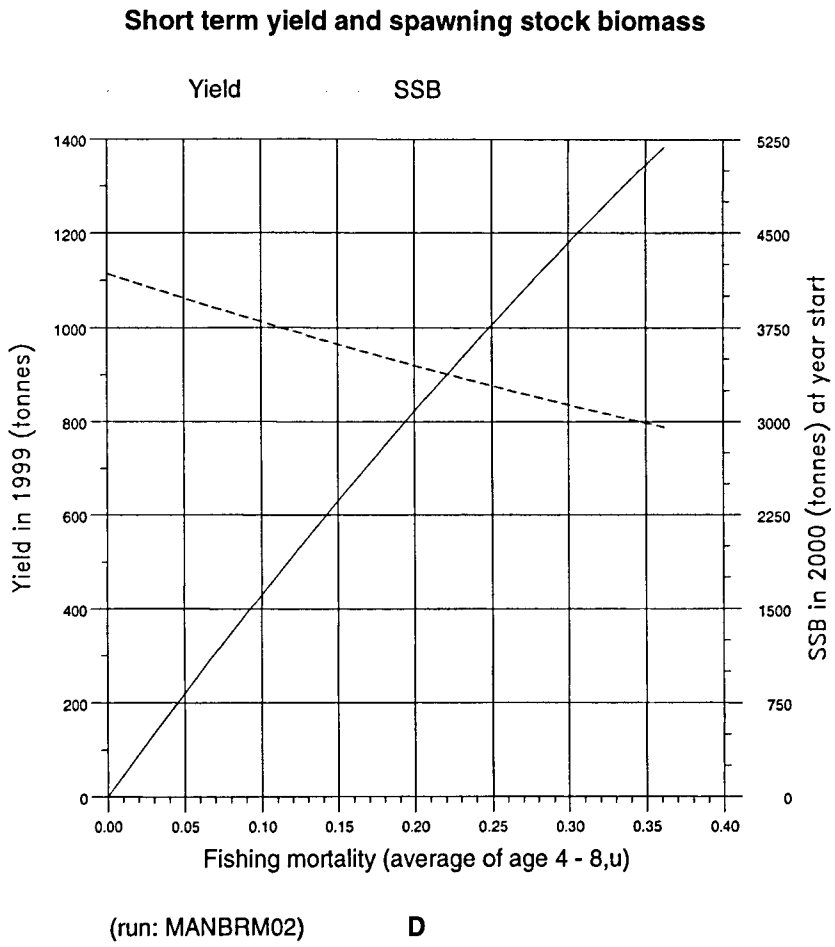


Figure 6.9

Figure 6.10. Medium term projections of sole spawning stock biomass in Division IIIA assuming the status quo fishing mortality (mean F(4-8) for 1995-1997), 60% of status quo and 140% of status quo. Each simulation was run 200 times.

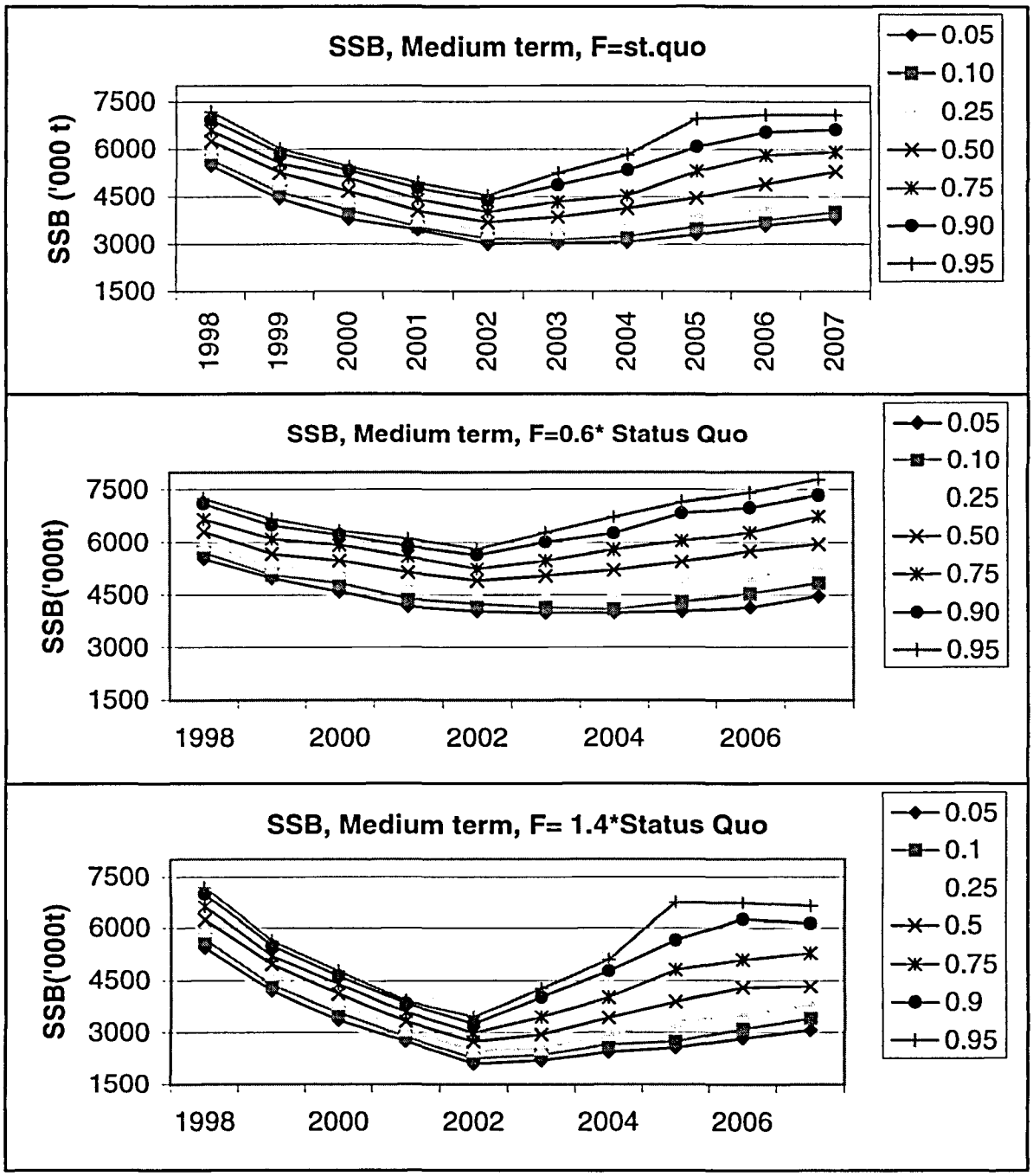


Figure 6.11. Medium term projections of sole recruitment in Division IIIA assuming the status quo fishing mortality (mean F(4-8) for 1995-1997), 60% of status quo and 140% of status quo. Each simulation was run 200 times.

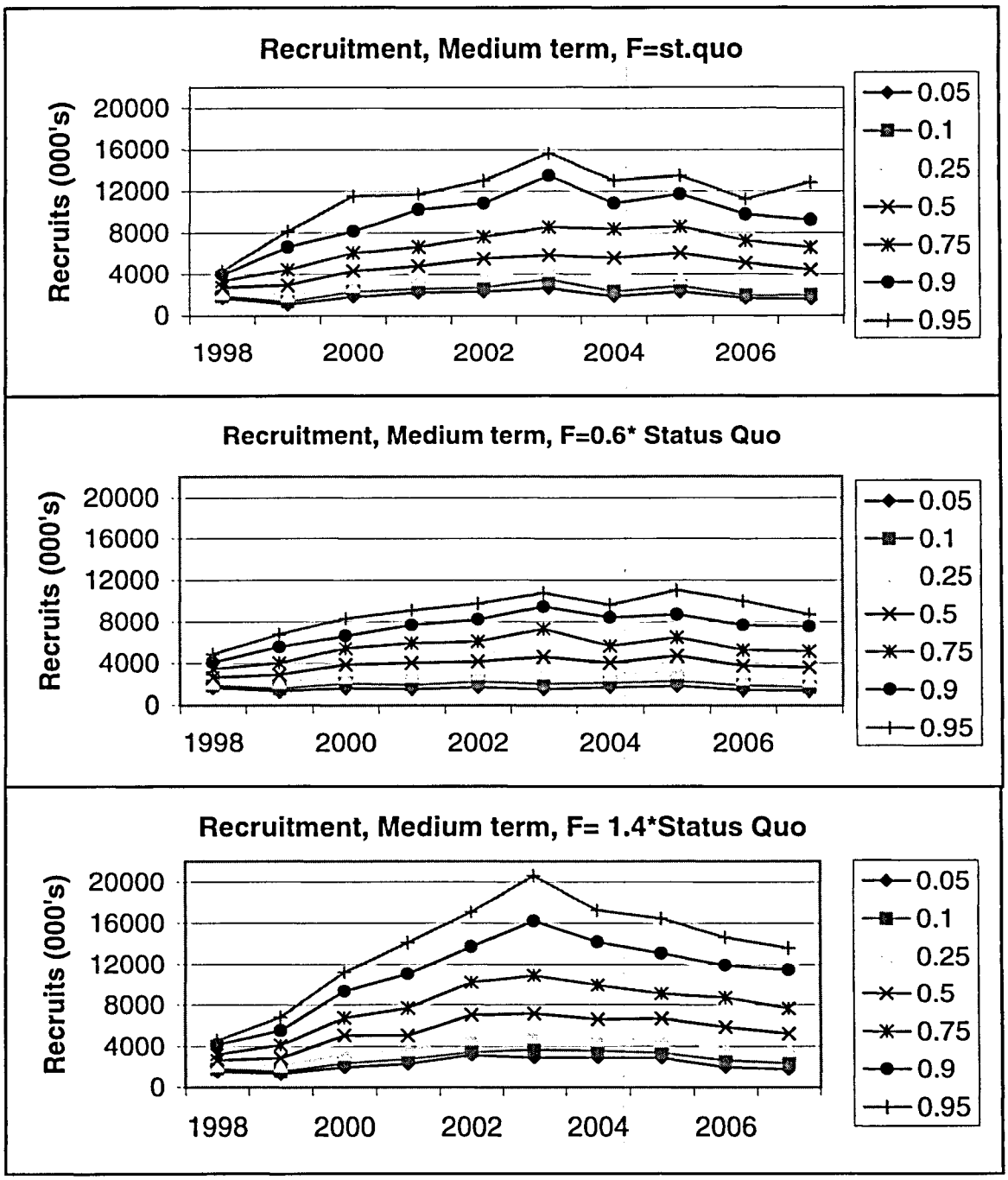
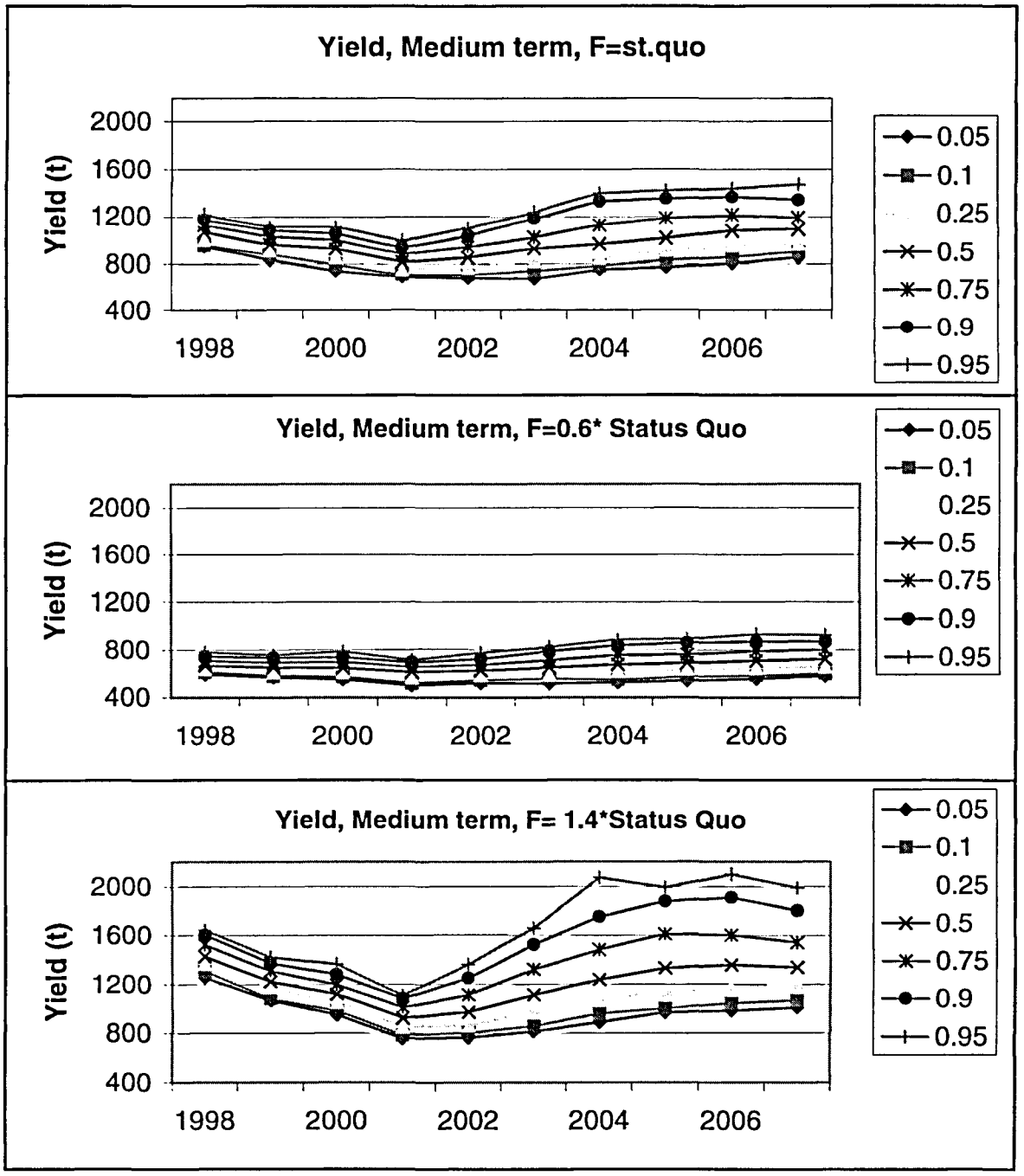


Figure 6.12. Medium term projections of sole fishing mortality in Division IIIA assuming the status quo fishing mortality (mean F(4-8) for 1995-1997), 60% of status quo and 140% of status quo. Each simulation was run 200 times.



7 FLOUNDER STOCKS IN THE BALTIC

According to the terms of reference, information on the state of flatfish stocks in the Baltic should be provided. Only for flounder in Sub-divisions 24 + 25 the stock assessment and the survey indices could be updated. For the other stocks the data base was still not sufficient. Considering the landings it was assumed that those stocks are moderately exploited.

Nominal landings of flounder in the Baltic are given by sub-division and country in Table 7.1.

A Working Paper "Information on flounder stocks in the Baltic Main Basin according to trawl survey in March 1998" was presented by E. Aro. The investigations comprise catch, length, age and maturity data of flounder in the Sub-divisions 24, 25, 26 and 28.

7.1 Flounder in Sub-division 22

Landings

The total landings amounted to about 2,011 t in 1997. This is an increase of 63% in comparison to 1996. These flounder landings were taken only by Denmark (1356 t) and Germany (655 t). The landings of Denmark increased by 30.3% and those of Germany by 28.8%. For Germany these landings were the highest on record. More effort was directed to the flounder fishery because the results of the cod fishery were bad and the abundance of flounder was higher in this year than in previous years. The increase of abundance was also observed during the German bottom trawl surveys in this sub-division.

Age composition

Catch at age data were not available.

7.2 Flounder in Sub-divisions 24 and 25

7.2.1 Catch trends

The 1997 total landings accumulated to 8,667 t and thus decreased by about 18% compared with 1996. The proportion of flounder landings in Sub-divisions 24 and 25 in relation to the total flounder landings in the Baltic decreased from 70 % in 1996 to 56 % in 1997. This is due to the increase of landings from Sub-divisions 22 and 28. In the period 1987–1993 the landings fluctuated between 5,000 t and 6,000 t. After this period the catches increased from 8,433 t in 1994 to 12,603 t in 1995 and decreased to 10,516 t in 1996 and in 1997 to 8,667 t. It seems that for 1994 and 1995 the total landings are overestimated due to misreporting of species in the landings.

7.2.2 Unallocated landings

There were no unallocated landings.

7.2.3 Discards

Discard data were not available.

7.2.4 Effort and CPUE data

Only survey data were available.

Table 7.2.4.1 shows the German catch data of the surveys on flounder. They were conducted by the research cutter "Clupea" in the Oderbank area in (Sub-division 24) in June/July every year. Because the survey area covered only a small part of the distribution area of the stock and the standard error of the log catchabilities estimated by XSA were in most cases much higher than 1, this survey was left out for tuning.

The data of the German stratified fixed station bottom trawl surveys carried out in November/December and February (Tables 7.2.4.2 and 7.2.4.3) were used for tuning XSA. But in the final run of this year's XSA the February survey had to be excluded because the regression statistics showed results that were not acceptable. From the November survey the data of 1990 were left out as it was done last year because it was supposed that there were exceptional conditions for the distribution of the flounder. The time series of the February surveys (Table 7.2.4.4) was too short to use them for tuning but it can give us already an indication of the stock abundance. All surveys mentioned in this paragraph were carried out by the RV "Eisbaer" and in the last years by the RV "Solea" using always the same trawl HG20/25. Further information regarding the catch data is given on the top of the tables.

7.2.5 Age composition

International catch at age data (Table 7.2.5) were available from Germany for Sub-division 24 and from Poland for Sub-division 25. The landings of the other countries were distributed according to the corresponding sub-division.

Because Poland summarised the older age groups in age group 8, and it was obvious from the time series of the catch at age data of the previous years that in some years it was done also, in all years the data were summarised as age group 8+.

Comparing the number at age group 2 of 1995 and 1996 with those of the previous years it is surprising that they are on the level of the years (1971–1974) when the minimum landing size was not implemented. From the ALKs it must be supposed that most flounders were below the minimum landing size.

7.2.6 Mean weight at age

Mean weight at age data (Table 7.2.6.1) of the catch were available from Germany for Sub-division 24 and from Poland for Sub-division 25. They were summarised by weighting them by the corresponding catch at age figures.

For the mean weights at age (Table 7.2.6.2) the time series implemented last year were used for the years 1971-1996. For 1997 the mean value of the combined (SD 24 and SD 25) values of 1993-1996 and 1998 were used because in 1997 there were only values for Sub-division 24.

7.2.7 Maturity ogives

No new data were available. Thus for all years the same proportions mature were used. They are 0 for age 2, 0.9 for age 3 and 1 for all older age groups.

7.2.8 Natural mortality

Natural mortality was assumed to be M=0.2 for all age groups and years.

7.2.9 Catch at age analysis

XSA was applied using the catch at age data from the surveys described above. The catchability of age group 2 was considered to be dependent on stock size and of age group 4 -the youngest fully recruited age group- as independent. The survivor estimates were shrunken towards the mean F of the final 4 years and the 3 oldest age groups because the catches were highest in the last three years and the mean fishing mortality was highest in the last three age groups, respectively. The tuning results are given in Table 7.2.9.1.

The fishing mortalities (Table 7.2.9.2) of the fully recruited age groups (mean of age groups 4–6) varied between 0.34 in 1978 and 0.78 in 1995 when the highest catch was recorded. On an average the fishing mortality amounted to $F_{(4-6,u)}$=0.54. The trend of the fishing mortality can be seen in Figure 7.2.9.1.

7.2.10 Recruitment estimates

The number of recruits as stock size at age 2 of the period investigated can be also seen in Table 7.2.9.2 and Figure 7.2.9.1.

In the periods 1971 to 1974 and 1995 to 1996 the number of recruits are influenced by the catch in number of age group 2, i.e. mostly by undersized flounders which were discarded in the other years.

7.2.11 Historical stock trends

The stock sizes and also the spawning stock sizes are presented in Table 7.2.9.2. The stock biomass was highest at the beginning of the seventieth. From 1977 it decreased continuously up to 23,387 t in 1988 and increased then again to a level of about 33 thousand t. The highest biomass was calculated for 1995. Thereafter the stock size decreased again.

The decrease of the stock size is also reflected in the catch/effort data of the German trawl surveys (Tables 7.2.4.2-7.2.4.4)

7.3 Flounder in Sub-division 26

Landings

The total landings amounted to 2,883 t in 1997. This means a decrease by 21% in comparison with 1996. The Polish fishery is mainly a gillnet fishery conducted along the coast whereas the Russian fishery was mainly a trawl fishery in 1997. The proportion of the Polish landings amounted to 60% of the international landings, those of Russia to 35%.

Catch at age in number

Poland and Russia supplied catch at age data and weight at age data in the catch. Poland supplied its data by year. Russian data are available for the 1st quarter from the trawl fishery and for 3rd quarter from the gillnet fishery. The catches of Germany, Latvia, Lithuania and Sweden were distributed according to the Russian data for trawl fishery.

Mean weight at age

Poland supplied mean weight at age data by year. The Russian mean weight at age data were supplied separately for trawl fishery and gillnet fishery. Therefore for the total landing in 1997 the mean weight at age were calculated using the corresponding catch in number dates of Poland, the Russian gillnet landings and all other landings of the trawl fishery for weighting.

7.4 Flounder in Sub-division 28

Landings

In 1997 the total landings amounted to 769 t. This is an increase by 167 % in comparison with 1996, but the last year results are still much lower than at the end of the period from 1973-1981 (mean landing = 2090 t). In 1995 and 1996 only Latvia carried out a directed flounder fishery in this area. In 1997 also Sweden started a directed flounder fishery. The landings of Estonia increased also in 1997.

Catch at age in number and mean weight at age

Estonia and Latvia supplied catch in number and weight at age data, Latvia by year and Estonia by quarter. Because there were no information for the Swedish landings which amounted to 48 % of the total landing in Sub-division 28, the catch in number for the total landing was not calculated.

7.5 Flounder in Sub-divisions 29 and 30

Landings

In 1997 the total landings amounted to 380 t in Sub-division 29 and 68 t in Sub-division 30. This is a decrease by 18 % and 13 %, respectively, compared with 1996. The flounder fishery in this area was carried out by Finland and Estonia. The Finnish landings contributed about 80% to the total landings. The landings of Estonia (only Sub-division 29) fluctuated between 3 t (1994) and 135 t (1991) and amounted to 96 t in 1997.

Catch at age in numbers and mean weight at age

Estonia supplied catch in number and weight at age data by quarter for Sub-division 29.

7.6 Flounder in Sub-division 32

Landings

The total landings amounted to 428 t in 1997. The landings were on the same level as in 1996. The flounder were mostly landed by Finland (95 % in 1994; 79% in 1995, 65 % in 1996, and 71% in 1997).The remaining portion was landed by Estonia.

Catch at age in numbers and mean weight at age

Catch at age in number and mean weight at age data by quarter were provided by Estonia. The total number at age landed from Sub-division 32 was not calculated because the landings of Estonia amounted only to 29 % of the total landings.

Table 7.1 Total landings (tonnes) of FLOUNDER in the Baltic by sub-division and country.(There are some gaps in the information. Therefore "Total" is preliminary.)

Year	Denmark[1]					Finland				German Dem. Rep.[2]			Germany, Fed. Rep.				Poland		Sweden[3]						
	22	23	24(25)	26	28	25	29[6]	30	32[7]	22	24	25(+26)	22	24(+25)	26	28	25(+24)	26	22	23	24	25	26	27	28	29
1973	1,983		386							181	1,624	1,516	349	4			1,580	2,070				502				
1974	2,097		2,578							165	1,482	654	304	3			1,635	2,473				470				
1975	1,992		1,678				113	22	47	163	1,469	406	469	1			1,871	2,585				400				
1976	2,038		482				118	23	59	174	1,556	901	392	2			1,549	2,289				400				
1977	1,974		389				115	32	56	555	2,708	1,096	393	4			2,071	2,089				416				
1978	2,965		415				174	61	155	348	2,572		477	1			996	2,106				346				
1979	2,451		405				192	54	153	189	2,509		259	3			1,230	1,860				315				
1980	2,185		286				194	69	165	138	2,775		212	1			1,613	1,380			16	46		20	181	32
1981	1,964		548				227	56	135	271	2,595		351	1			1,151	1,541			21	30		21	194	34
1982	1,563	104	257				219	58	144	263	3,202		248	1			2,484	1,623			22	33		65	16	3
1983	1,714	115	450				181	67	120	280	3,572		418	1			1,828	905			72	108		212	52	9
1984	1,733	85	306				174	108	135	349	2,719		371	1			2,471	1,288			18	27		53	13	2
1985	1,561	130	649				157	97	137	236	3,253		199	4			2,063	1,302			16	24		47	12	2
1986	1,525	65	1,558				199	128	181	127	2,838		125	10			3,030	1,784			20	31		60	15	3
1987	1,208	122	1,007				159	106	143	71	2,096		114	11			2,530	1,745			17	26		51	13	2
1988	1,162	125	990				177	118	159	92	2,981		133	5			1,728	1,292			23	35		68	17	3
1989	1,321	83	1,062				175	122	163	126	3,616		122	2			1,896	1,089			22	34		66	16	3
1990	941		1,389				219	81	161	52	1,622		183	10			1,617	599				120				
1991	925		1,497				236	81	167				246	1,814			2,008	1,905			24	31		88	20	
1992	713	185	975				405	40	627				227	1,972			1,877	1,869			41	88	3	86	11	3
1993	649	194	635				438	57	683				235	1,230			3,276	1,229		26	27	63	1	83	10	
1994	882	181	1,016				445	33	87				44	4,262	2	3	3,177	1,266		84	20	18	37	33	55	10
1995	859	231	2,110				398	28	131				286	2,825	4	40	7,437	1,482		58	28	186	7	81	18	
1996	1,041	227	2,306			1	365	78	271				189	1,322	10	9	6,069	2,556	2	58	101	718	48	114	31	
1997[5]	1,356		2,421	31	10	2	284	68	303				655	1,982	12	4	3,877	1,730		42	62	308	31	105	370	

Continued

Table 7.1 Continued

Year	USSR				Estonia					Latvia		Lithuania[8]		Russia		Total										
	26	28	29	32	25	26	28	29	32	26	28	25	26	26	28	22	23[1]	24	25[4]	26	27	28	29	30	32	Total
1973		2610														2,513		2,014	3,598	2,070		2,610				12,805
1974		2510														2,566		4,063	2,759	2,473		2,510				14,371
1975		6455														2,624		3,148	2,677	2,585		6,455	113	22	47	17,671
1976	471	1779	409	359												2,604		2,040	2,850	2,760		1,779	527	23	418	13,001
1977	210	1081	321	414												2,922		3,101	3,583	2,299		1,081	436	32	470	13,924
1978	288	1290	334	395												3,790		2,988	1,342	2,394		1,290	508	61	550	12,923
1979	158	1170	330	1012												2,899		2,917	1,545	2,018		1,170	522	54	1,165	12,290
1980	93	798	334	1080												2,535		3,078	1,659	1,473	20	979	560	69	1,245	11,618
1981	58	742	445	1078												2,586		3,165	1,181	1,599	21	936	706	56	1,213	11,463
1982	195	665	615	1121												2,074	104	3,482	2,517	1,818	65	681	837	58	1,265	12,901
1983	209	551	497	1114												2,412	115	4,095	1,936	1,114	212	603	687	67	1,234	12,475
1984	145	202	286	1226												2,453	85	3,044	2,498	1,433	53	215	462	108	1,361	11,712
1985	268	189	265	806												1,996	130	3,922	2,087	1,570	47	201	424	97	943	11,417
1986	442	159	281	556												1,777	65	4,426	3,061	2,226	60	174	483	128	737	13,137
1987	1315	203	279	397												1,393	122	3,131	2,556	3,060	51	216	440	106	540	11,615
1988	578	439	257	331												1,387	125	3,999	1,763	1,870	68	456	437	118	490	10,713
1989	783	512	214	214												1,569	83	4,702	1,930	1,872	66	528	392	122	377	11,641
1990	752	390	144	141												1,176		3,021	1,737	1,351		390	363	81	302	8,421
1991						49	1	135	51	123	323		125	216	10	1,171		3,335	2,039	2,418	88	354	371	81	218	10,075
1992							47	47	46	26	664		483	146		940	185	2,988	1,965	2,527	86	722	455	40	673	10,581
1993							52	86	55	99	389			225		884	220	1,892	3,339	1,554	83	451	524	57	738	9,742
1994								3	4	31	276			167		926	265	5,298	3,195	1,503	33	334	458	33	91	12,136
1995					8		16	52	35	39	322	8	53	271		1,145	289	4,963	7,639	1,856	81	396	450	28	166	17,013
1996							44	99	145	74	215		231	740		1,232	285	3,729	6,788	3,659	114	299	464	78	416	17,064
1997[5]					15		101	96	125	78	284			1001		2,011	42	4,465	4,202	2,883	105	769	380	68	428	15,353

[1] For the years 1973-1981 the catches of Sub-division 23 are included in Sub-division 22.
[2] From October-December 1990 landings of Germany, Fed. Rep. are included.
[3] For the years 1973-1979 and 1990 the catches of Sub-divisions 24-29 are included in Sub-division 25.
[4] For the years 1973-1979 and 1990 the Swedish catches of Sub-divisions 24-29 are included in Sub-division 25.
[5] Provisional.
[6] Landings of Sub-division 27 are included
[7] Landings of Sub-division 31 are included
[8] Lithuania, for 1993, 1994 and 1997 no data reported

Table 7.2.4.1 Flounder catches per hour of the German youngfish surveys for flounder in the Oderbank area (Sub-division 24) in June/July.

Year [1]	Catch	Catch in number							
	[kg]	Total	AG 1	AG 2	AG 3	AG 4	AG 5	AG 6	AG 7
1978	100.0	1590	118	1329	76	48	14	5	0
1979	72.0	752	60	332	330	22	7	1	0
1980	80.0	607	48	334	185	33	5	1	1
1981	94.0	934	128	624	135	35	9	3	0
1982	77.2	531	27	282	164	45	6	6	1
1983	82.0	551	7	192	308	38	1	2	3
1984	81.0	694	33	449	147	55	4	4	2
1985	58.0	381	5	123	217	29	6	1	0
1986	51.0	353	15	100	139	79	13	4	3
1987	76.6	1047	84	805	154	3	1	0	0
1988	47.5	396	3	177	200	13	1	1	1
1989	14.9	158	7	103	44	4	0	0	0
1990	88.5	639	41	310	203	75	7	2	1
1991	106.0	1077	87	573	308	89	12	4	4
1992	57.0	497	78	194	205	19	1	0	0
1993	44.4	310	37	173	85	5	4	4	2
1994	18.5	129	3	36	64	22	2	1	1
1995	20.1	138	6	63	57	10	2	0	0
1996	23.4	160	5	58	88	8	1	0	0
1997	19.1	116	1	48	55	11	1	0	0

[1] Up to 1982 commercial cutters (80-120 HP), from 1983 research cutter "Clupea" (120 HP).

Table 7.2.4.2 Flounder catches per half an hour (mean of the strata means 30-39m and 40-49m weighted by stratum areas) of the German bottom trawl surveys in ICES SD 24 in November/December.

Year	Catch	Catch in number							
	[kg]	Total	AG 2	AG 3	AG 4	AG 5	AG 6	AG 7	AG 8	AG 9+
1983	7.11	16.7	0.3	1.1	6.3	4.6	2.5	1.5	0.4	0.0
1984	6.87	20.1	1.1	3.1	8.8	4.2	1.9	0.5	0.5	0.0
1985	13.28	42.0	0.4	13.4	14.2	8.7	3.0	0.2	1.0	1.1
1986	5.19	16.5	0.0	1.2	8.7	3.7	1.3	0.9	0.5	0.2
1987	7.80	30.7	4.7	12.4	8.3	3.4	0.7	0.7	0.5	0.0
1988	2.70	12.0	0.2	8.0	2.7	0.5	0.2	0.2	0.2	0.0
1989	6.59	21.1	1.0	6.4	8.8	3.3	0.9	0.5	0.0	0.0
1990	59.63	213.0	28.3	78.8	52.2	37.5	10.4	4.3	0.9	0.6
1991	12.22	44.0	2.2	11.1	19.4	7.1	2.7	0.7	0.2	0.6
1992	11.00	34.5	3.4	20.1	7.9	2.0	0.7	0.3	0.0	0.0
1993	19.48	59.4	5.3	33.0	12.8	6.7	0.9	0.4	0.3	0.0
1994	12.07	37.4	1.3	17.3	11.5	5.0	1.4	0.7	0.1	0.1
1995	8.87	20.9	1.4	7.0	5.5	3.4	1.8	1.0	0.7	0.2
1996	8.68	19.6	0.6	4.4	5.3	3.6	1.9	1.4	0.9	1.0
1997	6.40	22.9	3.3	10.9	4.9	2.0	1.0	0.5	0.2	0.1

Table 7.2.4.3 Flounder catches per half an hour (mean of the strata means 30-39m and 40-49m weighted by stratum areas) of the German bottom trawl surveys in ICES SD 24 in February.

Year	Catch	Catch in number							
	[kg]	Total	AG 2	AG 3	AG 4	AG 5	AG 6	AG 7	AG 8	AG 9+
1992	20.87	90.9	0.2	14.2	37.4	24.1	9.4	3.4	1.4	0.8
1993	21.92	80.4	4.3	38.9	24.9	10.4	1.3	0.5	0.1	0.0
1994	17.39	58.1	1.6	28.9	17.2	7.0	2.2	0.7	0.4	0.1
1995	26.65	89.0	5.0	36.5	27.8	13.2	3.8	2.2	0.5	0.0
1996	10.62	35.0	3.9	13.1	8.3	5.9	2.1	1.0	0.4	0.3
1997	8.72	36.5	4.1	16.0	10.4	4.0	1.1	0.5	0.3	0.1
1998	11.65	50.9	3.9	31.0	11.3	3.0	0.7	0.5	0.4	0.2

Table 7.2.4.4 Flounder catches per half an hour (mean of the strata means from 50 m up to the deepest stratum weighted by stratum areas) of the German bottom trawl surveys in ICES SD 25 in February .

Year	Catch	Catch in number							
	[kg]	Total	AG 2	AG 3	AG 4	AG 5	AG 6	AG 7	AG 8	AG 9+
1993	26.61	89.4	2.2	22.9	41.9	19.2	1.8	1.0	0.3	0.1
1994	38.89	123.3	1.3	20.7	46.2	33.1	17.3	3.0	1.4	0.3
1995	50.09	154.3	3.6	47.4	57.1	28.8	11.2	4.1	1.5	0.6
1996	56.19	172.5	2.2	61.6	55.0	29.6	11.4	7.3	3.2	2.2
1997	No survey.									
1998	21.70	80.3	0.2	21.6	30.4	17.6	7.4	2.4	0.7	0.1

Table 7.2.5 FLOUNDER in SD 24 and 25. Catch in Numbers (Thousands)

CANUM01: Catch in numbers at age (Thousands)

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1971	578	4603	9346	4337	1633	1124	382
1972	62	2979	10245	7884	4132	1985	625
1973	120	3327	14709	8734	3307	1538	947
1974	14	2998	15033	9564	2833	997	782
1975	106	4789	14456	5405	2559	773	628
1976	28	1314	8263	7569	3861	1422	984
1977	2	703	7130	12524	4902	1990	850
1978	0	1210	5030	3834	2356	874	552
1979	0	2503	6059	3797	4057	1869	962
1980	0	940	5100	4997	1944	861	817
1981	0	1431	4472	3874	2138	1075	1073
1982	0	3450	5493	3156	2943	1436	1316
1983	0	3528	10712	4416	2096	976	726
1984	0	3348	5519	4847	2556	1170	1007
1985	0	5388	5286	3777	1605	1192	862
1986	0	4432	7830	4864	1975	1628	1635
1987	0	2712	5440	3218	1999	1018	1007
1988	12	5188	5240	4452	2038	870	872
1989	15	5123	9923	3135	1589	723	738
1990	41	5640	6081	2719	1188	529	533
1991	246	4865	7984	3185	1489	728	434
1992	0	1851	5031	3485	1605	665	727
1993	127	1946	6276	7138	3106	685	380
1994	0	4329	5949	4570	2746	748	450
1995	1125	8053	16108	8892	4869	1244	603
1996	640	6757	8354	5553	3180	1959	1620
1997	73	6584	8192	4251	2073	1237	1415

Table 7.2.6.1 FLOUNDER in SD 24 and 25. Mean weight in Catch (kg)

WECA01: Mean weight in Catch (kg)

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1971	0.109	0.171	0.274	0.334	0.388	0.465	0.493
1972	0.095	0.142	0.195	0.270	0.309	0.449	0.620
1973	0.124	0.173	0.240	0.307	0.369	0.491	0.493
1974	0.124	0.173	0.240	0.307	0.369	0.491	0.493
1975	0.158	0.205	0.243	0.325	0.416	0.546	0.682
1976	0.122	0.204	0.237	0.302	0.391	0.485	0.593
1977	0.105	0.199	0.239	0.269	0.373	0.472	0.608
1978	0.103	0.209	0.242	0.298	0.393	0.519	0.598
1979	0.103	0.203	0.260	0.313	0.362	0.445	0.509
1980	0.103	0.207	0.253	0.320	0.394	0.498	0.521
1981	0.103	0.195	0.246	0.313	0.413	0.458	0.537
1982	0.103	0.232	0.265	0.328	0.396	0.492	0.628
1983	0.103	0.233	0.268	0.325	0.390	0.497	0.640
1984	0.103	0.227	0.253	0.314	0.394	0.493	0.642
1985	0.103	0.216	0.253	0.310	0.381	0.461	0.593
1986	0.103	0.216	0.253	0.310	0.381	0.461	0.593
1987	0.103	0.243	0.302	0.374	0.427	0.541	0.764
1988	0.170	0.233	0.273	0.318	0.329	0.520	0.671
1989	0.080	0.238	0.286	0.348	0.410	0.464	0.672
1990	0.121	0.196	0.262	0.315	0.390	0.474	0.623
1991	0.103	0.212	0.261	0.328	0.394	0.466	0.631
1992	0.103	0.217	0.239	0.310	0.399	0.465	0.630
1993	0.230	0.193	0.225	0.291	0.306	0.437	0.517
1994	0.218	0.225	0.278	0.338	0.360	0.479	0.641
1995	0.190	0.253	0.275	0.328	0.390	0.534	0.693
1996	0.156	0.254	0.317	0.412	0.489	0.673	0.821
1997	0.112	0.252	0.291	0.349	0.434	0.530	0.553

Table 7.2.6.2 FLOUNDER in SD 24 and 25. Mean weight in Stock (kg)

WEST01: Mean weight in Stock (kg)

Year	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1971	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1972	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1973	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1974	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1975	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1976	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1977	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1978	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1979	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1980	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1981	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1982	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1983	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1984	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1985	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1986	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1987	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1988	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1989	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1990	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1991	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1992	0.103	0.202	0.290	0.406	0.547	0.681	0.879
1993	0.119	0.193	0.290	0.427	0.596	0.713	0.795
1994	0.099	0.198	0.277	0.380	0.483	0.682	0.837
1995	0.112	0.213	0.293	0.412	0.595	0.676	0.965
1996	0.083	0.204	0.301	0.405	0.512	0.652	0.918
1997	0.096	0.204	0.287	0.398	0.544	0.684	0.873

Table 7.2.9.1

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Lowestoft VPA Version 3.1

   22-Apr-98  17:06:54

 Extended Survivors Analysis

 Flounder in 24 & 25 (run: XSAHMU03/X03)

 CPUE data from file /users/fish/ifad/ifapwork/wgbfas/fle_2425/FLEET.X03

 Catch data for  27 years. 1971 to 1997. Ages  2 to   8.

      Fleet,            First, Last, First, Last, Alpha,  Beta
                ,        year, year,  age ,  age
 FLT02: FLT02: DEU BT,   1983, 1997,   2,     7,   .870,   .960


 Time series weights :

      Tapered time weighting applied
      Power =    3 over  20 years


 Catchability analysis :

      Catchability dependent on stock size for ages <    3

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


      Catchability independent of age for ages >=    4


 Terminal population estimation :

      Survivor estimates shrunk towards the mean F
      of the final   4 years or the   3 oldest ages.

      S.E. of the mean to which the estimates  are shrunk =    .500

      Minimum standard error for population
      estimates derived from each fleet =    .300

      Prior weighting not applied


 Tuning converged after   14 iterations


 Regression weights
       ,  .751,  .820,  .877,  .921,  .954,  .976,  .990,  .997, 1.000, 1.000


 Fishing mortalities
    Age,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996,  1997

      2,  .000,  .000,  .001,  .006,  .000,  .003,  .000,  .032,  .018,  .002
      3,  .187,  .247,  .203,  .166,  .057,  .060,  .117,  .307,  .268,  .252
      4,  .460,  .656,  .521,  .493,  .258,  .276,  .262,  .828,  .609,  .606
      5,  .752,  .557,  .371,  .576,  .415,  .713,  .333,  .793,  .782,  .736
      6,  .771,  .671,  .423,  .358,  .652,  .819,  .671,  .722,  .751,  .778
      7,  .791,  .701,  .493,  .501,  .267,  .653,  .467,  .754,  .734,  .759


 Log catchability residuals.


 Fleet : FLT02: FLT02: DEU BT

  Age  ,  1983,  1984,  1985,  1986,  1987
     2 ,  -.12,   .06,  -.03, 99.99,   .23
     3 , -1.96,  -.91,   .53, -1.78,   .66
     4 ,  -.39,   .18,   .65,   .35,   .25
     5 ,  -.02,  -.07,   .85,   .18,   .15
     6 ,   .13,  -.17,   .14,  -.32,  -.58
     7 ,   .41,  -.75, -1.69,  -.25,  -.16
```

Table 7.2.9.1 (Cont'd)

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
2	-.17	-.11	99.99	-.04	.06	-.01	-.04	.00	-.19	.30
3	-.15	-.06	99.99	.11	.55	1.05	.30	-.18	-.62	.25
4	-.74	.25	99.99	.90	-.29	.05	-.07	-.39	-.18	-.25
5	-1.63	.21	99.99	1.00	-.76	.42	-.37	-.34	.17	-.23
6	-1.74	-.17	99.99	.22	-.47	-.46	-.27	-.50	.03	-.13
7	-.85	.09	99.99	-.01	.83	-.17	-.12	.34	.18	-.34

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

Age	3	4	5	6	7
Mean Log q	-7.1432	-6.6326	-6.6326	-6.6326	-6.6326
S.E(Log q)	.7578	.4410	.6699	.5888	.5725

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	.21	2.295	10.34	.51	13	.16	-9.35

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
3	.39	1.211	9.13	.31	14	.29	-7.14
4	1.17	-.214	6.05	.15	14	.54	-6.63
5	1.63	-.516	5.02	.07	14	1.13	-6.69
6	.77	.582	7.33	.43	14	.38	-6.96
7	.81	.401	6.94	.33	14	.47	-6.74

1

XSA population numbers (Thousands)

YEAR	AGE 2	3	4	5	6	7
1988	3.16E+04	3.36E+04	1.57E+04	9.31E+03	4.19E+03	1.76E+03
1989	4.15E+04	2.59E+04	2.28E+04	8.12E+03	3.59E+03	1.59E+03
1990	4.31E+04	3.39E+04	1.65E+04	9.69E+03	3.81E+03	1.50E+03
1991	4.56E+04	3.52E+04	2.27E+04	8.04E+03	5.47E+03	2.04E+03
1992	4.51E+04	3.71E+04	2.45E+04	1.13E+04	3.70E+03	3.13E+03
1993	5.32E+04	3.70E+04	2.87E+04	1.55E+04	6.14E+03	1.58E+03
1994	4.11E+04	4.34E+04	2.85E+04	1.78E+04	6.21E+03	2.21E+03
1995	4.01E+04	3.36E+04	3.16E+04	1.80E+04	1.05E+04	2.60E+03
1996	4.06E+04	3.18E+04	2.02E+04	1.13E+04	6.65E+03	4.16E+03
1997	3.55E+04	3.26E+04	1.99E+04	9.02E+03	4.24E+03	2.57E+03

Estimated population abundance at 1st Jan 1998

	.00E+00	2.90E+04	2.08E+04	8.89E+03	3.54E+03	1.59E+03

Taper weighted geometric mean of the VPA populations:

	3.97E+04	3.24E+04	2.21E+04	1.13E+04	5.34E+03	2.42E+03

Standard error of the weighted Log(VPA populations) :

	.1679	.1739	.2208	.2826	.3152	.3421

Table 7.2.9.2

Run title : Flounder in 24 & 25 (run: XSAHMU03/X03)

At 22-Apr-98 17:09:23

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

,	RECRUITS, Age 2	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 4- 6,	FBARC,
1971,	65927,	38786,	31102,	4395,	.1413,	.3578,	.3289,
1972,	61759,	42164,	34723,	5685,	.1637,	.6511,	.5583,
1973,	64427,	43069,	35412,	5458,	.1541,	.7330,	.6120,
1974,	65097,	43003,	35235,	6596,	.1872,	.6805,	.5928,
1975,	39382,	41372,	36240,	5763,	.1590,	.4501,	.4115,
1976,	32132,	40016,	36057,	4780,	.1326,	.4628,	.4204,
1977,	38671,	36464,	31950,	5989,	.1874,	.6804,	.6149,
1978,	34510,	30731,	26537,	4960,	.1869,	.3377,	.3124,
1979,	28697,	31189,	27662,	5593,	.2022,	.5096,	.4272,
1980,	34884,	28616,	24548,	5058,	.2060,	.3858,	.3584,
1981,	46363,	31068,	25716,	4532,	.1762,	.3681,	.3351,
1982,	33260,	32015,	27823,	6002,	.2157,	.4554,	.3814,
1983,	32726,	29426,	25505,	5926,	.2323,	.4961,	.4403,
1984,	35986,	28198,	23950,	5554,	.2319,	.4828,	.4032,
1985,	31909,	26755,	22874,	5664,	.2476,	.3969,	.3712,
1986,	27087,	26796,	23478,	6404,	.2728,	.6087,	.5176,
1987,	41018,	23580,	18907,	5687,	.3008,	.5532,	.4454,
1988,	31606,	23387,	19453,	5762,	.2962,	.6612,	.5228,
1989,	41471,	23852,	19058,	6632,	.3480,	.6280,	.5254,
1990,	43094,	24449,	19325,	4607,	.2384,	.4385,	.4030,
1991,	45613,	27105,	21695,	5374,	.2477,	.4754,	.4264,
1992,	45148,	30999,	25599,	4121,	.1610,	.4417,	.3688,
1993,	53155,	33864,	26825,	5745,	.2142,	.6030,	.5413,
1994,	41078,	32946,	28020,	8493,	.3031,	.4222,	.3662,
1995,	40070,	37493,	32289,	12603,	.3903,	.7808,	.6126,
1996,	40585,	29768,	25751,	10516,	.4084,	.7140,	.5400,
1997,	35455,	25962,	21892,	8667,	.3959,	.7067,	.5470,
Arith. Mean	, 41893,	31966,	26949,	6169,	.2371,	.5364,	.4587,
0 Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),			

Flounder in Baltic Fishing Areas 24 and 25
22-4-1998

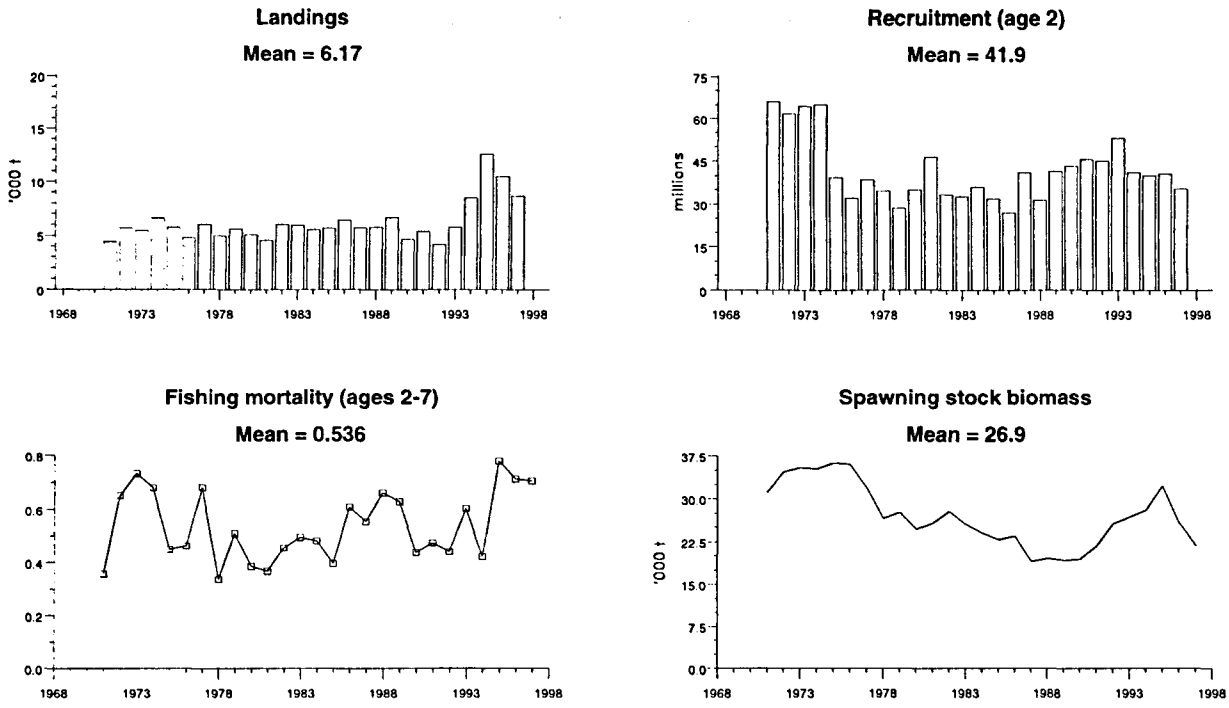

Figure 7.2.9.1

8 PLAICE, TURBOT, DAB AND BRILL IN THE BALTIC

The landings of plaice, turbot, dab and brill are presented by sub-divisions and countries in Tables 8.1-8.4.

In 1997 1,550 t plaice were landed. This is on the level of the two years before. The landings were mainly taken from Sub-division 22 (61% in 1997).

The landings of turbot increased from 1991 onward and reached an amount of 1,211 t in 1996. In 1997 the landings decreased to 998 t. The lowest landing on record was 42 t for 1965.

In 1997 the landings of dab decreased to the level of the seventies (1,248 t), compared to 1996 by 44 %. Considering the time series of the landings from Sub-division 22 it has to be taken in mind that the exceptionally high landings reported for 1994 and 1995 are due to the inclusion of an other species.

Table 8.1 Total landings (tonnes) of PLAICE in the Baltic by sub-division and country.
(There are some gaps in the information. Therefore "Total" is preliminary.)

Year	Denmark			Germ.Dem. R.[1]		Germany, Fed. Rep.				Poland		Sweden[2]							
	22	23	24(25)	22	24	22	24(+25)	26	28	25(+24)	26	22	23	24	25	26	27	28	29
1970	3,757		494			202	16							149					
1971	3,435		314			160	2							107					
1972	2,726		290			154	2							78					
1973	2,399		203	2	44	163	1			174	30			75					
1974	3,440		126	36	10	166	2			114	86			60					
1975	2,814		184	11	67	302	1			158	142			45					
1976	3,328		178	11	82	302	3			164	76			44					
1977	3,452		221	5	36	348	2			265	26			41					
1978	3,848		681	33	1,198	346	3			633	290			32					
1979	3,554		2,027	10	1,604	195	7			555	224			113					
1980	2,216		1,652	5	303	84	5			383	53			113					
1981	1,193		937	6	52	74	31			239	27			118					
1982	716		393	6	25	39	6			43	64			40	6		7	1	
1983	901		297	5	12	37	14			64	12			133	20		24	2	
1984	803		166	7	2	23	8			106				23	3		4	1	
1985	648		771	68	593	26	40			119	49			25	4		5	1	
1986	570		1,019	34	372	25	7			171	59			48	7		9	1	
1987	414		794	4	142	14	16			188	5			68	10		12	1	
1988	234		323	3	16	7	1			9	1			49	7		9	1	
1989	167		149		5	7				10				34	5		6	1	
1990	236		100		1	9	1			6				50					
1991	328		112			15	9			2	1			5	2		2		
1992	316		74			11	4			6				3	1		1		
1993	171		66			16	6			4			2	4					
1994	355		159			1				43	4		6	4	7				
1995	601	64	343			75	91		1	233	2		12	13	10	1			
1996	859	81	263			43	77			183	5	1	13	28	23	10	1		
1997[4]	902		201			51	56			308	3		13	7	8		1		

Continued

Table 8.1 Continued

Year	Total								
	22	23	24[3]	25	26	27	28	29	Total
1970	3,959		659						4,618
1971	3,595		423						4,018
1972	2,880		370						3,250
1973	2,564		323	174	30				3,091
1974	3,642		198	114	86				4,040
1975	3,127		297	158	142				3,724
1976	3,641		307	164	76				4,188
1977	3,805		300	265	26				4,396
1978	4,227		1,914	633	290				7,064
1979	3,759		3,751	555	224				8,289
1980	2,305		2,073	383	53				4,814
1981	1,273		1,138	239	27				2,677
1982	761		464	49	64	7	1		1,346
1983	943		456	84	12	24	2		1,521
1984	833		199	109		4	1		1,146
1985	742		1,429	123	49	5	1		2,349
1986	629		1,446	178	59	9	1		2,322
1987	432		1,020	198	5	12	1		1,668
1988	244		389	16	1	9	1		660
1989	174		188	15		6	1		384
1990	245		152	6					403
1991	343		126	4	1	2			476
1992	327		81	7		1			416
1993	187	2	76	4					269
1994	356	6	163	50	4				579
1995	676	76	447	243	3		1		1,446
1996	903	94	368	206	15	1			1,587
1997[4]	953	13	264	316	3	1			1,550

[1] From October-December 1990 landings of Germany, Fed. Rep. are included.

[2] For the years 1970-1981 and 1990 the catches of Sub-divisions 25-28 are included in Sub-division 24.

[3] For the years 1970-1981 and 1990 the Swedish catches of Sub-divisions 25-28 are included in Sub-division 24.

[4] Provisional.

Table 8.2 Total landings (tonnes) of TURBOT in the Baltic by sub-division and country.(There are some gaps in the information. Therefore "Total" is preliminary.)

Year	Denmark			Germ. Dem. R.[1]		Germany, Fed. Rep.						Poland		Sweden[2]							Latvia		Lithuania[5]	Russia
	22	23	24(25)	22	24	22	24	25	26	27	28	25(+24)	26	22	23	24	25	26	27	28(+29)	26	28	26	26
1965				3	39																			
1966	16		21	5	53																			
1967	14		20	7	10																			
1968	14		18	3	67																			
1969	13		13	4	57																			
1970	11		13	5	40											2								
1971	11		26	4	86											2								
1972	10		26	3	100											3								
1973	11		30	3	33							58	13			5								
1974	14		40	2	23							34	36			6								
1975	27		48	3	38	15						23	6			7								
1976	29		24		52	11						14	12			7								
1977	32		37		55	9						12	55			8								
1978	33		37	2	27	9						7	3			10								
1979	23		38	3	39	6						29	34			12								
1980	28		38		30	9						12	20			15								
1981	28		62	1	46	8						10	19			7								
1982	31		51	1	27	7						2	17			3	4		4	3				
1983	33		40	3	9	8						5	4			31	41		35	24				
1984	41		45	4	8	12						13	2			3	4		3	2				
1985	56		34	5	22	15						67	15			4	5		4	3				
1986	99		81	6	32	25						32	37			6	8		7	5				
1987	134		93	4	34	30						155	21			8	11		9	6				
1988	117		117	3	28	34						7	10			12	16		14	9				
1989	135		109	7	22	20							11			11	15		13	9				
1990	178		181	4	2	26						24	25			14								
1991	228		137			44	39					73	20			2	12		16					
1992	267		127			55	68					80	55			12	12		21	36				30
1993	159	29	152			74	56					520	72		2	4	14		13	38				34
1994	211	18	166			52	57	10				380	30		2	3	18	1	17	44				15
1995	257	11	94			65	53	4				30	15		2	3	54	9	31	83	33	28		20
1996	207	12	95			36	47	4		1		288	92	1	3	15	100	5	54	104	43	3	76	25
1997[4]	151		68			60	52	3				290	70		2	6	70	1	53	86	33	28		25

Continued

Table 8.2 Continued

Year	Total							
	22	23	24[3]	25	26	27	28(+29)	Total
1965	3		39					42
1966	21		74					95
1967	21		30					51
1968	17		85					102
1969	17		70					87
1970	16		55					71
1971	15		114					129
1972	13		129					142
1973	14		68	58	13			153
1974	16		69	34	36			155
1975	45		93	23	6			167
1976	40		83	14	12			149
1977	41		100	12	55			208
1978	44		74	7	3			128
1979	32		89	29	34			184
1980	37		83	12	20			152
1981	37		115	10	19			181
1982	39		81	6	17	4	3	150
1983	44		80	46	4	35	24	233
1984	57		56	17	2	3	2	137
1985	76		60	72	15	4	3	230
1986	130		119	40	37	7	5	338
1987	168		135	166	21	9	6	505
1988	154		157	23	10	14	9	367
1989	162		142	15	11	13	9	352
1990	208		197	24	25			454
1991	272		178	85	20	16		571
1992	322		207	92	85	21	36	763
1993	233	31	212	534	106	13	38	1,167
1994	263	20	226	408	46	17	44	1,024
1995	322	13	150	88	77	31	111	792
1996	244	15	157	392	241	55	107	1,211
1997[4]	211	2	126	363	129	53	114	998

[1] From October-December 1990 landings of Germany, Fed. Rep. are included.
[2] For the years 1970-1981 and 1990 the catches of Sub-divisions 25-28 are included in Sub-division 24.
[3] For the years 1970-1981 and 1990 the Swedish catches of Sub-divisions 25-28 are included in Sub-division 24.
[4] Provisional.
[5] Lithuania, for 1997 no data reported

Table 8.3 Total landings (tonnes) of DAB in the Baltic by sub-division and country.
(There are some gaps in the information. Therefore "Total" is preliminary.)

Year	Denmark				G. Dem. Rep.[1]		Germany, Fed. Rep.				Sweden[2]								Total								
	22	23	24(+25)	25-28	22	24	22	24	25	26	22	23	24	25	27	28	29	30	22	23	24[3]	25[5]	26	27	28	29	30	Total
1970	845		20		11		74												930		20							950
1971	911		26		10		64												985		26							1,011
1972	1110		30		9		63						23						1,182		53							1,235
1973	1087		58		18		118						30						1,223		88							1,311
1974	1178		51		18		118						34						1,314		85							1,399
1975	1273		74		20		131						32						1,424		106							1,530
1976	1238		60		17		114						27						1,369		87							1,456
1977	889		32		13		89						25						991		57							1,048
1978	928		51		19	14	128	4											1,075		69							1,144
1979	1413		50		18	25	123	1					9						1,554		85							1,639
1980	1593		21		15	25	101						3						1,709		49							1,758
1981	1601		32		24	39	164						5						1,789		76							1,865
1982	1863		50		46	38	182	4					6	5	8	6		1	2,091		98	5		8	6		1	2,209
1983	1920		42		46	28	198						24	20	32	22		2	2,164		94	20		32	22		2	2,334
1984	1796		65		30	47	175	2					4	3	5	4		1	2,001		118	3		5	4		1	2,132
1985	1593		58		52	51	187	2					3	3	5	3		1	1,832		114	3		5	3		1	1,958
1986	1655		85		36	35	185	1					1	1	1	1			1,876		122	1		1	1			2,001
1987	1706		93		14	87	276	4					1	1	1	1			1,996		185	1		1	1			2,184
1988	1846		75		22	91	281	1					1	1	1	1			2,149		168	1		1	1			2,320
1989	1722		48		26	19	218	1					1	1	2	1			1,966		69	1		2	1			2,039
1990	1743		146		14	11	252	1					8						2,009		166							2,175
1991	1731		95				340	5					1						2,071		101							2,172
1992	1406		81				409	6						1	1		4		1,815		87	1		1		4		1,908
1993	996		155				556	10				7	1	1			1		1,552	7	166	1				1		1,727
1994	1621		163				1190	80	45			5	1	1					2,811	5	244	46						3,106
1995	1510	47	127	10			1185	49	3			5	1	5		1			2,695	52	177	18			1			2,943
1996	913	37	128				991	134	13	2	3		3	4	1				1,907	37	265	17	2	1				2,229
1997[4]	728		60				413	21	2			5	5	10	3	1			1,141	5	86	12		3	1			1,248

[1] From October-December 1990 landings of Germany, Fed. Rep. are included.

[2] For the years 1970-1981 and 1990 the catches of Sub-divisions 25-28 are included in Sub-division 24.

[3] For the years 1970-1981 and 1990 the Swedish catches of Sub-divisions 25-28 are included in Sub-division 24.

[4] Provisional.

[5] In 1995 Danish landings of Sub-divisions 25-28 are included.

Table 8.4 Total landings (tonnes) of BRILL in the Baltic by sub-division and country. (There are some gaps in the information. Therefore "Total" is preliminary.)

Year	Denmark			Germany Fed. Rep.	Sweden		Total			
	22	23	24-28	22	23	24-28	22	23	24-28	Total
1970	4						4			4
1971	3						3			3
1972	7						7			7
1973	11		2				11		2	13
1974	25		1				25		1	26
1975	38		1	1			39		1	40
1976	45		1	2			47		1	48
1977	60		2	5			65		2	67
1978	37			3			40			40
1979	30						30			30
1980	26						26			26
1981	22			1			23			23
1982	19					17	19		17	36
1983	13					42	13		42	55
1984	12					3	12		3	15
1985	16					1	16		1	17
1986	15					3	15		3	18
1987	12					3	12		3	15
1988	5					1	5		1	6
1989	9					1	9		1	10
1990						1			1	1
1991	15						15			15
1992	28						28			28
1993	29	5	1				29	5	1	35
1994	57	4	1			1	57	4	2	63
1995	134	12	1		5	8	134	17	9	160
1996	56	6					56	6		62
1997[1]	25				1		25	1		26

[1] Provisional.

9 HERRING

9.1 Introduction

9.1.1 Herring and sprat landings

The uncertainties in the amounts of pelagic species landed is only to a lesser extent caused by inadequate reporting. The fact that a large part of the landings comes from mixed fisheries for Clupeoids (either fisheries targeting herring but with occasionally large by-catches of sprat or sprat fisheries - both industrial and for human consumption - with by-catches of herring) means that the species composition has to be estimated from samples.

In the industrial fisheries are (in Denmark and Sweden) two types of samples taken. Samples for estimating the species composition are collected and analysed by the authorities responsible for surveillance and enforcement, whereas the samples used for estimating the biological parameters (age, length, weight etc.) are analysed by the biologists. In Table 9.1.1 is given the species composition in the pelagic fisheries by quarter of the year and by Sub-division. The total landings amounted to a little less than 800, 000 ton. Herring was dominating in the southern, south-western parts (sub-divisions 22-24) and in the Gulf of Finland and sprat in Sub-divisions 25-28. Table 9.1.2, gives the level of sampling intensity of the biological samples.

9.1.2 Assessment units for herring stocks

The issue of how to separate the herring into unit stocks has been discussed on many occasions. This year's assessments used the same units as in the latest years, *i.e.* all herring in Sub-divisions 25-29 and 32 was assessed as one stock. Furthermore the so-called Gulf Herring in the Gulf of Riga was assessed separately as requested. This herring stock is mainly fished in the Gulf, but it is also caught to a varying extent on its migration routes in the open sea. The Gulf Herring is included in the assessment of all herring in Sub-divisions 25–29 and 32 and the results of the separate assessment may be used for setting a regional TAC and/or quota allocation for the countries concerned.

The Working Group was this year requested to give information on various local stock component spawning in parts of the area. The information available is presented in Sections 9.6 and 9.7.

9.2 Herring in Sub-Divisions 25–29 (including Gulf of Riga) and Sub-Division 32

9.2.1 Catch trends

The total landings (Table 9.2.1) amounted in 1997, as in 1996, to slightly below 200,000 t, which is a continuation of the downward trend observed during the last decade. The distribution of landings in tonnes and numbers are given in (Table 9.2.2) for the five latest years. The largest part of the landings are taken in the North-eastern parts (Sub-divisions 28-29, 32) constituting about 60% in tonnes and about 75% in number of fish landed.

9.2.2 Unallocated landings

No information was available.

9.2.3 Discards

No information was available.

9.2.4 Effort and CPUE data

Data on commercial effort and CPUE were not used in the assessment.

9.2.4.1 Stock estimates from acoustic surveys

Stock estimates from the International Hydroacoustic Surveys in 1997 were presented (see Section 1.3). The coverage was of the survey was regarded as insufficient by not including Sub-divisions 27, 29 and a large part of 25. Its results were thus not accepted for use in the tuning procedure. Therefore the data series 1982–1996, corrected for the proportion of the survey area covered in relation to the total sea area of the central Baltic was used for tuning the XSA.

9.2.5 Age composition

Data on catches in numbers at age were presented for about 95% of the total catches in 1997. The unsampled catches were assumed to have the same age distribution as the total for that Sub-division and quarter in which the were caught. Herring of age groups 2–5 constitute about 77% of the catches whereas the 0 group is practically not caught. As in last years, the catches in the Gulf of Finland and the Gulf of Riga make up ca 50% of the total number of herring caught. Table 9.2.5.1 gives the catch in numbers used as input for the further analyses and in Table 9.2.5.2 the same data are presented by Sub-division and quarter.

The 1996 catch at age data were updated based on the definitive data on Finnish catches.

9.2.6 Mean weight at age

The mean weights at age were compiled by Sub-division and quarter of the year (Table 9.2.6.1) and then combined to give the mean weight at age for the whole catch (Table 9.2.6.2). The variation observed in the mean weights is illustrated on Figures 9.2.6.1 It shows the quarterly weights for the year-classes 1989-92 by Sub-division. The seasonal changes in mean weights are conspicuous, with high weights during spawning time (quarter 2) and very much lower weights during the feeding season when the mixture of herring from different spawning regions is largest. The marked geographical differences in growth patterns are also evident.

9.2.7 Maturity ogive

The Working Group decided to use the same maturity ogive as during previous years. However, the data, presented during the last meeting, indicated large variability between Sub-divisions and emphasised the need for additional analysis of the historical database in order to revise the input data in coming years. This has not yet been done.

9.2.8 Natural mortality

The natural mortality in 1997 was taken as equal to the 1996 values which were based on the latest Multispecies VPA. Table 9.2.8.1.

9.2.9 Catch at age analysis

9.2.9.1 Input data

The standard input data for these analyses are found in Tables 9.2.5.1. (CANUM), (CATON). 9.2.6.2 (WECA equal to WEST), 9.2.8.1 (NATMOR), 9.2.9.1.4 (Tuning FLEET). Values for proportion of F and M before spawning were kept constant for all years and are 0.35 and 0.30 respectively.

9.2.9.2 XSA

The acoustic survey estimates (1982–1996 with lacking data for 1992–1993) corrected for varying coverage were used as tuning fleet.

The Polish youngfish survey indices from Sub-division 26 (GM of 0-group in December and 1-group in January-March) were not, as in the 1997 assessment, used in the tuning procedure, because this data set was heavily down-weighted due to high variance in the log catchabilities.

The catchability for ages < 3 was assumed to be dependent of stock size. The slope of the regression of log q against year class abundance was not significantly different from 1.0 for age-group 3 and older.

The residuals of log q over time did not indicate any clear time trend (Figure 9.2.9.2.1). The acoustic results indicated the influence of year effects: some years the residuals were mostly negative (i.e. 1985 and 1987) for others positive (i.e. 1990 and 1991).

Other settings applied in the XSA were the default values offered. Table 9.2.9.3.1 gives the details for the XSA. A retrospective analysis for the period 1996–1974 (Figure 9.2.9.2.2) showed a tendency during the latest years to underestimate the fishing mortality and overestimate the spawning stock biomass.

9.2.9.3 Results from catch at age analysis

Tables 9.2.9.3.1–3 give the diagnostics, fishing mortalities, stock size and summary from the XSA.

9.2.10 Recruitment estimates

No adequate estimate of the 1997 year-class was obtained from the acoustic survey in 1997. The Working Group decided, lacking other information on the recruitment, to use the value of the GM recruitment for 1994–1996 (22,648 millions).

9.2.11 Historical stock trends

The development of spawning stock biomass emerging from the XSA analyses is one of decline. The stock biomass in 1996 is estimated to about 40% of the 1974 level. The decline has been fairly constant over the period (Figure 9.2.11).

The perception of stock development becomes, however, quite different when spawning stock in numbers is considered. This metrics shows a stock that is varying around 23 billion fish from 1982–1991 and thereafter increases to about 30 billions during the latest five years.

A major cause for these deviating trends in stock development is the drastic changes in mean weight (size) during the period of assessment. As was pointed out in Section 9.2.6 the catches have during recent years been dominated by slow-growing herring, emanating from the North-eastern parts of the Baltic. These fish are caught - outside the spawning time - also in other parts of the Baltic, thereby decreasing the overall mean weights.

A given catch in tonnes of these slow-growing herrings will, consequently, contain many more individual herring and thus cause a higher fishing mortality. The distribution of the fishing mortalities over sub-divisions are included in Table 9.2.2 .

9.2.12 Short-term forecast and management options

The forecast was based on the stock size for age groups 2 to 9+ at 1 January 1998 as obtained from the XSA. The value for age group 1 (1997 year class) was taken as the GM average 1994-96. Natural mortality for 1997–1999 was assumed to be at the 1997 level. Weights at age (both in the catch and in the stock) were taken as the average for 1996–1997, thereby assuming that the present low level of mean weights will continue. The average exploitation pattern for 1995–1997 was applied and implied a reference fishing mortality of 0.2843.

Also for the recruitment in 1999 was the GM 1994–1996, (20,213 mill.) assumed. The catches in both 1998 and 1999 at *status quo* fishing mortality were predicted to be 185,000 - 190 000 t. The spawning stock is predicted to remain on the present low level (about 700,000 t) for the period 1999–2001. Tables 9.2.12.1 and 9.2.12.2 give input data and results.

An alternative short term-prediction was made under the assumption that the TAC, agreed within the IBSFC, was taken in both 1998 and 1999. The TAC, which is set to 550, 000 tonnes by the IBSFC is referring to the Sub-divisions 22-29, 32. It was divided between Sub-divisions 22-24 and 25-29,32 in the same proportions as the landings for these areas. By this simplistic procedure a TAC of 426,000 tonnes was obtained for Sub-divisions 25-29,32.

The result (in Table 9.2.12.3) indicates that the fishing mortality has to be increased by a factor 2.7 in 1998 and with 4.4 in 1999 (resulting in a reference F of 1.25) if the TAC would be taken. The resulting decrease in spawning stock size would be dramatic.

Yield and Spawning Stock per Recruit

The same input values as used in the short-term prediction were used in these calculations. Tables 9.2.12.3 and 9.2.12.4 give input data and results.

Stock Recruitment Relationship

Estimation of a stock recruitment relationship according to the Beverton-Holt model was made with data for 1974–1996 and is illustrated in Figure 9.2.12.1. The parameters in the function (calculated under the assumption of lognormal errors) were estimated as:

a= 54.80 , b= 726.31, SSQ= 2.09, s.dev= 0.32

9.2.13 Medium-term projections and precautionary reference points

Medium-term projections were performed using the same model as applied in the SGBFS, 1998. It is a Thompson and Bell type model in which stochastic variation has been included for some of the input parameters. The stock size as estimated per 1 January 1998 was taken as basis and the *status quo* fishing mortality is applied for the starting year. Stock size, recruitment and yield were then projected ten years ahead through 200 iterations per year. Fishing mortality was kept constant during the whole projected time span. From the results percentiles were compiled for SSB, recruitment and yield.

Stochasticity was introduced in the calculation of

- recruits from a stock-recruitment relation,
- in the initial stock size, (SE by age group from the XSA)

Mean weights at age, both in stock and in catches, where taken as the 1996-97 average and kept constant for the projection period, owing to the special circumstances in their dynamics in this stock.

Results from runs with different levels of fishing mortalities are presented in Tables 9.2.13.1 and are also given in Figures 9.2.13.1

The precautionary reference points were found by the procedure used in the SGMBFS, 1998. The B_{lim} was taken as 750 000 ton, *i.e.* the average of the 1996 and 1997 SSB estimates. Bpa was calculated as B_{lim} *exp(1.65*SE) with SE=0.2. Thus B_{pa} was found as 1 million ton.

The F_{pa} was derived from the projections as the fishing mortality that would give a low probability to obtain a SSB below Bpa.

The 10% percentile of spawning stock shows a decline at the *status quo* fishing mortality, is approximately constant at a F of 0.21 and is increasing to above 1 million ton at a F of 0.14. Thus the Fpa is taken as 0.14.

These calculations are dependent on the assumptions made about both future mean weights at age and natural mortality.

Simulations made by the SGMBFS, 1998, applying different combinations of weights and natural mortality demonstrates these effects. Would the mean weights remain low and the predation mortality increase, the F_{pa} drops to almost zero. It is only if an increase in the predation mortalities (through an increased cod stock) is accompanied by increased mean weights that the present F_{pa} is sustainable.

9.2.14 Biological reference points

Since most of these reference points are dependent on the mean weights on age they are not very suitable as references for this stock. They were however estimated based on the data for the latest years.

F_{max} : not found.
$F_{0.1}$: 0.24
F_{med} : 0.17
F_{low} : 0.04
F_{high} : 0.25

$B_{50\%R}$: 726 000 t - according to the Beverton-Holt S-R relation.

9.3 Herring in the Gulf of Riga

9.3.1 Catch trends

Herring fishery in the Gulf of Riga was performed by Estonia and Latvia, using both trawls and trapnets. Herring catches in the Gulf of Riga include the local Gulf herring and the open-sea herring, entering the Gulf of Riga for spawning. Discrimination between the two groups is based on the different otolith structure. Gulf herring is also taken by the Latvian fleet outside the Gulf in Sub-division 28.1-4 (2,941 t in 1997). These catches are included in the total Gulf herring landings.

The catches have shown a sharp increase in the 1990s, after being on record low level during the 1980s. In 1997 they are the highest for 1970–1997 period. The total reported landings of herring in the Gulf of Riga were 44,100 t in 1997, that is for 7,100 t more than in 1996. The share of open-sea herring in the total catches in the Gulf of Riga is gradually decreasing in 1990s, being only 9.8 % in 1997 (Table 9.3.1).

26.4 % of the catches were taken with trapnets on the herring spawning grounds in 1997.

9.3.2 Unallocated landing

According to the information about the level of misreporting obtained from the fishermen, the Latvian catches presented to the Working Group were taken to be 20 % higher compared to the official landings. The level of misreporting in Estonian herring fishery has been low in 1995–1997 and therefore the official catch figures were used in the assessment.

9.3.3 Discards

The discards of herring in the Gulf of Riga are very rare and have not been recorded by scientists working on the fishing vessels.

9.3.4 Effort and CPUE data

The number of trapnets used in herring fishery is slowly increasing. The trawl fishery is performed by 70 Latvian and 5–10 Estonian vessels with 150-300 HP engines. The number of trawlers in the Gulf of Riga is limited by the local authorities.

No historical time-series of CPUE data are available. The CPUE investigations in trawl fishery have started in 1995 both in Estonia and Latvia.

9.3.5 Age composition

The quarterly catches of Gulf herring from Estonian and Latvian trawl and trapnet fishery in millions were compiled to get the annual catch in numbers (Table 9.3.2).

9.3.6 Mean weight at age

The annual mean weights by age groups used for assessment were compiled from quarterly data on the trapnet and trawl fishery of Estonia and Latvia (Table 9.3.5).The mean weights at age in stock were assumed to be equal to the mean weights in catches.

A decreasing trend in mean weight at age of Gulf of Riga herring, observed since the mid–1980s has continued, especially in the oldest age groups. In the majority of the age groups it is the lowest since 1970. The mean weight in most age groups in 1990s make up just 30-50 % of the level of mid–1980s.

9.3.7 Maturity ogive

No new information on maturity ogives of the Gulf of Riga herring were presented to the Working Group. Therefore, the respective values used in previous assessments were used (Table 9.3.4).

9.3.8 Natural mortality

Since cod stock has remained on a low level in the Eastern Baltic and is currently absent in the Gulf of Riga, the natural mortality was taken to be the same as that used in the previous years - 0.2.

9.3.9 Catch at age analysis

The VPA was tuned in XSA using data on the effort (number of trapnets) directed at the Gulf herring in the Estonian and Latvian trapnet fishery and the corresponding abundances of Gulf herring in trapnet catches (Table 9.3.6). Since the 1-group is only occasionally presented in the trapnet catches, it was excluded from the tuning input data. The input data for the XSA and the diagnostics of the analysis are given in the Table 9.3.7. Age 8 was taken as a plus group taking into account the recommendations of Baltic Herring Age Reading Study Group. In contrary to the assessment of the previous year the catchability of age groups <4 was assumed to be dependent of stock size, because of the slope value of 3-group (0.74). The catchability independent age >6 was selected for the assessment because of best statistical performance (low variability of SE log q) (Table 9.3.7). Like in previous assessments the default level of shrinkage (SE=0.5) was used in terminal population estimation. This produced almost the same SSB estimates as in 1997. So, the SSB of 1996 was estimated on the level of 140,623 t in 1997. The respective value in 1998 was 138,379 t (–1.6 %) (Table 9.3.12).

The residuals of log q over time did not indicate any clear time trend (Figures 9.3.1, 9.3.2).

The fishing mortalities, stock numbers and biomasses obtained from the VPA are presented in the Tables 9.3.8-9.3.10.

9.3.10 Recruitment estimates

The historical dynamics of the recruitment (age 1) shows rather similar to the spawning stock biomass trend (Figure 9.3.3). The recruitment fluctuated at the level of 1,000-3,000 millions in the 1970s and 1980s. In 1990s the recruitment has increased reaching values above 3,000-5000 millions, but the year-class of 1995 at age of 1 is even over 7,000 millions (Table 9.3.10).

The values of mean water temperature in April and abundance of zooplankton in May (factors which significantly influence the year class strength of Gulf herring, ICES 1995/J:10) were regressed to the 1 group from the XSA using RCT3 program (Table 9.3.13). The results of the RCT3 analysis are presented in Table 9.3.14. The resulting estimate for 1997 year class would be 4, 527 millions, corresponding to a rich year class. Using the 1996 recruitment estimate and the catch in numbers of 1 group in 1997, the fishing mortality of 1 group in 1997 was calculated and then using that the number of 2 group at the beginning of 1998 was obtained - 1,561 millions (Table 9.3.15).

The estimates for 1998 and 1999 year classes as 1 group were taken to be equal to the long-term average (2,471 millions, Table 9.3.12).

9.3.11 Historical stock trends

The resulting estimates of the main stock parameters (Table 9.3.11 and 9.3.12) show that the spawning stock biomass of the Gulf of Riga herring has been rather stable on the level of 40,000-60,000 t in the 1970 and 1980s. The SSB started to increase in the late 1980s, reaching the record high level of 161 thousand t in 1997. The mean fishing mortality in age groups 3-7 has been rather stable since the mid 1980s. In 1997 it has increased in comparison with the previous years 1995–1996 (1997 - F_{3-7}=0.344, + 8.4 %), but is still significantly lower than in 1970s and the first half of the 1980s.

9.3.12 Short-term forecast and management options

The input data and summary of short-time forecast with management options are presented in the Tables 9.3.15-9.3.17. For prediction the mean weights at age were taken to be equal to the average of 1995–1997. Since the cod abundance is still on a very low level in the eastern Baltic and absent in the Gulf of Riga, the natural mortality was assumed to remain at the level of 0.2 and the exploitation pattern was calculated as the average in 1995–1997. At *status quo* fishing mortality the catches of the Gulf of Riga herring in 1998 and 1999 are predicted to be correspondingly 35,300 t and 35,000 t that is for 1,300 t and 3,400 t more than it was predicted in 1997. The SSB value for 1999 would be approximately 154,000 t (according to the 1997 assessment 140,000 t). If the year class of 1998 remains on the level of long-term average as expected, both SSB and catches, at the status quo exploitation level, will decrease in 2000 very

insignificantly, correspondingly to 148,000 t and 34,000 t. Catch corresponding to exploitation at $F_{0.1}$ (0.26) would be approximately 28,000 t in 1999 (Tables 9.3.17, 9.3.18 and Figure 9.3.6).

9.3.13 Medium-term predictions

At the Study Group on Management Strategies for Baltic Fish Stocks (SGBFS, ICES 1998) a spread sheet macro programme was used to calculate SSB in medium-term predictions with stochastic variations in a number of input parameters. Ricker's stock-recruitment relationship was fitted to stock-recruitment data. Mean weight at age, maturity and natural mortality were kept constant. The results of the simulation for different levels of F_{bar} are presented in Table 9.3.19. With F_{bar} values of 0.3, 0.4 and 0.5 the estimates of 10 % percentile of SSB in 2006 are correspondingly around 170,000, 120,000 and 60,000 t. According to the results probability of SSB falling below the MBAL (50,000 t), could become actual at F_{bar} around 0.6.

9.3.14 Biological reference poimts

On the basis of stock-recruitment plot (Figure 9.3.4) and the results of Yield-per-Recruit analysis (Table 9.3.18) the reference points were calculated for the Gulf of Riga herring stock:

$F_{0.1}$=0.26
F_{low}=0.04
F_{med}=0.32
F_{high}=0.91

The biomass reference points were based on the MBAL estimate (ICES 1996) of 50,000 t. The MBAL value was treated as an estimate of B_{pa} as there are many points left to the MBAL in stock-recruitment plot. Assuming standard error of log, at 0.2 level (basing on XSA estimates of standard errors) the estimate of B_{lim} is 36,500 t.

The stochastic prediction were run with stochastic variation in initial stock numbers, recruitment and in maturity assuming a Ricker type stock-recruitment relationship (ICES 1998). Fpa was estimated to be - 0.64 corresponding to a median SSB in the order of 100,000 t. The present F_{3-7} is 0.34.

9.4 Herring in Sub-Division 30

9.4.1 Catch trends

Total catch in Bothnian Sea in 1997 consists of Finnish and Swedish landings, which were 63,531 and 1995 t (97 % and 3 % respectively). The total provisional catch of 65,527 t is highest ever recorded and it was about 16 % bigger than the updated landings data of 1996 (56,642 t). In Finnish fishery ca. 61 % of the landings were caught by pelagic trawl, 33 % by bottom trawl and 6 % by trapnets.

9.4.2 Unallocated landings

No unallocated landings were reported. Misreporting has been estimated to be about 10 % annually and is included in the landings data.

9.4.3 Discards

No discarding was reported.

9.4.4 Effort and CPUE data

According to updated 1996 and provisional 1997 effort data, there is a decrease of 6 % in pelagic trawling and a decrease of 25 % in bottom trawling in total fishing hours. The number of trapnets has increased from 352 to 461 between years 1996 and -97.

In the period of 1980-1997 changes in the sizes (maximum opening) of trawls have taken place and estimated multiplicative factors (Figure 9.4.1) for fishing hour effort for that period were introduced as effort in new tuning input data. Still there is not much information about the actual changes in catchability of herring caught by gears of different

sizes. On the other hand one can also expect that better equipped vessels are more effective and have a manyfold effect on catchability of herring.

9.4.5 Age composition

Swedish landings from Bothnian sea were distributed according to Finnish age distribution and mean weight at age (Table 9.4.1). New catch numbers were calculated for year 1996 according to updated landings (Table 9.4.2). The updated catch at age input data is shown in Table 9.4.3.

9.4.6 Mean weight at age

Mean weight at age in Finnish catches (Table 9.4.4) was also used as mean weight in the stock.

9.4.7 Maturity ogive

Separate maturity samples divided in length classes were taken from the trawl catches before spawning time. The 1997 data on maturity (Table 9.4.5) show that the proportion of mature herring in younger age classes has decreased, but the maturity may have been underestimated due to late sampling time in 1997.

9.4.8 Natural mortality

The value of 0.2 natural mortality is assumed for all years and ages.

9.4.9 Catch at age analysis

The XSA was tuned with pelagic and bottom trawl fleets with revised effort data starting at 1980 (Table 9.4.6). The available trapnet fleet was omitted due to negative trend in log catchability residuals. The ages over 8 were combined to a plus group. The catchability was set to be independent on stock size for all ages and independent of age for ages ≥ 4 due to nearly constant catchability from age-groups 3 or 4 onwards in both tuning fleets. No shrinkage of final estimates was used because of the explicit trend in fishing mortality rate during the last five years and not very large year-to-year variation. The tuning results and diagnostics are shown in Table 9.4.7 and the log catchability residuals for both fleets in Figure 9.4.2.

According to the Table 9.4.8 the FBAR 3-7 is 0.21 in 1996 and 0.31 in 1997. The total biomass and the SSB have a different pattern compared to last year's assessment, being at the highest in mid 80's with a decreasing trend in biomasses and a drop of about one third in SSB between two latest years. Also the recruitment estimate is well below the long term average which is contradicting last year's assessment.

Due to the instability of tuning procedure demonstrated by retrospective analysis the assessment of this stock was not approved by the ACFM in 1997. In spite of new revisions in tuning effort data the XSA model for this stock still seems to be very unstable and sensitive to rather small changes in tuning options. The obvious mismatch between catch at age matrix and the tuning fleet information may be the main reason for the conflicting results of presents XSAs. Generally the tuning diagnostics showed improvement when the effort in tuning was changed from hours to hours multiplied with estimated trawl ize-factor, but when tuning the XSA with different effort data and differing combinations of other options, the retrospective analysis (Figure 9.4.3) showed no improvement in it's tendency to largely overestimate the F and underestimate the SSB.

Due to various XSA runs with consequent unacceptable retrospective analysis it was decided by the Working Group not to make any predictions for this stock and perform production models to evaluate historical SSB trends.

9.4.10 Recruitment estimates

No independent recruitment estimate for this stock is available.

9.4.11 Production Models

9.4.11.1 Schaefer dynamic production model

For Baltic herring in Sub-division 30 as well as Sub-division 31, a Schaefer dynamic production model was attempted to evaluate the history of stock in 1980-1997. A number of XSA runs were made in both areas, but without any reliable output due to severe problems in retrospective analysis. A short description of the production model used is given below:

Schaefer-model: $g(B) = rB * (1- B/K)$, where

B = current biomass
r = the intrisic growth rate parameter
K = the average unexploited equilibrium biomass

An observation-error estimator version of the model was used and it was assumed, that the population dynamics model is deterministic and that error occurs in the relationship between the biomass and the index of abundance (CPUE). Two sources of observation errors are sampling error and catchability fluctuations. In this situations, it was reasonable to assume that catchability fluctuations dominate sampling effects although catch rates in Sub-division 31 are rather low, and there might be some other variables influencing the relationships. As catchability is assumed to be influenced by large number of factors, each which may well be independent and have a multiplicative effect, the central limit theorem implies that the sum of the logarithms of the magnitudes of these factors approaches a normal distribution. The model is subjected to additive errors and in observation equation to log-normal error and thus:

$$B_{(y+1)} = B_y + g(B_y) - C_y + \varepsilon_y$$

and

$$I_y = q * B_y e^{\eta y}$$

where

$g(B_y)$ = biomass dynamic as a function of biomass
C_y = catch during year y
ε_y = process error in year y
I_y = abundance index in year y
q = catchability coefficient
ηy = observation error in year y

For this form of estimator, the quantity which is minimized in order to estimate values for the parameters r, q and K is:

$$SS = \sum_{y=1}^{n} [\ln Iy - \ln(q * By)]^2$$

$$= \sum_{y=1}^{n} (\ln Iy / q * By)^2$$

To calculate the biomass time series needed to evaluate equation for a specific choice of r, q and K, the biomass at the start of the catch series B_1 is projected forward using the basic equation above with $\varepsilon y = 0$.

The calculations need starting values for r, K (carrying capacity) and estimate of biomass at the beginning of time series.

For herring in the Bothnian Sea the starting values for biomass 250 000 tonnes was assumed, which about the highest value observed in the previous year's assessment time series (ICES 1997; Assess:12). The starting value for SSB estimate was set to 1980 level of 118 000 from XSA. The input of intrisic growth rate was set to 0.25. The results for Bothnian Sea herring are given in Tables 9.4.11.1 and 9.4.11.2. Solver was used for parameter estimation. The first run

shows the results of using CPUE data, where effort of bottom trawl and pelagic trawl has not been corrected to the change of the size of trawls and effort is used as trawling hours. In the second run a corrected effort data (effort CPUE values corrected to change in trawl size) and corresponding CPUE data array were used for estimation.

The attached figures in the Tables 9.4.11.1 and 9.4.11.2 show clearly that the fit to CPUEs is not very good and using uncorrected or corrected effort data give very different perspective. Uncorrected run gives an indication, that the stock has been at rather high level in early 1990s and is now slowly decreasing, SSB is as high as 193 000 tonnes. However the corrected run instead indicate, that the SSB has been decreasing since 1988 and is at a level of 114,000 t at present. According to corrected run catches has been above estimated MSY (40,000 t) last four years and there has been decreasing CPUE since 1993. Same time the total effort, which takes into account the changes of trawl size and trawling hours has increased about 20 fold since 1980 in these fisheries.

Comparing the estimated SSB values to XSA results from last year and to other production model developed by Horbowy (1992) and used here as one alternative, the results of these two production models are rather similar as shown in Figure 9.4.11.1 for Sub-division 30.

9.4.11.2 Difference production model (Horbowy,1992)

The analysis was based on the production model developed by Horbowy (1992). In the model the biomass in year y+1, B_{y+1}, is presented as

$$B_{y+1}=B_y\exp(g_y)+aR_y,$$

where

$$g=Hw^{-1/3}- k - M - qE,$$

and

H, k - parameters of the differential form of Bertalanffy's growth equation,
w - mean weight in the stock,
M - natural mortality,
q- catchability,
E - fishing effort,
R - recruitment index,
a - is scaling parameter.

For the present assessment the model has been reformulated to the form

$$B_{y+1}=[B_y\exp(g_y/2) - C_y]\exp(g_y/2) +aR_y,$$

were it is assumed that catches are taken in middle of the year, similar as in Pope's (1972) cohort analysis.

If the estimates of H, k, M and w are available, only q, a and initial biomass size have to be estimated within the model.

The model has been applied to simulate the dynamics of fish at age 2+ (which approximately reflect spawning stock) in the 1980-1997. The growth parameters were determined averaging weight at age over 1980-1997 and fitting von Bertalanffy's growth model. The M was taken as 0.2. Mean weights in the stock were calculated as the mean of weights at age in the stock weighted by catch numbers. This procedure slightly overestimates mean weights because age 2 is not fully recruited to the fishery. The model has been fitted to the CPUE data and the XSA estimate (Anon. 1997, ICES CM 1997/Assess:12) of the initial biomass size (i.e. biomass in 1980), assuming log-normal errors. The q, a, and B_{1980} were determined minimising the sum of squares

$$SS(q,a, B_{1980}) = \Sigma (\ln(qB)-\ln CPUE)^2 + v(\ln B_{1980} - \ln B_{1980}^{XSA})^2,$$

were v is a weighting factor. Two options for v values were assumed: v=0.5 and v=1.

The CPUE values were obtained as the combined CPUE's from bottom trawl fishery and pelagic trawl fishery. Two series of CPUE values were considered: one basing on effort data corrected by size of the trawl and one basing on the data being not corrected by trawl size. For recruitment indices the CPUE of age 2 herring from bottom trawl fishery were taken.

The dynamics of the biomass estimated by the model is presented in Tables 9.4.11.2.1a,b. In the Figures below the Tables the model estimates of the biomass are compared with XSA estimates obtained during the 1997 working group meeting. The estimated dynamics of the SSB is very dependent on the CPUE series used (trawl size corrected or uncorrected). With uncorrected CPUE's the development of SSB derived from the model is similar to the trend in XSA (Anon. 1997, ICES CM 1997/Assess:12) estimates of the SSB.

On the basis of the analyses conducted it is difficult to evaluate the dynamics of the herring stock in Sub-division 30. The XSA shows very scattered retrospective pattern and is considered to be unreliable. Both production models show similar trends of biomass development and their estimates are very close for years 1992-1997. However, the results of these models and their applicability for this stock have to be further investigated. Time did not allow to conduct retrospective analysis on production models, sensitivity analysis, and estimation of the variance of parameters. Though the XSA estimates of SSB are very different from production models estimates of the SSB, the trends in these estimates are not very different.

9.5 Herring in Sub-Division 31

9.5.1 Catch trends

The total landings in Bothnian bay in 1997 (4,281 t) comprised of Finnish (4,195 t) and Swedish (86 t) landings and they were about 18 % smaller than in 1996.

9.5.2 Unallocated landings

No unallocated landings were reported. Misreporting has been estimated to be about 10 % annually and is included in the landings data (Table 9.5.1).

9.5.3 Discards

No discarding was reported.

9.5.4 Effort and CPUE data

According to provisional 1997 Finnish data, there has been a decrease of 69 % in total fishing hours in bottom trawl and by 77 % in pelagic trawl and an increase in number of trapnets from 149 in 1996 to 202 in 1997 (Table 9.5.2).

9.5.5 Age composition

Swedish landings from Bothnian bay were distributed according to Finnish age distribution and mean weight at age (Table 9.5.3). New catch numbers were calculated for year 1996 according to updated landings (Table 9.5.4).

9.5.6 Mean weight at age

Mean weight at age in Finnish catches (Table 9.5.5) is also used as mean weight in the stock..

9.5.7 Maturity ogive

Separate maturity samples divided in length classes were taken from the trawl catches before spawning time. The 1997 data on maturity (Table 9.5.6) show that the proportion of mature herring in age class 2 has decreased.

9.5.8 Natural mortality

The value of 0.2 natural mortality is assumed for all years and ages.

9.5.9 Catch at Age Analysis

With several years' experience of unsuccessful XSA's it was decided by the Working Group not to perform a catch at age analysis for this stock this year and make a biomass model instead.

9.5.10 Recruitment estimates

No independent recruitment estimate for this stock is available.

9.5.11 Production model

As for Sub-division 30 a corresponding analysis for Sub-division 31 is shown in Table 9.5.11.1. In the input data no corrections for effort and CPUE was made, because there are very little evidence, that such a change exists. The fleet consists mainly of small vessels (10-20 GRT). The analysis indicate very low level of dynamics in the area and estimates of SSB do not change very much through time. The SSB has been increasing slowly in recent years and catches have been below estimated MSY in all observation years.

9.6 Status of Local Herring Stocks

9.6.1 Coastal herring in Sub-division 26

Three different herring stocks: spring-spawning coastal herring from Sub-divisions 25-27, spring-spawning open sea herring and autumn spawning herring inhabit Sub-division 26. They can be separated using differences in morphological structure of otoliths and growth rate.

The fast-growing short-lived coastal spring-spawning herring stock spawn near the coasts of Poland from the area east of Rugen, in Pomorska Bay, in Gdansk Bay and Vistula Lagoon, near the coast of Russia and Lithuania till Klaipeda (Popiel, 1964, Anon., 1987).

After spawning adult coastal herring take the feeding migrations to the open waters of the Southern Baltic where they mix with open sea and autumn herring populations. After feeding period they migrate back to the coast for spawning. The younger age groups (0- and 1- group) inhabit the shallow water in the breeding period.

The maturation usually is reached in the second year of life (about 90% of year class total numbers according to polish data for 1994), but in the last years the rate of maturation of coastal spring-spawning herring has decreased due to drastic decrease in the mean weights at age. This has negatively affected on the pound-net fisheries in Vistula Lagoon which based on the spawning stock.

Landings

The total landings of herring in Sub-division 26 amounted from 37.5,000 t in 1993 to 25.5,000 t in 1997. The share of coastal spring spawning herring in this period varies from 55% to 62%. The remaining part of landings consist mainly of open sea herring.

The total landings amounted to about 13,707 t in 1996 and 13,622 t in 1997 as reported. These coastal herring landings were taken by Poland (7,216 t), Russia (3,499 t) and Lithuania (2,908 t).

It could be assumed that substantial part of Swedish catches in Sub-divisions 25-27 consist of spring-spawning coastal herring but these catches never been separated on stocks component using otoliths.

The proportion of Swedish landings of herring in Sub-division 26 was 14.3% in 1997.

Catch trends

According to estimates of catches, apparent trend to decrease is observed in the coastal herring catches from SD 26 (Table 9.6.1.1). In 1980-1989 the coastal herring catches varied from 27 to 39,000 t. Since the 1990-1991 a continuous decrease of catches can be observed to about 14,000 t in 1996.

It should be noted that total catch in 1992-1996 may insignificantly change after correction of Lithuanian and Latvian catches for the above years.

Catch at age in numbers

An assessment exercise of coastal herring in the Sub-Division 26 was performed intersessionally by the *ad hoc* Workshop (Kaliningrad, 24-28 November 1998). The results of the assessment exercise were presented to the Working Group (see ANNEX 1).

The historical catch at age data from Poland, Russia and Latvia were used in the exercise. Lithuanian catches of coastal herring from Sub-division 26 were assumed as 1,500 t annually for years 1992 - 1996 and were distributed according to age composition of Russian catches (Table 9.6.1.1).

Mean weight at age

Poland, Russia and Latvia supplied yearly mean weight at age data (Table 9.6.1.2).

Maturity ogives

The proportion of mature coastal herring were available only from Poland for Sub-division 26 in 1994.

Natural Mortality

Natural mortality rate is assumed to be constant by ages equal to 0.3.

Tuning data

To VPA tuning the estimates of coastal herring abundance on the basis of hydroacoustic surveys in ICES Sub-division 26 for 1987-1996, carried out by Latvia (1987-1991, 1993) and Russia (1992, 1994-1996) were available.

Unavailable separate estimates of coastal and open sea herring abundance for 1996 in rectangles 4163,4164, 4165 were calculated by their ratio in the rest rectangles covered by the survey of the same vessel (R/V "Atlantniro").

Results of VPA

The XSA was used for stock assessment. Observation data cover the period from 1972 to 1996 and age groups 0-8+. The trial run, based on abundance index for 1987 - 1996 (age groups 0-7) shows that for this stock catchability coefficient depends on the stock size for age groups 0-5 and residuals are mainly of low absolute values. However in some cases (for 1987, for example) they exceed 1.0. Therefore, the final run was carried out where data from 1987 were excluded from abundance index.

Removal of data for 1987 significantly improved statistical characteristics of regression (squares of correlation coefficients increased to 0.5-0.7 for the main age groups), but variability of the residuals for different age groups shows some long-term trend.

Temporal dynamics of the total and spawning biomass shows that the coastal herring stock for the period considered varies from the average long-term value (127,000 t) without any constant trend revealed. Thus, from 1972 to 1993 such variations exceeded no 15%. However, during the recent years the biomass decreased to 74,000 t (the lowest value on record). The above said decrease of the biomass is not a result of fishery impact. It seems to be caused by two processes: apparent decrease of recruitment, starting from 1992 year class, and decrease of average fish weight by ages, observed during the latest years.

The Working Group regarded the results of the assessment exercise as tentative due to lacking information from some countries and areas.

In case of re-establishment of separate assessment of coastal herring the WGBFAS should be provided with precise data on catches structure in Sub-divisions 25, 26 and 27, separated by stock components. It is also advisable to include into estimation data on Lithuanian catches of coastal herring from 1997 backwards.

9.6.2 Herring in Sub-divisions 29 and 32

As a response to the request for separate information on local herring stocks in the northern Baltic and the Gulf of Finland (WGBFAS ToR a)) , a new data set for herring in Sub-divisions 29 and 32 was created during the Working Group meeting. The fisheries assessment data of catch in numbers and mean weight at age were compiled for Sub-divisions 29 and 32 using the MSVPA data base (catch in numbers and mean weights by Sub-division for years 1980-1996). The corresponding data for 1997 were compiled from Estonian, Finnish and Russian data on catch in numbers and mean weight at age for Sub-divisions 29 and 32.. The natural mortality was assumed to be constant for ages and equal to that used for the assessment of the Gulf of Riga herring. The data on maturity ogive were presented by Finland and they were variable by year. Three tuning fleet data sets were used for the assessment - Finnish trapnets, Finnish pelagic trawl and Finnish bottom trawl. Several XSA runs were performed and the results, indicating declining trend in herring SSB in the Sub-divisions 29 and 32 since late 1980s, were presented to the Working Group as a Working Paper. The Working Group considered that it is necessary to check the quality of fisheries assessment data and tuning fleet data intersessionally.

9.7 Stock components of herring in the northeastern Baltic

Gulf of Finland herring stock has been assessed earlier as a unit stock, but in 1990 at WGAPSB meeting both Gulf of Riga and Gulf of Finland were combined to the main stock in Sub-divisions 25-29S. The reason for combination of stocks was to solve the problem of mixing between stocks and lack of estimates of migration between Sub-divisions 28, 29 and 32 especially during third and fourth quarter of the year. However, separate Gulf of Riga herring assessment unit was re-established in 1997.

For assessment purposes, optimal location for borderlines of assessment units are where mixing between stocks is in minimum. The basic knowledge for determination of borderlines is not completely sufficient for the time being. Consequently, the assessment units have to be created without any firm base.

9.7.1 Migration patterns of northeastern Baltic herring

The general migration pattern is that the adult stock component of herring in Sub-division 29 (Archipelago Sea) mainly migrate after spawning to the open sea area in Sub-divisions 29 and 28, and also to the north to Sub-division 30 (Bothnian Sea). Herring returns again for spawning in the next year. Part of young herring stay in the Archipelago Sea also in autumn and winter. From Sub-Division 32 (Gulf of Finland) a part of adult stock migrates after spawning to the Baltic Sea proper (Sub-division 29), and returns in winter for spawning in the next spring. Young herring mainly stay in the gulf during the whole year (Anon. 1998).

9.7.1.1 Herring in the northern Baltic Sea proper and in the Archipelago Sea (Sub-divisions 28 and 29)

The annual migration of the various stocks in the Gulf of Riga, Ventspils-Saaremaa, Hiumaa and in the east coast of Gotland follow the general seasonal pattern observed in the neighbouring stocks and populations. There might be migrations out of the north-eastern Baltic to south with different intensities from year to year depending on feeding conditions in these areas (Ojaveer 1974). Because of insufficient number of tagging experiments, the migration patterns have not been very well documented.

The spring-spawning coastal herring in the Archipelago Sea and in the Åland Sea has a clear annual migration pattern and homing behaviour (Sjöblom, 1961; Parmanne and Sjöblom, 1982, 1986, Parmanne 1990). The spawning migration of the adults from the feeding areas occurs during winter and early spring. The feeding areas of adults are located in the outer parts of the archipelago near to the open sea and in the open sea areas. The migration activity of older specimens is higher than that of younger age groups (Sjöblom 1961). During autumn and early winter, the younger age groups gather inside the Archipelago near to the coast also from the neighbouring stocks (from the Bothnian Sea and the western Gulf of Finland) and they undertake both local migrations and from outer archipelago to the inner and vice versa (Sjöblom 1961).

The feeding migration of older age groups may extend to central parts of the Baltic, to the Swedish east coast and sometimes even to the southern Baltic, but in general such a long migrations are rare (Parmanne and Sjöblom 1982, 1986). Recoveries from taggings in the Archipelago Sea have been made in an area extending from the southern Baltic proper to the northern Quark (Parmanne 1990), but indications of migrations to the southern Baltic proper are based on inconsequential number of recoveries. The older age groups usually stay away from the archipelago during winter and return there in early spring (Sjöblom 1961). Through the migration from the Archipelago Sea there are connections to the Bothnian Sea stocks, to the western parts of the Gulf of Finland and to the Åland Sea and to the Stockholm Archipelago (Parmanne and Sjöblom 1986).

9.7.1.2 Herring in the Gulf of Finland (Sub-division 32)

Hydroacoustic surveys performed in the Gulf of Finland in successive seasons in 1989-90 indicate, that about 50% of total estimated biomass is emigrating outside the area late summer and early autumn (Aro *et al.* 1990). The lowest abundance of Baltic herring in the gulf was observed in November and highest in January indicating late summer emigration out of the Gulf of Finland to the Baltic Proper and vice versa spawning migration in mid-winter (Aro *et al.* 1990).

Tagging results also indicate migrations within the western and eastern parts of Gulf of Finland as well as to some extent to the Baltic proper in the last quarter of the year (Parmanne 1990). The migration during feeding period extends from the eastern Gulf of Finland westwards as far as the mouth of the gulf (Parmanne and Sjöblom 1982).

The seasonal variation in length distribution of commercial catches and age-structured CPUE data potentially indicate an existence of active migration of older herring out of Gulf of Finland to Northern Baltic Proper (Parmanne 1990, Raid 1995). Herring migrate back to the gulf in the winter (Parmanne 1990).

9.7.2 Establishment of new assessment units

Intensive migrations between Sub-divisions 29 and 32, revealed on the basis of tagging experiments, hydroacoustical surveys and length composition analyses, indicate, that the separate assessment area of herring in the Gulf of Finland, performed in the 1980s, does not cover present natural boundaries of distribution of herring reproducing in that gulf. The possible joint assessment of herring in Sub-divisions 29 and 32 would, therefore more adequately describe herring of that area, compared to the separate assessment of herring in the Gulf of Finland only. The necessary database can, if needed, be compiled on the basis of historical data stored in the ICES and national data sets. The compilation of those data sets should be performed intersessionally.

The first experimental assessment of herring in Sub-divisions 29 and 32(combined) was performed by the Working Group (see Section 9.6.2.).

Table 9.1.1
Pelagic landings and species composition in 1997 by Sub-division and quarter.

SD	Q1	Q2	Q3	Q4	Total
22-24	17.9	23.8	11.7	20.1	73.4
Her %	95	89	65	70	82
Spr %	5	11	35	30	18
25	110.0	77.2	13.0	43.4	243.5
Her %	6	18	65	25	16
Spr %	94	82	35	75	84
26	71.4	35.9	11.1	32.3	150.7
Her %	11	14	48	24	17
Spr %	89	86	52	76	83
27	16.8	7.5	0.7	29.7	54.7
Her %	11	45	96	12	17
Spr %	89	55	4	88	83
28	47.0	35.1	14.0	40.5	136.6
Her %	26	56	39	47	41
Spr %	74	44	61	53	59
29	10.9	17.6	5.1	35.0	68.6
Her %	25	76	54	37	46
Spr %	75	24	46	63	54
32	16.0	14.1	8.7	20.0	58.8
Her %	51	76	69	57	62
Spr %	49	24	31	43	38
Total	290.0	211.3	64.2	221.0	786.4
Her %	20	41	56	36	33
Spr %	80	59	44	64	67

Table 9.1.2 **Herring in Sub-divisions 22-32. Samples of commercial catches by quarter and Sub-division for 1997 available to the Working Group.**

Sub-division 22	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Denmark*	1	9900	5	1034	276
		2	11600	11	1897	1277
		3	3000	7	1095	149
		4	8300	3	513	364
		Total	32800	26	4539	2066
	Germany	1	886	10	2169	691
		2	723	3	546	272
		3	8	0	0	0
		4	459	0	0	0
		Total	2076	13	2715	963
Sub-division 24	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Germany	1	4369	7	1577	349
		2	6220	16	3237	1041
		3	2	0	0	0
		4	89	0	0	0
		Total	10680	23	4814	1390
	Poland*	1	2117	3	1912	295
		2	5536	10	5609	1031
		3	259	2	767	169
		4	231	0	0	0
		Total	8143	15	8288	1495
	Sweden	1	1800	0	0	0
		2	2800	6	1203	236
		3	4600	0	0	0
		4	5300	0	0	0
		Total	14500	6	1203	236
Sub-division 25	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Denmark*	1	4100	29	463	142
		2	1000	3	23	0
		3	1400	0	0	0
		4	2900	8	122	63
		Total	9400	40	608	205
	Poland*	1	1716	12	5402	940
		2	1836	8	1251	364
		3	4852	13	3583	516
		4	4681	5	1467	359
		Total	13085	38	11703	2179
	Sweden	1	1006	5	1040	326
		2	10936	5	1261	3654
		3	2178	4	895	276
		4	3039	8	1911	554
		Total	17159	22	5107	4810
Sub-division 26	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Poland*	1	3722	16	8862	1315
		2	2345	12	2563	741
		3	2876	6	2061	496
		4	4202	12	2581	439
		Total	13144	46	16067	2991
	Russia	1	1054	19	3770	1250
		2	1122	10	1700	471
		3	1303	78	15642	746
		4	1701	45	9022	600
		Total	5180	152	30134	3067
	Sweden	1	2134	9	84	81
		2	784	0	0	0
		3	263	0	0	0
		4	468	0	0	0
		Total	3649	9	84	81

Denmark* = Landings and samples for SD 22 = total of SD 22 and 24
= Landings and samples for SD 25 = total of SD 25-28

Poland* = Samples of research and commercial samples

continued

cont.

Table 9.1.2 **Herring in Sub-divisions 22-32. Samples of commercial catches by quarter and Sub-division for 1997 available to the Working Group.**

Sub-division 27	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Sweden	1	1930	4	919	244
		2	3332	4	887	236
		3	650	4	893	217
		4	3501	8	2354	432
		Total	9413	20	5053	1129
Sub-division 28	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Estonia	1	3094	12	1200	1200
		2	10003	28	2800	2800
		3	448	5	500	500
		4	4156	17	1700	1700
		Total	17701	62	6200	6200
	Latvia	1	6560	19	1825	1825
		2	9178	51	4850	4850
		3	4569	21	2000	2000
		4	12991	27	2525	2525
		Total	33298	118	11200	11200
	Sweden	1	2579	6	108	107
		2	505	6	176	83
		3	83	0	0	0
		4	1801	0	0	0
		Total	4968	12	284	190
Sub-division 29	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Estonia	1	1542	3	300	300
		2	3931	13	12500	1250
		3	865	3	250	250
		4	9867	13	1150	1150
		Total	16205	32	14200	2950
	Finland	1	1083	1	50	50
		2	9035	20	999	999
		3	1124	8	400	400
		4	1035	15	689	689
		Total	12277	44	2138	2138
Sub-division 30	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Finland	1	8963	21	1046	1046
		2	30930	42	2099	2099
		3	14690	18	898	898
		4	8948	17	850	850
		Total	63531	98	4893	4893
Sub-division 31	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Finland	1	0	0	0	0
		2	2401	21	1050	1050
		3	1459	17	847	847
		4	335	4	199	199
		Total	4195	42	2096	2096
Sub-division 32	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Estonia	1	5867	28	2800	2800
		2	4431	32	4400	3200
		3	4074	25	2500	2500
		4	6052	27	2700	2700
		Total	20424	112	12400	11200
	Finland	1	1327	6	300	300
		2	3749	35	1750	1750
		3	1435	12	600	600
		4	2080	10	500	500
		Total	8591	63	3150	3150
	Russia	1	1040	15	3000	950
		2	2614	21	4185	1563
		3	498	7	1450	315
		4	3194	26	5190	1320
		Total	7346	69	13825	4148

Table 9.2.1 Herring catches in Sub-divisions 25-29, 32 (thousand tonnes).

Year	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia**	Sweden	Total
1977	11.9		33.7	0.0			57.2	137.0	48.7	313.7
1978	13.9		38.3	0.1			61.3	130.6	55.4	305.2
1979	19.4		40.4	0.0			70.4	118.1	71.3	323.1
1980	10.6		44.0	0.0			58.3	118.0	72.5	304.4
1981	14.1		42.5	1.0			51.2	110.2	72.9	294.0
1982	15.3		47.5	1.3			63.0	99.2	83.8	311.1
1983	10.5		59.1	1.0			67.1	84.6	78.6	302.0
1984	6.5		54.1	0.0			65.8	105.6	56.9	289.9
1985	7.6		54.2	0.0			72.8	110.8	42.5	289.5
1986	3.9		49.4	0.0			67.8	115.7	29.7	268.3
1987	4.2		50.4	0.0			55.5	113.8	25.4	251.9
1988	10.8		58.1	0.0			57.2	122.8	33.4	286.3
1989	7.3		50.0	0.0			51.8	121.8	55.4	289.9
1990	4.6		26.9	0.0			52.3	116.2	44.2	244.2
1991	6.8	32.7	18.1	0.0	33.3	6.5	47.1	31.9	36.5	212.8
1992	8.1	29.7	30.0	0.0	25.8	4.6	39.2	29.5	43.0	209.9
1993	8.9	32.7	32.3	0.0	25.4	3.0	41.1	21.6	66.4	231.4
1994	11.3	33.7	38.2	3.7	26.2	4.9	46.1	16.7	61.6	242.4
1995	11.4	42.9	31.4	0.0	28.4	3.6	38.7	17.0	47.2	220.6
1996	12.1	44.9	31.5	0.0	31.0	4.2	30.7	14.6	25.9	195.1
1997*	9.4	54.7	21.1	0.0	33.6	3.3	26.2	12.5	38.5	199.3

* preliminary, ** in 1977-1990 sum of catches by Estonia, Latvia, Lithuania and Russia.

Table 9.2.2 HERRING in Sub-divisions 25-32 (incl. Gulf of Riga)

Distribution (in %) of Landings in TONNES

	Landings	SD 25	SD 26	SD 27	SD 28	28:G.Riga	SD 29	SD 32
1993	231373	22.3	16.2	10.5	14.6	9.6	12.2	14.7
1994	242392	28.0	14.8	9.2	9.3	10.0	14.7	13.9
1995	220620	23.4	12.8	8.0	11.2	14.8	11.8	17.9
1996	195109	22.8	12.9	3.5	10.2	16.7	16.1	17.8
1997	199317	20.0	12.8	4.7	8.3	20.0	16.0	18.2

Distribution (in %) of Landings in NUMBERS

	Total	SD 25	SD 26	SD 27	SD 28	28:G.Riga	SD 29	SD 32
1993	8287	12.6	10.4	8.7	13.0	15.6	14.2	25.5
1994	7828	15.0	11.4	6.7	7.2	17.9	17.4	24.4
1995	8530	13.9	8.7	6.5	8.4	22.2	13.2	27.1
1996	8678	13.8	8.2	2.5	8.8	23.9	16.0	26.7
1997	9418	10.7	7.3	3.5	7.0	28.2	17.4	26.1

Mean W in Landings by SD

	Sum	SD 25	SD 26	SD 27	SD 28	28:G.Riga	SD 29	SD 32
1993	27.9	49.4	43.4	33.8	31.2	17.2	23.9	16.1
1994	31.0	57.8	40.3	42.3	40.0	17.4	26.2	17.7
1995	25.9	43.7	38.2	31.7	34.6	17.2	23.1	17.1
1996	22.5	37.1	35.1	31.0	26.1	15.7	22.6	15.0
1997	21.2	39.7	37.3	28.5	25.1	15.0	19.5	14.8

Distribution of F according Landings in NUMBERS (xsabes02 - 98)

	Sum	SD 25	SD 26	SD 27	SD 28	28:G.Riga	SD 29	SD 32
1993	0.257	0.032	0.027	0.022	0.033	0.040	0.037	0.066
1994	0.287	0.043	0.033	0.019	0.021	0.051	0.050	0.070
1995	0.278	0.039	0.024	0.018	0.023	0.062	0.037	0.075
1996	0.266	0.037	0.022	0.007	0.023	0.064	0.043	0.071
1997	0.309	0.033	0.022	0.011	0.022	0.087	0.054	0.081

Table 9.2.5.1

The SAS System 14:26 Wednesday, April 29, 1998

HER-2532: Herring in Baltic Fishing Areas 25 to 29 and 32 plus Gulf of Riga

CANUM: Catch in Numbers (Total International Catch) (Total) (Millions)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1974	27.0	2739.0	1857.0	1390.0	1674.0	521.0	352.0	632.0	99.0	88.0	102.0
1975	56.0	1974.0	1792.0	1694.0	987.0	1032.0	379.0	277.0	374.0	78.0	99.0
1976	21.0	2519.0	1352.0	1398.0	1067.0	536.0	639.0	250.0	140.0	262.0	98.0
1977	20.0	1328.0	2711.0	915.0	718.0	657.0	381.0	300.0	218.0	122.0	206.0
1978	86.0	1156.0	1396.0	1979.0	476.0	391.0	380.0	190.0	238.0	117.0	129.0
1979	51.0	482.0	1372.0	977.0	1502.0	361.0	298.0	288.0	182.0	170.0	132.0
1980	81.0	1138.0	1033.0	1077.0	580.0	788.0	193.0	213.0	226.0	104.0	223.0
1981	68.0	1388.0	1696.0	792.0	698.0	395.0	508.0	154.0	132.0	157.0	242.0
1982	66.0	947.0	2373.0	927.0	403.0	355.0	218.0	275.0	97.0	96.0	231.0
1983	31.0	794.0	1924.0	2014.0	703.0	272.0	269.0	178.0	185.0	79.0	179.0
1984	60.0	866.0	1330.0	1538.0	1242.0	431.0	198.0	181.0	137.0	119.0	177.0
1985	30.0	1261.0	2408.0	1280.0	989.0	739.0	264.0	139.0	118.0	76.0	159.0
1986	44.0	530.0	1808.0	2089.0	2014.0	735.0	369.0	134.0	87.0	61.0	86.0
1987	10.0	990.0	775.0	1555.0	1442.0	682.0	493.0	243.0	91.0	36.0	69.0
1988	38.0	480.0	2289.0	859.0	1122.0	994.0	393.0	282.0	115.0	45.0	56.0
1989	123.0	854.0	588.0	2481.0	723.0	917.0	749.0	273.0	206.0	81.0	55.0
1990	45.4	731.4	1277.9	652.6	1509.4	486.2	568.7	385.1	165.6	93.9	50.6
1991	114.6	492.4	1805.7	1380.6	553.5	988.2	318.9	301.3	161.7	61.5	55.8
1992	199.8	1262.9	1478.5	2066.2	794.2	357.3	579.7	176.7	116.4	109.5	40.3
1993	116.8	1018.5	2234.0	1801.1	1697.8	682.5	293.0	276.3	70.5	50.4	46.1
1994	170.7	651.1	1427.0	1928.8	1332.4	1250.1	541.6	223.2	253.9	41.3	43.4
1995	69.8	1052.9	1277.1	2105.7	1982.3	922.9	611.3	244.5	90.3	135.3	38.0
1996	78.4	1414.6	1891.4	1377.3	1464.2	1089.1	675.8	406.7	154.0	40.2	86.6
1997	157.2	753.4	2281.0	2298.4	1519.3	1147.6	679.3	334.8	167.3	44.7	35.2

Stock: SD 25-29, 32 Species: HERRING Year: 1997

Catch in numbers (millions)

Table 9.2.5.2

Quarter: 1								
AGE	Sum	SD 25	SD 26	SD 27	SD 28	28:G.Rigc	SD 29	SD 32
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	106.5	11.3	44.9	0.0	2.8	18.0	0.3	29.2
2	589.5	34.3	35.0	0.9	20.1	270.5	38.8	189.9
3	578.0	79.7	51.4	26.6	37.7	144.5	65.5	172.7
4	369.5	36.0	39.3	20.2	38.9	83.5	28.0	123.5
5	259.7	36.5	36.2	12.5	31.7	54.7	21.6	66.5
6	126.9	19.7	18.4	3.1	6.3	49.0	7.8	22.7
7	53.5	6.6	7.1	1.8	2.0	24.8	1.9	9.1
8	25.2	2.7	3.7	0.3	0.5	14.5	0.4	3.0
9	8.3	0.4	0.8	0.0	1.6	2.1	0.3	2.9
10	5.4	0.2	0.4	0.0	0.0	1.5	1.5	1.7
Total N	2122.4	227.4	237.3	65.4	141.7	663.2	166.3	621.2
CATON	39763	6850	7750	1930	3772	8461	2766	8234
NoAgeTOt	229	0	88	0	0	0	141	0

Quarter: 2								
AGE	Sum	SD 25	SD 26	SD 27	SD 28	28:G.Rigc	SD 29	SD 32
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	170.1	2.8	25.1	0.0	5.1	26.7	43.0	67.3
2	716.1	12.0	32.0	2.7	37.8	262.5	136.2	232.8
3	683.4	53.7	30.4	25.8	62.3	185.3	158.2	167.7
4	496.4	73.5	12.5	36.2	45.7	114.5	106.7	107.3
5	407.8	47.0	10.5	30.1	41.3	91.6	84.9	102.5
6	270.8	25.8	8.9	12.2	36.2	75.1	67.1	45.5
7	144.6	17.6	3.2	7.2	21.7	39.7	36.7	18.5
8	74.4	3.5	1.5	3.0	13.1	20.1	21.1	11.9
9	23.9	0.9	0.5	0.7	4.5	4.4	9.5	3.4
10	21.7	0.3	0.3	0.3	2.3	4.6	11.4	2.4
Total N	3009.1	237.1	125.0	118.2	270.1	824.7	674.7	759.3
CATON	65823	13768	4861	3343	7100	12586	13370	10794
NoAgeTOt	55.462	1	43	11	0	0	0	0

Quarter: 3								
AGE	Sum	SD 25	SD 26	SD 27	SD 28	28:G.Rigc	SD 29	SD 32
0	24.7	3.0	2.2	0.0	0.0	0.0	13.0	6.5
1	95.9	13.0	2.5	0.0	1.3	34.6	25.4	19.1
2	241.8	32.4	4.9	1.2	13.1	98.2	36.7	55.4
3	299.1	79.6	17.8	6.7	6.9	49.4	28.5	110.2
4	194.1	33.9	20.8	8.0	5.8	32.2	21.7	71.7
5	153.2	29.0	29.9	3.3	3.8	24.8	17.3	45.1
6	89.9	17.5	20.8	1.1	2.9	18.5	10.4	18.7
7	46.3	8.9	13.9	0.4	2.0	6.6	5.7	8.8
8	24.4	3.2	8.7	0.2	1.4	4.3	1.5	5.2
9	5.6	0.1	1.7	0.3	0.6	0.5	1.0	1.2
10	3.0	0.4	0.7	0.1	0.1	0.9	0.5	0.3
Total N	1178.1	221.1	124.0	21.1	37.9	269.9	161.8	342.3
CATON	28551	8389	5310	650	891	4536	2769	6007
NoAgeTOt	1136	0	273	0	83	0	780	0

Quarter: 4								
AGE	Sum	SD 25	SD 26	SD 27	SD 28	28:G.Rigc	SD 29	SD 32
0	132.5	18.5	10.7	0.0	0.9	31.7	11.2	59.4
1	380.9	28.6	34.2	0.1	10.3	124.9	25.6	157.2
2	733.6	41.3	27.8	9.5	51.2	299.5	86.2	218.1
3	737.9	110.1	51.1	38.0	67.8	180.5	131.2	159.2
4	459.3	47.2	33.8	46.5	40.8	115.2	104.0	71.8
5	326.9	38.5	21.3	18.6	27.0	71.7	114.6	35.2
6	191.7	21.8	14.3	9.7	5.6	44.1	79.4	16.7
7	90.4	10.3	3.6	2.7	3.2	19.4	42.0	9.2
8	43.4	2.1	1.8	0.9	0.1	7.4	28.5	2.6
9	7.0	0.2	0.3	0.1	0.0	0.2	5.4	0.8
10	5.1	0.0	0.4	0.1	0.0	0.5	3.4	0.7
Total N	3108.5	318.6	199.5	126.0	206.9	895.0	631.5	731.0
CATON	65180	10855	7632	3501	4689	14261	12916	11326
NoAgeTOt	4617	220	582	0	1801	0	2014	0

Stock: SD 25-29, 32 **Species: HERRING** **Year: 1997**

Mean weight (g)

Quarter: 1 Table 9.2.6.1

AGE	Sum	SD 25	SD 26	SD 27	SD 28	28:G.Rigc	SD 29	SD 32
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	7.2	14.0	8.4	0.0	12.6	4.0	3.7	4.1
2	11.8	23.8	24.5	13.7	14.8	9.9	11.4	9.7
3	17.6	26.9	32.1	19.8	19.7	12.5	15.4	13.3
4	21.2	33.3	36.1	28.6	22.1	15.5	18.0	16.0
5	28.3	32.7	45.5	39.3	47.5	16.2	22.3	17.0
6	27.9	39.1	55.4	53.9	16.5	17.9	21.8	19.4
7	31.1	51.8	56.6	68.6	31.2	19.4	25.2	22.0
8	33.2	61.4	70.0	92.6	29.3	19.0	41.9	24.6
9	45.2	75.5	68.2	106.3	95.6	19.8	16.7	28.0
10	45.7	75.2	96.3	84.0	0.0	33.2	48.5	37.6
N*w	39718	6833	7735	1930	3774	8458	2755	8233

Quarter: 2

AGE	Sum	SD 25	SD 26	SD 27	SD 28	28:G.Rigc	SD 29	SD 32
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	5.7	14.9	13.0	0.0	4.4	4.5	4.7	4.0
2	11.9	28.8	26.4	9.5	11.2	10.5	11.9	10.6
3	17.9	39.3	32.1	17.4	17.0	14.2	16.6	14.1
4	25.8	53.8	42.5	25.0	25.0	18.0	21.1	18.4
5	28.2	62.8	48.3	28.3	30.7	20.0	23.3	20.6
6	32.6	89.4	59.2	38.4	37.5	20.1	24.0	23.1
7	38.7	94.4	61.0	54.8	39.7	22.1	27.9	31.3
8	38.2	83.7	80.9	61.6	47.0	25.1	33.8	33.3
9	45.0	116.7	91.2	59.0	45.1	31.6	41.7	42.1
10	49.1	137.8	76.7	73.5	60.7	31.6	51.6	41.4
N*w	65439	13812	4106	3342	7094	12592	13030	11465

Quarter: 3

AGE	Sum	SD 25	SD 26	SD 27	SD 28	28:G.Rigc	SD 29	SD 32
0	4.6	10.2	6.7	0.0	0.0	0.0	3.0	4.4
1	13.5	23.5	17.4	0.0	11.2	11.6	11.8	12.1
2	18.7	36.1	32.7	20.7	15.8	15.5	16.3	15.2
3	22.3	33.7	33.4	22.7	19.4	16.8	17.5	16.1
4	25.3	38.8	38.5	29.8	24.1	19.3	20.0	18.9
5	30.4	43.8	43.7	34.0	30.6	20.1	23.6	20.8
6	34.2	51.1	48.1	58.2	37.6	20.7	22.7	21.0
7	38.7	53.6	51.0	66.6	38.5	22.0	26.5	23.6
8	43.5	64.4	58.2	74.2	41.0	23.6	32.3	25.4
9	49.9	92.0	65.4	67.3	43.3	26.9	42.7	39.5
10	52.3	72.9	73.8	67.0	78.5	24.3	53.5	40.0
N*w	28529	8396	5302	650	891	4536	2791	5963

Quarter: 4

AGE	Sum	SD 25	SD 26	SD 27	SD 28	28:G.Rigc	SD 29	SD 32
0	6.1	13.7	7.9	0.0	3.6	4.9	3.8	4.6
1	13.4	22.8	21.6	10.0	15.3	11.2	12.5	11.7
2	17.8	29.2	35.9	20.4	21.3	15.3	17.3	16.1
3	21.3	29.9	33.6	22.4	22.0	17.0	18.6	17.8
4	23.9	38.7	36.2	26.7	24.7	18.8	20.2	19.9
5	26.1	43.8	44.1	34.9	24.9	19.8	21.3	20.7
6	30.2	56.5	60.3	40.2	31.2	20.1	23.5	22.8
7	30.3	54.3	62.3	48.2	28.6	21.3	26.3	23.3
8	28.3	55.3	35.3	48.8	0.0	22.2	27.4	23.1
9	37.2	95.9	83.3	70.3	0.0	20.0	34.4	28.4
10	42.5	135.0	89.8	62.0	0.0	23.2	41.0	36.0
N*w	64446	10846	6917	3501	4687	14268	12908	11319

Table 9.2.6.2

The SAS System 14:26 Wednesday, April 29, 1998

HER-2532: Herring in Baltic Fishing Areas 25 to 29 and 32 plus Gulf of Riga

WECA: Mean Weight in Catch (Total International Catch) (Total) (Grams)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1974	7.10	27.50	32.10	39.00	43.30	69.20	77.50	82.40	74.30	73.30	78.10
1975	6.40	29.20	28.70	46.70	49.10	51.20	77.20	77.50	82.30	69.60	74.60
1976	6.20	21.40	35.00	35.90	55.00	55.10	54.90	78.90	70.70	89.90	67.50
1977	5.90	27.60	25.80	46.10	53.40	67.00	60.10	69.70	88.60	91.10	93.30
1978	5.40	24.50	41.80	38.50	53.60	58.90	71.80	72.00	69.30	95.10	89.40
1979	5.40	21.70	38.90	55.20	47.30	64.00	70.40	76.30	82.50	79.70	95.60
1980	7.30	22.60	34.50	51.20	65.00	59.20	75.40	79.00	86.90	93.50	101.90
1981	6.80	25.40	33.70	50.20	65.90	73.70	71.90	83.60	87.50	97.90	107.40
1982	6.10	20.50	38.20	49.60	60.00	70.10	78.70	77.30	89.70	99.00	106.00
1983	6.50	18.40	30.00	53.90	56.50	71.50	83.90	88.10	89.20	104.70	115.40
1984	7.00	16.20	27.80	41.50	61.60	62.80	75.10	85.80	89.10	95.30	111.60
1985	5.90	15.60	21.60	39.20	53.90	66.40	72.60	83.30	93.00	99.70	107.80
1986	6.20	18.30	25.30	32.40	48.90	61.00	67.70	78.20	93.00	96.20	104.10
1987	5.70	14.90	32.30	37.10	42.20	55.70	62.40	70.30	82.40	93.80	102.50
1988	6.40	19.60	24.60	43.60	48.60	50.90	62.80	69.90	84.50	87.80	98.30
1989	7.45	22.30	33.70	33.10	45.90	53.80	56.90	66.00	74.60	84.40	103.80
1990	9.30	17.90	29.50	39.80	37.00	55.60	61.10	64.20	73.30	75.60	90.10
1991	10.00	19.60	23.10	34.10	46.50	37.00	55.20	53.30	59.80	71.80	65.66
1992	8.40	13.20	21.30	28.60	40.00	54.10	42.90	62.90	66.30	61.20	73.30
1993	7.10	12.80	19.80	28.70	33.30	41.70	48.50	43.60	59.40	61.10	62.90
1994	6.60	14.50	20.10	26.20	34.40	39.20	49.50	60.30	53.80	67.30	72.40
1995	7.90	11.10	18.90	23.30	29.10	34.60	37.40	44.70	52.40	45.60	57.10
1996	4.00	11.20	16.00	21.80	25.60	29.10	33.30	36.20	42.50	49.50	51.00
1997	5.90	10.80	14.50	19.50	24.10	27.90	31.30	35.20	35.60	44.40	47.90

Table 9.2.8.1

The SAS System 14:26 Wednesday, April 29, 1998

HER-2532: Herring in Baltic Fishing Areas 25 to 29 and 32 plus Gulf of Riga

NATMOR: Natural Mortality (Total International Catch) (Total)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9
1974	0.330	0.540	0.270	0.260	0.240	0.240	0.220	0.210	0.200	0.200
1975	0.370	0.610	0.300	0.290	0.270	0.270	0.250	0.250	0.240	0.220
1976	0.370	0.610	0.300	0.290	0.270	0.270	0.250	0.250	0.240	0.220
1977	0.353	0.478	0.290	0.270	0.250	0.248	0.234	0.227	0.224	0.218
1978	0.421	0.654	0.338	0.303	0.272	0.271	0.249	0.240	0.236	0.226
1979	0.480	0.800	0.390	0.347	0.303	0.300	0.269	0.257	0.251	0.236
1980	0.473	0.846	0.406	0.367	0.319	0.315	0.280	0.265	0.258	0.241
1981	0.457	0.771	0.384	0.349	0.307	0.302	0.273	0.258	0.251	0.237
1982	0.474	0.880	0.410	0.371	0.322	0.318	0.284	0.266	0.258	0.243
1983	0.440	0.774	0.390	0.357	0.315	0.311	0.278	0.262	0.255	0.240
1984	0.394	0.658	0.357	0.334	0.298	0.295	0.267	0.254	0.247	0.235
1985	0.363	0.580	0.334	0.317	0.287	0.284	0.260	0.247	0.242	0.231
1986	0.314	0.500	0.297	0.283	0.262	0.258	0.242	0.233	0.228	0.222
1987	0.310	0.416	0.274	0.262	0.246	0.244	0.232	0.225	0.222	0.217
1988	0.293	0.435	0.274	0.261	0.244	0.242	0.231	0.224	0.221	0.216
1989	0.259	0.361	0.251	0.243	0.231	0.230	0.221	0.217	0.215	0.211
1990	0.247	0.300	0.333	0.328	0.320	0.320	0.214	0.211	0.210	0.208
1991	0.235	0.273	0.224	0.219	0.214	0.214	0.210	0.208	0.207	0.205
1992	0.242	0.273	0.222	0.219	0.213	0.213	0.209	0.208	0.207	0.205
1993	0.264	0.320	0.239	0.231	0.222	0.222	0.215	0.212	0.211	0.208
1994	0.270	0.327	0.245	0.237	0.227	0.226	0.218	0.215	0.213	0.210
1995	0.273	0.336	0.250	0.242	0.231	0.231	0.222	0.218	0.216	0.216
1996	0.273	0.336	0.250	0.242	0.231	0.231	0.222	0.218	0.216	0.216
1997	0.273	0.336	0.250	0.242	0.231	0.231	0.222	0.218	0.216	0.216

Table 9.2.9.1.4

The SAS System 14:26 Wednesday, April 29, 1998

HER-2532: Herring in Baltic Fishing Areas 25 to 29 and 32 plus Gulf of Riga

FLTNY: Internat Acoustic Surveys 1982-95. Corrected for area coverage. (Catch: Millions)

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9
1982	1	8264	11691	4261	2476	2418	1863	1092	711	475
1983	1	4141	7015	6744	3000	1903	2054	4631	913	550
1984	1	9181	8007	8080	6434	2274	1413	909	569	290
1985	1	4251	9355	4935	4102	1410	650	493	275	177
1986	1	4336	10544	11366	4983	3447	1113	453	271	136
1987	1	9349	2966	6411	6489	2392	1369	435	135	42
1988	1	1753	6145	2743	6074	5089	2062	1034	317	104
1989	1	7186	3428	9591	3689	5452	3144	1262	438	96
1990	1	13726	11223	6691	5844	3441	2754	1402	642	272
1991	1	5670	16420	9156	3967	8708	2214	2071	1324	993
1992	1	-1	-1	-1	-1	-1	-1	-1	-1	-1
1993	1	-1	-1	-1	-1	-1	-1	-1	-1	-1
1994	1	3689	10991	20453	11972	5475	1951	878	509	144
1995	1	4999	3572	6836	8042	6945	3893	1870	632	175
1996	1	3692	14265	10430	7629	5029	2586	1285	482	259
1997	1	-1	-1	-1	-1	-1	-1	-1	-1	-1

Table 9.2.9.3.1

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Lowestoft VPA Version 3.1

   17-Apr-98  11:02:41

 Extended Survivors Analysis

 Herring 25-29&32Riga (run: XSABES02/X02)

 CPUE data from file /users/fish/ifad/ifapwork/wgbfas/her_2532/FLEET.X02

 Catch data for  24 years. 1974 to 1997. Ages  1 to   9.

      Fleet,           First, Last, First, Last, Alpha,  Beta
                     ,   year, year,  age ,  age
 FLTNY: Internat Acou,   1982, 1997,   1,     8,   .800,   .900


 Time series weights :

      Tapered time weighting applied
      Power =    3 over  20 years


 Catchability analysis :

      Catchability dependent on stock size for ages <    3

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


      Catchability independent of age for ages >=    6


 Terminal population estimation :

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

      S.E. of the mean to which the estimates  are shrunk =    .500

      Minimum standard error for population
      estimates derived from each fleet =    .300

      Prior weighting not applied


 Tuning had not converged after   40 iterations


 Total absolute residual between iterations
 39 and  40 =     .00027

 Final year F values
 Age          ,      1,      2,      3,      4,      5,      6,      7,      8
 Iteration 39,  .0455,  .1852,  .2255,  .3569,  .3388,  .3159,  .2598,  .2490
 Iteration 40,  .0455,  .1852,  .2255,  .3569,  .3387,  .3158,  .2598,  .2489

1


 Regression weights
       ,  .751,  .820,  .877,  .921,  .954,  .976,  .990,  .997, 1.000, 1.000


 Fishing mortalities
    Age,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996,  1997

      1,  .051,  .057,  .037,  .027,  .058,  .051,  .042,  .047,  .075,  .045
      2,  .155,  .095,  .133,  .128,  .113,  .146,  .103,  .121,  .122,  .185
      3,  .182,  .268,  .160,  .226,  .217,  .201,  .189,  .228,  .195,  .226
      4,  .230,  .242,  .284,  .214,  .199,  .285,  .232,  .316,  .255,  .357
      5,  .289,  .312,  .277,  .330,  .212,  .269,  .362,  .258,  .297,  .339
      6,  .287,  .383,  .333,  .319,  .333,  .274,  .364,  .310,  .315,  .316
      7,  .363,  .341,  .353,  .299,  .297,  .265,  .353,  .283,  .359,  .260
      8,  .441,  .507,  .363,  .248,  .181,  .186,  .422,  .238,  .296,  .249
```

Table 9.2.9.3.1 (Cont'd)

XSA population numbers (Thousands)

YEAR	AGE 1	2	3	4	5	6	7	8
1988	1.20E+07	1.83E+07	5.89E+06	6.17E+06	4.47E+06	1.77E+06	1.04E+06	3.60E+05
1989	1.84E+07	7.36E+06	1.19E+07	3.78E+06	3.84E+06	2.63E+06	1.05E+06	5.77E+05
1990	2.36E+07	1.21E+07	5.21E+06	7.16E+06	2.36E+06	2.24E+06	1.44E+06	6.04E+05
1991	2.09E+07	1.68E+07	7.62E+06	3.20E+06	3.91E+06	1.30E+06	1.29E+06	8.18E+05
1992	2.58E+07	1.55E+07	1.18E+07	4.89E+06	2.08E+06	2.27E+06	7.64E+05	7.79E+05
1993	2.39E+07	1.85E+07	1.11E+07	7.66E+06	3.23E+06	1.36E+06	1.32E+06	4.61E+05
1994	1.84E+07	1.65E+07	1.26E+07	7.21E+06	4.61E+06	1.98E+06	8.36E+05	8.21E+05
1995	2.73E+07	1.27E+07	1.17E+07	8.21E+06	4.55E+06	2.56E+06	1.11E+06	4.74E+05
1996	2.31E+07	1.86E+07	8.79E+06	7.29E+06	4.75E+06	2.79E+06	1.51E+06	6.70E+05
1997	2.00E+07	1.53E+07	1.28E+07	5.68E+06	4.48E+06	2.80E+06	1.63E+06	8.46E+05

Estimated population abundance at 1st Jan 1998

.00E+00	1.37E+07	9.89E+06	8.05E+06	3.16E+06	2.54E+06	1.64E+06	1.01E+06

Taper weighted geometric mean of the VPA populations:

2.25E+07	1.46E+07	9.62E+06	5.77E+06	3.40E+06	1.90E+06	1.05E+06	5.77E+05

Standard error of the weighted Log(VPA populations) :

.2868	.2851	.3022	.3200	.3323	.3484	.3537	.3778

Log catchability residuals.

Fleet : FLTNY: Internat Acou

Age	1982	1983	1984	1985	1986	1987
1	.15	-.42	.10	-.31	.30	.25
2	.19	-.13	-.07	-.16	.15	-.17
3	-.08	-.07	.03	-.58	.08	-.31
4	-.11	-.01	.33	-.31	-.08	-.17
5	-.16	-.05	.14	-.73	-.15	-.46
6	-.14	.30	.27	-.38	-.26	-.41
7	-.42	1.23	.05	-.20	-.12	-.51
8	-.02	-.07	-.37	-.55	-.19	-.62

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	-.33	.44	.71	.01	99.99	99.99	-.19	-.30	-.38	99.99
2	-.40	.06	.44	.30	99.99	99.99	.05	-.44	.12	99.99
3	-.67	-.06	.39	.28	99.99	99.99	.57	-.41	.26	99.99
4	-.08	-.09	-.16	.11	99.99	99.99	.43	-.03	-.01	99.99
5	-.10	.13	.21	.58	99.99	99.99	-.01	.16	-.17	99.99
6	.00	.10	.08	.39	99.99	99.99	-.12	.27	-.22	99.99
7	-.10	.06	-.14	.30	99.99	99.99	-.07	.35	-.26	99.99
8	-.16	-.26	-.05	.27	99.99	99.99	-.53	.08	-.49	99.99

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

Age	3	4	5	6	7	8
Mean Log q	-6.6296	-6.4384	-6.2297	-6.3114	-6.3114	-6.3114
S.E(Log q)	.4103	.2076	.3267	.2664	.3517	.3811

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	.89	.246	8.95	.42	13	.41	-7.96
2	.68	.938	10.15	.55	13	.31	-7.16

Table 9.2.9.3.1 (Cont'd)

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

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
3,	.98,	.043,	6.83,	.38,	13,	.43,	-6.63,
4,	1.00,	-.013,	6.41,	.74,	13,	.22,	-6.44,
5,	.89,	.326,	7.17,	.57,	13,	.31,	-6.23,
6,	1.02,	-.055,	6.19,	.64,	13,	.29,	-6.31,
7,	.84,	.511,	7.51,	.60,	13,	.31,	-6.32,
8,	.86,	.561,	7.45,	.71,	13,	.27,	-6.54,

1

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 1996

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLTNY: Internat Acou,	1.,	.000,	.000,	.00,	0,	.000,	.000
P shrinkage mean ,	14584308.,	.29,,,,				.755,	.043
F shrinkage mean ,	11256138.,	.50,,,,				.245,	.055

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
13686089.,	.25,	16.43,	2,	66.342,	.045

1

Age 2 Catchability dependent on age and year class strength

Year class = 1995

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLTNY: Internat Acou,	6742651.,	.441,	.000,	.00,	1,	.209,	.261
P shrinkage mean ,	9623546.,	.30,,,,				.579,	.190
F shrinkage mean ,	15585781.,	.50,,,,				.212,	.121

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
9892943.,	.22,	.33,	3,	1.484,	.185

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

Year class = 1994

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLTNY: Internat Acou,	7746916.,	.266,	.204,	.77,	2,	.710,	.233
F shrinkage mean ,	8848837.,	.50,,,,				.290,	.207

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
8051071.,	.24,	.13,	3,	.553,	.226

1

Table 9.2.9.3.1 (Cont'd)

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

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLTNY: Internat Acou,	2706265.,	.233,	.214,	.92,	3, .707,	.406
F shrinkage mean ,	4575660.,	.50,,,,			.293,	.259

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
3156145.,	.22,	.22,	4,	.998,	.357

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

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLTNY: Internat Acou,	2362728.,	.199,	.120,	.60,	3, .752,	.360
F shrinkage mean ,	3146733.,	.50,,,,			.248,	.281

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
2536459.,	.19,	.12,	4,	.607,	.339

1

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

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLTNY: Internat Acou,	1649862.,	.205,	.181,	.89,	3, .727,	.314
F shrinkage mean ,	1604277.,	.50,,,,			.273,	.321

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
1637305.,	.20,	.13,	4,	.626,	.316

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

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLTNY: Internat Acou,	1072518.,	.174,	.152,	.87,	4, .789,	.247
F shrinkage mean ,	816548.,	.50,,,,			.211,	.313

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
1012420.,	.17,	.13,	5,	.766,	.260

Age 8 Catchability constant w.r.t. time and age (fixed at the value for age) 6

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLTNY: Internat Acou,	570218.,	.177,	.136,	.77,	5, .756,	.234
F shrinkage mean ,	427197.,	.50,,,,			.244,	.301

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
531424.,	.18,	.12,	6,	.683,	.249

Table 9.2.9.3.2

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Run title : Herring 25-29&32Riga (run: XSABES02/X02)

At 17-Apr-98  11:03:37

                Terminal Fs derived using XSA (With F shrinkage)

      Table  8    Fishing mortality (F) at age
      YEAR,       1974,    1975,    1976,    1977,

      AGE
        1,        .1533,   .1423,   .0893,   .0820,
        2,        .1265,   .1802,   .1804,   .1716,
        3,        .1770,   .1776,   .2319,   .1959,
        4,        .2067,   .1975,   .1767,   .1930,
        5,        .1321,   .2018,   .1689,   .1675,
        6,        .1882,   .1407,   .1979,   .1842,
        7,        .2105,   .2308,   .1369,   .1397,
        8,        .1837,   .1908,   .1835,   .1770,
      +gp,        .1837,   .1908,   .1835,   .1770,
0  FBAR  3- 6,    .1760,   .1794,   .1938,   .1852,



      Table  8    Fishing mortality (F) at age
      YEAR,       1978,    1979,    1980,    1981,    1982,    1983,    1984,    1985,    1986,    1987,

      AGE
        1,        .0682,   .0378,   .0687,   .0532,   .0367,   .0332,   .0309,   .0599,   .0467,   .0430,
        2,        .1452,   .1523,   .1635,   .2181,   .1847,   .1549,   .1049,   .1549,   .1477,   .1087,
        3,        .2032,   .1672,   .2090,   .2215,   .2160,   .2913,   .2136,   .1615,   .2205,   .1997,
        4,        .1598,   .2633,   .1634,   .2370,   .1941,   .2979,   .3415,   .2343,   .4595,   .2509,
        5,        .1631,   .1922,   .2424,   .1802,   .2056,   .2212,   .3406,   .3916,   .2980,   .2936,
        6,        .1452,   .1946,   .1642,   .2709,   .1580,   .2654,   .2752,   .3976,   .3731,   .3530,
        7,        .1368,   .1656,   .2238,   .2062,   .2491,   .2028,   .3103,   .3390,   .3814,   .4718,
        8,        .1624,   .1978,   .2019,   .2246,   .2067,   .2837,   .2526,   .3624,   .3861,   .5039,
      +gp,        .1624,   .1978,   .2019,   .2246,   .2067,   .2837,   .2526,   .3624,   .3861,   .5039,
0  FBAR  3- 6,    .1678,   .2043,   .1948,   .2274,   .1934,   .2689,   .2927,   .2963,   .3378,   .2743,
1
```

Run title : Herring 25-29&32Riga (run: XSABES02/X02)

At 17-Apr-98 11:03:37

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	FBAR 95-97
AGE											
1,	.0511,	.0571,	.0367,	.0273,	.0579,	.0512,	.0425,	.0466,	.0753,	.0455,	.0558,
2,	.1547,	.0949,	.1327,	.1279,	.1126,	.1463,	.1028,	.1206,	.1221,	.1852,	.1427,
3,	.1819,	.2676,	.1598,	.2258,	.2166,	.2010,	.1894,	.2278,	.1946,	.2255,	.2160,
4,	.2299,	.2417,	.2841,	.2140,	.1995,	.2848,	.2320,	.3159,	.2554,	.3569,	.3094,
5,	.2889,	.3116,	.2773,	.3298,	.2116,	.2689,	.3617,	.2581,	.2973,	.3387,	.2980,
6,	.2868,	.3829,	.3328,	.3191,	.3329,	.2735,	.3640,	.3100,	.3152,	.3158,	.3137,
7,	.3627,	.3406,	.3534,	.2989,	.2967,	.2645,	.3526,	.2830,	.3585,	.2598,	.3004,
8,	.4409,	.5071,	.3634,	.2476,	.1811,	.1862,	.4218,	.2385,	.2957,	.2489,	.2610,
+gp,	.4409,	.5071,	.3634,	.2476,	.1811,	.1862,	.4218,	.2385,	.2957,	.2489,	
0 FBAR 3- 6,	.2469,	.3009,	.2635,	.2722,	.2402,	.2571,	.2868,	.2779,	.2656,	.3092,	

Run title : Herring 25-29&32Riga (run: XSABES02/X02)

At 17-Apr-98 11:03:37

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-4

YEAR,	1974,	1975,	1976,	1977,
AGE				
1,	2525118,	2019022,	3998735,	2141728,
2,	1788979,	1262419,	951529,	1987037,
3,	975615,	1203421,	780984,	588542,
4,	1010601,	630194,	753943,	463452,
5,	474703,	646497,	394842,	482318,
6,	229084,	327206,	403355,	254582,
7,	369752,	152310,	221382,	257742,
8,	65195,	242815,	94174,	150350,
+gp,	124532,	113147,	238469,	224370,
0 TOTAL,	7563570,	6597025,	7837405,	6550121,

Table 10 Stock number at age (start of year) Numbers*10**-4

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
1,	2430060,	1939091,	2618006,	3937626,	4076009,	3577790,	3948855,	2897139,	1490796,	2899096,
2,	1223352,	1180181,	838980,	1048912,	1726951,	1629667,	1596030,	1982737,	1527748,	862938,
3,	1252320,	754596,	686157,	474699,	574476,	952777,	945064,	1005600,	1215982,	979334,
4,	369336,	754884,	451214,	385732,	268332,	319409,	498251,	546571,	623171,	734930,
5,	297573,	239833,	428471,	278527,	223897,	160152,	173045,	262845,	324529,	302866,
6,	318344,	192789,	146601,	245377,	171962,	132626,	94063,	91648,	133744,	186125,
7,	167574,	214623,	121269,	94020,	142436,	110533,	77028,	54696,	47484,	72302,
8,	178619,	114967,	140655,	74381,	59103,	85093,	69442,	43809,	30440,	25688,
+gp,	182753,	188173,	200493,	221761,	196449,	116840,	148063,	85977,	50812,	29242,
0 TOTAL,	6419927,	5579134,	5631843,	6761035,	7439607,	7084882,	7549849,	6971024,	5444708,	6092518,

1

Run title : Herring 25-29&32Riga (run: XSABES02/X02)

At 17-Apr-98 11:03:37

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-4

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	1998,	GMST 74-95	AMST 74-95
AGE													
1,	1196801,	1844536,	2356297,	2094822,	2575059,	2393987,	1842816,	2733133,	2306490,	2004173,	0,	2489339,	2615296,
2,	1832068,	736031,	1214306,	1682637,	1551396,	1849683,	1651603,	1273534,	1864155,	1528690,	1368608,	1372467,	1427213,
3,	588541,	1193384,	520784,	762190,	1183519,	1110220,	1258231,	1166469,	879126,	1284889,	989294,	876715,	916949,
4,	617201,	377952,	716223,	319764,	488543,	765557,	720762,	821407,	729172,	568131,	805107,	541281,	574429,
5,	447147,	384256,	235581,	391463,	208428,	323422,	461204,	455447,	475377,	448324,	315615,	324710,	345320,
6,	176925,	262964,	223566,	129636,	227254,	136322,	197954,	256258,	279283,	280295,	253646,	192271,	206290,
7,	103687,	105419,	143758,	129396,	76370,	132175,	83636,	110613,	150533,	163202,	163731,	120172,	135828,
8,	36020,	57666,	60362,	81757,	77943,	46103,	82074,	47411,	67022,	84578,	101242,	72420,	84730,
+gp,	31247,	37590,	52195,	58896,	99724,	62696,	27089,	90424,	54786,	40135,	78354,		
0 TOTAL,	5029638,	4999796,	5523071,	5650565,	6488235,	6820173,	6325364,	6954703,	6805944,	6402416,	4075597,		

1

Table 9.2.9.3.3

Run title : Herring 25-29&32Riga (run: XSABES02/X02)

At 17-Apr-98 11:03:38

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 3- 6,
1974,	25251182,	3046871,	1865690,	310000,	.1662,	.1760,
1975,	20190216,	2807060,	1776304,	313000,	.1762,	.1794,
1976,	39987384,	2749670,	1543054,	318000,	.2061,	.1938,
1977,	21417312,	2629227,	1611226,	314000,	.1949,	.1852,
1978,	24300620,	2625977,	1575493,	305000,	.1936,	.1678,
1979,	19390904,	2367386,	1499492,	323000,	.2154,	.2043,
1980,	26180088,	2318423,	1351908,	304000,	.2249,	.1948,
1981,	39376288,	2590816,	1245352,	294000,	.2361,	.2274,
1982,	40760072,	2620194,	1297699,	311000,	.2397,	.1934,
1983,	35777892,	2360043,	1261478,	302000,	.2394,	.2689,
1984,	39488584,	2247629,	1209413,	290000,	.2398,	.2927,
1985,	28971394,	2003874,	1152194,	289000,	.2508,	.2963,
1986,	14907972,	1750324,	1104941,	268000,	.2425,	.3378,
1987,	28990958,	1767949,	1032089,	252000,	.2442,	.2743,
1988,	11968030,	1730842,	1134992,	286000,	.2520,	.2469,
1989,	18445384,	1728521,	1021614,	290000,	.2839,	.3009,
1990,	23562996,	1708391,	969234,	244000,	.2517,	.2635,
1991,	20948218,	1589819,	891034,	213000,	.2390,	.2722,
1992,	25750606,	1572838,	966393,	210000,	.2173,	.2402,
1993,	23939900,	1582618,	975402,	231000,	.2368,	.2571,
1994,	18428164,	1571253,	997477,	244000,	.2446,	.2868,
1995,	27331368,	1421168,	873360,	221000,	.2530,	.2779,
1996,	23064934,	1275946,	784460,	195109,	.2487,	.2656,
1997,	20041754,	1161545,	718299,	199317,	.2775,	.3092,
Arith. Mean	25769678,	2051183,	1202442,	271934,	.2323,	.2463,
0 Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		
1						

Table 9.2.12.1

The SAS System 14:26 Wednesday, April 29, 1998
Herring in Baltic Fishing Areas 25 to 29 and 32 plus Gulf of Riga

Prediction with management option table: Input data

Year: 1998								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	22648.000	0.3360	0.0000	0.3500	0.3000	11.000	0.0558	11.000
2	13686.000	0.2500	0.7000	0.3500	0.3000	15.250	0.1427	15.250
3	9892.000	0.2420	0.9000	0.3500	0.3000	20.650	0.2160	20.650
4	8051.000	0.2310	1.0000	0.3500	0.3000	24.850	0.3094	24.850
5	3156.000	0.2310	1.0000	0.3500	0.3000	28.500	0.2980	28.500
6	2536.000	0.2220	1.0000	0.3500	0.3000	32.300	0.3137	32.300
7	1637.000	0.2180	1.0000	0.3500	0.3000	35.700	0.3004	35.700
8	1012.000	0.2160	1.0000	0.3500	0.3000	39.050	0.2610	39.050
9+	784.000	0.2160	1.0000	0.3500	0.3000	48.233	0.2610	48.233
Unit	Millions	-	-	-	-	Grams	-	Grams

Year: 1999								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	22648.000	0.3360	0.0000	0.3500	0.3000	11.000	0.0558	11.000
2	.	0.2500	0.7000	0.3500	0.3000	15.250	0.1427	15.250
3	.	0.2420	0.9000	0.3500	0.3000	20.650	0.2160	20.650
4	.	0.2310	1.0000	0.3500	0.3000	24.850	0.3094	24.850
5	.	0.2310	1.0000	0.3500	0.3000	28.500	0.2980	28.500
6	.	0.2220	1.0000	0.3500	0.3000	32.300	0.3137	32.300
7	.	0.2180	1.0000	0.3500	0.3000	35.700	0.3004	35.700
8	.	0.2160	1.0000	0.3500	0.3000	39.050	0.2610	39.050
9+	.	0.2160	1.0000	0.3500	0.3000	48.233	0.2610	48.233
Unit	Millions	-	-	-	-	Grams	-	Grams

Year: 2000								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	.	0.3360	0.0000	0.3500	0.3000	11.000	0.0558	11.000
2	.	0.2500	0.7000	0.3500	0.3000	15.250	0.1427	15.250
3	.	0.2420	0.9000	0.3500	0.3000	20.650	0.2160	20.650
4	.	0.2310	1.0000	0.3500	0.3000	24.850	0.3094	24.850
5	.	0.2310	1.0000	0.3500	0.3000	28.500	0.2980	28.500
6	.	0.2220	1.0000	0.3500	0.3000	32.300	0.3137	32.300
7	.	0.2180	1.0000	0.3500	0.3000	35.700	0.3004	35.700
8	.	0.2160	1.0000	0.3500	0.3000	39.050	0.2610	39.050
9+	.	0.2160	1.0000	0.3500	0.3000	48.233	0.2610	48.233
Unit	Millions	-	-	-	-	Grams	-	Grams

Notes: Run name : MANBES05
Date and time: 22APR98:10:38

Table 9.2.12.2

The SAS System 14:26 Wednesday, April 29, 1998
Herring in Baltic Fishing Areas 25 to 29 and 32 plus Gulf of Riga

Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	0.2843	1169810	714681	189814	0.0000	0.0000	1167410	772993	0	1116024	948684
.	.	.	.	.	0.1000	0.0284	.	766263	20669	1094354	920979
.	.	.	.	.	0.2000	0.0569	.	759596	40853	1073205	894194
.	.	.	.	.	0.3000	0.0853	.	752990	60563	1052561	868298
.	.	.	.	.	0.4000	0.1137	.	746445	79813	1032411	843258
.	.	.	.	.	0.5000	0.1421	.	739960	98614	1012740	819045
.	.	.	.	.	0.6000	0.1706	.	733536	116978	993536	795629
.	.	.	.	.	0.7000	0.1990	.	727171	134916	974788	772982
.	.	.	.	.	0.8000	0.2274	.	720865	152440	956482	751077
.	.	.	.	.	0.9000	0.2558	.	714617	169560	938608	729887
.	.	.	.	.	1.0000	0.2843	.	708426	186286	921154	709388
.	.	.	.	.	1.1000	0.3127	.	702293	202629	904109	689554
.	.	.	.	.	1.2000	0.3411	.	696216	218599	887463	670364
.	.	.	.	.	1.3000	0.3696	.	690196	234205	871205	651793
.	.	.	.	.	1.4000	0.3980	.	684231	249456	855325	633822
.	.	.	.	.	1.5000	0.4264	.	678320	264362	839814	616427
.	.	.	.	.	1.6000	0.4548	.	672465	278932	824661	599591
.	.	.	.	.	1.7000	0.4833	.	666663	293174	809858	583292
.	.	.	.	.	1.8000	0.5117	.	660914	307096	795395	567512
.	.	.	.	.	1.9000	0.5401	.	655219	320708	781263	552234
.	.	.	.	.	2.0000	0.5686	.	649575	334015	767455	537440
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANBES05
Date and time : 22APR98:10:38
Computation of ref. F: Simple mean, age 3 - 6
Basis for 1998 : F factors

Table 9.2.12.3

The SAS System 14:26 Wednesday, April 29, 1998

Herring in Baltic Fishing Areas 25 to 29 and 32 plus Gulf of Riga

Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
2.6997	0.7675	1169810	615360	426000	0.0000	0.0000	922497	554132	0	891195	740637
.	.	.	.	.	0.2000	0.0569	.	544891	29361	860068	700951
.	.	.	.	.	0.4000	0.1137	.	535817	57430	830334	663741
.	.	.	.	.	0.6000	0.1706	.	526905	84271	801923	628839
.	.	.	.	.	0.8000	0.2274	.	518152	109946	774769	596089
.	.	.	.	.	1.0000	0.2843	.	509555	134513	748809	565346
.	.	.	.	.	1.2000	0.3411	.	501112	158026	723984	536476
.	.	.	.	.	1.4000	0.3980	.	492820	180537	700237	509352
.	.	.	.	.	1.6000	0.4548	.	484675	202097	677514	483860
.	.	.	.	.	1.8000	0.5117	.	476675	222752	655765	459890
.	.	.	.	.	2.0000	0.5685	.	468818	242545	634942	437342
.	.	.	.	.	2.2000	0.6254	.	461100	261519	615000	416122
.	.	.	.	.	2.4000	0.6823	.	453519	279714	595895	396143
.	.	.	.	.	2.6000	0.7391	.	446073	297166	577587	377325
.	.	.	.	.	2.8000	0.7960	.	438758	313913	560038	359592
.	.	.	.	.	3.0000	0.8528	.	431572	329987	543210	342874
.	.	.	.	.	3.2000	0.9097	.	424514	345421	527069	327104
.	.	.	.	.	3.4000	0.9665	.	417580	360245	511583	312224
.	.	.	.	.	3.6000	1.0234	.	410769	374488	496719	298175
.	.	.	.	.	3.8000	1.0802	.	404078	388177	482448	284906
.	.	.	.	.	4.0000	1.1371	.	397504	401339	468743	272367
.	.	.	.	.	4.2000	1.1940	.	391046	413997	455577	260511
.	.	.	.	.	4.4000	1.2508	.	384701	426176	442924	249297
.	.	.	.	.	4.6000	1.3077	.	378468	437897	430760	238685
.	.	.	.	.	4.8000	1.3645	.	372344	449182	419063	228637
.	.	.	.	.	5.0000	1.4214	.	366327	460050	407812	219118
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANBES03
Date and time : 22APR98:11:09
Computation of ref. F: Simple mean, age 3 - 6
Basis for 1998 : TAC constraints

Table 9.2.13.1

Stocastic forcast,Beverton&Holt recruitment

F-bar(98-07) 0.284

SSB

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
5%	740	704	688	688	685	672	653	646	646	655
10%	**771**	**724**	**719**	**723**	**719**	**699**	**684**	**689**	**695**	**706**
25%	815	804	791	781	766	765	763	762	758	763
50%	860	855	848	843	850	830	849	850	845	834
75%	898	913	911	925	921	941	943	942	958	945
90%	937	977	982	984	1002	1008	1016	1036	1031	1040
95%	967	1009	1009	1020	1028	1055	1065	1093	1085	1116

Recruitment

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
5%	14	13	13	13	13	13	13	13	14	12
10%	17	15	14	14	14	14	14	15	15	14
25%	19	17	18	17	17	17	18	18	17	17
50%	22	21	22	22	23	21	22	22	22	22
75%	27	26	27	28	27	28	27	27	28	27
90%	32	31	33	33	33	34	33	32	33	31
95%	35	37	36	36	36	40	40	39	36	38

Yield

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
5%	190	160	161	159	159	152	150	151	148	149
10%	190	169	165	166	164	162	160	158	159	162
25%	190	186	181	177	176	177	175	175	175	173
50%	190	196	194	193	193	193	191	193	191	192
75%	190	208	208	210	209	212	213	215	216	214
90%	190	219	221	225	225	229	233	235	235	237
95%	190	227	230	230	233	239	241	245	244	248

Stocastic forcast,Beverton&Holt recruitment

F-bar(98-07) 0.142

SSB

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
5%	735	725	767	806	840	869	902	954	1015	1038
10%	**762**	**740**	**804**	**846**	**879**	**911**	**965**	**1031**	**1049**	**1073**
25%	799	783	860	916	953	1014	1054	1105	1144	1160
50%	850	844	913	979	1039	1109	1160	1210	1262	1288
75%	903	906	992	1080	1150	1209	1262	1327	1366	1411
90%	955	973	1062	1146	1238	1307	1353	1418	1482	1541
95%	985	1003	1099	1192	1301	1378	1410	1485	1547	1645

Recruitment

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
5%	15	12	13	12	13	14	16	14	14	15
10%	16	14	14	14	14	16	17	16	16	18
25%	19	16	17	18	18	19	20	20	19	21
50%	22	21	21	23	22	23	25	24	24	25
75%	26	25	27	27	28	27	32	31	30	31
90%	30	29	33	34	34	35	40	40	36	39
95%	32	37	38	36	38	39	42	43	39	48

Yield

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
5%	190	87	93	99	103	107	110	116	121	125
10%	190	90	99	104	107	111	116	123	127	130
25%	190	94	104	112	117	122	127	132	138	141
50%	190	102	110	119	126	133	140	146	152	155
75%	190	109	121	131	138	146	153	159	164	169
90%	190	117	128	138	148	158	165	171	179	185
95%	190	121	130	145	155	165	168	177	186	196

Table 9.2.13.1

Stocastic forcast,Beverton&Holt recruitment

F-bar(98-07) 0.213

SSB

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
5%	750	720	767	787	798	796	803	807	830	819
10%	**767**	**750**	**788**	**804**	**814**	**822**	**836**	**832**	**870**	**866**
25%	808	804	845	852	860	881	900	927	930	954
50%	866	867	908	923	943	958	979	1002	1031	1042
75%	920	925	967	1005	1039	1039	1047	1075	1122	1149
90%	974	997	1039	1079	1127	1119	1137	1168	1214	1249
95%	1018	1031	1075	1165	1212	1183	1199	1218	1277	1312

Recruitment

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
5%	15	14	13	14	13	14	14	13	14	13
10%	17	15	14	15	15	16	15	15	17	15
25%	19	18	17	18	17	19	19	20	19	18
50%	23	22	21	22	21	22	23	23	24	23
75%	27	27	27	26	26	27	29	29	29	29
90%	30	34	33	33	30	33	35	38	36	34
95%	32	39	36	39	35	36	40	42	41	38

Yield

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
5%	190	127	136	140	139	142	142	144	144	147
10%	190	133	139	143	144	145	147	150	152	155
25%	190	143	149	151	153	157	161	163	164	167
50%	190	153	158	162	165	168	173	177	180	182
75%	190	164	170	177	180	183	184	188	194	198
90%	190	175	182	189	194	196	199	205	210	218
95%	190	183	191	201	210	209	215	215	227	228

Table 9.3.1

Category	Catch in ' 000 t							
	1976	1977	1978	1979	1980	1981	1982	1983
Total catch	31.9	26.6	23.0	21.8	20.7	22.7	17.5	20.3
Gulf of Riga herring	27.4	24.2	16.7	17.1	15.0	16.8	12.8	15.5
Open sea herring	4.5	2.4	6.3	4.7	5.7	5.9	4.7	4.8

Category	Catch in ' 000 t						
	1984	1985	1986	1987	1988	1989	1990
Total catch	19.6	20.2	18.2	17.7	19.8	22.7	20.8
Gulf of Riga herring	15.8	15.6	16.9	12.9	16.8	16.8	14.8
Open sea herring	3.8	4.6	1.3	4.8	3.0	5.9	6.0

Category	Catch in ' 000 t						
	1991	1992	1993	1994	1995	1996	1997
Total catch	20.8	23.9	26.5	29.3	38.8	37.0	44.1
Gulf of Riga herring	14.7	20.4	22.2	24.3	32.7	32.6	39.8
Open sea herring	6.1	3.5	4.3	5.0	6.1	4.4	4.3

Table 9.3.2

The SAS System 14:26 Wednesday, April 29, 1998

HER-RIGA: Herring in the Gulf of Riga

CANUM: Catch in Numbers (Total International Catch) (Total) (Millions)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1970	76.6	545.6	383.4	409.7	148.6	48.8	44.5	2.3	0.5	1.5	-11.0
1971	4.1	795.4	627.7	130.5	114.3	36.0	13.2	15.2	0.3	0.2	-11.0
1972	2.1	105.4	770.1	154.3	53.6	35.1	13.1	7.0	5.3	0.9	-11.0
1973	0.0	86.7	294.1	577.8	60.0	17.0	17.4	2.4	1.3	0.6	-11.0
1974	3.7	302.7	303.2	299.4	326.1	37.9	8.5	13.0	3.0	0.9	-11.0
1975	32.0	112.2	562.8	288.4	157.1	161.3	15.0	2.2	2.3	1.9	-11.0
1976	10.4	425.9	237.2	364.0	159.7	59.2	80.5	3.5	3.5	2.1	-11.0
1977	0.8	69.5	885.1	141.4	109.7	35.3	15.7	16.0	0.5	0.1	-11.0
1978	7.6	112.0	97.3	403.9	39.2	35.9	9.3	3.2	5.3	0.4	-11.0
1979	15.4	76.7	176.5	103.8	342.5	22.1	19.3	6.8	3.1	2.4	-11.0
1980	18.5	101.0	125.9	99.6	55.4	133.1	10.5	8.6	1.5	1.0	-11.0
1981	10.7	62.5	172.5	112.0	83.0	51.4	71.7	7.4	3.0	0.4	0.1
1982	1.4	80.0	96.0	116.9	68.8	43.0	29.9	24.5	1.7	1.0	0.6
1983	3.1	49.7	225.3	138.3	77.7	38.9	23.3	15.5	9.0	0.6	-11.0
1984	1.9	44.0	152.1	255.1	96.3	56.7	32.5	14.7	9.7	1.6	0.6
1985	4.4	23.2	283.9	203.9	121.7	31.8	23.7	8.0	3.8	1.6	0.7
1986	1.0	9.2	106.7	246.9	110.6	66.5	19.6	8.0	3.5	1.8	0.5
1987	1.0	70.0	49.0	110.0	205.0	75.0	32.0	5.0	1.0	1.0	-11.0
1988	1.4	6.0	197.7	112.7	112.4	144.6	38.7	27.8	3.8	1.7	0.4
1989	15.1	61.1	47.4	492.7	143.0	76.3	53.9	6.5	4.9	0.2	0.3
1990	12.5	88.1	83.1	67.1	263.5	66.8	27.6	14.6	2.6	1.2	0.3
1991	18.5	119.5	234.0	94.5	40.8	180.5	40.5	35.4	31.2	6.2	3.4
1992	12.1	150.3	339.1	369.3	91.3	33.2	157.4	19.0	17.4	23.8	6.4
1993	8.6	192.2	381.4	298.1	224.4	66.8	19.0	78.8	9.6	6.9	10.4
1994	11.8	164.2	288.4	368.9	263.5	192.7	46.1	9.4	48.7	2.9	4.6
1995	18.1	232.4	316.9	363.0	426.9	277.2	170.9	39.3	6.9	41.7	2.9
1996	31.7	428.8	450.1	281.4	247.6	291.0	183.8	105.6	28.0	7.3	21.7
1997	31.7	204.2	930.7	559.7	345.4	242.8	186.7	90.6	46.3	7.3	7.5

Table 9.3.3

The SAS System 14:26 Wednesday, April 29, 1998
HER-RIGA: Herring in the Gulf of Riga

CATON: Landings (Total International Catch)
(Total) (Tonnes)

Year	Total
1970	33196
1971	32178
1972	27145
1973	27895
1974	30850
1975	28523
1976	27422
1977	24186
1978	16728
1979	17142
1980	14998
1981	16769
1982	12777
1983	15541
1984	15843
1985	15575
1986	16927
1987	12884
1988	16791
1989	16783
1990	14931
1991	14791
1992	20000
1993	22200
1994	24300
1995	32656
1996	32584
1997	39843

Table 9.3.4

The SAS System 14:26 Wednesday, April 29, 1998

HER-RIGA: Herring in the Gulf of Riga

MATPROP: Proportion Mature at Year Start (Total International Catch) (Total)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1970	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1971	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1972	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1973	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1974	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1975	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1976	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1977	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1978	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1979	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1980	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1981	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1982	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1983	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1984	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1985	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1986	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1987	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1988	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1989	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1990	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1991	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1992	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1993	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1994	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1995	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1996	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00
1997	0.00	0.00	0.93	0.98	0.98	1.00	1.00	1.00	1.00	1.00	1.00

Table 9.3.5

The SAS System 14:26 Wednesday, April 29, 1998
HER-RIGA: Herring in the Gulf of Riga

WECA: Mean Weight in Catch (Total International Catch) (Total) (Grams)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1970	6.1	12.7	19.2	24.3	29.2	33.0	46.0	45.0	50.0	55.0	-1.0
1971	4.5	12.2	19.2	26.5	34.8	42.9	64.6	45.0	50.0	55.0	-1.0
1972	7.0	15.4	21.0	31.4	40.9	46.2	40.0	68.2	54.4	60.3	-1.0
1973	7.0	16.3	21.3	28.0	34.9	42.4	45.8	45.0	50.0	55.0	-1.0
1974	6.1	13.8	18.3	26.0	32.3	37.7	41.3	54.3	66.6	50.5	-1.0
1975	5.8	14.2	17.3	22.5	32.2	33.8	39.1	47.3	43.2	55.0	-1.0
1976	5.8	12.2	18.5	24.1	29.2	30.5	39.3	38.3	39.7	65.8	-1.0
1977	2.9	13.2	16.0	22.7	26.9	29.5	31.2	29.4	50.0	55.0	-1.0
1978	5.3	9.8	17.7	21.9	27.3	31.1	30.4	38.1	50.0	55.0	-1.0
1979	6.3	12.2	16.2	23.4	27.6	29.8	34.0	36.8	36.3	35.6	-1.0
1980	7.1	14.5	20.1	24.1	32.1	39.3	45.6	53.3	70.3	72.3	-1.0
1981	7.6	12.1	21.6	28.8	33.4	39.0	43.9	49.9	55.3	83.4	90.0
1982	5.4	14.1	21.4	28.7	35.7	37.2	45.1	50.3	62.4	84.5	143.0
1983	5.7	13.8	19.3	27.6	37.9	41.6	50.9	61.0	93.6	57.3	-1.0
1984	5.4	10.0	15.0	21.5	28.1	34.3	39.1	49.1	51.2	73.4	84.9
1985	6.0	12.9	17.2	20.8	27.8	35.8	48.7	53.1	59.1	75.8	85.0
1986	6.0	12.6	19.8	25.6	31.4	40.2	46.2	63.9	65.3	77.7	85.0
1987	6.0	10.1	15.4	19.7	26.3	30.3	37.9	43.1	40.6	140.3	-1.0
1988	6.6	11.7	18.6	21.0	27.3	36.8	43.4	58.6	61.1	100.1	100.1
1989	6.7	12.0	14.8	16.6	19.6	23.0	31.5	38.2	34.0	57.7	61.4
1990	11.4	14.6	17.8	19.8	26.9	30.6	33.1	52.2	59.6	46.9	53.5
1991	6.9	11.9	15.4	17.8	19.9	21.4	22.5	26.9	31.4	37.9	45.6
1992	6.3	11.2	13.6	17.7	21.5	23.6	25.0	26.4	30.4	34.7	55.3
1993	6.4	12.5	13.6	16.1	20.1	24.7	26.3	27.5	31.6	32.7	40.2
1994	4.1	11.2	14.6	16.2	18.8	21.5	25.2	26.3	29.6	30.8	32.3
1995	5.4	10.4	13.6	16.4	17.9	20.9	22.9	26.3	27.4	28.5	42.5
1996	3.9	10.5	12.5	15.7	17.7	18.9	21.5	23.5	26.8	28.2	29.5
1997	4.9	9.7	12.4	14.9	17.8	19.1	19.6	21.2	22.6	27.5	30.5

Table 9.3.6

The SAS System 14:26 Wednesday, April 29, 1998

HER-RIGA: Herring in the Gulf of Riga

TNET: Herring Gulf of Riga. Tuning (Catch: Millions)

Year	Fishing effort	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9
1980	92	16.6	16.2	10.8	27.4	3.1	1.6	0.5	0.4
1981	76	16.8	12.8	9.9	6.7	17.1	1.1	0.4	-11
1982	83	28.5	38.9	14.5	10.0	3.6	11.0	0.5	0.3
1983	44	26.9	16.5	9.3	4.6	2.8	1.9	1.1	-11
1984	122	34.5	57.9	21.9	12.9	7.4	3.4	2.2	0.4
1985	78	16.0	14.7	42.9	6.1	10.5	2.0	1.5	1.2
1986	145	30.7	70.5	31.6	26.9	3.9	2.0	0.5	0.9
1987	65	4.6	5.4	38.4	14.4	9.0	1.6	0.7	0.9
1988	106	24.6	26.4	29.9	82.9	13.9	16.2	1.6	1.0
1989	67	5.3	48.6	13.9	12.7	28.6	2.6	4.8	0.2
1990	41	8.1	0.7	25.6	7.2	6.7	8.2	1.9	1.2
1991	87	42.9	22.8	10.0	54.0	10.0	9.1	10.5	2.8
1992	102	99.0	95.1	21.8	7.9	56.6	4.2	5.9	8.0
1993	78	67.8	74.6	70.4	24.8	7.7	32.1	2.1	4.8
1994	54	17.7	43.6	62.7	40.7	13.1	2.0	17.8	3.2
1995	64	37.3	53.4	68.7	59.2	33.6	11.4	0.8	11.9
1996	94	84.4	87.4	88.8	95.6	67.9	33.4	8.7	10.9
1997	101	116	116	85.1	68.2	46.7	18.8	12.4	4.3

Table 9.3.7

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Lowestoft VPA Version 3.1

   18-Apr-98  16:09:00

 Extended Survivors Analysis

 Herring Gulf of Riga (run: TUNGEO08/T08)

 CPUE data from file /users/fish/ifad/ifapwork/wgbfas/her_riga/FLEET.T08

 Catch data for  28 years. 1970 to 1997. Ages  1 to   8.

      Fleet,           First, Last, First, Last, Alpha,  Beta
                     ,   year, year,  age ,  age
 TNET: Herring Gulf o,   1980, 1997,   2,     7,   .330,   .580


 Time series weights :

      Tapered time weighting applied
      Power =    3 over  20 years


 Catchability analysis :

      Catchability dependent on stock size for ages <    4

         Regression type = C
         Minimum of   5 points used for regression
         Survivor estimates shrunk to the population mean for ages <  4


      Catchability independent of age for ages >=    6


 Terminal population estimation :

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

      S.E. of the mean to which the estimates  are shrunk =    .500

      Minimum standard error for population
      estimates derived from each fleet =    .300

      Prior weighting not applied


 Tuning had not converged after   50 iterations


 Total absolute residual between iterations
 49 and  50 =     .00026

 Final year F values
 Age          ,      1,      2,      3,      4,      5,      6,      7
 Iteration 49,  .0605,  .1932,  .2436,  .2816,  .3612,  .4176,  .4162
 Iteration 50,  .0605,  .1932,  .2437,  .2816,  .3612,  .4176,  .4163


 Regression weights
       ,  .751,  .820,  .877,  .921,  .954,  .976,  .990,  .997, 1.000, 1.000


 Fishing mortalities
    Age,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996,  1997

      1,  .012,  .052,  .027,  .035,  .038,  .060,  .048,  .051,  .064,  .061
      2,  .077,  .129,  .094,  .093,  .132,  .126,  .120,  .122,  .133,  .193
      3,  .217,  .279,  .272,  .147,  .208,  .165,  .173,  .217,  .152,  .244
      4,  .300,  .471,  .236,  .264,  .206,  .188,  .215,  .311,  .226,  .282
      5,  .391,  .343,  .420,  .251,  .358,  .229,  .245,  .369,  .362,  .361
      6,  .663,  .245,  .200,  .488,  .363,  .358,  .245,  .358,  .448,  .418
      7,  .298,  .214,  .097,  .425,  .447,  .311,  .301,  .341,  .392,  .416


1
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Table 9.3.7 (Cont'd)

XSA population numbers (Thousands)

YEAR	AGE 1	2	3	4	5	6	7
1988	5.35E+05	2.95E+06	6.39E+05	4.79E+05	4.94E+05	8.82E+04	1.19E+05
1989	1.32E+06	4.32E+05	2.24E+06	4.21E+05	2.90E+05	2.74E+05	3.72E+04
1990	3.66E+06	1.03E+06	3.11E+05	1.39E+06	2.15E+05	1.69E+05	1.75E+05
1991	3.82E+06	2.91E+06	7.65E+05	1.94E+05	8.98E+05	1.16E+05	1.13E+05
1992	4.51E+06	3.02E+06	2.17E+06	5.41E+05	1.22E+05	5.72E+05	5.82E+04
1993	3.67E+06	3.55E+06	2.17E+06	1.45E+06	3.60E+05	6.98E+04	3.26E+05
1994	3.91E+06	2.83E+06	2.56E+06	1.50E+06	9.80E+05	2.35E+05	4.00E+04
1995	5.13E+06	3.05E+06	2.06E+06	1.77E+06	9.93E+05	6.28E+05	1.50E+05
1996	7.63E+06	3.99E+06	2.21E+06	1.35E+06	1.06E+06	5.62E+05	3.60E+05
1997	3.84E+06	5.85E+06	2.86E+06	1.56E+06	8.85E+05	6.04E+05	2.94E+05
Estimated population abundance at 1st Jan 1998							
	.00E+00	2.96E+06	3.95E+06	1.84E+06	9.61E+05	5.05E+05	3.26E+05
Taper weighted geometric mean of the VPA populations:							
	2.86E+06	2.08E+06	1.30E+06	7.47E+05	4.00E+05	1.99E+05	9.29E+04
Standard error of the weighted Log(VPA populations) :							
	.7307	.7605	.7378	.7821	.8603	.9299	.9913

Log catchability residuals.

Fleet : TNET: Herring Gulf o

Age	1980	1981	1982	1983	1984	1985	1986	1987
2	.39	.52	1.06	.92	.49	-.50	.17	-.79
3	.44	.48	1.16	1.09	.52	.17	.12	-.55
4	-.42	-.18	.21	.38	.45	.62	.07	.17
5	-.10	-.49	.07	.00	.09	.05	-.31	.43
6	-.29	.10	-.78	-.13	.01	.91	-.54	-.39
7	-.74	-.51	.23	-.09	-.22	-.06	-.63	.03

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
2	-.87	.01	.04	-.10	.55	.28	-.47	.03	.20	.08
3	.34	-.14	-.82	.17	.05	.05	-.23	.03	.01	-.07
4	-.03	-.13	-.33	-.04	-.47	-.02	.20	.01	.11	-.12
5	.66	-.25	.01	-.23	-.27	.00	-.13	.12	.15	-.08
6	.48	.34	-.16	-.01	-.08	.29	-.07	-.24	.23	-.30
7	.17	-.08	-.04	-.10	-.36	.16	-.16	.11	-.05	-.49

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

Age	4	5	6	7
Mean Log q	-14.0894	-13.7476	-13.5060	-13.5060
S.E(Log q)	.2576	.2635	.3534	.2675

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
2	.99	.047	15.35	.73	18	.48	-15.36
3	.71	1.714	14.56	.77	18	.42	-14.75

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
4	1.04	-.386	14.11	.90	18	.28	-14.09
5	.98	.214	13.73	.92	18	.27	-13.75
6	1.10	-.753	13.63	.86	18	.40	-13.51
7	.94	.825	13.50	.95	18	.23	-13.62

Table 9.3.7 (Cont'd)

```
Fleet disaggregated estimates of survivors :

 Age  1   Catchability dependent on age and year class strength

 Year class = 1996

 TNET: Herring Gulf o
        Age,         1,
   Survivors,        0.,
 Raw Weights,      .000,


 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,    Ratio,   , Weights,    F
 TNET: Herring Gulf o,        1.,    .000,      .000,     .00,   0,  .000,     .000

   P shrinkage mean  ,   2081085.,    .76,,,,                          .302,     .085

   F shrinkage mean  ,   3449235.,    .50,,,,                          .698,     .052

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
   2961420.,       .42,    14.90,    2,  35.671,   .061


 Age  2   Catchability dependent on age and year class strength

 Year class = 1995

 TNET: Herring Gulf o
        Age,         2,          1,
   Survivors,  4277511.,         0.,
 Raw Weights,     2.891,       .000,


 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,    Ratio,   , Weights,    F
 TNET: Herring Gulf o,   4277511.,    .534,      .000,     .00,   1,  .331,     .180

   P shrinkage mean  ,   1301328.,    .74,,,,                          .210,     .499

   F shrinkage mean  ,   6213486.,    .50,,,,                          .458,     .127

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
   3951123.,       .33,      .43,    3,   1.295,   .193


Age  3   Catchability dependent on age and year class strength

 Year class = 1994

 TNET: Herring Gulf o
        Age,         3,          2,          1,
   Survivors,  1708840.,   2232502.,         0.,
 Raw Weights,     3.923,      2.529,       .000,


 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,    Ratio,   , Weights,    F
 TNET: Herring Gulf o,   1897604.,    .340,      .130,     .38,   2,  .534,     .237

   P shrinkage mean  ,    747319.,    .78,,,,                          .135,     .517

   F shrinkage mean  ,   2510836.,    .50,,,,                          .331,     .184

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
   1835332.,       .27,      .23,    4,    .843,   .244
```

Table 9.3.7 (Cont'd)

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

Year class = 1993

TNET: Herring Gulf o
        Age,         4,          3,          2,          1,
  Survivors,   851754.,    969384.,    991494.,        0.,
Raw Weights,     8.384,      3.327,      2.229,       .000,



Fleet,                  Estimated,    Int,        Ext,    Var,    N, Scaled,  Estimated
    ,                   Survivors,    s.e,        s.e,    Ratio,   , Weights,    F
TNET: Herring Gulf o,     900064.,    .224,       .048,    .21,   3,  .777,     .298

  F shrinkage mean  ,    1206329.,    .50,,,,                          .223,     .230

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,    Ratio,
   960799.,       .21,      .09,    4,    .421,   .282


1
Age  5   Catchability constant w.r.t. time and dependent on age

Year class = 1992

TNET: Herring Gulf o
        Age,         5,          4,          3,          2,          1,
  Survivors,   464272.,    561788.,    518158.,    317202.,        0.,
Raw Weights,     7.743,      6.176,      2.305,      1.555,       .000,



Fleet,                  Estimated,    Int,        Ext,    Var,    N, Scaled,  Estimated
    ,                   Survivors,    s.e,        s.e,    Ratio,   , Weights,    F
TNET: Herring Gulf o,     486688.,    .182,       .091,    .50,   4,  .816,     .373

  F shrinkage mean  ,    594733.,    .50,,,,                          .184,     .314

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,    Ratio,
   504943.,       .17,      .08,    5,    .475,   .361


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

Year class = 1991

TNET: Herring Gulf o
        Age,         6,          5,          4,          3,          2,          1,
  Survivors,   242081.,    376965.,    328397.,    258186.,    429698.,        0.,
Raw Weights,     4.869,      5.095,      3.724,      1.452,       .902,       .000,



Fleet,                  Estimated,    Int,        Ext,    Var,    N, Scaled,  Estimated
    ,                   Survivors,    s.e,        s.e,    Ratio,   , Weights,    F
TNET: Herring Gulf o,     310699.,    .170,       .101,    .59,   5,  .800,     .434

  F shrinkage mean  ,    394391.,    .50,,,,                          .200,     .357

Weighted prediction :

Survivors,        Int,      Ext,    N,    Var,     F
at end of year,   s.e,      s.e,     ,    Ratio,
   325846.,       .17,      .09,    6,    .555,   .418
```

Table 9.3.7 (Cont'd)

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

 Year class = 1990

 TNET: Herring Gulf o
        Age,         7,          6,          5,          4,          3,          2,          1,
   Survivors,    97525.,    200791.,    178820.,    194584.,    167431.,    275476.,        0.,
 Raw Weights,     7.327,      3.113,      3.227,      2.584,       .995,       .606,       .000,



 Fleet,                 Estimated,    Int,       Ext,    Var,    N, Scaled,  Estimated
     ,                  Survivors,    s.e,       s.e,    Ratio,    , Weights,    F
 TNET: Herring Gulf o,    145612.,   .158,       .154,     .97,   6,  .817,     .447

   F shrinkage mean  ,    233253.,    .50,,,,                          .183,     .301

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
    158729.,       .16,      .15,    7,    .955,   .416


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1
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Table 9.3.8

Run title : Herring Gulf of Riga (run: TUNGEO08/T08)

At 18-Apr-98 16:09:43

Terminal Fs derived using XSA (With F shrinkage)

	Table 8	Fishing mortality (F) at age							
	YEAR,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
	AGE								
	1,	.3892,	.2553,	.0868,	.0738,	.1823,	.1563,	.1360,	.0905,
	2,	.8743,	1.0103,	.3963,	.3482,	.3728,	.5656,	.5370,	.4336,
	3,	.9636,	.8041,	.6907,	.5514,	.6784,	.6918,	.8474,	.6779,
	4,	1.1541,	.7454,	.8896,	.5971,	.6586,	.8961,	1.0262,	.6291,
	5,	.8942,	.9445,	.5026,	.7518,	.9149,	.7672,	1.0073,	.6158,
	6,	.8834,	.6056,	1.0920,	.4717,	1.0528,	1.1653,	1.1056,	.7670,
	7,	.9617,	.8282,	.7192,	.5473,	.7408,	.8233,	.9119,	.6287,
	+gp,	.9617,	.8282,	.7192,	.5473,	.7408,	.8233,	.9119,	.6287,
0	FBAR 3- 7,	.9714,	.7856,	.7788,	.5839,	.8091,	.8687,	.9797,	.6637,

	Table 8	Fishing mortality (F) at age									
	YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
	AGE										
	1,	.1218,	.0908,	.1067,	.0785,	.0495,	.0441,	.0209,	.0212,	.0099,	.0212,
	2,	.1674,	.2869,	.2235,	.2838,	.1756,	.2026,	.1896,	.1820,	.1281,	.0671,
	3,	.3394,	.2710,	.2755,	.3369,	.3362,	.4387,	.3834,	.4184,	.2383,	.1889,
	4,	.3745,	.5422,	.2400,	.4145,	.3798,	.4171,	.6544,	.3178,	.4219,	.3187,
	5,	.4051,	.3751,	.4450,	.3902,	.4181,	.4086,	.6404,	.4663,	.2873,	.5705,
	6,	.3018,	.3974,	.3252,	.4906,	.4409,	.4481,	.7510,	.6127,	.5928,	.2177,
	7,	.3190,	.3778,	.3273,	.4275,	.3255,	.4601,	.5917,	.4101,	.4285,	.2905,
	+gp,	.3190,	.3778,	.3273,	.4275,	.3255,	.4601,	.5917,	.4101,	.4285,	.2905,
0	FBAR 3- 7,	.3479,	.3927,	.3226,	.4119,	.3801,	.4345,	.6042,	.4451,	.3938,	.3172,

Run title : Herring Gulf of Riga (run: TUNGEO08/T08)

At 18-Apr-98 16:09:43

Terminal Fs derived using XSA (With F shrinkage)

	Table 8	Fishing mortality (F) at age										
	YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	FBAR 95-97
	AGE											
	1,	.0125,	.0525,	.0270,	.0352,	.0375,	.0596,	.0476,	.0513,	.0642,	.0605,	.0587,
	2,	.0768,	.1291,	.0937,	.0930,	.1324,	.1262,	.1195,	.1220,	.1331,	.1932,	.1494,
	3,	.2169,	.2786,	.2722,	.1467,	.2080,	.1649,	.1731,	.2171,	.1516,	.2437,	.2041,
	4,	.3004,	.4705,	.2355,	.2644,	.2064,	.1883,	.2152,	.3108,	.2256,	.2816,	.2727,
	5,	.3906,	.3432,	.4198,	.2513,	.3579,	.2292,	.2450,	.3689,	.3616,	.3612,	.3639,
	6,	.6631,	.2453,	.1996,	.4882,	.3627,	.3578,	.2447,	.3577,	.4483,	.4176,	.4079,
	7,	.2984,	.2144,	.0965,	.4247,	.4473,	.3111,	.3014,	.3409,	.3924,	.4163,	.3832,
	+gp,	.2984,	.2144,	.0965,	.4247,	.4473,	.3111,	.3014,	.3409,	.3924,	.4163,	
0	FBAR 3- 7,	.3739,	.3104,	.2447,	.3151,	.3165,	.2503,	.2359,	.3191,	.3159,	.3441,	

Table 9.3.9

Run title : Herring Gulf of Riga (run: TUNGEO08/T08)

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Terminal Fs derived using XSA (With F shrinkage)

	Table 10 Stock number at age (start of year)							Numbers*10**-4
	YEAR,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
	AGE								
	1,	182428,	380509,	136628,	131353,	195784,	83588,	360937,	86554,
	2,	70906,	106400,	253715,	107818,	105013,	140430,	61536,	271149,
	3,	71403,	25459,	33345,	146928,	65515,	62257,	68656,	30958,
	4,	23394,	23447,	9806,	14385,	72858,	28612,	26829,	25323,
	5,	8899,	6349,	9577,	3467,	6815,	32455,	10052,	8276,
	6,	8177,	3132,	2125,	4987,	1407,	2350,	12970,	3160,
	7,	401,	2909,	1471,	614,	2678,	423,	631,	3695,
	+gp,	345,	95,	1290,	482,	795,	798,	997,	137,
0	TOTAL,	365953,	548301,	447957,	410035,	450866,	350914,	542608,	429252,

	Table 10 Stock number at age (start of year)							Numbers*10**-4		
	YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
	AGE										
	1,	105236,	100160,	113040,	93803,	187807,	130578,	235167,	122335,	102935,	368539,
	2,	68050,	80187,	71236,	79122,	67538,	139204,	97308,	188557,	98060,	83444,
	3,	151266,	49544,	46873,	44368,	46397,	44127,	88530,	65906,	128689,	70630,
	4,	13528,	92724,	29425,	27715,	24670,	25818,	22161,	49399,	35510,	83021,
	5,	11618,	8007,	41988,	18027,	14260,	13141,	13250,	9430,	29433,	19066,
	6,	3848,	6669,	4285,	20954,	9503,	7311,	6802,	5718,	4843,	18081,
	7,	1263,	2449,	3491,	2411,	9992,	4763,	3638,	2628,	2537,	2192,
	+gp,	2239,	1960,	1005,	1127,	1333,	2914,	2911,	1987,	1823,	871,
0	TOTAL,	357047,	341700,	311343,	287527,	361500,	367855,	469766,	445961,	403831,	645844,

Run title : Herring Gulf of Riga (run: TUNGEO08/T08)

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Terminal Fs derived using XSA (With F shrinkage)

	Table 10 Stock number at age (start of year)									Numbers*10**-4				
	YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	1998,	GMST 70-95	AMST 70-95
	AGE													
	1,	53483,	132134,	365516,	382211,	450741,	366876,	390723,	513167,	762505,	384301,	0,	182534,	222009,
	2,	295400,	43245,	102654,	291287,	302115,	355436,	282982,	305037,	399117,	585487,	296142,	129195,	156455,
	3,	63884,	223964,	31117,	76526,	217313,	216668,	256496,	205586,	221069,	286043,	395112,	76964,	97400,
	4,	47874,	42107,	138785,	19405,	54104,	144505,	150419,	176624,	135474,	155534,	183533,	39163,	53940,
	5,	49423,	29025,	21535,	89785,	12196,	36035,	98006,	99310,	105980,	88513,	96080,	17907,	26901,
	6,	8823,	27380,	16860,	11587,	57178,	6981,	23459,	62804,	56226,	60438,	50494,	8190,	13131,
	7,	11908,	3722,	17540,	11307,	5822,	32571,	3996,	15037,	35956,	29403,	32585,	3237,	5773,
	+gp,	2510,	3076,	4910,	12918,	14454,	11043,	23688,	19561,	19250,	19660,	26488,		
0	TOTAL,	533305,	504654,	698917,	895027,	1113921,	1170115,	1229769,	1397128,	1735576,	1609379,	1080434,		

Table 9.3.10

Run title : Herring Gulf of Riga (run: TUNGEO08/T08)

At 18-Apr-98 16:09:43

Terminal Fs derived using XSA (With F shrinkage)

	Table 12	Stock biomass at age (start of year)							Tonnes
	YEAR,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
	AGE								
	1,	23716,	45661,	20494,	21017,	27410,	11702,	43312,	11252,
	2,	13472,	20216,	53280,	22642,	18902,	23873,	11692,	43384,
	3,	17137,	6874,	10337,	41140,	17034,	14319,	16477,	7120,
	4,	6784,	8207,	4020,	5035,	23314,	9156,	7780,	6837,
	5,	2937,	2730,	4406,	1456,	2590,	11035,	3116,	2483,
	6,	3761,	2036,	850,	2294,	577,	916,	5058,	980,
	7,	181,	1309,	1000,	276,	1446,	199,	240,	1072,
	+gp,	186,	49,	710,	251,	501,	391,	488,	70,
0	TOTALBIO,	68173,	87082,	95097,	94110,	91774,	71591,	88165,	73197,

	Table 12	Stock biomass at age (start of year)									Tonnes
	YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
	AGE										
	1,	10524,	12019,	16956,	11256,	26293,	18281,	23517,	15904,	13382,	36854,
	2,	12249,	12830,	14247,	17407,	14183,	26449,	14596,	32055,	19612,	12517,
	3,	33278,	11395,	11250,	12867,	13455,	12355,	19477,	13840,	33459,	14126,
	4,	3652,	25963,	9416,	9146,	8881,	9811,	6205,	13832,	11008,	21586,
	5,	3602,	2402,	16375,	7031,	5276,	5519,	4505,	3395,	11773,	5720,
	6,	1154,	2268,	1971,	9220,	4277,	3729,	2653,	2802,	2228,	6871,
	7,	480,	906,	1850,	1205,	4996,	2905,	1782,	1393,	1624,	943,
	+gp,	1119,	706,	714,	676,	1120,	2652,	1630,	1311,	1294,	418,
0	TOTALBIO,	66059,	68488,	72779,	68808,	78481,	81701,	74365,	84531,	94380,	99033,

Run title : Herring Gulf of Riga (run: TUNGEO08/T08)

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Terminal Fs derived using XSA (With F shrinkage)

	Table 12	Stock biomass at age (start of year)									Tonnes
	YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
	AGE										
	1,	6418,	15856,	54827,	45865,	49581,	47694,	42980,	51317,	83876,	38430,
	2,	56126,	6487,	18478,	43693,	42296,	49761,	42447,	42705,	51885,	70258,
	3,	13416,	38074,	6223,	13775,	39116,	34667,	41039,	32894,	35371,	42907,
	4,	12926,	8421,	37472,	3881,	11903,	28901,	28580,	31792,	24385,	27996,
	5,	18287,	6676,	6676,	18855,	2927,	9009,	21561,	20855,	20136,	16818,
	6,	3794,	8762,	5564,	2665,	14294,	1815,	5865,	14445,	12370,	12088,
	7,	7025,	1414,	9121,	3053,	1514,	9120,	1039,	3910,	8630,	6175,
	+gp,	1883,	1107,	2700,	4392,	5203,	3865,	7106,	5673,	5390,	4718,
0	TOTALBIO,	119874,	86798,	141061,	136179,	166835,	184832,	190617,	203591,	242043,	219390,

Table 9.3.11

Run title : Herring Gulf of Riga (run: TUNGEO08/T08)

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Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 3- 7,
1970,	1824285,	68173,	37396,	33196,	.8877,	.9714,
1971,	3805091,	87082,	34728,	32178,	.9266,	.7856,
1972,	1366275,	95097,	64269,	27145,	.4224,	.7788,
1973,	1313535,	94110,	64221,	27895,	.4344,	.5839,
1974,	1957844,	91774,	56037,	30850,	.5505,	.8091,
1975,	835882,	71591,	51488,	28523,	.5540,	.8687,
1976,	3609372,	88165,	38271,	27422,	.7165,	.9797,
1977,	865541,	73197,	53307,	24186,	.4537,	.6637,
1978,	1052361,	66059,	50001,	16728,	.3346,	.3479,
1979,	1001602,	68488,	48807,	17142,	.3512,	.3927,
1980,	1130397,	72779,	48932,	14998,	.3065,	.3226,
1981,	938027,	68808,	49977,	16769,	.3355,	.4119,
1982,	1878067,	78481,	45610,	12777,	.2801,	.3801,
1983,	1305777,	81701,	54816,	15541,	.2835,	.4345,
1984,	2351670,	74365,	44533,	15843,	.3558,	.6042,
1985,	1223349,	84531,	60163,	15575,	.2589,	.4451,
1986,	1029353,	94380,	72235,	16927,	.2343,	.3938,
1987,	3685386,	99033,	55644,	12884,	.2315,	.3172,
1988,	534827,	119874,	100523,	16791,	.1670,	.3739,
1989,	1321340,	86797,	63649,	16783,	.2637,	.3104,
1990,	3655160,	141061,	77592,	14931,	.1924,	.2447,
1991,	3822107,	136179,	80357,	14791,	.1841,	.3151,
1992,	4507408,	166835,	104368,	20000,	.1916,	.3165,
1993,	3668758,	184832,	122479,	22200,	.1813,	.2503,
1994,	3907230,	190617,	132425,	24300,	.1835,	.2359,
1995,	5131677,	203591,	135878,	32656,	.2403,	.3191,
1996,	7625049,	242043,	141124,	32584,	.2309,	.3159,
1997,	3843011,	219389,	160160,	39843,	.2488,	.3441,
Arith. Mean	2471085,	112466,	73178,	22195,	.3572,	.4827,
0 Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

Table 9.3.12

Run title : Herring Gulf of Riga (run: TUNGEO08/T08)

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Table 17 Summary (with SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	SOPCOFAC,	FBAR 3- 7,
1970,	1824285,	69873,	38328,	33196,	.8661,	1.0249,	.9714,
1971,	3805091,	87264,	34800,	32178,	.9247,	1.0021,	.7856,
1972,	1366275,	93227,	63005,	27145,	.4308,	.9803,	.7788,
1973,	1313535,	95244,	64994,	27895,	.4292,	1.0120,	.5839,
1974,	1957844,	92369,	56400,	30850,	.5470,	1.0065,	.8091,
1975,	835882,	69986,	50334,	28523,	.5667,	.9776,	.8687,
1976,	3609372,	85228,	36997,	27422,	.7412,	.9667,	.9797,
1977,	865541,	75917,	55288,	24186,	.4375,	1.0372,	.6637,
1978,	1052361,	75614,	57234,	16728,	.2923,	1.1446,	.3479,
1979,	1001602,	67123,	47834,	17142,	.3584,	.9801,	.3927,
1980,	1130397,	75261,	50601,	14998,	.2964,	1.0341,	.3226,
1981,	938027,	70912,	51505,	16769,	.3256,	1.0306,	.4119,
1982,	1878067,	74600,	43355,	12777,	.2947,	.9506,	.3801,
1983,	1305777,	77221,	51810,	15541,	.3000,	.9452,	.4345,
1984,	2351670,	75465,	45192,	15843,	.3506,	1.0148,	.6042,
1985,	1223349,	82543,	58748,	15575,	.2651,	.9765,	.4451,
1986,	1029353,	96315,	73716,	16927,	.2296,	1.0205,	.3938,
1987,	3685386,	99481,	55895,	12884,	.2305,	1.0045,	.3172,
1988,	534827,	109829,	92099,	16791,	.1823,	.9162,	.3739,
1989,	1321340,	87748,	64346,	16783,	.2608,	1.0110,	.3104,
1990,	3655160,	138200,	76018,	14931,	.1964,	.9797,	.2447,
1991,	3822107,	138663,	81823,	14791,	.1808,	1.0182,	.3151,
1992,	4507408,	151695,	94897,	20000,	.2108,	.9093,	.3165,
1993,	3668758,	183118,	121344,	22200,	.1830,	.9907,	.2503,
1994,	3907230,	190131,	132087,	24300,	.1840,	.9975,	.2359,
1995,	5131677,	204442,	136446,	32656,	.2393,	1.0042,	.3191,
1996,	7625049,	237335,	138379,	32584,	.2355,	.9806,	.3159,
1997,	3843011,	221075,	161390,	39843,	.2469,	1.0077,	.3441,
Arith. Mean	2471085,	111639,	72674,	22195,	.3574		.4827,
0 Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),			
1							

Table 9.3.13.

Herring recruitment in the Gulf of Riga

2 27 2

'Year'	'VPA'	'Temp.'	'Zoopl.'
1971	13662750	.8	7.4
1972	13135350.	7	10.5
1973	1957844	2	12.4
1974	835882	1.8	16.3
1975	3609372	2.7	16.5
1976	865541	0.5	7
1977	1052361	0.4	6.1
1978	1001602	0.6	9.3
1979	1130397	0.3	5.3
1980	938027	0.5	6.6
1981	1878067	0.7	6.1
1982	1306777	1	8.6
1983	2351670	1.4	12.9
1984	1223349	0.9	7.6
1985	1029353	0.1	4.2
1986	3685386	0.9	21
1987	534827	-0.2	4
1988	1321340	0.4	4.7
1989	3655160	3.1	7.9
1990	3822107	3.8	20.3
1991	4507408	1.7	13.3
1992	3668758	2.7	19.5
1993	3907230	2	10.8
1994	5131677	0.9	15.3
1995	7625049	1.3	31.5
1996	-11	0.1	10.6
1997	-11	1	21.5

VPA - recruitment values (age 1) from 1998 VPA
Temp. - mean watre temperature in April
Zoopl. - the abundance of zooplankton in May (number*1000^3)

Table 9.3.14

Analysis by RCT3 ver3.1 of data from file :

recruits.txt

Herring recruitment in the Gulf of Riga

Data for 2 surveys over 27 years : 1971 - 1997

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 .20
Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1996

	I----------Regression----------I				I----------Prediction---------I			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Temp.	2.90	12.41	1.11	.288	24	.10	12.69	1.452	.093
Zoopl.	1.56	10.91	.51	.731	25	2.45	14.74	.576	.594
					VPA Mean =		14.82	.794	.313

Yearclass = 1997

	I----------Regression----------I				I----------Prediction---------I			
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Temp.	3.05	12.26	1.20	.249	24	.69	14.38	1.421	.104
Zoopl.	1.55	10.96	.51	.729	25	3.11	15.77	.611	.561
					VPA Mean =		14.87	.791	.335

Year Class	Weighted Average Prediction	Log WAP Std Error	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1996	2131692	14.57	.44	.43	.93		
1997	4526974	15.33	.46	.37	.65		

Table 9.3.15

Herring in the Gulf of Riga

Single option prediction: Input data

Year: 1998								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	4526974.0	0.2000	0.0000	0.1000	0.3000	10.200	0.0587	10.200
2	1561140.0	0.2000	0.9300	0.1000	0.3000	12.833	0.1494	12.833
3	3951120.0	0.2000	0.9800	0.1000	0.3000	15.667	0.2041	15.667
4	1835330.0	0.2000	0.9800	0.1000	0.3000	17.800	0.2727	17.800
5	960800.00	0.2000	1.0000	0.1000	0.3000	19.633	0.3639	19.633
6	504940.00	0.2000	1.0000	0.1000	0.3000	21.333	0.4079	21.333
7	325850.00	0.2000	1.0000	0.1000	0.3000	23.667	0.3832	23.667
8+	264880.00	0.2000	1.0000	0.1000	0.3000	27.101	0.3832	27.101
Unit	Thousands	-	-	-	-	Grams	-	Grams

Year: 1999								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	3786000.0	0.2000	0.0000	0.1000	0.3000	10.200	0.0587	10.200
2	.	0.2000	0.9300	0.1000	0.3000	12.833	0.1494	12.833
3	.	0.2000	0.9800	0.1000	0.3000	15.667	0.2041	15.667
4	.	0.2000	0.9800	0.1000	0.3000	17.800	0.2727	17.800
5	.	0.2000	1.0000	0.1000	0.3000	19.633	0.3639	19.633
6	.	0.2000	1.0000	0.1000	0.3000	21.333	0.4079	21.333
7	.	0.2000	1.0000	0.1000	0.3000	23.667	0.3832	23.667
8+	.	0.2000	1.0000	0.1000	0.3000	27.101	0.3832	27.101
Unit	Thousands	-	-	-	-	Grams	-	Grams

Year: 2000								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	3786000.0	0.2000	0.0000	0.1000	0.3000	10.200	0.0587	10.200
2	.	0.2000	0.9300	0.1000	0.3000	12.833	0.1494	12.833
3	.	0.2000	0.9800	0.1000	0.3000	15.667	0.2041	15.667
4	.	0.2000	0.9800	0.1000	0.3000	17.800	0.2727	17.800
5	.	0.2000	1.0000	0.1000	0.3000	19.633	0.3639	19.633
6	.	0.2000	1.0000	0.1000	0.3000	21.333	0.4079	21.333
7	.	0.2000	1.0000	0.1000	0.3000	23.667	0.3832	23.667
8+	.	0.2000	1.0000	0.1000	0.3000	27.101	0.3832	27.101
Unit	Thousands	-	-	-	-	Grams	-	Grams

Notes: Run name : SPRGEO01
Date and time: 20APR98:14:16

Table 9.3.16

The SAS System 14:26 Wednesday, April 29, 1998
Herring in the Gulf of Riga

Single option prediction: Summary table

							1 January		Spawning time	
Year	F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
1998	1.0000	0.3264	2086298	35269	13931034	205306	9179051	155837	8432731	142968
1999	1.0000	0.3264	2055364	35047	13314829	197232	9209405	154191	8461197	141400
2000	1.0000	0.3264	1978498	33975	12838404	190174	8783809	147897	8067799	135570
Unit	-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : SPRGEO01
Date and time : 20APR98:14:16
Computation of ref. F: Simple mean, age 3 - 7
Prediction basis : F factors

Table 9.3.17

The SAS System 14:26 Wednesday, April 29, 1998
Herring in the Gulf of Riga

Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	0.3264	205306	142968	35269	0.0000	0.0000	183819	145211	0	198430	160279
.	.	.	.	.	0.1000	0.0326	.	144825	3875	194507	156159
.	.	.	.	.	0.2000	0.0653	.	144440	7644	190693	152166
.	.	.	.	.	0.3000	0.0979	.	144056	11311	186985	148296
.	.	.	.	.	0.4000	0.1305	.	143673	14877	183380	144546
.	.	.	.	.	0.5000	0.1632	.	143291	18348	179874	140911
.	.	.	.	.	0.6000	0.1958	.	142911	21725	176465	137387
.	.	.	.	.	0.7000	0.2285	.	142531	25011	173149	133970
.	.	.	.	.	0.8000	0.2611	.	142153	28209	169924	130658
.	.	.	.	.	0.9000	0.2937	.	141776	31322	166786	127445
.	.	.	.	.	1.0000	0.3264	.	141400	34353	163734	124329
.	.	.	.	.	1.1000	0.3590	.	141025	37303	160764	121306
.	.	.	.	.	1.2000	0.3916	.	140651	40176	157873	118374
.	.	.	.	.	1.3000	0.4243	.	140278	42973	155061	115530
.	.	.	.	.	1.4000	0.4569	.	139907	45698	152323	112769
.	.	.	.	.	1.5000	0.4895	.	139536	48351	149659	110090
.	.	.	.	.	1.6000	0.5222	.	139167	50936	147065	107490
.	.	.	.	.	1.7000	0.5548	.	138799	53454	144539	104967
.	.	.	.	.	1.8000	0.5874	.	138431	55907	142080	102517
.	.	.	.	.	1.9000	0.6201	.	138065	58297	139686	100138
.	.	.	.	.	2.0000	0.6527	.	137700	60627	137354	97828
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANGEO04
Date and time : 20APR98:14:24
Computation of ref. F: Simple mean, age 3 - 7
Basis for 1998 : F factors

Table 9.3.18

The SAS System 14:26 Wednesday, April 29, 1998
Herring in the Gulf of Riga

Yield per recruit: Summary table

						1 January		Spawning time	
F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0	0	20886058	384824	16790765	341887	15812947	321977
0.1000	0.0326	411124	8476	18838339	333137	14747040	290263	13847535	272494
0.2000	0.0653	713129	14251	17335846	295974	13248443	253160	12406028	236951
0.3000	0.0979	945676	18368	16180300	267983	12096701	225229	11297917	210209
0.4000	0.1305	1131222	21406	15259443	246144	11179557	203448	10415338	189366
0.5000	0.1632	1283437	23713	14504948	228623	10428687	185983	9692638	172662
0.6000	0.1958	1411121	25507	13872835	214243	9800114	171659	9087556	158969
0.7000	0.2285	1520196	26929	13333509	202219	9264248	159688	8571652	147531
0.8000	0.2611	1614797	28078	12866319	192004	8800438	149525	8125080	137825
0.9000	0.2937	1697898	29019	12456410	183206	8393832	140778	7733562	129475
1.0000	0.3264	1771695	29802	12092818	175541	8033469	133162	7386562	122207
1.1000	0.3590	1837844	30461	11767274	168792	7711083	126462	7076129	115816
1.2000	0.3916	1897622	31022	11473417	162797	7420314	120515	6796149	110144
1.3000	0.4243	1952024	31504	11206272	157430	7156191	115193	6541841	105072
1.4000	0.4569	2001844	31922	10961892	152589	6914767	110397	6309405	100502
1.5000	0.4895	2047718	32287	10737100	148196	6692868	106048	6095789	96360
1.6000	0.5222	2090166	32609	10529308	144186	6487908	102081	5898505	92583
1.7000	0.5548	2129615	32894	10336389	140507	6297763	98444	5715506	89121
1.8000	0.5874	2166421	33149	10156574	137117	6120663	95095	5545089	85934
1.9000	0.6201	2200882	33377	9988378	133978	5955128	91997	5385827	82987
2.0000	0.6527	2233251	33582	9830547	131063	5799903	89121	5236513	80253
2.1000	0.6854	2263742	33768	9682011	128345	5653921	86441	5096119	77705
2.2000	0.7180	2292541	33937	9541853	125802	5516267	83936	4963761	75326
2.3000	0.7506	2319806	34091	9409280	123418	5386150	81588	4838678	73095
2.4000	0.7833	2345677	34231	9283605	121175	5262882	79382	4720207	71000
2.5000	0.8159	2370276	34360	9164225	119061	5145864	77302	4607769	69027
2.6000	0.8485	2393707	34479	9050612	117063	5034567	75339	4500856	67163
2.7000	0.8812	2416066	34588	8942299	115171	4928528	73481	4399019	65401
2.8000	0.9138	2437436	34689	8838874	113376	4827334	71719	4301860	63730
2.9000	0.9464	2457891	34782	8739967	111670	4730617	70045	4209025	62144
3.0000	0.9791	2477498	34869	8645249	110045	4638050	68452	4120197	60635
-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : YLDGEO01
Date and time : 20APR98:15:22
Computation of ref. F: Simple mean, age 3 - 7
F-0.1 factor : 0.7990
F-max factor : Not found
F-0.1 reference F : 0.2608
F-max reference F : Not found
Recruitment : 3786000 (Thousands)

Table 9.3.19. Development in SSB (' 000 tons) of Gulf of Riga herring assuming constant F in the period 1998 to 2006. For each F value is given five examples of trajectories and the probability distribution where each row gives for each year the SSB, for which x% of the 200 calculated SSB is smaller than the figure given

Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
	Fbar=0.30									
Examples of trajectories										
	191	162	231	253	261	274	271	223	291	256
	205	180	150	169	156	169	168	170	195	195
	211	181	151	164	167	184	148	135	131	178
	173	150	258	226	329	285	269	416	371	390
	199	174	173	265	258	214	220	286	265	355
Fractiles										
5%	161	138	135	131	134	138	140	138	148	146
10%	165	143	139	145	140	150	153	167	173	171
25%	176	152	156	161	169	182	193	203	209	215
50%	190	167	176	193	207	218	236	246	256	267
75%	207	182	207	231	242	266	289	317	340	354
90%	220	201	240	263	295	324	367	385	421	454
95%	235	215	278	295	326	358	419	443	464	508
	Fbar=0.40									
Examples of trajectories										
	177	145	115	170	137	142	166	200	227	222
	219	197	211	186	237	199	191	178	135	119
	205	176	156	159	169	134	145	123	103	128
	183	165	169	184	181	188	179	158	147	138
	196	179	137	116	146	146	155	150	202	204
Fractiles										
5%	161	139	117	115	108	116	114	110	104	105
10%	166	143	129	121	120	125	129	123	126	122
25%	176	152	146	144	140	143	152	149	155	152
50%	189	166	169	168	172	179	188	185	192	192
75%	204	181	195	205	206	226	237	239	249	265
90%	220	196	230	234	266	303	305	296	336	330
95%	230	205	250	263	297	321	340	387	407	402
	Fbar=0.50									
Examples of trajectories										
	189	164	129	94	134	126	230	202	152	134
	179	160	125	120	94	97	116	102	87	108
	173	143	131	122	107	117	183	181	161	162
	202	178	427	356	301	325	385	368	471	463
	185	163	129	142	146	188	170	147	128	149
Fractiles										
5%	159	136	107	88	81	71	67	61	50	52
10%	163	141	113	95	88	80	74	69	63	61
25%	172	148	127	112	103	97	93	90	84	82
50%	186	163	141	132	133	126	118	119	117	106
75%	204	179	166	168	167	159	159	15	156	147
90%	214	190	197	194	210	208	207	195	200	196
95%	228	205	218	225	235	239	225	231	257	234

ICES: WGBFAS 1998

HERRING IN SD 30 IN 1997. CATCHES IN NUMBERS (MILLIONS) AND MEAN WEIGHTS.
QUARTERLY COMBINED PROVISIONAL FINNISH & SWEDISH DATA. MW FROM FINNISH SAMPLES.

QUARTER I

Country	FINLAND		SWEDEN		TOTAL		SOP-CORRECTED C(n)	
SD	30		30		30			
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	9	4.67	0.4	4.67	9.0	4.67	9.1	4.67
2	62	13.45	2.8	13.45	65.1	13.45	65.3	13.45
3	54	22.10	2.5	22.10	56.6	22.10	56.7	22.10
4	38	28.23	1.7	28.23	39.6	28.23	39.7	28.23
5	39	32.50	1.8	32.50	40.5	32.50	40.5	32.50
6	34	37.65	1.5	37.65	35.5	37.65	35.6	37.65
7	21	44.24	1.0	44.24	22.3	44.24	22.3	44.24
8	17	51.26	0.8	51.26	17.7	51.26	17.7	51.26
9	13	58.78	0.6	58.78	13.8	58.78	13.8	58.78
10	2	69.43	0.1	69.43	1.6	69.43	1.6	69.43
11+	8	75.86	0.3	75.86	7.8	75.86	7.9	75.86
SOP (t):		8944		406		9350		9370
SOP (%)		1.00		1.00		1.00		1.00
Nom. land.(t):		8963		407		9370		9370

QUARTER II

Country	FINLAND		SWEDEN		TOTAL		SOP-CORRECTED C(n)	
SD	30		30		30			
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	74	4.17	1.9	4.17	75.8	4.17	73.6	4.17
2	286	12.75	7.5	12.75	293.9	12.75	285.5	12.75
3	255	22.14	6.7	22.14	261.4	22.14	254.0	22.14
4	133	27.40	3.5	27.40	136.2	27.40	132.4	27.40
5	132	33.51	3.4	33.51	135.6	33.51	131.7	33.51
6	115	36.45	3.0	36.45	118.4	36.45	115.1	36.45
7	85	42.21	2.2	42.21	87.0	42.21	84.6	42.21
8	55	47.66	1.4	47.66	56.6	47.66	55.0	47.66
9	42	55.49	1.1	55.49	43.0	55.49	41.8	55.49
10	7	64.25	0.2	64.25	7.1	64.25	6.9	64.25
11+	13	74.19	0.3	74.19	13.5	74.19	13.1	74.19
SOP (t):		31834		831		32665		31737
SOP (%)		0.97		0.97		0.97		1.00
Nom. land.(t):		30930		807		31737		31737

QUARTER III

Country	FINLAND		SWEDEN		TOTAL		SOP-CORRECTED	
SD	30		30		30			
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	51	10.73	1.3	10.73	51.8	10.73	51.4	10.73
2	81	19.77	2.0	19.77	82.8	19.77	82.2	19.77
3	92	24.52	2.3	24.52	94.7	24.52	94.0	24.52
4	47	30.46	1.2	30.46	48.4	30.46	48.0	30.46
5	61	32.98	1.5	32.98	62.8	32.98	62.3	32.98
6	53	36.23	1.3	36.23	54.3	36.23	53.9	36.23
7	36	43.01	0.9	43.01	36.4	43.01	36.2	43.01
8	31	45.10	0.8	45.10	31.4	45.10	31.2	45.10
9	27	51.98	0.7	51.98	27.4	51.98	27.2	51.98
10	2	66.17	0.1	66.17	2.2	66.17	2.2	66.17
11+	8	71.06	0.2	71.06	8.3	71.06	8.3	71.06
SOP (t):		14807		372		15179		15059
SOP (%)		0.99		0.99		0.99		1.00
Nom. land.(t):		14690		369		15059		15059

QUARTER IV

Country	FINLAND		SWEDEN		TOTAL		SOP-CORRECTED C(n)	
SD	30		30		30			
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	36	12.75	1.7	12.75	38.0	12.75	38.0	12.75
2	54	20.25	2.5	20.25	56.1	20.25	56.1	20.25
3	52	26.54	2.4	26.54	54.2	26.54	54.2	26.54
4	47	31.26	2.1	31.26	48.7	31.26	48.7	31.26
5	36	35.02	1.7	35.02	37.7	35.02	37.7	35.02
6	27	38.08	1.3	38.08	28.5	38.08	28.5	38.08
7	22	42.87	1.0	42.87	22.7	42.87	22.7	42.87
8	14	47.21	0.6	47.21	14.2	47.21	14.2	47.21
9	6	55.88	0.3	55.88	5.8	55.88	5.8	55.88
10	2	62.80	0.1	62.80	1.8	62.80	1.8	62.80
11+	4	67.33	0.2	67.33	4.3	67.33	4.3	67.33
SOP (t):		8941		412		9353		9360
SOP (%)		1.00		1.00		1.00		1.00
Nom. land.(t):		8948		412		9360		9360

ANNUAL BY COUNTRY.

Country	FINLAND		SWEDEN		TOTAL		SOP-CORRECTED C(n)	
SD	30		30		30			
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	169	8.82	5	8.82	175	8.82	170	8.82
2	483	15.17	15	15.17	498	15.17	486	15.17
3	453	23.33	14	23.33	467	23.33	455	23.33
4	264	28.91	9	28.91	273	28.91	266	28.91
5	268	33.44	8	33.44	277	33.44	270	33.44
6	230	36.96	7	36.96	237	36.96	231	36.96
7	163	42.90	5	42.90	168	42.90	164	42.90
8	116	47.91	4	47.91	120	47.91	117	47.91
9	87	55.69	3	55.69	90	55.69	88	55.69
10	12	65.60	0	65.60	13	65.60	12	65.60
11+	33	73.11	1	73.11	34	73.11	33	73.11
SOP (t):		65158		2025		67182		65527
SOP (%)		0.98		0.99		0.98		1.00
Nom. land.(t):		63531		1995		65527		65527

ICES: WGBFAS 1998
HERRING IN SD 30 IN 1996. CATCHES IN NUMBERS (MILLIONS) AND MEAN WEIGHTS.
QUARTERLY COMBINED FINNISH & SWEDISH DATA. MW FROM FINNISH SAMPLES.

QUARTER I								
Country	FINLAND		SWEDEN		TOTAL		SOP-	
SD	30		30		30		CORRECTED C(n)	
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	7	4 75	0 2	4.75	7 6	4.75	7.6	4.75
2	49	15 39	1 6	15 39	50.5	15.39	50 6	15 39
3	43	25 15	1 4	25.15	44 1	25 15	44 2	25.15
4	45	29 66	1 4	29 66	46.0	29 66	46 0	29 66
5	41	32 52	1 3	32 52	41.9	32 52	42.0	32 52
6	32	39 45	1 0	39.45	33.2	39.45	33 2	39.45
7	31	43 67	1 0	43.67	31 6	43.67	31.6	43.67
8	22	49 35	0.7	49.35	23.0	49.35	23 0	49.35
9	5	59 50	0 1	59 50	4.7	59.50	4.7	59.50
10	4	66 79	0 1	66.79	3 8	66.79	3.8	66.79
11+	2	67 86	0 1	67.86	1.9	67.86	1.9	67.86
SOP (t):		8852		285		9137		9138
SOP (%)		1.00		1.00		1.00		1.00
Nom. land.(t):		8853		285		9138		9138
QUARTER II								
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	35	5 28	1 0	5.28	35.5	5.28	34	5.28
2	186	16 05	5 2	16 05	191.2	16.05	185	16 05
3	124	25 40	3 5	25.40	127.4	25.40	123	25.40
4	164	32 45	4 6	32.45	169 0	32.45	163	32 45
5	85	35 22	2 4	35 22	87.3	35.22	84	35.22
6	70	40 51	1 9	40 51	71.9	40.51	69	40.51
7	94	44 50	2 6	44 50	96.9	44.50	94	44 50
8	52	50 57	1 5	50 57	53.6	50.57	52	50 57
9	12	58 38	0 3	58 38	12 0	58.38	12	58 38
10	20	63 43	0 6	63 43	20.4	63.43	20	63.43
11+	10	76 03	0 3	76 03	10.0	76.03	10	76.03
SOP (t):		26987		752		27738		26796
SOP (%)		0.97		0.97		0.97		1.00
Nom. land.(t):		26070		726		26796		26796
QUARTER III								
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	27	12 18	0 7	12 18	27.9	12.18	28.3	12.18
2	124	21 91	3 4	21 91	127.7	21.91	129.6	21.91
3	41	26 15	1.1	26.15	41.8	26.15	42.4	26.15
4	67	29 93	1 8	29 93	68.5	29.93	69.6	29.93
5	87	38 35	2 4	38 35	89.8	38.35	91.2	38.35
6	31	41 73	0 8	41.73	31 5	41.73	32.0	41.73
7	46	41 88	1 3	41 88	47.0	41.88	47.7	41.88
8	27	52 11	0 7	52.11	27 6	52.11	28.0	52.11
9	0	43 00	0 0	43.00	0 4	43.00	0 4	43.00
10	0	65 47	0 0	65 47	0 0	0.00	0 0	0.00
11+	1	95 00	0 0	95.00	1.2	95.00	1 2	95.00
SOP (t):		14184		391		14575		14796
SOP (%)		1.02		1.02		1.02		1.00
Nom. land.(t):		14399		397		14796		14796
QUARTER IV								
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	17	13 32	1 0	13.32	18.5	13.32	18.5	13.32
2	30	21 84	1 8	21.84	32 0	21.84	32 1	21.84
3	14	27 16	0 8	27.16	15 0	27.16	15.0	27.16
4	32	31 58	1 9	31.58	33 5	31.58	33.5	31.58
5	21	33 70	1 2	33.70	22 2	33.70	22.2	33.70
6	19	37 69	1 1	37.69	20 3	37 69	20.3	37 69
7	17	44 91	1 0	44.91	17.6	44.91	17 6	44 91
8	15	47 94	0 9	47.94	15 5	47.94	15.5	47.94
9	2	51 83	0 1	51.83	2 0	51.83	2.0	51.83
10	3	67 50	0 2	67.50	3 3	67.50	3.3	67.50
11+	2	55 00	0 1	55.00	2 3	55.00	2.3	55 00
SOP (t):		5581		329		5910		5912
SOP (%)		1.00		1.00		1.00		1.00
Nom. land.(t):		5582		329		5912		5912

ANNUAL BY COUNTRY.

Country	FINLAND		SWEDEN		TOTAL		SOP-	
SD	30		30		30		CORRECTED	
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	86.5	9 90	3.0	9.90	89 5	9.90	89.4	9.90
2	389.6	17.19	12.0	17.19	401 5	17.19	400.8	17.19
3	221.6	25 50	6 8	25.50	228 4	25.50	228 0	25.50
4	307.3	31 68	9.7	31.68	317.1	31.68	316 5	31 68
5	234 0	34 40	7.3	34.40	241.3	34.40	240.9	34 40
6	151 8	39 92	5 0	39.92	156 8	39 92	156 5	39 92
7	187.2	44 29	5 8	44.29	193.0	44 29	192 7	44 29
8	115.9	49 91	3 8	49.91	119.7	49 91	119.5	49 91
9	18 4	57 82	0 6	57 82	19 0	57 82	19.0	57 82
10	26.7	64 48	0 9	64.48	27.5	64 48	27.5	64 48
11+	14 9	73 44	0 5	73.44	15 4	73 44	15 4	73 44
SOP (t):		55002		1738		56741		56642
SOP (%)		1.00		1.00		1.00		1.00
Nom. land.(t):		54904		1738		56642		56642

Table 9.4.3

The SAS System 14:26 Wednesday, April 29, 1998
HER-30: Herring in Baltic Fishing Area 30

CANUM: Catch in Numbers (Total International Catch) (Total) (Millions)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11
1973	-11	15	45	231	140	181	78	25	7	2	1	1
1974	1	7	75	121	183	80	62	60	25	16	10	8
1975	2	36	119	133	66	74	41	36	32	17	8	14
1976	-11	89	100	183	128	58	82	34	36	25	16	18
1977	-11	19	177	133	196	101	60	86	49	29	16	16
1978	-11	27	67	228	125	132	67	44	52	16	16	21
1979	-11	4	26	61	221	63	82	52	18	31	5	13
1980	-11	66	54	50	49	168	76	75	40	16	23	9
1981	-11	4	45	33	43	41	91	36	25	18	8	12
1982	-11	25	92	151	38	45	58	84	27	24	8	12
1983	-11	86	162	93	101	15	16	28	50	13	10	7
1984	-11	94	146	182	100	81	17	18	31	42	15	25
1985	-11	82	348	218	126	40	46	9	14	12	32	18
1986	-11	18	373	294	135	78	32	26	4	4	10	14
1987	-11	43	48	219	211	94	55	29	12	8	8	16
1988	2	7	177	53	167	168	77	42	16	9	9	15
1989	21	111	71	192	44	132	109	51	23	14	6	12
1990	2	179	351	53	97	31	81	85	31	14	9	13
1991	1	45	209	256	47	75	41	58	39	19	7	17
1992	9	70	207	406	270	62	70	63	45	23	12	16
1993	11	199	330	188	290	220	45	54	33	20	10	12
1994	2	76	362	327	207	318	269	47	67	28	21	17
1995	1	52	152	334	275	213	313	213	48	70	26	39
1996	-11	89	401	228	317	241	157	193	120	19	28	15
1997	-11	170	486	455	266	270	231	164	117	88	12	33

Table 9.4.4

The SAS System 14:26 Wednesday, April 29, 1998
HER-30: Herring in Baltic Fishing Area 30

WECA: Mean Weight in Catch (Total International Catch) (Total) (Grams)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11
1973	7.1	11.0	19.4	25.4	30.6	35.0	42.6	42.4	46.8	50.9	51.3	67.8
1974	7.1	11.0	19.4	25.4	30.6	35.0	42.6	42.4	46.8	50.9	51.3	67.8
1975	3.8	11.4	19.7	25.4	30.0	34.2	38.5	41.7	44.9	49.8	56.0	62.3
1976	7.3	11.1	19.0	24.8	29.2	33.2	37.0	40.6	45.0	48.4	55.3	60.4
1977	7.3	14.6	18.6	24.5	28.4	32.3	37.0	40.9	44.4	47.6	51.3	62.0
1978	7.3	9.6	18.7	24.2	28.7	31.9	35.4	41.6	45.4	49.5	55.9	58.0
1979	7.3	12.0	17.8	24.5	30.0	33.4	35.4	39.5	46.0	49.7	58.5	57.6
1980	10.7	15.8	20.5	26.0	31.7	33.5	36.7	38.9	44.4	50.8	56.9	63.9
1981	9.3	10.7	16.9	25.4	33.8	40.9	41.5	46.1	49.4	56.7	64.4	81.1
1982	9.3	6.1	16.2	24.3	33.6	38.6	42.1	43.2	50.0	50.6	61.0	68.5
1983	7.7	9.4	19.6	31.9	36.9	44.6	51.0	52.0	56.2	64.5	64.0	82.7
1984	6.0	10.4	20.1	32.2	40.2	45.4	54.2	62.9	62.2	62.2	66.4	76.6
1985	7.7	7.2	18.4	28.7	38.2	41.3	47.5	51.8	58.4	57.7	62.5	74.8
1986	7.7	10.7	18.1	25.9	32.3	39.0	43.6	47.1	53.6	59.6	57.2	65.0
1987	6.0	8.4	20.0	27.6	33.5	39.2	45.2	49.5	57.2	61.1	60.9	68.9
1988	5.1	12.9	19.0	28.8	35.6	40.8	45.9	53.7	61.4	64.9	75.2	77.6
1989	5.5	12.0	23.6	33.0	41.1	46.4	52.0	57.0	61.7	67.9	66.9	81.3
1990	5.3	9.3	21.1	33.4	40.1	48.7	53.8	60.2	66.7	71.7	79.1	99.5
1991	6.5	11.4	21.4	27.5	35.5	41.0	48.3	53.0	55.4	58.8	63.6	69.8
1992	7.4	11.3	20.1	27.3	31.1	40.9	46.9	51.8	55.9	60.7	66.9	71.4
1993	6.9	12.9	19.8	27.7	30.9	34.5	47.1	50.8	56.4	63.2	66.5	73.0
1994	8.5	9.0	19.9	26.7	32.3	35.6	40.1	50.2	56.8	63.0	71.1	73.1
1995	6.5	7.2	18.6	26.6	30.6	35.6	39.0	42.7	50.3	60.0	67.0	86.4
1996	-11.0	9.1	18.4	25.6	31.4	35.9	40.2	43.7	50.4	57.0	64.5	74.3
1997	4.0	8.8	15.2	23.3	28.9	33.4	37.0	42.9	47.9	55.7	65.6	73.1

Table 9.4.5

The SAS System 14:26 Wednesday, April 29, 1998
HER-30: Herring in Baltic Fishing Area 30

MATPROP: Proportion Mature at Year Start (Total International Catch) (Total)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11
1973	0.00	0.00	0.29	0.92	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1974	0.00	0.00	0.29	0.92	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1975	0.00	0.00	0.29	0.92	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1976	0.00	0.00	0.29	0.92	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1977	0.00	0.00	0.29	0.92	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1978	0.00	0.00	0.29	0.92	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1979	0.00	0.00	0.29	0.92	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1980	0.00	0.00	0.29	0.92	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1981	0.00	0.00	0.29	0.92	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1982	0.00	0.00	0.29	0.92	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1983	0.00	0.00	0.21	0.92	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1984	0.00	0.00	0.17	0.93	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1985	0.00	0.00	0.20	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1986	0.00	0.00	0.28	0.90	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1987	0.00	0.00	0.32	0.88	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1988	0.00	0.00	0.04	0.79	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1989	0.00	0.00	0.22	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1990	0.00	0.00	0.70	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1991	0.00	0.00	0.63	0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1992	0.00	0.00	0.53	0.92	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1993	0.00	0.00	0.45	0.81	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1994	0.00	0.10	0.65	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1995	0.00	0.00	0.37	0.92	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1996	0.00	0.00	0.67	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
1997	0.00	0.00	0.32	0.82	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table 9.4.6

The SAS System 14:26 Wednesday, April 29, 1998
HER-30: Herring in Baltic Fishing Area 30

FLT10: Peltrsize

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10
1980	3079	5.1	4.4	6.8	6.4	18.7	11.4	6.6	6.4	2.2	3.2
1981	1929	3.9	5.9	3.0	2.2	1.8	2.7	0.9	1.3	1.9	0.5
1982	3551	12.0	28.1	22.2	5.9	6.5	11.3	18.0	3.6	6.5	1.2
1983	5478	25.9	60.4	35.4	26.7	3.4	4.6	6.6	8.7	1.8	1.2
1984	7137	72.5	92.3	75.6	50.7	29.0	6.1	5.0	12.2	17.6	8.8
1985	7709	79.1	265.2	109.9	48.8	24.4	19.8	5.8	2.9	5.8	11.6
1986	11452	11.8	280.1	170.5	72.2	36.7	16.2	11.8	1.9	1.9	10.0
1987	9099	22.1	23.5	102.4	88.9	38.7	21.5	12.6	5.0	3.6	3.3
1988	13541	4.2	120.9	30.1	96.7	82.1	37.2	17.8	8.0	3.9	3.9
1989	17579	81.1	44.9	104.8	23.9	68.7	55.5	26.5	10.7	7.7	2.4
1990	18041	146.2	229.1	24.5	35.5	10.8	34.9	37.2	13.4	6.7	3.6
1991	20063	26.3	119.3	132.3	24.7	33.3	19.4	24.1	18.4	8.8	1.3
1992	23581	38.4	124.3	191.8	118.6	24.1	24.5	21.1	19.2	10.7	7.5
1993	30020	124.4	193.6	78.6	110.0	78.5	14.2	16.8	8.8	6.4	2.5
1994	42522	45.9	201.3	183.0	114.7	170.1	139.7	19.2	29.1	11.8	10.9
1995	53986	40.3	92.1	196.7	180.7	138.7	233.3	158.6	34.5	46.9	38.9
1996	53157	64.0	248.5	108.0	159.8	132.9	74.8	95.6	54.2	7.5	9.9
1997	58585	130.1	342.8	288.2	165.6	165.2	142.3	95.1	61.3	52.9	7.1

The SAS System 14:26 Wednesday, April 29, 1998
HER-30: Herring in Baltic Fishing Area 30

FLT12: Bottrsize (Catch: Millions)

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10
1980	4316	12.3	9.1	8.8	7.5	23.3	10.6	7.7	3.4	2.0	1.6
1981	2401	1.1	6.3	3.0	3.2	4.7	13.3	4.5	4.0	2.7	1.1
1982	2703	3.0	11.1	17.7	4.2	4.6	6.2	9.6	2.5	1.7	1.4
1983	2779	3.7	15.2	10.0	9.2	3.1	3.3	5.9	9.4	2.2	2.0
1984	2246	7.8	6.6	11.7	6.0	5.3	2.6	2.8	1.9	4.2	1.3
1985	1170	2.5	5.8	7.4	4.1	3.5	2.2	0.6	1.4	0.4	2.1
1986	2500	0.5	8.7	10.3	8.9	7.7	4.5	3.1	1.0	1.8	1.6
1987	3000	7.9	6.9	17.3	17.4	6.0	3.2	2.4	1.1	0.8	0.5
1988	3595	2.2	18.8	5.8	14.9	12.2	4.5	2.1	0.7	0.6	0.7
1989	5528	17.3	14.6	25.7	3.8	20.5	14.0	5.3	2.5	1.4	1.0
1990	7527	27.4	73.5	10.7	25.6	6.2	17.9	17.9	7.3	1.6	1.3
1991	17115	19.2	69.8	68.1	12.4	25.9	14.8	23.6	11.4	5.2	2.9
1992	24836	31.5	62.0	138.0	88.3	20.0	19.7	23.7	15.8	7.5	2.4
1993	26843	55.5	83.7	58.2	102.0	81.0	16.1	20.4	13.0	9.6	4.7
1994	33561	26.8	121.3	96.5	59.3	88.9	81.6	17.4	24.4	11.4	5.3
1995	30627	11.3	51.1	104.8	77.7	56.7	64.2	43.3	8.1	14.4	10.7
1996	52151	22.5	133.3	90.1	115.1	80.9	55.4	68.0	50.6	8.5	13.5
1997	45992	38.9	127.0	141.7	81.8	80.2	74.7	55.5	43.5	29.0	4.3

Table 9.4.7

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Lowestoft VPA Version 3.1

   23-Apr-98  17:31:08

 Extended Survivors Analysis

 Herring in 30 (run: XSAMKR32/X32)

 CPUE data from file /users/fish/ifad/ifapwork/wgbfas/her_30/FLEET.X32

 Catch data for  25 years. 1973 to 1997. Ages  1 to   8.

      Fleet,           First, Last, First, Last, Alpha,  Beta
                ,      year, year,  age ,  age
 FLT10: Peltrsize (Ca,   1980, 1997,   1,     7,   .400,   .800
 FLT12: Bottrsize (Ca,   1980, 1997,   1,     7,   .000,  1.000

 Time series weights :

      Tapered time weighting applied
      Power =    3 over  20 years

 Catchability analysis :

      Catchability independent of stock size for all ages

      Catchability independent of age for ages >=    4


 Terminal population estimation :

      Final estimates not shrunk towards mean F

      Minimum standard error for population
      estimates derived from each fleet =    .300

      Prior weighting not applied


 Tuning converged after   95 iterations

 Regression weights
       ,  .751,  .820,  .877,  .921,  .954,  .976,  .990,  .997, 1.000, 1.000


 Fishing mortalities
    Age,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996,  1997

      1,  .005,  .019,  .029,  .013,  .016,  .046,  .031,  .016,  .034,  .054
      2,  .075,  .065,  .075,  .043,  .075,  .098,  .112,  .081,  .170,  .262
      3,  .056,  .108,  .063,  .072,  .111,  .091,  .132,  .143,  .169,  .296
      4,  .064,  .061,  .073,  .073,  .101,  .108,  .137,  .157,  .196,  .304
      5,  .067,  .066,  .055,  .074,  .130,  .112,  .166,  .204,  .201,  .255
      6,  .061,  .057,  .052,  .096,  .092,  .132,  .195,  .245,  .227,  .302
      7,  .046,  .052,  .057,  .048,  .210,  .095,  .198,  .233,  .234,  .394


XSA population numbers (Thousands)
                                  AGE
 YEAR ,      1,            2,        3,        4,        5,        6,        7,

 1988 ,    1.53E+06, 2.72E+06, 1.07E+06, 2.99E+06, 2.86E+06, 1.43E+06, 1.02E+06,
 1989 ,    6.67E+06, 1.25E+06, 2.07E+06, 8.27E+05, 2.29E+06, 2.19E+06, 1.10E+06,
 1990 ,    6.85E+06, 5.36E+06, 9.59E+05, 1.52E+06, 6.38E+05, 1.76E+06, 1.70E+06,
 1991 ,    3.90E+06, 5.45E+06, 4.07E+06, 7.37E+05, 1.16E+06, 4.94E+05, 1.37E+06,
 1992 ,    4.87E+06, 3.15E+06, 4.27E+06, 3.10E+06, 5.61E+05, 8.79E+05, 3.67E+05,
 1993 ,    4.85E+06, 3.93E+06, 2.39E+06, 3.13E+06, 2.30E+06, 4.03E+05, 6.56E+05,
 1994 ,    2.71E+06, 3.79E+06, 2.92E+06, 1.79E+06, 2.30E+06, 1.68E+06, 2.90E+05,
 1995 ,    3.52E+06, 2.15E+06, 2.77E+06, 2.09E+06, 1.28E+06, 1.59E+06, 1.13E+06,
 1996 ,    2.95E+06, 2.84E+06, 1.62E+06, 1.97E+06, 1.46E+06, 8.53E+05, 1.02E+06,
 1997 ,    3.56E+06, 2.33E+06, 1.96E+06, 1.12E+06, 1.33E+06, 9.80E+05, 5.57E+05,

 Estimated population abundance at 1st Jan 1998

    ,      .00E+00, 2.76E+06, 1.47E+06, 1.19E+06, 6.78E+05, 8.42E+05, 5.93E+05,

 Taper weighted geometric mean of the VPA populations:

    ,    3.85E+06, 3.12E+06, 2.43E+06, 1.85E+06, 1.44E+06, 1.07E+06, 8.03E+05,

 Standard error of the weighted Log(VPA populations) :

    ,       .4515,    .4748,    .4908,    .5083,    .5009,    .5248,    .5586,
```

Table 9.4.7 (Cont'd)

Log catchability residuals.

Fleet : FLT10: Peltrsize (Ca

Age	1980	1981	1982	1983	1984	1985	1986	1987
1	-.37	-.07	.34	.58	.90	1.11	.15	.31
2	-.67	-.87	.19	.42	.48	1.03	.91	-.03
3	-.29	-.35	.08	.21	.64	.84	.45	.39
4	-.54	-.66	.01	.13	.60	.44	.34	.34
5	-.08	-1.11	.06	-.75	.20	.03	.01	.21
6	.44	-1.30	.36	-.48	-.19	-.02	-.54	-.04
7	-.09	-1.38	.23	-.37	-.43	-.09	-.70	-.33

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	-.96	.27	.82	-.45	-.46	.50	-.27	-.91	-.24	.19
2	.53	.05	.21	-.59	-.14	-.14	-.41	-.88	-.10	.38
3	.06	.42	-.32	-.18	.00	-.56	-.24	-.35	-.38	.39
4	.25	-.13	-.36	-.10	-.12	-.44	-.17	-.10	-.12	.45
5	.13	-.09	-.69	-.25	.02	-.46	-.01	.16	.00	.25
6	.03	-.26	-.53	.07	-.44	-.42	.13	.48	-.02	.43
7	-.38	-.32	-.43	-.76	.36	-.76	-.10	.43	.04	.65

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

Age	1	2	3	4	5	6	7
Mean Log q	-21.2347	-19.9039	-19.8963	-19.9441	-19.9441	-19.9441	-19.9441
S.E(Log q)	.6074	.5164	.4032	.3125	.3209	.3787	.5114

Regression statistics :

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
1	.54	2.561	18.45	.76	18	.27	-21.23
2	.82	.643	19.02	.57	18	.44	-19.90
3	.82	.873	18.97	.70	18	.33	-19.90
4	.96	.222	19.72	.74	18	.31	-19.94
5	.85	.968	19.13	.80	18	.26	-20.02
6	.94	.278	19.67	.70	18	.36	-20.03
7	1.42	-1.144	22.84	.43	18	.67	-20.12

Fleet : FLT12: Bottrsize (Ca

Age	1980	1981	1982	1983	1984	1985	1986	1987
1	.79	-.94	-.17	-.08	.43	.15	-.88	1.00
2	.31	-.43	.12	.31	-.41	-.32	-.46	.44
3	.02	-.18	.51	.01	.31	.41	-.45	.11
4	-.36	-.15	.29	.10	-.02	.20	.12	.17
5	.16	-.01	.34	.20	.01	.34	.33	-.19
6	.38	.43	.39	.22	.47	.03	.06	-.48
7	.08	.36	.23	.56	.50	-.12	-.15	-.53

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	.33	.49	.63	.00	-.09	.41	.04	-1.01	-.66	-.17
2	.59	.68	.53	-.37	-.30	-.29	-.10	-.32	-.13	.19
3	.12	.55	.11	-.30	.00	-.37	-.27	-.04	-.17	.28
4	.06	-.45	.54	-.28	-.11	-.05	-.24	-.03	-.09	.31
5	-.10	.21	-.01	.01	.13	.03	-.08	.17	-.14	.10
6	-.40	-.13	.03	.31	-.36	.16	.16	.09	.03	.35
7	-.84	-.41	.07	-.27	.76	-.11	.38	.03	.06	.66

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

Table 9.4.7 (Cont'd)

Age ,	1,	2,	3,	4,	5,	6,	7
Mean Log q,	-21.8680,	-20.5214,	-20.3090,	-20.3272,	-20.3272,	-20.3272,	-20.3272,
S.E(Log q),	.5728,	.3987,	.2948,	.2618,	.1657,	.2760,	.4551,

Regression statistics :

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

Age,	Slope ,	t-value ,	Intercept,	RSquare,	No Pts,	Reg s.e,	Mean Q
1,	.66,	1.369,	19.62,	.62,	18,	.37,	-21.87,
2,	1.73,	-1.842,	24.58,	.39,	18,	.63,	-20.52,
3,	1.21,	-.944,	21.47,	.67,	18,	.36,	-20.31,
4,	.90,	.700,	19.74,	.83,	18,	.24,	-20.33,
5,	1.07,	-.636,	20.67,	.90,	18,	.17,	-20.27,
6,	1.21,	-1.124,	21.64,	.74,	18,	.33,	-20.29,
7,	1.86,	-2.163,	26.02,	.39,	18,	.73,	-20.28,

1

Terminal year survivor and F summaries :

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

Year class = 1996

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: Peltrsize (Ca,	3343851.,	.632,	.000,	.00,	1,	.471,	.045
FLT12: Bottrsize (Ca,	2333750.,	.596,	.000,	.00,	1,	.529,	.064

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
2764201.,	.43,	.18,	2,	.414,	.054

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

Year class = 1995

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: Peltrsize (Ca,	1659360.,	.410,	.305,	.74,	2,	.408,	.235
FLT12: Bottrsize (Ca,	1353682.,	.341,	.397,	1.16,	2,	.592,	.281

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1470979.,	.26,	.22,	4,	.828,	.262

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

Year class = 1994

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: Peltrsize (Ca,	1197215.,	.294,	.350,	1.19,	3,	.374,	.296
FLT12: Bottrsize (Ca,	1191015.,	.229,	.301,	1.32,	3,	.626,	.297

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
1193331.,	.18,	.20,	6,	1.121,	.296

Table 9.4.7 (Cont'd)

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

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: Peltrsize (Ca,	660257.,	.219,	.291,	1.33,	4,	.413,	.311
FLT12: Bottrsize (Ca,	690541.,	.183,	.148,	.81,	4,	.587,	.299

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
677860.,	.14,	.14,	8,	1.023,	.304

Age 5 Catchability constant w.r.t. time and age (fixed at the value for age) 4

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: Peltrsize (Ca,	831773.,	.185,	.139,	.75,	5,	.425,	.258
FLT12: Bottrsize (Ca,	848774.,	.158,	.062,	.39,	5,	.575,	.253

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
841514.,	.12,	.07,	10,	.567,	.255

Age 6 Catchability constant w.r.t. time and age (fixed at the value for age) 4

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: Peltrsize (Ca,	602311.,	.169,	.114,	.67,	6,	.409,	.298
FLT12: Bottrsize (Ca,	587009.,	.141,	.108,	.76,	6,	.591,	.305

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
593221.,	.11,	.07,	12,	.686,	.302

Age 7 Catchability constant w.r.t. time and age (fixed at the value for age) 4

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT10: Peltrsize (Ca,	305783.,	.164,	.139,	.85,	7,	.413,	.396
FLT12: Bottrsize (Ca,	308296.,	.137,	.127,	.93,	7,	.587,	.393

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
307256.,	.11,	.09,	14,	.856,	.394

Table 9.4.8

Run title : Herring in 30 (run: XSAMKR32/X32)

At 23-Apr-98 17:34:04

Terminal Fs derived using XSA (Without F shrinkage)

	Table 8	Fishing mortality (F) at age				
	YEAR,	1973,	1974,	1975,	1976,	1977,
	AGE					
	1,	.0115,	.0014,	.0093,	.0110,	.0058,
	2,	.0592,	.0734,	.0289,	.0322,	.0273,
	3,	.2316,	.2237,	.1804,	.0566,	.0546,
	4,	.3947,	.2906,	.1828,	.2645,	.0793,
	5,	.6723,	.4121,	.1822,	.2424,	.3450,
	6,	.4092,	.5127,	.3846,	.3154,	.4255,
	7,	.6444,	.6444,	.6444,	.6444,	.6444,
	+gp,	.6444,	.6444,	.6444,	.6444,	.6444,
0	FBAR 2- 6,	.3534,	.3025,	.1918,	.1822,	.1863,
	FBAR 3- 7,	.4704,	.4167,	.3149,	.3047,	.3098,

	Table 8	Fishing mortality (F) at age								
	YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
	AGE										
	1,	.0132,	.0026,	.0162,	.0011,	.0061,	.0190,	.0133,	.0143,	.0119,	.0142,
	2,	.0253,	.0157,	.0430,	.0137,	.0311,	.0495,	.0406,	.0625,	.0832,	.0398,
	3,	.0445,	.0289,	.0379,	.0334,	.0582,	.0397,	.0722,	.0786,	.0689,	.0643,
	4,	.0666,	.0554,	.0292,	.0414,	.0489,	.0502,	.0547,	.0654,	.0638,	.0645,
	5,	.0703,	.0433,	.0543,	.0308,	.0555,	.0245,	.0518,	.0279,	.0525,	.0577,
	6,	.4062,	.0568,	.0675,	.0376,	.0555,	.0251,	.0349,	.0375,	.0280,	.0475,
	7,	.6444,	.6444,	.0675,	.0412,	.0442,	.0343,	.0356,	.0232,	.0268,	.0319,
	+gp,	.6444,	.6444,	.0675,	.0412,	.0442,	.0343,	.0356,	.0232,	.0268,	.0319,
0	FBAR 2- 6,	.1226,	.0400,	.0464,	.0314,	.0498,	.0378,	.0508,	.0544,	.0593,	.0548,
	FBAR 3- 7,	.2464,	.1658,	.0513,	.0369,	.0525,	.0348,	.0498,	.0465,	.0480,	.0532,
1											

Run title : Herring in 30 (run: XSAMKR32/X32)

At 23-Apr-98 17:34:04

Terminal Fs derived using XSA (Without F shrinkage)

	Table 8	Fishing mortality (F) at age										
	YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	FBAR 95-97
	AGE											
	1,	.0051,	.0186,	.0293,	.0128,	.0160,	.0464,	.0315,	.0164,	.0341,	.0542,	.0349,
	2,	.0746,	.0648,	.0751,	.0433,	.0754,	.0975,	.1116,	.0814,	.1697,	.2616,	.1709,
	3,	.0564,	.1082,	.0630,	.0720,	.1110,	.0909,	.1324,	.1428,	.1688,	.2964,	.2027,
	4,	.0638,	.0606,	.0731,	.0730,	.1011,	.1081,	.1369,	.1571,	.1955,	.3039,	.2188,
	5,	.0670,	.0657,	.0552,	.0744,	.1302,	.1119,	.1659,	.2038,	.2009,	.2549,	.2199,
	6,	.0613,	.0565,	.0523,	.0962,	.0921,	.1316,	.1946,	.2446,	.2267,	.3019,	.2577,
	7,	.0464,	.0525,	.0570,	.0481,	.2102,	.0953,	.1977,	.2329,	.2337,	.3941,	.2869,
	+gp,	.0464,	.0525,	.0570,	.0481,	.2102,	.0953,	.1977,	.2329,	.2337,	.3941,	
0	FBAR 2- 6,	.0646,	.0712,	.0637,	.0718,	.1020,	.1080,	.1483,	.1659,	.1923,	.2837,	
	FBAR 3- 7,	.0590,	.0687,	.0601,	.0727,	.1289,	.1076,	.1655,	.1962,	.2051,	.3102,	
1												

Run title : Herring in 30 (run: XSAMKR32/X32)

At 23-Apr-98 17:34:04

Terminal Fs derived using XSA (Without F shrinkage)

	Table 9	Relative F at age				
	YEAR,	1973,	1974,	1975,	1976,	1977,
	AGE					
	1,	.0326,	.0045,	.0485,	.0605,	.0311,
	2,	.1676,	.2428,	.1506,	.1767,	.1464,
	3,	.6554,	.7395,	.9408,	.3107,	.2931,
	4,	1.1168,	.9607,	.9530,	1.4515,	.4254,
	5,	1.9023,	1.3623,	.9502,	1.3301,	1.8516,
	6,	1.1578,	1.6947,	2.0054,	1.7310,	2.2835,
	7,	1.8234,	2.1301,	3.3603,	3.5364,	3.4583,
	+gp,	1.8234,	2.1301,	3.3603,	3.5364,	3.4583,
0	REFMEAN,	.3534,	.3025,	.1918,	.1822,	.1863,

	Table 9	Relative F at age									
	YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
	AGE										
	1,	.1073,	.0637,	.3495,	.0347,	.1221,	.5029,	.2619,	.2624,	.2010,	.2592,
	2,	.2066,	.3922,	.9277,	.4368,	.6231,	1.3097,	.7990,	1.1493,	1.4040,	.7272,
	3,	.3630,	.7230,	.8166,	1.0636,	1.1678,	1.0510,	1.4204,	1.4455,	1.1618,	1.1734,
	4,	.5434,	1.3832,	.6303,	1.3192,	.9810,	1.3281,	1.0762,	1.2027,	1.0771,	1.1784,
	5,	.5733,	1.0822,	1.1709,	.9813,	1.1140,	.6470,	1.0182,	.5122,	.8849,	1.0537,
	6,	3.3138,	1.4194,	1.4545,	1.1991,	1.1141,	.6642,	.6862,	.6903,	.4721,	.8673,
	7,	5.2570,	16.0977,	1.4563,	1.3136,	.8864,	.9060,	.6997,	.4270,	.4515,	.5829,
	+gp,	5.2570,	16.0977,	1.4563,	1.3136,	.8864,	.9060,	.6997,	.4270,	.4515,	.5829,
0	REFMEAN,	.1226,	.0400,	.0464,	.0314,	.0498,	.0378,	.0508,	.0544,	.0593,	.0548,
1											

Table 9.4.8 (Cont'd)

Run title : Herring in 30 (run: XSAMKR32/X32)

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Terminal Fs derived using XSA (Without F shrinkage)

Table 9 Relative F at age YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	MEAN 95-97
AGE											
1,	.0782,	.2607,	.4598,	.1789,	.1570,	.4299,	.2124,	.0991,	.1772,	.1909,	.1557,
2,	1.1543,	.9108,	1.1778,	.6037,	.7393,	.9030,	.7526,	.4905,	.8826,	.9219,	.7650,
3,	.8722,	1.5208,	.9884,	1.0027,	1.0890,	.8414,	.8927,	.8604,	.8777,	1.0447,	.9276,
4,	.9876,	.8511,	1.1475,	1.0174,	.9914,	1.0010,	.9232,	.9467,	1.0166,	1.0710,	1.0114,
5,	1.0374,	.9234,	.8666,	1.0359,	1.2769,	1.0362,	1.1191,	1.2282,	1.0444,	.8984,	1.0570,
6,	.9484,	.7939,	.8197,	1.3404,	.9035,	1.2184,	1.3124,	1.4742,	1.1787,	1.0639,	1.2390,
7,	.7186,	.7372,	.8935,	.6693,	2.0613,	.8828,	1.3335,	1.4036,	1.2150,	1.3889,	1.3358,
+gp,	.7186,	.7372,	.8935,	.6693,	2.0613,	.8828,	1.3335,	1.4036,	1.2150,	1.3889,	
0 REFMEAN,	.0646,	.0712,	.0637,	.0718,	.1020,	.1080,	.1483,	.1659,	.1923,	.2837,	

1

Run title : Herring in 30 (run: XSAMKR32/X32)

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Terminal Fs derived using XSA (Without F shrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-4 YEAR,	1973,	1974,	1975,	1976,	1977,
AGE					
1,	144623,	564933,	430067,	897540,	363688,
2,	86452,	117050,	461895,	348852,	726790,
3,	123475,	66709,	89046,	367400,	276567,
4,	47445,	80191,	43669,	60871,	284243,
5,	40868,	26177,	49096,	29781,	38255,
6,	25670,	17082,	14193,	33501,	19134,
7,	5816,	13959,	8376,	7910,	20009,
+gp,	2528,	13559,	16317,	21832,	25280,
0 TOTAL,	476878,	899660,	1112658,	1767685,	1753966,

Table 10 Stock number at age (start of year) Numbers*10**-4 YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
1,	228299,	173513,	453592,	406489,	455423,	504676,	785717,	639579,	167947,	337218,
2,	296044,	184472,	141698,	365398,	332443,	370607,	405412,	634785,	516223,	135874,
3,	579030,	236318,	148680,	111126,	295091,	263857,	288769,	318713,	488230,	388897,
4,	214400,	453439,	187961,	117205,	87997,	227937,	207613,	219956,	241215,	373127,
5,	214984,	164225,	351248,	149456,	92069,	68607,	177480,	160930,	168684,	185274,
6,	22181,	164070,	128756,	272376,	118654,	71308,	54814,	137979,	128139,	131049,
7,	10237,	12098,	126909,	98540,	214769,	91898,	56934,	43339,	108805,	102016,
+gp,	24131,	15398,	148492,	172039,	181095,	261978,	356612,	365226,	133631,	154444,
0 TOTAL,	1589304,	1403533,	1687336,	1692628,	1777541,	1860865,	2333349,	2520508,	1952872,	1807900,

1

Run title : Herring in 30 (run: XSAMKR32/X32)

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Terminal Fs derived using XSA (Without F shrinkage)

Table 10 Stock number at age (start of year) Numbers*10**-4 YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	1998,	GMST 73-95	AMST 73-95
AGE													
1,	153463,	667345,	684895,	389766,	487166,	484806,	270927,	352295,	294919,	356397,	0,	387434,	436694,
2,	272200,	125011,	536332,	544548,	315042,	392524,	378919,	214940,	283730,	233370,	276420,	296979,	343631,
3,	106901,	206843,	95926,	407352,	426927,	239205,	291512,	277477,	162224,	196032,	147098,	227575,	264959,
4,	298586,	82728,	151976,	73742,	310347,	312802,	178833,	209081,	196958,	112188,	119333,	160205,	194146,
5,	286398,	229351,	63751,	115650,	56122,	229660,	229861,	127686,	146298,	132617,	67786,	111185,	141548,
6,	143184,	219282,	175833,	49390,	87900,	40339,	168124,	159420,	85267,	97981,	84151,	75190,	103582,
7,	102317,	110262,	169670,	136630,	36727,	65633,	28955,	113308,	102201,	55650,	59322,	46124,	73266,
+gp,	119079,	118609,	133391,	192692,	55677,	90860,	81532,	96811,	95675,	84140,	77177,		
0 TOTAL,	1482129,	1759431,	2011772,	1909771,	1775907,	1855828,	1628661,	1551017,	1367272,	1268375,	831288,		

1

Run title : Herring in 30 (run: XSAMKR32/X32)

At 23-Apr-98 17:34:04

Terminal Fs derived using XSA (Without F shrinkage)

Table 11 Spawning stock number at age (spawning time) Numbers*10**-3 YEAR,	1973,	1974,	1975,	1976,	1977,
AGE					
1,	0,	0,	0,	0,	0,
2,	232622,	314283,	1248521,	942493,	1965017,
3,	1027104,	555568,	746427,	3137437,	2362478,
4,	406053,	697110,	385808,	531234,	2550555,
5,	345876,	230358,	447214,	268834,	340052,
6,	226003,	148074,	125417,	299120,	168048,
7,	49433,	118639,	71183,	67229,	170049,
+gp,	21485,	115236,	138674,	185550,	214847,

Table 9.4.8 (Cont'd)

Table 11 Spawning stock number at age (spawning time) Numbers*10**-3

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	800646,	499622,	382204,	989937,	898314,	723176,	641264,	1177395,	1336319,	404604,
3,	4953669,	2026447,	1273240,	952287,	2519345,	2258938,	2486949,	2683223,	4071152,	3172985,
4,	1927498,	4083385,	1699307,	1057688,	793211,	2075421,	1889092,	2038975,	2191828,	3355527,
5,	1991427,	1527406,	3261463,	1392655,	854732,	639901,	1648597,	1500238,	1566725,	1719462,
6,	195373,	1522875,	1193188,	2535449,	1101543,	665022,	510449,	1284413,	1194527,	1218081,
7,	87002,	102820,	1176063,	916774,	1997234,	855875,	530140,	404302,	1014482,	950443,
+gp,	205081,	130861,	1376068,	1600581,	1684088,	2439894,	3320592,	3407107,	1245953,	1438888,

1

Run title : Herring in 30 (run: XSAMKR32/X32)

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Terminal Fs derived using XSA (Without F shrinkage)

Table 11 Spawning stock number at age (spawning time) Numbers*10**-3

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE										
1,	0,	0,	0,	0,	0,	0,	252428,	0,	0,	0,
2,	100792,	254968,	3475181,	3190731,	1545503,	1629531,	2267395,	735451,	1734835,	672190,
3,	783928,	1828932,	889549,	3734667,	3616134,	1789252,	2595028,	2339122,	1480661,	1439358,
4,	2657794,	767436,	1407167,	682801,	2861536,	2794705,	1640090,	1816114,	1790493,	973327,
5,	2654243,	2125963,	591864,	1070629,	515216,	2114136,	2098898,	1159324,	1328895,	1194899,
6,	1328130,	2035441,	1633174,	455725,	811568,	370246,	1528582,	1438615,	771527,	876630,
7,	951175,	1024106,	1574821,	1269855,	333140,	605685,	263136,	1024297,	923778,	491059,
+gp,	1107001,	1101629,	1238089,	1790889,	505029,	838497,	740940,	875169,	864794,	742452,

1

Run title : Herring in 30 (run: XSAMKR32/X32)

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Terminal Fs derived using XSA (Without F shrinkage)

Table 12 Stock biomass at age (start of year) Tonnes

YEAR,	1973,	1974,	1975,	1976,	1977,
AGE					
1,	15909,	62143,	47307,	98729,	54553,
2,	16426,	22240,	92379,	66282,	138090,
3,	30869,	16677,	22262,	91850,	69142,
4,	14708,	24859,	13101,	17652,	79588,
5,	14304,	9162,	16693,	9828,	12241,
6,	11038,	7345,	5535,	12395,	7080,
7,	2443,	5863,	3518,	3243,	8203,
+gp,	1264,	7051,	8322,	11135,	12387,
0 TOTALBIO,	106960,	155340,	209116,	311114,	381285,

Table 12 Stock biomass at age (start of year) Tonnes

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
1,	22830,	20821,	72575,	44714,	27325,	45421,	78572,	44771,	18474,	26977,
2,	56248,	33205,	29757,	62118,	53191,	74121,	81082,	114261,	92920,	27175,
3,	138967,	59079,	38657,	27782,	70822,	84434,	92406,	92427,	126940,	108891,
4,	62176,	136032,	60148,	39850,	29919,	84337,	83045,	83583,	77189,	126863,
5,	68795,	54194,	119424,	61277,	35907,	30873,	79866,	65982,	65787,	72257,
6,	7763,	57424,	47640,	114398,	49835,	36367,	29599,	66230,	56381,	58972,
7,	4300,	4839,	49495,	45328,	92351,	47787,	35868,	22536,	51139,	51008,
+gp,	12065,	7853,	75731,	101503,	99602,	159807,	235364,	233745,	80179,	97299,
0 TOTALBIO,	373144,	373448,	493425,	496968,	458951,	563147,	715803,	723534,	569008,	569443,

1

Run title : Herring in 30 (run: XSAMKR32/X32)

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Terminal Fs derived using XSA (Without F shrinkage)

Table 12 Stock biomass at age (start of year) Tonnes

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE										
1,	19950,	80081,	61641,	46772,	53588,	63025,	24383,	24661,	26543,	32076,
2,	51718,	30003,	112630,	114355,	63008,	78505,	75784,	40839,	51071,	35006,
3,	31001,	68258,	31656,	114058,	115270,	66977,	78708,	74919,	42178,	45087,
4,	107491,	33918,	60790,	26547,	96208,	96969,	57227,	64815,	61057,	32534,
5,	117423,	105501,	31238,	47417,	23010,	80381,	82750,	44690,	52667,	43764,
6,	65865,	114027,	94950,	23707,	41313,	18959,	67249,	62174,	34107,	36253,
7,	55251,	62849,	101802,	72414,	19098,	33473,	14478,	48722,	44968,	23930,
+gp,	83355,	80654,	101377,	115615,	33963,	56334,	50550,	61959,	52621,	46277,
0 TOTALBIO,	532055,	575292,	596083,	560886,	445459,	494622,	451128,	422779,	365213,	294927,

1

Table 9.4.8 (Cont'd)

Run title : Herring in 30 (run: XSAMKR32/X32)

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Terminal Fs derived using XSA (Without F shrinkage)

	Table 13	Spawning stock biomass at age (spawning time)				Tonnes
	YEAR,	1973,	1974,	1975,	1976,	1977,
	AGE					
	1,	0,	0,	0,	0,	0,
	2,	4420,	5971,	24970,	17907,	37335,
	3,	25678,	13889,	18661,	78436,	59062,
	4,	12588,	21610,	11574,	15406,	71416,
	5,	12106,	8063,	15205,	8872,	10882,
	6,	9718,	6367,	4891,	11067,	6218,
	7,	2076,	4983,	2990,	2756,	6972,
	+gp,	1074,	5992,	7072,	9463,	10528,
0	TOTSPBIO,	67659,	66876,	85364,	143907,	202412,

	Table 13	Spawning stock biomass at age (spawning time)						Tonnes			
	YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
	AGE										
	1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
	2,	15212,	8993,	8026,	16829,	14373,	14464,	12825,	21193,	24054,	8092,
	3,	118888,	50661,	33104,	23807,	60464,	72286,	79582,	77813,	105850,	88844,
	4,	55897,	122502,	54378,	35961,	26969,	76791,	75564,	77481,	70138,	114088,
	5,	63726,	50404,	110890,	57099,	33335,	28796,	74187,	61510,	61102,	67059,
	6,	6838,	53301,	44148,	106489,	46265,	33916,	27564,	61652,	52559,	54814,
	7,	3654,	4113,	45866,	42172,	85881,	44506,	33399,	21024,	47681,	47522,
	+gp,	10254,	6674,	70180,	94434,	92625,	148834,	219159,	218055,	74757,	90650,
0	TOTSPBIO,	274470,	296648,	366592,	376791,	359912,	419591,	522280,	538728,	436141,	471068,
1											

Run title : Herring in 30 (run: XSAMKR32/X32)

At 23-Apr-98 17:34:04

Terminal Fs derived using XSA (Without F shrinkage)

	Table 13	Spawning stock biomass at age (spawning time)						Tonnes			
	YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
	AGE										
	1,	0,	0,	0,	0,	0,	0,	2272,	0,	0,	0,
	2,	1915,	6119,	72979,	67005,	30910,	32591,	45348,	13974,	31227,	10083,
	3,	22734,	60355,	29355,	104571,	97636,	50099,	70066,	63156,	38497,	33105,
	4,	95681,	31465,	56287,	24581,	88708,	86636,	52483,	56300,	55505,	28226,
	5,	108824,	97794,	29001,	43896,	21124,	73995,	75560,	40576,	47840,	39432,
	6,	61094,	105843,	88191,	21875,	38144,	17402,	61143,	56106,	30861,	32435,
	7,	51363,	58374,	94489,	67302,	17323,	30890,	13157,	44045,	40646,	21116,
	+gp,	77490,	74911,	94095,	107453,	30807,	51987,	45938,	56011,	47564,	40835,
0	TOTSPBIO,	419101,	434861,	464398,	436683,	324651,	343599,	365967,	330167,	292141,	205232,
1											

Run title : Herring in 30 (run: XSAMKR32/X32)

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Terminal Fs derived using XSA (Without F shrinkage)

	Table 14	Stock biomass at age with SOP (start of year)				Tonnes
	YEAR,	1973,	1974,	1975,	1976,	1977,
	AGE					
	1,	15984,	59336,	44400,	97223,	53486,
	2,	16504,	21235,	86702,	65271,	135388,
	3,	31016,	15924,	20893,	90449,	67789,
	4,	14778,	23736,	12295,	17383,	78031,
	5,	14372,	8748,	15667,	9678,	12002,
	6,	11091,	7014,	5195,	12206,	6941,
	7,	2455,	5598,	3302,	3194,	8043,
	+gp,	1270,	6732,	7810,	10965,	12145,
0	TOTALBIO,	107470,	148323,	196264,	306368,	373824,

	Table 14	Stock biomass at age with SOP (start of year)						Tonnes			
	YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
	AGE										
	1,	23579,	20747,	69654,	43843,	26728,	45291,	75029,	43107,	18489,	26488,
	2,	58095,	33087,	28559,	60908,	52028,	73910,	77427,	110016,	92994,	26682,
	3,	143529,	58869,	37101,	27241,	69273,	84193,	88240,	88992,	127041,	106916,
	4,	64217,	135548,	57727,	39074,	29265,	84096,	79301,	80478,	77250,	124562,
	5,	71053,	54002,	114618,	60084,	35121,	30785,	76265,	63530,	65839,	70946,
	6,	8018,	57220,	45722,	112171,	48745,	36263,	28265,	63769,	56426,	57902,
	7,	4441,	4822,	47503,	44446,	90331,	47650,	34251,	21699,	51179,	50083,
	+gp,	12461,	7825,	72683,	99527,	97424,	159350,	224753,	225059,	80243,	95535,
0	TOTALBIO,	385395,	372120,	473566,	487294,	448915,	561538,	683532,	696650,	569460,	559114,
1											

Table 9.4.8(Cont'd)

Run title : Herring in 30 (run: XSAMKR32/X32)

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Terminal Fs derived using XSA (Without F shrinkage)

Table 14 Stock biomass at age with SOP (start of year) Tonnes

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE										
1,	20332,	77630,	62817,	45790,	53730,	62279,	24470,	24478,	26308,	32208,
2,	52707,	29084,	114780,	111955,	63176,	77576,	76052,	40537,	50620,	35150,
3,	31594,	66169,	32260,	111665,	115576,	66185,	78987,	74365,	41806,	45273,
4,	109547,	32880,	61951,	25990,	96463,	95822,	57429,	64336,	60518,	32669,
5,	119670,	102272,	31834,	46422,	23071,	79430,	83043,	44360,	52202,	43944,
6,	67125,	110536,	96762,	23209,	41423,	18735,	67488,	61714,	33806,	36403,
7,	56308,	60925,	103745,	70895,	19149,	33077,	14529,	48362,	44571,	24028,
+gp,	84950,	78185,	103312,	113189,	34053,	55667,	50729,	61501,	52157,	46468,
0 TOTALBIO,	542234,	557681,	607462,	549115,	446640,	488771,	452726,	419653,	361988,	296142,

1

Run title : Herring in 30 (run: XSAMKR32/X32)

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Terminal Fs derived using XSA (Without F shrinkage)

Table 15 Spawning stock biomass with SOP (spawning time) Tonnes

YEAR,	1973,	1974,	1975,	1976,	1977,
AGE					
1,	0,	0,	0,	0,	0,
2,	4441,	5702,	23436,	17634,	36605,
3,	25800,	13262,	17514,	77239,	57906,
4,	12648,	20634,	10863,	15171,	70018,
5,	12163,	7698,	14271,	8736,	10669,
6,	9764,	6080,	4591,	10899,	6096,
7,	2086,	4758,	2806,	2714,	6836,
+gp,	1079,	5722,	6638,	9319,	10322,
0 TOTSPBIO,	67982,	63855,	80118,	141712,	198451,

Table 15 Spawning stock biomass with SOP (spawning time) Tonnes

YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
1,	0,	0,	0,	0,	0,	0,	0,	0,	0,	0,
2,	15712,	8961,	7703,	16501,	14059,	14422,	12247,	20406,	24073,	7945,
3,	122791,	50481,	31772,	23344,	59142,	72080,	75994,	74922,	105934,	87232,
4,	57733,	122066,	52189,	35261,	26379,	76571,	72157,	74602,	70194,	112018,
5,	65818,	50225,	106427,	55987,	32606,	28713,	70842,	59224,	61151,	65843,
6,	7063,	53111,	42371,	104416,	45253,	33819,	26322,	59361,	52601,	53819,
7,	3774,	4098,	44020,	41351,	84003,	44378,	31893,	20243,	47718,	46660,
+gp,	10591,	6650,	67355,	92596,	90599,	148408,	209279,	209953,	74816,	89006,
0 TOTSPBIO,	283480,	295592,	351837,	369456,	352041,	418392,	498734,	518710,	436488,	462524,

1

Run title : Herring in 30 (run: XSAMKR32/X32)

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Terminal Fs derived using XSA (Without F shrinkage)

Table 15 Spawning stock biomass with SOP (spawning time) Tonnes

YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE										
1,	0,	0,	0,	0,	0,	0,	2280,	0,	0,	0,
2,	1952,	5932,	74372,	65599,	30992,	32205,	45509,	13870,	30951,	10124,
3,	23169,	58507,	29916,	102376,	97895,	49506,	70314,	62689,	38157,	33242,
4,	97511,	30502,	57361,	24065,	88943,	85611,	52669,	55883,	55015,	28343,
5,	110906,	94801,	29555,	42975,	21180,	73119,	75828,	40276,	47418,	39594,
6,	62263,	102603,	89875,	21416,	38245,	17196,	61360,	55691,	30589,	32569,
7,	52346,	56587,	96293,	65890,	17369,	30525,	13203,	43719,	40287,	21203,
+gp,	78972,	72618,	95891,	105198,	30889,	51372,	46101,	55597,	47144,	41003,
0 TOTSPBIO,	427118,	421549,	473263,	427519,	325512,	339534,	367264,	327726,	289561,	206078,

1

Table 9.4.8(Cont'd)

Run title : Herring in 30 (run: XSAMKR32/X32)

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Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (Without F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 2- 6,	FBAR 3- 7,
1973,	1446230,	106960,	67659,	22531,	.3330,	.3534,	.4704,
1974,	5649333,	155340,	66876,	20294,	.3035,	.3025,	.4167,
1975,	4300671,	209116,	85364,	16264,	.1905,	.1918,	.3149,
1976,	8975396,	311114,	143907,	22012,	.1530,	.1822,	.3047,
1977,	3636885,	381285,	202412,	26304,	.1300,	.1863,	.3098,
1978,	2282984,	373144,	274470,	25105,	.0915,	.1226,	.2464,
1979,	1735124,	373449,	296648,	19049,	.0642,	.0400,	.1658,
1980,	4535922,	493425,	366592,	20150,	.0550,	.0464,	.0513,
1981,	4064888,	496969,	376791,	13700,	.0364,	.0314,	.0369,
1982,	4554234,	458951,	359912,	17847,	.0496,	.0498,	.0525,
1983,	5046759,	563147,	419591,	18501,	.0441,	.0378,	.0348,
1984,	7857176,	715803,	522280,	25629,	.0491,	.0508,	.0498,
1985,	6395788,	723534,	538728,	26120,	.0485,	.0544,	.0465,
1986,	1679468,	569008,	436141,	26489,	.0607,	.0593,	.0480,
1987,	3372182,	569443,	471068,	24520,	.0521,	.0548,	.0532,
1988,	1534629,	532055,	419101,	27650,	.0660,	.0646,	.0590,
1989,	6673447,	575292,	434861,	28658,	.0659,	.0712,	.0687,
1990,	6848954,	596083,	464397,	31282,	.0674,	.0637,	.0601,
1991,	3897665,	560885,	436683,	26219,	.0600,	.0718,	.0727,
1992,	4871659,	445459,	324651,	39310,	.1211,	.1020,	.1289,
1993,	4848055,	494622,	343599,	40179,	.1169,	.1080,	.1076,
1994,	2709274,	451128,	365967,	56380,	.1541,	.1483,	.1655,
1995,	3522950,	422779,	330167,	61086,	.1850,	.1659,	.1962,
1996,	2949191,	365213,	292141,	56642,	.1939,	.1923,	.2051,
1997,	3563969,	294927,	205232,	65527,	.3193,	.2837,	.3102,
Arith. Mean	4278113,	449565,	329810,	30298,	.1204,	.1214,	.1590,
0 Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),			
1							

Table 9.4.11.1 Herring in the Bothnian Sea SD 30; Schaefer model (observation error version)

Herring in the Bothnian Sea SD 30; Trawl information combined, effort not corrected

r	1.32	MSY	82436
K	250000	fMSY	1342
BI	118000		
q	0.00049143	SSQ	1.10

Time	Predicted Biomass	Predicted CPUE	Observed CPUE	Observed Catch	SSQ
1980	118000	57.99	69.74	20150	0.03
1981	180028	88.47	54.73	13700	0.23
1982	232788	114.40	86.78	17847	0.08
1983	236080	116.02	97.27	18501	0.03
1984	234917	115.45	127.96	25629	0.01
1985	227982	112.04	138.71	26120	0.05
1986	228346	112.22	106.24	26489	0.00
1987	227944	112.02	100.81	24520	0.01
1988	229949	113.00	93.88	27650	0.03
1989	226625	111.37	101.60	28658	0.01
1990	225915	111.02	114.36	31282	0.00
1991	223340	109.76	85.88	26219	0.06
1992	228535	112.31	103.07	39310	0.01
1993	215106	105.71	93.67	40179	0.01
1994	214528	105.43	117.52	56380	0.01
1995	198296	97.45	133.54	61086	0.10
1996	191302	94.01	125.55	56642	0.08
1997	193904	95.29	170.14	65527	0.34

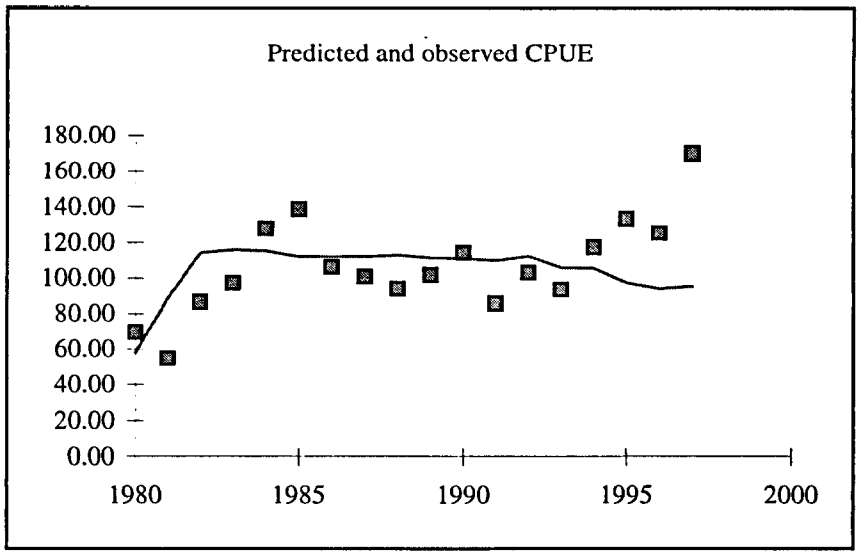


Table 9.4.11.2 Herring in the Bothnian Sea SD 30; Schaefer model (observation error version)

Herring in the Bothnian Sea SD 30; Trawl information combined, corrected effort data

r	0.65	MSY	40637
K	250000	fMSY	746
BI	118000		
q	0.0004359	SSQ	1.52

Time	Predicted SSB	Predicted CPUE	Observed CPUE	Observed Catch	SSQ
1980	118000	51.44	65.11	20150	0.06
1981	138359	60.31	54.17	13700	0.01
1982	164832	71.85	82.83	17847	0.02
1983	183496	79.99	85.72	18501	0.00
1984	196732	85.76	133.23	25629	0.19
1985	198358	86.46	161.82	26120	0.39
1986	198879	86.69	121.16	26489	0.11
1987	198832	86.67	98.63	24520	0.02
1988	200772	87.52	91.41	27650	0.00
1989	198827	86.67	78.22	28658	0.01
1990	196630	85.71	75.72	31282	0.02
1991	192641	83.97	54.40	26219	0.19
1992	195160	85.07	60.11	39310	0.12
1993	183685	80.07	48.13	40179	0.26
1994	175186	76.36	59.26	56380	0.06
1995	152892	66.65	64.90	61086	0.00
1996	130420	56.85	46.05	56642	0.04
1997	114338	49.84	54.81	65527	0.01

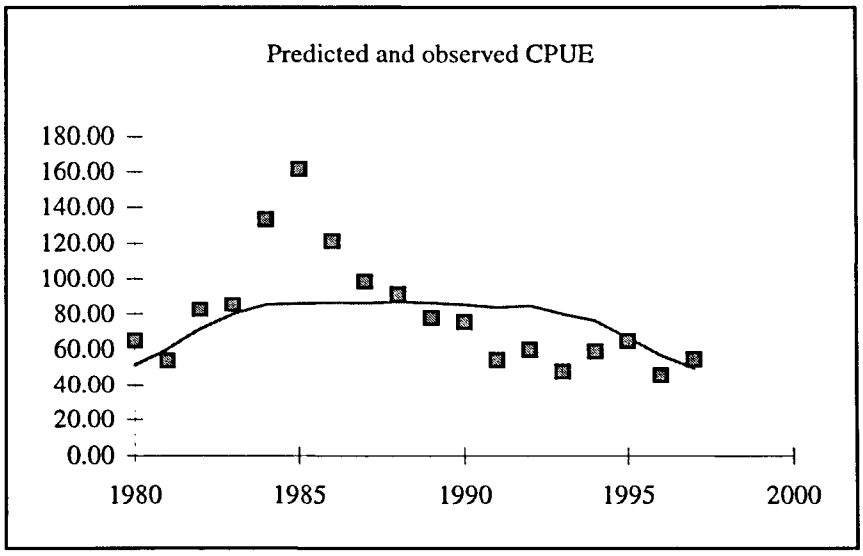
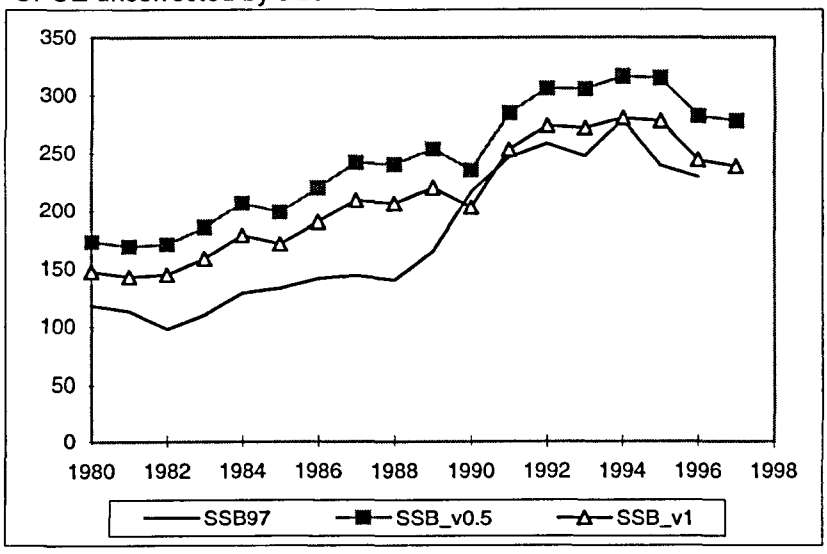


Table 9.4.11.2.1a. The SSB ('000 t) estimated from production model (Horbowy, 1992) with CPUE uncorrected for trawl size

Year	SSB XSA_97	Prod.Model SSB_v1	g	CPUE calc.	CPUE observ.	Catch observ.	CPUE Residuals	F
1980	118	148	0.02	0.7	0.70	20	0.06	0.15
1981	113	143	-0.01	0.72	0.55	14	0.28	0.10
1982	98	145	0.04	0.74	0.87	18	-0.16	0.13
1983	110	159	0.02	0.81	0.97	19	-0.19	0.12
1984	129	179	-0.01	0.89	1.28	26	-0.37	0.15
1985	133	172	0.07	0.88	1.39	26	-0.46	0.16
1986	141	190	0.11	1.00	1.06	26	-0.06	0.14
1987	144	209	0.03	1.07	1.01	25	0.06	0.12
1988	140	206	0.01	1.04	0.94	28	0.10	0.14
1989	165	220	-0.04	1.07	1.02	29	0.06	0.14
1990	216	203	0.00	1.00	1.14	31	-0.13	0.17
1991	246	253	0.04	1.31	0.86	26	0.42	0.11
1992	258	274	0.05	1.39	1.03	39	0.30	0.15
1993	247	272	0.06	1.39	0.94	40	0.39	0.16
1994	279	280	0.04	1.38	1.18	56	0.16	0.22
1995	239	278	0.02	1.33	1.34	61	0.00	0.24
1996	229	244	0.04	1.18	1.26	57	-0.06	0.26
1997		238	0.08	1.14	1.70	66	-0.40	0.31
1998		242		0.65				
					SScpue=		**1.126874**	
					SS_B0=		**0.086513**	
				SStotal=			**1.213387**	

Herring in 30, SSB from the model and from XSA(97)
CPUE uncorrected by size

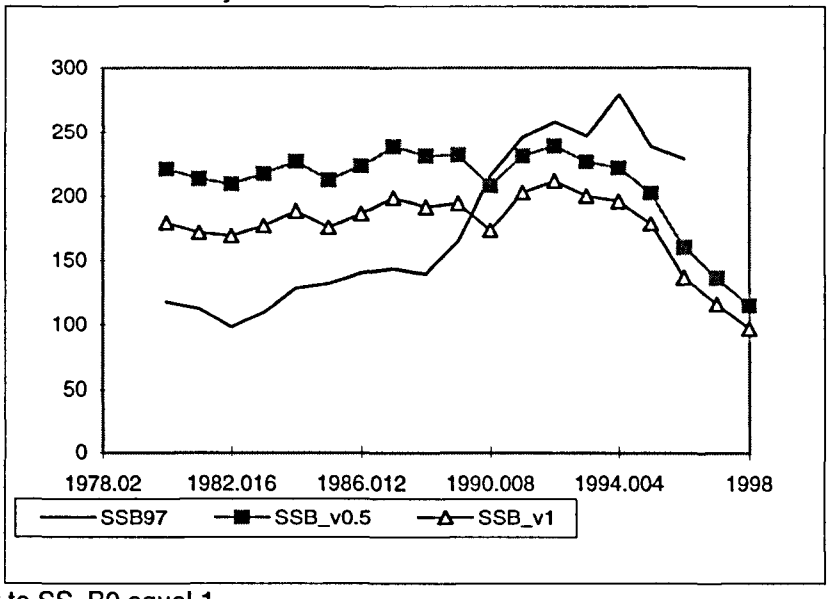


v1 - weight to SS_B0 equal 1
v0.5 - weight to SS_B0 equal 0.5

Table 9.4.11.2.1b. The SSB ('000 t) estimated from production model (Horbowy, 1992) with CPUE corrected for trawl size

Year	SSB XSA_97	Prod. Model SSB_v1	g	CPUE calc.	CPUE observ.	Catch observ.	CPUE Residuals	F
1980	118	179	0.02	0.7	0.70	20	0.06	0.12
1981	113	172	-0.01	0.71	0.51	14	0.33	0.08
1982	98	169	0.04	0.71	0.82	18	-0.14	0.11
1983	110	177	0.02	0.74	0.88	19	-0.18	0.11
1984	129	189	-0.01	0.76	1.15	26	-0.42	0.15
1985	133	176	0.07	0.73	1.25	26	-0.53	0.15
1986	141	187	0.11	0.80	0.93	26	-0.15	0.14
1987	144	199	0.03	0.82	0.85	25	-0.03	0.13
1988	140	192	0.01	0.78	0.76	28	0.03	0.15
1989	165	195	-0.04	0.77	0.78	29	-0.02	0.16
1990	216	174	0.00	0.69	0.82	31	-0.18	0.20
1991	246	203	0.04	0.84	0.55	26	0.43	0.14
1992	258	212	0.05	0.86	0.61	39	0.34	0.20
1993	247	200	0.06	0.81	0.52	40	0.44	0.22
1994	279	196	0.04	0.74	0.58	56	0.24	0.33
1995	239	179	0.02	0.65	0.60	61	0.08	0.41
1996	229	137	0.04	0.48	0.46	57	0.05	0.51
1997		117	0.08	0.38	0.54	66	-0.35	0.75
1998		97		0.210335				
					SScpue=		**1.357988**	
					SS_B0=		**0.237667**	
				SStotal=			**1.595655**	

Herring in 30, SSB from the model and from XSA(97)
CPUE corrected by size



v1 - weight to SS_B0 equal 1
v0.5 - weight to SS_B0 equal 0.5

Table 9.5.1

The SAS System 14:26 Wednesday, April 29, 1998
HER-31: Herring in Baltic Fishing Area 31

CATON: Landings (Total International Catch) (Total) (Tonnes)

Year	Total
1973	3976
1974	6482
1975	5547
1976	8508
1977	7330
1978	9768
1979	7060
1980	9659
1981	7826
1982	8652
1983	7707
1984	8916
1985	9312
1986	9090
1987	8108
1988	8768
1989	4437
1990	7818
1991	6800
1992	7305
1993	9167
1994	5825
1995	4681
1996	5242
1997	4281

Table 9.5.2

The SAS System 14:26 Wednesday, April 29, 1998
HER-31: Herring in Baltic Fishing Area 31

FLT08: FLT08: Peltrawlhours

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10
1980	3589	20.8	5.4	1.4	2.4	2.4	1.0	0.3	0.3	-11.0	-11.0
1981	3242	4.0	31.4	4.4	0.1	0.4	1.7	0.6	0.4	0.8	0.9
1982	1803	5.1	7.3	6.5	1.7	0.3	0.3	0.1	-11.0	-11.0	-11.0
1983	3014	16.8	1.8	1.9	5.7	0.9	0.8	1.6	2.3	1.1	0.7
1984	3940	21.2	34.4	2.3	1.5	10.1	2.6	1.0	-11.0	1.1	0.2
1985	6393	6.3	28.9	27.1	3.3	2.3	5.6	0.7	0.9	0.6	1.7
1986	4864	-11.0	9.2	18.1	23.8	4.4	4.1	7.2	1.3	1.2	1.3
1987	4898	0.9	5.3	6.8	10.4	11.9	3.0	2.9	1.9	0.7	1.3
1988	7447	-11.0	4.5	4.9	6.4	7.5	8.7	1.1	2.3	0.8	0.0
1989	2639	3.5	3.4	5.8	2.1	2.6	3.7	4.2	0.9	0.3	0.5
1990	3620	1.8	31.1	3.0	7.0	3.8	5.2	6.9	3.2	1.0	1.3
1991	4738	0.7	11.2	32.5	1.6	4.6	1.8	2.4	3.3	2.2	0.4
1992	4197	1.1	7.7	12.1	21.3	1.5	3.9	3.1	2.4	2.3	1.0
1993	3880	0.8	9.0	5.7	13.1	30.4	3.5	2.9	1.7	1.6	1.1
1994	1192	-11.0	3.4	3.4	1.3	3.9	10.8	1.0	2.4	1.8	1.2
1995	886	5.0	1.9	4.0	2.3	1.0	2.0	2.0	1.9	0.2	0.2
1996	1659	0.1	9.3	3.9	4.9	2.0	1.6	1.8	4.4	-11.0	0.4
1997	384	2.2	6.8	6.2	0.5	0.6	0.9	0.5	0.2	0.2	0.2

The SAS System 14:26 Wednesday, April 29, 1998
HER-31: Herring in Baltic Fishing Area 31

FLT07: FLT07: Bottrawlhours

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10
1980	23969	43.3	39.1	5.0	9.7	56.8	13.5	21.9	11.8	5.5	2.9
1981	12983	14.4	41.1	11.8	2.8	9.5	29.9	10.7	9.7	4.9	2.2
1982	9830	-11.0	4.6	71.3	13.0	4.6	11.9	27.4	6.1	8.4	2.3
1983	13836	20.7	10.0	16.7	50.7	8.7	8.0	6.7	8.7	2.0	0.7
1984	18421	36.9	62.6	15.2	6.9	25.7	3.3	2.6	1.2	8.1	0.5
1985	10080	1.4	28.3	55.7	10.5	11.2	19.2	4.2	1.8	0.7	6.6
1986	16230	7.0	10.0	31.4	39.8	6.1	8.5	17.5	1.8	2.7	3.6
1987	9223	12.7	26.4	19.6	25.7	25.6	5.2	6.9	4.9	2.5	1.1
1988	11936	7.0	28.3	18.3	12.9	23.6	22.1	4.7	4.6	3.6	2.6
1989	8445	6.7	4.9	14.4	7.2	7.2	10.8	9.3	2.7	1.3	1.3
1990	8910	10.7	82.2	3.8	16.2	7.1	6.7	11.8	9.4	1.7	2.1
1991	6746	1.1	17.7	55.4	3.5	14.5	7.0	6.4	6.2	5.1	1.2
1992	8069	14.2	10.7	33.4	61.3	4.4	6.7	7.7	7.4	4.1	1.4
1993	7994	17.4	45.0	16.1	37.2	57.7	5.2	5.1	4.9	3.1	2.5
1994	6892	11.2	26.7	25.9	9.8	15.5	22.4	1.5	1.4	0.3	-11.0
1995	4839	36.0	11.3	27.9	16.1	5.0	11.1	11.8	1.7	1.7	1.4
1996	7566	22.4	89.9	6.6	17.7	13.4	7.5	9.3	7.9	-11.0	0.1
1997	2383	23.8	28.5	43.5	6.7	14.8	1.9	5.6	3.1	1.2	0.3

The SAS System 14:26 Wednesday, April 29, 1998
HER-31: Herring in Baltic Fishing Area 31

FLT01: FLT01: Trapnet

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10
1974	529	0.2	8.9	10.2	14.1	14.1	14.9	17.3	6.2	1.9	1.5
1975	554	2.2	15.4	19.6	4.1	6.1	3.9	4.5	3.7	0.9	0.7
1976	695	0.4	9.8	16.6	17.3	6.1	9.3	10.5	9.2	3.8	1.4
1977	484	0.6	16.7	5.8	9.6	7.4	3.5	6.6	3.9	2.5	0.8
1978	424	-11.0	2.1	25.2	2.7	5.3	4.9	3.1	6.2	2.2	1.3
1979	556	2.8	0.6	1.1	12.3	1.6	2.2	2.3	1.1	1.5	0.3
1980	424	0.8	8.4	0.6	0.8	13.2	1.8	2.8	1.9	0.9	1.8
1981	370	0.4	16.6	3.6	0.5	1.0	8.5	1.6	1.5	0.9	0.5
1982	272	0.1	4.8	17.8	3.2	0.8	2.4	3.6	0.9	1.1	0.7
1983	233	0.8	2.3	2.1	6.8	0.6	0.3	0.9	1.5	0.4	0.6
1984	232	0.8	17.3	3.2	1.7	6.6	0.9	0.9	0.3	2.0	0.4
1985	203	0.3	7.0	14.2	3.4	1.5	4.4	0.5	0.7	0.6	1.8
1986	292	1.3	2.3	4.9	7.9	1.1	1.0	2.5	0.6	0.3	0.4
1987	263	0.1	2.8	2.3	3.7	6.5	1.0	0.9	1.0	0.4	0.4
1988	182	-11.0	4.8	1.9	1.2	2.1	2.7	0.5	0.5	0.6	0.2
1989	78	-11.0	1.1	2.6	1.2	0.7	1.2	0.9	0.2	0.2	0.2
1990	158	2.1	7.8	1.0	2.4	1.2	1.0	2.3	1.3	0.2	0.1
1991	126	0.1	4.0	10.1	0.4	0.8	0.1	0.7	0.4	0.4	0.1
1992	95	-11.0	2.1	2.5	2.7	0.3	0.5	0.1	0.2	0.1	-11.0
1993	79	0.5	1.7	2.4	4.8	5.8	0.9	0.6	0.3	0.3	0.1
1994	120	-11.0	9.8	4.4	1.9	4.1	3.0	-11.0	0.4	-11.0	-11.0
1995	150	-11.0	4.3	5.5	2.0	1.2	2.2	1.8	0.4	0.1	-11.0
1996	149	0.1	7.9	1.0	3.2	1.5	0.9	1.3	0.5	-11.0	-11.0
1997	202	0.8	5.1	12.5	2.2	4.5	1.5	0.9	0.7	0.5	-11.0

Table 9.5.2

The SAS System 14:26 Wednesday, April 29, 1998
HER-31: Herring in Baltic Fishing Area 31

FLT08: FLT08: Peltrawlhours

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10
1980	3589	20.8	5.4	1.4	2.4	2.4	1.0	0.3	0.3	-11.0	-11.0
1981	3242	4.0	31.4	4.4	0.1	0.4	1.7	0.6	0.4	0.8	0.9
1982	1803	5.1	7.3	6.5	1.7	0.3	0.3	0.1	-11.0	-11.0	-11.0
1983	3014	16.8	1.8	1.9	5.7	0.9	0.8	1.6	2.3	1.1	0.7
1984	3940	21.2	34.4	2.3	1.5	10.1	2.6	1.0	-11.0	1.1	0.2
1985	6393	6.3	28.9	27.1	3.3	2.3	5.6	0.7	0.9	0.6	1.7
1986	4864	-11.0	9.2	18.1	23.8	4.4	4.1	7.2	1.3	1.2	1.3
1987	4898	0.9	5.3	6.8	10.4	11.9	3.0	2.9	1.9	0.7	1.3
1988	7447	-11.0	4.5	4.9	6.4	7.5	8.7	1.1	2.3	0.8	0.0
1989	2639	3.5	3.4	5.8	2.1	2.6	3.7	4.2	0.9	0.3	0.5
1990	3620	1.8	31.1	3.0	7.0	3.8	5.2	6.9	3.2	1.0	1.3
1991	4738	0.7	11.2	32.5	1.6	4.6	1.8	2.4	3.3	2.2	0.4
1992	4197	1.1	7.7	12.1	21.3	1.5	3.9	3.1	2.4	2.3	1.0
1993	3880	0.8	9.0	5.7	13.1	30.4	3.5	2.9	1.7	1.6	1.1
1994	1192	-11.0	3.4	3.4	1.3	3.9	10.8	1.0	2.4	1.8	1.2
1995	886	5.0	1.9	4.0	2.3	1.0	2.0	2.0	1.9	0.2	0.2
1996	1659	0.1	9.3	3.9	4.9	2.0	1.6	1.8	4.4	-11.0	0.4
1997	384	2.2	6.8	6.2	0.5	0.6	0.9	0.5	0.2	0.2	0.2

The SAS System 14:26 Wednesday, April 29, 1998
HER-31: Herring in Baltic Fishing Area 31

FLT07: FLT07: Bottrawlhours

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10
1980	23969	43.3	39.1	5.0	9.7	56.8	13.5	21.9	11.8	5.5	2.9
1981	12983	14.4	41.1	11.8	2.8	9.5	29.9	10.7	9.7	4.9	2.2
1982	9830	-11.0	4.6	71.3	13.0	4.6	11.9	27.4	6.1	8.4	2.3
1983	13836	20.7	10.0	16.7	50.7	8.7	8.0	6.7	8.7	2.0	0.7
1984	18421	36.9	62.6	15.2	6.9	25.7	3.3	2.6	1.2	8.1	0.5
1985	10080	1.4	28.3	55.7	10.5	11.2	19.2	4.2	1.8	0.7	6.6
1986	16230	7.0	10.0	31.4	39.8	6.1	8.5	17.5	1.8	2.7	3.6
1987	9223	12.7	26.4	19.6	25.7	25.6	5.2	6.9	4.9	2.5	1.1
1988	11936	7.0	28.3	18.3	12.9	23.6	22.1	4.7	4.6	3.6	2.6
1989	8445	6.7	4.9	14.4	7.2	7.2	10.8	9.3	2.7	1.3	1.3
1990	8910	10.7	82.2	3.8	16.2	7.1	6.7	11.8	9.4	1.7	2.1
1991	6746	1.1	17.7	55.4	3.5	14.5	7.0	6.4	6.2	5.1	1.2
1992	8069	14.2	10.7	33.4	61.3	4.4	6.7	7.7	7.4	4.1	1.4
1993	7994	17.4	45.0	16.1	37.2	57.7	5.2	5.1	4.9	3.1	2.5
1994	6892	11.2	26.7	25.9	9.8	15.5	22.4	1.5	1.4	0.3	-11.0
1995	4839	36.0	11.3	27.9	16.1	5.0	11.1	11.8	1.7	1.7	1.4
1996	7566	22.4	89.9	6.6	17.7	13.4	7.5	9.3	7.9	-11.0	0.1
1997	2383	23.8	28.5	43.5	6.7	14.8	1.9	5.6	3.1	1.2	0.3

The SAS System 14:26 Wednesday, April 29, 1998
HER-31: Herring in Baltic Fishing Area 31

FLT01: FLT01: Trapnet

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6	Catch, age 7	Catch, age 8	Catch, age 9	Catch, age 10
1974	529	0.2	8.9	10.2	14.1	14.1	14.9	17.3	6.2	1.9	1.5
1975	554	2.2	15.4	19.6	4.1	6.1	3.9	4.5	3.7	0.9	0.7
1976	695	0.4	9.8	16.6	17.3	6.1	9.3	10.5	9.2	3.8	1.4
1977	484	0.6	16.7	5.8	9.6	7.4	3.5	6.6	3.9	2.5	0.8
1978	424	-11.0	2.1	25.2	2.7	5.3	4.9	3.1	6.2	2.2	1.3
1979	556	2.8	0.6	1.1	12.3	1.6	2.2	2.3	1.1	1.5	0.3
1980	424	0.8	8.4	0.6	0.8	13.2	1.8	2.8	1.9	0.9	1.8
1981	370	0.4	16.6	3.6	0.5	1.0	8.5	1.6	1.5	0.9	0.5
1982	272	0.1	4.8	17.8	3.2	0.8	2.4	3.6	0.9	1.1	0.7
1983	233	0.8	2.3	2.1	6.8	0.6	0.3	0.9	1.5	0.4	0.6
1984	232	0.8	17.3	3.2	1.7	6.6	0.9	0.9	0.3	2.0	0.4
1985	203	0.3	7.0	14.2	3.4	1.5	4.4	0.5	0.7	0.6	1.8
1986	292	1.3	2.3	4.9	7.9	1.1	1.0	2.5	0.6	0.3	0.4
1987	263	0.1	2.8	2.3	3.7	6.5	1.0	0.9	1.0	0.4	0.4
1988	182	-11.0	4.8	1.9	1.2	2.1	2.7	0.5	0.5	0.6	0.2
1989	78	-11.0	1.1	2.6	1.2	0.7	1.2	0.9	0.2	0.2	0.2
1990	158	2.1	7.8	1.0	2.4	1.2	1.0	2.3	1.3	0.2	0.1
1991	126	0.1	4.0	10.1	0.4	0.8	0.1	0.7	0.4	0.4	0.1
1992	95	-11.0	2.1	2.5	2.7	0.3	0.5	0.1	0.2	0.1	-11.0
1993	79	0.5	1.7	2.4	4.8	5.8	0.9	0.6	0.3	0.3	0.1
1994	120	-11.0	9.8	4.4	1.9	4.1	3.0	-11.0	0.4	-11.0	-11.0
1995	150	-11.0	4.3	5.5	2.0	1.2	2.2	1.8	0.4	0.1	-11.0
1996	149	0.1	7.9	1.0	3.2	1.5	0.9	1.3	0.5	-11.0	-11.0
1997	202	0.8	5.1	12.5	2.2	4.5	1.5	0.9	0.7	0.5	-11.0

Table 9.5.3
ICES: WGBFAS 1998
HERRING IN SD 31 IN 1997. CATCHES IN NUMBERS (MILLIONS) AND MEAN WEIGHTS.
QUARTERLY COMBINED PROVISIONAL FINNISH & SWEDISH DATA. MW FROM FINNISH SAMPLES.

QUARTER I								
Country	FINLAND		SWEDEN		TOTAL		SOP-CORRECTED	
SD	31		31		31			
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
2	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
3	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
4	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
5	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
6	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
7	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
8	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
9	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
10	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
11+	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
SOP (t):		0		0		0		
SOP (%)								
Nom. land.(t):		0		0		0		0
QUARTER II								
Country	FINLAND		SWEDEN		TOTAL		SOP-CORRECTED	
SD	31		31		31			
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	0.0		0.0	0.00	0.0	0.00	0.0	0.00
2	12.5	14.42	0.4	14.42	12.9	14.42	12.8	14.42
3	41.0	21.65	1.2	21.65	42.2	21.65	42.0	21.65
4	7.0	29.98	0.2	29.98	7.2	29.98	7.2	29.98
5	15.2	34.13	0.4	34.13	15.6	34.13	15.5	34.13
6	6.0	36.75	0.2	36.75	6.2	36.75	6.1	36.75
7	5.4	40.92	0.2	40.92	5.5	40.92	5.5	40.92
8	2.5	42.27	0.1	42.27	2.6	42.27	2.6	42.27
9	1.3	43.44	0.0	43.44	1.3	43.44	1.3	43.44
10	0.3	42.50	0.0	42.50	0.3	42.50	0.3	42.50
11+	0.0		0.0	0.00	0.0	0.00	0.0	0.00
SOP (t):		2413		68		2481		2469
SOP (%)		1.00		1.00		1.00		1.00
Nom. land.(t):		2401		68		2469		2469
QUARTER III								
Country	FINLAND		SWEDEN		TOTAL		SOP-CORRECTED	
SD	31		31		31			
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	15.5	8.78	0.2	8.78	15.7	8.78	16.0	8.78
2	21.7	17.17	0.2	17.17	21.9	17.17	22.3	17.17
3	19.4	23.94	0.2	23.94	19.6	23.94	19.9	23.94
4	2.1	30.56	0.0	30.56	2.1	30.56	2.1	30.56
5	4.3	35.38	0.0	35.38	4.3	35.38	4.4	35.38
6	2.1	38.15	0.0	38.15	2.1	38.15	2.2	38.15
7	1.6	42.61	0.0	42.61	1.7	42.61	1.7	42.61
8	1.2	43.21	0.0	43.21	1.3	43.21	1.3	43.21
9	0.6	46.73	0.0	46.73	0.6	46.73	0.6	46.73
10	0.2	56.50	0.0	56.50	0.2	56.50	0.2	56.50
11+	0.0	52.00	0.0	52.00	0.0	52.00	0.0	52.00
SOP (t):		1435		16		1450		1475
SOP (%)		1.02		1.02		1.02		1.00
Nom. land.(t):		1459		16		1475		1475
QUARTER IV								
Country	FINLAND		SWEDEN		TOTAL		SOP-CORRECTED	
SD	31		31		31			
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	11.4	12.71	0.1	12.71	11.4	12.71	10.4	12.71
2	6.2	21.39	0.0	21.39	6.2	21.39	5.6	21.39
3	1.8	27.04	0.0	27.04	1.8	27.04	1.6	27.04
4	0.2	35.00	0.0	35.00	0.2	35.00	0.2	35.00
5	0.4	45.70	0.0	45.70	0.4	45.70	0.4	45.70
6	0.2	35.00	0.0	35.00	0.2	35.00	0.2	35.00
7	0.0	38.33	0.0	38.33	0.0	38.33	0.0	38.33
8	0.2	38.50	0.0	38.50	0.2	38.50	0.2	38.50
9	0.0		0.0	0.00	0.0	0.00	0.0	0.00
10	0.0		0.0	0.00	0.0	0.00	0.0	0.00
11+	0.0		0.0	0.00	0.0	0.00	0.0	0.00
SOP (t):		370		2		371		337
SOP (%)		0.91		0.91		0.91		1.00
Nom. land.(t):		335		2		337		337

ANNUAL BY COUNTRY.

Country	FINLAND		SWEDEN		TOTAL		SOP-CORRECTED	
SD	31		31		31			
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	26.9	10.15	0.2	10.15	27.1	10.15	27	10.15
2	40.4	16.82	0.6	16.82	41.0	16.82	41	16.82
3	62.2	22.76	1.4	22.76	63.6	22.76	63	22.76
4	9.3	30.39	0.2	30.39	9.6	30.39	9	30.39
5	19.9	34.93	0.5	34.93	20.3	34.93	20	34.93
6	8.3	37.11	0.2	37.11	8.5	37.11	8	37.11
7	7.0	41.33	0.2	41.33	7.2	41.33	7	41.33
8	4.0	42.39	0.1	42.39	4.1	42.39	4	42.39
9	1.9	44.78	0.0	44.78	2.0	44.78	2	44.78
10	0.5	49.50	0.0	49.50	0.5	49.50	1	49.50
11+	0.0	52.00	0.0	52.00	0.0	52.00	0	52.00
SOP (t):		4227		88		4316		4281
SOP (%)		0.99		0.97		0.99		1.00
Nom. land.(t):		4195		86		4281		4281

Table 9.5.4

ICES: WGBFAS 1998

HERRING IN SD 31 IN 1996. CATCHES IN NUMBERS (MILLIONS) AND MEAN WEIGHTS. QUARTERLY COMBINED FINNISH & SWEDISH DATA. MW FROM FINNISH SAMPLES.

QUARTER I								
Country	FINLAND		SWEDEN		TOTAL		SOP-CORRECTED C(n)	
SD	31		31		31			
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	0.0	4.00	0.0	4.00	0.0	4.00	0.0	4.00
2	0.3	13.74	0.0	13.74	0.3	13.74	0.3	13.74
3	0.0	24.75	0.0	24.75	0.0	24.75	0.0	24.75
4	0.1	31.09	0.0	31.09	0.1	31.09	0.1	31.09
5	0.0	35.22	0.0	35.22	0.0	35.22	0.0	35.22
6	0.0	41.40	0.0	41.40	0.0	41.40	0.0	41.40
7	0.0	42.57	0.0	42.57	0.0	42.57	0.0	42.57
8	0.0	54.17	0.0	54.17	0.0	54.17	0.0	54.17
9	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
10	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
11+	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
SOP (t):		13		0		13		13
SOP (%)		1.00				1.00		1.00
Nom. land.(t):		13		0		13		13
QUARTER II								
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	1.3	4.00	0.0	4.00	1.3	4.00	1.3	4.00
2	74.3	13.99	2.5	13.99	76.7	13.99	77.8	13.99
3	5.6	27.90	0.2	27.90	5.8	27.90	5.9	27.90
4	16.5	31.00	0.5	31.00	17.1	31.00	17.3	31.00
5	12.8	34.58	0.4	34.58	13.2	34.58	13.4	34.58
6	7.3	35.93	0.2	35.93	7.5	35.93	7.6	35.93
7	10.1	40.95	0.3	40.95	10.4	40.95	10.5	40.95
8	8.1	50.91	0.3	50.91	8.3	50.91	8.4	50.91
9	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
10	0.0		0.0	0.00	0.0	0.00	0.0	0.00
11+	0.0		0.0	0.00	0.0	0.00	0.0	0.00
SOP (t):		3238		108		3345		3391
SOP (%)		1.01		1.01		1.01		1.00
Nom. land.(t):		3282		109		3391		3391
QUARTER III								
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	14.2	10.82	0.0	10.82	14.2	10.82	14.1	10.82
2	29.2	17.38	0.1	17.38	29.3	17.38	29.2	17.38
3	5.5	26.97	0.0	26.97	5.5	26.97	5.5	26.97
4	6.6	31.03	0.0	31.03	6.6	31.03	6.6	31.03
5	2.9	33.30	0.0	33.30	2.9	33.30	2.9	33.30
6	1.8	37.27	0.0	37.27	1.8	37.27	1.8	37.27
7	2.1	35.93	0.0	35.93	2.1	35.93	2.1	35.93
8	4.5	38.88	0.0	38.88	4.5	38.88	4.5	38.88
9	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
10	0.5	55.00	0.0	55.00	0.5	55.00	0.5	55.00
11+	0.6	57.67	0.0	57.67	0.6	57.67	0.6	57.67
SOP (t):		1485		5		1490		1485
SOP (%)		1.00		1.00		1.00		1.00
Nom. land.(t):		1480		5		1485		1485
QUARTER IV								
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	7.2	12.38	0.0	12.38	7.2	12.38	7.3	12.38
2	3.3	18.57	0.0	18.57	3.3	18.57	3.3	18.57
3	0.4	31.67	0.0	31.67	0.4	31.67	0.4	31.67
4	2.6	33.50	0.0	33.50	2.6	33.50	2.7	33.50
5	1.2	35.82	0.0	35.82	1.2	35.82	1.2	35.82
6	1.0	38.56	0.0	38.56	1.0	38.56	1.0	38.56
7	0.2	42.50	0.0	42.50	0.2	42.50	0.2	42.50
8	0.2	49.00	0.0	49.00	0.2	49.00	0.2	49.00
9	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
10	0.0		0.0	0.00	0.0	0.00	0.0	0.00
11+	0.0		0.0	0.00	0.0	0.00	0.0	0.00
SOP (t):		352		0		352		353
SOP (%)		1.00				1.00		1.00
Nom. land.(t):		353		0		353		353

ANNUAL BY COUNTRY.

Country	FINLAND		SWEDEN		TOTAL		SOP-CORRECTED C(n)	
SD	31		31		31			
Age	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)	C(n)	MW (g)
1	22.6	11.25	0.1	11.25	22.7	11.25	22.2	11.25
2	107.1	16.76	2.6	16.76	109.7	16.76	107.3	16.76
3	11.5	27.50	0.2	27.50	11.7	27.50	11.4	27.50
4	25.8	31.59	0.6	31.59	26.4	31.59	25.8	31.59
5	16.9	34.31	0.4	34.31	17.4	34.31	17.0	34.31
6	10.1	37.03	0.2	37.03	10.3	37.03	10.1	37.03
7	12.5	39.08	0.3	39.08	12.8	39.08	12.5	39.08
8	12.8	43.97	0.3	43.97	13.0	43.97	12.8	43.97
9	0.0	0.00	0.0	0.00	0.0	0.00	0.0	0.00
10	0.5	55.00	0.0	55.00	0.5	55.00	0.5	55.00
11+	0.6	57.67	0.0	57.67	0.6	57.67	0.5	57.67
SOP (t):		5240		118		5358		5242
SOP (%)		0.98		0.97		0.98		1.00
Nom. land.(t):		5128		114		5242		5242

Table 9.5.5

The SAS System

14:26 Wednesday, April 29, 1998
HER-31: Herring in Baltic Fishing Area 31

WECA: Mean Weight in Catch (Total International Catch) (Total) (Grams)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11
1973	6.0	12.6	22.9	30.2	35.9	38.7	41.9	44.4	46.8	49.8	52.9	57.1
1974	5.0	15.0	20.5	28.3	34.1	37.9	40.3	42.7	45.4	46.5	60.2	50.0
1975	5.0	13.0	21.3	30.3	36.2	38.8	44.5	45.7	49.5	51.6	61.3	63.0
1976	5.0	12.2	21.7	29.6	34.5	40.1	41.6	44.0	46.1	50.5	49.6	57.7
1977	5.0	13.3	20.9	29.9	34.3	38.4	41.2	44.4	46.9	48.0	51.0	56.3
1978	5.5	14.8	22.8	31.0	36.4	37.8	42.1	43.3	46.3	49.7	50.0	63.1
1979	5.9	14.5	23.9	32.0	35.7	39.0	41.0	45.2	48.7	49.6	51.5	50.7
1980	5.0	11.9	22.3	31.1	37.5	39.7	41.8	43.9	46.7	49.3	57.7	55.6
1981	5.0	14.1	21.5	29.0	35.2	39.7	42.4	45.7	47.3	50.7	51.8	57.3
1982	2.0	16.0	24.5	31.3	37.2	42.3	46.9	48.2	50.9	54.7	57.2	60.6
1983	4.0	13.0	25.1	34.7	39.8	42.9	47.8	52.7	55.7	59.0	60.0	63.6
1984	4.0	16.1	23.4	35.0	41.0	43.8	46.6	53.1	53.4	56.7	56.5	61.8
1985	4.0	13.0	22.1	30.7	38.3	43.5	45.8	52.2	53.9	57.8	57.2	62.9
1986	4.0	12.3	18.7	29.4	36.7	41.4	45.3	49.0	50.7	59.2	58.0	64.9
1987	4.0	14.3	23.8	32.4	38.9	44.2	48.9	53.5	56.7	59.4	61.3	68.8
1988	6.0	9.2	23.7	35.2	41.4	45.7	50.5	54.6	60.7	59.5	61.9	73.5
1989	6.0	13.8	23.5	34.0	42.2	47.0	50.6	53.3	57.7	65.3	60.7	70.5
1990	-11.0	12.5	19.2	33.7	38.4	44.8	49.9	53.4	55.1	61.6	60.3	68.3
1991	-11.0	15.1	22.0	27.8	35.7	41.4	46.5	50.0	53.2	58.3	64.9	79.3
1992	5.6	13.3	19.9	27.1	30.3	39.7	41.6	47.7	51.0	55.5	61.1	70.7
1993	7.5	14.7	21.9	28.8	32.2	33.9	42.1	49.8	52.5	54.7	59.1	76.8
1994	5.0	10.6	19.9	27.6	32.7	35.2	36.7	43.4	51.2	58.8	54.3	70.0
1995	7.4	9.1	17.9	29.1	32.7	36.0	38.7	40.9	49.3	61.0	56.0	72.6
1996	3.5	11.3	16.8	27.5	31.6	34.3	37.0	39.1	44.0	49.5	55.0	57.7
1997	-11.0	10.2	16.8	22.8	30.4	34.9	37.1	41.3	42.4	44.8	49.5	52.0

Table 9.5.6

The SAS System 14:26 Wednesday, April 29, 1998
HER-31: Herring in Baltic Fishing Area 31

MATPROP: Proportion Mature at Year Start (Total International Catch) (Total)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11
1973	0.00	0.00	0.32	0.95	0.98	1.00	1.00	1.00	1.00	1.00	1.00	
1974	0.00	0.00	0.32	0.95	0.98	1.00	1.00	1.00	1.00	1.00	1.00	
1975	0.00	0.00	0.32	0.95	0.98	1.00	1.00	1.00	1.00	1.00	1.00	
1976	0.00	0.00	0.32	0.95	0.98	1.00	1.00	1.00	1.00	1.00	1.00	
1977	0.00	0.00	0.32	0.95	0.98	1.00	1.00	1.00	1.00	1.00	1.00	
1978	0.00	0.00	0.32	0.95	0.98	1.00	1.00	1.00	1.00	1.00	1.00	
1979	0.00	0.00	0.32	0.95	0.98	1.00	1.00	1.00	1.00	1.00	1.00	
1980	0.00	0.00	0.32	0.95	0.98	1.00	1.00	1.00	1.00	1.00	1.00	
1981	0.00	0.00	0.32	0.95	0.98	1.00	1.00	1.00	1.00	1.00	1.00	
1982	0.00	0.00	0.32	0.95	0.98	1.00	1.00	1.00	1.00	1.00	1.00	
1983	0.00	0.00	0.32	0.95	0.98	1.00	1.00	1.00	1.00	1.00	1.00	
1984	0.00	0.00	0.30	0.92	0.92	1.00	1.00	1.00	1.00	1.00	1.00	
1985	0.00	0.00	0.19	0.94	0.95	1.00	1.00	1.00	1.00	1.00	1.00	
1986	0.00	0.00	0.29	0.95	0.96	1.00	1.00	1.00	1.00	1.00	1.00	
1987	0.00	0.00	0.33	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
1988	0.00	0.00	0.39	0.97	0.99	1.00	1.00	1.00	1.00	1.00	1.00	
1989	0.00	0.00	0.33	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
1990	0.00	0.00	0.32	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
1991	0.00	0.00	0.37	0.82	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
1992	0.00	0.00	0.20	0.71	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
1993	0.00	0.00	0.41	0.93	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
1994	0.00	0.00	0.42	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
1995	0.00	0.00	0.15	0.85	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
1996	0.00	0.00	0.63	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
1997	0.00	0.00	0.29	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	

Table 9.5.11.1 Herring in the Bothnian Bay SD 31; Schaefer model (observation error version)

Herring in the Bothnian Bay SD 31; Bottom trawl and Pelagic trawl combined

r	0.59	MSY	14837
K	100000	fMSY	546
BI	73000		
q	0.0005432	SSQ	1.74

Time	Predicted Biomass	Predicted CPUE	Observed CPUE	Observed Catch	SSQ
1980	73000	39.65	22.73	9659	0.31
1981	75038	40.76	33.98	7826	0.03
1982	78328	42.55	42.12	8652	0.00
1983	79750	43.32	33.36	7707	0.07
1984	81627	44.34	36.34	8916	0.04
1985	81612	44.33	41.20	9312	0.01
1986	81206	44.11	38.30	9090	0.02
1987	81173	44.09	43.49	8108	0.00
1988	82135	44.62	29.81	8768	0.16
1989	82075	44.58	35.66	4437	0.05
1990	86369	46.92	54.14	7818	0.02
1991	85538	46.47	49.43	6800	0.00
1992	86079	46.76	50.15	7305	0.00
1993	85886	46.65	67.02	9167	0.13
1994	83913	45.58	58.44	5825	0.06
1995	86099	46.77	66.26	4681	0.12
1996	88521	48.09	47.60	5242	0.00
1997	89309	48.51	112.64	4281	0.71

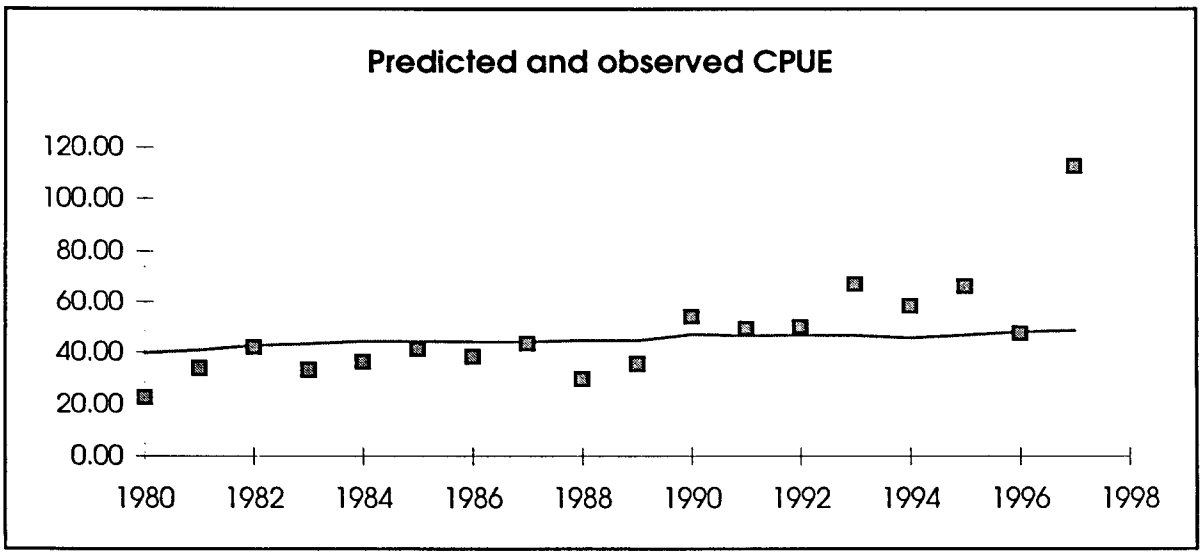


Table 9.6.1.1

Catch at age in numbers (coastal herring in SD 26) (th.)

	0	1	2	3	4	5	6	7	8	Landings (t)
1972	98000	239800	152600	119300	25200	26100	2200	600	0	30707
1973	128000	287200	224100	86400	68500	14700	10600	900	0	37509
1974	257000	563000	237000	104500	53500	27100	2700	2500	0	46900
1975	231000	450900	206400	176100	64100	41400	12600	1700	0	51728
1976	244000	388600	372700	177700	60500	11200	0	0	0	54338
1977	24200	269100	222000	121600	39000	11700	2100	0	0	33892
1978	8600	109600	449700	112800	33300	10000	3600	0	0	44970
1979	27800	100000	127800	239100	63400	15100	4000	200	0	32609
1980	38200	152000	244000	123500	70600	41100	9100	2100	0	37057
1981	30700	94700	164300	111900	45500	28000	7200	1200	200	31238
1982	16300	57000	351300	56900	21000	10600	4700	1100	300	29711
1983	73000	25900	173700	312700	34300	13800	9700	1900	2000	38817
1984	63400	96100	71000	124000	129900	11900	2900	900	100	27845
1985	8200	143600	103800	111400	106500	71100	7500	1	500	29516
1986	37300	142300	154800	118800	75200	50600	14600	2000	1100	27860
1987	5200	66800	134300	191700	70100	33300	9300	2600	900	26601
1988	7700	160200	218900	141400	109600	32000	15600	1400	1	33386
1989	5500	45100	106000	151700	102000	71700	23700	9900	7600	32674
1990	2700	24000	95500	64000	73300	36100	21200	9900	4300	19247
1991	6877.4	42445	113683	137253	78984	39183	14187	5918.8	3629.3	22982
1992	7787.3	79742	86917	146745	75617	26004	10634	2953.8	1600.4	21741
1993	20293	53727	183005	112902	71517	27694	7390.1	1715.4	981.8	20524
1994	50108	115558	84703	141671	77226	40417	13937	5726.1	918.3	20159
1995	18339	139568	73018	65938	74889	41307	19926	8928.9	3173.2	17420
1996	3290.1	87170	134162	43624	30374	41423	26006	7826.5	3907.6	13707
1997*										13622

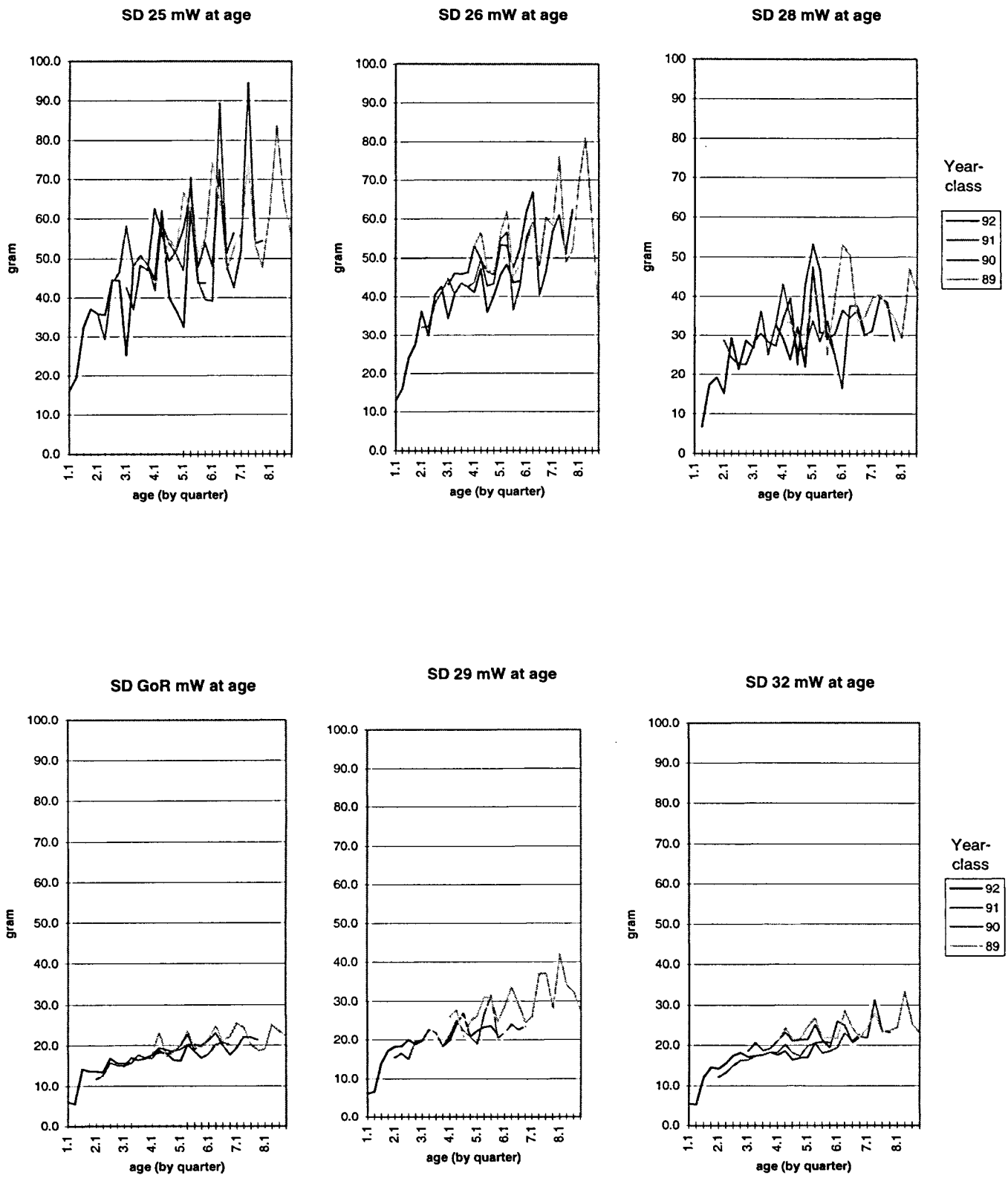
*)Provisional

Table 9.6.1.2
Coastal herring in Subdivision 26

Mean weight at age in catch (kg.)

	0	1	2	3	4	5	6	7	8
1972	0.014	0.022	0.059	0.076	0.09	0.128	0.136	0.136	0.136
1973	0.014	0.022	0.059	0.076	0.09	0.128	0.136	0.136	0.136
1974	0.014	0.022	0.059	0.076	0.09	0.128	0.136	0.136	0.136
1975	0.014	0.022	0.059	0.076	0.09	0.128	0.136	0.136	0.136
1976	0.014	0.022	0.059	0.076	0.09	0.128	0.136	0.136	0.136
1977	0.014	0.022	0.059	0.076	0.09	0.128	0.136	0.136	0.136
1978	0.014	0.024	0.061	0.086	0.102	0.12	0.136	0.136	0.136
1979	0.014	0.022	0.055	0.072	0.091	0.113	0.119	0.119	0.119
1980	0.014	0.017	0.055	0.076	0.09	0.089	0.1	0.1	0.1
1981	0.014	0.021	0.063	0.082	0.1	0.127	0.138	0.138	0.138
1982	0.012	0.018	0.055	0.083	0.108	0.126	0.138	0.138	0.138
1983	0.009	0.018	0.039	0.078	0.095	0.117	0.121	0.121	0.121
1984	0.008	0.017	0.045	0.069	0.093	0.115	0.137	0.146	0.143
1985	0.011	0.019	0.038	0.06	0.078	0.095	0.102	0.121	0.129
1986	0.012	0.02	0.034	0.055	0.078	0.098	0.104	0.104	0.143
1987	0.009	0.021	0.038	0.055	0.074	0.095	0.1	0.098	0.101
1988	0.01	0.018	0.042	0.059	0.075	0.087	0.104	0.101	0.132
1989	0.01	0.016	0.047	0.061	0.075	0.086	0.096	0.09	0.1
1990	0.014	0.026	0.043	0.06	0.07	0.079	0.076	0.072	0.089
1991	0.009	0.018	0.04	0.054	0.068	0.075	0.082	0.082	0.094
1992	0.012	0.022	0.041	0.052	0.068	0.083	0.094	0.099	0.105
1993	0.009	0.023	0.035	0.049	0.06	0.073	0.092	0.097	0.106
1994	0.008	0.016	0.036	0.045	0.054	0.066	0.079	0.097	0.111
1995	0.011	0.018	0.036	0.046	0.056	0.062	0.065	0.082	0.093
1996	0.008	0.015	0.025	0.043	0.053	0.066	0.069	0.081	0.095

Figure 9.2.6.1 Herring in Sub-div 25-29, 32. Mean weight in landings by quarter for year-classes 1989-1992.



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Log catchability residuals. RUN: BES02
Fleet : FLTNY: Internat Acou **HERRING SD 25-32 (incl GoR)**

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	0.15	-0.42	0.10	-0.31	0.30	0.25	-0.33	0.44	0.71	0.01			-0.19	-0.30	-0.38	
2	0.19	-0.13	-0.07	-0.16	0.15	-0.17	-0.40	0.06	0.44	0.30			0.05	-0.44	0.12	
3	-0.08	-0.07	0.03	-0.58	0.08	-0.31	-0.67	-0.06	0.39	0.28			0.57	-0.41	0.26	
4	-0.11	-0.01	0.33	-0.31	-0.08	-0.17	-0.08	-0.09	-0.16	0.11			0.43	-0.03	-0.01	
5	-0.16	-0.05	0.14	-0.73	-0.15	-0.46	-0.10	0.13	0.21	0.58			-0.01	0.16	-0.17	
6	-0.14	0.30	0.27	-0.38	-0.26	-0.41	0.00	0.10	0.08	0.39			-0.12	0.27	-0.22	
7	-0.42	1.23	0.05	-0.20	-0.12	-0.51	-0.10	0.06	-0.14	0.30			-0.07	0.35	-0.26	
8	-0.02	-0.07	-0.37	-0.55	-0.19	-0.62	-0.16	-0.26	-0.05	0.27			-0.53	0.08	-0.49	

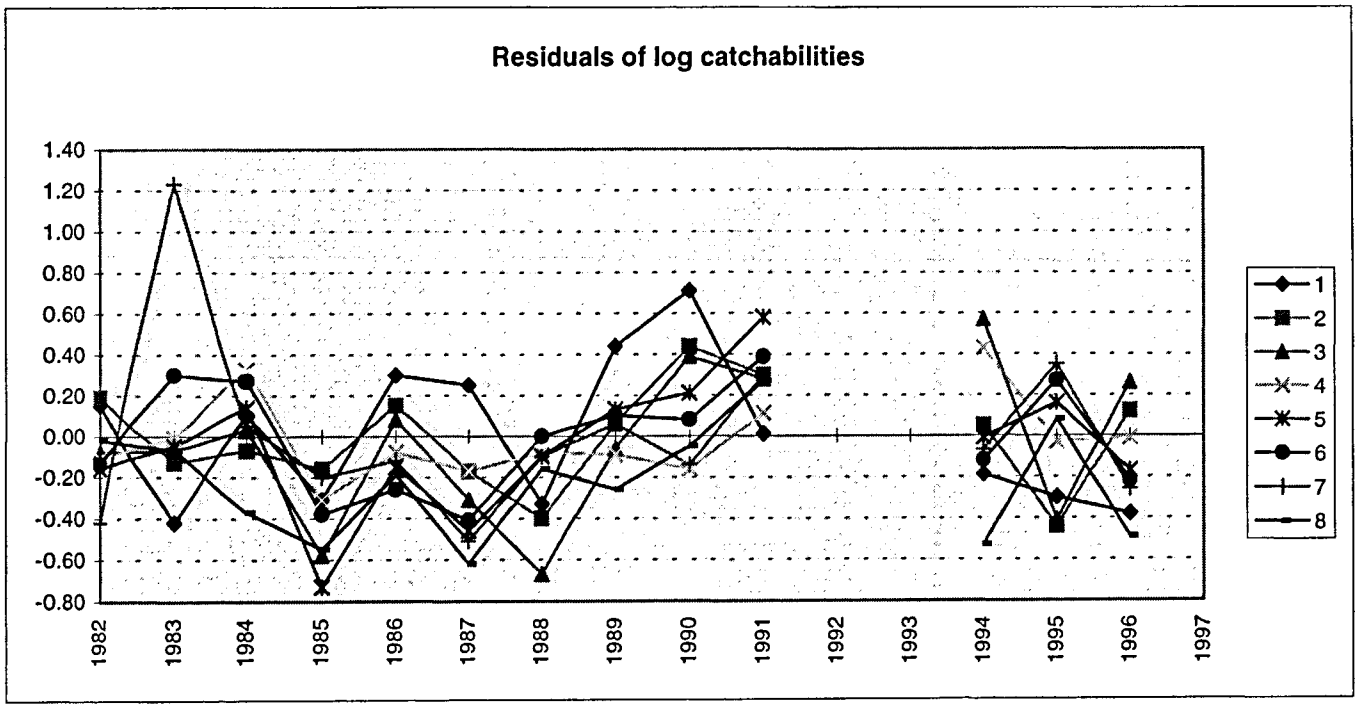
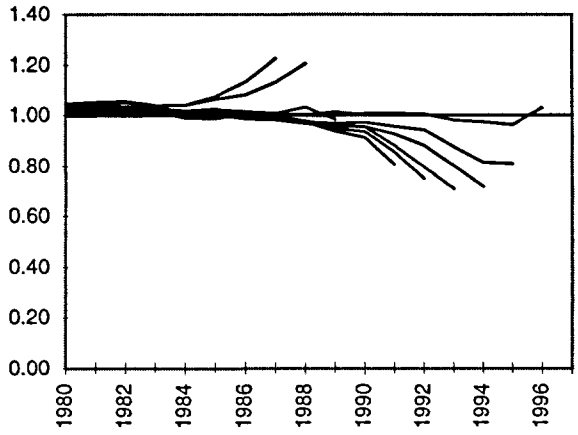


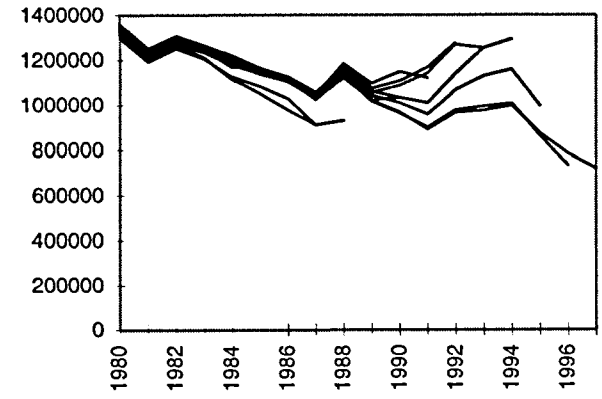
Figure 9.2.9.2.2 Retrospective analysis HERRING in SD 25-32

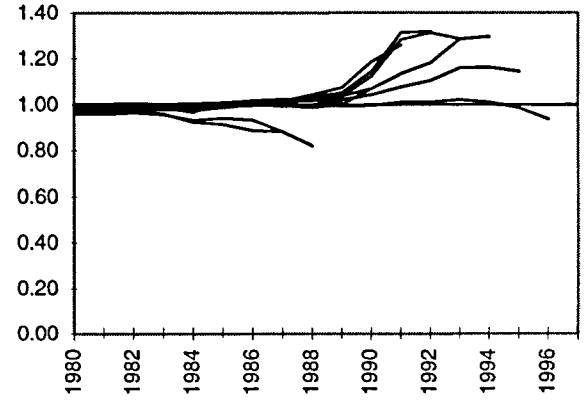
Fishing mortalities F(3-6)

Relative to 1997 values

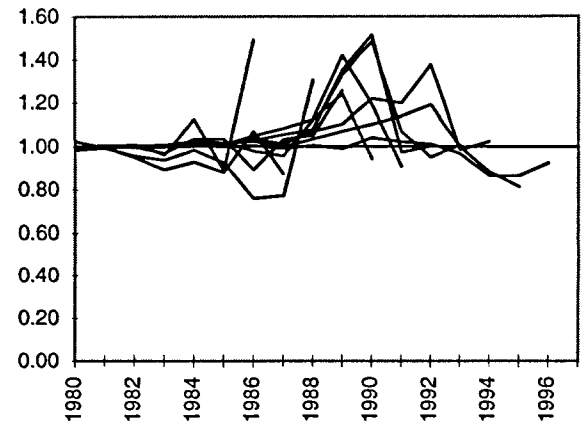


Spawning Stock Biomass





Recruitment (age 1)



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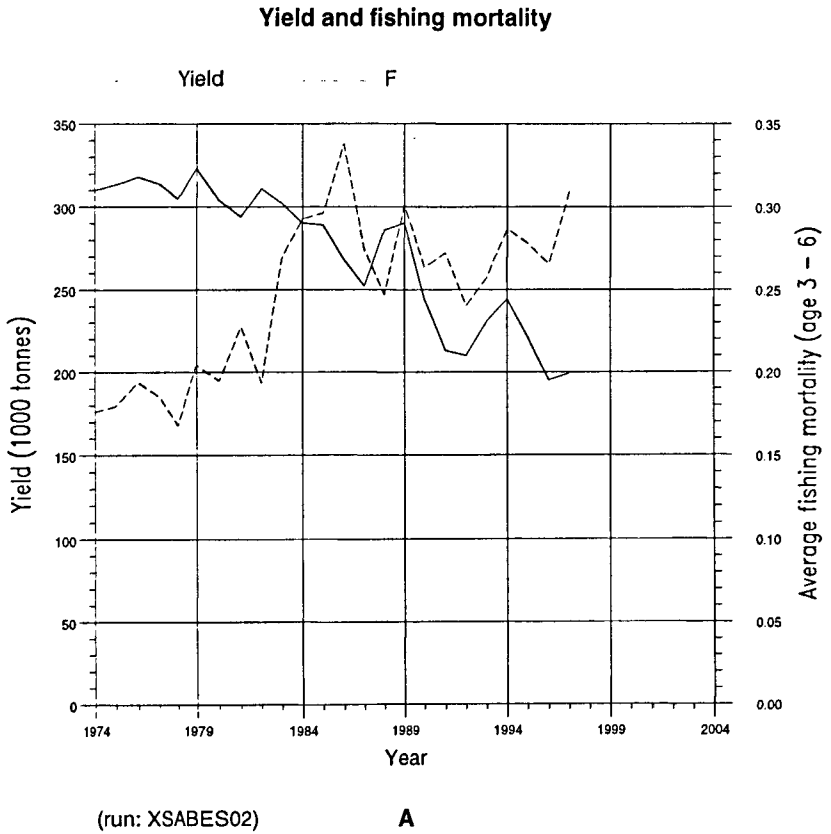
Fish Stock Summary
Herring in Baltic Fishing Areas 25 to 29 and 32 plus Gulf of Riga
18-4-1998



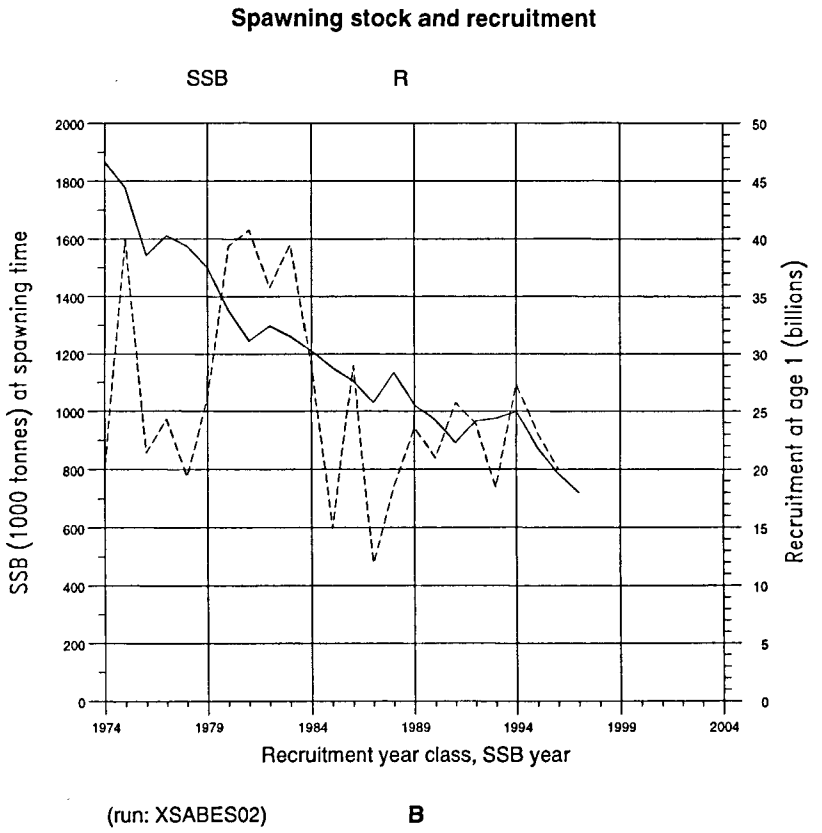
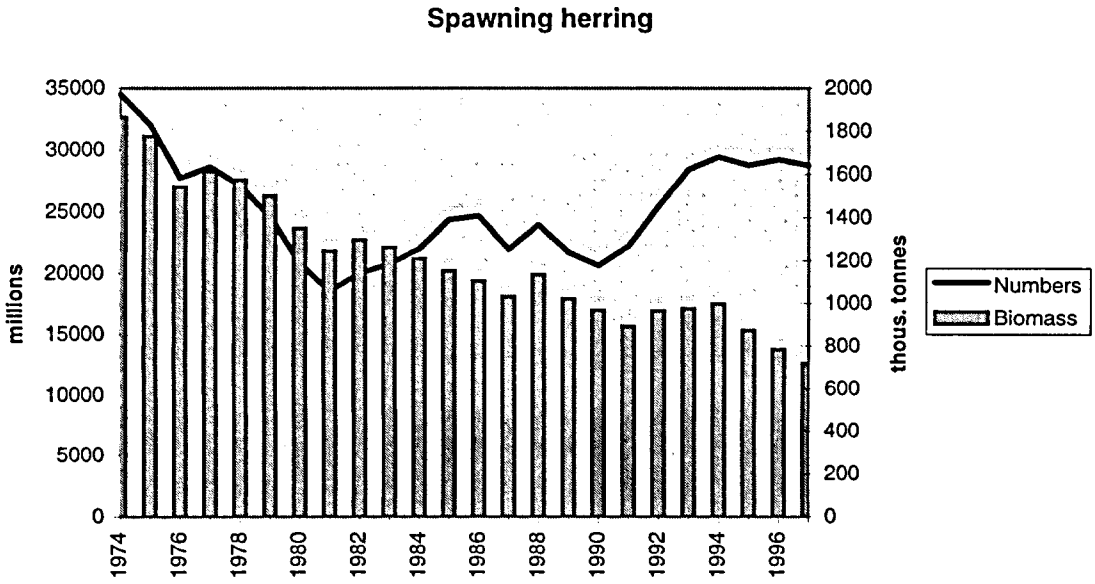


Figure 9.2.11.1

Figure 9.2.11.2 Herring in Sub-division 25-29, 32
Spawnings stock in millions of fish and in thous. tonnes.



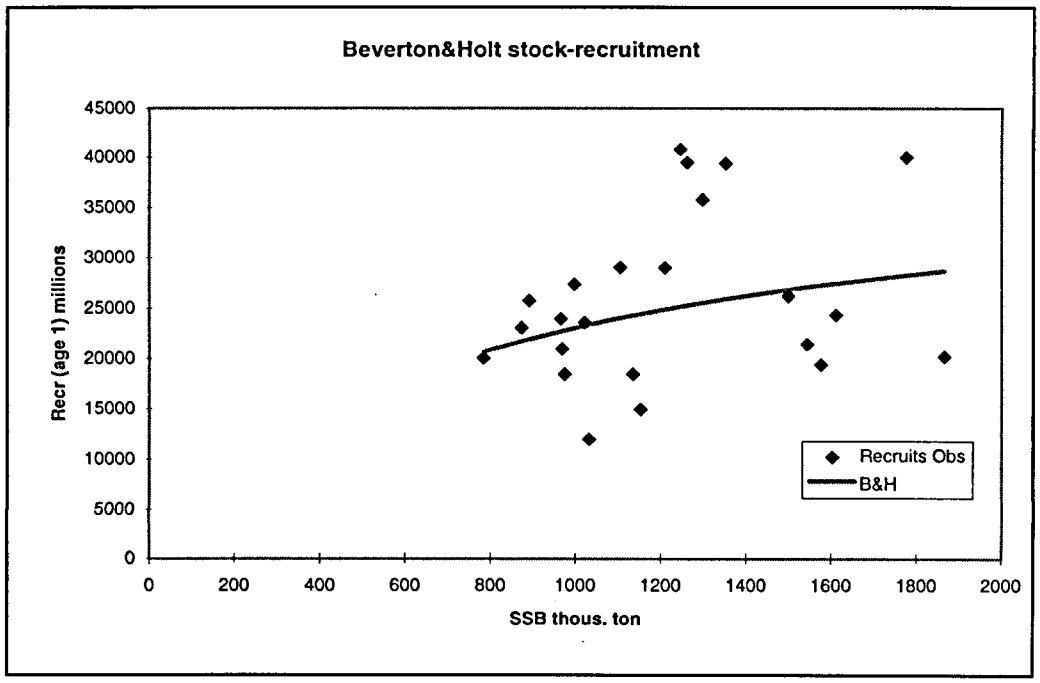


Figure 9.2.12.1

HERRING in Sub-divisions 25-29, 32

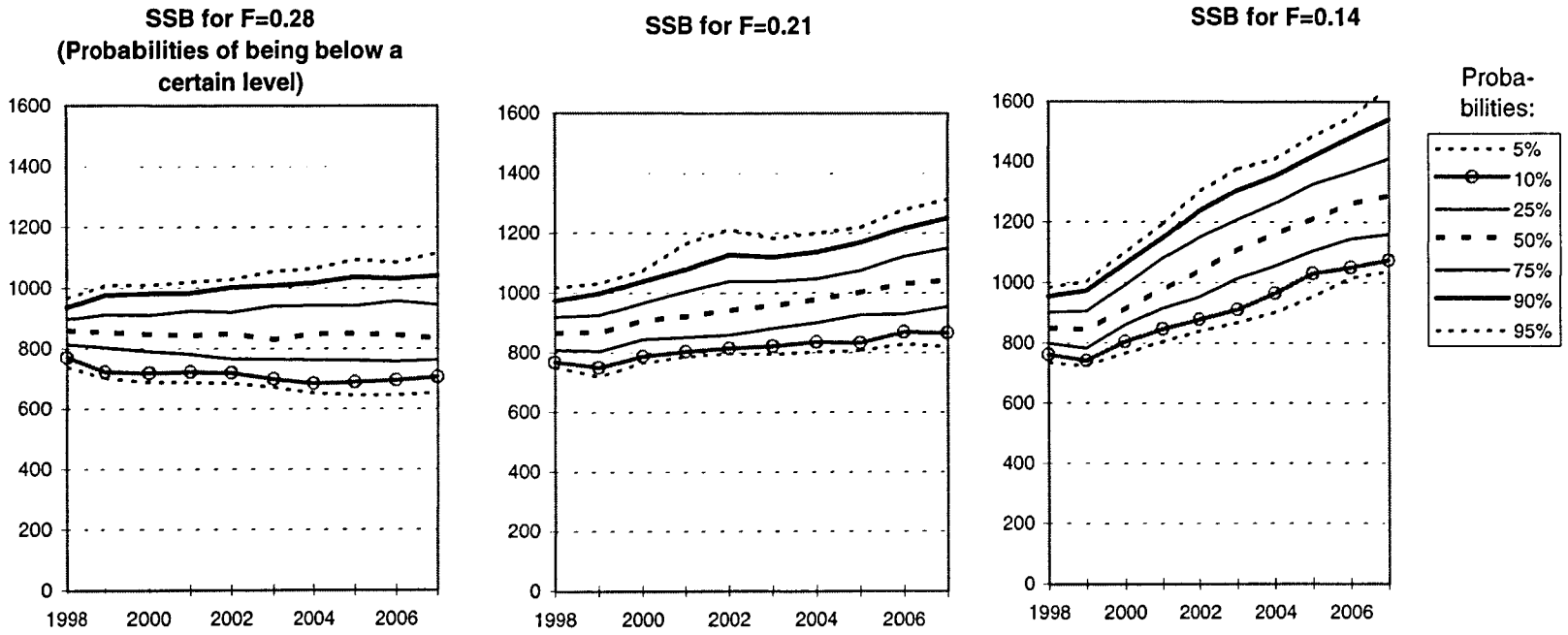


Figure 9.2.13.1

Figure 9.3.1 Herring in the Gulf of Riga. Log residuals of catchability (age 2-4)

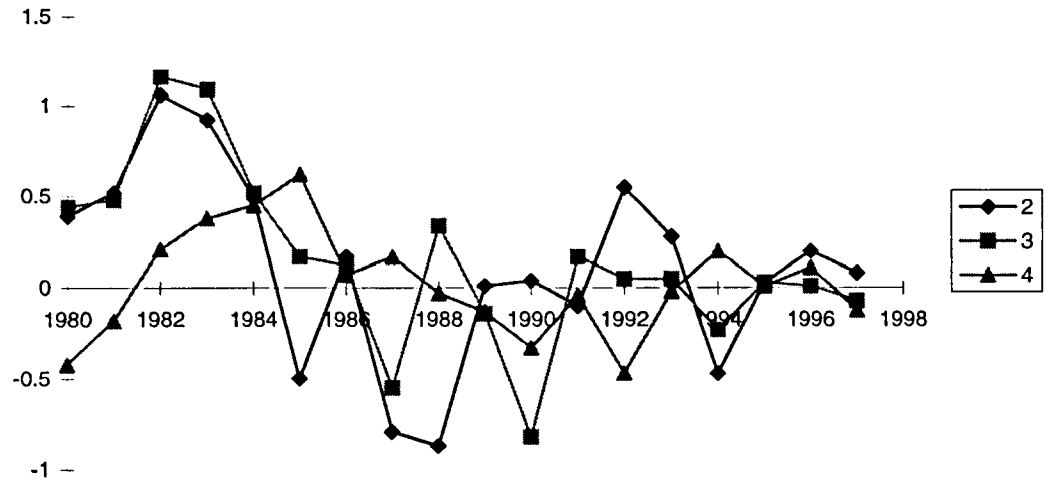


Figure 9.3.2 Herring in the Gulf of Riga. Log residuals of catchability (age 5-7)

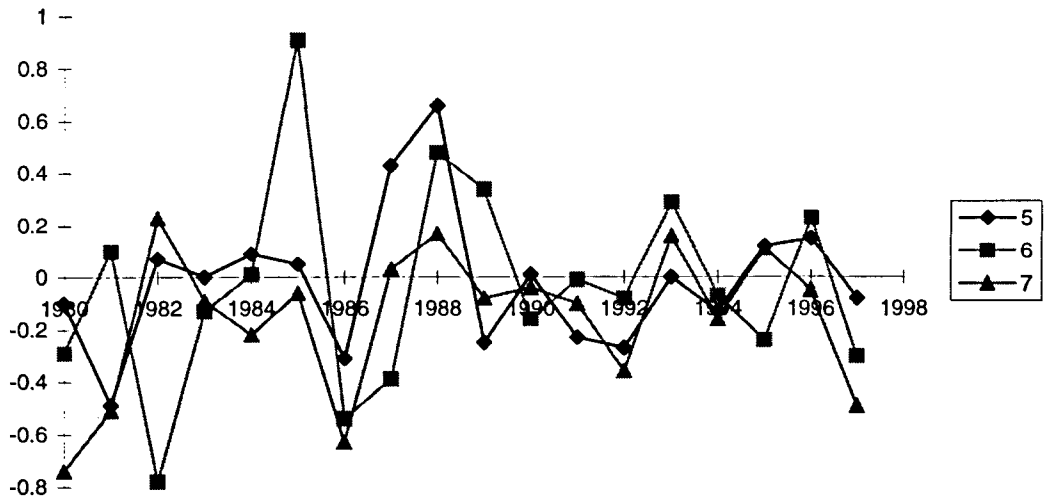
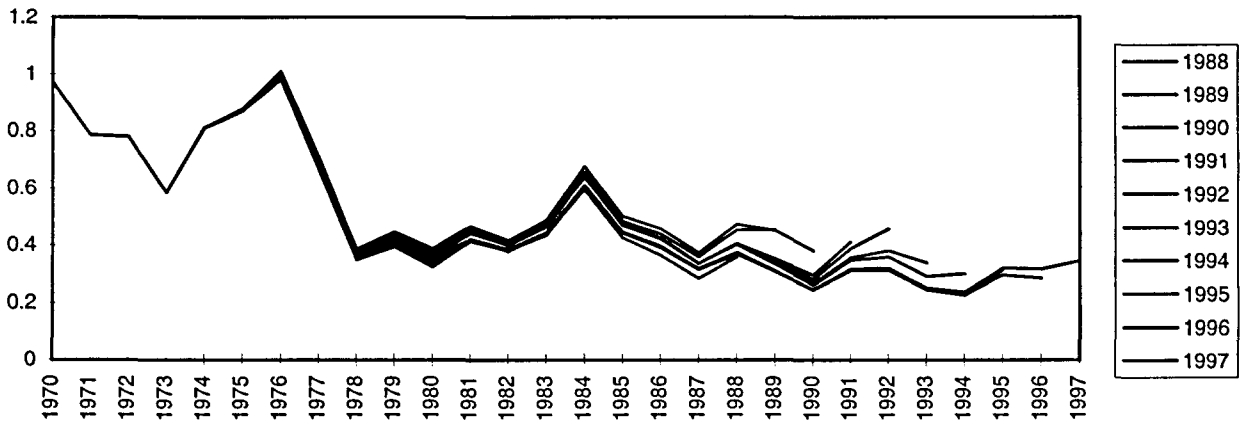
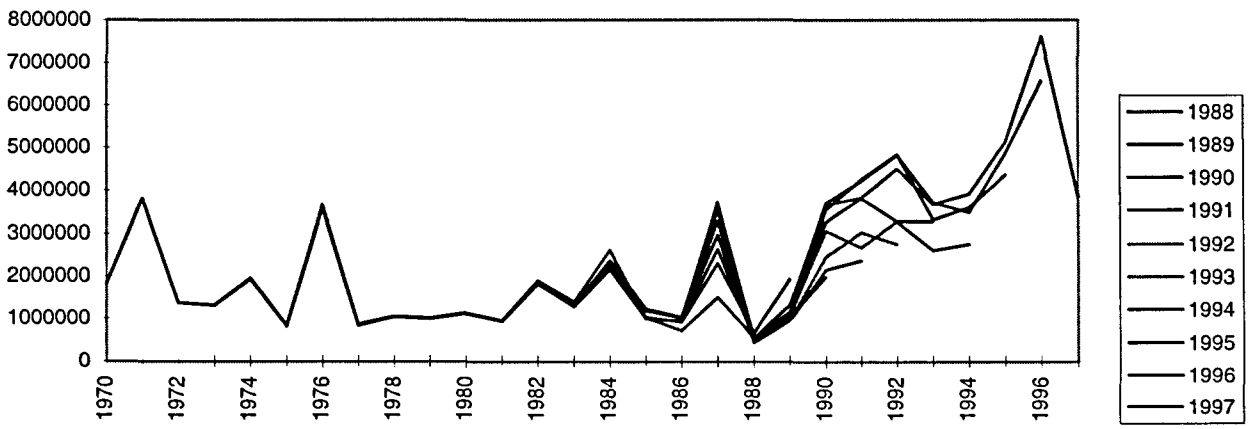


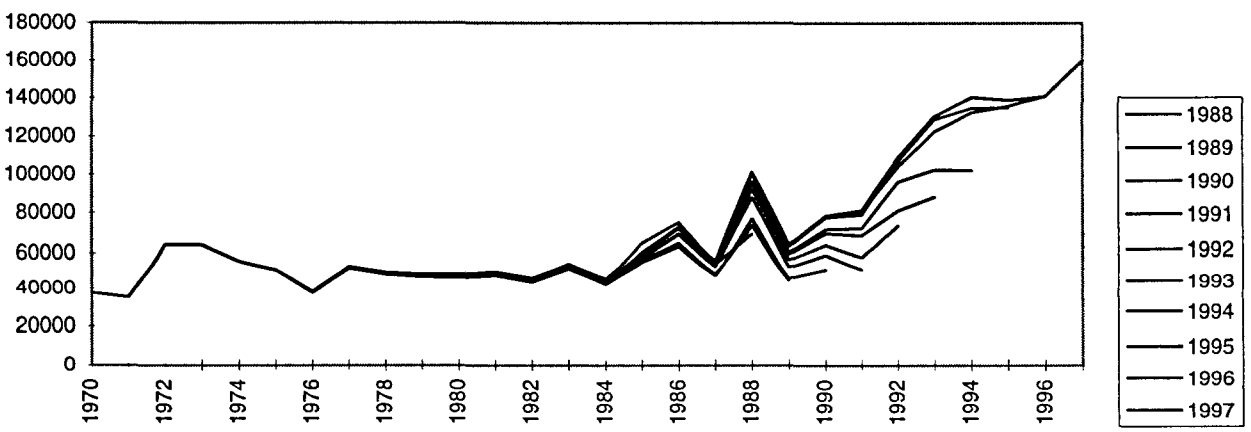
Figure 9.3.5 Gulf of Riga herring. Retrospective analysis
FBAR (3-7)



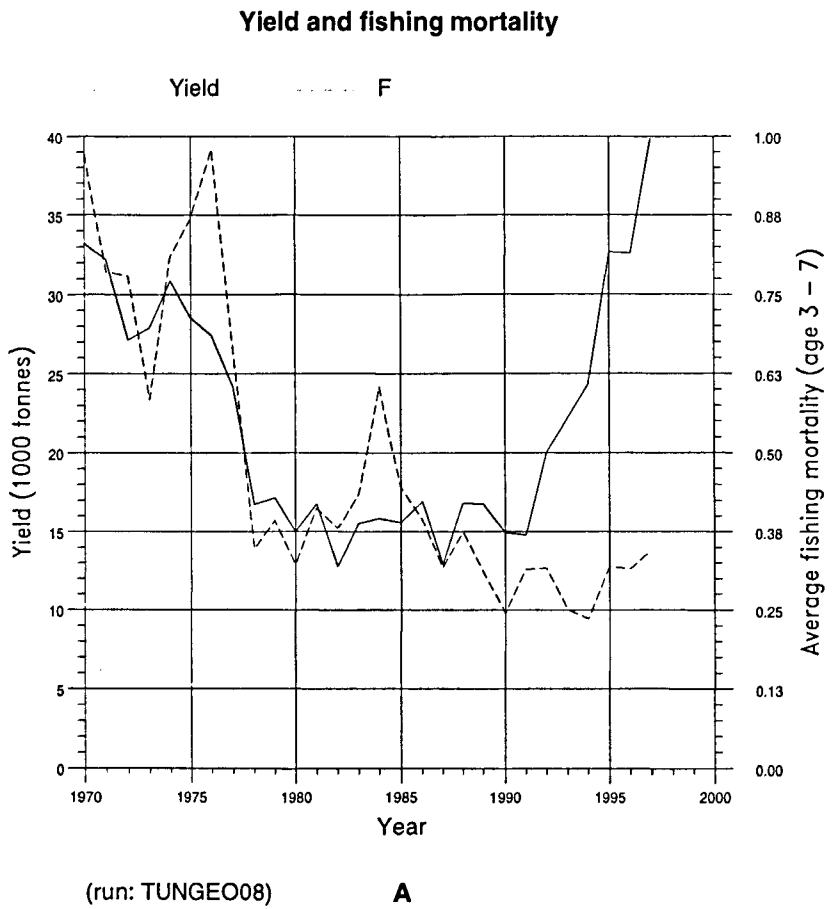
Recruitment



Spawning stock biomass



Fish Stock Summary
Herring in the Gulf of Riga
18-4-98



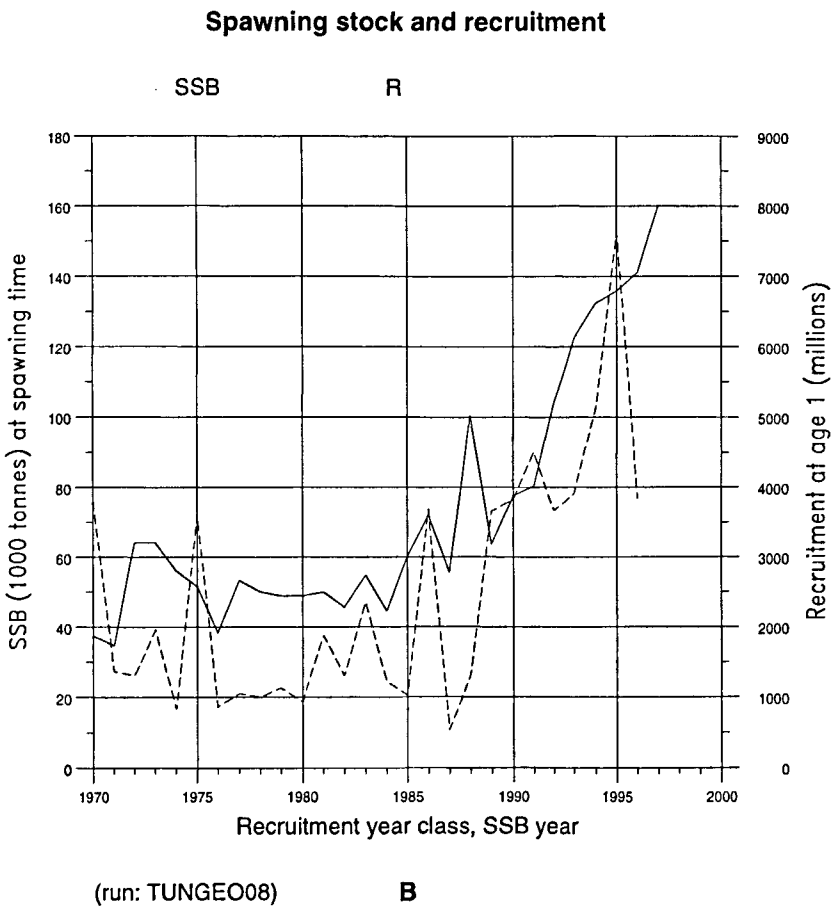


Figure 9.3.3

Herring in the Gulf of Riga
18-4-1998

Stock - Recruitment

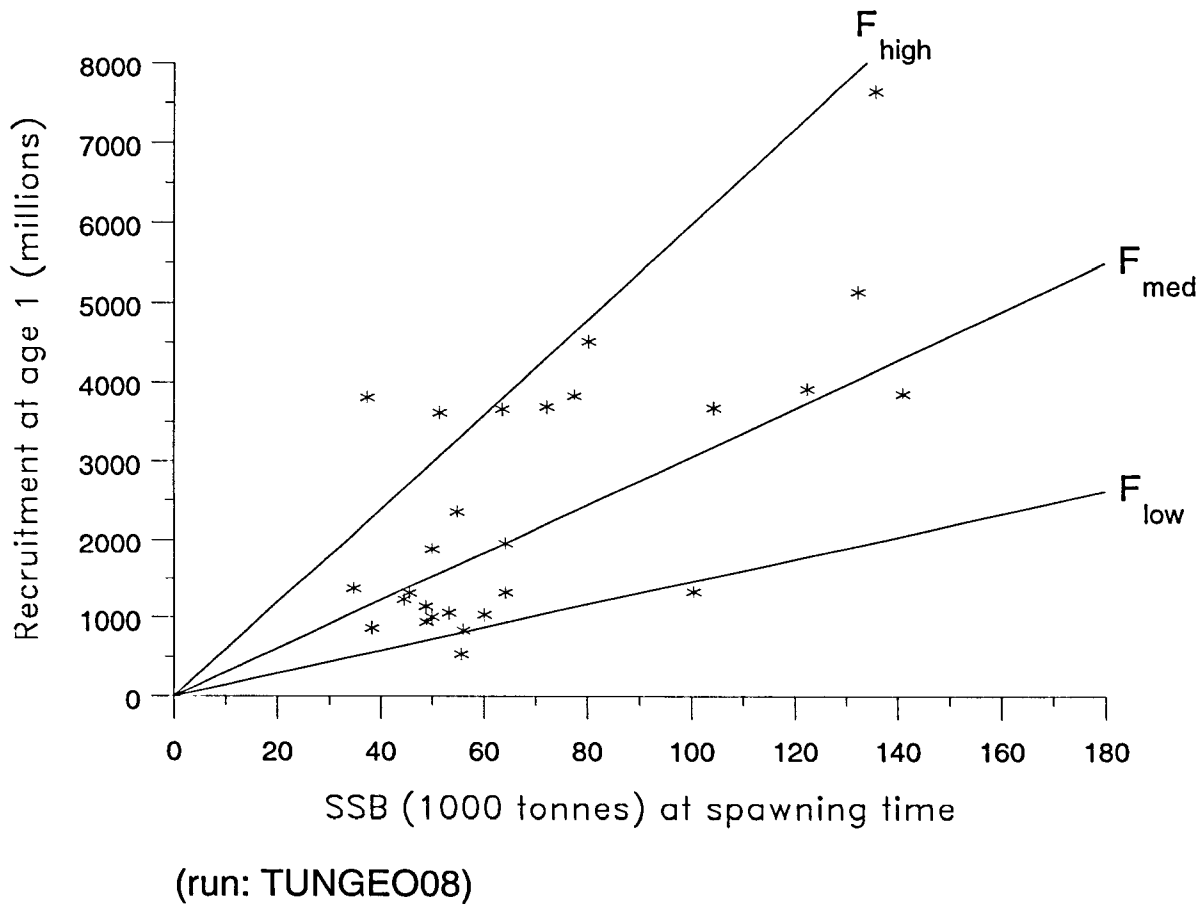
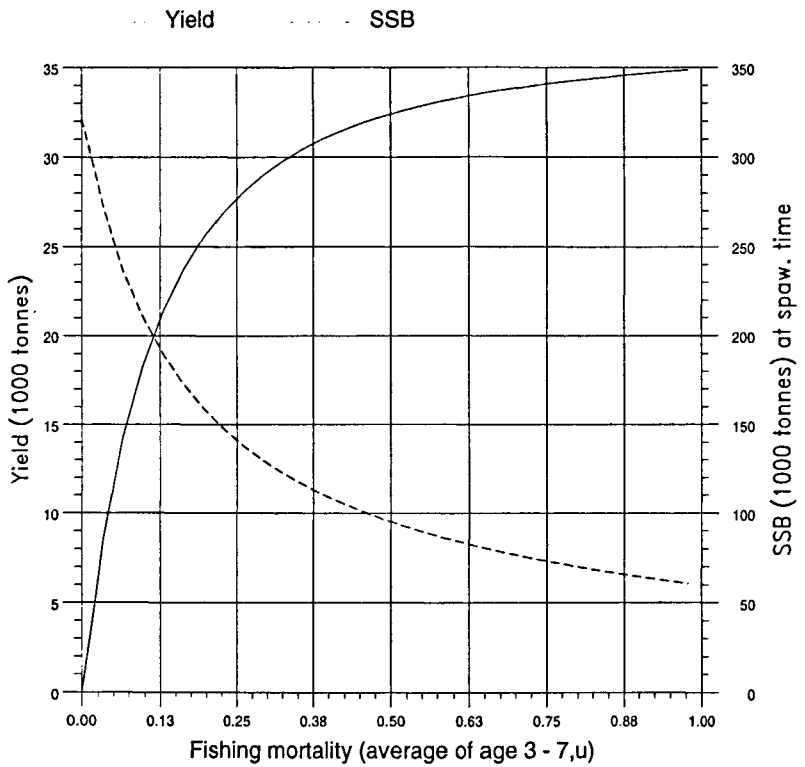


Figure 9.3.4

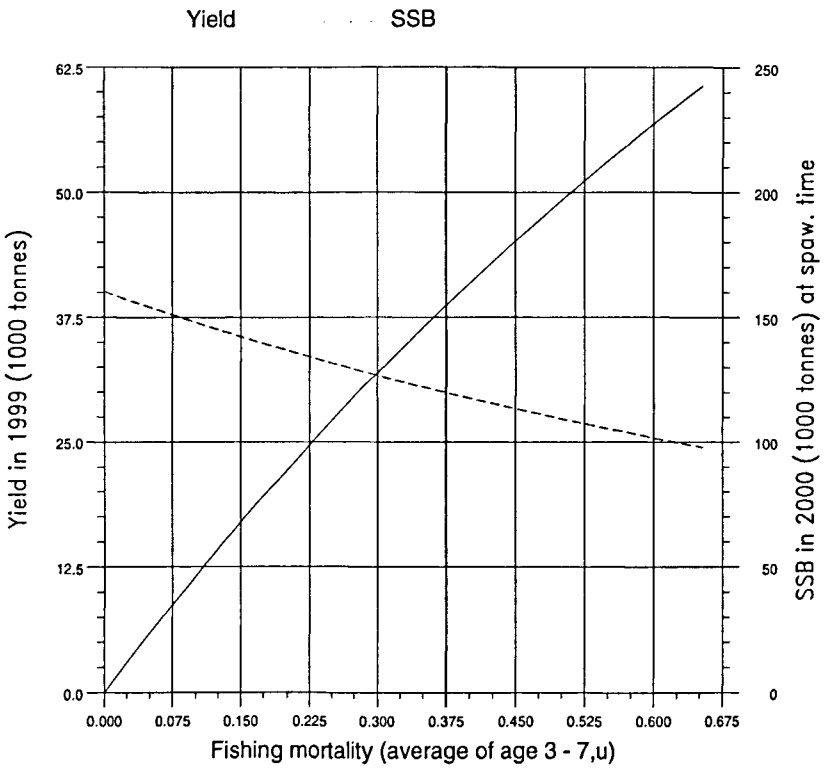
Fish Stock Summary
Herring in the Gulf of Riga
20-4-1998

Long term yield and spawning stock biomass



(run: YLDGEO01) **C**

Short term yield and spawning stock biomass



(run: MANGEO04) **D**

Figure 9.3.6

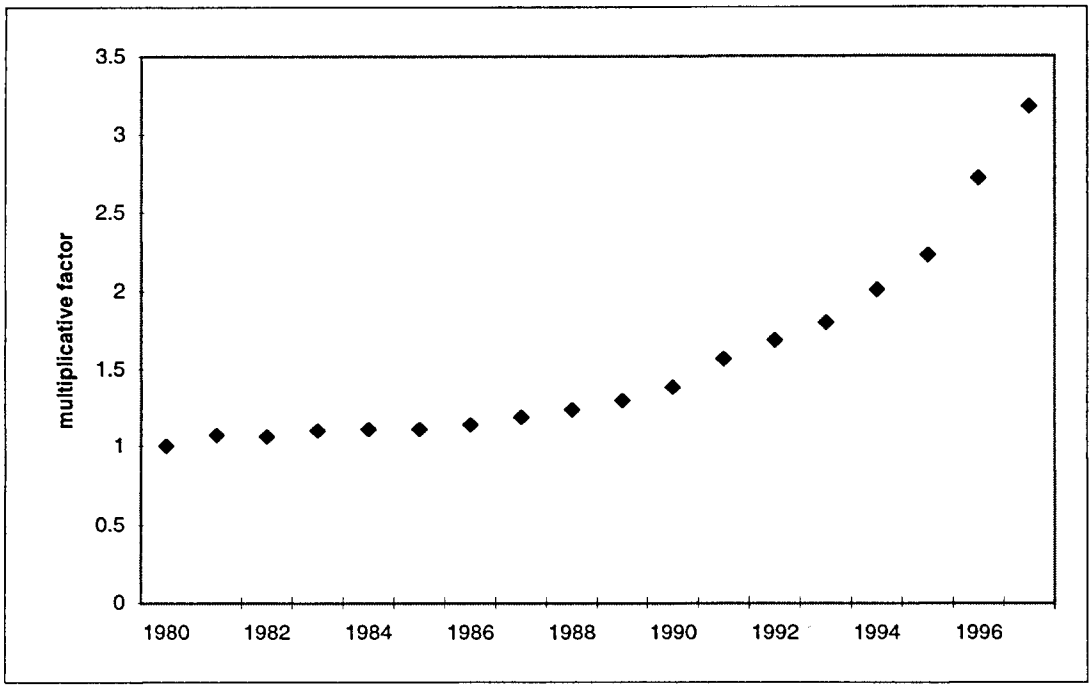


Figure 9.4.1 Estimated increase in trawl size (maximum opening).

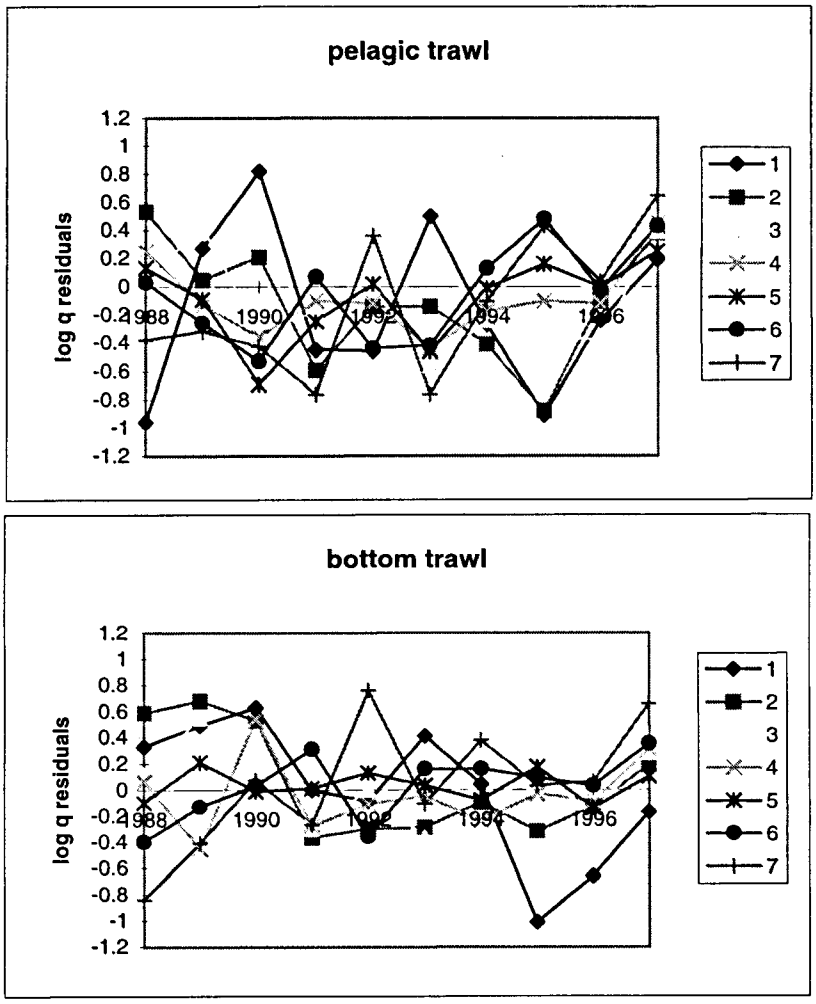


Figure 9.4.2 Log catchability residuals.

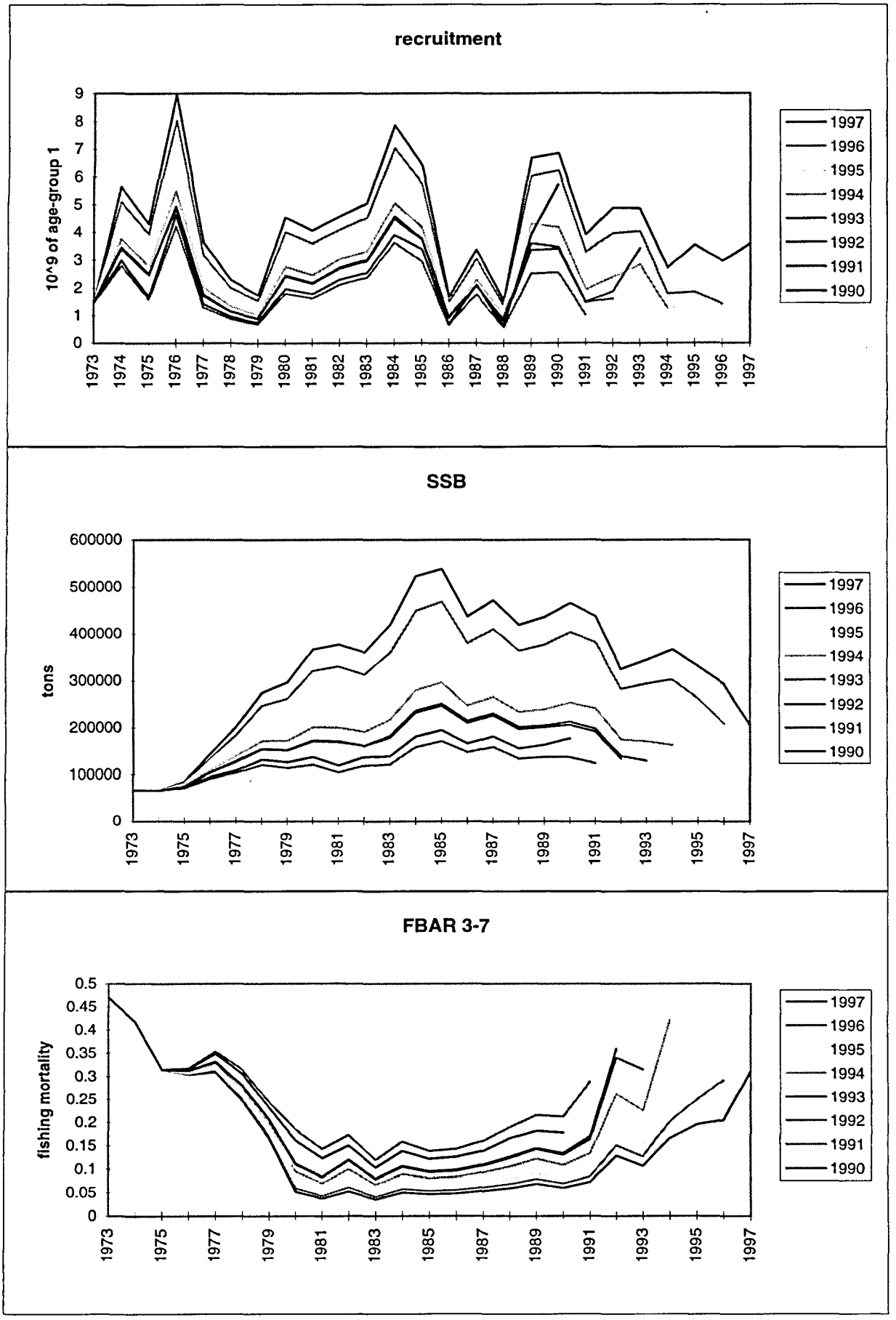
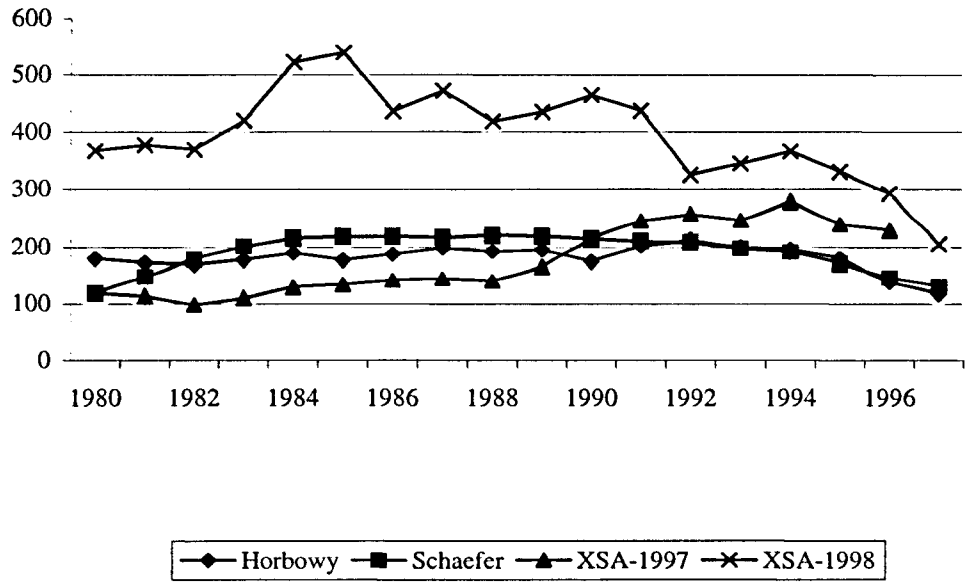


Figure 9.4.3 Retrospective analysis.

Figure 9.4.11.1 Herring in SD 30, SSB from production models, XSA(97) and XSA(98) (CPUE corrected by size)



10 SPRAT

10.1 Assessment Units

As in previous years sprat in Baltic Sub-divisions 22–32 was assessed as a single unit.

10.2 Sprat in Sub-Divisions 22–32

10.2.1 Catch trends

In 1997 sprat catches reached a new record high level of 529,000 t, which is by 20% higher than the already 1996 record catch figure of 441,000 t. Since 1991 sprat catches have increased over 5 times. All countries increased their catches in 1997 except Lithuania and Sweden. The highest increase was observed in Sub-divisions 25, 27 and 29. A decrease of catches was only observed in Sub-division 26 (-8.6 %). Landings by country and Sub-division are presented in Tables 10.2.1.1–10.2.1.2. Table 10.2.1.3 contains landings, catch numbers and weight at age by Sub-division and quarter. The sampling activity is presented in Table 10.2.1.4. Swedish catches were sampled with similar intensity as in the 1996 but due to technical problems the samples for second half of year got lost. This has a serious implication on the assessment data as Swedish catches constitute about 1/3 of the total catches. The samples used to estimate species composition were, however, not effected.

10.2.2 Unallocated landings

No information on unallocated catches was presented to the group. It is felt, however, that the problem of misreported catches practically does not exist in case of sprat.

10.2.3 Discards

In most of the countries discards is not supposed to exist because small and of lower quality fish can be used for production of the fish meal and feeding in animal farms. In Polish sprat fishery, however, a part of the small sprat in the catches is discarded, mainly at the beginning of winter and spring on fishing grounds of Gdansk Bay and southern part of the Bornholm Basin. The amount of this discard is unknown.

10.2.4 Effort and CPUE data

No effort and CPUE data were presented to the group.

10.2.5 Age composition

All countries provided their catch at age data by quarter and Sub-division. As it has been already mentioned in section 10.2.1 Sweden presented little information on age composition due to samples being lost. So Swedish catches were splitted to numbers at age according to the data of other countries. The estimated catch at age in numbers is presented in Table 10.2.9.1.

10.2.6 Mean weight at age

Most of the countries presented rather extensive data on weight at age in the catch by quarter and Sub-division. Mean weights at age in the catch were obtained as means weighted by catch in numbers. Mean weights in the stock were assumed the same as mean weights in the catch. The weights at age have decreased over 30% since 1990. It is to be investigated whether this is a result of the decreasing growth rate or the change in spatial catch distribution or the mixture of both effects. If weights at age in 1997 had been the same as in 1996 then the catch in 1997 would have been at a level of 580,000 t.

10.2.7 Maturity ogives

No new information on maturity ogives was presented to the Working Group and maturity has been kept constant through the whole period as in previous years.

10.2.8 Natural mortality

As in previous years the natural mortalities used varied between years and ages as an effect of cod predation. The estimates of predation mortality were derived from MSVPA (Anon. 1997, ICES CM 1997/Assess:12) The original mortality estimates were smoothed multiplying rows and columns means and dividing them by overall mean. To obtain total natural mortality residual mortality of 0.2 was added to predation mortality.

10.2.9 Catch at age analysis

The input data to catch at age analysis are presented in Tables 10.2.9.1–10.2.9.7. Three tuning data sets were available from: International Acoustic Survey in 1983–1996, Latvian/Russian Acoustic Survey in 1983–1997, and acoustic estimates of age-0 sprat in Sub-divisions 26 and 28. As tuning analysis comprised ages 1–7 the young fish survey data referring to age-0 in October and December were assumed to represent CPUE of the relevant year class at the beginning of age 1. The tuning data are given in Tables 10.2.9.8–10.2.9.10.

The VPA was tuned using XSA with shrinkage option. The settings of the XSA were the same as in last year. The ages 1 to 3 were treated as recruits (most of the slopes for these ages for Latvian/Russian fleet and international fleet were significantly different from 1) and catchability plateau was set at age 4. During last six years catches increased over five times so lower weights to the shrinkage mean F were given by selecting SE of the mean as 0.75 (Table 10.2.9.11). The log q residuals are presented in Figure 10.2.9.1, and retrospective analyses in Figure 10.2.9.2. The log-catchability SE for Latvian/Russian acoustic are moderate, being in the interval of 0.25–0.4; the log-catchability SE for international acoustic are much higher (ranging from 0.7 to 1.2), especially for ages 6 and 7. The estimate of SSB for 1997 is 1,134,000 t. The assessment with the F shrinkage SE of 0.5 gave SSB estimate 1,530,000 tonnes (about 30% higher than the 0.75 shrinkage option) and increasing SSB trend in most recent five years which was considered unrealistic. The fishing mortalities, stock in numbers and summary table are presented in Tables 10.2.9.12–10.2.9.14. The higher rate of increase of fishing mortality at ages 1 and 2 compared to older ages is a matter of concern and it is probably related to increasing catches for fish meal production.

The estimate of fishing mortality for age 4 in 1997 (the 1993 year-class) being equal to 0.8 is considered to be highly biased. This is because the 1993 year-class was a poor one and its representation in the catches was probably overestimated. More realistic estimate of F at this age is 0.42 (mean of F estimates at age 3 and 5), because the mean of the 1992-1996 F's at age 3 and 5 is almost the same as the mean of the 1992-1996 F's at age 4. Replacing the XSA estimate of F at age 4 by 0.42 gives FBAR(3-5) equal 0.42 and this is considered to be more realistic estimate of FBAR than the 0.54 figure produced by XSA. This new estimate of FBAR in 1997 is related to the 1996 FBAR estimate by the same proportion as the 1997 and 1996 yield to SSB ratio. Fish stock summary plots are presented in Figure 10.2.9.3.

10.2.10 Recruitment estimates

Polish YFS data and Latvian\Russian acoustic estimates of age-0 sprat in Sub-divisions 26 + 28 were analysed using RCT3 program (Tables 10.2.10.1–10.2.10.2). As Polish YFS data had very small influence on the RCT3 output they were excluded from the final analysis. The relation between VPA estimates and acoustic estimates of year class strength is presented in Fig. 10.2.10.1. The 1997 year class was estimated at a level of 90 billion fish at age 1 which is one of the highest in last ten years. The Latvian\Russian acoustic estimates of the 0 age group numbers in 1992–1997 underestimate the year class strength when compared with previous estimates because of smaller coverage of shallow waters. At present foreign research vessel cannot survey waters within 12 NM zone, because of new territorial water legislation.

10.2.11 Historical stock trends

The SSB is still on the historically high level. Its present estimate is about 9 times higher than the lowest in the series SSB of 1981. In terms of numbers the increase of stock size is even more pronounced because the observed downward trend in weights affects the present stock biomass.

10.2.12 Short-term forecast and management options

The RCT3 program estimate of the 1997 year class was used in the predictions. The 1998 and 1999 year classes were taken as the geometric averages of the last 10 years' estimates. The natural mortality was assumed as the mean of 1995–1997 values. The weights at age used were the 1996–1997 averages. The average was constrained to two most recent years only to take into account decreasing trend in weight at age. The fishing pattern was smoothed as the average F at

age for 1995–1997 and next rescaled to the 1997 mean F. In calculation of the exploitation pattern the F at age 4 in 1997 was taken as mean of F at ages 3 and 5, for reasons described at the end of section 10.2.9. Input data for catch prediction are presented in Table 10.2.12.1. The status quo catch for 1998 and 1999 were predicted to be 345,000 and 304,000 t, respectively (Table 10.2.12.2a). The SSB is predicted to decrease markedly to the level of 640,000 tonnes in 2000. In addition, predictions were made assuming:

- F factor in 1998 of 1.2,
- catch level in 1998 similar to the catch in 1997 (Tables 10.2.12.2 b-c).

These predictions show that continuing catch level of 530,000 tonnes in 1998 and 1999 will lead SSB to the level of 280,000 tonnes in 2000 i.e. the level of B_{pa} estimated as 275,000 tonnes.

In the figure under Table 10.2.12.3 the sensitivity of the 1999 and 2000 catch estimate to the assumed strength of 1998 and 1999 year class is presented. These year classes have rather small influence on the 1999 catch value, constituting about 7% of it. They contribute, however, in 35% to the 2000 catch estimate, showing that this figure is very dependent on the assumed year class strength.

10.2.13 Medium-term projections

In the medium-term consideration the uncertainty in survivors estimates and uncertainty about stock-recruitment model were taken into account. Weight at age and natural mortalities were kept constant and used the same as in short term prediction. The Beverton- Holt stock recruitment model was used in projections (Figure 10.2.13.1). Its parameters were estimated assuming log-normal errors. The model explains very small amount of the recruitment variance. Its estimates of recruitment within the range of observed data are very close to the geometrical mean of the observations. Two options of exploitation pattern have been used in projections:

- the 1995-1997 mean F rescaled to the 1997 mean fishing mortality (the same as in short term predictions),
- the exploitation pattern from 1997 with F at age 4 corrected as in the short term predictions.

The second option was used to evaluate the impact of the increasing fishing mortality at age 1 and 2 on the projected SSB.

The results of the projections for fishing mortality ranging from 0.6 to 1.4 of status quo values are presented in Figure 10.2.13.2 and Tables 10.2.13.1a, b. All options show decreasing trend in spawning stock biomass. The median (50 percentile) of spawning stock biomass under status quo fishing mortality tend to an equilibrium of about 430,000 t and, 405,000 t for two applied fishing pattern options, respectively. For the projections with *status quo* F there is a higher than 10% probability that stock will decrease below B_{pa} in medium term. The simulations show that continuing catches with the 1997 exploitation pattern leads to the 10-18% higher reduction of SSB than the fishing with 1995-1997 exploitation pattern (Figure 10.2.13.3).

10.2.14 Biological reference points

Most of these points were estimated during last the 1997 working group meeting. The estimate of F-0.1 was 0.42 and F_{max} value was not found under the assumed range of F factors. The estimates of F_{med} and F_{high} are equal to 0.42 and 1.3, respectively. The approximate estimate of F_{loss} is 1.7. It was obtained averaging SSB and recruitment of four smallest SSB estimates and drawing replacement line through that point. It should be noted that these points are dependent on growth and natural mortality used. Natural mortality of sprat may increase if cod stock recovers.

B_{lim} and B_{pa} are estimated at 200,000 t and 275,000 t, respectively (Report of the Study Group on Management Strategies for Baltic Stocks, 1998). Basing on medium term projections new estimates of F_{pa} were determined. The F_{pa}=0.34 when mean exploitation pattern is assumed while F_{pa}=0.31 in case of catching with the 1997 exploitation pattern.

Table 10.2.1.1 Sprat catches in Sub-divisions 22-32 (thousand tonnes).

Year	Denmark	Finland	German Dem. Rep.	German 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	142.2
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	288.7
1995	64.1	13.1	5.2	0.2	24.4	2.9	44.2	14.8	143.7	313.0
1996	109.1	21.1	17.4	0.2	34.2	10.2	72.4	18.2	158.2	441.1
1997	137.4	38.9	24.4	0.4	49.3	4.8	99.9	22.4	151.9	529.4

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

Table 10.2.1.2. Sprat catches in the Baltic Sea by country and Sub-division ('000 t).

Year 1996

Country	Total catch	22	23	24	25	26	27	28	29	30	31	32
Denmark	109.1	7.7	-	0.5	100.9	-	-	-	-	-	-	-
Estonia	21.2	-	-	-	-	-	-	1.1	5.4	-	-	14.7
Finland	17.4	-	-	-	-	-	-	0.0	8.3	1.7	-	7.4
Germany	0.2	0.1	-	0.0	-	-	-	-	-	-	-	-
Latvia	34.2	-	-	-	-	4.0	-	30.2	-	-	-	-
Lithuania	10.2	-	-	-	-	10.2	-	-	-	-	-	-
Poland	72.4	-	-	0.3	30.0	42.1	-	-	-	-	-	-
Russia	18.2	-	-	-	-	18.2	-	-	-	-	-	-
Sweden	158.2	-	-	0.9	22.6	62.4	33.7	37.5	1.1	-	-	-
Total	**441.1**	**7.9**	**0.0**	**1.7**	**153.5**	**136.9**	**33.7**	**68.8**	**14.9**	**1.7**	**0.0**	**22.1**

Year 1997

Country	Total catch	22	23	24	25	26	27	28	29	30	31	32
Denmark	137.4	8.1	-	0.8	128.6	-	-	-	-	-	-	-
Estonia	38.9	-	-	-	-	-	-	3.3	17.7	-	-	17.9
Finland	24.4	-	-	0.5	3.8	2.0	0.1	0.8	10.3	2.3	0.0	4.5
Germany	0.4	0.4	-	0.0	-	-	-	-	-	-	-	-
Latvia	49.3	-	-	-	-	3.6	-	45.7	-	-	-	-
Lithuania	4.8	-	-	-	-	4.8	-	-	-	-	-	-
Poland	99.9	-	-	1.1	33.2	65.5	-	-	-	-	-	-
Russia	22.4	-	-	-	-	22.4	-	-	-	-	-	-
Sweden	151.9	-	-	2.6	38.0	26.9	45.1	30.5	8.7	-	-	-
Total	**529.4**	**8.5**	**0.0**	**5.0**	**203.7**	**125.2**	**45.2**	**80.3**	**36.8**	**2.3**	**0.0**	**22.4**

Table 10.2.1.3 SPRAT in SD 22-32. Catch in numbers and weight at age by quarter and Sub-division

Subdivision 22

	Numbers (mio)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.0	0.0	15.7	399.1	414.8			3.3	4.8
1	47.1	2.5	78.3	88.2	216.2	4.1	6.6	15.3	12.0
2	8.4	0.9	70.6	26.7	106.7	9.8	15.1	18.9	19.2
3	1.9	1.1	55.0	18.8	76.7	16.7	18.8	20.8	20.2
4	1.8	0.2	12.6	2.2	16.9	18.6	21.5	22.7	18.8
5	0.3	0.1	1.6	0.2	2.1	21.8	21.9	22.3	25.6
6	0.0	0.0	0.0	0.0	0.1	23.7			25.8
7	0.0	0.0	0.0	0.0	0.0	23.7			
8	0.0	0.0	0.0	0.0	0.0	25.4			
9	0.0	0.0	0.0	0.0	0.0				
10	0.0	0.0	0.0	0.0	0.0				
Sum	59.5	4.8	233.9	535.3	833.5				
Catch	350	129	4057	3922	8458				
SOP	347	57	4051	3916	8372				

Subdivision 24

	Numbers (mio)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.0	0.0	0.0	42.8	42.8				4.8
1	0.3	17.1	0.0	9.4	26.8	3.2	8.0	8.9	12.0
2	0.9	54.6	0.6	2.4	58.6	11.6	11.1	12.1	17.6
3	1.3	76.4	0.8	2.1	80.6	13.9	12.7	12.4	18.0
4	0.8	19.5	0.3	0.4	20.9	16.0	14.8	13.9	15.2
5	1.1	13.2	0.3	0.1	14.7	16.3	15.2	14.6	15.5
6	0.7	3.0	0.1	0.0	3.9	17.6	16.6	15.1	16.5
7	0.5	0.9	0.0	0.0	1.4	17.5	17.2	16.2	16.9
8	0.2	0.1	0.0	0.0	0.3	18.0	17.0		15.9
9	0.0	0.0	0.0	0.0	0.1	21.5	18.0	17.5	
10	0.0	0.0	0.0	0.0	0.0				
Sum	5.9	184.8	2.2	57.0	249.9				
Catch	513	2374	28	2064	4978				
SOP	86	2267	28	403	2784				

Subdivision 25

	Numbers (mio)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.0	0.0	8.4	330.3	338.6			2.2	2.5
1	88.3	10.1	4.5	125.1	228.0	4.2	3.3	5.6	5.3
2	4661.4	1639.3	111.4	1556.7	7968.8	7.0	7.2	10.2	7.9
3	4076.4	1741.3	127.7	1533.5	7478.8	8.1	8.3	11.1	8.8
4	1535.8	537.5	37.3	168.6	2279.3	9.5	10.0	13.4	10.7
5	628.6	251.9	33.2	38.2	951.9	12.3	12.9	14.5	12.9
6	217.0	68.8	10.3	6.0	302.0	13.8	14.2	15.1	14.0
7	38.1	12.9	1.4	4.0	56.5	15.0	15.6	15.9	12.8
8	7.8	1.4	0.0	0.4	9.7	16.9	16.9		15.9
9	1.3	0.5	0.8	0.0	2.6	19.0	18.0	17.5	
10	0.0	0.0	0.0	0.0	0.0				
Sum	11254.7	4263.7	334.9	3762.9	19616.2				
Catch	103163	63414	4582	32517	203675				
SOP	91842	36087	3765	29693	161387				

Table 10.2.1.3 continued

Subdivision 26

	Numbers (mio)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.0	0.0	10.3	307.9	318.2			2.1	2.2
1	79.5	58.6	17.3	127.9	283.3	3.4	6.0	7.1	7.5
2	2239.8	1486.0	265.1	854.6	4845.6	6.9	7.8	8.7	8.6
3	2354.7	834.4	159.9	642.0	3991.0	8.6	9.1	9.6	9.8
4	1083.5	311.9	38.3	153.4	1587.1	10.5	11.1	10.6	11.0
5	769.9	168.0	18.0	84.1	1040.0	13.1	12.2	12.2	11.8
6	384.3	56.1	5.4	32.1	477.9	13.6	12.7	12.3	11.4
7	126.2	19.0	3.5	12.6	161.3	14.1	12.3	11.9	12.0
8	34.8	7.1	1.1	15.3	58.3	14.9	14.1	12.2	11.3
9	7.8	0.7	0.0	0.0	8.5	17.5	17.2		
10	0.0	0.0	0.0	0.0	0.0				
Sum	7080.5	2941.9	518.9	2230.0	12771.4				
Catch	63617	31057	5812	24642	125128				
SOP	65073	26149	4721	18701	114645				

Subdivision 27

	Numbers (mio)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.0	0.0	0.0	0.0	0.0				
1	0.0	0.0	0.0	0.0	0.0				
2	0.0	0.0	0.0	0.0	0.0				
3	0.0	0.0	0.0	0.0	0.0				
4	0.0	0.0	0.0	0.0	0.0				
5	0.0	0.0	0.0	0.0	0.0				
6	0.0	0.0	0.0	0.0	0.0				
7	0.0	0.0	0.0	0.0	0.0				
8	0.0	0.0	0.0	0.0	0.0				
9	0.0	0.0	0.0	0.0	0.0				
10	0.0	0.0	0.0	0.0	0.0				
Sum	0.0	0.0	0.0	0.0	0.0				
Catch	14903	4163	24	26197	45287				
SOP	0	0	0	0	0				

Subdivision 28

	Numbers (mio)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.0	0.0	0.0	23.8	23.8				2.8
1	16.2	9.8	49.0	120.7	195.6	2.9	4.3	5.9	6.6
2	756.5	493.9	384.6	551.9	2186.9	6.6	6.5	7.6	8.0
3	433.1	496.2	367.2	770.7	2067.2	7.7	7.7	8.9	8.8
4	149.4	198.4	57.0	42.8	447.5	9.1	9.7	10.1	9.5
5	136.7	258.4	81.0	136.7	612.8	9.7	10.7	10.5	10.0
6	62.8	132.3	33.6	64.2	292.8	10.4	11.3	11.5	10.8
7	40.8	98.5	13.9	30.7	183.9	11.2	12.0	12.1	11.3
8	10.7	58.0	7.5	13.9	90.1	11.6	12.1	12.3	10.4
9	0.0	0.0	0.0	0.0	0.0				
10	0.0	2.9	0.0	0.0	2.9		11.5		9.8
Sum	1606.1	1748.3	993.7	1755.4	6103.5				
Catch	34755	15450	8547	21593	80345				
SOP	12311	15165	8539	15025	51039				

Table 10.2.1.3 continued

Subdivision 29

	Numbers (mio)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.0	0.0	4.2	147.9	152.1			1.8	2.3
1	7.3	7.8	13.3	103.5	132.0	2.6	2.1	6.4	6.7
2	92.2	39.4	68.6	612.6	812.8	5.4	4.9	7.1	7.3
3	573.3	353.7	136.9	909.3	1973.2	7.4	6.8	8.3	8.3
4	119.3	50.1	11.0	99.5	279.9	8.8	8.8	10.3	10.0
5	90.0	67.5	7.4	53.7	218.5	9.6	9.1	10.6	10.7
6	44.1	15.4	2.2	16.9	78.6	10.7	9.6	12.5	10.3
7	20.2	6.5	3.1	3.5	33.4	10.7	10.7	13.0	12.7
8	5.5	3.2	0.8	0.0	9.6	12.8	10.1	12.5	
9	0.0	2.5	0.0	0.0	2.5		9.8		
10	1.9	0.1	0.0	1.2	3.1	10.3	14.0		12.3
Sum	953.8	546.2	247.5	1948.1	3695.6				
Catch	8133	4241	2316	22096	36786				
SOP	7429	3944	1981	14840	28194				

Subdivision 30

	Numbers (mio)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.0	0.0	1.8	0.0	1.8				
1	0.5	0.0	5.3	4.5	10.3	2.5			7.3
2	1.1	14.3	20.0	13.0	48.5	7.3	7.1		9.4
3	10.1	52.1	57.6	53.9	173.7	8.6	8.7		10.8
4	0.0	0.0	3.9	0.4	4.3				10.0
5	0.5	4.2	3.7	0.7	9.2	12.5	8.3		11.0
6	0.0	0.1	0.9	1.1	2.1		12.0		14.7
7	0.3	4.2	2.0	1.1	7.5	12.0	10.7		13.7
8	0.8	1.4	0.5	0.0	2.7	15.0	13.0		
9	0.0	0.0	0.0	0.0	0.0				
10	0.0	0.0	0.0	0.4	0.4				19.0
Sum	13.4	76.3	95.8	75.0	260.5				
Catch	124	629	793	800	2345				
SOP	119	652	0	789	1561				

Subdivision 31

	Numbers (mio)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.0	0.0	0.0	0.0	0.0				
1	0.0	0.0	0.0	0.0	0.0				
2	0.0	0.0	0.0	0.0	0.0				
3	0.0	0.0	0.1	0.1	0.1				
4	0.0	0.0	0.0	0.0	0.0				
5	0.0	0.0	0.0	0.0	0.0				
6	0.0	0.0	0.0	0.0	0.0				
7	0.0	0.0	0.0	0.0	0.0				
8	0.0	0.0	0.0	0.0	0.0				
9	0.0	0.0	0.0	0.0	0.0				
10	0.0	0.0	0.0	0.0	0.0				
Sum	0	0	0	0	0				

Table 10.2.1.3 continued

Subdivision 32

	Numbers (mio)					Weight (g)			
Age	Q1	Q2	Q3	Q4	Total	Q1	Q2	Q3	Q4
0	0.0	0.0	1.9	43.1	45.0			2.8	3.1
1	56.6	7.4	22.5	51.3	137.7	2.2	2.0	6.3	6.5
2	173.3	61.5	102.9	301.3	639.0	5.4	5.5	7.5	7.9
3	649.0	350.9	145.3	538.0	1683.1	7.0	6.8	8.8	8.7
4	89.0	13.6	19.3	57.2	179.1	9.0	9.6	10.4	10.3
5	92.0	29.2	17.2	31.8	170.3	9.7	9.6	11.2	11.2
6	22.7	11.3	4.6	11.6	50.2	10.7	10.1	11.4	11.1
7	19.1	5.1	2.3	11.6	38.1	11.4	10.7	12.2	12.3
8	1.3	0.0	0.5	0.2	1.9	10.7		9.9	11.7
9	4.0	0.2	0.3	1.4	5.9	10.5	10.0	16.0	14.0
10	2.4	0.0	0.5	0.0	2.8	12.3		11.0	
Sum	1109.3	479.2	317.2	1047.4	2953.2				
Catch	7758	3348	2663	8659	22428				
SOP	7875	3339	2675	8766	22654				

Table 10.2.1.4 Sprat in Sub-divisions 22-32. Samples of commercial catches by quarter and Sub-division for 1997 available to the Working Group.

Sub-division 22	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Denmark*	1	300	4	200	79
		2	400	9	949	595
		3	4000	5	149	128
		4	4000	4	375	197
		Total	8700	22	1673	999
	Germany	1	37	1	783	100
		2	72	0	0	0
		3	11	0	0	0
		4	282	1	722	100
		Total	402	2	1505	200
Sub-division 24	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Denmark	1	s. SD 22	s. SD 22		
		2	s. SD 22	s. SD 22		
		3	s. SD 22	s. SD 22		
		4	s. SD 22	s. SD 22		
		Total	0	0	0	0
	Germany	1	0	0	0	0
		2	26	4	2566	460
		3	0	0	0	0
		4	0	0	0	0
		Total	26	4	2566	460
	Sweden	1	37	0	0	0
		2	899	6	56	53
		3	0	0	0	0
		4	1659	0	0	0
		Total	2595	6	56	53
Sub-division 25	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Denmark	1	78700	34	4176	525
		2	22000	4	427	0
		3	900	0	0	0
		4	27000	8	1254	369
		Total	128600	46	5857	894
	Poland* (24+25 SD)	1	13136	51	9261	711
		2	15423	21	3510	400
		3	2910	16	1604	284
		4	2894	16	1638	245
		Total	34362	104	16013	1640
Sub-division 26	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Latvia	1	1039	5	496	496
		2	1304	3	197	197
		3	110	0	0	0
		4	1178	15	2373	1313
		Total	3631	23	3066	2006
	Poland*	1	35734	77	8326	860
		2	17832	25	5726	486
		3	2039	5	871	196
		4	9898	39	4433	596
		Total	65502	146	19356	2138
	Russia	1	6696	112	22422	341
		2	7194	39	7891	245
		3	2471	4	780	80
		4	6006	72	14451	365
		Total	22367	227	45544	1031
	Sweden	1	17995	8	1217	209
		2	4122	0	0	0
		3	11	0	0	0
		4	4736	0	0	0
		Total	26864	8	1217	209

Denmark* = Landings and samples for SD 22 and 24

Poland* = Samples of research and commercial catches

continued

cont.

Table 10.2.1.4 Sprat in Sub-divisions 22-32. Samples of commercial catches by quarter and Sub-division for 1997 available to the Working Group.

Sub-division 28	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Estonia	1	966	2	200	200
		2	1194	1	52	52
		3	147	1	100	100
		4	1013	5	500	500
		Total	3320	9	852	852
	Latvia	1	11345	14	1350	1350
		2	11968	10	958	958
		3	8392	16	1900	1450
		4	13978	49	8500	3758
		Total	45683	89	12708	7516
	Sweden	1	21725	6	855	148
		2	2173	6	835	155
		3	3	0	0	0
		4	6602	0	0	0
		Total	30503	12	1690	303
Sub-division 29	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Estonia	1	5434	6	600	600
		2	3511	9	850	850
		3	533	2	120	120
		4	8249	13	1194	1194
		Total	17727	30	2764	2764
	Finland	1	1942	0	0	0
		2	427	12	557	557
		3	1447	6	297	297
		4	6516	14	744	744
		Total	10332	32	1598	1598
Sub-division 30	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Finland	1	124	1	50	50
		2	629	5	99	99
		3	793	0	0	0
		4	800	5	204	204
		Total	2346	11	353	353
Sub-division 32	Country	Quarter	Landings in tons	Number of samples	Number of fish meas.	Number of fish aged
	Estonia	1	6790	14	1190	1190
		2	3101	10	1000	1000
		3	1996	10	925	925
		4	6046	15	1440	1440
		Total	17933	49	4555	4555
	Finland	1	968	6	299	299
		2	247	8	374	374
		3	667	7	316	316
		4	2613	9	442	442
		Total	4495	30	1431	1431

Table 10.2.9.1 SPRAT in SD 22-32. Catch in Numbers (Millions)

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

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1971	-1	-1	-1	-1	-1	-1	-1	-1	-1
1972	-1	-1	-1	-1	-1	-1	-1	-1	-1
1973	-1	-1	-1	-1	-1	-1	-1	-1	-1
1974	33.0000	2615.0000	6172.0000	3618.0000	1940.0000	1929.0000	933.0000	1213.0000	278.0000
1975	125.0000	628.0000	2032.0000	5678.0000	2387.0000	790.0000	878.0000	247.0000	546.0000
1976	215.0000	4682.0000	818.0000	2106.0000	3510.0000	1040.0000	350.0000	548.0000	422.0000
1977	104.0000	2371.0000	8399.0000	997.0000	1907.0000	1739.0000	364.0000	140.0000	399.0000
1978	97.0000	500.0000	3325.0000	4936.0000	480.0000	817.0000	683.0000	73.0000	189.0000
1979	51.0000	1340.0000	597.0000	1037.0000	2291.0000	188.0000	150.0000	335.0000	125.0000
1980	35.0000	369.0000	1476.0000	378.0000	500.0000	1357.0000	72.0000	67.0000	235.0000
1981	26.0000	2303.0000	920.0000	405.0000	94.0000	88.0000	527.0000	13.0000	99.0000
1982	24.0000	363.0000	2460.0000	425.0000	225.0000	64.0000	57.0000	231.0000	51.0000
1983	105.0000	1852.0000	297.0000	531.0000	107.0000	47.0000	12.0000	18.0000	148.0000
1984	76.0000	1005.0000	2393.0000	388.0000	447.0000	77.0000	38.0000	9.0000	83.0000
1985	65.0000	566.0000	1703.0000	2521.0000	447.0000	271.0000	30.0000	19.0000	65.0000
1986	32.0000	495.0000	1142.0000	1425.0000	2099.0000	340.0000	188.0000	16.0000	50.0000
1987	4.0000	779.0000	394.0000	1320.0000	1833.0000	1805.0000	227.0000	149.0000	73.0000
1988	180.9840	78.0670	2695.7750	730.4950	1148.8010	762.4800	760.3430	64.6660	141.1590
1989	117.5678	2101.8490	290.0210	1771.9320	403.6520	739.2420	390.2550	398.3820	137.1390
1990	70.0000	1049.0000	3171.0000	346.0000	952.0000	188.0000	316.0000	112.0000	200.0000
1991	391.6850	1043.5470	2649.3590	2438.6460	406.5360	568.6110	106.1810	160.2590	152.2260
1992	495.0000	1782.0000	2939.0000	3040.0000	1643.0000	444.0000	311.0000	121.0000	163.0000
1993	47.4000	1832.2000	5685.2000	3243.7000	1898.1000	883.7000	267.1000	244.4000	256.6880
1994	552.0000	1079.0000	8169.0000	8176.0000	3525.0000	2201.0000	779.0000	193.0000	208.0000
1995	775.4000	6373.2000	2341.3000	6643.3000	6636.1000	3366.4000	1901.8000	626.6000	409.2000
1996	71.2000	8388.7000	27674.9000	4704.1000	6517.1000	3323.0000	1499.2000	690.1000	403.4000
1997	1979.3000	1717.8000	23181.9000	23395.0000	6343.2000	4107.9000	1650.8000	682.7000	279.1000

Table 10.2.9.2 SPRAT in SD 22-32. Mean weight in Catch (Grams)

WECA: Mean weight in Catch (Total International Catch) (Total) (Grams)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1974	4.80	6.60	10.50	12.20	13.40	13.90	15.40	14.10	14.30
1975	4.00	6.80	11.20	12.40	13.40	14.70	14.30	15.70	13.50
1976	4.00	6.90	10.70	12.70	13.50	14.50	16.10	14.70	14.30
1977	4.40	5.40	11.00	13.40	14.00	14.40	15.90	15.90	15.80
1978	4.30	5.10	10.90	12.50	13.10	14.10	15.20	15.80	15.10
1979	4.00	5.50	12.70	13.00	13.70	15.10	15.80	15.60	16.20
1980	4.20	7.80	11.30	14.30	14.10	14.30	16.70	15.80	16.00
1981	4.30	6.30	14.10	16.10	18.00	16.50	15.90	16.80	16.10
1982	4.20	8.80	11.70	16.00	16.20	16.70	16.40	16.30	17.30
1983	4.70	9.20	14.50	16.20	17.10	16.90	17.00	16.90	16.80
1984	3.90	9.70	11.10	14.60	15.30	15.80	16.30	16.90	17.20
1985	3.40	9.10	11.30	12.70	14.00	16.00	17.10	17.10	15.80
1986	4.40	7.90	12.10	12.90	14.00	14.80	16.10	17.00	16.70
1987	3.80	8.50	11.70	13.30	14.50	15.20	16.40	17.00	17.60
1988	4.38	5.58	10.29	12.15	14.20	15.21	15.31	16.59	17.04
1989	5.02	9.68	13.56	14.54	15.81	16.89	17.32	17.51	18.10
1990	4.57	10.36	12.60	14.89	15.96	17.52	17.72	18.43	18.09
1991	5.60	9.00	12.90	14.30	15.80	16.60	17.50	16.90	16.90
1992	6.00	8.70	12.10	14.70	15.40	17.30	17.20	18.10	18.40
1993	3.80	6.60	11.10	13.80	14.60	15.00	16.20	16.60	16.60
1994	4.90	8.00	9.80	12.10	14.00	14.50	15.20	15.50	15.90
1995	3.30	6.50	10.60	11.00	12.60	13.70	14.10	14.30	14.50
1996	2.60	4.30	7.50	10.30	11.10	12.40	12.80	12.70	12.90
1997	3.10	6.70	7.40	8.50	10.10	11.70	12.40	12.50	12.70

Table 10.2.9.3 SPRAT in SD 22-32. Mean weight in Stock (Grams)

WEST: Mean weight in Stock (Total International Catch) (Total) (Grams)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1974	4.80	6.60	10.50	12.20	13.40	13.90	15.40	14.10	14.30
1975	4.00	6.80	11.20	12.40	13.40	14.70	14.30	15.70	13.50
1976	4.00	6.90	10.70	12.70	13.50	14.50	16.10	14.70	14.30
1977	4.40	5.40	11.00	13.40	14.00	14.40	15.90	15.90	15.80
1978	4.30	5.10	10.90	12.50	13.10	14.10	15.20	15.80	15.10
1979	4.00	5.50	12.70	13.00	13.70	15.10	15.80	15.60	16.20
1980	4.20	7.80	11.30	14.30	14.10	14.30	16.70	15.80	16.00
1981	4.30	6.30	14.10	16.10	18.00	16.50	15.90	16.80	16.10
1982	4.20	8.80	11.70	16.00	16.20	16.70	16.40	16.30	17.30
1983	4.70	9.20	14.50	16.20	17.10	16.90	17.00	16.90	16.80
1984	3.90	9.70	11.10	14.60	15.30	15.80	16.30	16.90	17.20
1985	3.40	9.10	11.30	12.70	14.00	16.00	17.10	17.10	15.80
1986	4.40	7.90	12.10	12.90	14.00	14.80	16.10	17.00	16.70
1987	3.80	8.50	11.70	13.30	14.50	15.20	16.40	17.00	17.60
1988	4.38	5.58	10.29	12.15	14.20	15.21	15.31	16.59	17.04
1989	5.02	9.68	13.56	14.54	15.81	16.89	17.32	17.51	18.10
1990	4.57	10.36	12.60	14.89	15.96	17.52	17.72	18.43	18.09
1991	5.60	9.00	12.90	14.30	15.80	16.60	17.50	16.90	16.90
1992	6.00	8.70	12.10	14.70	15.40	17.30	17.20	18.10	18.40
1993	3.80	6.60	11.10	13.80	14.60	15.00	16.20	16.60	16.60
1994	4.90	8.00	9.80	12.10	14.00	14.50	15.20	15.50	15.90
1995	3.30	6.50	10.60	11.00	12.60	13.70	14.10	14.30	14.50
1996	2.60	4.30	7.50	10.30	11.10	12.40	12.80	12.70	12.90
1997	3.10	6.70	7.40	8.50	10.10	11.70	12.40	12.50	12.70

Table 10.2.9.4 SPRAT in SD 22-32. Natural Mortality

NATMOR: Natural Mortality (Total International Catch) (Total)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1974	0.32	0.60	0.46	0.39	0.36	0.40	0.39	0.41	0.41
1975	0.32	0.60	0.46	0.39	0.36	0.40	0.39	0.41	0.41
1976	0.32	0.60	0.46	0.39	0.36	0.40	0.39	0.41	0.41
1977	0.32	0.60	0.46	0.39	0.36	0.40	0.39	0.41	0.41
1978	0.39	0.86	0.63	0.52	0.47	0.53	0.51	0.56	0.56
1979	0.44	1.04	0.75	0.60	0.54	0.62	0.60	0.65	0.65
1980	0.46	1.09	0.79	0.63	0.56	0.65	0.62	0.68	0.68
1981	0.43	0.99	0.72	0.58	0.52	0.60	0.57	0.63	0.63
1982	0.47	1.15	0.82	0.66	0.58	0.68	0.65	0.71	0.71
1983	0.42	0.96	0.70	0.57	0.51	0.59	0.56	0.61	0.61
1984	0.37	0.79	0.59	0.49	0.44	0.50	0.48	0.52	0.52
1985	0.34	0.68	0.52	0.43	0.40	0.45	0.43	0.46	0.46
1986	0.32	0.60	0.46	0.39	0.36	0.40	0.39	0.42	0.42
1987	0.29	0.49	0.39	0.34	0.32	0.35	0.34	0.36	0.36
1988	0.29	0.52	0.41	0.35	0.33	0.36	0.35	0.37	0.37
1989	0.26	0.42	0.34	0.30	0.29	0.31	0.30	0.32	0.32
1990	0.24	0.33	0.29	0.27	0.25	0.27	0.26	0.27	0.27
1991	0.23	0.30	0.27	0.25	0.24	0.25	0.25	0.25	0.25
1992	0.23	0.30	0.27	0.25	0.24	0.25	0.25	0.26	0.26
1993	0.25	0.37	0.31	0.28	0.27	0.29	0.28	0.29	0.29
1994	0.25	0.37	0.31	0.28	0.27	0.29	0.28	0.29	0.29
1995	0.25	0.37	0.32	0.28	0.27	0.29	0.28	0.29	0.29
1996	0.25	0.37	0.32	0.28	0.27	0.29	0.28	0.29	0.29
1997	0.25	0.37	0.32	0.28	0.27	0.29	0.28	0.29	0.29

Table 10.2.9.5 SPRAT in SD 22-32. Proportion Mature at Year Start

MATPROP: Proportion of Mature at Year Start (Total international Catch) (Total)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1974	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1975	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1976	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1977	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1978	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1979	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1980	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1981	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1982	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1983	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1984	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1985	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1986	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1987	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1988	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1989	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1990	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1991	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1992	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1993	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1994	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1995	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1996	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0
1997	0.0	0.0	0.7	1.0	1.0	1.0	1.0	1.0	1.0

Table 10.2.9.6 SPRAT in SD 22-32. Proportion of M before Spawning

MPROP: Proportion of M before Spawning (Total International Catch) (Total)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1974	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1975	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1976	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1977	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1978	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1979	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1980	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1981	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1982	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1983	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1984	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1985	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1986	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1987	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1988	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1989	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1990	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1991	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1992	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1993	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1994	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1995	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1996	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1997	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4

Table 10.2.9.7 SPRAT in SD 22-32. Proportion of F before Spawning

FPROP: Proportion of F before Spawning (Total international Catch) (Total)

Year	Age 0	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8+
1974	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1975	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1976	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1977	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1978	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1979	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1980	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1981	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1982	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1983	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1984	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1985	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1986	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1987	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1988	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1989	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1990	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1991	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1992	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1993	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1994	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1995	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1996	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
1997	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4

Table 10.2.9.8 SPRAT in SD 22-32. Tuning Fleet/ Latvian and Russian Acoustic Survey In SD 26+28

FLT02: Latvian and Russian Acoustic Survey in SD 26+28

Year	Fishing Effort	Catch, Age 1	Catch, Age 2	Catch, Age 3	Catch, Age 4	Catch, Age 5	Catch, Age 6	Catch, Age 7	Catch, Age 8+
1983	1	21087	2066	1938	501	166	20	69	231
1984	1	16531	12765	981	441	61	-11	-11	38
1985	1	9752	7748	7174	663	357	37	58	150
1986	1	5604	5351	5283	4693	107	175	19	24
1987	1	23035	2246	2992	2489	2341	110	81	41
1988	1	741	14404	1251	1667	1451	1301	59	60
1989	1	22461	433	8394	681	875	934	825	142
1990	1	22837	16790	170	3885	380	485	491	609
1991	1	30060	15080	12210	311	2486	284	218	592
1992	1	23758	16947	13439	5223	1008	1757	155	73
1993	1	-11	-11	-11	-11	-11	-11	-11	-11
1994	1	8407	31589	15182	6598	3439	1370	53	430
1995	1	80333	8144	23732	11722	5374	3282	1169	523
1996	1	44341	66345	11374	10668	3919	1751	1433	404
1997	1	4391	39350	35170	3344	4420	1643	1193	370

Table 10.2.9.9 SPRAT in SD 22-32. Tuning Fleet/Acoustic Survey in SD 26+28

FLT06: Acoustic Survey in SD 26+28 (Catch: Number)

Year	Fishing Effort	Catch, Age 1	.....
1985	1	9752	
1986	1	5604	
1987	1	11200	
1988	1	750	
1989	1	18815	
1990	1	12124	
1991	1	29172	
1992	1	31190	
1993	1	37800	
1994	1	2264	
1995	1	26007	
1996	1	23080	
1997	1	2075	

Table 10.2.9.10 SPRAT in SD 22-32. Tuning Fleet/International Acoustic Survey

FLT11: International Acoustic Survey corrected by area surveyed (Catch: Millions)

Year	Fishing Effort	Catch, Age 1	Catch, Age 2	Catch, Age 3	Catch, Age 4	Catch, Age 5	Catch, Age 6	Catch, Age 7	Catch, Age 8+
1983	1	39922	10303	9247	2180	354	215	125	11
1984	1	15035	23677	5928	2041	229	54	82	72
1985	1	4498	13423	10559	2274	321	88	66	93
1986	1	1539	7362	10190	3002	408	28	21	54
1987	1	13749	3618	7836	3324	1170	215	21	108
1988	1	902	7024	4191	4655	2044	243	37	12
1989	1	34917	2706	20291	4031	2406	1757	1702	270
1990	1	12488	27233	5920	4871	1847	952	233	87
1991	1	39277	30643	27862	2678	5341	1182	1042	1679
1992	1	-11	-11	-11	-11	-11	-11	-11	-11
1993	1	-11	-11	-11	-11	-11	-11	-11	-11
1994	1	9893	37796	26604	12663	7631	3200	652	1118
1995	1	-11	-11	-11	-11	-11	-11	-11	-11
1996	1	65155	118732	18148	20517	10480	5285	3152	1076
1997	1	-11	-11	-11	-11	-11	-11	-11	-11

Table 10.2.9.11 SPRAT in SD 22-32. Output from XSA

```
Lowestoft VPA Version 3.1
  17-Apr-98  11:32:15
Extended Survivors Analysis
Sprat Baltic Sea (run: XSAJAH01/X01)

CPUE data from file /users/fish/ifad/ifapwork/wgbfas/spr_2232/FLEET.X01
Catch data for  24 years. 1974 to 1997. Ages  1 to   8.

     Fleet,            First, Last, First, Last, Alpha,  Beta
                ,       year, year,  age ,  age
FLT02: Latvian and R,   1983, 1997,   1,     7,   .750,   .850
FLT06: Acoustic in 2,   1985, 1997,   1,     1,   .000,   .100
FLT11: International,   1983, 1997,   1,     7,   .750,   .850

Time series weights :

     Tapered time weighting applied
     Power =    3 over  20 years

Catchability analysis :

     Catchability dependent on stock size for ages <    4
        Regression type = C
        Minimum of   5 points used for regression
        Survivor estimates shrunk to the population mean for ages <  4
     Catchability independent of age for ages >=    4


Terminal population estimation :

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

     Prior weighting not applied


Tuning had not converged after   30 iterations


Total absolute residual between iterations
29 and  30 =      .00045

Final year F values
Age          ,      1,      2,      3,      4,      5,      6,      7
Iteration 29,  .0841,  .3758,  .4780,  .7979,  .3618,  .3546,  .2559
Iteration 30,  .0841,  .3757,  .4779,  .7978,  .3617,  .3545,  .2559

Regression weights
      ,  .751,  .820,  .877,  .921,  .954,  .976,  .990,  .997, 1.000, 1.000


Fishing mortalities
   Age,  1988,  1989,  1990,  1991,  1992,  1993,  1994,  1995,  1996,  1997

     1,  .011,  .054,  .022,  .021,  .024,  .021,  .026,  .040,  .077,  .084
     2,  .134,  .065,  .128,  .080,  .081,  .113,  .146,  .084,  .287,  .376
     3,  .234,  .145,  .115,  .148,  .132,  .130,  .262,  .188,  .270,  .478
     4,  .296,  .224,  .117,  .205,  .148,  .122,  .222,  .385,  .310,  .798
     5,  .254,  .364,  .168,  .100,  .382,  .118,  .221,  .377,  .373,  .362
     6,  .280,  .231,  .287,  .144,  .077,  .454,  .159,  .334,  .317,  .354
     7,  .457,  .270,  .104,  .245,  .258,  .085,  .804,  .204,  .213,  .256
```

Table 10.2.9.11 SPRAT in SD 22-32. Output from XSA (continued)

XSA population numbers (Thousands)

YEAR	AGE 1	2	3	4	5	6	7
1988	9.27E+06	2.63E+07	4.17E+06	5.29E+06	4.07E+06	3.71E+06	2.12E+05
1989	4.90E+07	5.45E+06	1.53E+07	2.33E+06	2.83E+06	2.20E+06	1.98E+06
1990	5.61E+07	3.05E+07	3.63E+06	9.79E+06	1.39E+06	1.44E+06	1.29E+06
1991	5.97E+07	3.95E+07	2.01E+07	2.47E+06	6.78E+06	8.98E+05	8.35E+05
1992	8.62E+07	4.33E+07	2.78E+07	1.35E+07	1.58E+06	4.78E+06	6.06E+05
1993	1.04E+08	6.23E+07	3.05E+07	1.90E+07	9.16E+06	8.42E+05	3.45E+06
1994	5.09E+07	7.04E+07	4.08E+07	2.02E+07	1.28E+07	6.09E+06	4.04E+05
1995	1.96E+08	3.43E+07	4.46E+07	2.38E+07	1.24E+07	7.70E+06	3.92E+06
1996	1.36E+08	1.30E+08	2.29E+07	2.80E+07	1.23E+07	6.35E+06	4.16E+06
1997	2.56E+07	8.69E+07	7.08E+07	1.32E+07	1.56E+07	6.36E+06	3.50E+06
Estimated population abundance at 1st Jan 1998							
	.00E+00	1.63E+07	4.33E+07	3.32E+07	4.54E+06	8.16E+06	3.37E+06
Taper weighted geometric mean of the VPA populations:							
	5.41E+07	3.33E+07	1.73E+07	8.53E+06	4.38E+06	1.94E+06	8.65E+05
Standard error of the weighted Log(VPA populations) :							
	.8374	.9416	.9947	1.0364	1.1651	1.2685	1.4015

Log catchability residuals.

Fleet : FLT02: Latvian and R

Age	1983	1984	1985	1986	1987
1	-.26	.23	.29	.73	.52
2	.17	-.14	.09	.23	.42
3	.42	.19	-.17	.18	.18
4	.94	-.67	-.08	.12	.07
5	.01	-.34	-.18	-1.14	.09
6	-.30	99.99	-.09	-.15	-.16
7	.21	99.99	.27	-.01	.10

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	-.64	.37	.17	.31	-.24	99.99	-.50	-.04	-.13	-.29
2	.42	-.59	.31	-.07	-.08	99.99	-.06	-.33	-.05	.03
3	.40	.29	-.89	.24	-.03	99.99	-.25	-.08	.15	-.12
4	.04	-.13	.06	-1.03	.05	99.99	-.04	.51	.19	.17
5	.15	.06	-.26	-.03	.74	99.99	-.22	.39	.07	-.05
6	.15	.26	.04	-.15	-.05	99.99	-.45	.33	-.12	-.16
7	.07	.29	.02	-.26	-.26	99.99	-.47	-.12	.03	.05

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

Age	4	5	6	7
Mean Log q	-7.5985	-7.5985	-7.5985	-7.5985
S.E(Log q)	.4246	.4097	.2317	.2280

Table 10.2.9.11 SPRAT in SD 22-32. Output from XSA (continued)

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	.79	1.326	9.82	.83	14	.42	-7.76
2	.71	2.796	10.35	.92	14	.30	-7.57
3	.66	2.766	10.61	.89	14	.37	-7.52

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
4	.84	1.431	8.91	.91	14	.34	-7.60
5	.93	.632	8.14	.90	14	.39	-7.60
6	.97	.495	7.86	.97	13	.23	-7.65
7	.99	.136	7.69	.97	13	.23	-7.64

Fleet : FLT06: Acoustic in 2

Age	1983	1984	1985	1986	1987
1	99.99	99.99	.47	.90	.26
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	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	-.53	.60	.08	.77	.47	.45	-1.28	-.51	-.24	-.67
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	.87	.515	9.75	.62	13	.70	-8.52

Fleet : FLT11: International

Age	1983	1984	1985	1986	1987
1	-.03	.06	-.20	.02	.08
2	.83	-.07	.02	-.11	.06
3	.57	.12	-.77	-.30	-.28
4	1.57	.03	.31	-1.17	-.48
5	-.08	.14	-1.13	-.64	-1.44
6	1.23	-1.28	-.06	-2.82	-.33
7	-.03	1.06	-.44	-.75	-2.09

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	-.06	.54	-.30	.34	99.99	99.99	-.33	99.99	-.10	99.99
2	-.67	-.04	.28	.08	99.99	99.99	-.24	99.99	.26	99.99
3	-.32	.41	.08	.52	99.99	99.99	-.09	99.99	-.03	99.99
4	.22	.81	-.55	.29	99.99	99.99	-.23	99.99	.01	99.99
5	-.35	.23	.48	-.11	99.99	99.99	-.26	99.99	.22	99.99
6	-2.37	.05	-.13	.44	99.99	99.99	-.44	99.99	.14	99.99
7	-1.24	.17	-1.56	.47	99.99	99.99	1.20	99.99	-.03	99.99

Table 10.2.9.11 SPRAT in SD 22-32. Output from XSA (continued)

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

   Age ,          4,          5,          6,          7
Mean Log q,   -6.7585,    -6.7585,    -6.7585,    -6.7585,
S.E(Log q),     .6280,      .6339,     1.2391,     1.1366,

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,     .63,    2.520,     11.45,      .89,     11,      .31,    -7.78,
 2,     .88,     .925,      8.25,      .91,     11,      .36,    -7.02,
 3,    1.38,   -2.100,      2.74,      .84,     11,      .41,    -6.51,

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
 4,    1.67,   -2.239,       .79,      .66,     11,      .83,    -6.76,
 5,    1.06,    -.260,      6.49,      .77,     11,      .68,    -6.97,
 6,    1.10,    -.252,      6.56,      .54,     11,     1.33,    -7.24,
 7,     .97,     .099,      7.24,      .63,     11,     1.15,    -7.04,
```

Terminal year survivor and F summaries :

```
Age  1   Catchability dependent on age and year class strength
Year class = 1996
 Fleet,                    Estimated,     Int,         Ext,     Var,     N, Scaled,
Estimated
    ,                   Survivors,     s.e,       s.e,   Ratio,     , Weights,     F
 FLT02: Latvian and R,  12183740.,    .457,       .000,     .00,    1,   .502,     .111
 FLT06: Acoustic in 2,   8370831.,    .789,       .000,     .00,    1,   .168,     .157
 FLT11: International,         1.,    .000,       .000,     .00,    0,   .000,     .000
   P shrinkage mean  ,  33301392.,     .94,,,,                            .128,     .042
   F shrinkage mean  ,  36869524.,     .75,,,,                            .202,     .038
 Weighted prediction :
 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
  16280029.,       .33,       .39,    4,  1.200,   .084

Age  2   Catchability dependent on age and year class strength
Year class = 1995
 Fleet,                    Estimated,     Int,         Ext,     Var,     N, Scaled,
Estimated
    ,                   Survivors,     s.e,       s.e,   Ratio,     , Weights,     F
 FLT02: Latvian and R,  42288116.,    .267,       .072,     .27,    2,   .517,     .383
 FLT06: Acoustic in 2,  33925252.,    .748,       .000,     .00,    1,   .063,     .459
 FLT11: International,  39068584.,    .362,       .000,     .00,    1,   .267,     .409
   P shrinkage mean  ,  17341706.,     .99,,,,                            .056,     .760
   F shrinkage mean  , 128442544.,     .75,,,,                            .098,     .143

 Weighted prediction :

 Survivors,        Int,      Ext,    N,    Var,     F
 at end of year,   s.e,      s.e,     ,   Ratio,
  43323988.,       .20,       .19,    6,   .950,   .376
```

Table 10.2.9.11 SPRAT in SD 22-32. Output from XSA (continued)

Age 3 Catchability dependent on age and year class strength

Year class = 1994

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	F
FLT02: Latvian and R,	30678036.,	.232,	.026,	.11,	3,	.624,	.509
FLT06: Acoustic in 2,	19961398.,	.753,	.000,	.00,	1,	.051,	.703
FLT11: International,	42902228.,	.445,	.000,	.00,	1,	.151,	.388
P shrinkage mean ,	8530267.,	1.04,,,,				.060,	1.219
F shrinkage mean ,	93011952.,	.75,,,,				.114,	.198

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
33203340.,	.20,	.21,	7,	1.070,	.478

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

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	F
FLT02: Latvian and R,	4035270.,	.195,	.161,	.83,	4,	.581,	.864
FLT06: Acoustic in 2,	1264771.,	.788,	.000,	.00,	1,	.031,	1.683
FLT11: International,	3666003.,	.270,	.145,	.54,	2,	.277,	.921
F shrinkage mean ,	20514868.,	.75,,,,				.111,	.239

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
4540859.,	.16,	.24,	8,	1.503,	.798

Age 5 Catchability constant w.r.t. time and age (fixed at the value for age) 4

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	F
FLT02: Latvian and R,	8083577.,	.201,	.059,	.29,	4,	.682,	.364
FLT06: Acoustic in 2,	12749613.,	.778,	.000,	.00,	1,	.032,	.246
FLT11: International,	6942986.,	.344,	.116,	.34,	2,	.190,	.413
F shrinkage mean ,	10273161.,	.75,,,,				.097,	.297

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
8155948.,	.17,	.06,	8,	.364,	.362

Age 6 Catchability constant w.r.t. time and age (fixed at the value for age) 4

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	F
FLT02: Latvian and R,	3184368.,	.190,	.112,	.59,	5,	.775,	.372
FLT06: Acoustic in 2,	5375874.,	.777,	.000,	.00,	1,	.019,	.237
FLT11: International,	3580660.,	.410,	.154,	.38,	2,	.114,	.337
F shrinkage mean ,	4621024.,	.75,,,,				.093,	.270

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
3373836.,	.17,	.09,	9,	.506,	.354

Table 10.2.9.11 SPRAT in SD 22-32. Output from XSA (continued)

Age 7 Catchability constant w.r.t. time and age (fixed at the value for age) 4

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT02: Latvian and R,	2084549.,	.159,	.070,	.44,	6,	.813,	.249
FLT06: Acoustic in 2,	4395899.,	.788,	.000,	.00,	1,	.015,	.126
FLT11: International,	2432552.,	.319,	.166,	.52,	3,	.107,	.217
F shrinkage mean ,	885710.,	.75,,,,				.065,	.511

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N,	Var, Ratio,	F
2025792.,	.14,	.09,	11,	.652,	.256

Table 10.2.9.12 SPRAT IN SD 22-32. Output from XSA. Fishing mortality (F) at age

Run title : Sprat Baltic Sea (run: XSAJAH01/X01)

At 17-Apr-98 11:34:07

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR	1974	1975	1976	1977
AGE				
1	0.093	0.0625	0.0527	0.1092
2	0.1544	0.1377	0.1539	0.1803
3	0.3777	0.2678	0.2666	0.3713
4	0.4978	0.5807	0.3232	0.5152
5	0.3727	0.4848	0.6963	0.3236
6	0.6798	0.3641	0.5281	0.7398
7	0.5267	0.4853	0.5258	0.5364
+gp	0.5267	0.4853	0.5258	0.5364
FBAR 3-5	0.4161	0.4444	0.4287	0.4033

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
1	0.0723	0.0882	0.0395	0.0798	0.0215	0.0250	0.0274	0.0253	0.0537	0.0229
2	0.3555	0.2236	0.2926	0.2854	0.2475	0.0459	0.0736	0.0950	0.0961	0.0748
3	0.2102	0.2828	0.3802	0.2046	0.3627	0.1295	0.1179	0.1438	0.1409	0.1910
4	0.4045	0.2039	0.3305	0.2287	0.2552	0.2202	0.2142	0.2547	0.2122	0.3250
5	0.5988	0.4107	0.2782	0.1314	0.3838	0.1154	0.3476	0.2562	0.3993	0.3424
6	0.2698	0.3077	0.4487	0.2604	0.1862	0.1780	0.1850	0.2982	0.3686	0.6431
7	0.4358	0.3166	0.3642	0.2120	0.2841	0.1294	0.2887	0.1774	0.3333	0.7216
+gp	0.4358	0.3166	0.3642	0.2120	0.2841	0.1294	0.2887	0.1774	0.3333	0.7216
FBAR 3-5	0.4045	0.2991	0.3296	0.1882	0.3339	0.1550	0.2266	0.2183	0.2508	0.2861

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	FBAR 95-97
AGE											
1	0.0110	0.0543	0.0223	0.0205	0.0243	0.0214	0.0258	0.0399	0.0772	0.0841	0.0671
2	0.1343	0.0652	0.1280	0.0799	0.0808	0.1126	0.1456	0.0836	0.2874	0.3757	0.2489
3	0.2339	0.1448	0.1154	0.1480	0.1322	0.1304	0.2617	0.1878	0.2698	0.4779	0.3118
4	0.2958	0.2238	0.1168	0.2051	0.1477	0.1215	0.2222	0.3851	0.3104	0.7978	0.4978
5	0.2542	0.3639	0.1679	0.0998	0.3822	0.1183	0.2210	0.3775	0.3728	0.3617	0.3707
6	0.2798	0.2307	0.2870	0.1438	0.0766	0.4541	0.1592	0.3343	0.3169	0.3545	0.3352
7	0.4567	0.2698	0.1043	0.2453	0.2580	0.0855	0.8037	0.2041	0.2126	0.2559	0.2242
+gp	0.4567	0.2698	0.1043	0.2453	0.2580	0.0855	0.8037	0.2041	0.2126	0.2559	
FBAR 3-5	0.2613	0.2441	0.1333	0.1510	0.2207	0.1234	0.2349	0.3168	0.3176	0.5458	

Table 10.2.9.13 SPRAT IN SD 22-32. Output from XSA. Stock number at age (Number*10-5)**

Run title : Sprat Baltic Sea (run: XSAJAH01/X01)

At 17-Apr-98 11:34:07

Terminal Fs derived using XSA (With F shrinkage)

Table 10 Stock number at age (start of year) Numbers*10-5**

YEAR	1974	1975	1976	1977
AGE				
1	397528	140005	1230523	309468
2	542985	198796	72184	640640
3	139795	293739	109352	39069
4	59226	64879	152158	56708
5	75728	25116	25327	76839
6	22986	34969	10368	8462
7	36364	7885	16451	4140
+gp	8130	17028	12359	11506
TOTAL	1282743	782417	1628721	1146834

YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
1	110147	266923	164319	492786	303336	1213076	552087	317690	127699	439620
2	152275	43358	86379	53107	169070	94005	453018	243791	156918	66415
3	337693	56835	16378	29259	19431	58138	44588	233304	131808	89986
4	18248	162706	23509	5964	13352	6988	28885	24279	131433	77516
5	23636	7611	77328	9650	2821	5792	3367	15016	12615	74166
6	37269	7644	2715	30564	4644	974	2861	1442	7411	5672
7	2734	17087	3084	933	13322	2013	465	1471	696	3470
+gp	6849	6160	10397	6909	2833	16188	4192	4955	2135	1656
TOTAL	688851	568323	384108	629171	528808	1397172	1089464	841948	570715	758501

YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	GMST 74-95	AMST 74-95
AGE													
1	92676	490342	561445	597274	862118	1041086	509044	1959116	1358423	256346	0	406393	553559
2	263226	54496	305141	394742	433490	623335	703886	342646	1300260	868590	162800	197312	276995
3	41725	152729	36342	200895	278190	305239	408494	446303	228861	708353	433240	102216	157695
4	52913	23271	97893	24719	134937	189826	202495	237655	279554	132074	332033	50799	81344
5	40668	28300	13921	67838	15839	91573	128326	123782	123440	156465	45409	25605	42966
6	37111	22005	14426	8985	47814	8417	60876	76982	63502	63621	81559	11598	20663
7	2122	19769	12942	8348	6060	34493	4040	39237	41648	34960	33738	5474	10779
+gp	4543	6728	22988	7869	8095	36026	4256	25409	24137	14155	28458		
TOTAL	534985	797639	1065096	1310670	1786543	2329998	2021417	3251131	3419826	2234566	1117238		

Table 10.2.9.14 SPRAT IN SD 22-32. Output from XSA. Stock summary

Run title : Sprat Baltic Sea (run: XSAJAH01/X01)

At 17-Apr-98 11:34:07

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS Age 1	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 3-5
1974	39752852	1323090	648163	241700	0.3729	0.4161
1975	14000464	876595	537493	201434	0.3748	0.4444
1976	123052280	1392504	379748	194775	0.5129	0.4287
1977	30946872	1135767	581529	180800	0.3109	0.4033
1978	11014716	788941	495404	132360	0.2672	0.4045
1979	26692274	579034	289130	77100	0.2667	0.2991
1980	16431872	416758	173391	58100	0.3351	0.3296
1981	49278632	505518	133323	49300	0.3698	0.1882
1982	30333580	566695	154618	48700	0.3150	0.3339
1983	121307536	1380117	184109	37320	0.2027	0.1550
1984	55208704	1178499	366377	52560	0.1435	0.2266
1985	31768976	928284	442061	69497	0.1572	0.2183
1986	12769866	681411	416516	75800	0.1820	0.2508
1987	43962000	837817	326974	88276	0.2700	0.2861
1988	9267590	570980	344646	80300	0.2330	0.2613
1989	49034192	966176	372153	85817	0.2306	0.2441
1990	56144480	1284967	514483	85578	0.1663	0.1333
1991	59727492	1530581	721954	103200	0.1429	0.1510
1992	86211776	2049475	960875	142195	0.1480	0.2207
1993	104108616	2397213	1241292	178100	0.1435	0.1234
1994	50904384	2181885	1280242	288700	0.2255	0.2349
1995	195911520	2922292	1162737	313000	0.2692	0.3168
1996	135842272	2436149	1247173	441100	0.3537	0.3176
1997	25634610	1885000	1134411	529400	0.4667	0.5458
Arith. Mean	57471140	1283989	587867	156463	0.2692	0.2889
Units	(Thousands)	(Tonnes)	(Tonnes)	(Tonnes)		

Table 10.2.10.1 SPRAT in SD 22-32. Input Data for RCT3 analysis

SPRAT22-32: results from the Latvian-Russian acoustic YFS

```
1      22      2
         'year'    'VPA'      'Acoustic0'
         1976      30947      -11
         1977      11015      -11
         1978      26692      -11
         1979      16432      -11
         1980      49279      -11
         1981      30334      -11
         1982      121308     -11
         1983      55209      -11
         1984      31769      9752
         1985      12770      5604
         1986      43962      11200
         1987      9268       750
         1988      49034      18815
         1989      56144      12124
         1990      59727      29172
         1991      86212      31190
         1992      104109     37800
         1993      50904      2264
         1994      195912     26007
         1995      135842     23080
         1996      25635      2075
         1997      -11        34933
```

Table 10.2.10.2 SPRAT in SD 22-32. Results from RCT3

Analysis by RCT3 ver3.1 of data from file : recspr98.txt
SPRAT22-32: results from the Latvian-Russian acoustic YFS
Data for 1 surveys over 22 years : 1976 - 1997
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 .20
Minimum of 3 points used for regression
Forecast/Hindcast variance correction used.

Yearclass = 1992

	I----------Regression----------I				I----------Prediction---------I				
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	.71	3.91	.37	.839	8	10.54	11.43	.496	.698
					VPA Mean =		10.53	.755	.302

Yearclass = 1993

	I----------Regression----------I				I----------Prediction---------I				
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	.73	3.79	.35	.861	9	7.73	9.41	.472	.732
					VPA Mean =		10.63	.780	.268

Yearclass = 1994

	I----------Regression----------I				I----------Prediction---------I				
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	.77	3.59	.63	.633	10	10.17	11.38	.767	.488
					VPA Mean =		10.66	.749	.512

Yearclass = 1995

	I----------Regression----------I				I----------Prediction---------I				
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	.91	2.36	.75	.601	11	10.05	11.48	.897	.463
					VPA Mean =		10.81	.833	.537

Yearclass = 1996

	I----------Regression----------I				I----------Prediction---------I				
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	.94	2.08	.75	.602	12	7.64	9.27	.960	.436
					VPA Mean =		10.93	.844	.564

Yearclass = 1997

	I----------Regression----------I				I----------Prediction---------I				
Survey/ Series	Slope	Inter-cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Acoust	.86	2.89	.70	.626	13	10.46	11.93	.842	.497
					VPA Mean =		10.90	.837	.503

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1992	69812	11.15	.41	.41	.99	104110	11.55
1993	16935	9.74	.40	.54	1.77	50904	10.84
1994	60697	11.01	.54	.36	.45	195912	12.19
1995	67567	11.12	.61	.33	.30	135842	11.82
1996	27060	10.21	.63	.82	1.67	25635	10.15
1997	90347	11.41	.59	.52	.76		

Table 10.2.12.1

The SAS System 14:26 Wednesday, April 29, 1998
Sprat in the Baltic Sea (Fishing Areas 22 to 32)

Prediction with management option table: Input data

Year: 1998								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	90347.000	0.3700	0.0000	0.4000	0.4000	5.500	0.0800	5.500
2	16280.000	0.3200	0.7000	0.4000	0.4000	7.450	0.2970	7.450
3	43324.000	0.2800	1.0000	0.4000	0.4000	9.400	0.3720	9.400
4	33203.000	0.2700	1.0000	0.4000	0.4000	10.600	0.4440	10.600
5	4541.000	0.2900	1.0000	0.4000	0.4000	12.050	0.4430	12.050
6	8156.000	0.2800	1.0000	0.4000	0.4000	12.600	0.4000	12.600
7	3374.000	0.2900	1.0000	0.4000	0.4000	12.600	0.2680	12.600
8+	2846.000	0.2900	1.0000	0.4000	0.4000	12.800	0.2680	12.800
Unit	Millions	-	-	-	-	Grams	-	Grams

Year: 1999								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	58569.000	0.3700	0.0000	0.4000	0.4000	5.500	0.0800	5.500
2	.	0.3200	0.7000	0.4000	0.4000	7.450	0.2970	7.450
3	.	0.2800	1.0000	0.4000	0.4000	9.400	0.3720	9.400
4	.	0.2700	1.0000	0.4000	0.4000	10.600	0.4440	10.600
5	.	0.2900	1.0000	0.4000	0.4000	12.050	0.4430	12.050
6	.	0.2800	1.0000	0.4000	0.4000	12.600	0.4000	12.600
7	.	0.2900	1.0000	0.4000	0.4000	12.600	0.2680	12.600
8+	.	0.2900	1.0000	0.4000	0.4000	12.800	0.2680	12.800
Unit	Millions	-	-	-	-	Grams	-	Grams

Year: 2000								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	58569.000	0.3700	0.0000	0.4000	0.4000	5.500	0.0800	5.500
2	.	0.3200	0.7000	0.4000	0.4000	7.450	0.2970	7.450
3	.	0.2800	1.0000	0.4000	0.4000	9.400	0.3720	9.400
4	.	0.2700	1.0000	0.4000	0.4000	10.600	0.4440	10.600
5	.	0.2900	1.0000	0.4000	0.4000	12.050	0.4430	12.050
6	.	0.2800	1.0000	0.4000	0.4000	12.600	0.4000	12.600
7	.	0.2900	1.0000	0.4000	0.4000	12.600	0.2680	12.600
8+	.	0.2900	1.0000	0.4000	0.4000	12.800	0.2680	12.800
Unit	Millions	-	-	-	-	Grams	-	Grams

Notes: Run name : MANJAH05
Date and time: 20APR98:09:08

Table 10.2.12.2a

The SAS System

Sprat in the Baltic Sea (Fishing Areas 22 to 32)

Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	0.4197	1613818	826858	345100	0.0000	0.0000	1394181	838897	0	1542488	1006396
-	-	-	-	-	0.2000	0.0839	-	814339	69242	1473899	918898
-	-	-	-	-	0.4000	0.1679	-	790526	133939	1409980	839732
-	-	-	-	-	0.6000	0.2518	-	767435	194417	1350388	768061
-	-	-	-	-	0.8000	0.3357	-	745045	250983	1294805	703134
-	-	-	-	-	1.0000	0.4197	-	723332	303916	1242940	644278
-	-	-	-	-	1.2000	0.5036	-	702276	353475	1194521	590890
-	-	-	-	-	1.4000	0.5875	-	681856	399902	1149298	542230
-	-	-	-	-	1.6000	0.6715	-	662052	443419	1107041	498411
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	To[illegible]

Table 10.2.12.2b

The SAS System

Sprat in the Baltic Sea (Fishing Areas 22 to 32)

Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.2000	0.5036	1613818	801644	401070	0.0000	0.0000	11340093	792455	0	1497692	966409
-	-	-	-	-	0.2000	0.0839	-	769360	65653	1432510	883099
-	-	-	-	-	0.4000	0.1679	-	746963	127028	1371732	807[illegible]
-	-	-	-	-	0.6000	0.2518	-	725242	184432	1315036	739[illegible]
-	-	-	-	-	0.8000	0.3357	-	704177	238151	1262124	677401
-	-	-	-	-	1.0000	0.4197	-	683747	288446	1212722	621212
-	-	-	-	-	1.2000	0.5036	-	663933	335562	1166575	570208
-	-	-	-	-	1.4000	0.5875	-	644714	379724	1123448	523880
-	-	-	-	-	1.6000	0.6715	-	626074	421140	1083125	481768
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Table 10.2.12.2c

Sprat in the Baltic Sea (Fishing Areas 22 to 32)

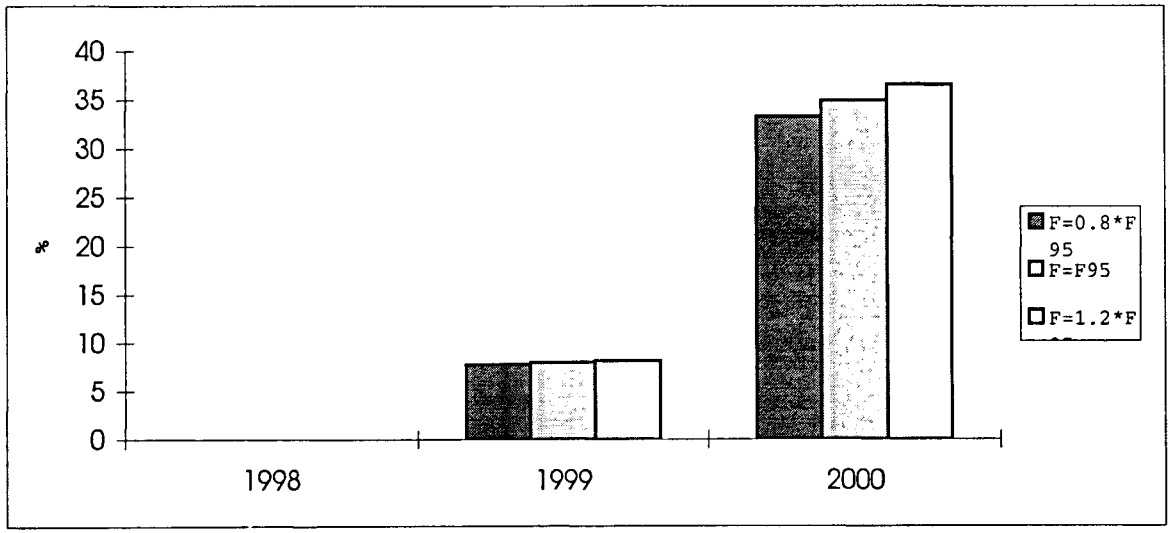
Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.7200	0.7218	1613818	739694	530281	0.0000	0.0000	1215904	686255	0	1394639	874415
.	.	.	.	.	0.2000	0.0839	.	666493	57452	1337258	800708
.	.	.	.	.	0.4000	0.1679	.	647321	111235	1283673	733859
.	.	.	.	.	0.6000	0.2518	.	628722	161609	1233611	673193
.	.	.	.	.	0.8000	0.3357	.	610678	208815	1186820	618100
.	.	.	.	.	1.0000	0.4197	.	593172	253077	1143064	568034
.	.	.	.	.	1.2000	0.5036	.	576187	294600	1102127	522507
.	.	.	.	.	1.4000	0.5875	.	559707	333577	1063809	481076
.	.	.	.	.	1.6000	0.6715	.	543717	370184	1027924	443346
.	.	.	.	.	1.8000	0.7554	.	528202	404584	994300	408962
.	.	.	.	.	2.0000	0.8393	.	513146	436931	962780	377604
.	.	.	.	.	2.2000	0.9233	.	498537	467365	933215	348982
.	.	.	.	.	2.4000	1.0072	.	484359	496016	905470	322839
.	.	.	.	.	2.6000	1.0911	.	470601	523005	879417	298940
.	.	.	.	.	2.8000	1.1751	.	457249	548445	854941	277076
.	.	.	.	.	3.0000	1.2590	.	444291	572440	831932	257057
.	.	.	.	.	3.2000	1.3429	.	431714	595086	810290	238713
.	.	.	.	.	3.4000	1.4269	.	419507	616473	789922	221888
.	.	.	.	.	3.6000	1.5108	.	407660	636684	770742	206445
.	.	.	.	.	3.8000	1.5947	.	396160	655797	752669	192257
.	.	.	.	.	4.0000	1.6787	.	384997	673883	735628	179211
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANJAH05
Date and time : 20APR98:09:08
Computation of ref. F: Simple mean, age 3 - 5
Basis for 1998 : F factors

Table 10.2.12.3 **SPRAT in SD 22-32. Projected catches and biomass of sprat ('000 tonnes) under assumption of mean recruitment in 1999-2000, and catches in 1998 at 1997 level**

Fishing mortality in 1999-2000	Total stock biomass			Spawning stock biomass			Projected catches		
	1998	1999	2000	1998	1999	2000	1998	1999	2000
F=0.8*F97	1612	1222	1195	738	614	623	528	209	204
F=F97	1612	1222	1151	738	597	573	528	254	235
F=1.2*F97	1612	1222	1110	738	579	527	528	295	261



The share (%) of year-class with assumed strength (1998-1999 year-classes) in the projected catches

Table 10.2.13.1a SPRAT in SD 22-32. Results of medium-term projections. Spawning stock biomass ('000 tonnes)

a) Fishing pattern: mean 1995-97, rescaled to mean F(3-5) in 1997

F=0.6

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
10%	782	706	619	517	474	436	417	397	357	365
25%	839	764	705	635	575	532	514	485	461	460
50%	903	863	861	794	718	676	648	648	652	619
75%	967	979	1049	981	990	927	893	899	866	840
90%	1045	1100	1226	1231	1248	1392	1227	1199	1209	1260

F=0.8

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
10%	759	655	528	427	387	329	295	287	293	285
25%	820	727	612	515	481	433	392	406	383	378
50%	867	806	770	635	604	550	527	510	504	506
75%	941	959	943	856	776	750	741	738	694	721
90%	1016	1078	1112	1110	1155	1125	1100	997	929	955

F=1

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
10%	736	602	444	370	330	287	246	250	239	224
25%	786	654	506	437	394	349	324	320	321	313
50%	848	730	636	546	504	458	434	446	451	433
75%	905	846	800	678	683	650	626	617	624	626
90%	998	985	1004	1033	883	915	922	944	946	854

F=1.2

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
10%	705	541	406	305	242	209	210	201	214	218
25%	758	596	469	366	319	285	273	272	273	279
50%	822	659	545	459	428	388	366	366	373	385
75%	893	767	669	605	586	532	506	530	553	502
90%	948	881	864	811	787	759	758	695	759	679

F=1.4

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
10%	688	491	355	255	212	194	173	182	182	178
25%	743	549	417	313	272	234	235	245	244	223
50%	786	640	513	416	369	333	322	348	332	354
75%	838	743	655	564	490	456	458	489	437	492
90%	932	867	847	734	691	652	628	661	590	698

With Bpa=275,000 tonnes, Fpa=0.8*referenceF=0.34

Table 10.2.13.1b SPRAT in SD 22-32. Results of medium-term projections. Spawning stock biomass ('000 tonnes)

b) Fishing pattern from 1997, F at age 4 corrected

F=0.6

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
10%	757	688	578	480	426	373	380	380	366	373
25%	816	736	650	564	546	489	498	506	467	462
50%	891	820	756	730	707	649	648	652	611	606
75%	952	950	946	923	910	834	859	860	864	849
90%	1036	1140	1203	1234	1188	1115	1160	1116	1246	1299

F=0.7

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
10%	761	665	568	444	386	337	320	322	328	312
25%	821	735	641	537	479	427	395	419	423	426
50%	868	842	771	662	618	554	544	568	549	570
75%	925	959	932	862	784	715	746	774	719	808
90%	1029	1069	1136	1066	1051	1028	978	1047	941	1010

F=0.8

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
10%	750	647	496	419	378	325	273	281	262	254
25%	803	698	565	483	442	390	358	366	355	349
50%	866	779	695	604	555	495	498	484	491	473
75%	924	897	862	731	737	704	672	670	667	677
90%	1015	1037	1069	1100	952	966	987	999	1002	927

F=1

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
10%	726	586	435	336	283	230	207	216	207	229
25%	782	638	491	394	338	317	292	293	278	288
50%	853	710	597	485	450	404	395	393	374	405
75%	903	798	732	612	624	598	561	542	560	565
90%	972	903	886	908	884	797	752	786	756	778

F=1.2

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
10%	705	519	377	291	237	214	206	189	169	173
25%	755	563	447	355	302	277	255	241	226	227
50%	811	635	558	457	385	355	331	336	318	323
75%	869	737	687	579	563	487	494	457	481	459
90%	937	836	831	743	716	780	627	684	703	704

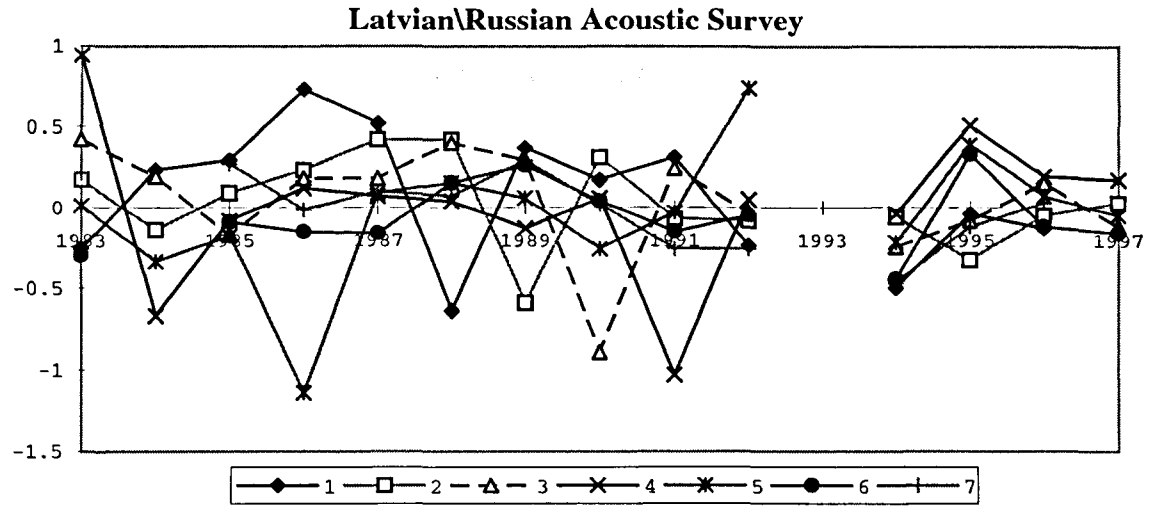
F=1.4

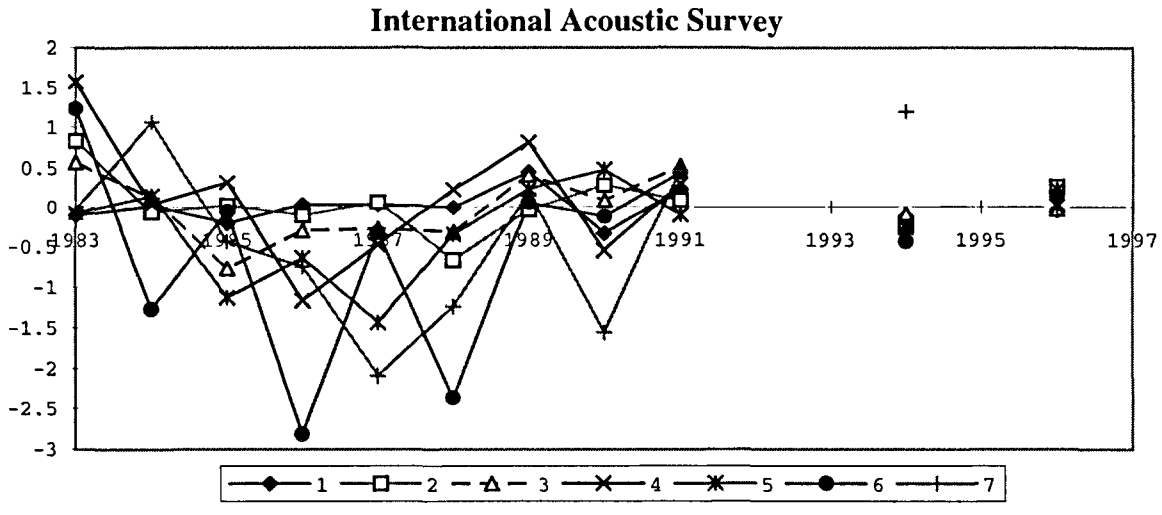
Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
10%	678	459	323	230	197	171	153	170	159	148
25%	723	514	379	275	256	234	206	212	204	192
50%	766	588	445	352	346	316	284	284	269	277
75%	821	688	570	465	483	460	411	382	412	374
90%	883	798	690	619	671	621	633	661	537	573

F=1.6

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
10%	658	437	273	205	168	139	115	121	115	103
25%	708	480	311	244	205	181	162	159	154	153
50%	760	538	391	312	279	249	226	234	231	221
75%	809	639	508	405	395	360	369	337	336	336
90%	887	748	663	651	535	491	541	526	525	521

With Bpa=275,000 tonnes, Fpa=0.75*referenceF=0.31





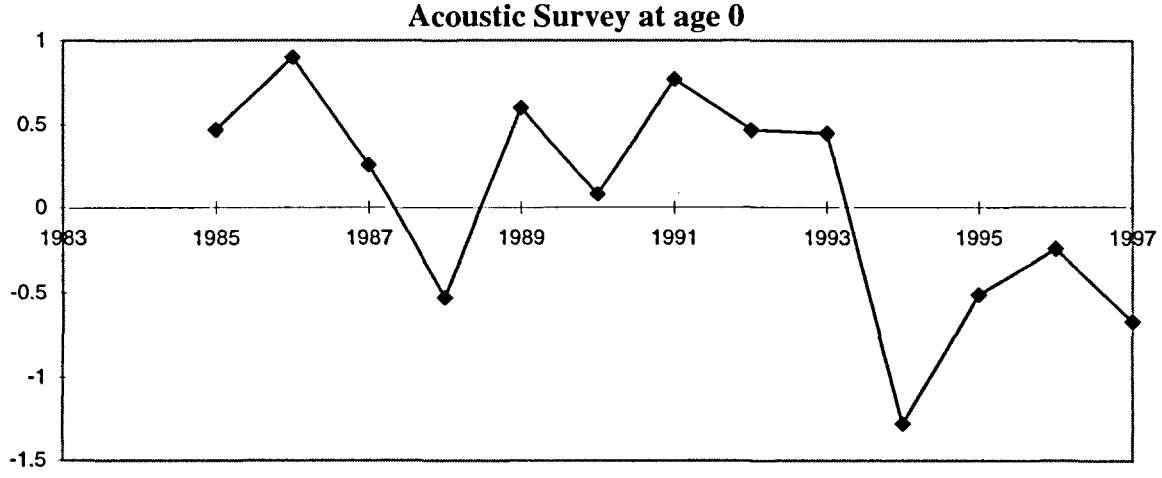


Figure 10.2.9.1 Residuals of catchabilities for Sprat (SD 22-32)

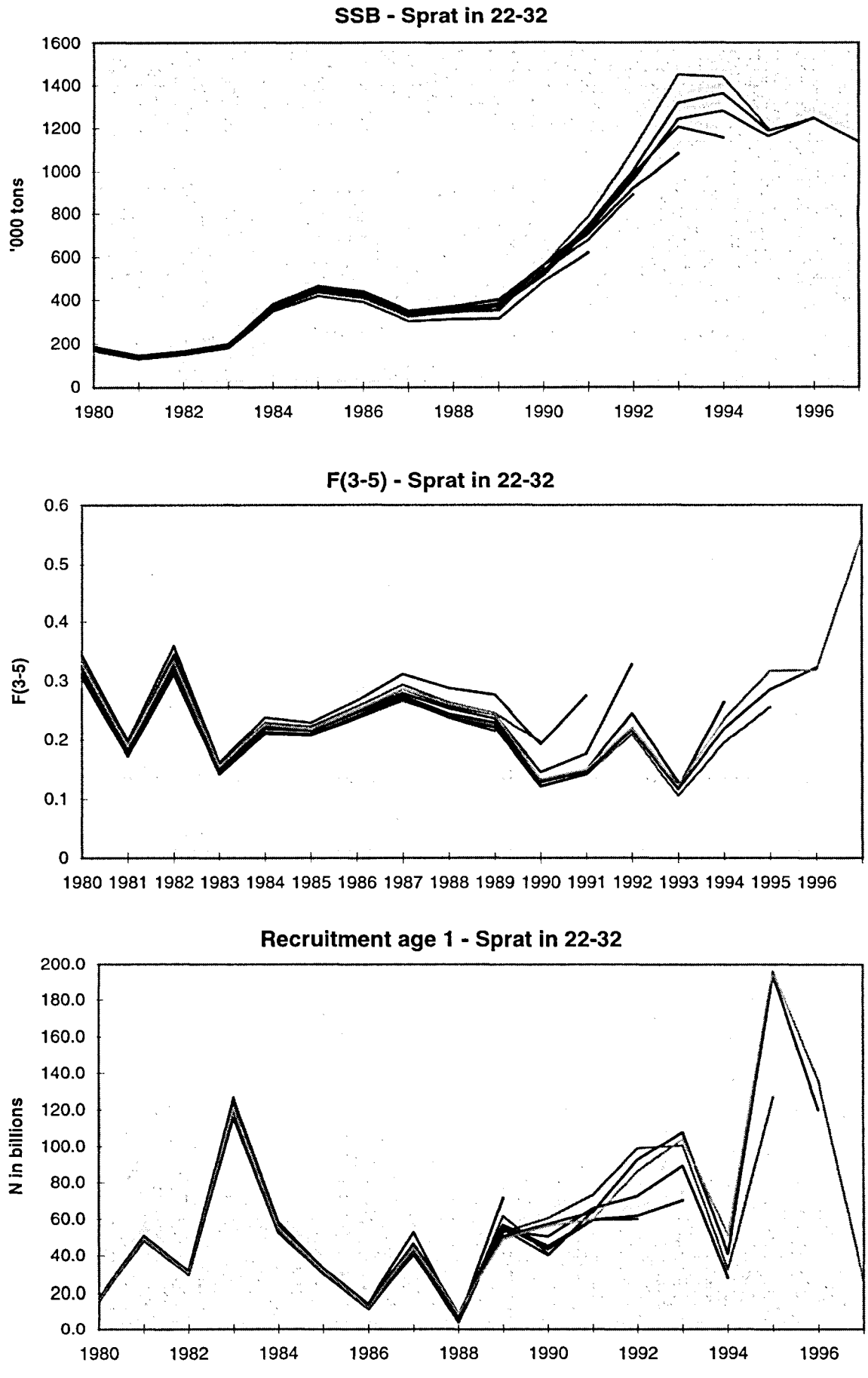


Figure 10.2.9.2 Retrospective analysis, s.e. for F-shrinkage is 0.75

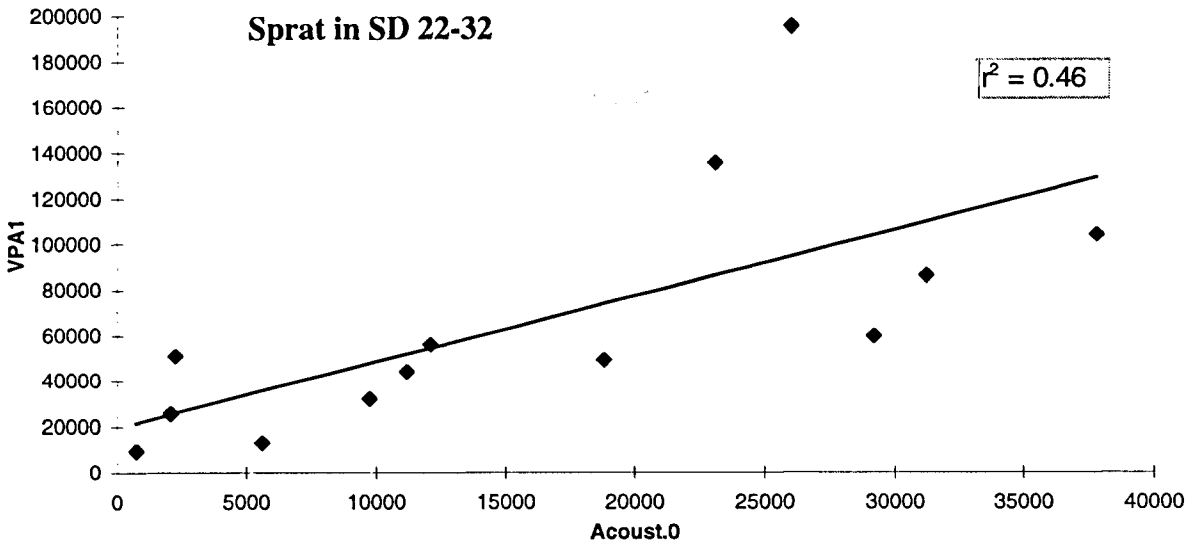


Figure 10.2.10.1 **SPRAT in SD 22-32.**
Recruitment estimates from VPA vs.
recruitment estimates from acoustic survey

R=a*SSB/(b+SSB)

a	48072.6
b	54940.1
SSresiduals=	15.94
SE=	0.87

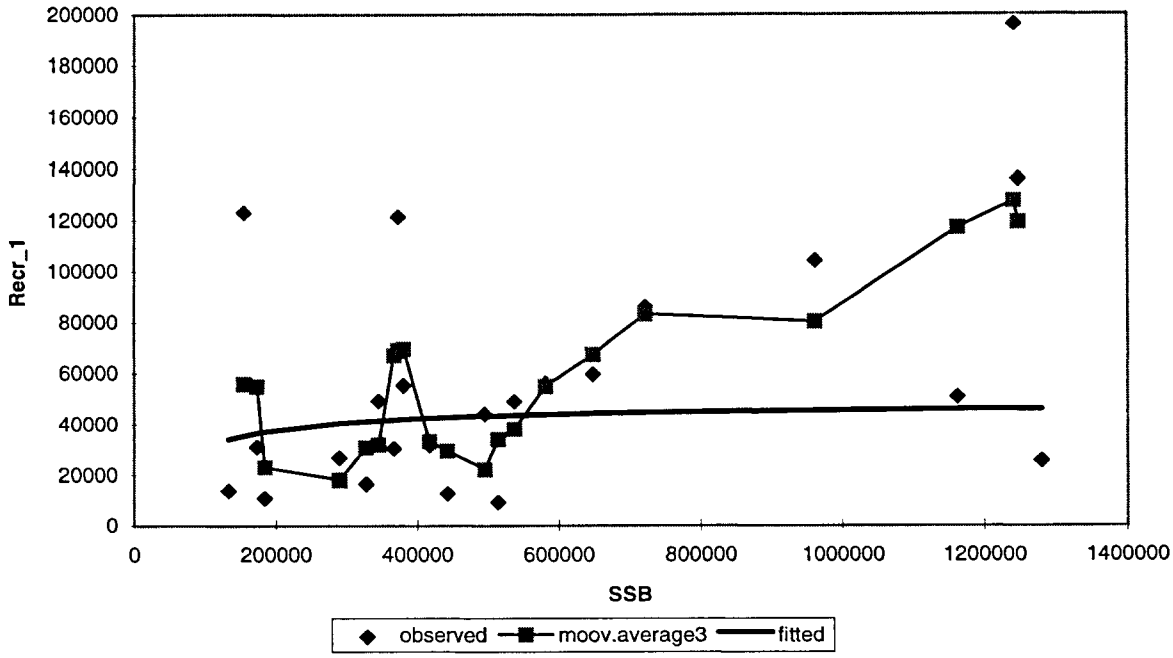


Figure 10.2.13.1 SPRAT in SD 22-32. Stock-recruitment relationship. (Beverton and Holt model and moowing average estimate(3 points), recruits at age 1).

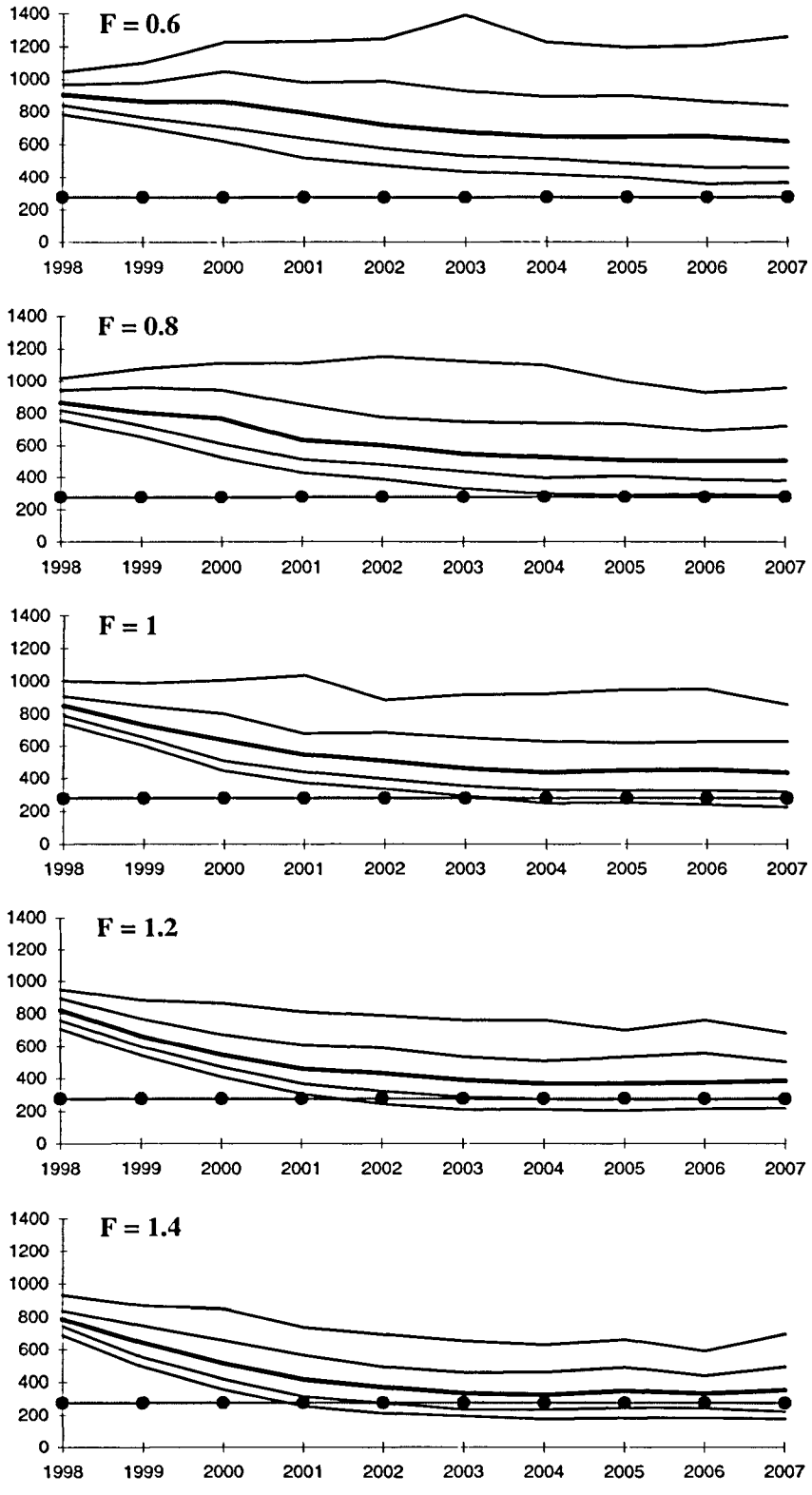


Figure 10.2.13.2 SPRAT in SD 22-32. Medium-term projections of SSB.
F=1 refers to status quo fishing mortality (=0.42).
Fishing pattern: 1995-1997mean.
Lines present 10, 25, 50, 75 and 90 percentile of biomass distribution.
Line with dots presents BPA.

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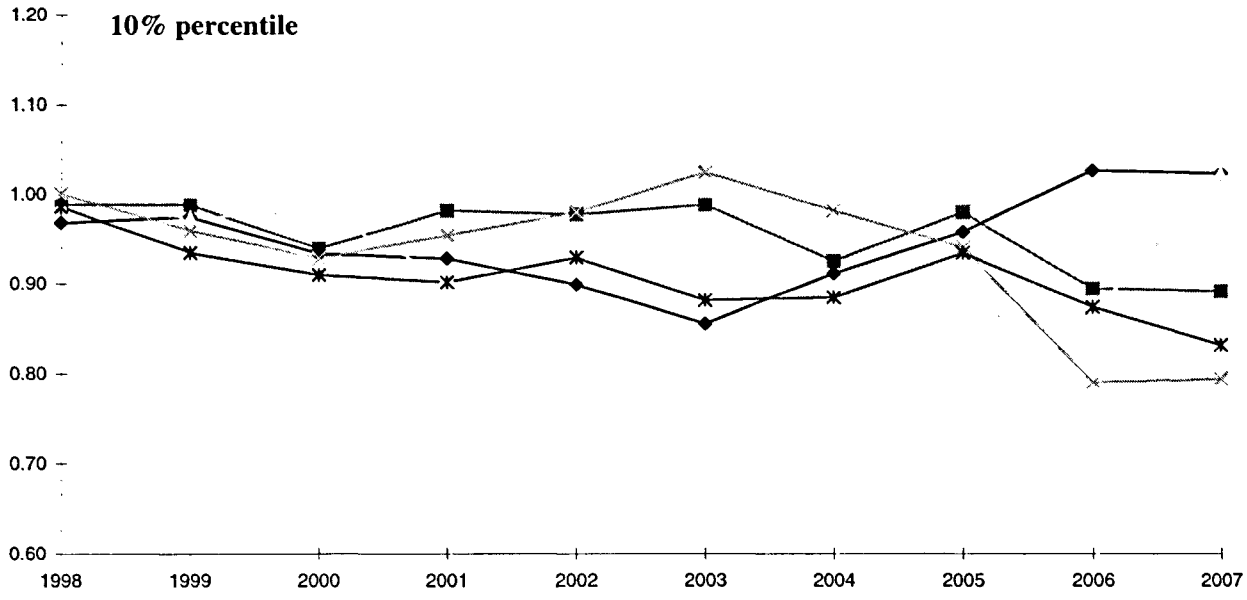

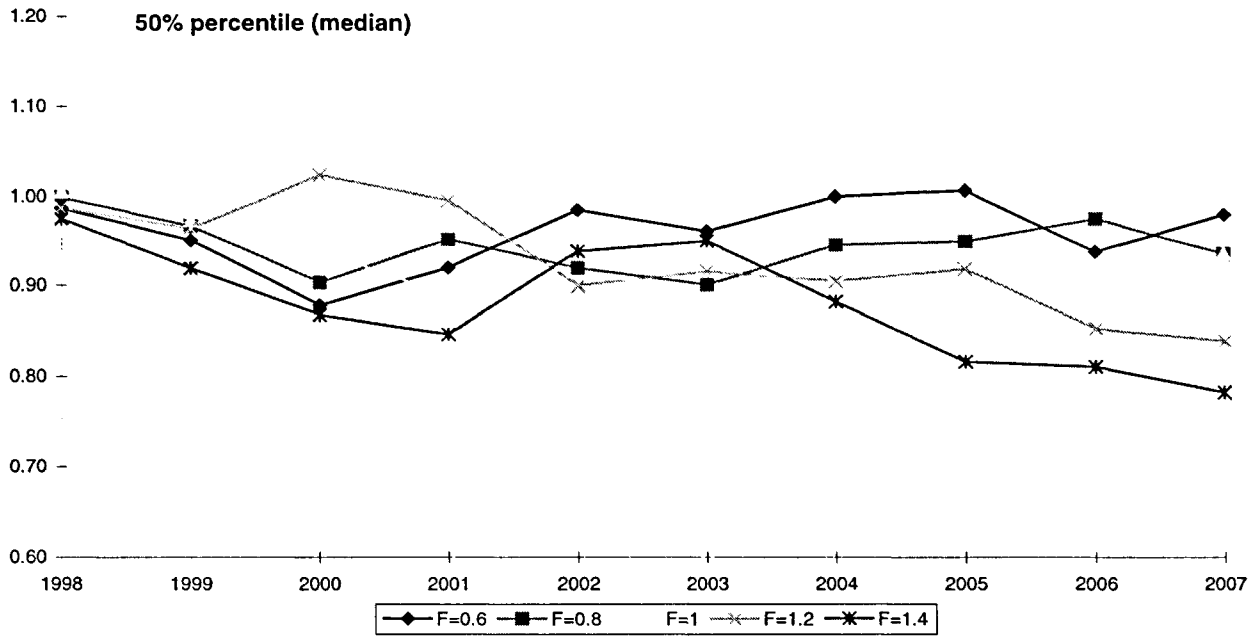

10% percentile

	slope	decrease after 10 years (%)
F=0.6	0.005	5
F=0.8	-0.009	-9
F=1	-0.008	-8
F=1.2	-0.017	-17
F=1.4	-0.011	-11

50% percentile (median)

	slope	decrease after 10 years (%)
F=0.6	0.004	4
F=0.8	-0.002	-2
F=1	-0.011	-11
F=1.2	-0.018	-18
F=1.4	-0.016	-16

Figure 10.2.13.3 **Ratio of the SSB resulting from the 1997 fishing pattern to the SSB resulting from the mean 1995-97 fishing pattern in medium-term projections. F=1 is the reference F.**

11 RECOMMENDATIONS

1. The Working Group recommends that in order to investigate the stock structure of Baltic herring and in respect to the assessment units, an *ad hoc* Study Group (Workshop) should be established (organised) or the Terms of Reference of Study Group on the Stock Structure of Baltic Spring Spawning Herring (SGSSBH) should be respectively expanded.

2. The Working Group recommends that the meeting of the Study Group on Baltic Acoustic data should take place well before the WGBFAS meeting to ensure the availability of their report for the assessments.

3. The Working Group recommends that an *ad hoc* Study Group should be established to compile and analyse data on discards in the Baltic. This Study Group should present the results in a such form that they are ready for use in the assessments.

4. The Working Group recommends that all available data on Baltic herring maturity ogives should be completed before the next Working Group meeting and an *ad hoc* Study Group should be established for that task.

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12.1 Working Papers and Documents

The following working papers and background documents were available at the meeting.

ICES CM 1997/Assess:12. Report of the Baltic Fisheries Assessment Working Group. ICES Headquarters 14-23 April 1997. 504 pp.

ICES CM 1997/J:4. Report of the Baltic International Fish Survey Working Group. Rostock, 9-13 June 1997. 52 pp.

ICES CM 1998/H:2. Report of the Baltic Herring Age-Reading Study Group. Riga, 23-27 February 1998. 86 pp.

ICES CM 1998/D:6. Report of the International Bottom Trawl Survey in the North Sea, Skagerrak and Kattegat in 1997: Quarter 1. 53 pp.

ICES CM 1998/Assess: . A draft Report of the Study Group on the Precautionary Approach to Fisheries Management . ICES Headquarters 3-6 February 1998. 38 pp.

ICES CM 1998/Assess:xxx . A draft Report of the Study Group on Management Strategies for Baltic Fish Stocks. Charlottenlund, 9-12 February 1998. 36 pp.

ICES CM 1998/ H: xxx. A draft Report of the Study Group on Baltic Acoustic Data. Gdynia 6-8 April 1998.

Tomkiewicz, J. Eriksson, M., Baranova, T., Feldman, V., Müller, H. 1997. Maturity ogives and sex ratios for Baltic cod: establishment of a database and time series. ICES CM 1997/CC:20. 21 p.

The Working Group discussed the following working papers:

Aro, E. 1998. Information on flounder stocks in the Baltic Main Basin according to trawl survey in March 1998. Working Document.

Grygiel, W. 1998. *Ad hoc* Workshop on Baltic Sprat Age Reading. Kaliningrad, 24-28 November 1997. Working Document No. 24 p.

Feldman, V., Gasjukov, P., Nazarov, N., Krasovskaja, N. 1998. The results of the tentative separate assessment of spring spawning coastal herring in Sub-division 26. Working Document No. 1. 25 p.

An experimantal assessment of a combined herring assessment for the Sub-divisions 29 and 32 was also presented to the Working Group as a Working Paper.