

**REPORT OF THE  
BALTIC FISHERIES ASSESSMENT WORKING GROUP**

ICES Headquarters, Copenhagen, Denmark  
16–25 April 1996

**PART 1**

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

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# 1 INTRODUCTION

## 1.1 List of Participants

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Horbowy, J. (Chairman)	Poland
Hovgaard, H.	Denmark
Kornilovs, G.	Latvia
Lundahl, L.	Sweden
Mosegaard, H.	Denmark
Netzel, J.	Poland
Neuenfeldt, S.	Denmark
Plikshs, M.	Latvia
Pönni, J.	Finland
Raid, T.	Estonia
Shvetsov, F.	Latvia
Sjöstrand, B.	Sweden
Tomkiewicz, J.	Denmark
Walther, Y.	Sweden

H. Sparholt, ICES Fisheries Assessment Scientist, participated in part of the meeting.

## 1.2 Terms of Reference

The Baltic Fisheries Assessment Working Group met at ICES Headquarters from 16–21 April 1996 (C.Res. 1995/2:13:7) to:

- a) assess the status of and provide catch options for 1996 and 1997 for the cod stocks in the Baltic (including Sub-Division 23);
- b) assess the status of and provide catch options for 1997 for the cod stock in the Kattegat and sole stocks in Division IIIa;
- c) assess the status of and provide catch options for 1997 for the stocks of sprat in Sub-Divisions 22–32;
- d) assess the status of and provide catch options for 1997 for the stocks of herring in Sub-Divisions 25–32, providing separate information for Gulf of Riga herring;
- e) report on changes in the fisheries for demersal and pelagic stocks in the Baltic Sea;
- f) provide information on the state of flatfish stocks in the Baltic;
- g) review any new information on maturity ogives;
- h) provide estimates of the minimum biologically acceptable level of spawning stock biomass (MBAL) for as many stocks as possible, with an explanation of the basis on which the estimates are obtained;
- i) prepare medium-term forecasts under different management scenarios, taking into account uncertainties in data and assessments and possible stock-recruitment relationships, and indicate the associated probability of the stocks falling or remaining below MBAL within a stated time period;
- j) evaluate the potential for multispecies and multi-annual catch options;
- k) identify and evaluate the interaction between cod, herring, sprat and salmon stocks in the Baltic Sea;

l) evaluate the effect of a ban on the pelagic trawl fishery for cod in April-May on the spawning stock biomass and yield of cod;

m) describe the fleets operating in the Baltic and the catches and by-catches in terms of species and size composition.

The above terms of reference are set up to provide the Advisory Committee on Fishery Management with the information required to respond to requests for advice from the North-East Atlantic Fisheries Commission, the International Baltic Sea Fishery Commission, the European Commission and the Helsinki Commission.

Since the above terms of reference were decided, ICES has received a request for advice from the Government of Finland. To address this request, the additional terms of reference were set up:

n) compile data on human consumption and industrial landings (including landings for fodder) of Baltic herring on a stock basis;

o) estimate partial fishing mortalities for the two types of landings and estimate the short- and medium-term effects of the present exploitation pattern on the Baltic herring stocks;

p) provide information on possible effects of the present Baltic herring fishery on other fish stocks managed by IBSFC.

### 1.3 Description and Results from Acoustic Surveys in 1995

As seen in Figure 1.3.1–1.3.3 Sub-divisions 22, 24 and 25–28 were sufficiently covered in 1995. In Sub-division 27 the survey was carried out by the R/V “Baltica”. The total coverage of this Sub-division was 4,343 square nautical miles in comparison with 5,791 square nautical miles in 1994. In 1995 “Monokristall” covered only the south part of Sub-division 29, which amounted to 1,756 square nautical miles in comparison with 4,943 in 1994.

The participating vessels, time periods and survey areas in the 1995 surveys are summarised in the text table below.

Country	Vessel	Period	Survey Area (Sub-division)
Germany/Denmark	Solea	5.10–20.10 1995	21S, 22, 23, 24
Poland	Baltica	2.10–19.10 1995	25, 26, 27
Russia/Latvia	Monokristall	2.10–30.10 1995	26, 28, 29

#### 1.3.1 The joint German-Danish survey

A joint German-Danish acoustic survey was carried out with R/V “Solea” from 5 to 10 October 1995. The survey covered the whole of Sub-divisions 22, 23 and 24. Because of bad weather conditions the planned coverage of the southern Kattegat (Division IIIa) was incomplete and therefore the estimation of abundance is not realistic in this area.

All investigations were performed at night in the last years.

The acoustic equipment used was an echo sounder EK500 connected to the Bergen-Integrator BI500. The transducer 38-26 was installed in a towed body. 48 trawl hauls were made with the midwater trawl “Krake” (10 mm bar length in the codend) for biological samples.

The SA values for each stratum were converted into fish numbers using the TS-length regressions:

Clupeids:  $TS = 20 \log L \text{ (cm)} - 71.2$

Gadoids:  $TS = 20 \log L \text{ (cm)} - 67.5$

The total number of fish was divided into species and age groups according to the species and age composition of the catches. The calculated stock size and mean weight of herring and sprat per age group are given in Tables 1.3.1–1.3.4. Survey statistics are given in Table 1.3.5.

### 1.3.2 The Polish survey

The Polish acoustic survey was carried out by R/V "Baltica" in Sub-divisions 25, 26 and 27 from 2–19 October 1995.

The measurements were carried out both during day and night. The acoustic equipment used on board R/V "Baltica" was EK400 echo sounder and QD echo integrator. Echo deflection, SV values and layers thickness were transferred into PC and stored on hard disk in time intervals corresponding to a distance of 1 nm. Usually the working speed of the vessel was 8–10 knots depending on weather conditions and wave interactions. Calibration of the acoustic system was conducted in 1994 in the vicinity of the Swedish Island of Hogon.

Fishing was performed only during daytime. R/V "Baltica" used the same fishing gear as R/V "Profesor Siedlecki" pelagic trawl WP 53/64, with 11 mm mesh bar. The speed was 3.6–4.4 knots, and haul duration 30 to 60 minutes.

Statistical rectangles were used as strata.

Total number of fish was estimated from total biomass and mean weight of individual of specimens. Total biomass was calculated using Orłowski's (1993) method. TS for 1 kg herring and sprat for each rectangle were as follows:

$$TS \text{ 1 kg [dB]} = 10 \text{ LOG}(\text{MeanLength}^2[\text{cm}] / \text{MeanWeight}[\text{g}]) - 41.2$$

Total survey area was 20,386 Nm<sup>2</sup> and the integrated cruise track 1,788 Nm. Of the total mileage 1,450 ESDU was chosen for analysis (Orłowski *et al.* 1993).

The calculated stock size of herring and sprat in number per age group is given in Tables 1.3.6 and 1.3.7 for each rectangle and Sub-division. ALKs were made for each rectangle.

Estimated mean weight of herring and sprat is given in Table 1.3.8 and 1.3.9.

Survey statistics for rectangles are given in Table 1.3.10.

### 1.3.3 The joint Russian-Latvian survey

Russian and Latvian scientists carried out an acoustic survey on board R/V "Monokristall" in Sub-divisions 26, 28 and 29S (partly) from 2.10–30.10 1995.

The acoustic equipment used was a 50 kHz FQ-70 FURUNO echo sounder/echo integrator connected to PC 9801RX.NEC. The integration covered 18,620 square nautical miles and the integrated cruise track 1,350 nm. The equipment was calibrated near Pionersk on the depth 41 m against a standard copper sphere" Simrad" type 819-072285, diameter 45 mm (TS = -36.2 dB on the frequency 50 kHz). The investigations were performed only during daytime.

The backscattered energy was allocated to species on the basis of the catch and its length composition, using the following target strength regression for clupeids:

$$TS_{ind} = 20.0 \log L \text{ (cm)} - 71.2 \text{ dB}$$

A midwater trawl (33 C type) was used as a fishing gear. The parameters of the trawl are as follows:

- vertical opening 18–20 m
- horizontal opening 18–22 m
- bar length in the codend 6.5 mm

The estimated number of herring and sprat per age group is given in Tables 1.3.11 and 1.3.12. Estimated mean weights at age are given in Tables 1.3.13 and 1.3.14. Survey statistics for rectangles are given in Table 1.3.15.

### 1.3.4 Rectangles which were covered by two vessels

The rectangles 3864, 3964, 4063 and 3963 were covered by R/V "Baltica" and R/V "Monokristall". Rectangles 3864 and 3964 were covered only partly by R/V "Baltica", but R/V "Monokristall" has covered more completely. Therefore it was decided to use the results of R/V "Monokristall".

Rectangles 3963 and 4063 were covered completely by both vessels. Nevertheless, R/V "Baltica" had four trawls there, but R/V "Monokristall" had seven. The abundance of sprat and herring as well as the age compositions differ insignificantly according to these surveys (Figures 1.3.4 and 1.3.5). Only the abundances of 0-group sprat differ significantly. These differences could be explained by the migrations of young sprat. R/V "Baltica" carried out her research on 5–6 October, while R/V "Monokristall" did it on 23–25 October. This time gap was the reason to decide using the results of R/V "Monokristall".

The rectangle 3859 was covered by R/Vs "Solea" and "Baltica", but R/V "Solea" covered it completely - 1,036 square nautical miles as opposed to R/V "Baltica" which covered 839 square nautical miles. Therefore the results of R/V "Solea" were used for estimating the numbers of fish in this rectangle.

### **1.3.5 Application of acoustic results for the analytical assessment**

The results of different vessels were compiled, discussed and presented to the Working Group by Latvian and Russian specialists.

It was concluded that the results of the 1995 hydroacoustic survey in Sub-divisions 26 and 28 are representative for use in VPA tuning for sprat stock in Sub-divisions 22–32.

In compilation of the results of the 1994 surveys in 1995, the number of sprat was overestimated by 6% due to technical mistake. Therefore the acoustic estimates of sprat stock size for 1994 were corrected.

### **1.4 Assessment Methods and Software Used**

The main tool for the assessment of the state of stocks was VPA tuned with the XSA method. For most of the stocks the ICA was also run and the results of the two models were compared. In addition, the fishing mortalities of the cod stocks, for which significant under-reporting of the landings has occurred in the latest years, were estimated using a catch-independent method based on survey data (Cook, 1995). The calculations were performed using the RCCPUE5 program developed by R. Cook. An attempt to estimate MBAL was based on the Myers *et al.* (1994) approach. The procedure recommended by the authors consists in fitting a stock-recruitment relationship and defining the MBAL value as the SSB producing 50% of maximum recruitment from the fitted relationship. Next, this value may be verified by inspecting the slopes of the stock-recruitment relationship on the log scale for the SSB values lower than MBAL and for the values higher than MBAL. When fitting a stock-recruitment model log-normal errors were assumed. For the medium-term considerations two approaches were attempted. For the cod stock in Sub-division 25–32 the EXCEL spreadsheet with @RISK add-in module developed by H. Sparholt (see Sub-section 1.5) was used. For some other stocks the TBASIC program developed by J. Horbowy was applied. In this approach uncertainties in survivors estimates and in the stock-recruitment model were taken into account. Weights at age and natural mortalities were kept constant.

### **1.5 Working Papers**

A Working Group Doc. was presented by Feldman, Nazarov and Zezera on "Salinity/oxygen regime of water in the South-Eastern Baltic proper in 1992–1996 and its impact on cod spawning conditions and distribution". Observation shows that the thickness of layer optimal to cod spawning in the Gdansk Deep decreased from its maximum in April 1994 to its minimum in March–May 1995 and March 1996. In the Southern Gotland Deep maximum thickness of optimal spawning layer was only 5–7 m and by March 1996 totally disappeared. Unfavourable conditions occurred in 1995 and caused low abundance of the 1995 year class.

Kornilovs presented a Working Group Doc. on "The comparison of Baltic herring age between age readings from scales and otoliths". The age of Baltic herring previously estimated from the scales was determined by two specialists from LatFRI. The comparison of the results by the two reading methods shows that for the age groups 2–6 they are rather similar. The differences increase with the age of the herring reaching 1–3 years for the oldest age groups. The ageing from the scales gives smaller ages for the oldest age groups.

A Working Group Doc. by Sparholt, Munch-Petersen and Tomkiewicz on "A new way of compiling the international bottom trawl survey data for the use in the central Baltic cod stock assessment" was presented to the Group. The paper was a refinement of the ACFM Working Doc. considered at the May meeting of ACFM in 1995. The basic idea was to make a robust survey data index which could be used in the tuning of the VPA, based on depth and sub-division stratified arithmetic mean catch rates. The catch rates were corrected for differences in fishing power by the various vessels participating in the survey. Both an SSB index and age disaggregated indices were calculated. They both correlated

well with VPA values. Especially the SSB index gave a good correlation with  $R^2$  of 0.95 and a slope = 0.81. However the S.E. of slope was 0.18 and as this is the only tuning data for the VPA now that the commercial fishery CPUE series are biased due to misreporting we are lacking at least something like one more survey of similar precision in order to bring the reliability of this cod stock assessment in line with similar cod stock assessments in other areas (e.g. the North Sea, the Barents Sea, and the Iceland area). This other survey should preferably be conducted in the 4th quarter of the year in order to avoid the spawning period which can be as late as August/September. The SSB index was not very sensitive to the estimated fishing power. Assuming equal fishing power gave actually a slightly better correlation to the VPA (but probably a biased picture of the changes in distribution by sub-division over the years). The index was more sensitive to the depth stratification, which seen to be important to include. Fishing power regarding the catch of age 2 was not estimated but assumed to be similar to that of SSB and this need to be analysed further.

A Working Group Doc was presented by Sparholt about a medium-term projection program for cod in Sub-divisions 25-32 which could take into account cannibalism and effects on recruitment from cod SSB, spawning volume and sprat predation on cod eggs (sprat 25, 26, and 28 SSB). The program was made in @Risk Excel Add-in. Uncertainties in initial stock numbers and recruitment were included but not in biological parameters like weight-at-age. Several management strategies could be analysed such as: 1) status quo F, 2) scaled F, 3) MBAL determined closure of the fishery, 4) and SSB target strategy, where the annual catch is the amount that leaves an SSB surviving equal to a target size.

Table 1.3.1 Estimated number (millions) of herring. R/V "Solea", October 1995.

SD	Strata	Total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8	age 9	age 10+
21	4156	223	215	8	0	0	0	0	0	0	0	0	0
	4256	351	198	145	4	2	1	0	0	1	0	0	0
22	22a	260	259	1	0	0	0	0	0	0	0	0	0
	22b	704	571	120	8	1	2	1	1	0	0	0	0
	22c	1380	1134	174	23	14	21	8	6	0	0	0	0
	22d	1392	1050	239	36	15	25	14	13	0	0	0	0
23	4057	224	23	11	21	43	48	23	21	19	8	5	2
	4157	97	43	21	17	13	3	0	0	0	0	0	0
24	3757	120	65	38	5	5	3	3	1	0	0	0	0
	3857	1228	833	203	39	49	54	29	15	2	4	0	0
	3858	788	311	147	73	75	79	67	28	6	2	0	0
	3859	126	36	37	14	12	11	11	4	1	0	0	0
	3957	486	348	66	15	17	18	14	7	1	0	0	0
	3958	680	67	201	84	98	100	86	32	8	4	0	0
	3959	141	25	57	18	12	11	13	5	0	0	0	0

Table 1.3.2 Estimated number (millions) of sprat. R/V "Solea", October 1995.

SD	Strata	Total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
21	4156	3	0	1	2	0	0	0	0	0	0
	4256	261	6	94	114	36	10	1	0	0	0
22	22a	27	25	2	0	0	0	0	0	0	0
	22b	74	20	43	7	1	0	1	2	0	0
	22c	902	539	228	62	9	16	15	28	2	3
	22d	1471	530	459	150	51	100	84	71	10	16
23	4057	11	2	2	2	2	2	1	0	0	0
	4157	16	1	4	4	3	3	1	0	0	0
24	3757	546	129	163	82	25	83	29	27	4	4
	3857	1090	380	425	178	28	46	17	11	4	1
	3858	4635	2122	1349	779	88	162	79	37	14	5
	3859	1132	350	404	227	33	65	29	16	6	2
	3957	350	82	122	75	15	30	14	8	3	1
	3958	533	22	156	118	43	106	47	28	11	2
	3959	2313	370	976	539	92	185	79	49	18	5



∞ Table 1.3.3 Estimated mean weight (grammes) of herring. R/V "Solea", October 1995.

SD	Strata	Total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8	age 9	age 10+
21	4156	16.9	16.3	32.5				0.0	0.0	0.0	0.0	0.0	0.0
	4256	26.3	17.5	37.2	47.5	63.7	51.0	0.0	0.0	1.0	0.0	0.0	0.0
22	22a	11.8	11.7	27.4									
	22b	17.3	13.3	32.1	39.7	79.1	86.0	71.6	60.7				
	22c	16.6	10.7	33.6	49.9	85.0	77.3	72.3	69.2				
	22d	18.5	10.5	34.5	47.0	82.9	73.7	67.6	62.4				
23	4057	156.8	11.3	64.1	108.4	128.4	177.2	206.7	222.0	236.1	254.5	263.0	303.5
	4157	43.1	12.5	50.7	70.1	85.8	91.6	149.8	150.1	160.2	179.3		
24	3757	22.9	10.0	32.2	52.5	48.2	55.5	48.8	58.7				
	3857	26.8	9.1	32.6	63.4	89.7	117.3	111.2	89.7	150.0	150.0		
	3858	46.9	8.1	33.6	64.5	80.4	104.4	98.4	85.8	198.7	150.0		
	3859	44.4	12.9	32.8	63.2	68.0	81.4	74.7	72.3	215.3	162.2		
	3957	26.5	11.6	33.1	66.3	78.7	112.5	102.8	99.8	150.0	150.0		
	3958	65.2	14.1	33.8	62.2	81.5	105.3	93.9	88.7	166.7	150.0		
	3959	42.6	11.5	31.9	62.0	64.6	74.0	65.3	68.3	150.0	150.0		

Table 1.3.4 Estimated mean weight (grammes) of sprat. R/V "Solea", October 1995.

SD	Strata	Total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
21	4156	11.3	11.4	10.5	11.7	12.4	11.6				
	4256	12.0	11.1	10.8	12.3	14.1	13.2	19.3			
22	22a	5.6	5.3	9.2	13.3				13.9		
	22b	11.3	6.4	12.7	14.1	18.5	18.6	18.6	14.2	18.6	20.9
	22c	8.9	4.8	14.0	15.0	19.5	20.8	20.2	14.7	20.5	24.1
	22d	12.5	4.9	14.7	15.5	20.0	21.9	21.0	16.1	21.0	24.7
23	4057	14.2	4.9	13.0	14.4	16.5	19.0	20.4	22.4	17.5	
	4157	14.6	4.6	13.5	14.0	15.9	17.6	19.2	21.6	17.3	
24	3757	13.0	4.9	11.6	13.9	16.8	20.4	20.0	21.9	18.0	23.5
	3857	10.0	5.2	10.7	13.4	16.6	18.6	18.6	19.6	17.8	20.5
	3858	8.9	4.2	11.7	12.3	17.1	18.7	18.6	18.8	18.4	17.8
	3859	10.7	4.2	12.1	12.8	17.1	19.1	18.8	19.7	18.3	20.1
	3957	12.0	4.6	12.4	13.3	16.9	18.9	19.0	19.5	18.4	20.7
	3958	15.3	4.3	12.9	13.1	17.4	19.4	18.9	19.7	18.5	18.7
	3959	12.3	4.5	12.2	12.9	17.0	19.0	18.7	19.7	18.3	19.9

Table 1.3.5 Survey statistics. R/V "Solea", October 1995.

SD	ICES rect.	Area in nm <sup>2</sup>	Mean Sa m <sup>2</sup> /nm <sup>2</sup>	N (nm)	Ts (Sigma)	Total abundance in million	Species composition (%)		Abundance in million	
							herring	sprat	herring	sprat
21	4156	711	59	99	1.802	233	95.4	1.5	222	3
	4256	457	295	49	1.857	719	48.8	36.2	351	260
22	22a	1297	58	114	1.065	707	36.9	3.9	260	28
	22b	1694	120	92	1.065	1919	36.9	3.9	704	75
	22c	1086	329	176	1.467	2435	56.6	37.1	1378	903
	22d	1102	443	98	1.688	2892	48.1	50.9	1392	1471
23	4057	195	948	90	7.73	239	92.5	4.5	221	11
	4157	56	650	29	3.085	118	81.7	13.7	96	16
24	3757	205	541	15	1.658	669	17.9	81.6	120	546
	3857	853	503	67	1.837	2335	52.6	46.8	1229	1093
	3858	882	1195	101	1.864	5654	13.9	82	787	4634
	3859	1036	208	30	1.673	1288	9.8	88	127	1134
	3957	438	407	45	2.093	652	57.3	41.2	488	351
	3958	780	505	72	3.088	1276	53.2	41.7	679	532
	3959	529	710	56	1.529	2456	5.7	94.1	141	2312

**Table 1.3.6** Estimated number (million) of herring. R/V "Baltica", October 1995.

SD	Strata	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8	age 9	age 10+
24.00	3859.00	155.59	15.71	27.70	7.00	26.14	28.32	20.69	19.60	9.18	1.24	0.00	0.00
25.00	3760.00	46.33	40.35	5.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3860.00	540.70	167.62	96.25	35.15	71.91	65.97	41.63	41.09	15.68	5.41	0.00	0.00
	3861.00	629.02	23.90	53.47	62.27	71.71	140.90	142.79	81.77	50.32	1.26	0.63	0.00
	3862.00	160.24	13.46	35.09	8.17	18.27	24.20	21.79	28.68	7.53	1.92	1.12	0.00
	3960.00	398.35	54.57	47.40	40.63	52.58	76.08	56.17	60.15	7.97	2.79	0.00	0.00
	3961.00	647.30	23.97	68.03	51.19	71.27	143.20	154.86	93.31	35.64	5.18	0.65	0.00
	3962.00	670.48	56.32	146.84	34.19	76.44	101.24	91.19	120.02	31.51	8.05	4.69	0.00
	4059.00	137.27	15.63	6.17	19.88	20.71	41.00	15.08	13.44	5.35	0.00	0.00	0.00
	4060.00	395.62	42.68	46.24	52.57	52.57	86.16	52.57	46.24	15.02	0.00	0.00	1.58
	4061.00	251.44	3.52	22.61	11.05	30.90	49.99	70.08	34.66	21.35	6.78	0.50	0.00
	4062.00	214.25	0.43	30.39	21.19	36.39	61.43	28.04	31.25	3.42	0.43	0.86	0.43
	4162.00	480.28	1.44	119.11	18.25	61.48	128.23	106.62	21.13	14.89	4.32	2.40	2.40
26.00	3763.00	26.81	12.73	11.42	1.37	0.72	0.19	0.19	0.19	0.00	0.00	0.00	0.00
	3764.00	36.32	7.52	24.01	0.94	2.76	0.73	0.18	0.18	0.00	0.00	0.00	0.00
	3863.00	489.81	108.25	86.70	45.06	25.47	75.43	56.33	53.88	25.47	10.29	2.94	0.00
	3864.00	1543.12	118.70	490.22	64.75	232.78	246.65	223.53	84.79	41.62	37.00	0.00	3.08
	3963.00	1195.84	0.00	26.31	62.18	95.67	459.20	261.89	224.82	31.09	23.92	3.59	7.18
	3964.00	2037.78	156.75	647.37	85.50	307.40	325.72	295.18	111.97	54.97	48.86	0.00	4.07
	4063.00	484.61	0.00	32.95	50.88	122.61	124.54	92.56	39.74	21.32	0.00	0.00	0.00
27.00	4262.00	337.09	0.67	195.17	22.25	19.55	30.68	35.06	24.61	5.06	3.03	0.00	1.01
	4362.00	163.10	0.00	111.77	2.44	14.01	19.88	11.41	2.61	0.33	0.33	0.33	0.00
	4462.00	1478.59	23.63	313.15	76.81	131.46	293.95	342.69	101.92	101.92	45.79	23.63	23.63
	4562.00	1006.58	32.18	226.25	126.70	211.17	201.11	120.67	38.21	29.16	10.06	9.05	2.01
	4563.00	1580.78	45.84	526.40	194.44	374.64	237.12	180.21	6.32	15.81	0.00	0.00	0.00

Table 1.3.7 Estimated number (million) of sprat. R/V "Baltica", October 1995.

SD	Strata	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
24	3859	24	0	6	1	6	5	4	1	1	0
25	3760	2584	2361	168	18	0	18	18	0	0	0
	3860	2164	818	959	39	100	76	93	6	76	0
	3861	164	1	89	6	24	30	9	0	1	3
	3862	650	166	253	42	85	74	19	7	3	0
	3960	1317	21	560	51	292	232	119	16	24	3
	3961	783	11	390	35	132	135	63	4	5	7
	3962	2633	674	1027	169	345	300	79	29	11	0
	4059	35	3	11	2	2	7	9	3	0	0
	4060	951	13	357	55	29	169	223	103	0	3
	4061	1785	11	841	150	259	294	202	20	0	7
	4062	2715	54	1165	423	624	320	114	5	0	5
	4162	4129	29	1358	260	1243	756	429	0	0	54
26	3763	169	0	76	24	54	8	4	2	1	0
	3764	232	2	142	33	41	13	1	0	0	0
	3863	1390	0	727	218	361	46	21	10	7	0
	3864	4908	29	2910	633	888	383	39	20	5	5
	3963	1077	0	369	189	336	127	41	14	0	0
	3964	559	5	301	89	106	47	9	1	0	0
	4063	2281	5	953	379	541	285	112	0	5	5
27	4262	3320	20	1212	156	707	757	259	50	37	126
	4362	7891	0	3867	805	1484	979	608	126	39	0
	4462	7552	1473	5136	174	438	219	113	0	0	0
	4562	2449	522	818	125	451	211	213	69	27	17
	4563	2354	0	725	127	588	464	327	92	9	24

Table 1.3.8 Estimated mean weight (grammes) of herring. R/V "Baltica", October 1995.

SD	Strata	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8	age 9	age 10+
24	3859	38.5	14.3	26.2	45	46.1	47.1	38.1	46.8	42.3	73	0	0
25	3760	14.9	13.5	24.6	0	0	0	0	0	0	0	0	0
	3860	35.6	13.7	23.8	41.3	50.4	50.4	56.4	62.1	59.8	77.5	0	0
	3861	51.3	13.3	23	37.5	42.8	60.5	57.3	68.8	55.1	98	98	0
	3862	47.8	15.3	27	35	41.7	62.2	60	61.2	76.4	111	91.3	0
	3960	45.2	12.5	23.2	41.1	46.4	57	55.7	62.4	77.6	98	0	0
	3961	48.1	13.4	24.1	39.7	44.4	52.9	53.5	59.5	58.8	79.3	95.5	0
	3962	47.9	15.3	27	35	41.7	62.6	60	61.2	76.4	111	91.3	0
	4059	39.2	13.9	23.5	41.4	44.2	39.2	47.1	49.2	55.5	0	0	0
	4060	38.5	14.3	25.7	40.2	44.7	41	44.9	47.8	55.6	0	0	0
	4061	51.2	15.7	24.3	42.1	42.5	49	56.5	64.9	57.1	83	93	0
	4062	46.9	12.5	19.7	35.1	39	50.9	63.7	61.7	89	75	50	104
	4162	35.2	8.8	15.9	27.6	35.6	37.5	41.4	63.4	64.2	83.9	83.8	96.4
26	3763	15.5	9	17.4	37.5	34.8	33.3	40.8	68.5	0	0	0	0
	3764	17.9	9.5	18.2	30.2	29	29.6	35	35	0	0	0	0
	3863	37.5	9.4	17.7	36.3	33.6	54.6	51.8	64.4	68.5	75.8	102.5	0
	3864	34.7	10.2	18.7	30.3	38.8	45.7	42.6	53.8	79.1	82.9	0	109
	3963	46.8	0	17.8	43	29.9	45.5	43.8	53.2	92.3	70.8	92.5	102
	3964	34.7	10.2	18.7	30.3	38.8	45.7	42.6	53.8	79.1	82.9	0	109
	4063	36.6	0	17.4	27.5	34.9	42.6	39.6	41.2	41.3	0	0	0
27	4262	25.9	4	14.4	23.7	31.4	36.6	46.7	54	74.1	72	0	83
	4362	19.4	0	13.5	19.8	24	34	33.1	55.1	54	96	81	0
	4462	29.1	6	13.9	21.2	20.6	26.9	32.8	44.4	40.7	60	64.3	89
	4562	25.0	4.3	13.4	20.7	27.4	28	32.7	41.2	43.1	56.9	53.1	61
	4563	20.5	3.7	12.9	20.9	21.9	30.3	29.9	38.3	27.5	0	0	0

Table 1.3.9 Estimated mean weight (grammes) of sprat. R/V "Baltica", October 1995.

SD	Strata	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
24	3859	16.3	4.5	11.5	11.6	16.3	18.8	19.4	19.6	21.7	22
25	3760	4.2	3.4	10.6	10	0	18	20	0	0	0
	3860	9.6	3.5	11.6	10	17.6	21	22.5	20	20.8	0
	3861	14.8	6	12.4	18.2	19.1	20	21.3	24	22	19.1
	3862	11.3	4.5	11	15	15.6	17.4	18.7	17.8	21	0
	3960	14.7	4.5	11.5	11.6	16.3	18.8	19.4	19.6	21.7	22
	3961	13.8	4.8	11.5	14.6	16.9	18.3	18.2	20.3	22.2	19.5
	3962	11.7	4.5	11	15	15.6	17.4	18.7	17.8	21	0
	4059	14.0	6.5	11.7	13.4	14.3	15.6	17.3	17.6	0	0
	4060	14.6	6.5	11.7	13.4	14.3	17	17.5	19	0	24
	4061	13.2	3	10.6	13.3	14.5	15.4	16.4	18.6	0	17.9
	4062	13.2	4.4	10.8	13.2	16.2	18.1	19.1	30	0	30
	4162	11.7	3.9	8.4	10.6	12.9	13.8	15.5	0	0	16.7
26	3763	10.3	0	8.3	10.4	12.2	14.5	15.2	16.3	13.3	0
	3764	9.9	8.8	8.3	12.3	13.1	14.6	15.5	16.7	15	0
	3863	10.5	0	8.7	10.9	12.4	14.5	15.4	16.3	13.3	0
	3864	10.2	8.8	8.6	12.7	13.2	14.4	15.5	15.8	15	15
	3963	14.2	0	12.7	12.4	15.5	17.6	18.4	27.5	0	0
	3964	11.0	8.8	8.6	12.7	13.2	14.4	15.5	15.8	15	15
	4063	11.6	2	8.1	11.4	14.5	18	20	0	25	26
27	4262	11.3	3.7	8.5	11.6	12.3	13.3	14.8	15.3	14.3	16.7
	4362	10.9	0	8.1	11	13.6	15.4	15.1	17.5	19	0
	4462	7.4	3	8	10.6	11.6	12.3	12.3	0	0	0
	4562	9.2	2.9	7.8	10.7	11.8	13.3	14.3	14.6	18.4	17.9
	4563	11.2	0	8	10.4	11.2	13.6	14.7	16	21	18

Table 1.3.10 Survey statistics. R/V "Baltica", October 1995.

SD	Strata	Area Nm <sup>2</sup>	Sa m <sup>2</sup> /Nm <sup>2</sup>	IS1kgHER dB	IS1kgSPR dB	%HER	%SPR	ESDU no of 4Nm
24	3859	838.5	64	-31.90	-30.10	93.9	6.1	6
25	3760	372.3	512	-30.40	-28.70	5.7	88.8	12
	3860	1035.8	419	-31.80	-30.20	41.4	44.9	31
	3861	789.4	414	-31.70	-30.80	79.5	6.0	33
	3862	371.4	387	-32.10	-30.20	48.6	46.6	8
	3960	976.9	394	-31.90	-30.80	37.5	40.3	29
	3961	1026.4	398	-31.80	-30.70	63.0	21.9	35
	3962	1032.2	583	-32.10	-30.60	48.6	46.6	39
	4059	579.2	88	-31.80	-30.50	91.6	8.4	4
	4060	1012.5	288	-31.70	-30.40	51.2	46.6	21
	4061	1019.3	371	-31.80	-30.40	34.8	63.7	27
	4062	961.4	525	-31.90	-30.30	21.7	77.5	37
	4162	989.5	756	-31.50	-30.10	25.9	74.1	13
26	3763	49.1	536	-30.60	-30.00	19.1	80.0	3
	3764	138	261	-30.60	-30.00	22.0	77.6	7
	3863	541.4	609	-32.00	-30.20	52.5	41.7	16
	3864	883.4	1236	-31.60	-30.00	50.2	47.0	16
	3963	1032.2	604	-31.90	-30.50	78.4	21.4	30
	3964	1032.2	614	-32.00	-30.40	91.7	8.0	5
	4063	1019.3	475	-31.40	-30.10	40.1	59.9	17
27	4262	992.1	567	-31.20	-29.90	18.8	80.9	11
	4362	881	1291	-30.60	-29.90	3.6	96.5	11
	4462	966.8	1110	-31.30	-30.20	38.7	50.3	15
	4562	892.2	642	-30.70	-29.80	52.5	47.0	7
	4563	953.5	733	-30.60	-29.80	55.2	44.8	13



Table 1.3.11 Estimated number (millions) of herring. R/V "Monokristall", October 1995.

SD	Strata	Total	age0	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10+
26	3864	222	-	11	21	24	51	61	28	16	10	1	1
	3963	956	1	27	66	106	256	250	158	64	18	10	-
	3964	455	1	22	21	47	101	114	93	38	14	3	-
	3965	800	375	274	17	32	44	35	13	4	1	3	1
	4063	408	-	4	5	25	82	104	110	45	22	8	3
	4064	1500	-	31	72	173	352	380	288	137	54	6	7
	4065	637	161	106	40	71	103	84	45	13	7	6	2
	4163	382	-	20	13	68	90	73	63	35	16	3	1
	4164	323	-	12	7	38	62	63	65	46	10	9	9
	4165	698	116	160	20	92	100	76	76	40	8	-	8
28	4263	429	0	16	9	61	75	138	70	43	8	3	5
	4264	428	0	5	12	67	87	115	103	19	13	3	4
	4265	630	21	38	21	116	147	122	100	36	14	5	11
	4364	322	0	5	8	52	58	71	79	40	3	2	3
	4365	277	1	17	15	51	55	72	39	14	9	2	2
	4366	31	0	6	3	7	6	5	3	0	0	1	0
	4464	140	0	4	4	24	43	33	20	9	3	0	0
	4465	969	0	58	86	127	187	236	141	73	49	7	6
	4466	319	0	93	69	59	50	35	5	6	0	1	2
	4564	308	0	3	30	78	75	59	30	22	11	0	0
	4565	1130	0	25	107	260	293	234	106	75	28	1	1
	4566	812	0	62	138	228	190	120	51	14	2	0	7
29	4665	690	-	15	65	158	179	143	65	46	17	1	0
	4666	1252	-	96	212	352	294	185	79	21	2	1	9

Table 1.3.12 Estimated number (millions) of sprat. R/V "Monokristall", October 1995.

SD	Strata	Total	age0	age1	age2	age3	age4	age5	age6	age7	age8+
26	3864	4015	1116	2372	157	262	94	10	2	1	0
	3963	1144	353	258	134	241	96	46	11	3	0
	3964	4950	541	2717	348	709	385	155	57	38	0
	3965	6810	4057	1352	104	837	259	103	98	0	0
	4063	3042	517	435	158	680	482	438	270	42	19
	4064	5742	739	3240	374	795	352	213	31	0	0
	4065	10108	4715	4044	188	814	258	67	22	0	0
	4163	5475	1030	2200	185	443	745	488	256	55	74
	4164	7236	640	3781	611	1255	684	147	71	47	0
	4165	9647	4647	4656	115	164	41	11	3	9	1
28	4263	3202	0	786	156	592	595	458	455	96	64
	4264	12669	13	5524	781	2131	1849	1057	801	391	123
	4265	15067	2144	9037	576	1979	797	310	93	70	61
	4364	5328	25	2256	392	1420	860	155	101	72	46
	4365	13850	1367	8036	959	1932	1098	284	172	0	0
	4366	1836	46	1325	72	215	72	0	107	0	0
	4464	2798	0	1459	173	526	294	158	28	81	80
	4465	12857	410	6872	1017	2884	963	404	163	137	7
	4466	10044	591	7269	545	1059	383	105	92	0	0
	4564	699	3	307	16	170	81	65	33	16	8
	4565	10250	7	5953	482	2216	762	502	221	68	39
	4566	8798	118	5509	325	1951	504	173	183	36	0
29	4665	6210	13	4997	286	530	249	100	30	3	0
	4666	9456	18	7612	435	807	380	153	46	5	0

Table 1.3.13 Estimated mean weight (grammes) of herring. R/V "Monokristall", October 1995.

SD	Strata	Total	age0	age1	age2	age3	age4	age5	age6	age7	age8	age9	age10+
26	3864	41.48	-	23.1	35.1	39.4	43.1	42.4	50.7	60.2	59.2	65.0	100.0
	3963	43.80	12.7	27.0	36.9	35.6	45.9	43.4	53.0	58.4	69.7	89.6	-
	3964	45.28	13.0	17.5	34.0	38.9	43.0	45.5	49.4	66.5	59.1	104.2	-
	3965	17.10	8.2	15.9	28.9	32.3	35.3	38.1	48.0	52.8	85.0	158.8	195.0
	4063	44.54	-	22.0	37.7	36.9	39.3	41.9	47.7	51.7	64.1	70.2	101.3
	4064	41.75	-	21.8	34.0	31.0	38.4	42.8	51.0	52.5	59.4	84.1	119.0
	4065	29.82	7.3	18.9	34.5	35.2	36.1	41.9	51.0	64.6	74.1	93.2	185.0
	4163	31.79	-	18.9	29.6	28.0	30.2	30.4	31.7	38.4	42.6	34.5	250.0
	4164	33.91	-	20.3	29.4	27.1	35.1	30.2	34.5	41.8	46.1	68.4	98.1
	4165	21.58	8.9	17.3	21.7	25.7	27.7	30.5	32.9	33.0	55.5	-	177.0
28	4263	30.3	-	19.0	25.3	25.9	25.3	28.5	35.8	43.8	44.0	31.0	43.0
	4264	24.5	-	14.7	23.0	23.9	23.2	24.5	26.1	24.9	26.1	27.0	27.5
	4265	27.1	7.0	18.1	21.7	23.8	23.7	24.2	26.7	33.9	37.9	135.0	142.0
	4364	24.7	-	15.9	18.7	22.2	22.6	23.0	28.9	27.8	24.0	25.0	31.7
	4365	26.9	7.8	14.3	18.0	21.6	24.5	27.1	29.5	47.8	38.2	85.5	76.0
	4366	36.9	-	13.4	16.8	19.0	36.1	58.7	70.1	116.2	112.7	136.9	130.8
	4464	22.3	-	15.2	19.7	21.4	20.5	24.1	24.0	23.9	30.0	42.0	-
	4465	23.2	-	15.4	18.9	21.3	22.3	24.5	24.9	27.6	26.5	36.7	41.0
	4466	20.8	-	13.2	15.6	18.2	22.3	27.3	98.9	53.0	162.5	146.3	141.6
	4564	22.5	-	15.5	20.1	21.4	21.7	23.6	26.4	23.0	27.4	-	-
	4565	21.0	-	13.9	17.8	19.7	19.9	21.8	23.5	25.1	33.2	35.0	82.0
	4566	19.8	-	12.4	18.2	19.1	20.4	20.9	22.6	23.5	21.5	-	82.0
29	4665	22.46	-	13.7	17.9	19.6	21.1	23.5	24.6	25.9	27.8	38.3	79.6
	4666	19.19	-	13.1	18.1	19.7	20.5	21.9	23.8	24.8	27.7	35.5	81.3

Table 1.3.14 Estimated mean weight (grammes) of sprat. R/V "Monokristall", October 1995.

SD	Strata	Total	age0	age1	age2	age3	age4	age5	age6	age7	age8+
26	3864	5.3	3.3	8.2	9.7	11.0	11.8	13.8	16.3	15.2	-
	3963	9.4	3.3	8.7	10.5	10.8	10.9	12.9	13.1	16.0	-
	3964	9.4	3.3	8.2	10.2	11.1	12.2	13.8	16.3	15.2	-
	3965	5.1	2.9	7.2	10.1	10.2	11.4	11.9	14.3	-	-
	4063	12.1	3.8	10.3	11.6	11.7	12.8	13.9	14.3	14.5	17.6
	4064	7.7	2.3	8.3	10.2	10.7	11.9	13.1	14.5	-	-
	4065	5.6	2.3	7.2	11.1	10.2	11.4	11.9	14.3	-	-
	4163	9.8	3.4	11.2	12.0	12.4	13.1	13.7	14.0	14.4	14.5
	4164	9.0	3.1	8.3	10.2	11.1	12.1	12.9	14.5	16.3	-
	4165	5.5	2.6	7.8	10.5	10.6	12.1	13.7	14.2	14.6	16.1
28	4263	11.9	-	8.1	10.3	11.2	12.4	13.2	13.5	14.5	14.8
	4264	10.4	2.6	7.3	9.8	11.0	12.2	13.0	14.8	11.5	12.3
	4265	7.7	2.6	7.5	9.5	10.5	11.8	12.3	11.8	14.2	11.7
	4364	9.7	2.9	7.4	10.4	11.3	11.9	12.1	11.9	16.3	11.4
	4365	8.0	2.9	7.3	9.9	10.5	11.5	11.7	12.0	-	-
	4366	7.9	2.9	7.1	10.2	10.0	11.0	-	12.2	-	-
	4464	9.2	-	7.1	9.7	10.6	12.2	12.1	13.8	13.8	13.8
	4465	8.8	2.6	7.2	9.9	10.9	11.9	12.2	12.5	15.1	13.0
	4466	7.4	2.6	6.8	9.9	10.6	11.5	12.8	12.4	-	-
	4564	9.7	2.6	7.2	9.1	11.3	11.8	12.0	13.6	13.5	12.0
	4565	8.7	2.6	6.8	9.9	10.9	11.3	13.3	12.6	12.8	15.1
	4566	8.3	2.8	6.7	10.2	11.2	12.1	11.8	11.9	10.8	-
29	4665	9.0	2.9	10.4	12.1	12.7	13.3	13.7	14.3	14.3	-
	4666	7.8	2.9	6.6	11.7	11.1	12.2	12.7	13.5	12.5	-

Table 1.3.15 Survey statistics. R/V "Monokristall", October 1995.

SD	ICES rect.	Area in nm <sup>2</sup>	Mean Sa m <sup>2</sup> /nm <sup>2</sup>	Sigma in m <sup>2</sup> *10 <sup>-4</sup>	Total abundance in million	Species composition [%]	
						herring	sprat
26	3864	450	1000.9	1.06	4236.4	5.2	94.8
	3963	1026	406.8	1.99	2099.5	45.5	54.5
	3964	1032	674.0	1.29	5405.0	8.4	91.6
	3965	855	772.1	0.87	7609.8	10.5	89.5
	4063	1019	517.6	1.53	3449.9	11.8	88.2
	4064	1019	1097.3	1.54	7242.0	20.7	79.3
	4065	918	1032.9	0.87	10843.0	6.8	93.2
	4163	797	982.8	1.34	5856.3	6.5	93.5
	4164	1006	904.1	1.20	7559.2	4.3	95.7
	4165	647	1371.6	0.86	10344.8	6.7	93.3
28	4263	607	983.7	1.64	3631.1	11.8	88.2
	4264	993	1743.3	1.32	13096.4	3.3	96.7
	4265	814	2113.9	1.10	15696.2	4.0	96.0
	4364	980	778.7	1.35	5649.6	5.7	94.3
	4365	980	1621.0	1.12	14127.3	2.0	98.0
	4366	166	1258.9	1.12	1867.2	1.7	98.3
	4464	322	1152.1	1.26	2938.7	4.8	95.2
	4465	967	1781.4	1.25	13826.8	7.0	93.0
	4466	452	2483.9	1.08	10362.7	3.1	96.9
	4564	315	520.2	1.63	1007.0	30.6	69.4
	4565	954	1561.6	1.31	11380.6	9.9	90.1
	4566	541	2184.1	1.23	9609.8	8.5	91.5
29	4665	914	958.0	1.29	6899.4	10.0	90.0
	4666	842	1642.9	1.18	10708.7	11.7	88.3

Figure 1.3.1 Cruise track and trawl stations of "Solea" October 1995.

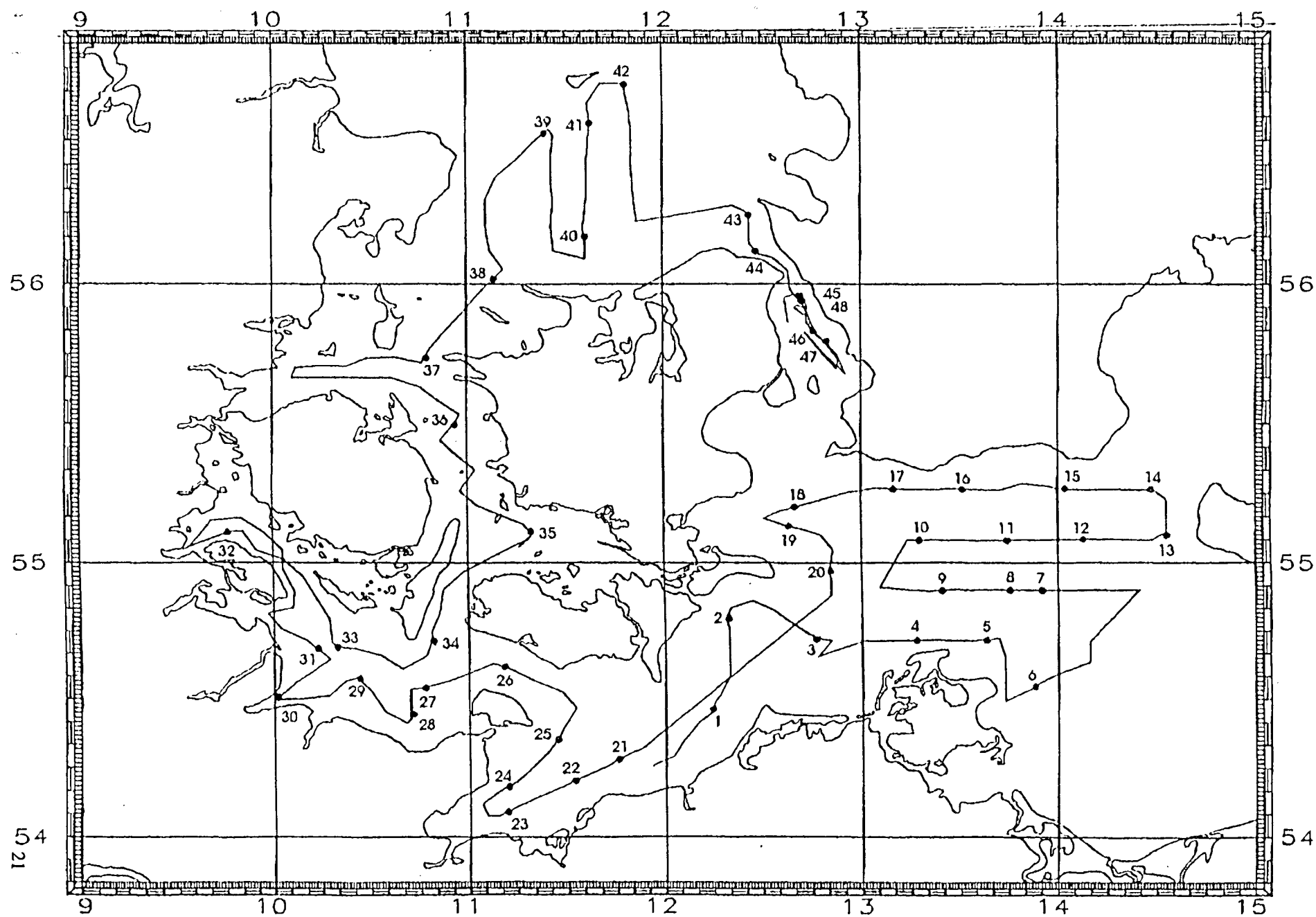


Figure 1.3.2 Acoustic track and trawl stations of R/V "Baltica" in October 1995.

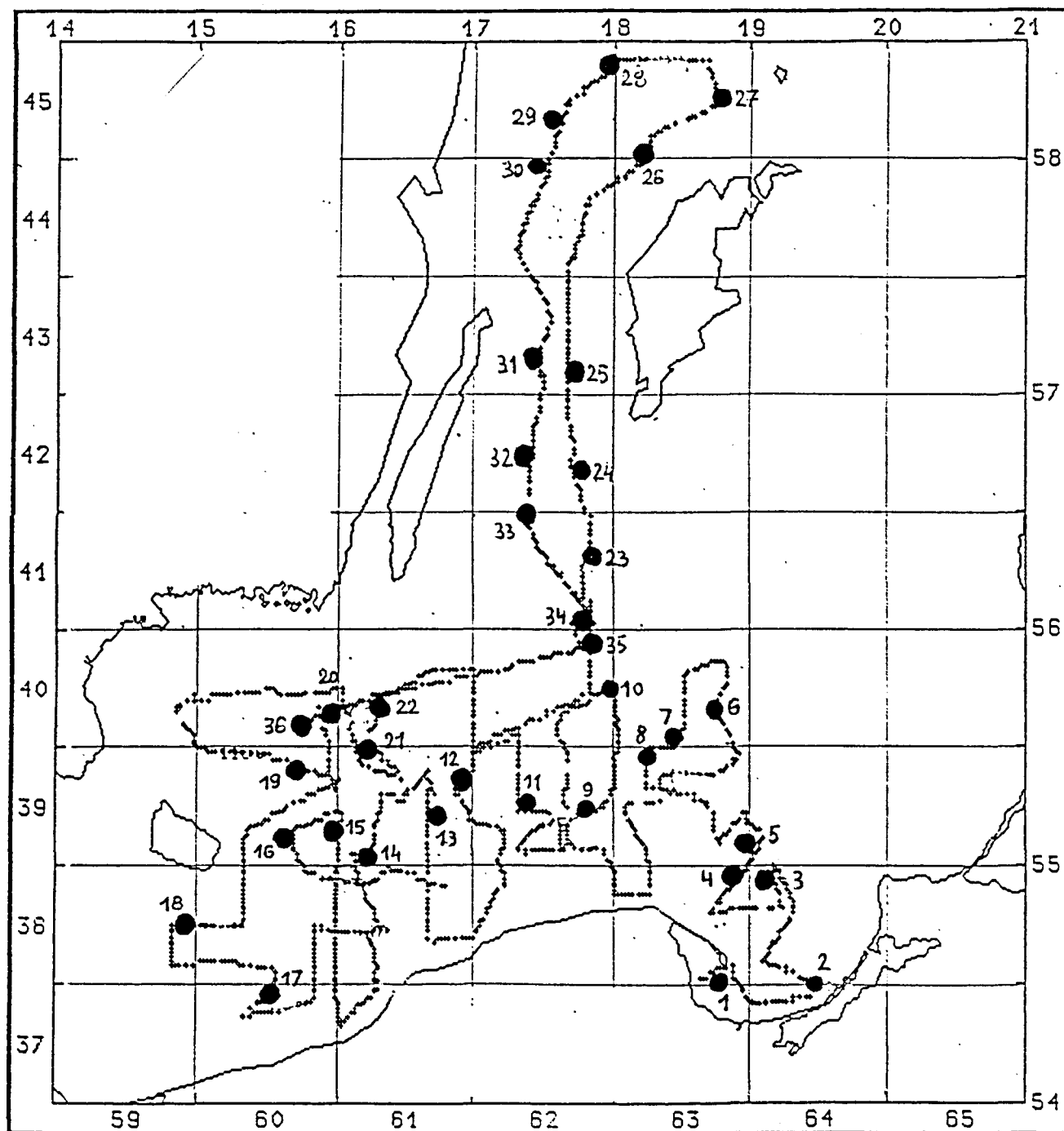


Figure 1.3.3 Acoustic survey of R/V "Monokristall" in October 1995.

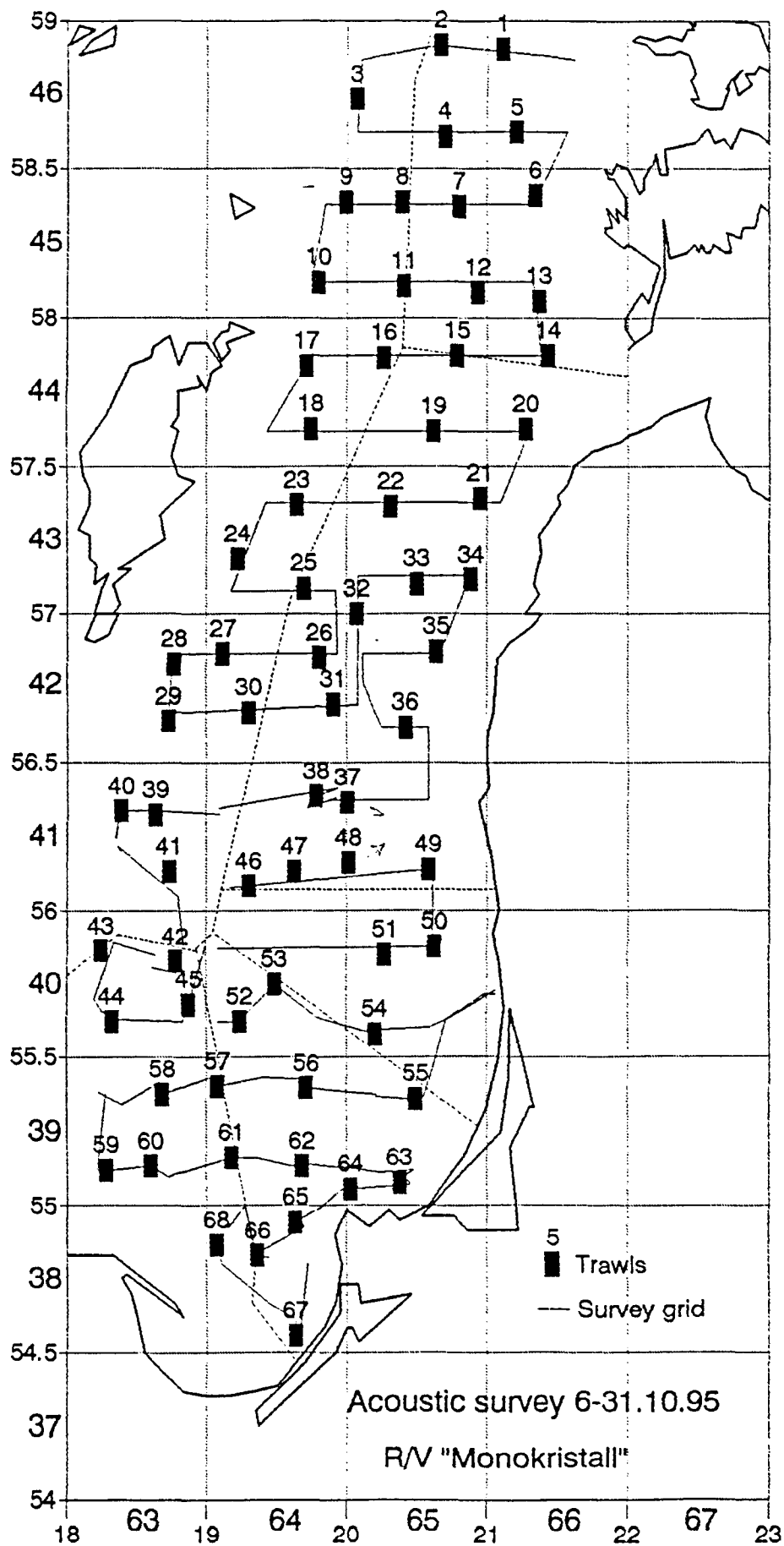




Figure 1.3.4 Overlap strata 3963+4063 sprat.

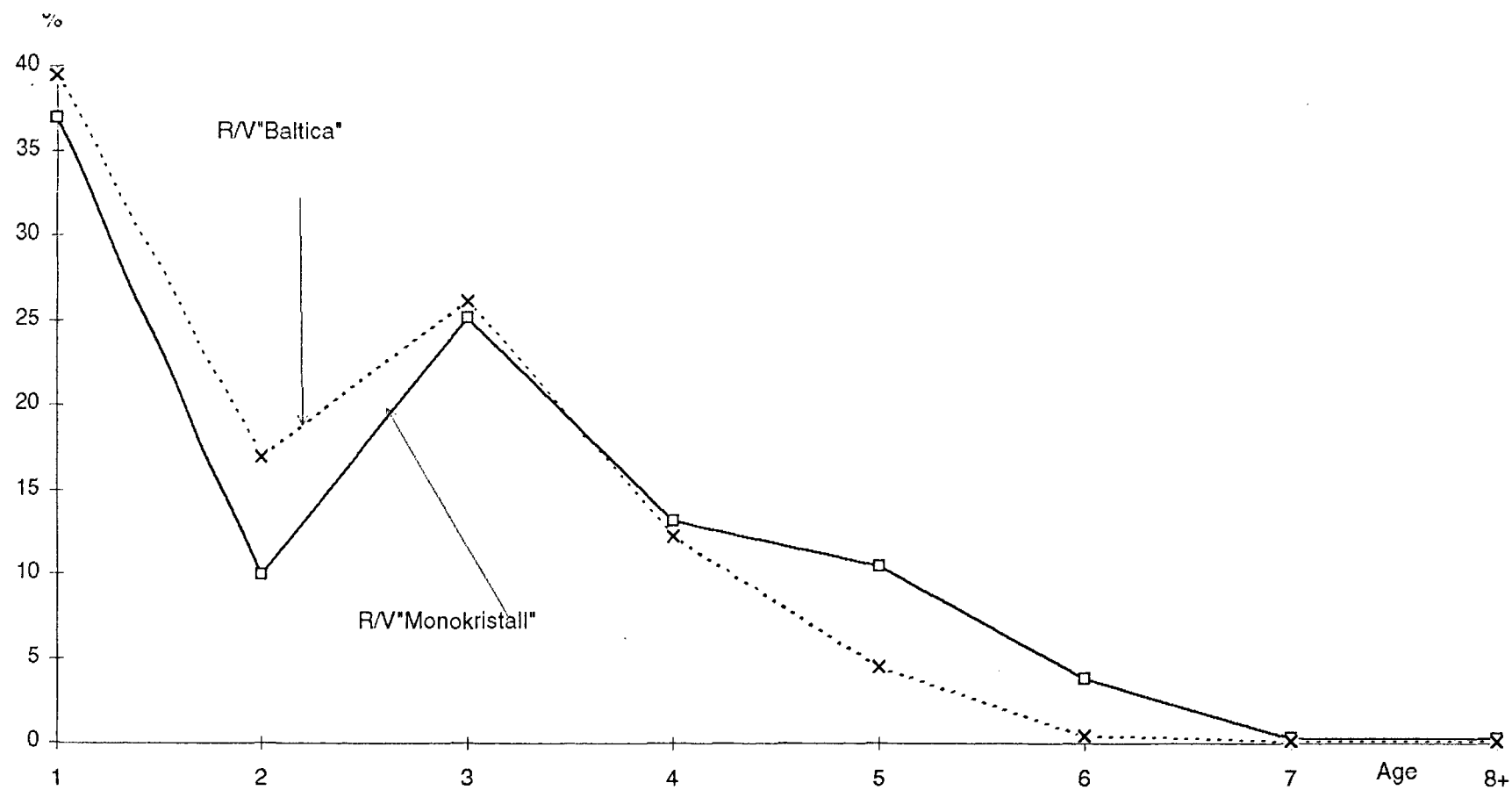
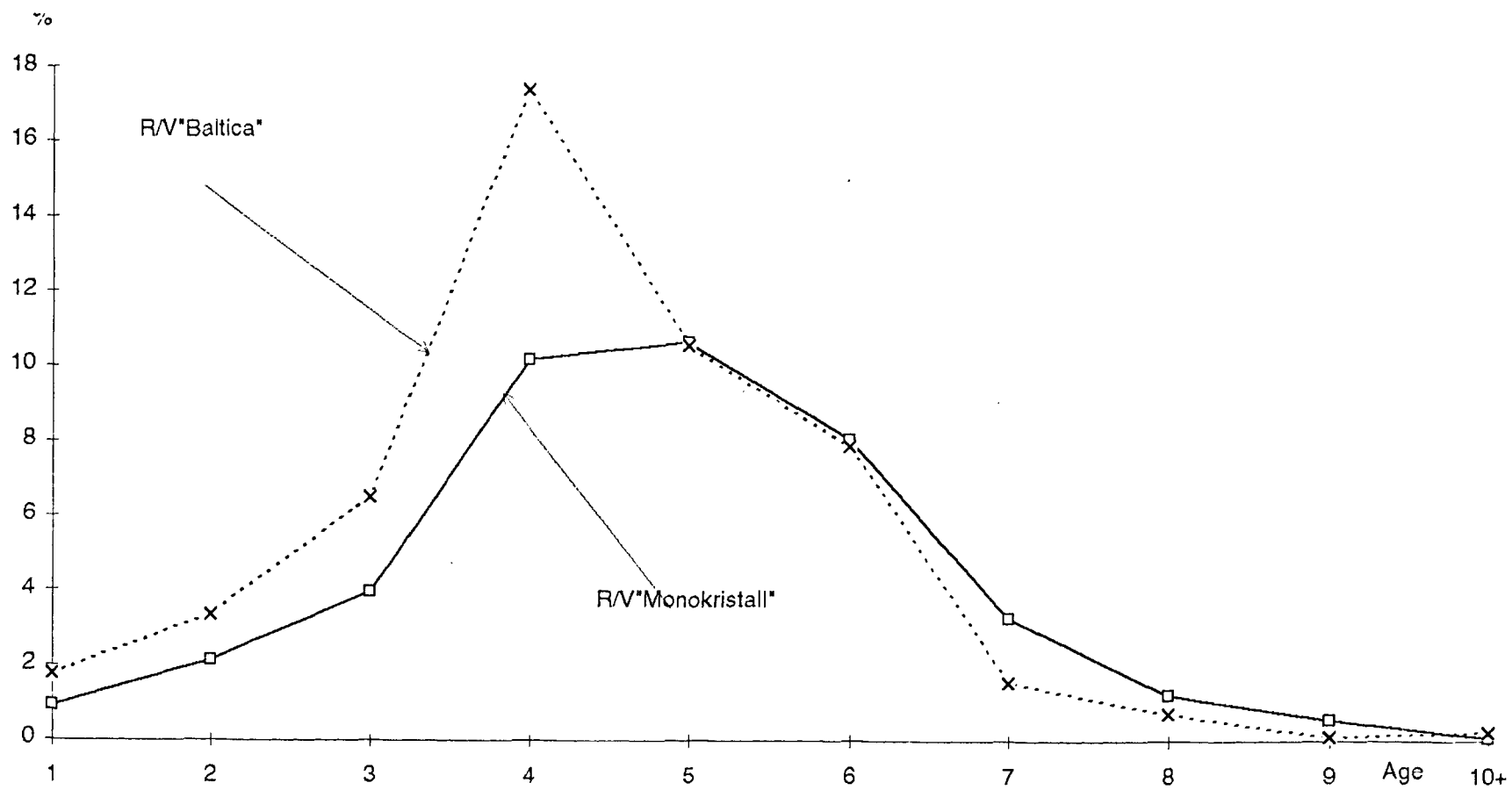


Figure 1.3.5 Overlap strata 3963+4063 herring.



## **2 COD IN SUB-DIVISIONS 22-24**

### **2.1 Trends in Landings, Effort and CPUE**

The landings of cod from Sub-divisions 22-32 are shown in Table 2.1.1 and 2.1.2 and for each Sub-division separately in Table 2.1.3 and 2.1.4. Polish landings from Sub-division 24 (712 t) were transferred to Sub-division 25, because these catches are taken close to this Sub-division and no biological samples were available for these landings separately. The total landings in Sub-divisions 22-24 have increased from about 27,000 t in 1994 to 32,000 t in 1995. The increase in landings refers primarily to Sub-division 22, while landings in Sub-division 24 have remained at approximate the same level as last year. The information provided by Sweden and Denmark about landings was given for trawl and gillnet separately.

As there were no biological samplings of cod catches in Sub-division 23, catches for this area are not included in the assessment.

### **2.2 Unallocated Landings**

The estimates of German and Danish landings provided by Working Group members include unallocated catches. The estimates of Swedish landings are provisional.

### **2.3 Mean Weight at Age**

Estimates of mean at age in the landings were provided by Germany, Sweden and Denmark on a quarterly basis. Swedish and Danish mean weights were given for trawl and gillnet separately (Table 2.3.1). The Swedish sampling did not cover quarter 2 and 3. These were substituted with the Swedish mean weights at age from quarter 1 and 4 for trawl and gill net. Combined mean weights were obtained based on the relative landings by gear and quarter (Table 2.3.2). The German data include samples landed undersized cod, since it is legal to land these up to an amount of 5 % of the regular landing. The mean weights for age 2 to 7 in the combined data for Sub-divisions 22 and 24 are somewhat lower than in the preceding year, but correspond to the level observed in the 1980s. The mean weights at age in the Sub-division 22 landings were considerably higher than in Sub-division 24.

Number of samples, number of cod length measured and otoliths aged are given in Table 2.3.3. The intensity of sampling has increased in quarter 4 due to an international project to improve the quality of assessment data started in September 1995. The program is funded by the EU and includes sampling at sea on board commercial vessels.

Estimates of the mean weight at age in the stock were provided by Germany for Sub-division 22 and by Germany, Sweden and Denmark for Sub-division 24. The data have been obtained through surveys in quarter 1, 1995. New mean weights were obtained as the mean of Sub-division 22 and 24 (average) (Table 2.3.4). No data on cod older than 6 years were available and the mean weights at age from the previous years for these age groups were maintained. The fraction of these age classes in the stock is very low.

### **2.4 Age Composition**

Quarterly data on the age composition in the landings were provided by Germany and Denmark for Sub-division 22, and by Germany, Sweden and Denmark for Sub-division 24 (Tables 2.3.1-2.3.2). In Sub-division 24 the Swedish data were combined for quarter 1 and 2 and for quarter 3 and 4. The data were split into quarters taking into account the relative contribution of trawl and gillnet landings, since the numbers caught at age differed between gears. The age composition in the landings differed between the two Sub-divisions.

### **2.5 Discards**

The sampling of discards has been intensified in Sub-division 22 and 24 by Denmark, Germany and Sweden, through the EU-project to improve cod assessment data. Sampling was made onboard commercial fishing vessels in directed trawl and gillnet fisheries for cod. The data, however, are not representative for the whole year due to the short sampling period and discards were not included in the assessment. Sampling in the EU-project will continue in 1996 and the data will be available for the Working Group in 1997.

German and Danish investigations indicate that discards of cod in bottom-trawl herring fishery in Sub-division 22 is highly variable, whereas discards in general tend to be low in pelagic herring fisheries. Discards of cod in bottom-trawl herring fisheries can on occasions be substantial and more sampling is recommended to give better estimates.

## 2.6 Maturity Ogives

Maturity ogive has been kept constant in assessment and represents females and males combined. New data were available from Denmark and Germany for both sexes and from Sweden for females. The Danish and German data did not cover the area well and it was decided to keep the maturity ogive constant as in previous year. Based on the literature (Berner & Vaske, C.M.1981/J:16), unpublished data by F. Thurow (1958-85) and the available national survey data, the trends in sex specific maturity ogives and sex ratio were investigated. Disaggregated by year, country and Sub-division, the data ranged from 1958-1995, and included 22 observations of female maturity ogives, 13 male maturity ogives and 16 regarding sex ratio. This preliminary analysis showed that on average the female proportion in the stock increase with age and that females mature later than males (Table 2.6.1; Figures 2.6.1-2.6.2). Also changes over the year seems to have taken place. Table 2.6.2 shows the female maturity ogives averaged over some time intervals. Data were not available to test the male maturity ogives in a similar way. Denmark, Germany and Sweden have data from previous years that will be available for the Working Group next year and it will be attempted to establish a timeseries.

## 2.7 Estimates of Fishing Mortality Rates

For cod in Sub-divisions 22-24 the available potential data for XSA tuning this year consists of:

1. GLM estimates from survey data covering years 1978-1995 and both Sub-divisions 22 and 24.
2. German CPUE data for Sub-division 24 covering years 1985-1995.

CPUE data from commercial fisheries are available from all countries and several fleets, but at present only the data from a specialised German cod fishery in Sub-division 24 are considered reliable enough to be used for the tuning.

As tuning data for this year's VPA the Working Group decided to use both the survey estimates (GLM estimates) and German CPUE data for Sub-division 24. The German survey data are not particularly consistent probably due to mixing of stocks, but being the only commercial fishery data available it was included into the analysis.

The input data to the XSA are given in Table 2.7.1. The results of the XSA are shown in Table 2.7.2, where catchability of ages dependent on stock size was set  $< 5$  group and catchability independent of age  $> 5$  group. Several other runs were also made changing catchability parameters and even assuming catchability being independent of stock size for all age groups, but those runs were not particularly different from the first one. Tuning showed rather fast convergence in this first run, which is in contrast to last years runs, where there was a poor convergence. The diagnostics show rather tolerable residuals in GLM estimates except in older ages at the beginning of 1990s. The German fleet, as expected did not perform so well and high residuals were observed (Table 2.7.2). The problem with this stock lies in the basic data, especially in 1991-1994 data (unreliable catch figures and poor sampling), and thus the information available is not really adequate for analysis.

## 2.8 VPA and RCCPUE5

The estimated fishing mortalities from XSA are given in Table 2.7.2. Also in this year's analysis older age groups were combined as a plus group (+7) because the catches of old age groups are small and sampling is poor. The mean fishing mortality calculated has been kept to  $F(3-6)$  as in the last year's report.

In this year's assessment, the fishing mortalities for the last 5 years are very high except for 1994, where fishing mortality is estimated to be about half of the 1993 and 1995 levels. This kind of inconsistency and drop in fishing mortality rate could not be seen in the catch data (official catches increasing from 1991 onwards) or explained from what is known about the fishery in this period. However, fishing mortality estimates in general are more reasonable in recent years and much lower than last years' analysis, but still high. The Working Group considered that except for the fact that  $F$ s have been downscaled in the latest years and they are more reasonable than before, the change in  $F$  from 1994 to 1995 (two times higher in 1995 than 1994), does not reflect the real situation. The only explanation to this is the poor data quality.

To estimate fishing mortalities independently from survey data and stock trends, a separate analysis was made using RCCPUE5 program available at ICES Headquarters. The GLM estimates were used as abundance indices data and average fishing mortality rates were estimated for age groups 3-6 as in XSA. Table 2.8.1 gives the input and output of the analysis.

According to analysis, the fishing mortality rates from 1990 onwards there is a downward trend in fishing mortality rates and that pattern is not seen in the XSA output. Estimated fishing mortality rates in recent years are very small.

A retrospective analysis based on the results from XSA (Figure 2.8.1) indicate data problems in 1991–1995.

## 2.9 Recruitment Estimates and SSB Estimates

Young Fish Survey data including survey data from 1996 January–March are available from Denmark (1982–1995), Germany (1980–1996) and Sweden (1989–1995). German data include both Sub-divisions 22 and 24 (separately) and Danish and Swedish data for Sub-division 24 only. The data base include the former German Democratic Republic surveys covering period 1978–1991 in both Sub-divisions. In total, the data from Germany cover period 1978–1996 in Sub-divisions 22 and 24. The data base includes a total of all 2,726 hauls.

GLM analyses of data on a individual trawl haul basis were used for estimating recruitment, SSBs and for tuning the VPA. All age groups (1–10+) were included in the analysis. The whole data base was used for tuning, because it gave the best fit to the model in all age groups. No interaction terms were used in the model. A constant of 0.5 was added to all observations to avoid zeros before log transformations.

The model applied was of the type:

$$\log(\text{CPUE}) = Y + C + S + D + Q + e$$

where,

CPUE = Catch in numbers per hour of age group 1 cod

and the class variables are,

- Y = Year effect (year-class strength)
- C = Country effect (the different surveys and gear type)
- S = Sub-division effect (spatial distribution, horizontal)
- D = Depth effect (spatial distribution, vertical)
- Q = Quarter of the year

and,

e = Error term

The results of GLM analysis for estimating recruitment at age 1, spawning stock in numbers and spawning stock biomass are presented in Table 2.9.1. In estimating spawning stock in numbers the maturity ogive data was use and for spawning stock biomass the mean weight at age in stock was applied. The back transformed estimates by age group are given in Table 2.9.2.

The RCT3 program and GLM analyses were used to estimate absolute recruitment. Year class 1994 was estimated to be about 109 million at age 1, which is well above long term average (68 million at age 1) and year class 1995 to 30 million at age (Table 2.9.3), which is less than a half of the long-term average.

GLM estimates of total spawning stock biomasses, VPA spawning stock biomasses and RCCPUE5 analysis indicate the same kind of pattern in recent years (Figure 2.9.1). The regression between XSA SSB estimates and GLM as well as COOK estimates gave quite consistent results as shown in Tables 2.9.4–2.9.5. However, the estimated levels in the latest years for SSB biomass are rather different from those from XSA as shown in Table 2.9.6.

Stock-recruitment relationship is shown in Figure 2.9.2. According to the plot the region, where the probability of higher recruitment is growing lies around 25,000–30,000 tonnes.

## 2.10 Catch Prediction and Management Options

### 2.10.1 Short-term predictions

For the prediction the estimated value of 29.5 million specimens for year class 1995 at age 1 was used at the beginning of 1996. For 1997 and 1998 the average value of years 1993–1995 at age 1 (56.7 millions) was used. Mean weights at age in the catch and in the stock have been revised and therefore those used in the predictions are taken from 1995. The mean 1993–1995 exploitation pattern was used for prediction. Stock numbers in 1995 were taken from the VPA.

The standard catch prediction and yield-per-recruit calculations were performed using the input data shown in Table 2.10.1. The results are summarised in Tables 2.10.2–2.10.4.

Tables 2.10.2–2.10.4 show short-term predictions for 1996 and 1997. The predictions indicate an increase of spawning stock from 30,000 t in 1996 to about 39,000 t in 1997 with *status quo* fishery (Table 2.10.3) and a catch of about 38,000 t in 1996 and 36,000 t in 1997 if fishing mortality is at the last 3 years' average level. It should be noted that the predicted catches for 1997 and 1998 with the present exploitation pattern are influenced by the high year class 1994 and the very low abundance of year class 1995 estimated by RCT3 at age 1 in 1996 (Table 2.9.3). All observations available from the first quarter of 1996 indicate a low abundance of year class 1995.

The current level of  $F_{3-6}$  exceeds  $F_{0.1}$  (0.15) and  $F_{max}$  (0.24).

### 2.11 MBAL Estimation

It was attempted to estimate MBAL by applying the approach of Myers *et al.* (1994), i.e. a function was fitted to the stock-recruitment relationship and defining MBAL as the spawning stock biomass producing 50 % of maximum recruitment (see Section 1). The spawning stock and recruitment estimates were based on the presented VPA estimates and the relationship and fitted models are shown in Figures 2.11.1–2. The estimate of MBAL resulting from the Ricker curve is about 23,000 tonnes, however, the scatter of the observations around the fitted function is considerable. An attempt to fit the MBAL from the Beverton and Holt curve failed as the threshold value was reached at an unrealistically low level.

Since the VPA spawning stock estimate includes both males and females it was attempted to reduce the scatter of the observations by relating recruitment to the female spawning biomass (as an approximation to the population fecundity). The female spawning stock was computed using the average sex ratio at age and the average female maturity ogive computed in Table 2.6.2. This attempt, however, did not improve the stock-recruitment relationship, and more accurate data are needed to evaluate the relationship between the population fecundity and recruitment.

### 2.12 Medium-Term Considerations

In the medium-term considerations the uncertainty in survivors estimates and uncertainty in stock-recruitment model (the Ricker model) were taken into account. Weight at age and natural mortalities were kept constant. The fractiles of SSB distribution for *status quo* fishing mortality and for fishing mortality equal to 80% of the status quo value are presented in Figure 2.12.1.

Table 2.1.1 Baltic cod stocks, exploitation parameters for 1970-1995.

	Sub-divisions/Stocks											Total Baltic Agreed TAC <sup>4</sup>	Total catch SD 22-32	
	22 + 24						25-32							
	Recruit- ment <sup>1</sup>	SSB	TAC <sup>3</sup>	F <sub>3-6</sub> <sup>4</sup>	Catch	Y/B	Recruit- ment <sup>2</sup>	SSB	TAC <sup>3</sup>	F <sub>4-7</sub> <sup>4</sup>	Catch			Y/B
1970	139	37		0.93	44	1.18	217	261		1.00	154	0.59		198
1971	108	45		1.00	47	1.04	242	235		0.78	118	0.50		165
1972	147	46		1.30	49	1.06	289	257		0.85	144	0.56		193
1973	57	45		0.99	54	1.20	398	336		0.80	143	0.42		198
1974	143	49		1.33	47	0.96	468	388		0.75	148	0.38		194
1975	76	36		1.10	44	1.22	280	426		0.66	195	0.45		239
1976	67	48	41	1.44	49	1.02	281	424	150	0.92	203	0.47		253
1977	118	33	39.6	1.41	45	1.36	463	398	120	0.84	165	0.41	185	211
1978	84	28	40 <sup>5</sup>	1.00	39	1.39	782	488	131	0.53	154	0.31	173.8	195
1979	38	40	39 <sup>5</sup>	0.90	42	1.05	568	727	136	0.49	228	0.31	175	273
1980	102	46	33 <sup>5</sup>	0.94	38	0.82	405	829	179	0.72	348	0.42	235	390
1981	74	41	27 <sup>5</sup>	1.34	51	1.24	657	783	170	0.77	331	0.42	227	385
1982	78	39	29 <sup>5</sup>	0.85	46	1.18	654	812	- <sup>6</sup>	0.68	316	0.39	-	364
1983	95	41	<54 <sup>8</sup>	0.93	47	1.14	434	786	- <sup>6</sup>	0.67	332	0.42	-	381
1984	31	38	- <sup>7</sup>	0.81	48	1.26	280	707	<274 <sup>8</sup>	0.86	391	0.51	-	441
1985	24	40	<33 <sup>8</sup>	1.24	39	0.98	228	625	<162 <sup>8</sup>	0.72	315	0.50	-	355
1986	68	24	<24 <sup>1</sup>	1.74	26	1.08	245	450	<232 <sup>8</sup>	1.14	253	0.55	-	279
1987	39	17	9	1.04	27	1.65	331	369	<245 <sup>8</sup>	1.00	207	0.54	-	236
1988	12	24	16	0.99	28	1.17	203	355	150	0.88	194	0.56	-	224
1989	18	21	14	1.16	18	0.82	117	288	179	1.13	179	0.61	220	198
1990	15	14	8	1.34	17	1.21	116	223	129	1.11	154	0.68	210.5	171
1991	25	9	11	2.04	15	1.67	79	160	122	1.30	122	0.73	171	139
1992	53	7	SRF <sup>10</sup>	1.38	15	2.14	125	103	LPF <sup>F</sup>	0.43	54	0.51	100	72
1993	60	12	SRF	1.13	18	1.63	240	124	LPF <sup>11</sup>	0.35	38	0.26	40 <sup>11</sup>	60*
1994	109	23	NE <sup>13</sup>	0.52	27	1.50	222	212	LPF	0.53	90	0.26	60	118*
1995	30	24	NE <sup>14</sup>	1.24	32	1.33		244	NOF <sup>15</sup>	0.69	107	0.44	120	139*

<sup>1</sup>Recruitment at age 1. <sup>2</sup>Recruitment at age 2. <sup>3</sup>TAC recommended by ACFM. <sup>4</sup>F = unweighted since 1975 F<sub>3-7</sub>. <sup>5</sup>TAC agreed by IBSFC. <sup>6</sup>Sum of Sub-divisions 22 and 24 TACs. <sup>7</sup>Due to good state of stock only options given by ACFM. <sup>8</sup>ACFM recommended only fishing mortality reduction. <sup>9</sup>Reduction of fishing mortality towards F<sub>max</sub>. <sup>10</sup>SRF=substantial reduction of F. <sup>11</sup>LPF = lowest possible F. <sup>12</sup>TAC combined for the whole Baltic. <sup>13</sup>Not exceed the catch 1992. \* WG estimates. <sup>14</sup>Not exceed the catch 1994. <sup>15</sup>No fishery in 1995 and a second advice effort in 1995 be reduced by about 30% from the 1994 level.

Table 2.1.2 Total landings of COD by countries in Sub-divisions 22-32.

Year	Denmark	Estonia	Finland	German Dem. Rep.	Germany, Fed. Rep.	Latvia	Lithuania	Poland	Russia	Sweden	USSR	Faroe Islands	Norway	Unallo- cated*	Total
1965	35,313	-	23	10,680	15,713	-	-	41,498	-	21,705	22,420	-	-	-	147,352
1966	37,070	-	26	10,589	12,831	-	-	56,007	-	22,525	38,270	-	-	-	177,318
1967	39,105	-	27	21,027	12,941	-	-	56,003	-	23,363	42,980	-	-	-	196,446
1968	44,109	-	70	24,478	16,833	-	-	63,245	-	24,008	43,610	-	-	-	216,353
1969	44,061	-	58	25,979	17,432	-	-	60,749	-	22,301	41,580	-	-	-	212,160
1970	42,392	-	70	18,099	19,444	-	-	68,440	-	17,756	32,250	-	-	-	198,451
1971	46,831	-	53	10,977	16,248	-	-	54,151	-	15,670	20,910	-	-	-	164,840
1972	59,717	-	76	13,720	15,516	-	-	57,093	-	16,471	30,140	-	-	-	192,733
1973	66,050	-	95	14,408	28,706	-	-	49,790	-	18,389	20,083	-	-	-	197,521
1974	57,810	-	160	10,970	22,224	-	-	48,650	-	16,435	38,131	-	-	-	194,386
1975	62,524	-	298	14,742	24,880	-	-	69,318	-	17,965	49,289	-	-	-	239,016
1976	77,570	-	287	8,552	26,626	-	-	70,466	-	20,188	49,047	-	-	-	252,736
1977	73,505	-	310	10,967	30,806	-	-	47,702	-	18,127	29,680	-	-	-	211,097
1978	50,611	-	1,437	9,345	15,122	-	-	64,113	-	16,793	37,200	-	-	-	194,621
1979	59,704	-	2,938	8,997	19,375	-	-	79,754	-	23,093	75,034	3,850	-	-	272,745
1980	75,529	-	5,962	7,406	18,407	-	-	123,486	-	33,201	124,350	1,250	-	-	389,591
1981	92,648	-	5,681	12,936	18,281	-	-	120,901	-	44,330	87,746	2,765	-	-	385,288
1982	91,927	-	8,126	11,368	21,860	-	-	92,541	-	46,548	86,906	4,300	-	-	363,576
1983	107,624	-	8,927	10,521	25,154	-	-	76,474	-	53,740	92,248	6,065	-	-	380,753
1984	113,701	-	9,358	9,886	42,031	-	-	93,429	-	65,927	100,761	6,354	-	-	441,447
1985	107,627	-	7,224	6,593	31,798	-	-	63,260	-	54,723	78,127	5,890	-	-	355,242
1986	98,464	-	5,633	3,179	22,422	-	-	43,236	-	49,572	52,148	4,596	-	-	279,250
1987	83,844	-	3,007	5,114	18,816	-	-	32,667	-	47,429	39,203	5,567	-	-	235,647
1988	74,742	-	2,904	4,634	18,295	-	-	33,351	-	54,968	28,137	6,915	-	-	223,946
1989	65,935	-	2,254	2,147	15,342	-	-	36,855	-	55,919	14,722	4,520	-	-	197,654
1990	56,700	-	1,731	1,629 <sup>2</sup>	7,745	-	-	32,028	-	54,474	13,461	3,558	-	-	171,326
1991	50,606	1,810	1,712	-	9,443	2,627	1,865	25,748	3,299	39,491	-	2,611	-	-	139,212
1992	30,420	1,368	485	-	6,449	1,250	1,266	13,314	1,793	15,940	-	605	-	-	72,890
1993	11,707	70	225	-	5,126	1,333	605	8,909	892	12,048	-	-	-	18,978	59,893
1994	19,805	952	594	-	7,079	2,379	1,887	14,426	1,257	25,530	-	-	-	44,000	117,909
1995 <sup>1</sup>	38,204	1,049	1,577	-	16,081	6,653	4,513	24,288	1,551	27,966	-	866	247	18,993	122,622

<sup>1</sup>Provisional data.

<sup>2</sup>Includes landings from October-December 1991 in former GDR.

\*Working Group estimates. No information available for years prior to 1993.



Table 2.1.3 Total landings (t) of COD in Sub-divisions 22-32 by Sub-division and country.

Year	Denmark				Faroe Islands	Finland				
	22	23	24	25-28		25-28	29	30 <sup>2</sup>	31	32
1972	17,717	-	7,928	34,072	-	-	-	76	-	-
1973	21,400	-	9,195	35,455	-	-	-	95	-	-
1974	18,300	-	7,482	32,028	-	-	-	160	-	-
1975	15,981	-	7,500	39,043	-	-	270	8	-	20
1976	19,764	712	9,682	47,412	-	-	81	24	-	182
1977	17,726	1,166	10,213	44,400	-	-	85	26	-	199
1978	12,641	1,177	6,527	30,266	-	-	249	323	6	859
1979	16,093	2,029	7,232	34,350	3,850	-	707	518	16	1,697
1980	16,033	2,425	7,367	49,704	1,250	-	2,163	880	45	2,874
1981	15,502	1,473	7,152	68,521	2,765	-	3,036	684	11	1,950
1982	11,669	1,638	7,469	71,151	4,300	-	4,557	1,368	42	2,159
1983	14,100	1,257	7,861	84,406	6,065	-	5,322	2,013	36	1,556
1984	13,867	1,703	8,042	90,089	6,334	-	5,433	2,741	7	1,177
1985	15,563	1,076	7,461	83,527	5,890	-	4,646	1,706	7	865
1986	8,914	748	7,281	81,521	4,596	-	3,571	1,306	2	754
1987	7,990	1,503	5,470	68,881	5,567	-	1,389	1,143	2	473
1988	5,680	1,121	7,505	60,436	6,915	614	998	1,257	1	34
1989	3,422	636	4,637	57,240	4,520	392	603	1,097	1	161
1990	3,235	722	5,349	47,394	3,558	833	187	685	-	26
1991	5,536	1,431	3,847	39,792	2,611	1,061	228	404	-	18
1992	7,567	2,449	2,379	18,025	605	253	48	174	-	10
1993	4,901	1,001	3,765	2,040	-	61	11	142	2	9
1994	6,078	1,073	7,753	4,901	-	232	240	108	-	14
1995 <sup>1</sup>	11,851	2,547	6,911	16,895	866	235	216	75	0	4

Year	Federal Republic of Germany						German Democratic Republic						
	22	24	25	26	27	28	22	24	25	26	27	28	29
1972	10,531	1,782	3,193	10	-	-	4,560	5,105	1,950	2,072	-	33	-
1973	12,833	900	9,100	5,200	-	673	4,004	4,370	4,065	1,912	-	57	-
1974	9,998	395	5,242	5,769	-	820	3,028	5,431	1,469	996	-	52	-
1975	12,415	497	8,809	1,975	-	1,184	3,471	2,571	3,320	5,250	50	60	20
1976	12,312	581	7,526	4,490	-	1,717	1,292	3,290	800	3,150	10	10	-
1977	10,807	879	3,649	13,803	-	1,668	977	2,471	324	5,996	73	1,119	7
1978	9,972	880	2,178	1,793	-	299	1,619	5,466	414	1,714	1	131	-
1979	8,910	688	7,616	2,149	-	12	1,024	6,570	54	1,301	1	46	1
1980	5,968	689	10,985	673	-	92	880	4,700	5	1,818	-	3	-
1981	9,095	2,165	7,021	-	-	-	1,743	9,916	2	1,275	-	-	-
1982	7,394	666	13,069	662	-	69	1,908	8,707	-	728	-	25	-
1983	8,937	323	14,179	1,599	-	116	1,441	7,656	-	1,402	-	22	-
1984	11,340	208	21,948	7,926	-	609	1,851	6,242	-	1,793	-	-	-
1985	4,992	531	12,733	11,572	-	1,970	1,508	3,870	-	1,215	-	-	-
1986	2,236	666	10,545	8,399	-	576	825	2,173	1	180	-	-	-
1987	3,611	645	7,757	5,009	-	1,794	504	4,392	1	217	-	-	-
1988	3,670	547	11,321	2,577	-	180	330	4,302	1	1	-	-	-
1989	2,099	399	12,201	640	-	3	217	1,927	3	-	-	-	-
1990	1,997	1,057	3,232	1,427	-	32	129 <sup>5</sup>	1,500 <sup>5</sup>	+	-	-	-	-
1991	1,648	1,231	5,419	1,114	8	23	-	-	-	-	-	-	-
1992	2,320	1,336	2,187	586	-	20	-	-	-	-	-	-	-
1993	2,395	1,689	902	140	-	-	-	-	-	-	-	-	-
1994	2,151	1,872	2,858	134	-	64	-	-	-	-	-	-	-
1995	5,086 <sup>1</sup>	4,111 <sup>1</sup>	4,960 <sup>1</sup>	225 <sup>1</sup>	-	311 <sup>1</sup>	-	-	-	-	-	-	-

continued

Table 2.1.3 (continued)

Year	Poland			Sweden								
	24	25 <sup>1</sup>	26	23	24	25	26	27 <sup>1</sup>	28	29	30	31
1972		24,926	32,167	-	1,277	13,842	-	876	440	-	36	-
1973		29,010	20,780	-	1,655	15,224	-	971	485	-	54	-
1974		25,221	23,429	-	1,937	11,950	-	1,682	825	-	41	-
1975		35,373	33,945	-	1,932	12,511	-	2,052	1,367	103	-	-
1976		26,082	44,384	-	1,800	14,109	-	1,979	2,180	115	5	-
1977		18,172	29,530	550	1,516	11,775	-	2,584	1,560	120	22	-
1978		31,161	32,952	600	1,730	9,017	26	3,207	1,740	417	55	1
1979		40,146	39,608	700	1,800	13,628	50	3,458	2,665	641	145	6
1980		50,832	72,654	1,300	2,610	18,694	88	6,014	3,185	790	516	4
1981		50,698	70,203	900	5,700	24,600	260	7,200	4,450	712	500	8
1982		41,830	50,711	140	7,933	20,429	2,279	4,109	9,264	687	1,669	38
1983		35,153	41,321	120	6,910	27,630	1,810	6,490	9,200	1,260	320	-
1984		35,261	58,168	228	6,014	33,493	4,413	8,223	11,947	1,338	271	-
1985		19,332	43,928	263	4,895	22,737	8,170	7,068	9,523	1,115	929	23
1986		18,297	24,939	227	3,622	19,214	7,764	7,554	9,606	1,233	298	54
1987	91	12,254	20,413	137	4,314	15,173	7,833	5,708	7,507	903	5,817	37
1988		14,910	18,441	155	5,849	20,893	7,453	6,674	7,946	535	5,456	7
1989		20,819	16,036	192	4,987	28,068	6,742	7,703	6,829	440	927	31
1990		14,528	17,500	120	3,671	23,311	13,512	6,702	6,525	252	353	28
1991		9,853	15,895	232	2,768	18,413	7,034	5,096	5,548	180	207	12
1992		5,449	7,865	290	1,655	7,169	2,133	2,145	2,153	93	301	1
1993		5,039	3,870	274	1,675	5,872	2,161	940	972	40	114	-
1994		9,659	4,676	555	3,711	16,675	846	2,845	842	17	39	-
1995 <sup>1</sup>	712	18,049	6,239	611	2,632	18,699	2,765	2,180	992	56	29	2

Year	USSR						Total	
	25	26	27	28	29	32	Unallocated	
1972	-	23,951	-	6,189	-	-	-	192,733
1973	-	8,768	1	11,250	50	14	-	197,521
1974	811	18,633	-	17,677	1,010	-	-	194,386
1975	946	17,884	3	28,677	1,735	44	-	239,016
1976	8,855	25,302	126	14,645	106	13	-	252,736
1977	390	17,880	4	11,304	91	11	-	211,097
1978	12	18,010	78	18,623	166	311	-	194,621
1979	13	30,776	-	39,875	1,575	2,795	-	272,745
1980	7	45,734	-	59,892	4,575	14,142	-	389,591
1981	2	44,254	-	32,195	3,733	7,562	-	385,288
1982	5	33,221	-	40,876	3,308	9,496	-	363,576
1983	-	33,600	-	39,464	6,095	13,089	-	380,753
1984	-	39,871	-	43,802	6,185	10,903	-	441,447
1985	-	32,096	-	27,137	8,822	10,072	-	355,242
1986	-	22,818	-	21,840	3,289	4,201	-	279,250
1987	-	22,652	-	11,457	1,654	3,440	-	235,647
1988	-	15,928	-	10,868	172	1,169	-	223,946
1989	-	8,440	-	6,058	121	103	-	197,694
1990	-	10,020	-	3,420	3	18	-	171,310
1991	-	-	-	-	-	-	-	139,212
1992	-	-	-	-	-	-	-	72,890
1993	-	-	-	-	-	-	-	18,978
1994 <sup>1</sup>	-	-	-	-	-	-	-	44,000
								59,893
								117,909

continued

Table 2.1.3 (continued)

Year	Estonia					Latvia						Lithuania		Russia		
	25	26	28	29	32	24	25	26	27	28	29	26	28	26	28	32
1991		1,537	273	-	-			1,190		1,432	-	1,854	11	3,034	264	1
1992		1,011	352	5	-			383		867	-	1,266	-	1,793	-	-
1993		61	8	-	1			761		572	-	605	-	892	-	-
1994	147	579	208	17	1	-	630	1,619	-	582	-	1,887	-	1,257	-	-
1995 <sup>1</sup>	338	246	465	-	-	15	1,124	3,649	1	1,864	-	-	-	-	-	-

<sup>1</sup>Provisional. <sup>2</sup>Finland: 1972-1974, Sub-divisions combined. <sup>3</sup>Sweden: 1972-1974, Sub-divisions combined.

<sup>4</sup>Poland: some catches from Sub-division 24 included. <sup>5</sup>Includes landings from October-December 1990.

Table 2.1.4 Total landings (t) of COD in Sub-divisions 22, 23 and 24.

Year	Denmark		German Dem. Rep.	Germany, Fed. Rep.	Poland	Sweden		Total				
	23	22 + 24	22 + 24	22 + 24	24	23	24	22	23	24	Unallo- cated	22 + 24
1965		19,457	9,705	13,350		-	2,182	27,867	-	7,007	-	44,874
1966		20,500	8,393	11,448		-	2,110	27,864	-	14,587	-	42,451
1967		19,181	10,007	12,884		-	1,996	28,875	-	15,193	-	44,068
1968		22,593	12,360	14,815		-	2,113	32,911	-	18,970	-	51,881
1969		20,602	7,519	12,717		-	1,413	29,082	-	13,169	-	42,251
1970		20,085	7,996	14,589		-	1,289	31,363	-	12,596	-	43,959
1971		23,715	8,007	13,482		-	1,419	32,119	-	14,504	-	46,623
1972		25,645	9,665	12,313		-	1,277	32,808	-	16,092	-	48,900
1973		30,595	8,374	13,733		-	1,655	38,237	-	16,120	-	54,357
1974		25,782	8,459	10,393		-	1,937	31,326	-	15,245	-	46,571
1975		23,481	6,042	12,912		-	1,932	31,867	-	12,500	-	44,367
1976	712	29,446	4,582	12,893		-	1,800	33,368	712	15,353	-	48,721
1977	1,166	27,939	3,448	11,686		550	1,516	29,510	1,716	15,079	-	44,589
1978	1,177	19,168	7,085	10,852		600	1,730	24,232	1,777	14,603	-	38,835
1979	2,029	23,325	7,594	9,598		700	1,800	26,027	2,729	16,290	-	42,317
1980	2,425	23,400	5,580	6,652		1,300	2,610	22,881	3,725	15,366	-	38,247
1981	1,473	22,654	11,659	11,260		900	5,700	26,340	2,373	24,933	-	51,273
1982	1,638	19,138	10,615	8,060		140	7,933	20,971	1,778	24,775	-	45,746
1983	1,257	21,961	9,097	9,260		120	6,910	24,478	1,377	22,750	-	47,228
1984	1,703	21,909	8,093	11,548		228	6,014	27,058	1,931	20,506	-	47,564
1985	1,076	23,024	5,378	5,523		263	4,895	22,063	1,339	16,757	-	38,820
1986	748	16,195	2,998	2,902		227	3,622	11,975	975	13,742	-	25,717
1987	1,503	13,460	4,896	4,256	-	137	4,314	12,105	1,640	14,281	-	26,926
1988	1,121	13,185	4,632	4,217	-	155	5,849	9,680	1,276	18,203	-	27,883
1989	636	8,059	2,145	2,498	-	192	4,987	5,738	828	11,637	-	17,689
1990	722	8,584	1,629 <sup>2</sup>	3,054	-	120	3,671	5,361	842	11,577	-	16,938
1991	1,431	9,383	-	2,879	-	232	2,768	7,184	1,663	7,846	-	15,030
1992	2,449	9,946	-	3,656	-	290	1,655	9,887	2,739	5,370	-	15,257
1993	1,001	8,666	-	4,084	-	274	1,675	7,591	1,275	6,896	3,650	18,075
1994	1,073	13,831	-	4,023	91	555	3,711	8,229	1,628	13,427	6,000	27,216
1995 <sup>1</sup>	2,547	18,762	-	10,472	-	611	2,632	18,177	611	13,689	-	31,866

<sup>1</sup> Provisional data.

<sup>2</sup> Includes landings from October–December 1990 in the former GDR.

Table 2.3.1: Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches by Sub-division (22 and 24), quarter and gear (trawl and gillnet) for Denmark and Sweden.

SUBDIVISION 22. Trawl and Gillnet  
DENMARK

SD 22						
Quarter 1						
Age	Trawl		Gillnet		Tot landings	
	numbers*1000	mean weight [g]	numbers*1000	mean weight [g]	numbers*1000	Mean weight
	numbers*1000	mean weight [g]	numbers*1000	mean weight [g]	numbers*1000	Mean weight
1						
2	646 583	669	144 769	669	791 352	669
3	1137 091	955	351 138	1100	1488 229	989
4	1231 229	1978	637 621	2193	1868 850	2051
5	156 698	4014	96 342	3943	253 040	3987
6	23 390	7122	12 539	6941	35 930	7059
7	0 000		0 000			
8	0 000		0 000			
9	0 240	11014	0 067	11014	0 306	11014
10	0 000		0 000			
11+	0 000		0 000			
SOP(1)	4752		2349		7101	
Tot landings	4752		2349		7101	
Quarter 2						
Age	Trawl		Gillnet		Tot landings	
	numbers*1000	mean weight [g]	numbers*1000	mean weight [g]	numbers*1000	Mean weight
	numbers*1000	mean weight [g]	numbers*1000	mean weight [g]	numbers*1000	Mean weight
1						
2	126 772	695	91 498	699	218 269	697
3	114 476	1016	106 313	1163	220 788	1087
4	115 180	2185	140 641	2186	255 821	2186
5	15 791	3431	12 996	3511	28 787	3487
6	0 649	6580	0 447	6534	1 096	6561
7	0 244	10064	0 276	10064	0 520	10064
8	0 244	14750	0 276	14750	0 520	14750
9	0 000		0 000			
10	0 000		0 000			
11+	0 244	11918	0 271	11918	0 515	11918
SOP(1)	523		554		1077	
Tot landings	523		554		1077	
Quarter 3						
Age	Trawl		Gillnet		Tot landings	
	numbers*1000	mean weight [g]	numbers*1000	mean weight [g]	numbers*1000	Mean weight
	numbers*1000	mean weight [g]	numbers*1000	mean weight [g]	numbers*1000	Mean weight
1						
2	84 698	891	97 186	901	181 883	896
3	49 595	1690	55 377	1627	104 972	1657
4	71 196	2841	64 914	2638	136 110	2743
5	5 200	4631	3 951	3961	9 152	4342
6	0 000		0 000			
7	0 000		0 000			
8	0 000		0 000			
9	0 000		0 000			
10	0 000		0 000			
11+	0 000		0 000			
SOP(1)	388		364		750	
Tot landings	388		364		750	
Quarter 4						
Age	Trawl		Gillnet		Tot landings	
	numbers*1000	mean weight [g]	numbers*1000	mean weight [g]	numbers*1000	Mean weight
	numbers*1000	mean weight [g]	numbers*1000	mean weight [g]	numbers*1000	Mean weight
1						
2	24 039	532	13 075	601	37 114	556
3	1102 617	891	704 390	958	1807 007	917
4	138 235	1350	126 182	1605	264 416	1472
5	160 509	2254	188 120	2411	348 629	2338
6	3 403	3522	4 379	3521	7 783	3521
7	1 991	6580	2 493	1709	4 485	3872
8	0 000		0 000			
9	0 000		0 000			
10	0 183	9402	0 218	9402	0 400	9402
11+	0 000		0 000			
SOP(1)	1570		1356		2926	
Tot landings	1581		1356		2936	
all						
Age	Trawl		Gillnet		Tot landings	
	numbers*1000	mean weight [g]	numbers*1000	mean weight [g]	numbers*1000	Mean weight
	numbers*1000	mean weight [g]	numbers*1000	mean weight [g]	numbers*1000	Mean weight
1						
2	24 039	532	13 075	601	37 114	556
3	1960 669	805	1037 642	890	2998 311	834
4	1439 396	1023	639 009	1256	2078 405	1096
5	1578 113	2060	1029 296	2259	2607 410	2139
6	181 093	3872	117 669	3880	298 762	3936
7	26 031	7087	15 479	6086	41 510	6701
8	0 244	10064	0 276	10064	0 520	10064
9	0 244	14750	0 276	14750	0 520	14750
10	0 240	11014	0 067	11014	0 306	11014
11+	0 244	11918	0 271	11918	0 515	11918
SOP(1)	7230		4623		11853	
Tot landings	7222		4623		11845	

Table 2.3.1, continued: Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches by Sub-division (22 and 24), quarter and gear (trawl and gillnet) for Denmark and Sweden.

SUBDIVISION 24, Trawl and Gillnet  
DENMARK

SU 24						
Quarter 1 200						
Age	Gear				Tot. landings	
	Trawl		Gillnet		numbers*1000	Mean weight
	numbers*100	mean weight [g]	numbers*1000	mean weight [g]		
1	0 000		0 000			
2	414 602	685	114 896	720	529 497	693
3	552 357	921	293 682	1105	846 039	985
4	536 421	1204	451 349	1402	987 770	1294
5	96 473	1369	93 982	1551	190 455	1459
6	2 005	3752	4 268	3826	6 273	3802
7	1 190	5692	2 711	5692	3 902	5692
8	0 437	11719	0 314	11719	0 751	11719
9	0 000		0 000			
10	0 000		0 000			
11+	0 218	13712	0 157	13712	0 375	13712
SOP(t)	1593 069		1223 388		2816 447	
Tot. landings	1593		1223		2816	
Quarter 2						
Age	Gear				Tot. landings	
	Trawl		Gillnet		numbers*1000	Mean weight
	numbers*100	mean weight [g]	numbers*1000	mean weight [g]		
1	5 035	484 000	6 019	484 000	11 054	484
2	15 237	575	25 700	795	40 937	713
3	67 938	904	142 471	1179	210 409	1090
4	104 968	1328	332 180	1522	437 147	1475
5	30 129	1256	78 093	1614	106 222	1512
6	2 289	1918	5 499	2728	7 787	2491
7	0 074	5158	0 342	5158	0 415	5158
8	0 185	5606	0 854	5606	1 039	5606
9	0 074	12556	0 342	12556	0 415	12556
10	0 000		0 000			
11+	0 000		0 000			
SOP(t)	256 538		645 551		1102 089	
Tot. landings	257		646		1102	
Quarter 3						
Age	Gear				Tot. landings	
	Trawl		Gillnet		numbers*1000	Mean weight
	numbers*100	mean weight [g]	numbers*1000	mean weight [g]		
1	0 001	500 000	0 307	500 000	0 008	500
2	62 798	1272	57 694	1317	120 490	1294
3	12 566	1548	17 847	1719	30 413	1648
4	1 179	2724	4 367	2731	5 546	2730
5	1 220	2335	3 598	2581	4 818	2519
6	0 039	5865	0 238	5865	0 277	5865
7	0 007	5158	0 042	5158	0 050	5158
8	0 017	5606	0 105	5606	0 122	5606
9	0 007	12556	0 042	12556	0 050	12556
10	0 000		0 000			
11+	0 000		0 000			
SOP(t)	105 847		130 813		236 460	
Tot. landings	108		131		236	
Quarter 4						
Age	Gear				Tot. landings	
	Trawl		Gillnet		numbers*1000	Mean weight
	numbers*100	mean weight [g]	numbers*1000	mean weight [g]		
1	333 240	538 000	88 201	541 000	421 441	539
2	1148 464	795	401 897	903	1550 361	823
3	441 943	991	204 171	1158	646 114	1044
4	188 963	1351	126 287	1522	316 240	1419
5	36 143	1464	26 815	1841	62 759	1624
6	8 918	1531	6 432	1928	15 350	1697
7	0 112	6157	0 232	6135	0 343	6142
8	0 082	5662	0 167	5662	0 249	5662
9	0 000		0 000			
10	0 000		0 000			
11+	0 000		0 000			
SOP(t)	1654 640		903 087		2757 707	
Tot. landings	1855		303		2758	
Quarter all						
Age	Gear				Tot. landings	
	Trawl		Gillnet		numbers*1000	Mean weight
	numbers*100	mean weight [g]	numbers*1000	mean weight [g]		
1	338 278	537 196	34 227	537 356	432 502	537
2	1641 098	783	600 187	903	2241 286	815
3	1074 805	956	658 171	1154	1732 975	1031
4	832 520	1256	914 183	1468	1746 703	1367
5	163 968	1378	200 288	1632	364 254	1517
6	13 230	1948	16 437	2745	29 668	2369
7	1 383	5698	3 327	5681	4 710	5672
8	0 721	9342	1 440	6968	2 162	7760
9	0 081	12556	0 384	12556	0 465	12556
10						
11+	0 218	13712	0 157	13712	0 375	13712
SOP(t)	3810 084		3102 819		6912 703	
Tot. landings	3810		3103		6913	

Table 2.3.1, continued: Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches by Sub-division (22 and 24), quarter and gear (trawl and gillnet) for Denmark and Sweden.

SUBMISSION 24, Trawl and Gillnet  
SWEDEN

SD 24						
Quarter 1						
Age	Gear		Tot. landings			
	Trawl		Gillnet		numbers*1000	Mean weight
	numbers*1000	mean weight [g]	numbers*1000	mean weight [g]		
1						
2	245 757	630	34 438	955	280.194	670
3	495 128	929	233.191	1132	728 319	994
4	160 826	1505	136 766	1650	297 592	1572
5	18 974	1972	12.791	2046	31.765	2002
6	0 361	5552	0.197	4521	0 558	5189
7	0 090	6993			0 090	6993
8	0 181	8451			0.181	8451
9	0 181	9524			0.181	9524
10						
11+						
SOP(t)	900		550		1450	
Tot. landings	899		551		1450	
Quarter 2						
Age	Gear		Tot. landings			
	Trawl		Gillnet		numbers*1000	Mean weight
	numbers*1000	mean weight [g]	numbers*1000	mean weight [g]		
1						
2	26 243	630	0 572	955	26 815	637
3	52 872	929	3 871	1132	56 744	943
4	17 174	1505	2 270	1650	19 444	1522
5	2 026	1972	0 212	2046	2.238	1979
6	0 039	5552	0 003	4521	0 042	5472
7	0 010	6993			0 010	6993
8	0 019	8451			0 019	8451
9	0 019	9524			0 019	9524
10						
11+						
SOP(t)	96		3		105	
Tot. landings	96		9		105	
Quarter 3						
Age	Gear		Tot. landings			
	Trawl		Gillnet		numbers*1000	Mean weight
	numbers*1000	mean weight [g]	numbers*1000	mean weight [g]		
1	22 222	468	1.246	468	23 468	468
2	210 772	797	25 968	1100	236 740	830
3	63 636	1177	18 282	1443	81 917	1236
4	9 091	1321	1 870	1684	10 961	1383
5	0 337	3922	0 104	2868	0 441	3678
6						
7						
8						
9						
10						
11+						
SOP(t)	267		59		326	
Tot. landings	267		59		326	
Quarter 4						
Age	Gear		Tot. landings			
	Trawl		Gillnet		numbers*1000	Mean weight
	numbers*1000	mean weight [g]	numbers*1000	mean weight [g]		
1	43 778	468	4 754	468	48 532	468
2	415 228	797	99 032	1100	514 260	856
3	125 364	1177	69 718	1443	195 083	1272
4	17 909	1321	7.130	1684	25 039	1424
5	0 663	3922	0 396	2868	1 059	3535
6						
7						
8						
9						
10						
11+						
SOP(t)	525		225		750	
Tot. landings	526		225		751	
Quarter all						
Age	Gear		Tot. landings			
	Trawl		Gillnet		numbers*1000	Mean weight
	numbers*1000	mean weight [g]	numbers*1000	mean weight [g]		
1	66 000	468	6 000	468	72 000	468
2	898 000	746	160 009	1068	1058 009	796
3	737 000	993	325 062	1216	1062 062	1061
4	205 000	1481	148 036	1652	353 036	1553
5	22 000	2061	13 503	2077	35 503	2067
6	0 400	5552	0 200	4521	0 600	5208
7	0 100	6993			0 100	6993
8	0 200	8451			0 200	8451
9	0 200	9524			0 200	9524
10						
11+						
SOP(t)	1738		843		2581	
Tot. landings	1738		844		2582	

Table 2.3.2: Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches by country, Sub-division and quarter.  
SD 22

95 Quarter 1						
Country	Denmark		Germany		Total	
Age	Numbers	Mean weight [g]	Numbers *1000	Mean weight [g]	Numbers	Mean weight [g]
1	0.000		0.000			
2	791.352	889	119.150	884	910.502	871
3	1488.229	989	173.677	1185	1661.905	1009
4	1868.850	2051	318.071	1521	2186.921	1974
5	253.040	3987	364.519	3487	617.559	3680
6	35.930	7059	32.312	8581	68.241	8823
7	0.000		0.000		0.000	
8	0.000		0.000		0.000	
9	0.308	11014	0.000		0.308	11014
10	0.000		0.000		0.000	
11+	0.000		0.000		0.000	
SOP (t)	7100		2247		9347	
Tot. landings	7102		2247		9349	
95 Quarter 2						
Country	Denmark		Germany		Total	
Age	Numbers	Mean weight [g]	Numbers *1000	Mean weight [g]	Numbers	Mean weight [g]
1	0.000		0.877	200	0.877	200
2	218.289	897	488.586	884	706.855	889
3	220.788	1087	187.715	1185	408.503	1132
4	255.821	2186	180.898	1521	436.519	1910
5	28.787	3487	18.886	3487	45.453	3487
6	1.098	8581		8581	1.098	8581
7	0.520	10064			0.520	10064
8	0.520	14750			0.520	14750
9	0.000					
10	0.000					
11+	0.515	11918			0.515	11918
SOP (t)	1077		889		1967	
Tot. landings	1077		857		1934	
95 Quarter 3						
Country	Denmark		Germany		Total	
Age	Numbers	Mean weight [g]	Numbers *1000	Mean weight [g]	Numbers	Mean weight [g]
1	0.000					
2	181.883	898	583.782	771	765.665	801
3	104.972	1857	103.800	1207	208.772	1433
4	138.110	2743	48.587	2441	184.897	2683
5	9.152	4340			9.152	4340
6	0.000					
7	0.000					
8	0.000					
9	0.000					
10	0.000					
11+	0.000					
SOP (t)	750		694		1444	
Tot. landings	750		692		1442	
95 Quarter 4						
Country	Denmark		Germany		Total	
Age	Numbers	Mean weight [g]	Numbers *1000	Mean weight [g]	Numbers	Mean weight [g]
1	37.114	558	386.374	540	403.488	541
2	1807.007	917	2250.171	890	4057.178	902
3	284.418	1470	230.786	1090	495.202	1293
4	348.629	2338	25.963	2249	372.592	2331
5	7.783	3521	2.884	5911	10.667	4168
6	4.485	8581			4.485	8581
7	0.000					
8	0.000					
9	0.000					
10	0.400	9402			0.400	9402
11+	0.000					
SOP (t)	2937		2527		5464	
Tot. landings	2916		2530		5446	
95 Quarter all						
Country	Denmark		Germany		Total	
Age	Numbers	Mean weight [g]	Numbers *1000	Mean weight [g]	Numbers	Mean weight [g]
1	37.114	558	387.251	539	404.385	541
2	2998.511	834	3441.889	827	6440.200	830
3	2078.405	1094	895.978	1184	2774.383	1112
4	2807.410	2138	573.319	1586	3180.728	2039
5	298.782	3938	384.089	3476	682.831	3677
6	41.510	8992	32.312	8581	73.822	8804
7	0.520	10064	0.000		0.520	10064
8	0.520	14750	0.000		0.520	14750
9	0.308	11014	0.000		0.308	11014
10	0.400	9402	0.000		0.400	9402
11+	0.515	11918	0.000		0.515	11918
SOP (t)	11864		6311		18174	
Tot. landings	11851		6328		18177	



Table 2.3.2, continued: Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches by country, Sub-division and quarter.

30 24

Year 95 Quarter 1														
Country	Denmark		Sweden		Germany		Total DK, S, FRG		Finland		Latvia		Total	ALL
Age	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean
	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]
1	0 000				44 212	187	44 212	187	0 709	187			44 921	187
2	529 497	893	279 881	870	566 171	579	1375 550	841	22 073	841			1397 622	841
3	848 039	985	727 888	994	304 577	913	1878 304	977	30 140	977			1908 444	977
4	987 770	1294	297 387	1572	243 171	1094	1528 328	1316	24 524	1316			1552 852	1316
5	190 455	1459	31 741	2002	70 003	1280	292 199	1470	4 889	1470			296 888	1470
6	6 273	3802	0 558	5188	1 228	1423	8 058	3538	0 129	3538			8 188	3538
7	3 902	5692	0 090	8993			3 992	5721	0 064	5721			4 056	5721
8	0 751	11719	0 180	8451			0 932	11086	0 015	11086			0 947	11086
9	0 000		0 180	9524			0 180	9524	0 003	9524			0 183	9524
10	0 000													
11 +	0 375	13712					0 375	13712	0 008	13712			0 381	13712
SOP (t)	2818		1449		970		5235		84				5319	
Tot. landings	2818		1450		989		5235		84				5319	
Year 95 Quarter 2														
Country	Denmark		Sweden		Germany		Total DK, S, FRG		Finland		Latvia		Total	ALL
Age	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean
	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]
1	11 054	484			37	187 000	47 555	258	1 328	258	0 355	258	49 237	258
2	40 937	713	28 781	838 938	467	579 000	535 145	592	14 928	592	3 998	592	554 069	592
3	210 409	1090	58 878	942 885	251	913 000	518 542	988	14 483	988	3 874	988	538 879	988
4	437 147	1475	19 422	1521 950	201	1094 000	657 330	1380	18 334	1380	4 911	1380	680 574	1380
5	108 222	1512	2 238	1979 028	58	1280 000	188 252	1431	4 837	1431	1 242	1431	172 131	1431
6	7 787	2489	0 042	5471 445	1	1423 000	8 822	2381	0 248	2381	0 088	2381	9 134	2381
7	0 415	5158	0 010	8993 000			0 425	5200	0 012	5200	0 003	5200	0 440	5200
8	1 039	5808	0 019	8451 000			1 058	5858	0 030	5858	0 008	5858	1 098	5858
9	0 415	12558	0 019	9524 000			0 434	12422	0 012	12422	0 003	12422	0 450	12422
10	0 000													
11 +	0 000													
SOP (t)	1102		105		801		2008		58		15		2079	
Tot. landings	1102		105		800		2007		58		15		2083	
Year 95 Quarter 3														
Country	Denmark		Sweden		Germany		Total DK, S, FRG		Finland		Latvia		Total	ALL
Age	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean
	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]
1	0 008	500	23 501	488	10 299	309	33 808	419					33 808	419
2	120 490	1293	237 048	830	131 893	572	489 429	874					489 429	874
3	30 413	1845	82 010	1236	70 953	814	183 378	1141					183 378	1141
4	5 548	2729	10 974	1383	58 848	1241	73 188	1375					73 188	1375
5	4 818	2515	0 441	3878	16 308	1838	21 567	2027					21 567	2027
6	0 277	5885			0 288	5885	0 583	5885					0 583	5885
7	0 050	5158					0 050	5158					0 050	5158
8	0 122	5808					0 122	5808					0 122	5808
9	0 050	12558					0 050	12558					0 050	12558
10	0 000													
11 +	0 000													
SOP (t)	238		328		238		801		0		0		801	
Tot. landings	238		328		228		788		0		0		788	
Year 95 Quarter 4														
Country	Denmark		Sweden		Germany		Total DK, S, FRG		Finland		Latvia		Total	ALL
Age	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean
	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]
1	421 441	538 822	48 532	488	987 394	424	1457 368	459					1457 368	481
2	1550 381	823	514 280	855	1637 555	780	3702 178	808					3702 178	809
3	646 114	1043	195 083	1272	340 271	1049	1181 468	1083					1181 468	1081
4	316 240	1419	25 039	1424	66 838	1319	408 117	1403					408 117	1404
5	62 759	1823	1 059	3535	8 078	1881	69 894	1957					69 894	1954
6	15 350	1898					15 350	1898					15 350	1898
7	0 343	8142					0 343	8142					0 343	8142
8	0 249	5882					0 249	5882					0 249	5882
9	0 000													
10	0 000													
11 +	0 000													
SOP (t)	2757		750		2151		5658		0		0		5662	
Tot. landings	2757		751		2151		5659		0		0		5659	
Year 95 Quarter all														
Country	Denmark		Sweden		Germany		Total DK, S, FRG		Finland		Latvia		Total	ALL
Age	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean
	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]	*1000	weight [g]
1	432 502	537	72 032	488	1078 408	405	1582 941	444	2 036	232	0 355	258	1585 332	444
2	2241 286	818	1057 968	795	2803 348	896	6102 300	757	38 999	821	3 998	592	6143 297	756
3	1732 975	1031	1081 458	1081	387 258	954	3781 690	1020	44 603	980	3 874	988	3810 187	1019
4	1748 703	1388	352 823	1553	587 417	1135	2868 943	1343	42 858	1335	4 911	1380	2714 712	1343
5	364 254	1518	25 477	2087	150 181	1340	549 912	1505	9 328	1450	1 242	1431	580 480	1504
6	29 888	2353	0 800	5208	2 527	1925	32 794	2372	0 375	2779	0 088	2381	33 235	2372
7	4 710	5878	0 100	8993			4 809	5703	0 078	5840	0 003	5200	4 888	5702
8	2 152	7738	0 200	8451			2 381	7799	0 044	7483	0 008	5858	2 414	7793
9	0 495	12558	0 200	9524			0 694	11645	0 015	11883	0 003	12422	0 683	11549
10	0 000													
11 +	0 375	13712					0 375	13712	0 008	13712			0 381	13712
SOP (t)	8914		2830		4181		13705		140		15		13881	
Tot. landings	8912		2832		4148		13690		140		15		13830	

Table 2.3.2, continued: Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches by country, Sub-division and quarter.

		Year 95 Quarter 1					
Subdiv.	Age	SD22		SD24		SD22 + 24	
		Numbers	Mean Weights [g]	Numbers	Mean Weights [g]	Numbers	Mean Weights [g]
	1	0 000	0	44 921	187	44 921	187
	2	910 502	871	1397 622	841	2308 124	853
	3	1861 905	1009	1908 444	977	3570 348	992
	4	2186 921	1974	1552 852	1316	3739 773	1701
	5	617 559	3080	296 888	1470	914 447	2963
	6	68 241	5823	8 188	3536	76 429	6471
	7			4 056	5721	4 056	5721
	8			0 947	11086	0 947	11086
	9	0 306	11014	0 183	9524	0 489	10456
	10						
	11 +			0 381	13712	0 381	13712
	SOP [t]	9347		5319		14666	
	Tot. landings	9349		5319		14668	
		Year 95 Quarter 2					
Subdiv.	Age	SD22		SD24		SD22 + 24	
		Numbers	Mean Weights [g]	Numbers	Mean Weights [g]	Numbers	Mean Weights [g]
	1	0 877	200	49 237	258	50 114	255
	2	706 855	888	554 089	592	1260 925	848
	3	408 503	1132	536 879	988	945 383	1050
	4	436 519	1910	880 574	1360	1117 093	1575
	5	45 453	3467	172 131	1431	217 584	1858
	6	1 096	8561	9 134	2381	10 230	2829
	7	0 520	10064	0 440	5200	0 959	7834
	8	0 520	14750	1 096	5858	1 615	8582
	9	0 000	0	0 450	12422	0 450	12422
	10	0 000	0	0 000	0	0 000	0
	11 +	0 515	11918	0 000	0	0 515	11918
	SOP [t]	1967		2079		4045	
	Tot. landings	1934		2063		3997	
		Year 95 Quarter 3					
Subdiv.	Age	SD22		SD24		SD22 + 24	
		Numbers	Mean Weights [g]	Numbers	Mean Weights [g]	Numbers	Mean Weights [g]
	1	0 000	0	33 808	419	33 808	419
	2	765 665	801	489 429	874	1255 094	830
	3	208 772	1433	183 376	1141	392 148	1296
	4	184 697	2663	73 168	1375	257 865	2298
	5	9 152	4340	21 567	2027	30 719	2716
	6	0 000	0	0 563	5865	0 563	5865
	7	0 000	0	0 050	5158	0 050	5158
	8	0 000	0	0 122	5806	0 122	5806
	9	0 000	0	0 050	12556	0 050	12556
	10	0 000	0	0 000	0	0 000	0
	11 +	0 000	0	0 000	0	0 000	0
	SOP [t]	1444		801		2244	
	Tot. landings	1442		788		2231	
		Year 95 Quarter 4					
Subdiv.	Age	SD22		SD24		SD22 + 24	
		Numbers	Mean Weights [g]	Numbers	Mean Weights [g]	Numbers	Mean Weights [g]
	1	403 488	541	1457 366	481	1860 854	478
	2	4057 178	902	3702 176	809	7759 354	858
	3	495 202	1293	1181 468	1081	1676 670	1143
	4	372 592	2331	408 117	1404	780 709	1847
	5	10 667	4168	69 894	1654	80 561	1987
	6	4 485	8561	15 350	1696	19 835	2796
	7	0 000	0	0 343	8142	0 343	8142
	8	0 000	0	0 249	5882	0 249	5882
	9	0 000	0	0 000	0	0 000	0
	10	0 400	9402	0 000	0	0 400	9402
	11 +	0 000	0	0 000	0	0 000	0
	SOP [t]	5464		5662		11126	
	Tot. landings	5446		5659		11105	
		Year 95 Quarter all					
Subdiv.	Age	SD22		SD24		SD22 + 24	
		Numbers	Mean Weights [g]	Numbers	Mean Weights [g]	Numbers	Mean Weights [g]
	1	404 365	541	1585 332	444	1989 697	464
	2	8440 200	830	8143 297	756	12583 497	794
	3	2774 383	1112	3810 167	1019	6584 550	1058
	4	3180 728	2039	2714 712	1343	5895 440	1716
	5	682 831	3677	560 480	1504	1243 311	2697
	6	73 822	8804	33 235	2377	107 057	5429
	7	0 520	10064	4 888	5702	5 408	8121
	8	0 520	14750	2 414	7793	2 933	9025
	9	0 306	11014	0 683	11649	0 989	11453
	10	0 400	9402	0 000	0	0 400	9402
	11 +	0 515	11918	0 381	13712	0 896	12681
	SOP [t]	18174		13861		32035	
	Tot. landings	18177		13830		32007	

**Table 2.3.3** International sampling of cod commercial and research catches (number of samples, fish length measured and fish aged) in the Western Baltic (SD 22-24).

DENMARK - COMMERCIAL						
Species	Sub-div.	1. Quarter	2. Quarter	3. Quarter	4. Quarter	Total
Cod	22 Landings (t)	7102	1077	756	2916	11851
	Samples (n)	10	14	11	15	50
	Measured (n)	1259	1447	1611	5639	9956
	Aged (n)	392	355	456	535	1738
	23 Landings (t)	1519	180	67	781	2547
	Samples (n)	0	0	0	0	0
	Measured (n)	0	0	0	0	0
	Aged (n)	0	0	0	0	0
	24 Landings (t)	2816	1102	236	2757	6911
	Samples (n)	5	2	1	16	24
	Measured (n)	1148	1430	250	6474	9302
	Aged (n)	187	268	60	842	1357
SWEDEN - COMMERCIAL						
Species	Sub-div.	1. Quarter	2. Quarter	3. Quarter	4. Quarter	Total
Cod	22 Landings (t)	0	0	0	0	0
	Samples (n)	0	0	0	0	0
	Measured (n)	0	0	0	0	0
	Aged (n)	0	0	0	0	0
	23 Landings (t)	324	21	14	252	611
	Samples (n)	0	0	0	0	0
	Measured (n)	0	0	0	0	0
	Aged (n)	0	0	0	0	0
	24 Landings (t)	1450	105	326	751	2632
	Samples (n)	10	0	2	10	22
	Measured (n)	2815	0	596	2363	5774
	Aged (n)	200	0	80	120	400
GERMANY - COMMERCIAL						
Species	Sub-div.	1. Quarter	2. Quarter	3. Quarter	4. Quarter	Total
Cod	22 Landings (t)	2247	857	692	2530	6326
	Samples (n)	8	10	1	10	29
	Measured (n)	646	2750	273	1514	5183
	Aged (n)	231	635	129	599	1594
	23 Landings (t)	0	0	0	0	0
	Samples (n)	0	0	0	0	0
	Measured (n)	0	0	0	0	0
	Aged (n)	0	0	0	0	0
	24 Landings (t)	969	800	226	2151	4146
	Samples (n)	0	8	2	8	18
	Measured (n)	0	2635	679	2010	5324
	Aged (n)	0	1155	310	819	2284
GERMANY - RESEARCH						
Species	Sub-div.	1. Quarter	2. Quarter	3. Quarter	4. Quarter	Total
Cod	22 Landings (t)	2247	857	692	2530	6326
	Samples (n)	1	10	0	32	43
	Measured (n)	740	4194	0	2541	7475
	Aged (n)	349	152	0	330	831
	23 Landings (t)	0	0	0	0	0
	Samples (n)	0	0	0	0	0
	Measured (n)	0	0	0	0	0
	Aged (n)	0	0	0	0	0
	24 Landings (t)	969	800	226	2151	4146
	Samples (n)	40	0	0	25	65
	Measured (n)	18646	0	0	6376	25022
	Aged (n)	735	0	0	454	1189

Table 2.3.4

WEST - weight in stock - Sd22+24.								
Age	22+24	Sub-division 22		Sub-division 24				22+24
	WG-repor 1990-199	Germany 1995	Denmark 1995	DK-Dana 1995	Feb-March Germany 1995	Feb-March Sweden 1995	Feb-March Average	Average
0								
1	0.194	0.09		0.082	0.061	0.094	0.079	0.085
2	0.539	0.469		0.256	0.109	0.268	0.211	0.340
3	0.854	0.785		0.68	0.951	0.685	0.772	0.779
4	1.718	1.075		1.195	1.583	1.224	1.334	1.334
5	2.339			1.762	2.943	1.303	2.003	2.003
6	2.931				3.516	2.61	3.063	3.063
7	4.664							4.664
8	6.544							6.544
9	8.181							8.181
10	9.297							9.297
11+	10.942							10.942

Table 2.6.1

## Averages

## Sex ratios (Proportion of females)

SD	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7+
22	0.41	0.44	0.49	0.61	0.73	0.97	1.00
24	0.52	0.45	0.50	0.52	0.66	0.61	0.74
Average	0.47	0.44	0.50	0.56	0.69	0.79	0.87
25	0.44	0.48	0.57	0.58	0.67	0.70	0.87
26	0.50	0.56	0.58	0.59	0.74	0.70	0.60
27	0.79	0.52	0.53	0.60	0.65	0.72	0.60
28	0.56	0.48	0.53	0.77	0.69	1.00	0.67
Average	0.57	0.51	0.55	0.63	0.69	0.78	0.69

Proportion reproducing (females)  
(~maturity ogives)

SD	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
22	0.00	0.21	0.66	0.90	0.96	0.96	0.98			
24	0.00	0.25	0.56	0.89	0.99	1.00				
Average	0.00	0.23	0.61	0.90	0.97	0.98	0.98			
25	0.78	0.87								
26	0.00	0.06	0.45	0.81	0.94	0.98	0.94	1.00		
27	0.00	0.11	0.37	0.79	0.95	0.98	1.00	1.00		1.00
28	0.00	0.07	0.41	0.70	0.98	0.98	1.00	1.00		
28	0.00	0.05	0.27	0.58	0.74	0.84	0.90	1.00	0.81	1.00
Average	0.00	0.07	0.37	0.72	0.90	0.94	0.96	0.97 (8+)		

Proportion reproducing (males)  
(~maturity ogives)

SD	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
22	0.00	0.43	0.87	0.96	0.98	0.98	0.99			
24	0.04	0.45	0.74	0.89	0.96	1.00	1.00			
Average	0.02	0.44	0.81	0.92	0.97	0.99	1.00			
25	0.13	0.23	0.68	0.91	0.97	0.99	1.00			
26	0.00	0.54	0.75	0.91	0.99	1.00	1.00	1.00	1.00	
28	0.00	0.26	0.50	0.65	0.79	0.82	0.85	0.88	1.00	0.83
Average	0.04	0.34	0.64	0.82	0.92	0.94	0.95	0.94 (8+)		

OGIVES7.XLS

Table 2.6.2. Changes in female maturity during the time from 1958 to 1995.

SD	Year range		Distribution factor	Female maturity ogive at age									
				Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
22	1958	1969	0.00	0.07	0.62	0.83	0.91	0.94	0.96				
22	1967	1977	0.01	0.09	0.46	0.88	0.98	1.00					
22	1979	1985	0.00	0.29	0.66	0.94	0.97	0.93	1.00				
22	1995		0.00	0.12	0.54	0.81	0.95						
22	1967	1995	0.00	0.17	0.55	0.88	0.96	0.96	1.00				
24	1967	1977	0.01	0.09	0.43	0.85	0.98	1.00					
24	1985	1994	0.00	0.30	0.62	0.93	1.00	1.00	1.00				
24	1995		0.00	0.10	0.38	0.92	1.00	1.00					
24	1967	1995	0.00	0.16	0.48	0.90	0.99	1.00	1.00				
22+24	1967	1995	0.00	0.16	0.51	0.89	0.98	0.99	1.00				

Table 2.7.1

COD-2224: Cod in Baltic Fishing Areas 22 and 24

10:27 Sunday, April 21, 1996

FLT09: GLM estimates of YFS in SD 22 and 24 (Catch: Number)

Year	Fishing effort	Catch, age 1	Catch, age 2	Catch, age 3	Catch, age 4	Catch, age 5	Catch, age 6
1978	100	714	1960	544	201	73	15
1979	100	655	2619	1545	305	73	13
1980	100	3251	1121	1302	445	102	23
1981	100	1860	6673	670	512	206	30
1982	100	1229	5399	1966	304	155	53
1983	100	2785	2951	718	383	124	34
1984	100	309	3378	726	389	127	44
1985	100	153	1100	1286	475	174	55
1986	100	485	690	372	257	88	34
1987	100	618	3862	483	199	145	44
1988	100	66	1131	711	134	35	8
1989	100	39	162	201	173	60	12
1990	100	45	196	181	184	97	18
1991	100	101	124	169	130	37	7
1992	100	784	742	139	96	31	10
1993	100	908	2271	412	98	39	9
1994	100	1225	1377	1106	205	48	8
1995	100	4573	8091	1318	495	91	15
1996	100	284	9058	1996	436	255	78

COD-2224: Cod in Baltic Fishing Areas 22 and 24

09:57 Sunday, April 21, 1996

FLT10: GDR fleet 24 (Catch: Number)

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	Catch, age 10	Catch, age 11
1985	48	1305	1195	399	158	71	11	2	2	0	1
1986	30	1168	710	190	66	51	16	3	3	3	1
1987	40	3610	637	203	72	13	12	6	2	0	0
1988	44	2474	2181	222	30	17	5	5	2	1	0
1989	26	406	850	308	76	25	9	0	1	0	0
1990	20	664	545	227	115	40	10	3	0	0	0
1991	14	56	115	167	43	8	2	1	0	0	0
1992	23	660	613	170	41	16	10	4	0	1	0
1993	15	565	248	78	28	6	1	1	0	0	0
1994	21	979	1008	160	12	1	0	0	0	0	0
1995	23	1907	675	380	98	2	0	0	0	0	0

Table 2.7.1 (continued)

COD-2224: Cod in Baltic Fishing Areas 22 and 24

09:57 Sunday, April 21, 1996

## CATON: Landings (Tonnes)

Year	Total
1970	43959
1971	46623
1972	48900
1973	54357
1974	46571
1975	44367
1976	48721
1977	44583
1978	38835
1979	42317
1980	37924
1981	50583
1982	45686
1983	47228
1984	47564
1985	38820
1986	25220
1987	27776
1988	27883
1989	17689
1990	16939
1991	15030
1992	15257
1993	18132
1994	27000
1995	32007

COD-2224: Cod in Baltic Fishing Areas 22 and 24

09:57 Sunday, April 21, 1996

## CANUM: Catch in Numbers (Thousands)

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
1970	0	19405	51528	11152	3643	903	248	53	39	12	5	3
1971	5867	14844	54628	17162	2638	1157	461	121	56	27	8	4
1972	107	20932	38631	18247	4667	1030	487	120	53	19	10	5
1973	953	3846	53659	15956	4552	974	142	93	32	10	5	3
1974	959	13668	23462	22905	5327	1302	472	52	46	13	7	4
1975	376	2985	49230	8425	4974	786	318	131	31	11	4	1
1976	82	3817	33202	28799	2459	1366	285	68	37	7	3	1
1977	57	7311	28824	12630	5326	539	243	63	29	9	3	1
1978	34	3362	46497	9414	2186	711	106	29	12	7	1	1
1979	6	640	26905	18557	2286	542	247	35	15	8	4	2
1980	1	4024	8739	18114	5049	719	226	175	25	20	5	2
1981	17	864	41202	11726	5471	1990	375	88	82	5	3	1
1982	6	9138	27952	16666	1595	793	391	119	30	18	3	2
1983	27	11979	30106	13933	4547	750	321	113	38	10	5	2
1984	3	3209	34742	9511	3578	1146	306	93	45	10	11	1
1985	0	1193	8025	15277	4167	1447	658	99	39	19	21	3
1986	0	2329	6126	7603	3875	1195	474	114	19	13	8	3
1987	1	2376	24060	5077	1235	478	99	47	22	5	5	1
1988	0	641	12975	13322	1902	239	131	39	20	10	2	3
1989	0	639	2306	8026	3767	544	121	44	8	5	2	2
1990	0	730	6342	3019	2207	984	196	39	23	4	1	0
1991	0	992	4375	4348	1459	393	204	31	7	7	4	2
1992	0	2555	6788	3597	459	82	58	41	9	0	3	0
1993	0	97	12135	4733	870	102	11	20	2	2	2	2
1994	0	607	9375	11195	1375	63	9	6	5	3	0	0
1995	0	1990	12583	6585	5895	1243	107	5	2	1	0	1



Table 2.7.1 (continued)

COD-2224: Cod in Baltic Fishing Areas 22 and 24

09:57 Sunday, April 21, 1996

WECA: Mean Weight in Catch (Kilograms)

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
1970	0.100	0.288	0.561	0.960	1.626	2.406	3.362	5.570	6.817	9.530	10.500	11.000
1971	0.100	0.288	0.561	0.960	1.626	2.406	3.362	5.570	6.817	9.530	10.500	11.000
1972	0.100	0.288	0.561	0.960	1.626	2.406	3.362	5.570	6.817	9.530	10.500	11.000
1973	0.100	0.288	0.561	0.960	1.626	2.406	3.362	5.570	6.817	9.530	10.500	11.000
1974	0.100	0.288	0.561	0.960	1.626	2.406	3.362	5.570	6.817	9.530	10.500	11.000
1975	0.100	0.288	0.561	0.960	1.626	2.406	3.362	5.570	6.817	9.530	10.500	11.000
1976	0.100	0.288	0.561	0.960	1.626	2.406	3.362	5.570	6.817	9.530	10.500	11.000
1977	0.100	0.288	0.561	0.960	1.626	2.406	3.362	5.570	6.817	9.530	10.500	11.000
1978	0.100	0.288	0.561	0.960	1.626	2.406	3.362	5.570	6.817	9.530	10.500	11.000
1979	0.100	0.288	0.561	0.960	1.626	2.406	3.362	5.570	6.817	9.530	10.500	11.000
1980	0.100	0.288	0.561	0.960	1.626	2.406	3.362	5.570	6.817	9.530	10.500	11.000
1981	0.100	0.288	0.561	0.960	1.626	2.406	3.362	5.570	6.817	9.530	10.500	11.000
1982	0.100	0.306	0.549	1.225	1.715	2.949	3.598	4.664	7.202	9.037	11.185	13.000
1983	0.059	0.402	0.608	1.031	1.680	2.445	3.465	4.592	5.775	6.964	11.000	12.624
1984	0.045	0.358	0.701	1.263	1.737	2.287	2.539	4.347	6.577	6.975	11.117	12.000
1985	0.309	0.434	0.791	1.229	1.879	2.237	3.118	4.257	5.887	7.908	8.214	10.500
1986	0.010	0.443	0.668	1.141	1.841	1.920	2.651	3.874	5.540	8.896	9.725	11.025
1987	0.010	0.362	0.713	1.132	1.899	3.202	4.104	5.270	6.453	8.829	4.820	11.160
1988	0.010	0.555	0.736	1.072	1.466	3.089	4.757	5.291	6.750	9.133	9.000	11.44
1989	0.010	0.442	0.694	1.018	1.489	2.125	3.356	5.429	7.129	6.252	6.584	9.18
1990	-1.000	0.594	0.889	1.027	1.993	2.576	3.148	5.329	7.023	8.116	9.829	10.000
1991	-1.000	0.570	0.946	1.317	1.542	2.972	4.503	7.710	7.946	8.912	8.903	10.000
1992	-1.000	0.578	0.926	1.614	2.335	3.088	6.059	6.767	8.660	8.514	9.996	10.000
1993	-1.000	0.494	0.741	1.294	2.457	3.923	3.494	8.211	13.681	6.120	15.434	14.302
1994	0.000	0.414	0.980	1.262	2.189	4.203	6.362	7.228	7.028	7.936	9.366	10.000
1995	0.000	0.464	0.794	1.058	1.172	2.697	5.429	6.121	9.025	11.453	9.402	12.681

COD-2224: Cod in Baltic Fishing Areas 22 and 24

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wEST: Mean Weight in Stock (Kilograms)

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
1970	0.027	0.092	0.422	1.060	1.738	2.442	3.387	5.036	6.881	8.500	10.500	12.800
1971	0.027	0.092	0.422	1.060	1.738	2.442	3.387	5.036	6.881	8.500	10.500	12.800
1972	0.027	0.092	0.422	1.060	1.738	2.442	3.387	5.036	6.881	8.500	10.500	12.800
1973	0.027	0.092	0.422	1.060	1.738	2.442	3.387	5.036	6.881	8.500	10.500	12.800
1974	0.027	0.092	0.422	1.060	1.738	2.442	3.387	5.036	6.881	8.500	10.500	12.800
1975	0.027	0.092	0.422	1.060	1.738	2.442	3.387	5.036	6.881	8.500	10.500	12.800
1976	0.027	0.092	0.422	1.060	1.738	2.442	3.387	5.036	6.881	8.500	10.500	12.800
1977	0.027	0.092	0.422	1.060	1.738	2.442	3.387	5.036	6.881	8.500	10.500	12.800
1978	0.027	0.092	0.422	1.060	1.738	2.442	3.387	5.036	6.881	8.500	10.500	12.800
1979	0.027	0.092	0.422	1.060	1.738	2.442	3.387	5.036	6.881	8.500	10.500	12.800
1980	0.027	0.092	0.422	1.060	1.738	2.442	3.387	5.036	6.881	8.500	10.500	12.800
1981	0.027	0.092	0.422	1.060	1.738	2.442	3.387	5.036	6.881	8.500	10.500	12.800
1982	0.027	0.092	0.422	1.060	1.738	2.442	3.387	5.036	6.881	8.500	10.500	12.800
1983	0.027	0.092	0.422	1.060	1.738	2.442	3.387	5.036	6.881	8.500	10.500	12.800
1984	0.027	0.092	0.422	1.060	1.738	2.442	3.387	5.036	6.881	8.500	10.500	12.800
1985	0.010	0.147	0.594	1.155	1.764	2.103	2.968	4.340	5.454	7.500	9.000	10.000
1986	0.001	0.045	0.604	1.115	1.822	1.912	2.651	3.774	5.540	8.896	9.725	10.500
1987	0.001	0.090	0.522	0.919	1.579	3.048	3.922	5.248	6.271	6.346	8.779	11.160
1988	0.001	0.090	0.451	0.935	1.441	3.006	4.542	5.555	6.681	7.944	8.996	11.447
1989	0.001	0.159	0.596	1.003	1.625	2.433	3.768	5.426	7.163	7.330	9.675	9.744
1990	-1.000	0.194	0.539	0.854	1.718	2.339	2.931	4.664	6.544	8.181	9.297	10.942
1991	-1.000	0.194	0.539	0.854	1.718	2.339	2.931	4.664	6.544	8.181	9.297	10.942
1992	-1.000	0.194	0.539	0.854	1.718	2.339	2.931	4.664	6.544	8.181	9.297	10.942
1993	-1.000	0.194	0.539	0.854	1.718	2.339	2.931	4.664	6.544	8.181	9.297	10.942
1994	-1.000	0.194	0.539	0.854	1.718	2.339	2.931	4.664	6.544	8.181	9.297	10.942
1995	-1.000	0.085	0.340	0.779	1.334	2.003	3.063	4.664	6.544	8.181	9.297	10.942

Table 2.7.1 (continued)

COD-2224: Cod in Baltic Fishing Areas 22 and 24

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MATPROP: Proportion Mature at Year Start

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
1970	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1971	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1972	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1973	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1974	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1975	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1976	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1977	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1978	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1979	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1980	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1981	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1982	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1983	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1984	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1985	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1986	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1987	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1988	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1989	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1990	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1991	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1992	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1993	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1994	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00
1995	0.00	0.00	0.16	0.72	0.87	0.91	1.00	1.00	1.00	1.00	1.00	1.00

COD-2224: Cod in Baltic Fishing Areas 22 and 24

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NATMOR: Natural Mortality

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
1970	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1971	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1972	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1973	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1974	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1975	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1976	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1977	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1978	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1979	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1980	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1981	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1982	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1983	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1984	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1985	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1986	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1987	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1988	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1989	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1990	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1991	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1992	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1993	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1994	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1995	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

**Table 2.7.2**

Lowestoft VPA Version 3.1

22-Apr-96 12:40:35

Extended Survivors Analysis

Cod in 22 and 24 (run: XSASTN06/X06)

CPUE data from file /users/fish/ifad/ifapwork/wgbfas/cod\_2224/FLEET.X06

Catch data for 26 years. 1970 to 1995. Ages 1 to 7.

Fleet,	First,	Last,	First,	Last,	Alpha,	Beta
	year,	year,	age,	age		
FLT09: GLM estimates,	1978,	1995,	1,	6,	.000,	.250
FLT10: GDR fleet 24 ,	1985,	1995,	2,	6,	.000,	.250

Time series weights :

Tapered time weighting applied  
Power = 3 over 20 years

Catchability analysis :

Catchability dependent on stock size for ages < 5

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

Catchability independent of age for ages >= 5

Terminal population estimation :

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

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

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

Prior weighting not applied

Tuning converged after 18 iterations

Regression weights

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

Fishing mortalities

Age,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995
1,	.039,	.070,	.061,	.041,	.055,	.045,	.055,	.003,	.012,	.027
2,	.456,	.690,	.656,	.323,	.701,	.538,	.487,	.397,	.452,	.350
3,	1.501,	.878,	1.116,	1.207,	.939,	1.906,	1.260,	.765,	.797,	.674
4,	1.684,	1.178,	1.030,	1.233,	1.547,	2.522,	1.342,	1.371,	.524,	1.535
5,	1.995,	1.082,	.757,	.993,	1.497,	1.633,	1.544,	1.459,	.301,	1.432
6,	1.786,	1.029,	1.060,	1.205,	1.376,	2.107,	1.355,	.924,	.440,	1.305

Table 2.7.2 (continued)

XSA population numbers (Thousands)

YEAR ,	1,	AGE 2,	3,	4,	5,	6,
1986 ,	6.77E+04	1.85E+04	1.08E+04	5.26E+03	1.53E+03	5.29E+02
1987 ,	3.90E+04	5.33E+04	9.60E+03	1.97E+03	7.99E+02	1.70E+02
1988 ,	1.20E+04	2.98E+04	2.19E+04	3.27E+03	1.97E+02	2.22E+02
1989 ,	1.77E+04	9.24E+03	1.27E+04	5.87E+03	9.55E+02	1.91E+02
1990 ,	1.50E+04	1.39E+04	5.48E+03	3.10E+03	1.40E+03	2.90E+02
1991 ,	2.48E+04	1.16E+04	5.64E+03	1.75E+03	5.40E+02	2.57E+02
1992 ,	5.28E+04	1.94E+04	5.55E+03	6.87E+02	1.15E+02	8.64E+01
1993 ,	3.49E+04	4.09E+04	9.78E+03	1.29E+03	1.47E+02	2.02E+01
1994 ,	5.82E+04	2.85E+04	2.25E+04	3.72E+03	2.68E+02	2.80E+01
1995 ,	8.23E+04	4.71E+04	1.48E+04	8.30E+03	1.80E+03	1.62E+02

Estimated population abundance at 1st Jan 1996

, .00E+00, 6.56E+04, 2.72E+04, 6.20E+03, 1.47E+03, 3.53E+02,

Taper weighted geometric mean of the VPA populations:

, 3.68E+04, 2.74E+04, 1.25E+04, 3.35E+03, 7.38E+02, 1.89E+02,

Standard error of the weighted Log(VPA populations) :

, .6714, .6573, .5853, .7792, 1.0370, 1.1699,

Log catchability residuals.

Fleet : FLT09: GLM estimates

Age ,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985
1 ,	-.56,	.18,	-.06,	.01,	-.23,	-.05,	-.07,	-.01
2 ,	-.89,	-.44,	-.13,	-.14,	.04,	-.19,	-.30,	.21
3 ,	-.13,	-.02,	-.07,	-.04,	.30,	-.33,	-.38,	.18
4 ,	-.24,	.26,	.10,	.58,	.38,	.02,	.19,	.64
5 ,	-.60,	-.41,	-.37,	-.36,	-.02,	-.24,	-.68,	-.27
6 ,	-.18,	-1.24,	-.55,	-.55,	-.34,	-.51,	-.31,	-.54

Age ,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995
1 ,	-.52,	.14,	.29,	-.34,	-.11,	-.24,	-.05,	.43,	.06,	.32
2 ,	-.14,	-.02,	-.07,	.09,	-.20,	-.26,	.13,	-.04,	.06,	.46
3 ,	-.02,	.25,	-.25,	-.69,	.04,	.05,	-.15,	.10,	.05,	.59
4 ,	-.06,	.42,	-.75,	-.89,	-.09,	.10,	.33,	-.26,	-.30,	.51
5 ,	-.41,	.63,	-.36,	-.44,	-.29,	-.28,	1.08,	1.05,	.52,	-.61
6 ,	-.50,	.98,	-.99,	-.42,	-.41,	-1.15,	.21,	1.51,	1.01,	-.02

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

Age ,	5,	6
Mean Log q,	-6.7838,	-6.7838,
S.E.(Log q),	.6202,	.8244,

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,	.46,	4.253,	9.86,	.86,	18,	.28,	-9.10,
2,	.51,	4.580,	8.94,	.90,	18,	.23,	-7.72,
3,	.79,	1.272,	8.07,	.79,	18,	.32,	-7.71,
4,	1.60,	-3.229,	6.63,	.74,	18,	-.8,	-7.19,

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

Age, Slope , t-value , Intercept, RSquare, No Pts, Reg s.e, Mean q

5,	2.03,	-5.055,	6.97,	.71,	18,	.70,	-6.78,
6,	2.20,	-3.953,	8.82,	.52,	18,	.19,	-6.86,

Table 2.7.2 (continued)

Fleet : FLT10: GDR fleet 24

Age	1978	1979	1980	1981	1982	1983	1984	1985
1	No data for this fleet at this age							
2	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-.10
3	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-.72
4	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-.88
5	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-.94
6	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-.85

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	No data for this fleet at this age									
2	.37	.04	.23	.29	.55	-1.03	.06	-.44	.09	.06
3	.02	-.67	.55	.35	.84	-1.09	.83	-.64	.38	-.08
4	-1.61	-1.83	-2.42	.75	1.42	2.70	.39	-1.17	-1.06	2.09
5	-.80	-.45	-.98	-.17	.20	.54	1.52	1.33	-.60	-.36
6	-.19	-.62	-.70	.36	.71	-.34	.84	1.72	-.81	-1.85

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

Age	5	6
Mean Log q	-5.4864	-5.4864
S.E(Log q)	.8819	1.0409

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	.83	.631	7.09	.63	11	.47	-6.48
3	1.75	-1.737	3.42	.40	11	.72	-5.94
4	4.38	-4.226	-2.12	.16	11	1.86	-5.67

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

Age, Slope, t-value, Intercept, RSquare, No Pts, Reg s.e., Mean Q

5	2.45	-2.683	4.15	.30	11	1.66	-5.49
6	1.49	-1.113	5.91	.40	11	1.51	-5.61

Terminal year survivor and F summaries :

Age 1 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,	Estimated F
FLT09: GLM estimates,	90009.,	.323,	.000,	.00,	1,	.597,
FLT10: GDR fleet 24 ,	1.,	.000,	.000,	.00,	0,	.000,
P shrinkage mean ,	27412.,	.66,,,				.148,
F shrinkage mean ,	51920.,	.50,,,				.255,
						.034

Weighted prediction :

Survivors at end of year	Int. s.e.	Ext. s.e.	N	Var. Ratio	F
65606.	.25	.38	3	1.509	.027

Table 2.7.2 (continued)

Age 2 Catchability dependent on age and year class strength

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT09: GLM estimates,	35246.,	.212,	.202,	.95,	2,	.621,	.280
FLT10: GDR fleet 24 ,	28864.,	.524,	.333,	.33,	1,	.103,	.333
P shrinkage mean ,	12484.,	.59,,,				.117,	.648
F shrinkage mean ,	16718.,	.50,,,				.160,	.519

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,		Ratio,	
27155.,	.18,	.24,	5,	1.355,	.350

Age 3 Catchability dependent on age and year class strength

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT09: GLM estimates,	8978.,	.186,	.155,	.83,	3,	.591,	.509
FLT10: GDR fleet 24 ,	6325.,	.429,	.383,	.19,	2,	.114,	.664
P shrinkage mean ,	3349.,	.78,,,				.086,	1.022
F shrinkage mean ,	2771.,	.50,,,				.209,	1.147

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,		Ratio,	
6197.,	.17,	.25,	7,	1.450,	.674

Age 4 Catchability dependent on age and year class strength

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N,	Scaled, Weights,	Estimated F
FLT09: GLM estimates,	1640.,	.194,	.131,	.67,	4,	.351,	1.448
FLT10: GDR fleet 24 ,	1569.,	.445,	.343,	.21,	3,	.055,	1.481
P shrinkage mean ,	738.,	1.04,,,				.112,	2.107
F shrinkage mean ,	1571.,	.50,,,				.482,	1.481

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,		Ratio,	
1465.,	.28,	.12,	9,	.443,	1.535

Age 5 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
FLT09: GLM estimates,	291.,	.209,	.141,	.67,	5,	.359,	1.583
FLT10: GDR fleet 24 ,	252.,	.501,	.177,	.35,	4,	.082,	1.697
F shrinkage mean ,	420.,	.50,,,				.560,	1.303

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,		Ratio,	
353.,	.29,	.12,	10,	.401,	1.432

Table 2.7.2 (continued)

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

Year class = 1989

Fleet,	Estimated, Survivors,	Int, s.e.,	Ext, s.e.,	Var, Ratio,	N,	Scaled, weights,	Estimated F
FLT09: GLM estimates,	40.,	.351,	.144,	.41,	5,	.223,	1.222
FLT10: GDR fleet 24 ,	12.,	.637,	.307,	.58,	5,	.089,	2.216
F shrinkage mean ,	40.,	.50,,,,				.687,	1.229

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e.,	s.e.,		Ratio,	
36.,	.36,	.15,	12,	.420,	1.305

Run title : Cod in 22 and 24 (run: XSASTN06/X06)

At 22-Apr-96 12:42:05

Terminal Fs derived using XSA (with F shrinkage)

Table 8	Fishing mortality (F) at age					
YEAR,	1970,	1971,	1972,	1973,	1974,	1975,
AGE						
1,	.1675,	.1637,	.1704,	.0781,	.1118,	.0445,
2,	.9767,	.9861,	.9333,	.8714,	.9291,	.7353,
3,	1.1500,	1.1195,	1.1575,	1.0680,	1.2903,	1.1150,
4,	.9212,	.9769,	1.1564,	1.0932,	1.5079,	1.1994,
5,	.7013,	.8834,	1.5598,	.8103,	1.1811,	1.0048,
6,	.9343,	1.0045,	1.3076,	1.0017,	1.3434,	1.1196,
+9p,	.9343,	1.0045,	1.3076,	1.0017,	1.3434,	1.1196,
FBAR 3- 6,	.9267,	.9961,	1.2953,	.9933,	1.3307,	1.1097,

Table 8	Fishing mortality (F) at age									
YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
1,	.0655,	.0706,	.0450,	.0185,	.0445,	.0130,	.1383,	.1502,	.1236,	.0567,
2,	.9632,	.9792,	.8399,	.5977,	.3739,	.8411,	.7249,	.9079,	.8539,	.5138,
3,	1.4961,	1.3974,	1.0880,	1.0260,	1.1166,	1.3587,	1.0545,	1.0443,	.8457,	1.2989,
4,	1.3117,	1.5255,	1.0317,	.8766,	.9034,	1.4185,	.6546,	.9763,	.8617,	1.2432,
5,	1.5029,	1.2952,	.8833,	.7916,	.7742,	1.2264,	.8081,	.7568,	.7120,	1.1251,
6,	1.4557,	1.4244,	1.0133,	.9215,	.9538,	1.3647,	.8631,	.9541,	.8298,	1.3022,
+9p,	1.4557,	1.4244,	1.0133,	.9215,	.9538,	1.3647,	.8631,	.9541,	.8298,	1.3022,
FBAR 3- 6,	1.4416,	1.4106,	1.0041,	.9039,	.9370,	1.3421,	.8450,	.9329,	.8123,	1.2398,

**Table 2.7.2 (continued)**

Run title : Cod in 22 and 24 (run: XSAS\*NCb/XCb.

At 22-Apr-96 12:42:05

Terminal Fs derived using XSA (with F shrinkage)

Table 8	Fishing mortality (F) at age										FBAR 93-95
YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	
AGE											
1,	.0388,	.0697,	.0609,	.0407,	.0553,	.0451,	.0550,	.0031,	.0116,	.0271,	.0139,
2,	.4556,	.6902,	.6564,	.3227,	.7015,	.5385,	.4874,	.3972,	.4520,	.3502,	.3998,
3,	1.5014,	.8777,	1.1158,	1.2071,	.9393,	1.9065,	1.2601,	.7655,	.7974,	.6737,	.7455,
4,	1.6843,	1.1776,	1.0302,	1.2334,	1.5474,	2.5222,	1.3422,	1.3711,	.5243,	1.5349,	1.1434,
5,	1.9950,	1.0825,	.7572,	.9926,	1.4971,	1.6325,	1.5436,	1.4587,	.3011,	1.4319,	1.0639,
6,	1.7861,	1.0294,	1.0596,	1.2047,	1.3755,	2.1066,	1.3552,	.9243,	.4396,	1.3052,	.8897,
*gp,	1.7861,	1.0294,	1.0596,	1.2047,	1.3755,	2.1066,	1.3552,	.9243,	.4396,	1.3052,	
FBAR 3- 6,	1.7417,	1.0418,	.9907,	1.1595,	1.3398,	2.0420,	1.3753,	1.1299,	.5156,	1.2364,	

Run title : Cod in 22 and 24 (run: XSAS\*NCb/XCb.

At 22-Apr-96 12:42:05

Terminal Fs derived using XSA (with F shrinkage)

Table 10	Stock number at age (start of year)						Numbers*10**3
YEAR,	1970,	1971,	1972,	1973,	1974,	1975,	
AGE							
1,	139058,	108636,	147667,	56589,	142747,	75780,	
2,	91340,	96292,	75512,	101960,	42851,	104504,	
3,	18036,	28159,	29408,	26869,	34925,	13854,	
4,	6689,	4676,	7526,	7567,	7561,	7869,	
5,	1980,	2180,	1441,	1939,	2076,	1370,	
6,	451,	804,	738,	248,	706,	522,	
*gp,	200,	370,	307,	245,	178,	286,	
TOTAL,	257754,	241116,	262598,	195416,	231044,	204185,	

Table 10	Stock number at age (start of year)						Numbers*10**3			
YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
1,	66533,	118533,	84435,	38524,	102232,	74133,	78212,	94904,	30508,	23914,
2,	59342,	51019,	90432,	66087,	30961,	80059,	59913,	55766,	66862,	22074,
3,	41016,	18543,	15690,	31967,	29763,	17442,	28266,	23761,	18417,	23306,
4,	3720,	7522,	3754,	4327,	9381,	7978,	3670,	8062,	6846,	6472,
5,	1942,	820,	1340,	1095,	1475,	3112,	1581,	1561,	2486,	2368,
6,	411,	354,	184,	453,	406,	557,	747,	577,	600,	999,
*gp,	163,	149,	95,	116,	401,	260,	324,	297,	309,	269,
TOTAL,	173126,	196941,	195918,	142569,	174620,	183540,	172713,	184929,	126028,	79403,



Table 2.7.2 (continued)

Run title : Cod in 22 and 24 (run: XSAS\*Vob.kob)

At 22-Apr-96 12:42:05

Terminal Fs derived using XSA (with F shrinkage)

Table 10	Stock number at age (start of year)					Numbers*10**-3						QMST
YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	
AGE												
1,	67720,	39019,	11993,	17687,	14991,	24848,	52793,	34910,	58166,	82330,	0,	548
2,	18500,	53337,	29796,	9239,	13903,	11613,	19446,	40912,	28494,	47073,	65606,	436
3,	10812,	9603,	21898,	12655,	5178,	5644,	5549,	9779,	22516,	14846,	27155,	173
4,	5258,	1972,	3259,	5874,	3098,	1753,	687,	1289,	3724,	8304,	6197,	44
5,	1529,	799,	477,	955,	1401,	540,	115,	147,	268,	1805,	1465,	11
6,	629,	170,	222,	191,	290,	257,	86,	20,	28,	162,	353,	3
+gp,	202,	135,	123,	94,	97,	62,	77,	50,	43,	13,	39,	
TOTAL,	104650,	105036,	67798,	46695,	39257,	44717,	78754,	87107,	113239,	154535,	100815,	

Run title : Cod in 22 and 24 (run: XSAS\*Vob.kob)

At 22-Apr-96 12:42:05

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,	
AGE							
1,	12793,	9994,	13585,	5206,	13133,	6972,	
2,	38546,	40635,	31866,	43027,	18083,	44101,	
3,	19118,	29848,	31172,	28481,	37020,	14685,	
4,	11625,	8127,	13079,	13151,	13141,	13676,	
5,	4835,	5323,	3520,	4734,	5070,	3346,	
6,	1529,	2723,	2499,	340,	2391,	1767,	
+gp,	1303,	2328,	1924,	1483,	1189,	1643,	
TOTALBIO,	89748,	98978,	97646,	96922,	90027,	86190,	

Table 12	Stock biomass at age (start of year)					Tonnes				
YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
1,	6121,	10905,	7768,	3544,	9405,	6820,	7196,	8731,	2807,	3515,
2,	25043,	21530,	38162,	27989,	13066,	33785,	25283,	23533,	28216,	13112,
3,	43476,	19656,	16631,	33885,	31549,	18488,	29962,	25186,	19522,	26919,
4,	6465,	13074,	6524,	7521,	16305,	13865,	6378,	14012,	11899,	11417,
5,	4741,	2003,	3271,	2675,	3601,	7600,	3861,	3813,	6072,	4980,
6,	1391,	1198,	623,	1536,	1376,	1885,	2532,	1954,	2031,	2965,
+gp,	985,	906,	531,	749,	2300,	1586,	1911,	1756,	1914,	1490,
TOTALBIO,	88223,	69271,	73510,	77799,	77601,	84030,	77123,	78986,	72460,	64397,

Table 2.7.2 (continued)

Run title : Cod in 22 and 24 (run: XASSTNOCX06)

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Terminal Fs derived using XSA (with F shrinkage)

Table 12 YEAR,	Stock biomass at age (start of year)					Tonnes				
	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
AGE										
1,	3047,	3512,	1079,	2812,	2908,	4821,	10242,	6773,	11284,	6998,
2,	11174,	27842,	13438,	5507,	7493,	6259,	10482,	22051,	15358,	16005,
3,	12055,	8826,	20475,	12693,	4678,	4820,	4739,	8351,	19228,	11565,
4,	9581,	3114,	4710,	9546,	5323,	3012,	1180,	2214,	6398,	11078,
5,	2923,	2435,	1495,	2324,	3277,	1263,	270,	344,	626,	3615,
6,	1668,	668,	1006,	720,	850,	752,	253,	59,	82,	497,
*gp,	980,	796,	800,	574,	541,	373,	404,	294,	263,	82,
TOTALBIO,	41428,	47192,	43004,	34175,	25070,	21300,	27569,	40086,	53240,	49841,

Run title : Cod in 22 and 24 (run: XASSTNOCX06)

At 22-Apr-96 12:42:05

Table 16 Summary (without SCP correction)

Terminal Fs derived using XSA (with F shrinkage)

	RECRUITS, Age 1	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 3- 6,
1970,	139057,	89748,	37277,	43959,	1.1792,	.9267,
1971,	108636,	98978,	44957,	46023,	1.0371,	.9961,
1972,	147667,	97646,	46548,	48900,	1.0505,	1.2953,
1973,	56589,	96922,	45463,	54357,	1.1956,	.9933,
1974,	142747,	90027,	49174,	46571,	.9471,	1.3307,
1975,	75780,	86190,	35983,	44367,	1.2330,	1.1097,
1976,	66533,	88223,	47625,	48721,	1.0230,	1.4416,
1977,	118533,	69271,	32897,	44583,	1.3552,	1.4106,
1978,	84435,	73510,	27896,	38835,	1.3926,	1.0041,
1979,	38524,	77799,	40122,	42317,	1.0547,	.9039,
1980,	102232,	77601,	45943,	37924,	.8255,	.9370,
1981,	74133,	84030,	41167,	50583,	1.2287,	1.3421,
1982,	78212,	77123,	39124,	45686,	1.1677,	.8450,
1983,	94904,	78986,	41270,	47228,	1.1444,	.9329,
1984,	30508,	72460,	38393,	47564,	1.2389,	.8123,
1985,	23914,	64397,	40398,	38820,	.9609,	1.2398,
1986,	67720,	41428,	24111,	25220,	1.0460,	1.7417,
1987,	39019,	47192,	17198,	27776,	1.6151,	1.0418,
1988,	11993,	43004,	24157,	27883,	1.1543,	.9907,
1989,	17687,	34175,	21733,	17689,	.8139,	1.1595,
1990,	14991,	25070,	13571,	16939,	1.2482,	1.3398,
1991,	24848,	21300,	9367,	15030,	1.6046,	2.0420,
1992,	52793,	27569,	7013,	15257,	2.1739,	1.3753,
1993,	34910,	40086,	12133,	18132,	1.4944,	1.1299,
1994,	58166,	53240,	22782,	27000,	1.1851,	.5156,
1995,	82330,	49841,	24375,	32007,	1.3120,	1.2364,
Arith.						
Mean	68725,	65608,	31950,	36537,	1.2185,	1.1575,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

**Table 2.8.1** ANALYSIS BY RCSEP OF Cod in in the western Baltic SDs 22 and 24

Source data

Age	M	Prop.mat.	cat.wt	stk.wt
1	.20	.00	.4640	.0850
2	.20	.16	.7940	.3400
3	.20	.72	1.0580	.7790
4	.20	.87	1.1720	1.3340
5	.20	.91	2.6970	2.0030
6	.20	1.00	5.4290	3.0630
7	.20	1.00	6.1210	4.6640

Abundance index data

Age	1978	1979	1980	1981	1982	1983
1	7.1	6.6	32.5	18.6	12.3	27.9
2	19.6	26.2	11.2	66.7	54.0	29.5
3	5.4	15.5	13.0	6.7	19.7	7.2
4	2.0	3.1	4.5	5.1	3.0	3.8
5	.7	.7	1.0	2.1	1.6	1.2
6	.2	.1	.2	.3	.5	.3
7	.1	.1	.1	.1	.2	.2

Age	1984	1985	1986	1987	1988	1989
1	3.1	1.5	4.9	6.2	.7	.4
2	33.8	11.0	6.9	38.6	11.3	1.6
3	7.3	12.9	3.7	4.8	7.1	2.0
4	3.9	4.8	2.6	2.0	1.3	1.7
5	1.3	1.7	.9	1.5	.4	.6
6	.4	.6	.3	.4	.1	.1
7	.1	.3	.1	.2	.1	.1

Age	1990	1991	1992	1993	1994	1995
1	.5	1.0	7.8	9.1	12.3	45.7
2	2.0	1.2	7.4	22.7	13.8	80.9
3	1.8	1.7	1.4	4.1	11.1	13.2
4	1.8	1.3	1.0	1.0	2.1	5.0
5	1.0	.4	.3	.4	.5	.9
6	.2	.1	.1	.1	.1	.2
7	.1	.1	.1	.0	.1	.1

Age	1996
1	2.8
2	90.6
3	20.0
4	4.4
5	2.6
6	.8
7	-99.0

Relative weight applied by age

Age	Rel.wt
1	1.0000
2	1.0000
3	1.0000
4	1.0000
5	1.0000
6	1.0000
7	1.0000

Value for smoother set to 1.0000

IFAIL on exit from E04FDF = 5  
 Residual sum of squares= 20.3351  
 Number of observations= 149  
 Number of parameters = 48  
 Residual mean square = .2013  
 Coefficient of determination = .9594  
 Adj. coeff. of determination = .9405  
 IFAIL from E04YCF= 0

continued

Table 2.8.1 (continued)

	Parameter	s.d.
year effects		
	.9382	.2019
	.9473	.1672
	.7733	.1625
	1.0292	.1611
	1.1859	.1605
	.8636	.1606
	1.3168	.1612
	1.4969	.1617
	1.1647	.1609
	1.2783	.1609
	1.2739	.1609
	1.1462	.1607
	1.2497	.1616
	1.0123	.1611
	.5816	.1627
	.5763	.1650
	.6589	.1764
age effects		
	-1.3029	.1426
	.6179	.1399
	.6932	.1388
	.7564	.1390
	1.1954	.1405
	.5100	.1432
y/c effects		
	-2.3026	.4487
	-1.7130	.3282
	-.3564	.3168
	.5940	.2861
	1.7705	.2672
	3.2020	.2537
	2.0426	.3123
	1.8371	.2930
	2.8473	.2892
	2.5042	.2941
	1.9387	.2987
	2.4847	.2926
	1.1772	.3028
	.7017	.3080
	1.5820	.2996
	.8447	.3020
	-.0604	.3014
	-.1867	.2982
	-.4460	.3005
	.7415	.2958
	2.2910	.2899
	2.2482	.2951
	3.0297	.3103
	3.9342	.3503
	1.0438	.4487

## F-at-age

Age	1978	1979	1980	1981	1982	1983
1	-1.2223	-1.2343	-1.0076	-1.3409	-1.5451	-1.1252
2	.5797	.5853	.4778	.6359	.7328	.5336
3	.6503	.6567	.5360	.7134	.8221	.5986
4	.7096	.7166	.5850	.7785	.8971	.6532
5	1.1215	1.1324	.9244	1.2303	1.4176	1.0323
6	.4785	.4832	.3944	.5249	.6048	.4404
7	.4785	.4832	.3944	.5249	.6048	.4404

Age	1984	1985	1986	1987	1988	1989
1	-1.7157	-1.9502	-1.5175	-1.6654	-1.6597	-1.4934
2	.8136	.9249	.7197	.7898	.7871	.7082
3	.9128	1.0376	.8074	.8860	.8830	.7945
4	.9961	1.1322	.8810	.9669	.9636	.8670
5	1.5741	1.7893	1.3923	1.5280	1.5227	1.3701
6	.6716	.7634	.5940	.6519	.6497	.5846
7	.6716	.7634	.5940	.6519	.6497	.5846

continued

Table 2.8.1 (continued)

Age	1990	1991	1992	1993	1994	1995
1	-1.6283	-1.3189	-.7577	-.7508	-.8584	-.6605
2	.7722	.6255	.3593	.3561	.4071	.3133
3	.8663	.7017	.4031	.3995	.4567	.3514
4	.9453	.7657	.4399	.4359	.4984	.3835
5	1.4939	1.2100	.6952	.6889	.7876	.6060
6	.6374	.5163	.2966	.2939	.3360	.2586
7	.6374	.5163	.2966	.2939	.3360	.2586

## fitted catch-at-age

Age	1978	1979	1980	1981	1982	1983	1984	1985
1	-16.4	-13.6	-26.7	-30.6	-22.7	-22.2	-13.0	-10.7
2	9.9	8.7	6.1	16.7	18.2	10.1	15.5	8.2
3	2.6	5.0	3.7	4.2	8.6	6.2	7.1	6.5
4	.8	1.2	1.9	2.3	2.0	2.7	3.9	2.6
5	.4	.5	.6	1.4	1.2	.7	1.9	1.6
6	.1	.1	.1	.1	.2	.1	.2	.2
7	.0	.0	.0	.0	.1	.1	.1	.1

Age	1986	1987	1988	1989	1990	1991	1992	1993
1	-15.3	-8.8	-3.5	-2.5	-2.3	-5.1	-10.0	-9.5
2	5.5	9.1	5.0	1.9	1.5	1.1	1.8	4.7
3	2.4	2.5	3.6	1.9	.9	.5	.4	1.1
4	1.7	1.0	.9	1.2	.8	.3	.2	.2
5	.8	.8	.4	.3	.6	.3	.1	.1
6	.1	.1	.1	.0	.0	.1	.0	.0
7	.1	.1	.0	.0	.0	.0	.0	.0

Age	1994	1995
1	-25.1	-42.9
2	5.0	9.8
3	3.3	2.4
4	.7	1.5
5	.2	.4
6	.0	.0
7	.0	.0

## Log Population residuals

Age	1978	1979	1980	1981	1982	1983
1	-.0769	.0424	.6342	.4189	.5701	.8421
2	-.2265	.2005	-.4545	.5458	.3436	.1009
3	-.0767	.3153	.2869	-.2914	.1596	-.7411
4	.1041	.1950	-.0728	.0896	-.1683	-.4541
5	.0417	.0009	.0162	-.0580	-.1268	.0321
6	-.1842	-.3624	.1783	-.0831	.0147	-.0262
7	.0000	.1842	.3208	-.2833	-.0514	.0273

Age	1984	1985	1986	1987	1988	1989
1	-.0490	-.2765	-.0030	.9767	-.3551	-.7549
2	.1100	-.2950	-.5205	.7542	.1156	-.9168
3	-.5679	.1578	-.2543	.0425	.0518	-.6249
4	-.5554	.1207	-.2148	.1275	-.1536	-.2786
5	-.7047	-.1638	-.2331	.2939	-.4436	.2065
6	.2283	.2326	.1928	.6661	-.8754	.2087
7	-.3471	.6115	-.4134	.5050	-.6567	-.3134

Age	1990	1991	1992	1993	1994	1995
1	-.3525	-.7316	-.2318	-.0421	-.5241	-.1115
2	-.4337	-.7671	.1438	.2741	-.1766	.7052
3	.1023	.3903	.1725	.1148	.1107	.3868
4	.2813	.8376	.7264	.4261	.0162	-.0366
5	.2098	-.1774	.3697	.4655	.3483	-.0975
6	.5726	-.7251	-.0757	.0282	-.2297	.1727
7	.7056	.1291	-.0088	-.4954	-.0657	-.1637

continued

Table 2.8.1

Age	1996
1	.0000
2	.1115
3	-.1811
4	-.1681
5	-.1164
6	.5543
7	.0000

Year,	TSB,	SSB,	Yield,	Fbar,	RECS
1978,	18,	9,	5,	.740,	7
1979,	22,	12,	9,	.747,	6
1980,	24,	14,	0,	.610,	17
1981,	33,	18,	10,	.812,	12
1982,	37,	21,	20,	.935,	6
1983,	34,	21,	10,	.681,	11
1984,	36,	23,	24,	1.039,	3
1985,	25,	17,	17,	1.181,	2
1986,	16,	10,	4,	.919,	4
1987,	15,	8,	9,	1.008,	2
1988,	12,	8,	9,	1.005,	0
1989,	9,	6,	5,	.904,	0
1990,	6,	4,	3,	.986,	0
1991,	4,	2,	0,	.798,	2
1992,	5,	2,	-2,	.459,	9
1993,	11,	4,	1,	.455,	9
1994,	18,	9,	-2,	.520,	20
1995,	34,	15,	-6,	.400,	51
1996,	60,	30,	0,	.000,	2

Table 2.9.1

GLM estimates of cod age groups 1 and 2, spawning stock in numbers and spawning stock biomass (SD 22 and 24) (Revised and updated 24.04.1996)

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General Linear Models Procedure  
Class Level Information

Class	Levels	Values
COUNTRY	4	DENMARK GDR GERMANY SWEDEN
YEAR	19	1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996
QUARTER	4	1 2 3 4
SD	2	22 24
DSTRATA	4	1 = < 20 m; 2 = 21-30 m; 3 = 31-40 m; 4 = >41 m

Number of observations in data set = 2726

NOTE: Due to missing values, only 2711 observations can be used in this analysis.

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General Linear Models Procedure

Dependent Variable: LNA1 = Means for age group 1

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	28	7405.78232847	264.49222602	126.75	0.0001
Error	2682	5596.54019437	2.08670402		
Corrected Total	2710	13002.32252284			

R-Square	C.V.	Root MSE	LNA1 Mean
0.569574	75.20147	1.44454284	1.92089713

Source	DF	Type I SS	Mean Square	F Value	Pr > F
COUNTRY	3	580.71046438	193.57015479	92.76	0.0001
YEAR	18	4779.66234060	265.53679670	127.25	0.0001
QUARTER	3	855.76184249	285.25394750	136.70	0.0001
SD	1	135.57318425	135.57318425	64.97	0.0001
DSTRATA	3	1054.07449674	351.35816558	168.38	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
COUNTRY	3	510.12373020	170.04124340	81.49	0.0001
YEAR	18	3681.68864347	204.53825797	98.02	0.0001
QUARTER	3	934.23197789	311.41065930	149.24	0.0001
SD	1	121.71629897	121.71629897	58.33	0.0001
DSTRATA	3	1054.07449674	351.35816558	168.38	0.0001

Table 2.9.1 (continued)

Parameter	Estimate	T for H0: Parameter=0	Pr >  T	Std Error of Estimate
INTERCEPT	3.067515828 B	8.69	0.0001	0.35281044
COUNTRY DENMARK	-0.681912178 B	-2.57	0.0101	0.26505822
GDR	0.882097609 B	3.73	0.0002	0.23627029
GERMANY	-0.228076407 B	-0.97	0.3297	0.23393636
SWEDEN	0.000000000 B	.	.	.
YEAR 1978	0.828117185 B	2.32	0.0205	0.35721507
1979	0.747982718 B	2.33	0.0201	0.32152053
1980	2.291912463 B	7.41	0.0001	0.30910149
1981	1.744902599 B	6.07	0.0001	0.28733937
1982	1.343734236 B	4.61	0.0001	0.29156971
1983	2.139646700 B	7.36	0.0001	0.29064919
1984	0.073884210 B	0.26	0.7968	0.28684384
1985	-0.498777874 B	-1.73	0.0830	0.28758474
1986	0.472778359 B	1.64	0.1002	0.28749312
1987	0.694668282 B	2.38	0.0172	0.29139977
1988	-1.057908845 B	-3.70	0.0002	0.28621230
1989	-1.319576448 B	-4.64	0.0001	0.28422435
1990	-1.260740599 B	-4.31	0.0001	0.29238108
1991	-0.795600042 B	-2.69	0.0073	0.29620839
1992	0.915998661 B	3.18	0.0015	0.28842049
1993	1.055089167 B	3.57	0.0004	0.29581962
1994	1.340670123 B	4.50	0.0001	0.29768952
1995	2.628828823 B	8.87	0.0001	0.29638021
1996	0.000000000 B	.	.	.
QUARTER 1	-1.258054947 B	-20.47	0.0001	0.06145896
2	-2.161728572 B	-8.33	0.0001	0.25965668
3	-0.696791325 B	-2.08	0.0376	0.33503745
4	0.000000000 B	.	.	.
SD 22	0.698633940 B	7.64	0.0001	0.09147570
24	0.000000000 B	.	.	.
DSTRATA 1	-2.440447999 B	-22.08	0.0001	0.11051323
2	-1.765825198 B	-17.48	0.0001	0.10099243
3	-0.497353774 B	-4.47	0.0001	0.11128398
4	0.000000000 B	.	.	.

NOTE: The X'X matrix has been found to be singular and a generalized inverse was used to solve the normal equations. Estimates followed by the letter 'B' are biased, and are not unique estimators of the parameters.

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General Linear Models Procedure  
Least Squares Means

YEAR	LNAL LSMEAN	Std Err LSMEAN	Pr >  T  H0:LSMEAN=0
1978	2.03292679	0.26563760	0.0001
1979	1.95279232	0.22093450	0.0001
1980	3.49672206	0.14623839	0.0001
1981	2.94971220	0.17072786	0.0001
1982	2.54854384	0.17825776	0.0001
1983	3.34445630	0.17699591	0.0001
1984	1.27869381	0.16963313	0.0001
1985	0.70603173	0.16558424	0.0001
1986	1.67758796	0.17060055	0.0001
1987	1.89947788	0.17740692	0.0001
1988	0.14690076	0.17288569	0.3956
1989	-0.11476685	0.16459809	0.4857
1990	-0.05593100	0.17500662	0.7493
1991	0.40920956	0.18213923	0.0247
1992	2.12080826	0.18139800	0.0001
1993	2.25989877	0.19585567	0.0001
1994	2.54547972	0.19832888	0.0001
1995	3.83363842	0.18797604	0.0001
1996	1.20480960	0.30259730	0.0001



Table 2.9.1 (continued)

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General Linear Models Procedure  
Class Level Information

Class	Levels	Values
COUNTRY	4	DENMARK GDR GERMANY SWEDEN
YEAR	19	1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996
QUARTER	4	1 2 3 4
SD	2	22 24
DSTRATA	4	1 = < 20 m; 2 = 21-30 m; 3 = 31-40 m; 4 = >41 m

Number of observations in data set = 2726

NOTE: Due to missing values, only 2711 observations can be used in this analysis.

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## General Linear Models Procedure

Dependent Variable: LNA2 = Means for age group 2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	28	6247.43423315	223.12265118	122.61	0.0001
Error	2682	4880.53701684	1.81973789		
Corrected Total	2710	11127.97124999			
	R-Square	C.V.	Root MSE	LNA2 Mean	
	0.561417	54.06834	1.34897661	2.49494755	

Source	DF	Type I SS	Mean Square	F Value	Pr > F
COUNTRY	3	384.39932393	128.13310798	70.41	0.0001
YEAR	18	3832.49607090	212.91644838	117.00	0.0001
QUARTER	3	88.94828013	29.64942671	16.29	0.0001
SD	1	663.95354319	663.95354319	364.86	0.0001
DSTRATA	3	1277.63701500	425.87900500	234.03	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
COUNTRY	3	122.02218951	40.67406317	22.35	0.0001
YEAR	18	3552.92942247	197.38496792	108.47	0.0001
QUARTER	3	53.59278395	17.86426132	9.82	0.0001
SD	1	13.78193314	13.78193314	7.57	0.0060
DSTRATA	3	1277.63701500	425.87900500	234.03	0.0001

Table 2.9.1 (continued)

Parameter	Estimate	T for H0: Parameter=0	Pr >  T	Std Error of Estimate
INTERCEPT	6.822016623 B	20.71	0.0001	0.32946965
COUNTRY DENMARK	-1.554553549 B	-6.28	0.0001	0.24752283
GDR	-0.914540533 B	-4.14	0.0001	0.22063942
GERMANY	-1.293486376 B	-5.92	0.0001	0.21845989
SWEDEN	0.000000000 B	.	.	.
YEAR 1978	-1.511011717 B	-4.53	0.0001	0.33358289
1979	-1.227571583 B	-4.09	0.0001	0.30024978
1980	-2.051701428 B	-7.11	0.0001	0.28865235
1981	-0.303695247 B	-1.13	0.2578	0.26832993
1982	-0.513800937 B	-1.89	0.0593	0.27228041
1983	-1.110305478 B	-4.09	0.0001	0.27142079
1984	-0.977324129 B	-3.65	0.0003	0.26786719
1985	-2.069806033 B	-7.71	0.0001	0.26855908
1986	-2.509617553 B	-9.35	0.0001	0.26847352
1987	-0.845133589 B	-3.11	0.0019	0.27212171
1988	-2.042933923 B	-7.64	0.0001	0.26727742
1989	-3.758511260 B	-14.16	0.0001	0.26542100
1990	-3.611735553 B	-13.23	0.0001	0.27303811
1991	-3.957876406 B	-14.31	0.0001	0.27661221
1992	-2.442661908 B	-9.07	0.0001	0.26933953
1993	-1.367134346 B	-4.95	0.0001	0.27624916
1994	-1.853864583 B	-6.67	0.0001	0.27799536
1995	-0.112268626 B	-0.41	0.6850	0.27677266
1996	0.000000000 B	.	.	.
QUARTER 1	0.282228410 B	4.92	0.0001	0.05739303
2	-0.012138749 B	-0.05	0.9601	0.24247864
3	-0.526493540 B	-1.68	0.0925	0.31287247
4	0.000000000 B	.	.	.
SD 22	0.235087956 B	2.75	0.0060	0.08542397
24	0.000000000 B	.	.	.
DSTRATA 1	-2.645766836 B	-25.64	0.0001	0.10320203
2	-2.165114345 B	-22.96	0.0001	0.09431110
3	-0.881380244 B	-8.48	0.0001	0.10392180
4	0.000000000 B	.	.	.

NOTE: The X'X matrix has been found to be singular and a generalized inverse was used to solve the normal equations. Estimates followed by the letter 'B' are biased, and are not unique estimators of the parameters.

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General Linear Models Procedure  
Least Squares Means

YEAR	LNA2 LSMEAN	Std Err LSMEAN	Pr >  T  H0:LSMEAN=0
1978	3.00073744	0.24806388	0.0001
1979	3.28417758	0.20631819	0.0001
1980	2.46004773	0.13656373	0.0001
1981	4.20805391	0.15943306	0.0001
1982	3.99794822	0.16646480	0.0001
1983	3.40144368	0.16528644	0.0001
1984	3.53442503	0.15841075	0.0001
1985	2.44194313	0.15462973	0.0001
1986	2.00213161	0.15931418	0.0001
1987	3.66661557	0.16567026	0.0001
1988	2.46881524	0.16144813	0.0001
1989	0.75323790	0.15370882	0.0001
1990	0.90001361	0.16342875	0.0001
1991	0.55387275	0.17008949	0.0011
1992	2.06908725	0.16939730	0.0001
1993	3.14461481	0.18289850	0.0001
1994	2.65788458	0.18520809	0.0001
1995	4.39948054	0.17554016	0.0001
1996	4.51174916	0.28257845	0.0001

Table 2.9.1 (continued)

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General Linear Models Procedure  
Class Level Information

Class	Levels	Values
COUNTRY	4	DENMARK GDR GERMANY SWEDEN
YEAR	19	1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996
QUARTER	4	1 2 3 4
SD	2	22 24
DSTRATA	4	1 = < 20 m; 2 = 21-30 m; 3 = 31-40 m; 4 = >41 m

Number of observations in data set = 2726

NOTE: Due to missing values, only 2711 observations can be used in this analysis.

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## General Linear Models Procedure

Dependent Variable: LSSNTOT = Means for spawning stock in numbers

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	28	4180.67036847	149.30965602	120.02	0.0001
Error	2682	3336.45905881	1.24401904		
Corrected Total	2710	7517.12942727			
	R-Square	C.V.	Root MSE	LSSNTOT Mean	
	0.556153	48.18361	1.11535601	2.31480361	

Source	DF	Type I SS	Mean Square	F Value	Pr > F
COUNTRY	3	468.62213947	156.20737982	125.57	0.0001
YEAR	18	1434.46379871	79.69243326	64.06	0.0001
QUARTER	3	882.22227830	294.07409277	236.39	0.0001
SD	1	822.82542695	822.82542695	661.43	0.0001
DSTRATA	3	572.53672503	190.84557501	153.41	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
COUNTRY	3	118.01067148	39.33689049	31.62	0.0001
YEAR	18	1430.37185955	79.46510331	63.88	0.0001
QUARTER	3	743.83142715	247.94380905	199.31	0.0001
SD	1	43.01575705	43.01575705	34.58	0.0001
DSTRATA	3	572.53672503	190.84557501	153.41	0.0001

Table 2.9.1 (continued)

Parameter	Estimate	T for H0: Parameter=0	Pr >  T	Std Error of Estimate
INTERCEPT	5.434841508 B	19.95	0.0001	0.27241092
COUNTRY DENMARK	-1.637610004 B	-8.00	0.0001	0.20465594
GDR	-1.255449215 B	-6.88	0.0001	0.18242830
GERMANY	-1.551134027 B	-8.59	0.0001	0.18062623
SWEDEN	0.000000000 B	.	.	.
YEAR 1978	-1.034530342 B	-3.75	0.0002	0.27581181
1979	-0.453281424 B	-1.83	0.0680	0.24825145
1980	-0.652681173 B	-2.73	0.0063	0.23866250
1981	-0.300035963 B	-1.35	0.1764	0.22185960
1982	-0.036335575 B	-0.16	0.8718	0.22512592
1983	-0.730366008 B	-3.25	0.0011	0.22441516
1984	-0.617877231 B	-2.79	0.0053	0.22147699
1985	-0.583822784 B	-2.63	0.0086	0.22204905
1986	-1.474814145 B	-6.64	0.0001	0.22197831
1987	-0.798262284 B	-3.55	0.0004	0.22499470
1988	-1.276366838 B	-5.78	0.0001	0.22098936
1989	-2.176438349 B	-9.92	0.0001	0.21945444
1990	-2.074406048 B	-9.19	0.0001	0.22575239
1991	-2.342309213 B	-10.24	0.0001	0.22870752
1992	-2.185715385 B	-9.81	0.0001	0.22269435
1993	-1.342532046 B	-5.88	0.0001	0.22840734
1994	-0.876398897 B	-3.81	0.0001	0.22985113
1995	-0.013479859 B	-0.06	0.9530	0.22884018
1996	0.000000000 B	.	.	.
QUARTER 1	1.116366812 B	23.53	0.0001	0.04745350
2	0.938819500 B	4.68	0.0001	0.20048532
3	-0.891776665 B	-3.45	0.0006	0.25868810
4	0.000000000 B	.	.	.
SD 22	-0.415325978 B	-5.88	0.0001	0.07062994
24	0.000000000 B	.	.	.
DSTRATA 1	-1.810009795 B	-21.21	0.0001	0.08532914
2	-1.357041330 B	-17.40	0.0001	0.07797796
3	-0.607475670 B	-7.07	0.0001	0.08592425
4	0.000000000 B	.	.	.

NOTE: The X'X matrix has been found to be singular and a generalized inverse was used to solve the normal equations. Estimates followed by the letter 'B' are biased, and are not unique estimators of the parameters.

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General Linear Models Procedure  
Least Squares Means

YEAR	LSSNTOT LSMEAN	Std Err LSMEAN	Pr >  T  H0:LSMEAN=0
1978	2.42882058	0.20510329	0.0001
1979	3.01006950	0.17058727	0.0001
1980	2.81066975	0.11291314	0.0001
1981	3.16331496	0.13182187	0.0001
1982	3.42701535	0.13763583	0.0001
1983	2.73298491	0.13666154	0.0001
1984	2.84547369	0.13097661	0.0001
1985	2.87952814	0.12785040	0.0001
1986	1.98853678	0.13172358	0.0001
1987	2.66508864	0.13697889	0.0001
1988	2.18698408	0.13348797	0.0001
1989	1.28691257	0.12708898	0.0001
1990	1.38894487	0.13512558	0.0001
1991	1.12104171	0.14063278	0.0001
1992	1.27763554	0.14006047	0.0001
1993	2.12081887	0.15122348	0.0001
1994	2.58695202	0.15313309	0.0001
1995	3.44987106	0.14513949	0.0001
1996	3.46335092	0.23364050	0.0001

Table 2.9.1 (continued)

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General Linear Models Procedure  
Class Level Information

Class	Levels	Values
COUNTRY	4	DENMARK GDR GERMANY SWEDEN
YEAR	19	1978 1979 1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996
QUARTER	4	1 2 3 4
SD	2	22 24
DSTRATA	4	1 = < 20 m; 2 = 21-30 m; 3 = 31-40 m; 4 = >41 m

Number of observations in data set = 2726

NOTE: Due to missing values, only 2711 observations can be used in this analysis.

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## General Linear Models Procedure

Dependent Variable: LSSBTOT = Means for total spawning stock biomass

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	28	4506.57843664	160.94922988	121.25	0.0001
Error	2682	3560.12054123	1.32741258		
Corrected Total	2710	8066.69897787			
	R-Square	C.V.	Root MSE	LSSBTOT Mean	
	0.558665	49.20710	1.15213392	2.34139774	

Source	DF	Type I SS	Mean Square	F Value	Pr > F
COUNTRY	3	608.63862868	202.87954289	152.84	0.0001
YEAR	18	1247.05421028	69.28078946	52.19	0.0001
QUARTER	3	1254.23529809	418.07843270	314.96	0.0001
SD	1	909.97146237	909.97146237	685.52	0.0001
DSTRATA	3	486.67883722	162.22627907	122.21	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
COUNTRY	3	164.05572583	54.68524194	41.20	0.0001
YEAR	18	1274.29383293	70.79410183	53.33	0.0001
QUARTER	3	1080.85449692	360.28483231	271.42	0.0001
SD	1	86.20503355	86.20503355	64.94	0.0001
DSTRATA	3	486.67883722	162.22627907	122.21	0.0001

Table 2.9.1

Parameter	Estimate	T for H0: Parameter=0	Pr >  T	Std Error of Estimate
INTERCEPT	5.270802029 B	18.73	0.0001	0.28139344
COUNTRY DENMARK	-1.774341613 B	-8.39	0.0001	0.21140430
GDR	-1.280963861 B	-6.80	0.0001	0.18844372
GERMANY	-1.702805962 B	-9.13	0.0001	0.18658222
SWEDEN	0.000000000 B	.	.	.
YEAR 1978	-1.010726966 B	-3.55	0.0004	0.28490647
1979	-0.358748476 B	-1.40	0.1619	0.25643733
1980	-0.424136430 B	-1.72	0.0855	0.24653219
1981	-0.276916091 B	-1.21	0.2270	0.22917523
1982	0.052465484 B	0.23	0.8215	0.23254925
1983	-0.636328767 B	-2.74	0.0061	0.23181506
1984	-0.485474642 B	-2.12	0.0339	0.22878001
1985	-0.249495812 B	-1.09	0.2768	0.22937093
1986	-1.186350863 B	-5.17	0.0001	0.22929786
1987	-0.727207868 B	-3.13	0.0018	0.23241371
1988	-1.274733184 B	-5.58	0.0001	0.22827630
1989	-1.925966754 B	-8.50	0.0001	0.22669076
1990	-1.754654050 B	-7.52	0.0001	0.23319638
1991	-2.116887646 B	-8.96	0.0001	0.23624895
1992	-2.102432874 B	-9.14	0.0001	0.23003750
1993	-1.432820147 B	-6.07	0.0001	0.23593888
1994	-0.834356473 B	-3.51	0.0004	0.23743027
1995	-0.035464299 B	-0.15	0.8808	0.23638599
1996	0.000000000 B	.	.	.
QUARTER 1	1.353351598 B	27.61	0.0001	0.04901824
2	1.222842557 B	5.90	0.0001	0.20709615
3	-0.875011008 B	-3.27	0.0011	0.26721812
4	0.000000000 B	.	.	.
SD 22	-0.587951663 B	-8.06	0.0001	0.07295890
24	0.000000000 B	.	.	.
DSTRATA 1	-1.682618933 B	-19.09	0.0001	0.08814279
2	-1.183618770 B	-14.69	0.0001	0.08054922
3	-0.555431866 B	-6.26	0.0001	0.08875753
4	0.000000000 B	.	.	.

NOTE: The X'X matrix has been found to be singular and a generalized inverse was used to solve the normal equations. Estimates followed by the letter 'B' are biased, and are not unique estimators of the parameters.

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General Linear Models Procedure  
Least Squares Means

YEAR	LSSBTOT LSMEAN	Std Err LSMEAN	Pr >  T  H0:LSMEAN=0
1978	2.34644977	0.21186640	0.0001
1979	2.99842826	0.17621224	0.0001
1980	2.93304030	0.11663635	0.0001
1981	3.08026064	0.13616858	0.0001
1982	3.40964222	0.14217426	0.0001
1983	2.72084797	0.14116784	0.0001
1984	2.87170209	0.13529545	0.0001
1985	3.10768092	0.13206616	0.0001
1986	2.17082587	0.13606705	0.0001
1987	2.62996887	0.14149565	0.0001
1988	2.08244355	0.13788962	0.0001
1989	1.43120998	0.13127963	0.0001
1990	1.60252268	0.13958123	0.0001
1991	1.24028909	0.14527003	0.0001
1992	1.25474386	0.14467884	0.0001
1993	1.92435659	0.15620995	0.0001
1994	2.52282026	0.15818252	0.0001
1995	3.32171243	0.14992534	0.0001
1996	3.35717673	0.24134460	0.0001

Table 2.9.2 Cod in Sub-divisions 22 and 24. Stock abundance estimates by GLM-model.

## Population estimates

## Transformed means (Numbers/hour and kg/hour) by age groups

Year	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10+	TOTN	TOTW
1978	7.14	19.60	5.44	2.01	0.73	0.15	0.10	0.04	0.00	0.01	64.68	29.45
1979	6.55	26.19	15.45	3.05	0.73	0.13	0.11	0.03	0.00	0.01	70.22	38.81
1980	32.51	11.21	13.02	4.45	1.02	0.23	0.13	0.03	0.00	0.00	120.50	47.43
1981	18.60	66.73	6.70	5.12	2.06	0.30	0.08	0.06	0.00	0.01	146.09	70.16
1982	12.29	53.99	19.66	3.04	1.55	0.53	0.15	0.06	0.00	0.01	142.11	68.25
1983	27.85	29.51	7.18	3.83	1.24	0.34	0.24	0.05	0.00	0.01	107.63	48.61
1984	3.09	33.78	7.26	3.89	1.27	0.44	0.13	0.05	0.00	0.01	56.59	39.18
1985	1.53	11.00	12.86	4.75	1.74	0.55	0.27	0.04	0.00	0.01	48.49	40.64
1986	4.85	6.90	3.72	2.57	0.88	0.34	0.11	0.04	0.00	0.01	31.74	20.61
1987	6.18	38.62	4.83	1.99	1.45	0.44	0.21	0.10	0.03	0.04	68.20	39.39
1988	0.66	11.31	7.11	1.34	0.35	0.08	0.05	0.04	0.00	0.01	24.39	16.00
1989	0.39	1.62	2.01	1.73	0.60	0.12	0.06	0.03	0.00	0.01	6.32	5.46
1990	0.45	1.96	1.81	1.84	0.97	0.18	0.09	0.03	0.00	0.02	7.19	6.94
1991	1.01	1.24	1.69	1.30	0.37	0.07	0.05	0.03	0.00	0.01	7.81	5.69
1992	7.84	7.42	1.39	0.96	0.31	0.10	0.07	0.03	0.00	0.00	25.47	10.63
1993	9.08	22.71	4.12	0.98	0.39	0.09	0.04	0.03	0.00	0.00	69.03	28.12
1994	12.25	13.77	11.06	2.05	0.48	0.08	0.05	0.04	0.00	0.00	110.68	37.94
1995	45.73	80.91	13.18	4.95	0.91	0.15	0.05	0.03	0.00	0.00	211.34	68.35
1996	2.84	90.58	19.96	4.36	2.55	0.78	0.00	0.05	0.00	0.00	162.59	86.77

**Table 2.9.2 (continued)**  
**Spawning stock estimates**

**Transformed means (Numbers/hour) by age groups**

<b>Year</b>	<b>SSNA1</b>	<b>SSNA2</b>	<b>SSNA3</b>	<b>SSNA4</b>	<b>SSNA5</b>	<b>SSNA6</b>	<b>SSNA7</b>	<b>SSNA8</b>	<b>SSNA9</b>	<b>SSNA10+</b>	<b>SSNTOTN</b>
1978	-	3.51	4.14	1.84	0.70	0.15	0.10	0.04	0.00	0.01	10.85
1979	-	4.78	11.50	2.73	0.68	0.13	0.11	0.03	0.00	0.01	19.79
1980	-	2.25	9.62	3.97	0.95	0.23	0.13	0.03	0.00	0.00	16.12
1981	-	10.21	5.09	4.57	1.91	0.30	0.08	0.06	0.00	0.01	23.15
1982	-	8.42	14.31	2.75	1.45	0.53	0.15	0.06	0.00	0.01	30.28
1983	-	4.65	5.44	3.43	1.16	0.34	0.24	0.05	0.00	0.01	14.88
1984	-	5.51	5.48	3.48	1.19	0.44	0.13	0.05	0.00	0.01	16.71
1985	-	2.20	9.70	4.26	1.62	0.55	0.27	0.04	0.00	0.01	17.31
1986	-	1.50	2.88	2.32	0.83	0.34	0.11	0.04	0.00	0.01	6.80
1987	-	6.73	3.77	1.84	1.37	0.44	0.21	0.10	0.03	0.04	13.87
1988	-	2.30	5.45	1.23	0.33	0.08	0.05	0.04	0.00	0.01	8.41
1989	-	0.43	1.61	1.58	0.57	0.12	0.06	0.03	0.00	0.01	3.12
1990	-	0.58	1.45	1.67	0.91	0.18	0.09	0.03	0.00	0.02	3.51
1991	-	0.33	1.32	1.18	0.35	0.07	0.05	0.03	0.00	0.01	2.57
1992	-	1.33	1.12	0.89	0.29	0.10	0.07	0.03	0.00	0.00	3.09
1993	-	3.70	3.13	0.90	0.37	0.09	0.04	0.03	0.00	0.00	7.84
1994	-	2.33	8.20	1.86	0.45	0.08	0.05	0.04	0.00	0.00	12.79
1995	-	13.29	9.81	4.43	0.86	0.15	0.05	0.03	0.00	0.00	31.00
1996	-	13.72	15.05	3.89	2.37	0.78	0.00	0.05	0.00	0.00	31.42



**Table 2.9.2 (continued)**  
**Spawning stock estimates**

**Transformed means (kg/hour) by age groups**

<b>Year</b>	<b>SSBA1</b>	<b>SSBA2</b>	<b>SSBA3</b>	<b>SSBA4</b>	<b>SSBA5</b>	<b>SSBA6</b>	<b>SSBA7</b>	<b>SSBA8</b>	<b>SSBA9</b>	<b>SSBA10+</b>	<b>SSBTOT</b>
1978	-	1.67	4.24	2.61	1.10	0.25	0.19	0.08	0.00	0.03	9.95
1979	-	2.25	11.93	4.27	1.24	0.27	0.23	0.06	0.00	0.02	19.55
1980	-	1.20	9.90	6.27	1.75	0.42	0.26	0.07	0.01	0.00	18.28
1981	-	4.53	5.24	7.23	3.73	0.59	0.15	0.13	0.00	0.02	21.26
1982	-	3.88	14.86	4.10	2.73	1.09	0.32	0.12	0.01	0.04	29.75
1983	-	2.15	5.60	5.29	2.11	0.63	0.53	0.11	0.00	0.04	14.69
1984	-	2.52	5.66	5.39	2.22	0.88	0.29	0.11	0.00	0.02	17.17
1985	-	1.45	10.80	6.68	2.77	1.02	0.57	0.07	0.00	0.02	21.87
1986	-	1.03	3.08	3.61	1.24	0.61	0.22	0.10	0.01	0.03	8.27
1987	-	3.88	3.47	2.41	2.67	0.88	0.45	0.22	0.06	0.09	13.37
1988	-	1.26	5.06	1.53	0.54	0.17	0.09	0.08	0.00	0.03	7.52
1989	-	0.30	1.58	2.15	0.88	0.23	0.12	0.06	0.00	0.03	3.68
1990	-	0.38	1.27	2.41	1.54	0.33	0.18	0.07	0.00	0.05	4.47
1991	-	0.21	1.14	1.71	0.57	0.12	0.09	0.06	0.00	0.02	2.96
1992	-	0.79	0.99	1.22	0.44	0.16	0.12	0.06	0.00	0.01	3.01
1993	-	2.17	2.71	1.26	0.58	0.15	0.06	0.07	0.00	0.01	6.35
1994	-	1.36	7.04	2.72	0.69	0.12	0.07	0.09	0.00	0.01	11.96
1995	-	7.68	8.39	6.84	1.36	0.22	0.07	0.06	0.00	0.01	27.21
1996	-	7.85	12.74	6.11	4.50	1.56	0.00	0.08	0.00	0.00	28.21

**Table 2.9.3** Cod in SD 22 and 24.

Analysis by RCT3 ver3.1 of data from file : glmvpa96.dat

Cod SD 22 and 24, Age group 1. (GLM versus VPA)

Data for 1 surveys over 19 years : 1977 - 1995

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 = 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
GLM96	.72	9.30	.31	.839	16	2.58	11.16	.369	.771
VPA Mean =						10.46		.676	.229

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
GLM96	.71	9.31	.30	.843	17	3.84	12.02	.401	.729
VPA Mean =						10.47		.658	.271

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
GLM96	.63	9.38	.31	.837	18	1.35	10.23	.356	.780
VPA Mean =						10.51		.670	.220

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1993	59796	11.00	.32	.30	.84	58166	10.97
1994	109260	11.60	.34	.69	4.08	82331	11.32
1995	29511	10.29	.31	.12	.14		

**Table 2.9.4** Regression input and output to estimate SSBs from XSA and GLM.

Cod SD 22 and 24, SSB-data (VPA versus GLM SSB estimates)

1 19 2 ( No. of surveys, No. SSB, VPA column no. )

1978	27886	9.95
1979	40122	19.55
1980	45943	18.28
1981	41167	21.26
1982	39124	29.75
1983	41270	14.69
1984	38939	17.17
1985	40398	21.87
1986	24111	8.27
1987	17198	13.37
1988	24157	7.52
1989	21733	3.68
1990	13571	4.47
1991	9367	2.96
1992	7018	3.01
1993	12133	6.35
1994	22782	11.96
1995	24395	27.21
1996	-11	28.21

GLM

Analysis by RCT3 ver3.1 of data from file :

a:\glmssb96.dat

Cod SD 22 and 24, SSB-data (GLM versus VPA SSB estimates)

Data for 1 surveys over 19 years : 1978 - 1996

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.

SSB = 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
GLM	.90	7.97	.34	.719	14	1.39	9.21	.426	.590
						VPA Mean =	10.16	.511	.410

SSB = 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
GLM	1.00	7.69	.38	.749	15	1.99	9.69	.434	.670
						VPA Mean =	10.03	.618	.330

SSB = 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
GLM	1.05	7.57	.39	.734	16	2.56	10.25	.450	.654
						VPA Mean =	9.94	.619	.346

SSB = 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
GLM	1.05	7.54	.39	.721	17	3.34	11.06	.488	.596
						VPA Mean =	9.91	.592	.404

SSB = 1996

(continued)

Table 2.9.4

I-----Regression-----I					I-----Prediction-----I				
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
GLM96	1.01	7.57	.45	.633	18	3.37	10.97	.562	.503
					VPA Mean =		9.89	.566	.497

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1992	14769	9.60	.33	.47	2.02	7018	8.86
1993	18075	9.80	.36	.16	.20	12133	9.40
1994	25502	10.15	.36	.15	.16	22782	10.03
1995	40073	10.60	.38	.56	2.24	24396	10.10
1996	34105	10.44	.40	.54	1.84		

**Table 2.9.5** Regression input and output to estimate SSBs from XSA and Cook model.

```

Cod SD 22 and 24, SSB (VPA versus Cook model)
 1 19 2 ( No. of surveys, No. of year classes, VPA column no. )
1978 27886 9
1979 40122 12
1980 45943 14
1981 41167 18
1982 39124 21
1983 41270 21
1984 38939 23
1985 40398 17
1986 24111 10
1987 17198 8
1988 24157 8
1989 21733 6
1990 13571 4
1991 9367 2
1992 7018 2
1993 12133 4
1994 22782 9
1995 24395 15
1996 -11 30
Cook

```

Analysis by RCT3 ver3.1 of data from file :

a:\vpacook.dat

```

Cod SD 22 and 24, SSB (VPA versus Cook model)
Data for 1 surveys over 19 years : 1978 - 1996
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.

SSB = 1992

```

I-----Regression-----I I-----Prediction-----I

Survey/ Slope Inter- Std Rsquare No. Index Predicted Std WAP
Series cept Error Pts Value Value Error Weights
Cook .83 8.17 .18 .898 14 1.10 9.09 .241 .818
VPA Mean = 10.16 .511 .182

```

SSB = 1993

```

I-----Regression-----I I-----Prediction-----I

Survey/ Slope Inter- Std Rsquare No. Index Predicted Std WAP
Series cept Error Pts Value Value Error Weights
Cook .88 8.03 .19 .921 15 1.61 9.45 .226 .883
VPA Mean = 10.03 .618 .117

```

SSB = 1994

```

I-----Regression-----I I-----Prediction-----I

Survey/ Slope Inter- Std Rsquare No. Index Predicted Std WAP
Series cept Error Pts Value Value Error Weights
Cook .89 8.02 .18 .928 16 2.30 10.06 .206 .900
VPA Mean = 9.94 .619 .100

```

SSB = 1995

```

I-----Regression-----I I-----Prediction-----I

Survey/ Slope Inter- Std Rsquare No. Index Predicted Std WAP
Series cept Error Pts Value Value Error Weights
Cook .88 8.03 .17 .931 17 2.77 10.47 .199 .898
VPA Mean = 9.91 .592 .102

```

SSB = 1996

Table 2.9.5

I-----Regression-----I					I-----Prediction-----I				
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
Cook	.86	8.04	.19	.909	18	3.43	11.00	.242	.845
					VPA Mean =		9.89	.566	.155

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1992	10746	9.28	.22	.41	3.59	7018	8.86
1993	13654	9.52	.21	.18	.76	12133	9.40
1994	23157	10.05	.20	.04	.03	22782	10.03
1995	33351	10.41	.19	.17	.80	24396	10.10
1996	50250	10.82	.22	.40	3.21		

**Table 2.9.6 SSB estimates from regressions and XSA**

	GLM/VPA	COOK/VPA	XSA
1992	14769	10746	7018
1993	18075	13654	12133
1994	25502	23157	22782
1995	40073	33351	24395

**Figure 2.9.2. SSB estimates from regressions and XSA**

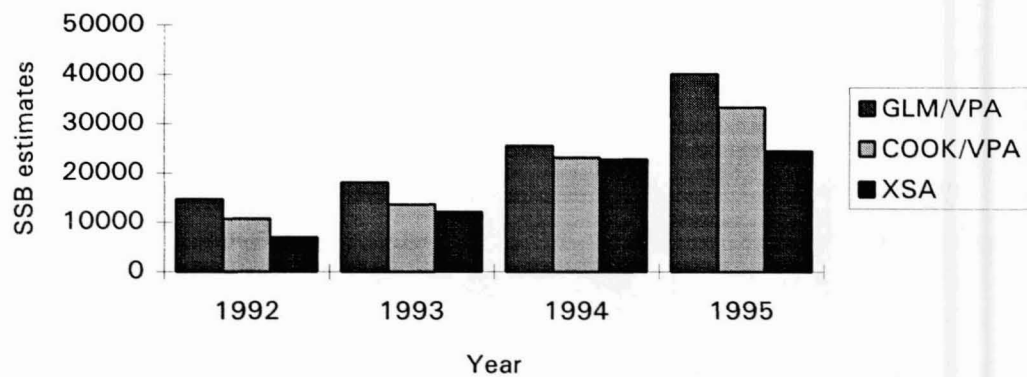


Table 2.10.1

Cod in Baltic Fishing Areas 22 and 24

15:06 Friday, April 26, 1996 1

Prediction with management option table: Input data

Year: 1996								
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	29511.000	0.2000	0.0000	0.0000	0.0000	0.085	0.0140	0.464
2	65606.000	0.2000	0.1600	0.0000	0.0000	0.340	0.4000	0.794
3	27155.000	0.2000	0.7200	0.0000	0.0000	0.779	0.7460	1.058
4	6197.000	0.2000	0.8700	0.0000	0.0000	1.334	1.1430	1.172
5	1465.000	0.2000	0.9100	0.0000	0.0000	2.003	1.0630	2.697
6	353.000	0.2000	1.0000	0.0000	0.0000	3.063	0.8900	5.429
7+	39.000	0.2000	1.0000	0.0000	0.0000	4.664	0.8900	6.121
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1997								
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	56700.000	0.2000	0.0000	0.0000	0.0000	0.085	0.0140	0.464
2	.	0.2000	0.1600	0.0000	0.0000	0.340	0.4000	0.794
3	.	0.2000	0.7200	0.0000	0.0000	0.779	0.7460	1.058
4	.	0.2000	0.8700	0.0000	0.0000	1.334	1.1430	1.172
5	.	0.2000	0.9100	0.0000	0.0000	2.003	1.0630	2.697
6	.	0.2000	1.0000	0.0000	0.0000	3.063	0.8900	5.429
7+	.	0.2000	1.0000	0.0000	0.0000	4.664	0.8900	6.121
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1998								
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	56700.000	0.2000	0.0000	0.0000	0.0000	0.085	0.0140	0.464
2	.	0.2000	0.1600	0.0000	0.0000	0.340	0.4000	0.794
3	.	0.2000	0.7200	0.0000	0.0000	0.779	0.7460	1.058
4	.	0.2000	0.8700	0.0000	0.0000	1.334	1.1430	1.172
5	.	0.2000	0.9100	0.0000	0.0000	2.003	1.0630	2.697
6	.	0.2000	1.0000	0.0000	0.0000	3.063	0.8900	5.429
7+	.	0.2000	1.0000	0.0000	0.0000	4.664	0.8900	6.121
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANEA01  
Date and time: 24APR96:19:19

15:06 Friday, April 26, 1996 2

Cod in Baltic Fishing Areas 22 and 24

Prediction with management option table

Year: 1996					Year: 1997					Year: 1998	
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
0.2450	0.2353	58433	29925	11644	0.2450	0.2353	87363	61141	17687	112771	83015
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANEA01  
Date and time : 24APR96:19:19  
Computation of ref. F: Simple mean, age 3 - 6  
Basis for 1996 : F factors



Table 2.10.2

09:22 Thursday, May 2, 1996 1

Cod in Baltic Fishing Areas 22 and 24

Prediction with management option table

Year: 1996					Year: 1997					Year: 1998	
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
0.8000	0.7684	58433	29925	32045	0.0000	0.0000	66033	43393	0	106172	76483
.	.	.	.	.	0.1000	0.0961	.	43393	5598	99590	70680
.	.	.	.	.	0.2000	0.1921	.	43393	10765	93556	65369
.	.	.	.	.	0.3000	0.2882	.	43393	15535	88021	60505
.	.	.	.	.	0.4000	0.3842	.	43393	19943	82942	56050
.	.	.	.	.	0.5000	0.4803	.	43393	24019	78277	51965
.	.	.	.	.	0.6000	0.5763	.	43393	27790	73991	48218
.	.	.	.	.	0.7000	0.6724	.	43393	31283	70050	44781
.	.	.	.	.	0.8000	0.7684	.	43393	34519	66425	41624
.	.	.	.	.	0.9000	0.8645	.	43393	37520	63088	38724
.	.	.	.	.	1.0000	0.9605	.	43393	40305	60014	36058
.	.	.	.	.	1.1000	1.0566	.	43393	42891	57181	33607
.	.	.	.	.	1.2000	1.1526	.	43393	45295	54568	31351
.	.	.	.	.	1.3000	1.2487	.	43393	47530	52157	29274
.	.	.	.	.	1.4000	1.3447	.	43393	49611	49931	27360
.	.	.	.	.	1.5000	1.4408	.	43393	51549	47874	25596
.	.	.	.	.	1.6000	1.5368	.	43393	53355	45972	23970
.	.	.	.	.	1.7000	1.6329	.	43393	55040	44213	22469
.	.	.	.	.	1.8000	1.7289	.	43393	56613	42584	21083
.	.	.	.	.	1.9000	1.8250	.	43393	58083	41075	19802
.	.	.	.	.	2.0000	1.9210	.	43393	59457	39677	18619
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANEA01  
Date and time : 02MAY96:09:25  
Computation of ref. F: Simple mean, age 3 - 6  
Basis for 1996 : F factors

Table 2.10.3

09:22 Thursday, May 2, 1996 2

Cod in Baltic Fishing Areas 22 and 24

Prediction with management option table

Year: 1996					Year: 1997					Year: 1998	
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	0.9605	58433	29925	37820	0.0000	0.0000	60158	38561	0	98557	69556
.	.	.	.	.	0.1000	0.0961	.	38561	5039	92658	64378
.	.	.	.	.	0.2000	0.1921	.	38561	9694	87244	59633
.	.	.	.	.	0.3000	0.2882	.	38561	13999	82271	55284
.	.	.	.	.	0.4000	0.3842	.	38561	17981	77702	51294
.	.	.	.	.	0.5000	0.4803	.	38561	21669	73500	47632
.	.	.	.	.	0.6000	0.5763	.	38561	25085	69635	44270
.	.	.	.	.	0.7000	0.6724	.	38561	28253	66077	41181
.	.	.	.	.	0.8000	0.7684	.	38561	31193	62799	38341
.	.	.	.	.	0.9000	0.8645	.	38561	33922	59777	35729
.	.	.	.	.	1.0000	0.9605	.	38561	36458	56991	33325
.	.	.	.	.	1.1000	1.0566	.	38561	38816	54419	31111
.	.	.	.	.	1.2000	1.1526	.	38561	41011	52045	29072
.	.	.	.	.	1.3000	1.2487	.	38561	43055	49850	27192
.	.	.	.	.	1.4000	1.3447	.	38561	44959	47821	25457
.	.	.	.	.	1.5000	1.4408	.	38561	46736	45944	23857
.	.	.	.	.	1.6000	1.5368	.	38561	48394	44206	22379
.	.	.	.	.	1.7000	1.6329	.	38561	49943	42596	21013
.	.	.	.	.	1.8000	1.7289	.	38561	51390	41103	19751
.	.	.	.	.	1.9000	1.8250	.	38561	52745	39719	18583
.	.	.	.	.	2.0000	1.9210	.	38561	54013	38434	17502
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANEA01  
Date and time : 02MAY96:09:25  
Computation of ref. F: Simple mean, age 3 - 6  
Basis for 1996 : F factors

Table 2.10.4

09:22 Thursday, May 2, 1996 3

Cod in Baltic Fishing Areas 22 and 24

Prediction with management option table

Year: 1996					Year: 1997					Year: 1998	
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	1.1526	58433	29925	42938	0.0000	0.0000	55024	34362	0	91880	63500
.	.	.	.	.	0.1000	0.0961	.	34362	4553	86576	58864
.	.	.	.	.	0.2000	0.1921	.	34362	8765	81701	54612
.	.	.	.	.	0.3000	0.2882	.	34362	12664	77218	50708
.	.	.	.	.	0.4000	0.3842	.	34362	16277	73093	47124
.	.	.	.	.	0.5000	0.4803	.	34362	19626	69296	43830
.	.	.	.	.	0.6000	0.5763	.	34362	22733	65798	40802
.	.	.	.	.	0.7000	0.6724	.	34362	25618	62574	38017
.	.	.	.	.	0.8000	0.7684	.	34362	28298	59600	35453
.	.	.	.	.	0.9000	0.8645	.	34362	30791	56855	33092
.	.	.	.	.	1.0000	0.9605	.	34362	33109	54320	30917
.	.	.	.	.	1.1000	1.0566	.	34362	35268	51977	28911
.	.	.	.	.	1.2000	1.1526	.	34362	37280	49811	27061
.	.	.	.	.	1.3000	1.2487	.	34362	39156	47807	25353
.	.	.	.	.	1.4000	1.3447	.	34362	40907	45951	23776
.	.	.	.	.	1.5000	1.4408	.	34362	42542	44232	22319
.	.	.	.	.	1.6000	1.5368	.	34362	44070	42638	20971
.	.	.	.	.	1.7000	1.6329	.	34362	45499	41160	19725
.	.	.	.	.	1.8000	1.7289	.	34362	46837	39787	18571
.	.	.	.	.	1.9000	1.8250	.	34362	48090	38512	17502
.	.	.	.	.	2.0000	1.9210	.	34362	49264	37327	16511
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANEA01  
Date and time : 02MAY96:09:25  
Computation of ref. F: Simple mean, age 3 - 6  
Basis for 1996 : F factors

Figure 2.6.1

Averages Chart 1

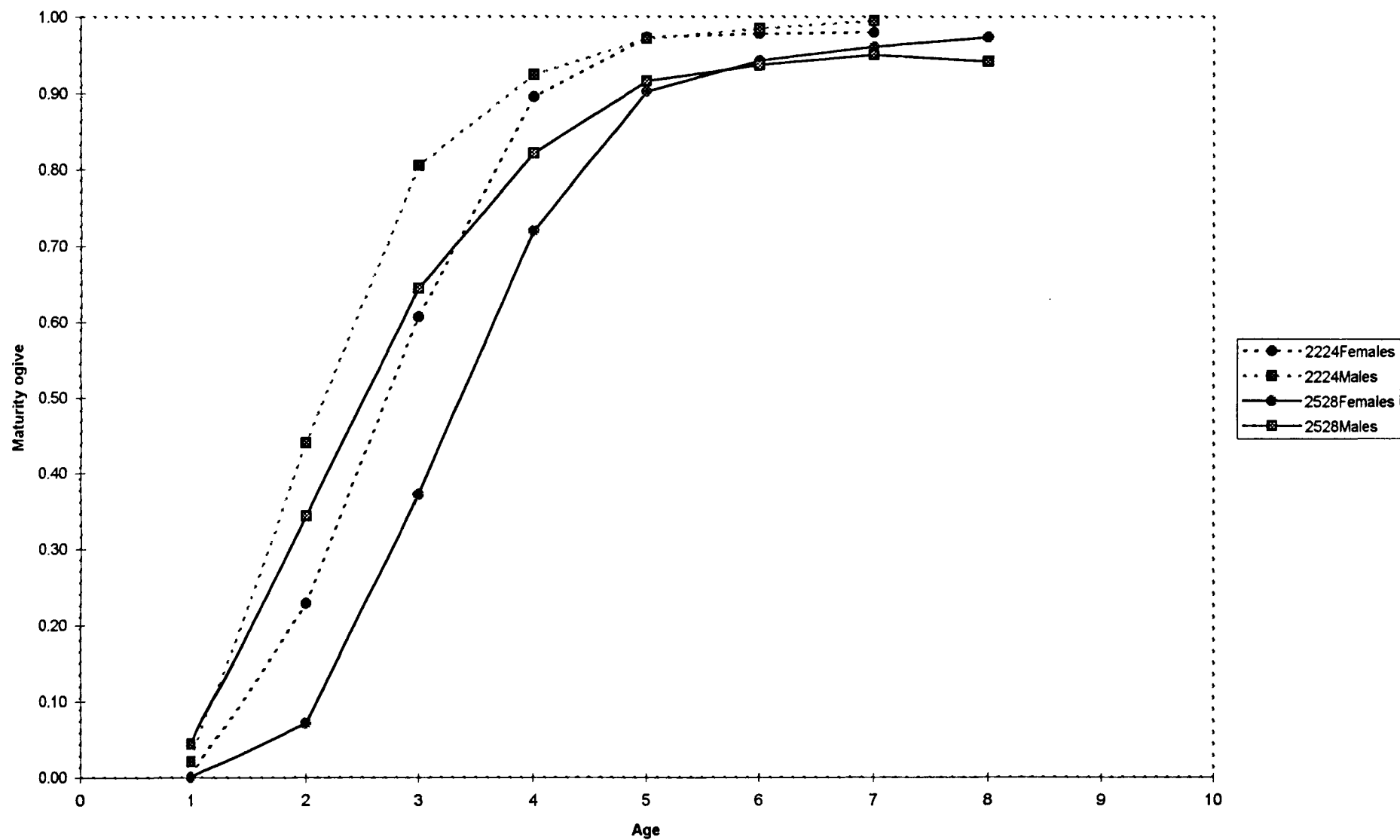
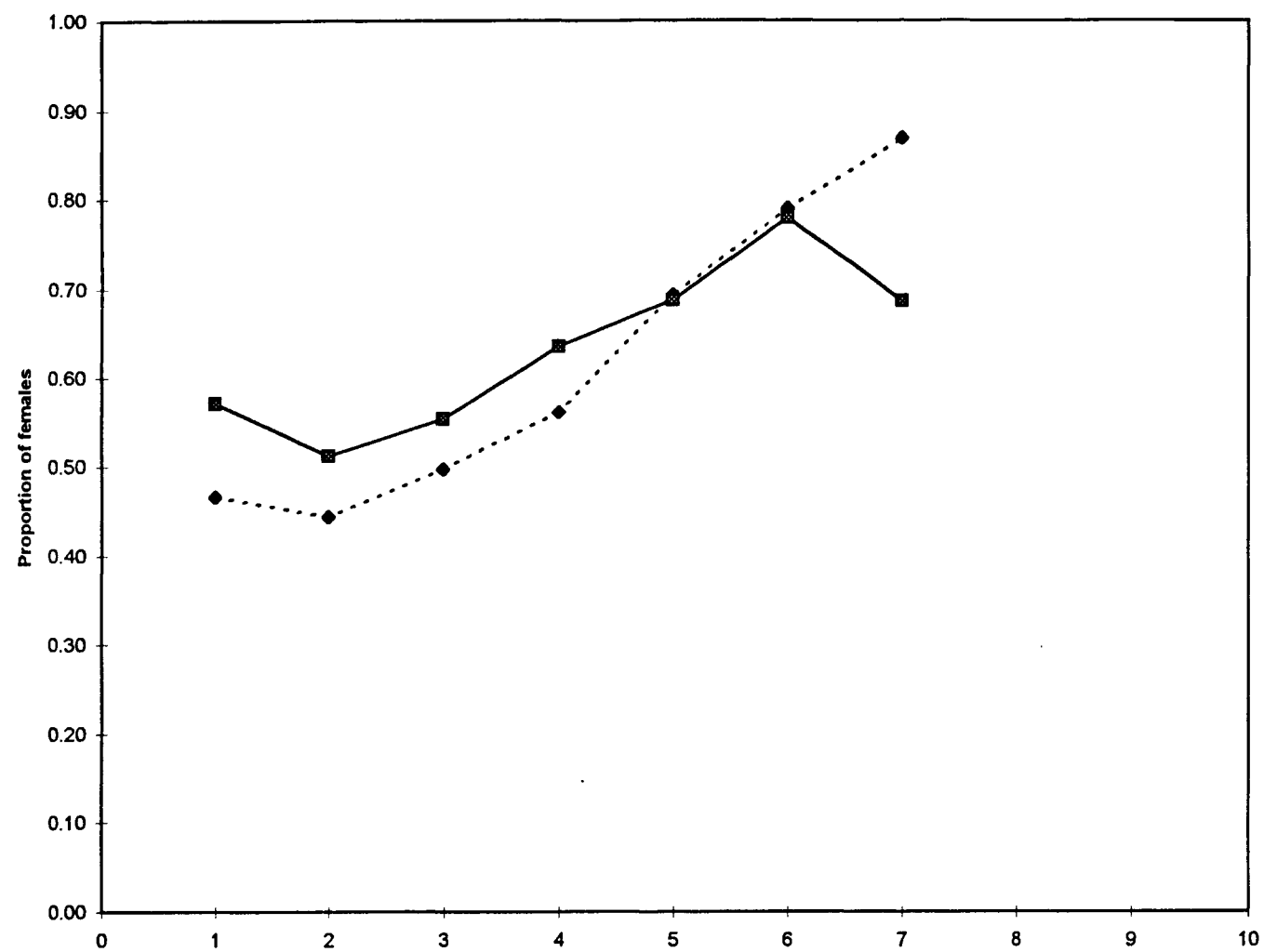


Figure 2.6.2

Averages Chart 2



**Figure 2.8.1** SD 22 + 24. Retrospective analysis, including FBARS 3–6, SSB estimates and Recruits age 1.

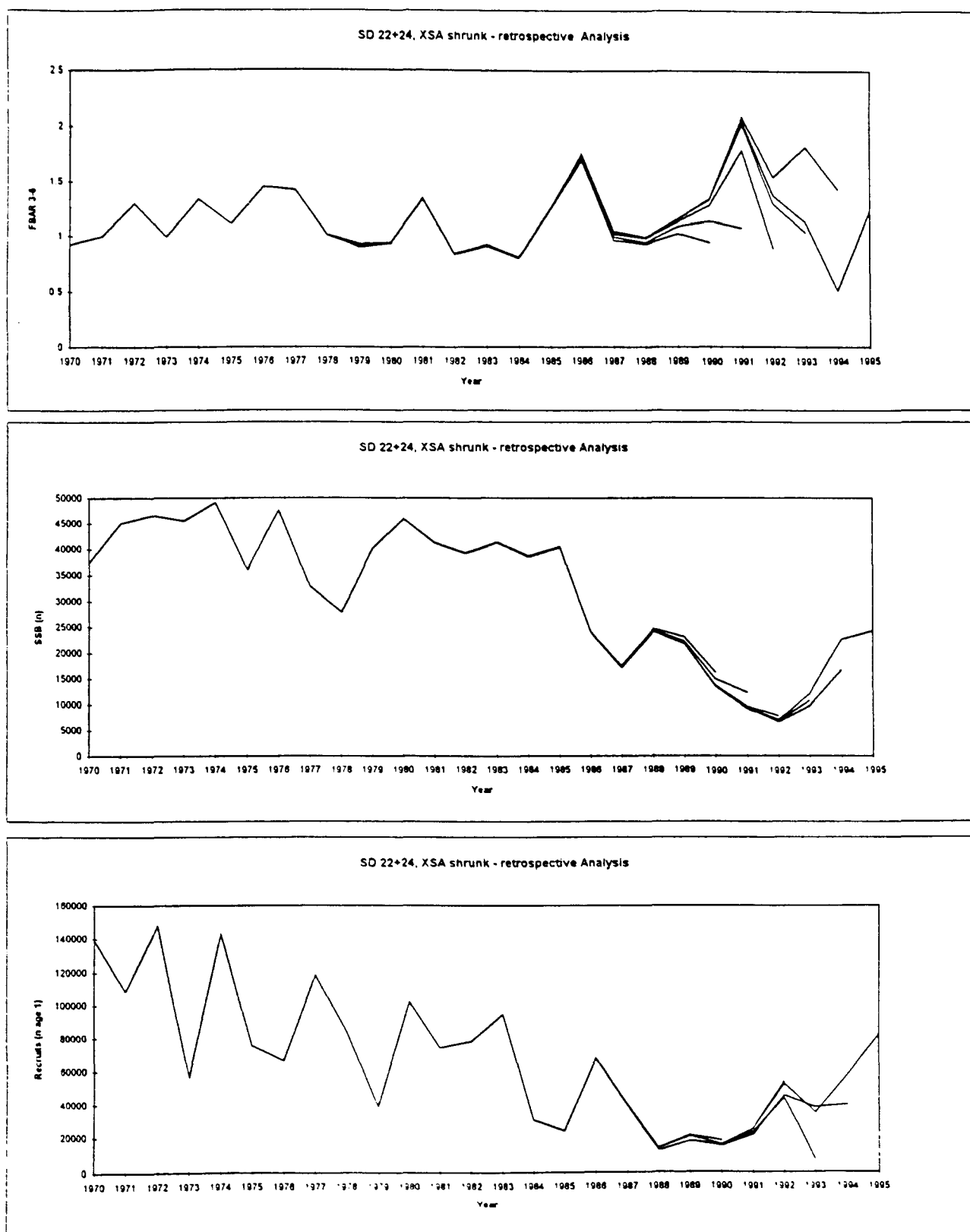


Figure 2.9.1 SSB indices from surveys (GLM), XSA and Cook-method

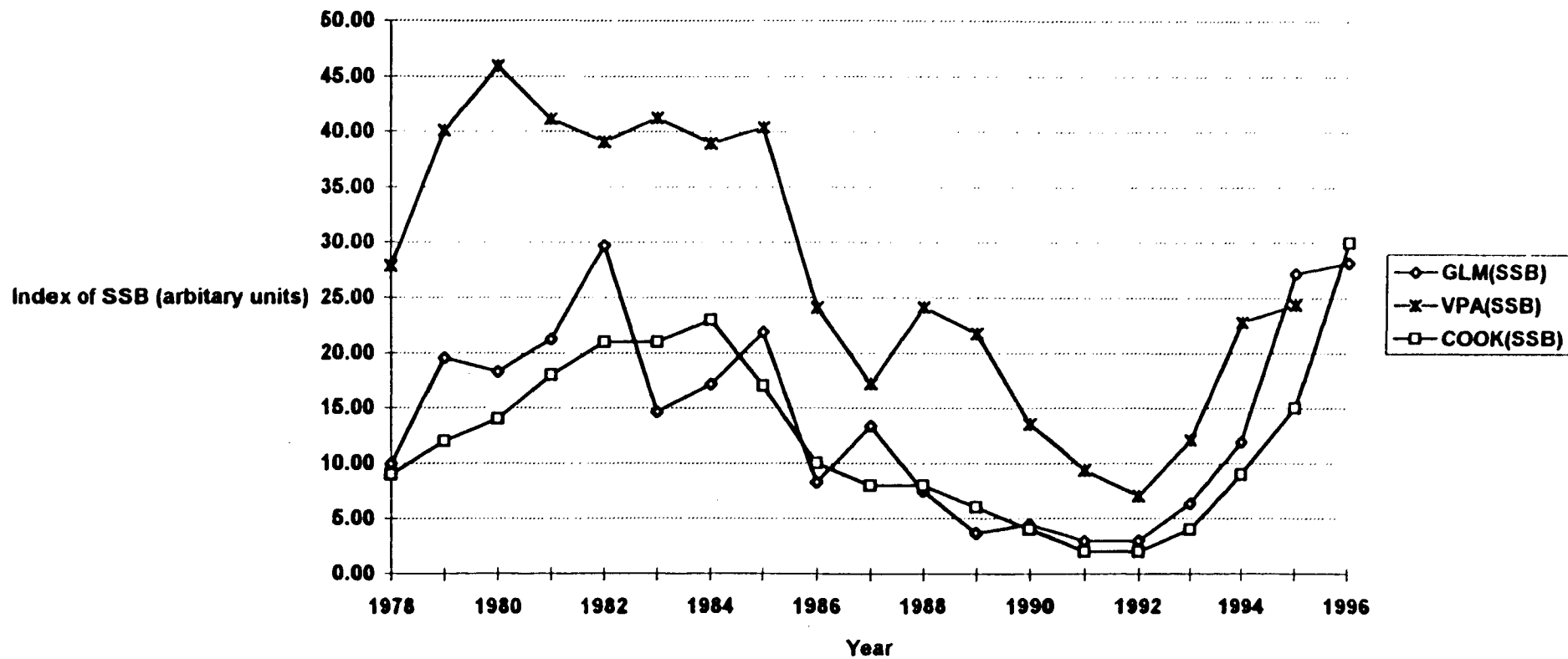


Figure 2.9.2 SSB/R relationship (VPA data).

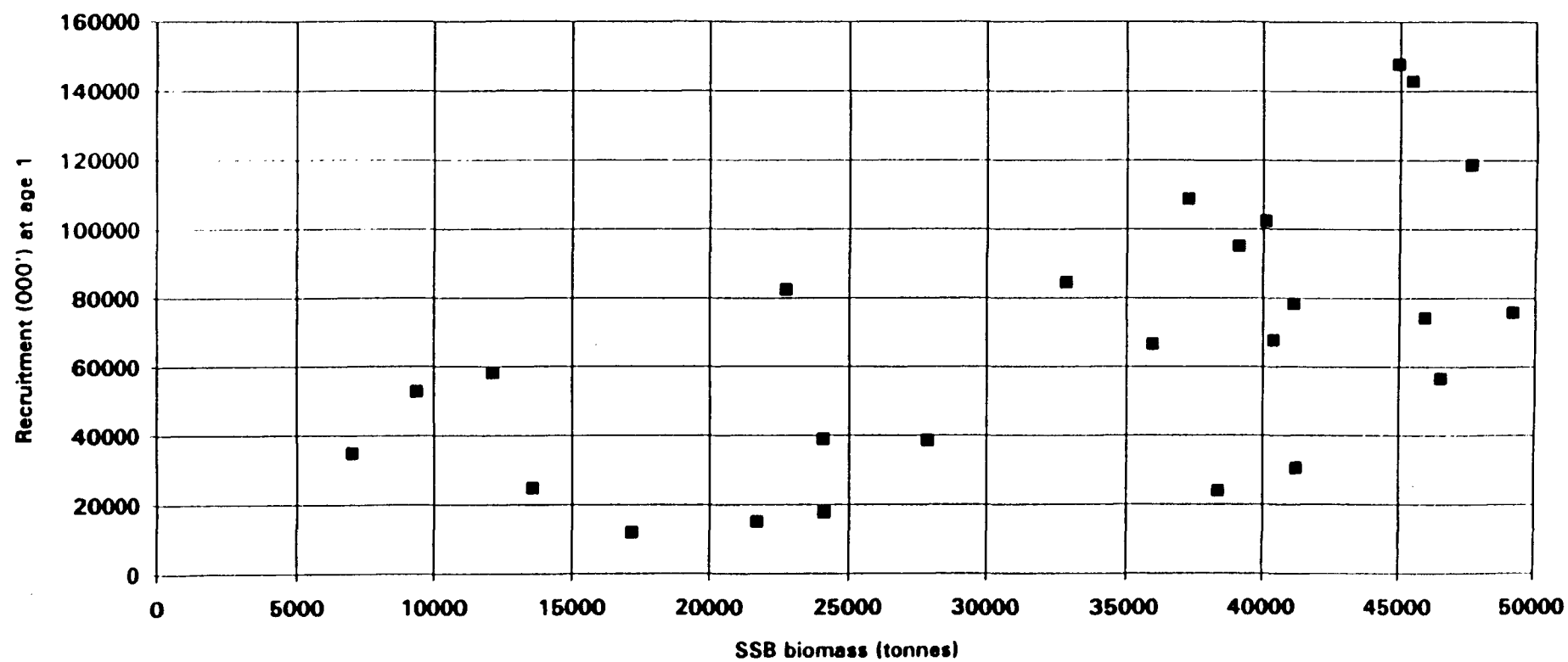
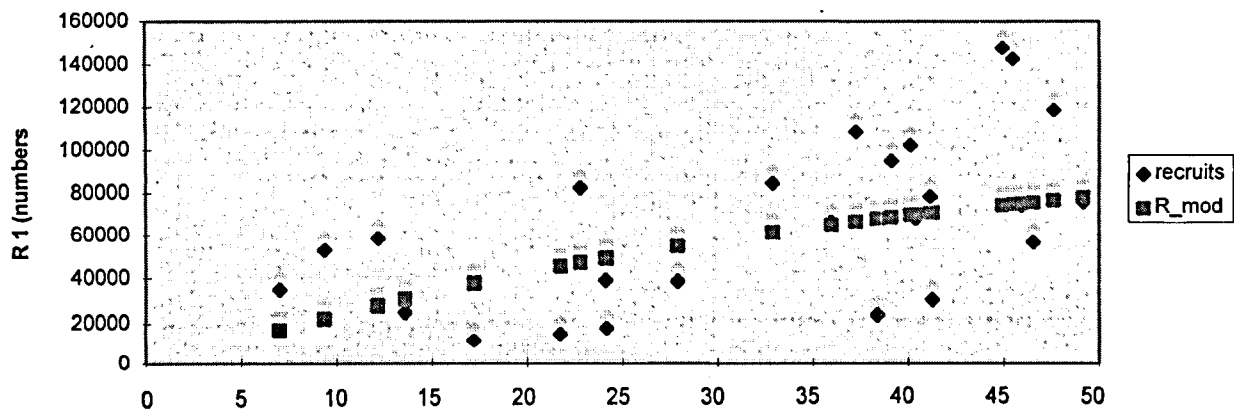


Figure 2.11.1

Ricker

ssb recruitment 22-24									
Estimation of MBAL with Ricker function for cod in SD 22-24									
a=	2591.317		Rmax	=(a/b)*(exp(-1))					
b=	0.010009		R_mod	=a*SSB*EXP(-b*SSB)			Residual in		
							year y		
		observed		Model	Logs	Log	(R_mod-	(R_mod-	Residuals
	year	ssb	recruits	R_mod	R_mod	R_obs.	R_obs)	R_obs)^2	in year y-1
	1970	37.277	108636	66516.13	4.822927	5.035974	-0.21305	0.045389	
	1971	44.957	147667	74284.83	4.8709	5.169283	-0.29838	0.089033	
	1972	46.548	56589	75698.64	4.879088	4.752732	0.126356	0.015966	-0.29838
	1973	45.463	142747	74741.43	4.873561	5.154567	-0.28101	0.078964	0.126356
	1974	49.174	75780	77894.71	4.891508	4.879555	0.011953	0.000143	-0.28101
	1975	35.983	66533	65044.13	4.813208	4.823037	-0.00983	9.66E-05	0.011953
	1976	47.625	118533	76619.72	4.884341	5.073839	-0.1895	0.03591	-0.00983
	1977	32.897	84435	61331.15	4.787681	4.926523	-0.13884	0.019277	-0.1895
	1978	27.886	38524	54662.91	4.737693	4.585731	0.151961	0.023092	-0.13884
	1979	40.122	102232	69582.82	4.842502	5.009587	-0.16708	0.027917	0.151961
	1980	45.943	74133	75168.56	4.876036	4.870012	0.006025	3.63E-05	-0.16708
	1981	41.167	78212	70652.29	4.849126	4.893273	-0.04415	0.001949	0.006025
	1982	39.124	94904	68533.16	4.835901	4.977285	-0.14138	0.019989	-0.04415
	1983	41.27	30508	70756.09	4.849764	4.484414	0.36535	0.133481	-0.14138
	1984	38.393	23914	67746.53	4.830887	4.378652	0.452235	0.204516	0.36535
	1985	40.398	67720	69868.2	4.84428	4.830717	0.013563	0.000184	0.452235
	1986	24.111	39019	49082.97	4.690931	4.591276	0.099655	0.009931	0.013563
	1987	17.198	11993	37518.27	4.574243	4.078928	0.495315	0.245337	0.099655
	1988	24.157	17687	49153.97	4.691559	4.247654	0.443904	0.197051	0.495315
	1989	21.733	14991	45307.69	4.656172	4.175831	0.480341	0.230728	0.443904
	1990	13.571	24848	30700.28	4.487142	4.395291	0.091851	0.008437	0.480341
	1991	9.367	52793	22100.64	4.344405	4.722576	-0.37817	0.143014	0.091851
	1992	7.018	34910	16952.29	4.229228	4.54295	-0.31372	0.098421	-0.37817
	1993	12.133	58166	27845.14	4.444749	4.764669	-0.31992	0.102349	-0.31372
	1994	22.782	82330	46998.53	4.672084	4.915558	-0.24347	0.05928	-0.31992
			Rmax=	95245.31			SSQ=	1.790489	
			50 % of R	47622.66					
	MBAL=	23	47622.66	47344.84					

MBAL using Ricker curve cod in SD 22-24





ssb recruitment 22-24									
Estimation of MBAL with Beverton & Holt function for cod in SD 22-24									
a=	119770		Rmax	0.462432					
b=	0.462432		R_mod	$(a \cdot \text{SSB}) / (1 + (\text{SSB}/b))$			Residual in		
							year y		
	observed		Model	Logs	Log	(R_mod-	(R_mod-	Residuals	
year	ssb	recruits	R_mod	R_mod	R_obs.	R_obs)	R_obs)^2	in year y-1	
1970	37.277	108636	54706.85	4.738042	5.035974	-0.29793	0.088763		
1971	44.957	147667	54821.61	4.738952	5.169283	-0.43033	0.185185		
1972	46.548	56589	54840.69	4.739103	4.752732	-0.01363	0.000186	-0.43033	
1973	45.463	142747	54827.82	4.739001	5.154567	-0.41557	0.172695	-0.01363	
1974	49.174	75780	54869.52	4.739331	4.879555	-0.14022	0.019663	-0.41557	
1975	35.983	66533	54682.76	4.73785	4.823037	-0.08519	0.007257	-0.14022	
1976	47.625	118533	54852.89	4.7392	5.073839	-0.33464	0.111984	-0.08519	
1977	32.897	84435	54617.75	4.737334	4.926523	-0.18919	0.035792	-0.33464	
1978	27.886	38524	54482.04	4.736253	4.585731	0.150522	0.022657	-0.18919	
1979	40.122	102232	54754.43	4.738419	5.009587	-0.27117	0.073532	0.150522	
1980	45.943	74133	54833.59	4.739047	4.870012	-0.13096	0.017152	-0.27117	
1981	41.167	78212	54770.27	4.738545	4.893273	-0.15473	0.023941	-0.13096	
1982	39.124	94904	54738.52	4.738293	4.977285	-0.23899	0.057117	-0.15473	
1983	41.27	30508	54771.79	4.738557	4.484414	0.254143	0.064589	-0.23899	
1984	38.393	23914	54726.35	4.738196	4.378652	0.359544	0.129272	0.254143	
1985	40.398	67720	54758.69	4.738453	4.830717	-0.09226	0.008513	0.359544	
1986	24.111	39019	54343.24	4.735146	4.591276	0.143869	0.020698	-0.09226	
1987	17.198	11993	53935.26	4.731873	4.078928	0.652945	0.426337	0.143869	
1988	24.157	17687	54345.19	4.735161	4.247654	0.487507	0.237663	0.652945	
1989	21.733	14991	54231.58	4.734252	4.175831	0.558422	0.311835	0.487507	
1990	13.571	24848	53560.43	4.728844	4.395291	0.333553	0.111257	0.558422	
1991	9.367	52793	52779.86	4.722468	4.722576	-0.00011	1.17E-08	0.333553	
1992	7.018	34910	51961.64	4.715683	4.54295	0.172733	0.029837	-0.00011	
1993	12.133	58166	53352.07	4.727151	4.764669	-0.03752	0.001408	0.172733	
1994	22.782	82330	54283.65	4.734669	4.915558	-0.18089	0.032721	-0.03752	
			Rmax=	55385.51			SSQ=	2.190053	
			50 % of R	27692.75					
			SSB 50%	0.462432					
MBAL=	0.462432								

MBAL using Bev. and Holt curve for cod in SD 22-24

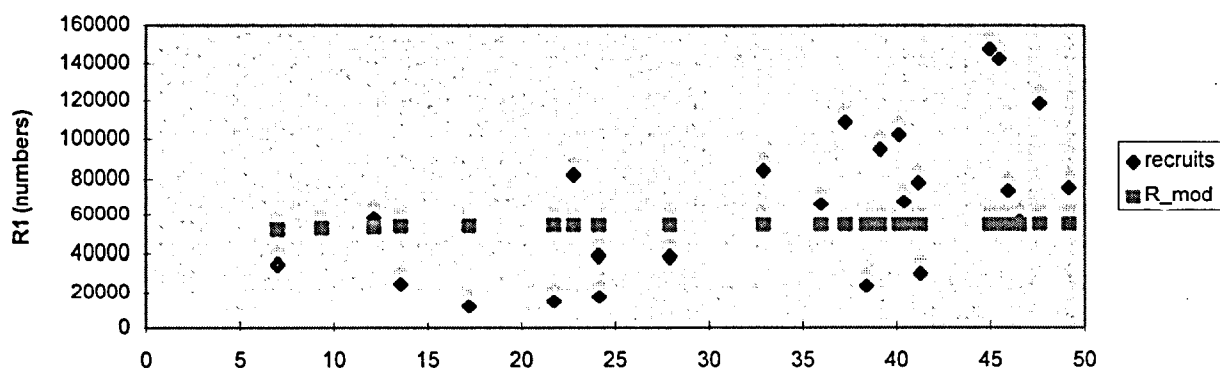


Figure 2.12.1

Medium-term projections: COD 22-24

F-factor = 1

Examples of trajectories

33	42	36	31	40	43	53	64	57	46
28	34	33	39	44	41	41	47	49	47
34	40	40	43	48	44	41	43	42	46
33	42	37	37	36	36	37	36	41	51
32	29	26	29	30	36	40	38	36	34
30	39	37	36	34	31	36	38	38	39
35	44	42	47	46	41	45	40	35	36

Fractiles of SSB distribution

year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
5%	27	29	26	27	31	31	31	33	33	35
25%	31	36	31	32	36	37	38	39	40	41
50%	34	40	36	36	40	42	44	45	46	47
75%	37	47	41	42	48	48	49	52	53	55
95%	43	57	51	50	56	58	59	61	66	66

F-factor = 0.8

Examples of trajectories

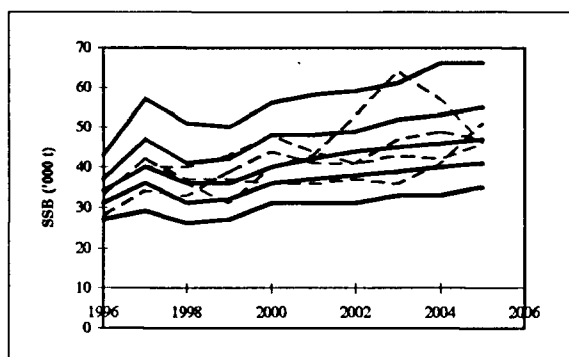
39	61	59	57	72	85	84	82	83	85
29	32	29	33	31	34	43	44	49	60
22	32	40	42	42	42	43	48	59	69
37	49	47	47	66	82	84	91	83	64
35	52	52	54	68	72	75	79	71	64
32	42	42	39	49	64	69	67	75	74
31	42	43	46	53	54	54	57	67	68

Fractiles of SSB distribution

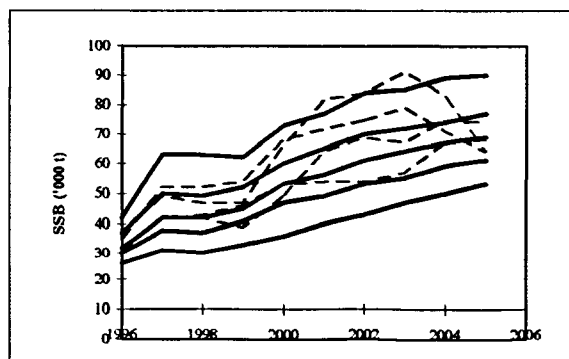
year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
5%	26	31	30	33	36	40	43	47	50	53
25%	30	38	37	41	47	49	53	55	59	61
50%	32	42	42	45	53	56	61	64	67	69
75%	37	50	49	52	60	65	70	72	74	77
95%	42	63	63	62	73	77	84	85	89	90

Rys. 2.12.1. Medium-term projections of SSB for cod in Sub-divisions 22-24  
Fractiles (5,25,50,75, and 95%) and selected trajectories

A. Status quo fishing mortality



B. Fishing mortality equals 80% of the status quo F



### **3 COD IN SUB-DIVISIONS 25-32**

#### **3.1 Estimates of Landings**

National landings by Sub-division are given in Table 2.1.3 and the national landings from the eastern Baltic cod stock (Subdivisions 25-32) in Table 3.1.1. Finnish and Latvian landings were revised for 1994. Estimates of quarterly landings were available. Unallocated landings were estimated and distributed by quarter by the members of the Working Group.

The total landings in 1995 were 107,474 tonnes, which is an increase compared to the period 1992-1994. As previously stated by the Working Group (Anon. 1994c, 1995x) the estimates of the landings in 1993 and 1994 were uncertain, but a bit improved in 1994 due to improved national reporting and of landings in foreign harbours. It is the opinion of the Working Group members that the reporting of landings has improved further in 1995. The estimated amount of unallocated landings was also considerably lower in 1995 than in 1994. However, the quality of landing statistics is still a major problem for the assessment of this stock.

#### **3.2 Discards**

The available information on discards of cod has increased since last year's assessment due to an EU project started in September 1995. Countries participating in this project are Denmark, Germany, Latvia, Poland, Russia and Sweden. The purpose of the project is to improve the database for cod assessment. Sampling was carried out onboard commercial fishing vessels in directed trawl and gillnet fisheries for cod. It is not realistic to use the data collected in this project for assessment yet as few samples were collected in 1995. The material from sampling in the EU assessment project from 1996 will be available for the Working Group in 1997. Discards are still assumed to be an important issue and could influence assessment significantly, and the Working Group intends to use the material from the EU project in the forthcoming assessment work. It is, however, very important to get a better estimate of annual discards and longer time series, since variation between, e.g. season, area and gear could be substantial. The Working Group suggests that in the future discards should be reported as numbers and mean weight at age.

#### **3.3 Age Distribution**

Data for 1995 on age distributions by quarters were provided from Denmark, Finland, Germany, Latvia, Poland, Russia and Sweden. These data were all based on samples from the commercial fisheries. The data could be applied to nationally allocated catches, representing 82 % of the total catches. Estimates of the Lithuanian quarterly catches were distributed according to a mean calculated from the Latvian and Russian catch at age distributions. The remaining catches (Estonian, Finish in Sub-divisions 25-27, Faroes, German in Sub-divisions 26 and 28 and Norwegian) were disaggregated according to total age proportions by quarter. Unallocated catches were disaggregated according to the national age proportions. Estimates of total catch numbers by age are shown in Table 3.3.1. The sampling intensity is shown in Table 3.3.2 by Sub-division and country.

#### **3.4 Mean Weight at Age**

The mean weight at age in the catches were calculated as the weighted average (by catch in numbers) of the quarterly weights at age provided by most countries. The German data for the 4th quarter was applied on the 3rd. The Swedish data for the 1st and the 4th quarter were applied to the 2nd and 3rd respectively. A mean calculated from the Latvian and Russian data were applied to Lithuanian catches. The average mean weights at age in the catch are found in Table 3.4.1.

Estimates of the mean weight at age in the stock referring to the first quarter 1995, were provided by Germany, Sweden, Denmark, Latvia and Russia for various Sub-divisions (25-28) (Table 3.4.1 and Figure 3.4.1). The variation in mean weight at age was relatively little both within and between Sub-divisions, and new mean weights were obtained as the average of the mean weight at age per Sub-division. The new data were used for 1995 and 1994 (replacing the mean weights used for 1994 that were only based on Danish survey data from 1995).

#### **3.5 Maturity Ogives**

The maturity ogive has been kept constant in the assessment. Maturity ogives for females and males combined were provided by Latvia for Sub-division 28, Russia for Sub-division 26, Germany for Sub-division 25 and Denmark for Sub-division 25, 26 and 28. Sweden provided data on female maturity ogives in Sub-divisions 25, 26, 27 and 28. However, spatial coverage and data for combined maturity ogives are at present incomplete, but national data from

surveys exist and sex specific maturity ogives will be available at the next Working Group meeting. The Group agreed not to change the maturity ogives for this year's assessment, but to establish a time series next year covering the period 1987–1996. A preliminary analysis based on data from the literature (e.g. Berner & Vaske, C.M. 1981/J:16), data from F. Thurow (unpubl.) and available survey data. The data, disaggregated into Sub-division, year and country, ranged from 1967–1995 and included 50 records of female maturity ogives, 23 of male maturity ogives and 33 records on sex ratio. Based on this material the proportion of females in the stock and the maturity ogives by sex were computed per Sub-division (Table 2.6.1 and Figure 3.5.1–3.5.3). The proportion of females increased with age especially in Sub-division 25, and the females matured earlier than males (Table 2.6.1 and Figures 2.6.1–2). Also differences between Sub-divisions existed as both females and males matured later in more northern Sub-divisions (Figures 2.3.1–2). Tables 3.5.1 and 3.5.2 show the female maturity ogives and proportion of females in the stock averaged over time intervals and Sub-divisions. To account for changes in the distribution of the stock the ogives per Sub-division were weighted according to the distribution factors given in the working paper by Sparholt *et al.*, 1995. Sub-division 27 were given the weight of 1/3 of Sub-division 28. Based on the results of this analysis the female maturity ogives seem not to be constant over time (Table 3.5.1). Unfortunately, data were not available to present the male maturity ogives in a similar way. Also the sex ratios tended to vary over time (Table 3.5.2)

### 3.6 CPUE and Effort

CPUE data were submitted from national fisheries in Denmark, Finland, Latvia and Sweden. Data were given for gillnets and bottom trawls separately, except the Swedish data, which only described the bottom trawl CPUE. Due to inconsistencies in the Danish effort data for the period 1993 to 1995, these data were not used by the Working Group.

The information is presented in Tables 3.6.1 A–F. Changes in the bottom trawl CPUE (shown in Figure 3.6.1) indicate a decrease in catch rates up to 1992 and a subsequent increase in 1994 and 1995. The relative indices of total effort by country are given in Table 3.6.2.

### 3.7 Tuning and VPA Results

The set of indices available for VPA tuning includes :

- two CPUE indices of commercial fleets (Sweden, Latvia);
- five indices based on bottom trawl surveys (Denmark, Sweden, Germany, Poland and Latvia);
- a scaled arithmetic mean by age groups, which was obtained by aggregation of individual bottom trawl survey data (Denmark, Sweden, Poland, Germany, Russia and Latvia) by applying fishing power (Sparholt *et al.*, 1996).

These data were used in several trial XSA runs with various options. The analysis of diagnostic parameters has shown, that the use of a set of indices based on both the fishery information and trawl surveys gives results different from results obtained by the XSA method when only scaled index is used for tuning XSA.

The Working Group accepted the decision to use the last variant; after using several options for parameter values, the XSA run with the following setting was accepted:

- catchability dependent on stock size for age 2;
- catchability independent of age for ages from 4 to 8;
- mean fishing mortality coefficient is calculated as average of fishing mortality coefficient for 4–7 groups.

The main input data for XSA are presented in the Table 3.7.1.

Diagnostics of this XSA run are shown in Table 3.7.2. Residuals obtained in the calculations in general have small values. Only in several absolute values of residuals exceeded 0.5. This run differs significantly from the run carried out in previous year assessment. The reason may be in different input data, which were used for tuning. It is worth to mention very low values of standard errors of log reciprocal catchability coefficient by age groups: these values do not exceed 0.41.

Regressions to calculate catchability coefficients give a rather high explained variation ( $R^2$  higher than 0.72). This applies especially for ages groups with catchability independent of age ( $R^2$  higher than 0.84). XSA derived estimates of survivors based on tuning data have significantly larger contribution to the final estimates of survivors than estimates obtained from shrinkage option.

The XSA results for cod in Sub-divisions 25–32 are shown in Table 3.7.3 and Figure 3.10.1. Fishing mortality coefficients increased since 1993, however, these values are lower than in 1990–1992. These estimates differ from estimates obtained in 1995, and it seems that it is connected to the use of a new tuning data-set, and also with the corrections of catch at age data in 1992 (see input data - CANUM).

The estimates of total and spawning biomass are increasing since 1993, caused by increase of abundance of 2–4 age groups by years.

To study the stability of obtained estimates a retrospective analysis was carried out using the XSA options mentioned above. The results of retrospective analysis are presented in Figure 3.7.1.

Due to uncertainties in the cod catch level in the terminal and two previous years, it has been attempted to evaluate the level of catches by comparing SSB indices from survey data with XSA estimates. Three levels of catches have been assumed in the terminal and the two previous years:

- low level, corresponding to official catch statistics
- medium level, evaluated by Working Group members
- suggested high level

The high level in 1995 was assumed as 130,000 tonnes. The SSB estimates corresponding to the above mentioned levels and SSB indices derived from trawl surveys are shown in Table 3.7.4.

The evaluated results do not reveal significant differences, however, it seems that the best approximation was obtained using low and medium catch levels.

### 3.8 ICA Results

The stock assessment of cod in Sub-divisions 25–32 was carried out by the ICA method. The same input data as in XSA runs were used in those calculations.

The options used were as follows:

- separable model was fitted on 6 last years;
- F reference (5 age group) was calculated for 4–7 age groups;
- S value for oldest age group was assumed equal to 1;
- catchability coefficients by age groups were fitted by linear model;
- stock-recruitment relationship was used;
- shrinkage option was used with s.e. equal to 0.5 and 5 years for calculation of the mean.

The results are presented in the Table 3.8.1 and Figures 3.8.1a–j. The SSQ curve, which has a clear minimum, shows that the main impact on the objective function is from the separable part of the model. The correspondent impact of the abundance index and especially the stock-recruitment relationship is notably lower.

This run produced estimates of total and spawning biomass, which exceeded the estimates on the base of XSA approximately for 100 thousand tonnes.

At the same time this run produced unrealistic estimates of fishing mortality coefficients for the last three years (e.g. 0.3 for 1993). It seems that the method tends to increase abundance of age groups in terminal years, as it was shown in the Working Group report (1994) for Central Baltic Herring.

Next the attempt was made to investigate the sensitivity of the stock estimates on the value of S for the oldest age group. This run with  $S = 0.5$  was successful, but gives an increase of total biomass as compared with XSA estimates for almost 170,000 thousand tonnes. The results for 1995 for this method as compared with XSA estimates is shown in text table below:

Model	SSB	Total biomass
ICA	390	486
XSA	244	313

There was made an attempt to investigate the stability of estimates by ICA method on the base of retrospective analysis. But unfortunately the runs for 1991, 1992 and 1993 failed when calculations stated the ICA2 programme.

Out of three runs produced to show the influence of changes in catches in several terminal years on the final estimates (as in XSA runs) one was unsuccessful. This attempt with officially reported catches was unsuccessful with 0 and 0.3 values as estimates for autocorrelation in errors, but the run was successful with a value equal to 1, however, this seems unrealistic, because this value corresponds to fully correlated errors. The results in total and spawning biomass (in thousand tonnes) of catch corrections in 1995 on medium and high level as compared with XSA calculations are:

	Total biomass		Spawning biomass	
	Medium	High	Medium	High
XSA	313	350	244	273
ICA	414	428	324	331

It should be mentioned that the attempt was made to use for ICA runs the trawl survey indices (Denmark, Sweden, Latvia and Poland). But ICA1 module was unable to find  $F_{ref}$ .

Because of the lack of time those calculations have not been finished.

### 3.9 Recruitment

The Baltic International data base were updated by surveys in 1996. Catch at age data for Poland in 1993 and Russia in 1995 also have been revised. The database now covers 4268 hauls with age-aggregated data distributed over Sub-divisions 25 to 28 from 1980 and onwards.

Data now contain hauls from:

Danish survey	March	since 1982
Latvian survey	January-April, November, December	since 1982
Former GDR surveys	January, November	since 1980
German surveys	February-April, November	since 1981
Polish survey	January-April, December	since 1981
Russian surveys	March, April	since 1993
Swedish surveys	March, December	since 1986

As in previous assessments, data were analysed by a GLM model in order to provide recruitment indices at age 2 for 1995 and 1996. The models applied were:

Model 1  $\ln(\text{CPUE}) = Y + C + S + D + Q + e$

Model 2  $\ln(\text{CPUE}) = Y + C + S + D + Q + Y*S + e$  where,

CPUE = catch in numbers per hour of agegroup 2 cod  
Y = year effect  
C = country effect ( gear and vessel by different national surveys)  
S = Sub-division effect (horizontal distribution)  
D = depth effect (vertical distribution)  
Y\*S = interaction between year and area (migration and density distribution)  
e = error term

A constant of 0.5 was added to all observations to avoid zeros before log transformation. Five depth strata were defined: <40, 41–60, 61–70, 71–100 and >100 m. The output from the models, run with the SAS software at ICES, is found in Table 3.9.1.

Both models show a same recruitment indices patterns. The models account for 29 and 34% of the total variation, respectively. The year class strength (year effects), depth and country effects were more important. The GLM estimates comparison with scaled arithmetic mean for age group 2 (Sparholt *et al.*, 1996, see tuning data for age group 2) are

shown Figure 3.9.1. Although the correlation between these two indices is relatively high (coefficient of correlation - 0.837) certain differences are observed for year classes 1982 and 1985.

The GLM indices were regressed against output VPA estimates with the RCT3 program. Results with GLM estimates shows the increase in predicted recruit numbers for 1993 year class, while for 1994 prediction is on a same level as in 1992 (Tables 3.9.2 and 3.9.3).

### 3.10 Catch Predictions and Management Options

The standard catch projections and yield per recruit estimates were based on the input data given in Table 3.10.1. Input for recruitment at age 2 in 1995 as in previous assessments was based on GLM estimates with an RCT3 regression described in Section 3.9. Accordingly, the estimated recruitment at age 2 in 1996 was set to 151,306 thousand individuals. Stock sizes at ages 3–8 in 1996 were taken from the XSA output. Recruitment in 1997 and 1998 was assumed equal to the arithmetic mean of the XSA output for 1987–1995 - 130,000 thousand. Thus, the assumed recruitment in 1997 and 1998 was considered to be below the long-term average (1984–1995: 184,000 thousand). The mean weights at age in the stock were derived from combined survey data for 1995. The mean weights in stock were set as arithmetic mean for 1993–1995. The fishing pattern was assumed the same as for 1995.

The outputs from a standard short-term prediction in 1996 are presented in Table 3.10.2a–c and Figure 3.10.2. The prediction assuming *status quo* efforts in 1996 and 1997 indicates approximately the same SSB level (255–260 thousand tonnes) in 1997 and 1998, which is below the long-term average (1984–1995: 330 thousand tonnes). The catch level constitutes in 1996 and 1997 approximately 114 thousand tonnes.

The current level of  $F_{4.7}$  is 0.6873 and exceeds both  $F_{0.1} = 0.3661$  and  $F_{max} = 0.6534$ . The catch corresponding to the exploitation at  $F_{0.1}$  level in 1997 is below 50 thousand tonnes. It should be mentioned that 1993 year class strength estimated by XSA is lower than in the last year's assessment (from 209 to 175 million).

Yield per recruit calculations are shown in Table 3.10.3 and Figure 3.10.2.

### 3.11 MBAL estimation

The MBAL was estimated by applying the approach of Myers *et al.* (1994), (see Section 1.4). The spawning stock and recruitment estimates were based on the presented VPA estimates and the relationship and fitted models are shown in Figures 3.11.1a and 3.11.1b. The estimate of MBAL resulting from the Ricker curve is about 240,000 tonnes. Fitting the data to the Beverton and Holt curve yielded an MBAL of about 480,000 tonnes. The female spawning stock was computed based on the average sex ratio and female maturity ogive (Table 3.6.1). Relating the female spawning biomass to the recruitment did not reduce the scatter. The estimate of MBAL (F) based on the Beverton and Holt curve approximated 100,000 tonnes and based on the Ricker curve the estimate was 87,000 tonnes (Figure 3.11.2). Both estimates seem very low compared with the relationship between the total spawning stock, and the recruitment and the estimation of the female spawning stock should be recompiled using more accurate data.

### 3.12 Medium-Term Projections of Catch and Stock Biomass

The Working Group made a preliminary attempt to produce the medium-term projections. Medium-term projections aimed at illustrating the trends in yield and in SSB were run using a spreadsheet program under the @RISK for Excel software (Sparholt, 1996). This program is a standard projection. The scenario studied is the *status quo* fishery, i.e. projecting the 1995 F-at-age array into the next century.

For medium-term projections the F-at-age, weight-at-age, maturity ogives were the same as in the short-term projections.

In contrast to the model used in last years report, the present model assumes that recruitment is a function of the cod SSB, sprat SSB (sprat are eating cod eggs) and spawning volume as determined in the Working Group doc. (Sparholt, 1996). The model includes also cannibalism of cod on age groups 0–2. Cod predation data were derived from the Working Group on Multispecies Assessment of Baltic (Anon., 1996/Assess:6).

The initial value for the spawning volume was assumed as average for the time period 1977–1991 and was set as 107 km<sup>3</sup>.

The sprat SSB was assumed as autocorrelated time series with parameters determined on the base on data from 1977–1991.

There were conducted 1000 simulations in yield prediction and 100 simulations for SSB prediction. The trend graphs for yield and SSB are given in Figure 3.12.1. These graphs show the projected mean and the 10/90% and 25/75% confidence intervals.

With options used and taking into account the constant environmental conditions (spawning volume) the mean values do not reveal any significant trends. Time did not allow analysis of alternative management strategies.



Table 3.1.1 Total catch (t) of COD by countries in Sub-divisions 25-32.

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Year	Denmark	Estonia	Finland	German Dem.Rep.	Germany, Fed.Rep.	Latvia	Lithuania	Poland	Russia	Sweden	USSR	Faroe Islands	Norway	Unallocated	Total
1965	15,856	-	23	975	2,183	-	-	41,498	-	19,523	22,420	-	-	-	102,478
1966	16,570	-	26	2,1969	1,383	-	-	56,007	-	20,415	38,270	-	-	-	134,867
1967	19,924	-	27	11,020	1,057	-	-	56,003	-	21,367	42,980	-	-	-	152,378
1968	21,516	-	70	12,118	2,018	-	-	63,245	-	21,895	43,610	-	-	-	164,472
1969	23,459	-	58	18,460	4,715	-	-	60,749	-	20,888	41,580	-	-	-	169,909
1970	22,307	-	70	10,103	4,855	-	-	68,440	-	16,467	32,250	-	-	-	154,492
1971	23,116	-	53	2,970	2,766	-	-	54,151	-	14,251	20,910	-	-	-	118,217
1972	34,072	-	76	4,055	3,204	-	-	57,093	-	15,194	30,140	-	-	-	143,833
1973	35,455	-	95	6,034	14,973	-	-	49,790	-	16,734	20,083	-	-	-	143,164
1974	32,028	-	160	2,517	11,831	-	-	48,650	-	14,498	38,131	-	-	-	147,815
1975	39,043	-	298	8,700	11,968	-	-	69,318	-	16,033	49,289	-	-	-	194,649
1976	47,412	-	287	3,970	13,733	-	-	70,466	-	18,388	49,047	-	-	-	203,303
1977	44,400	-	310	7,519	19,120	-	-	47,702	-	16,061	29,680	-	-	-	164,792
1978	30,266	-	1,437	2,260	4,270	-	-	64,113	-	14,463	37,200	-	-	-	154,009
1979	34,350	-	2,938	1,403	9,777	-	-	79,754	-	20,593	75,034	3,850	-	-	227,699
1980	49,704	-	5,962	1,826	11,750	-	-	123,486	-	29,291	124,350	1,250	-	-	347,619
1981	68,521	-	5,681	1,277	7,021	-	-	120,901	-	37,730	87,746	2,765	-	-	330,742
1982	71,151	-	8,126	753	13,800	-	-	92,541	-	38,475	86,906	4,300	-	-	316,052
1983	84,406	-	8,927	1,424	15,894	-	-	76,474	-	46,710	92,248	6,065	-	-	332,148
1984	90,089	-	9,358	1,793	29,577	-	-	93,429	-	59,685	100,761	6,354	-	-	391,046
1985	83,527	-	7,224	1,215	26,275	-	-	63,260	-	49,565	78,127	5,890	-	-	315,083
1986	81,521	-	5,633	181	19,520	-	-	43,236	-	45,723	52,148	4,596	-	-	252,558
1987	68,881	-	3,007	218	14,560	-	-	32,667	-	42,978	39,203	5,567	-	-	207,081
1988	60,436	-	2,904	2	14,078	-	-	33,351	-	48,964	28,137	6,915	-	-	194,477
1989	57,240	-	2,254	3	12,844	-	-	36,855	-	50,739	14,722	4,520	-	-	179,172
1990	47,394	-	1,731	+	4,691	-	-	32,028	-	50,683	13,461	3,558	-	-	152,870
1991	39,792	1,810	1,712	-	6,564	2,627	1,865	25,748	3,299	36,490	-	2,611	-	-	122,517
1992	18,025	1,368	485	-	2,793	1,250	1,266	13,314	1,793	13,995	-	605	-	-	54,894
1993	2,040	70	225	-	1,942	1,333	605	8,909	892	10,099	-	-	-	13,450	38,117
1994	4,901	952	292	-	3,056	5,660	1,887	14,335	1,257	21,264	-	-	-	36,498	90,102
1995 <sup>1</sup>	16,895	1,049	1,427	-	5,496	6,653	4,513	25,000	1,612	24,723	-	866	247	18,993	107,474

<sup>1</sup>Provisional data.

<sup>2</sup>Includes landings from October-December 1991 in former GDR.

Table 3.3.1

Cod 25-32. Catch-at-age and weight-at-age for 1994 and 1995.

ICES BALTIC DEMERSAL WG: COD IN SUB-DIVISIONS 25-32

Baltic Demersal WG 1996

CATCHES IN NUMBERS (THOUSANDS) AND MEAN WEIGHTS. BY QUARTER YEAR: 1994

QUARTER I1																										
Country	Denmark		Germany		Estonia		Finland		Poland		Latvia		Lithuania		Russia		Sweden		Total		Finland unsp. Faroes, Estonia		G-Total			
Age	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	MW(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)		
1										0.000				7	0.022	6	0.022			13	0.022			14	0.022	
2	7	0.447	274	0.474					368	0.502	40	0.320	32	0.245	27	0.245	2021	0.774	2770	0.689			2976	0.689		
3	3123	0.990	2364	0.778					4217	0.717	20	0.580	198	0.424	165	0.424	7668	0.964	17755	0.874			19080	0.874		
4	1467	1.249	1215	1.179					7310	1.022	165	0.920	163	0.840	136	0.840	1761	1.444	12218	1.120			13129	1.120		
5	130	1.658	130	1.732			1	1.033	2894	1.379	198	1.300	243	1.550	203	1.550	63	2.993	3863	1.443			4151	1.443		
6	26	2.438	13	2.764			7	1.606	447	1.786	123	1.820	64	2.323	53	2.323	45	3.885	777	2.030			835	2.030		
7	2	4.136	1				9	2.129	19	2.954	23	3.000	24	3.038	20	3.038	13	5.593	110	3.235			119	3.235		
8	2	5.191	1				3	3.096			1	4.000	5	3.467	4	3.467	9	7.074	25	4.752			27	4.752		
9			1						5	5.620			5	4.489	4	4.489	4	7.172	18	5.112			20	5.112		
10+							0	5.650					7	7.308	6	7.308			13	7.296			14	7.296		
SOP (t):		5225		3663		0		41		15551		730		918		765		12028		38919		0		41824		
Nom. land (t):		5161		3377		0		43		15554		730		940		784		12043		38632		3192		41824		
QUARTER II2																										
Country	Denmark		Germany		Estonia		Finland		Poland		Latvia		Lithuania		Russia		Sweden		Total		Finland unsp. Faroes		G-Total			
Age	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)		
1				5	0.236									5	0.022	3	0.022			13	0.105			14	0.105	
2	8	0.606	563	0.474					30	0.329	123	0.345	21	0.245	13	0.245	217	1.158	975	0.599			1063	0.599		
3	2112	1.187	1659	0.778					2252	0.657	38	0.690	132	0.424	81	0.424	868	1.299	7142	0.913			7787	0.913		
4	859	1.435	1144	1.179			21	0.994	3072	1.251	107	1.150	107	0.840	66	0.840	406	1.570	5782	1.271			6305	1.271		
5	172	1.742	181	1.732			62	1.189	2709	1.834	230	1.470	161	1.550	99	1.550	41	2.819	3654	1.782			3984	1.782		
6	20	1.705	18	2.764			29	1.572	378	2.960	209	2.000	42	2.323	26	2.323	20	4.030	742	2.567			809	2.567		
7	3	6.434					11	2.028	86	6.198	108	3.500	16	3.038	10	3.038	7	4.812	241	4.416			263	4.416		
8	3	7.055					4	2.890	58	7.120	42	4.500	3	3.467	2	3.467	2	6.618	114	5.829			124	5.829		
9		7.230					1	3.910	12	9.985	15	5.700	3	4.489	2	4.489	2	7.032	35	6.957			38	6.957		
10+							1	6.609	16	11.886	22	6.400	5	7.308	3	7.308			47	8.463			51	8.463		
SOP (t):		4119		3271		0		185		12673		1740		610		375		2273		25245		0		27525		
Nom. land (t):		4053		3520		0		185		12642		1740		626		385		2274		25425		2101		27525		

Table 3.3.1 (continued)

ICES BALTIC DEMERSAL WG: COD IN SUB-DIVISIONS 25-32

CATCHES IN NUMBERS (THOUSANDS) AND MEAN WEIGHTS. BY QUARTER YEAR: 1994

QUARTER III 3																								
Country	Denmark		Germany		Estonia		Finland		Poland		Latvia		Lithuania		Russia		Sweden		Total		Finland unsp. G-Total			
Age	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)		
1							1	0.082			6	0.170	0	0.000					7	0.157		7	0.157	
2	49	0.652	5	0.447			0	0.113	95	0.246	60	0.390	6	0.250	3	0.250	1829	0.661	2047	0.631		2207	0.631	
3	382	0.971	36	0.785			1	0.666	1413	0.468	185	0.720	54	0.658	26	0.658	1443	1.000	3540	0.760		3817	0.760	
4	105	1.147	10	1.311			1	0.952	82	0.908	148	1.000	122	0.917	59	0.917	166	1.457	693	1.103		748	1.103	
5	16	1.438	1	2.125			2	1.354			92	1.500	189	1.530	91	1.530	19	2.496	411	1.566		443	1.566	
6	8	1.992	1	2.125			2	1.806			9	2.150	54	2.325	26	2.325	3	3.892	102	2.321		110	2.321	
7							1	2.478			4	3.200	15	3.316	7	3.316	1	6.439	28	3.420		30	3.420	
8											1	4.000	6	3.373	3	3.373	0	7.729	10	3.600		11	3.600	
9	2	2.114											0	0.000					2	2.114		2	2.114	
10+													0	0.000					0	0.000		0	0.000	
SOP (t):		566		48		0		10		759		479		633		305		2966		5766		0		6217
Nom. land (t):		545		51		0		12		857		478		562		271		2966		5742		474		6217

QUARTER IV 4																								
Country	Denmark		Germany		Estonia		Finland		Poland		Latvia		Lithuania		Russia		Sweden		Total		Finland unsp. G-Total			
Age	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)	C(n)	W (kg)		
1							1	0.085			75	0.210	0	0.000					76	0.208		81	0.208	
2	13	0.523	5	0.447			5	0.345	79	0.321	377	0.420	13	0.250	8	0.250	2439	0.661	2940	0.616		3117	0.616	
3	91	0.963	38	0.785			2	0.724	2257	0.504	855	0.840	128	0.658	77	0.658	1924	1.000	5373	0.751		5696	0.751	
4	40	1.140	17	1.311			2	1.303	1970	1.068	775	1.320	287	0.917	173	0.917	221	1.457	3485	1.131		3695	1.131	
5	2	2.745	1	2.125			3	1.941	619	1.287	403	1.780	446	1.530	269	1.530	26	2.496	1769	1.518		1875	1.518	
6	1	4.102					2	2.801	236	1.297	25	2.500	128	2.325	77	2.325	4	3.892	473	1.841		501	1.841	
7	1	6.645					1	3.154			5	3.700	37	3.316	22	3.316	2	6.439	67	3.475		71	3.475	
8	1	7.214					2	4.811					13	3.373	8	3.373	1	7.729	25	3.748		26	3.748	
9							1	6.500					0	0.000					1	6.500		1	6.500	
10+							2	9.636					0	0.000					2	9.636		2	9.636	
SOP (t):		163		57		0		56		4368		2713		1496		902		3956		13711		0		14536
Nom. land (t):		142		60				55		4372		2714		1327		800		3956		13426		1109		14536

Table 3.3.1 (continued)

ICES BALTIC DEMERSAL WG: COD IN SUB-DIVISIONS 25-32

Baltic Demersal WG 1996

CATCHES IN NUMBERS (THOUSANDS) AND MEAN WEIGHTS.

YEAR: 1994

ANNUAL BY COUNTRY.

Country	Denmark		Germany		Estonia		Finland		Poland		Latvia		Lithuania		Russia		Sweden		Total		Finland unsp. Faroes		G-Total	
Age	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)
1	0	0.000	5	0.236	0	0.000	2	0.084			81	0.207	12	0.022	9	0.022	0	0.000	109	0.170			117	0.170
2	77	0.607	847	0.474	0	0.000	5	0.345	573	0.426	600	0.395	73	0.246	51	0.246	6506	0.713	8731	0.641			9406	0.641
3	5708	1.061	4097	0.778	0	0.000	3	0.705	10139	0.621	1098	0.810	511	0.507	349	0.493	11903	0.999	33809	0.851			36421	0.851
4	2471	1.308	2386	1.180	0	0.000	24	1.018	12435	1.085	1195	1.210	680	0.886	434	0.881	2554	1.466	22178	1.161			23892	1.161
5	320	1.699	313	1.735	0	0.000	68	1.225	6222	1.568	923	1.572	1040	1.538	662	1.539	149	2.795	9697	1.590			10446	1.590
6	55	2.137	32	2.749	0	0.000	40	1.651	1061	2.095	365	1.977	288	2.324	182	2.324	72	3.926	2095	2.192			2256	2.192
7	6	5.703	1	0.000	0	0.000	22	2.141	104	5.621	140	3.417	91	3.193	59	3.175	23	5.472	447	3.920			481	3.920
8	6	6.460	1	0.000	0	0.000	9	3.386	58	7.120	44	4.482	28	3.400	17	3.406	12	7.055	174	5.247			188	5.247
9	2	2.114	1	0.000	0	0.000	2	5.205	16	8.738	15	5.700	8	4.489	6	4.489	6	7.125	57	6.176			61	6.176
10+	0	0.000	0	0.000	0	0.000	3	8.531	16	11.886	22	6.400	12	7.308	9	7.308	0	0.000	62	8.251			67	8.251
SOP (t):		10073		7038		0		292		33350		5660		3657		2347		21223		83640				90102
Nom. land (t):		9901		7008		0		295		33425		5662		3456		2240		21239		83226		6876		90102

COD IN SUB-DIVISIONS 25-32

CATCHES IN NUMBERS (THOUSANDS) AND MEAN WEIGHTS. YEAR: 1994  
QUARTERLY. ALL COUNTRIES.

Quarter		1		2		3		4		Annual	
Age	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	C(n)	W(kg)	
1	14	0.022	14	0.105	7	0.157	81	0.208	116	0.170	
2	2976	0.689	1063	0.599	2207	0.631	3117	0.616	9363	0.641	
3	19080	0.874	7787	0.913	3817	0.760	5696	0.751	36380	0.851	
4	13129	1.120	6305	1.271	748	1.103	3695	1.131	23876	1.161	
5	4151	1.443	3984	1.782	443	1.566	1875	1.518	10454	1.591	
6	835	2.030	809	2.567	110	2.321	501	1.841	2256	2.195	
7	119	3.235	263	4.416	30	3.420	71	3.475	483	3.925	
8	27	4.752	124	5.829	11	3.600	26	3.748	189	5.255	
9	20	5.112	38	6.957	2	2.114	1	6.500	61	6.183	
10+	14	7.296	51	8.463	0	0.000	2	9.636	67	8.252	
SOP (t):		41824		27525		6217		14536		90102	
Nom. land. (t):		41824		27525		6217		14536		90102	

Lithuanian catches distributed according to Russian m-w and age distributions.

Finnish catches SD 25-

Unspec Bornholm landi

Faroes landings

Estonian landings

Total

609 t

3000

648

2619

6876

Quarterly distributed according to total available quarterly

Table 3.3.1 (continued)

ICES BALTIC DEMERSAL WG:

COD IN SUB-DIVISIONS 25-32

Baltic Demersal WG 1995

CATCHES IN NUMBERS (THOUSANDS) AND MEAN WEIGHTS. BY QUARTER.

YEAR: 1995

QUARTER I1																								
Country	Denmark		Germany		Estonia		Finland 28-32		Poland		Latvia		Lithuania		Russia		Sweden		Total		Finland unsp. Faroes, Estonia, Ger		G-Total	
Age	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)
1																			0	0.000			0	0.000
2	10	0.476	17	0.449			0	0.280	221	0.273	1	0.404	0	0.404			383	0.524	633	0.433			652	0.433
3	2390	0.959	157	0.631			0	0.544	1562	0.845	3	0.640	13	0.551	31	0.461	5629	1.034	9784	0.976			10089	0.976
4	2719	1.375	770	0.985			0	1.065	3793	1.081	37	0.915	35	0.885	68	0.855	3087	1.443	10509	1.254			10836	1.254
5	1354	1.416	490	1.362			0	1.490	2546	1.433	242	1.437	83	1.450	64	1.462	218	2.754	4998	1.480			5153	1.480
6	104	2.432	79	1.997			0	2.466	445	2.549	112	2.417	43	2.324	41	2.230	87	4.173	910	2.602			938	2.602
7	32	3.18	28	2.871			0	2.913	129	3.518	12	2.979	10	2.965	18	2.950	56	5.021	283	3.640			292	3.640
8	5	7.625							40	5.648	4	5.556	5	4.408	10	3.260	26	5.737	89	5.449			91	5.449
9	2	6.950							36	6.748	2	6.328	5	5.320	12	4.312	35	5.449	91	5.871			94	5.871
10+	2	7.872					0	7.470	6	10.005	1	5.377	7	5.779	17	6.180	55	6.384	88	6.560			91	6.560
SOP (t):		8374		1768		0		1		11245		729		372		496		12410		35395		0		36496
Nom. land. (t):		8374		1769				1		11243		729		372		508		12410		35406		1090		36496
QUARTER II2																								
Country	Denmark		Germany		Estonia		Finland 28-32		Poland		Latvia		Lithuania		Russia		Sweden		Total		Finland unsp. Faroes		G-Total	
Age	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)
1							1	0.090											1	0.090			1	0.090
2	32	0.776	20	0.637			1	0.474	160	0.421	24	0.321	21	0.312	2	0.303	5	0.524	264	0.464			280	1.054
3	830	0.980	265	0.885			3	1.396	1930	0.728	57	0.617	135	0.548	35	0.478	76	1.034	3331	0.799			3524	0.924
4	1678	1.270	735	1.129			2	1.755	4187	1.079	165	0.916	232	0.905	45	0.893	42	1.443	7086	1.121			7497	1.091
5	358	2.025	543	1.552			1	2.290	3158	1.492	424	1.247	446	1.364	64	1.480	3	2.754	4996	1.505			5287	1.401
6	18	3.289	207	2.321			1	2.740	906	2.568	181	2.073	197	2.179	30	2.285	1	4.173	1540	2.431			1630	2.170
7	6	6.411	33	3.284			1	2.913	151	3.684	90	3.610	87	3.355	11	3.100	1	5.021	380	3.581			402	3.360
8	2	6.986	7	5.034			1	4.407	50	5.727	12	4.202	33	3.851	9	3.500	0	5.737	114	4.824			121	4.744
9			5	4.278				5.850	27	6.707	8	5.521	16	4.911	4	4.300	0	5.449	61	5.701			65	5.316
10+	1	20.154						5.800	8	9.959	10	6.305	50	6.303	15	6.300	1	6.384	85	6.759			90	6.759
SOP (t):		3819		2566		0		21		14136		1584		2137		396		168		24827		0		25543
Nom. land. (t):		3818		2584				22		14139		1584		2137		396		168		24848		1421		26269

Table 3.3.1 (continued)

ICES BALTIC DEMERSAL WG:

COD IN SUB-DIVISIONS 25-32

CATCHES IN NUMBERS (THOUSANDS) AND MEAN WEIGHTS, BY QUARTER.

YEAR: 1995

QUARTER III		3																							
Country		Denmark		Germany		Estonia		Finland 28-32		Poland		Latvia		Lithuania		Russia		Sweden		Total		Finland unsp. Faroes		G-Total	
Age		C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)
1		11	0.587																	12	0.557			12	0.557
2		147	0.840	1	0.406			0	0.240	191	0.383	3	0.500	2	0.449	1	0.397	533	0.814	888	0.713			910	0.713
3		113	1.213	11	0.706			0	0.431	976	0.686	25	0.785	27	0.678	7	0.570	398	1.179	1580	0.840			1619	0.840
4		187	1.553	33	0.972			0	1.312	1499	1.094	207	0.997	95	1.011	15	1.025	247	1.493	2272	1.166			2328	1.166
5		71	2.023	22	1.355			1	1.780	969	1.511	157	1.411	72	1.516	12	1.620	31	2.259	1318	1.562			1350	1.562
6		12	2.938	6	2.448			1	2.707	141	2.439	96	1.977	28	2.234	2	2.490	7	2.880	287	2.343			294	2.343
7		3	3.266	0	3.614			1	3.421	43	3.923	49	2.569	11	3.035	0	3.500	3	4.947	111	3.241			113	3.241
8		1	8.731	0	4.155			1	4.497	12	4.870	14	3.447	3	3.824	0	4.200	1	6.740	32	4.376			33	4.376
9								0	5.329	3	6.610	4	5.586	1	5.586			0	6.352	8	5.954			8	5.954
10+										2	13.847	4	5.888	1	5.888			0		7	7.917			7	7.917
SOP (t):			755		86		0		13		4461		856		344		46		1388		7948		0		8144
Nom. land.(t):			755		86				13		4460		856		344		46		1388		7948		196		8144

QUARTER IV		4																							
Country		Denmark		Germany		Estonia		Finland 28-32		Poland		Latvia		Lithuania		Russia		Sweden		Total		Finland unsp. Faroes		G-Total	
Age		C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)
1		58	0.587																	66	0.519			69	0.519
2		780	0.845	8	0.406					261	0.655	59	0.428	24	0.413	8	0.397	4134	0.814	5395	0.785			5712	0.785
3		586	1.237	129	0.706			5	0.589	1962	0.897	146	0.617	155	0.594	97	0.570	3087	1.179	6421	1.006			6799	1.006
4		948	1.646	383	0.972			4	1.178	4266	1.169	1499	0.892	626	0.959	222	1.025	1913	1.493	9732	1.227			10305	1.227
5		360	2.133	254	1.355			5	1.809	2872	1.485	768	1.548	389	1.584	169	1.620	242	2.259	4868	1.646			5154	1.646
6		62	2.601	63.3	2.448			10	2.510	424	2.300	220	2.077	93	2.284	33	2.490	57	2.880	902	2.474			955	2.474
7		10	2.814	3.4	3.614			8	3.371	125	3.489	111	2.635	30	3.068	3	3.500	22	4.947	312	3.226			331	3.226
8		2	6.937	3.4	4.155			6	4.171	31	5.515	24	3.193	8	3.697	2	4.200	10	6.740	82	4.879			87	4.879
9								4	5.460	16	5.742	1	4.900	0	0.000			2	6.352	23	5.707			24	5.707
10+								2	8.246	4	10.369	3	5.800	1	5.800			0		10	8.073			10	8.073
SOP (t):			3948		992		0		132		12898		3484		1660		662		10757		34533		0		36565
Nom. land.(t):			3948		995				127		12897		3484		1660		662		10757		34530		2035		36565

Table 3.3.1 (continued)

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ICES BALTIC DEMERSAL WG:

COD IN SUB-DIVISIONS 25-32

Baltic Demersal WG 1996

CATCHES IN NUMBERS (THOUSANDS) AND MEAN WEIGHTS.

YEAR: 1995

ANNUAL BY COUNTRY.

Country	Denmark		Germany		Estonia		Finland 28-32		Poland		Latvia		Lithuania		Russia		Sweden		Total		Finland unsp. Faroes		G-Total	
Age	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)
1	69	0.587	0	0.000	0	0.000	1	0.090	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	78	0.519			82	0.519
2	969	0.838	45	0.525	0	0.000	1	0.421	834	0.446	86	0.400	47	0.370	11	0.380	5055	0.792	7180	0.733			7513	0.742
3	3919	1.012	562	0.769	0	0.000	8	0.877	6429	0.801	232	0.636	329	0.580	170	0.531	9191	1.089	21116	0.947			22097	0.952
4	5533	1.396	1920	1.037	0	0.000	6	1.365	13745	1.109	1908	0.906	987	0.949	350	0.975	5289	1.463	29599	1.207			30974	1.205
5	2144	1.658	1308	1.439	0	0.000	7	1.865	9546	1.476	1590	1.437	989	1.469	308	1.558	494	2.481	16179	1.544			16931	1.525
6	195	2.596	354	2.274	0	0.000	12	2.545	1917	2.495	609	2.123	360	2.227	106	2.333	152	3.629	3639	2.478			3808	2.430
7	51	3.481	64	3.125	0	0.000	10	3.329	448	3.605	260	2.974	138	3.239	32	3.061	82	4.998	1086	3.460			1137	3.427
8	10	7.477	11	4.739	0	0.000	8	4.241	132	5.578	54	3.678	49	3.879	20	3.462	37	6.035	317	4.968			332	4.913
9	2	6.950	5	4.278	0	0.000	4	5.459	82	6.530	14	5.583	22	5.032	15	4.309	37	5.498	183	5.797			191	6.198
10+	3	10.706	0	0.000	0	0.000	2	8.235	20	10.412	18	6.086	59	6.223	32	6.236	56	6.384	190	6.778			199	5.717
SOP (t):		16896		5412		0		167		42739		6652		4513		1600		24723		102703				106894
Nom. land (t):		16895		5434		0		163		42739		6653		4513		1612		24723		102732		4742		107474

COD IN SUB-DIVISIONS 25-32

CATCHES IN NUMBERS (THOUSANDS) AND MEAN WEIGHTS. .

YEAR: 1995

QUARTERLY. ALL COUNTRIES.

Quarter	1		2		3		4		Annual	
Age	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)	C(n)	MW (kg)
1	0	0.000	1	0.090	12	0.557	69	0.519	82	0.519
2	652	0.433	280	1.054	910	0.713	5712	0.785	7554	0.756
3	10089	0.976	3524	0.924	1619	0.840	6799	1.006	22030	0.967
4	10836	1.254	7497	1.091	2328	1.166	10305	1.227	30966	1.199
5	5153	1.480	5287	1.401	1350	1.562	5154	1.646	16944	1.512
6	938	2.602	1630	2.170	294	2.343	955	2.474	3817	2.365
7	292	3.640	402	3.360	113	3.241	331	3.226	1138	3.381
8	91	5.449	121	4.744	33	4.376	87	4.879	332	4.937
9	94	5.871	65	5.316	8	5.954	24	5.707	191	5.665
10+	91	6.560	90	6.759	7	7.917	10	8.073	199	6.780
SOP (t):		36496		25542.76		8144		36565		106748
Nom. land (t):		36496		26269		8144		36565		107474

Lithuanian catches distributed according to Russian m-w and age distributions.

Finnish catches SD 25-28

Unspec Bornholm landings

Faroes landings

Estonian landings

Total

Quarterly distributed according to total available quarterly

Table 3.3.2 International sampling of cod commercial and research catches in 1995, (number of samples, fish length measured and fish aged) in Subdivisions 25-32.

DENMARK - COMMERCIAL						
Species	Sub-div.	1. Quarter	2. Quarter	3. Quarter	4. Quarter	Total
Cod	25-28 Landings (t)	332	133	165	229	859
	Samples (n)	24	15		14	53
	Measured (	5610	1996		3083	10689
	Aged (n)	650	330		573	1553
SWEDEN - COMMERCIAL						
Species	Sub-div.	1. Quarter	2. Quarter	3. Quarter	4. Quarter	Total
Cod	25 Landings (t)	10459	113	1097	7030	18699
	Samples (n)	8	0	4	15	27
	Measured (	2538	0	1799	4235	8572
	Aged (n)	200	0	0	400	600
	26 Landings (t)	299	0	81	2385	2765
	Samples (n)	0	0	0	0	0
	Measured (	0	0	0	0	0
	Aged (n)	0	0	0	0	0
	27 Landings (t)	1361	1	110	708	2180
	Samples (n)	14	0	0	6	20
	Measured (	3448	0	0	1247	4695
	Aged (n)	200	0	0	200	400
	28 Landings (t)	273	0	90	629	992
	Samples (n)	7	0	0	10	17
	Measured (	2514	0	0	2984	5478
	Aged (n)	200	0	0	200	400
GERMANY - COMMERCIAL						
Species	Sub-div.	1. Quarter	2. Quarter	3. Quarter	4. Quarter	Total
Cod	25 Landings (t)	1769	2584	86	945	5384
	Samples (n)	1	10	0	1	12
	Measured (	253	2924	0	227	3404
	Aged (n)	206	991	0	139	1336
	26 Landings (t)	109	93	0	23	225
	Samples (n)	0	0	0	8	8
	Measured (	0	0	0	852	852
	Aged (n)	0	0	0	0	0
GERMANY - RESEARCH						
Species	Sub-div.	1. Quarter	2. Quarter	3. Quarter	4. Quarter	Total
Cod	25 Landings (t)	1769	2584	86	945	5384
	Samples (n)	31	0	0	0	31
	Measured (	3468	0	0	0	3468
	Aged (n)	700	0	0	0	700
RUSSIA - COMMERCIAL						
Species	Sub-div.	1. Quarter	2. Quarter	3. Quarter	4. Quarter	Total
Cod	26 Landings (t)	508	396	46	601	1551
	Samples (n)	9	21	0	7	37
	Measured (	1916	4092	0	1306	7314
	Aged (n)	350	326	0	275	951
RUSSIA - RESEARCH						
Species	Sub-div.	1. Quarter	2. Quarter	3. Quarter	4. Quarter	Total
Cod	26 Landings (t)	508	396	46	601	1551
	Samples (n)	16	0	0	0	16
	Measured (	3200	0	0	0	3200
	Aged (n)	350	0	0	0	350

may include fishes from SD 26



Table 3.3.2 (continued) International sampling of cod commercial and research catches in 1995, (number of samples, fish length measured and fish aged) in Subdivisions 25-32.

POLAND - RESEARCH - TRAWL						
Species	Sub-div.	1. Quarter	2. Quarter	3. Quarter	4. Quarter	Total
Cod	25 Landings (t)	3188	5614	2378	6870	18049
	Samples (n)	6	12	4	10	32
	Measured (	825	22230	1607	1493	26155
	Aged (n)	100	494	328	310	1232
	26 Landings (t)	1347	1812	947	2134	6239
	Samples (n)	1	2	0	0	3
	Measured (	18523	180	0	0	18703
	Aged (n)	0	166	0	0	166
POLAND - RESEARCH - GILLNET						
Species	Sub-div.	1. Quarter	2. Quarter	3. Quarter	4. Quarter	Total
Cod	25 Landings (t)	3188	5614	2378	6870	18049
	Samples (n)	1	0	0	2	3
	Measured (	7898	0	0	131	8029
	Aged (n)	0	0	0	0	0
	26 Landings (t)	1347	1812	947	2134	6239
	Samples (n)	1	2	0	0	3
	Measured (	18523	180	0	0	18703
	Aged (n)	0	166	0	0	166
LATVIA - COMMERCIAL						
Species	Sub-div.	1. Quarter	2. Quarter	3. Quarter	4. Quarter	Total
Cod	25 Landings (t)	213	623	52	236	1124
	Samples (n)	1	1	0	0	2
	Measured (	1594	3694	0	0	5288
	Aged (n)	272	405	0	0	677
	26 Landings (t)	377	835	562	1875	3649
	Samples (n)	1	1	1	0	3
	Measured (	1204	1098	12150	0	14452
	Aged (n)	130	110	146	0	386
	28 Landings (t)	138	111	242	1373	1864
	Samples (n)	0	1	0	1	2
	Measured (	0	987	0	6467	7454
	Aged (n)	0	152	0	344	496
FINLAND						
Species	Sub-div.	1. Quarter	2. Quarter	3. Quarter	4. Quarter	Total
Cod	24-27 Landings (t)	514	584	121	195	1414
	Samples (n)	0	0	0	0	0
	Measured (	0	0	0	0	0
	Aged (n)	0	0	0	0	0
	28-32 Landings (t)	1	22	13	127	163
	Samples (n)	5	8	9	11	33
	Measured (	75	113	123	140	451
	Aged (n)	75	113	123	140	451

Table 3.4.1

Mean weight of stock (WEST) for COD 25-32, 1995											
Data are based on surveys in 1. Quarter. Mean weights are in kg											
SD25	Country	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
	Denmark	0.049	0.286	0.751	1.319	2.040	3.864	3.496	5.825		9.350
	Germany	0.096	0.165	0.437	0.883	1.359	2.387	3.205	3.932		
	Sweden	0.043	0.250	0.593	1.393	1.900					
	Average	0.063	0.234	0.594	1.198	1.766	3.126	3.351	4.879		9.350
SD26	Denmark	0.040	0.323	0.764	1.377	2.322	3.000	3.311	4.332	3.818	7.023
	Latvia	0.012	0.449	0.684	0.990	1.347	2.253	2.837	5.626	6.300	
	Russia	0.076	0.220	0.425	0.879	1.433	2.233	2.942	3.515	4.414	4.996
	Sweden		0.344	0.580	1.415	2.580					
	Average	0.043	0.334	0.613	1.165	1.921	2.495	3.030	4.491	4.844	6.009
SD27	Sweden	0.106	0.256	0.783	1.075	2.251	2.079				
SD28	Latvia coast		0.298	0.514	1.138	1.202	2.194	4.220	4.165	3.700	
	Latvia sp.gr.		0.404	0.638	0.905	1.464	2.511	3.177	4.550	9.000	
	Denmark		0.298	0.850	1.354	1.985	3.546	3.444			
	Sweden	0.032	0.246	0.509	1.124	1.480	3.470	4.590			
	Average	0.032	0.312	0.628	1.130	1.533	2.930	3.858	4.358	6.350	
All	SD	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
	25	0.063	0.234	0.594	1.198	1.766	3.126	3.351	4.879		9.350
	26	0.043	0.334	0.613	1.165	1.921	2.495	3.030	4.491	4.844	6.009
	27	0.106	0.256	0.783	1.075	2.251	2.079				
	28	0.032	0.312	0.628	1.130	1.533	2.930	3.858	4.358	6.350	
	Average	0.061	0.284	0.654	1.142	1.868	2.658	3.413	4.576	5.597	7.680

**Table 3.5.1** Changes in female maturity ogive during the time from 1958 to 1995. Averages were weighed by a distribution factor (relative fraction of stock in Sub-division) derived from Sparholt *et al.* Working Group paper 1996.

SD	Year range		Distribution factor	Female maturity ogive at age									
				Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
25	1967	1977		0.00	0.05	0.41	0.90	0.99	1.00				
25	1980	1984	0.50	0.00	0.06	0.62	0.88	0.97	0.98	1.00			
26	1980	1984	0.34										
27	1980	1984	0.06										
28	1980	1984	0.17		0.00	0.14	0.18	0.37	0.24	0.75	1.00	0.25	
Average	1980	1984		0.00	0.04	0.50	0.70	0.81	0.79	0.94	1.00	0.25	
25	1985	1989	0.39	0.00	0.05	0.32	0.60	0.89	0.99	1.00			
26	1985	1989	0.37	0.00	0.00	0.40	1.00	0.80	1.00				
27	1985	1989	0.08	0.00	0.00	0.24	0.68	0.94	1.00	1.00			
28	1985	1989	0.25	0.00	0.01	0.30	0.58	0.68	0.72	0.83	1.00	1.00	1.00
Average	1985	1989		0.00	0.02	0.33	0.74	0.81	0.93	0.94	1.00	1.00	0.00
25	1990	1994	0.48	0.00	0.07	0.36	0.85	0.96	0.96	1.00	1.00		
26	1990	1994	0.43	0.00	0.08	0.32	0.71	0.99	1.00	1.00	1.00		
27	1990	1994	0.03	0.00	0.03	0.37	0.64	1.00	0.96	1.00	1.00		
28	1990	1994	0.10	0.00	0.05	0.21	0.38	0.67	1.00	1.00	1.00	1.00	1.00
Average	1990	1994		0.00	0.07	0.33	0.74	0.94	0.98	1.00	1.00		1.00
25	1995		0.65	0.00	0.05	0.55	0.88	0.92	0.98	0.80	1.00		
26	1995		0.31	0.00	0.02	0.22	0.76	0.94	0.96	0.99	1.00		1.00
27	1995		0.01	0.00	0.40	0.98	1.00	1.00	1.00				
28	1995		0.04	0.00	0.17	0.28	0.68	0.87	0.99	1.00	1.00	1.00	
Average	1995			0.00	0.05	0.44	0.84	0.92	0.97	0.87	1.00	1.00	1.00

SD	Year		Female maturity ogive at age										
			Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	
25	1967	1977	0.00	0.05	0.41	0.90	0.99	1.00					
Avg. 25-2	1980	1984	0.00	0.04	0.50	0.70	0.81	0.79	0.94	1.00	0.25		
Avg. 25-2	1985	1989	0.00	0.02	0.33	0.74	0.81	0.93	0.94	1.00	1.00		
Avg. 25-2	1990	1994	0.00	0.07	0.33	0.74	0.94	0.98	1.00	1.00		1.00	
Avg. 25-2	1995		0.00	0.05	0.44	0.84	0.92	0.97	0.87	1.00	1.00	1.00	
	Average		0.00	0.05	0.40	0.78	0.90	0.93	0.94	1.00	0.75	1.00	

**Table 3.5.2** Changes in proportion of females in the stock during the time from 1967 to 1995. Averages were weighed by a distribution factor (relative fraction of stock in Sub-division) derived from Sparholt *et al.* Working Group paper 1996.

SD	Year range		Distribution factor	Proportion of females at age									
				Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
25	1967	1977		0.46	0.45	0.37	0.46	0.58	0.65	0.78			
25	1985	1989	0.39	0.40	0.45	0.51	0.59	0.57	0.58	0.50		1.00	
26	1985	1989	0.37	0.44	0.55	0.67	0.59	0.60	0.67	0.33			
27	1985	1989	0.08	1.00	0.53	0.51	0.61	0.75	0.83	0.67			
28	1985	1989	0.25	0.46	0.49	0.57	0.74	0.88	1.00	0.92	0.75	1.00	
Average	1985	1989		0.47	0.50	0.58	0.62	0.67	0.73	0.55	0.75	1.00	
25	1990	1994	0.48	0.48	0.51	0.72	0.62	0.69	0.84	0.76	1.00	1.00	
26	1990	1994	0.43	0.50	0.57	0.51	0.65	0.94	0.71	1.00	0.00	1.00	
27	1990	1994	0.03	0.75	0.51	0.52	0.57	0.60	0.75	0.65	0.64	0.50	1.00
28	1990	1994	0.10	0.54	0.49	0.47	0.83	0.57	1.00	0.45	0.75	0.75	0.00
Average	1990	1994		0.50	0.54	0.60	0.65	0.78	0.80	0.83	0.55	0.96	0.25
25	1995		0.65	0.42	0.47	0.50	0.56	0.78	0.75	0.50	1.00	1.00	1.00
26	1995		0.31	0.50	0.46	0.50	0.58	0.68	0.78	1.00	0.20		0.50
27	1995		0.01	0.67	0.54	0.63	0.67	0.69	0.40	0.00	1.00	0.00	0.50
28	1995		0.04	0.71	0.49	0.64	0.67	0.59	0.80	0.31	1.00	1.00	
Average	1995			0.46	0.47	0.50	0.57	0.74	0.76	0.65	0.76	0.98	0.83

SD	Year		Proportion of females at age										
			Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10+	
25	1967	1977	0.46	0.45	0.37	0.46	0.58	0.65	0.78				
Avg. 25-2	1985	1989	0.47	0.50	0.58	0.62	0.67	0.73	0.55	0.75	1.00		
Avg. 25-2	1990	1994	0.50	0.54	0.60	0.65	0.78	0.80	0.83	0.55	0.96	0.25	
Avg. 25-2	1995		0.46	0.47	0.50	0.57	0.74	0.76	0.65	0.76	0.98	0.83	
Average	1967	1995	0.47	0.49	0.51	0.58	0.69	0.73	0.70	0.69	0.98	0.54	

**Table 3.6.1A** Cod in Sub-divisions 25-32. Danish effort data.

Year	CPUE (t/day)			Index of effort
	Trawls	Gillnets	Total Catch (t)	
1987	1.89	0.35	66,881	37
1988	1.68	0.40	60,436	36
1989	1.82	0.50	57,240	31
1990	1.25	0.70	47,394	38
1991	0.82	0.67	39,792	49
1992	0.69	0.58	18,025	26
1993	0.71	0.28	8,000	11
1994	1.19	0.56	9,901	8
1995 <sup>1</sup>	1.55	0.48	16,895	11

<sup>1</sup> Preliminary data. Due to inconsistencies in the data for 1993, 1994 and 1995, data for these years should not be used by the Working Group.

**Table 3.6.1B** COD in Sub-divisions 25-32. German effort data.

Year	Total catch (t)	Total effort hours trawling
1975	11,968	48,381
1976	13,733	84,031
1977	19,020	99,727
1978	4,270	44,258
1979	9,777	45,886
1980	11,750	40,040
1981	7,021	21,167
1982	13,801	45,782
1983	15,894	73,244
1984	30,483	106,584
1985	26,275	111,689
1986	19,520	86,990
1987	14,560	82,662
1988	14,078	78,518
1989	12,844	66,024
1990	4,691	40,440
1991	6,564	68,621
1992	2,793	-
1993	489	-
1994	7,010	-
1995	5,496	-

**Table 3.6.1C** Cod in Sub-divisions 25-32. Finnish effort data (indices of total effort).

Year	Sub-divisions				Total	Relative Index of Effort
	29	30	31	32		
1982	899	512	94	371	1,876	1.00
1983	1,318	561	89	263	2,231	1.19
1984	1,123	928	41	331	2,423	1.29
1985	1,053	580	74	222	1,929	1.03
1986	582	661	54	194	1,491	0.79
1987	510	579	47	170	1,306	0.70
1988	325	610	28	120	1,083	0.58
1989	270	550	15	70	905	0.48
1990	260	520	8	32	820	0.44
1991	220	408	1	15	644	0.34
1992	168	320	1	8	497	0.26
1993	52	218	1	6	277	0.15
1994	184	168	0	0	352	0.19
1995	0	22	0	0	22	0.01

**Table 3.6.1D** Cod in Sub-division 25-32. Latvia effort data.

Year	Trawl fishery			Gillnet fishery			Gillnet and trawls combined			
	Catch (th.t)	CPUE	Rel. CPUE	Catch (th.t)	CPUE	Rel. CPUE	Catch (th.t)	CPUE	Rel. CPUE	Index of Effort
1982	36.1	3.141	1.00				36.1	3.141	1.00	36.1
1983	36.0	3.379	1.08				36.0	3.379	1.08	33.3
1984	39.0	3.212	1.02				39.0	3.212	1.02	38.2
1985	26.5	3.222	1.03				26.5	3.222	1.03	25.7
1986	20.2	2.665	0.85				20.2	2.665	0.85	23.8
1987	13.3	2.201	0.70				13.3	2.201	0.70	19.0
1988	10.6	2.212	0.70				10.6	2.212	0.70	15.1
1989	6.1	1.713	0.55				6.1	1.713	0.55	11.1
1990	5.2	0.897	0.29	0.2	1.831	0.58	5.4	0.932	0.30	18.0
1991	1.8	0.657	0.21	0.8	0.923	0.29	2.6	0.739	0.24	10.8
1992	1	0.392	0.12	0.3	0.352	0.11	1.3	0.383	0.12	10.8
1993	0.2	0.56	0.18	1.1	0.965	0.31	1.3	0.903	0.29	4.4
1994	0.8	1.01	0.32	0.6	0.620	0.20	1.5	0.790	0.25	6.0
1995	3.4	2.18	0.60	3.2	1.655	0.52	6.6	1.925	0.61	10.8

CPUE - catch (t) per fishing cruise.



**Table 3.6.1E**

Cod in Sub-divisions 25–32. Polish effort data, CPUE from coastal fisheries.

Year	Total Catch (t)	CPUE	Index of total effort
1983	76,474	4.89	15.6
1984	93,429	5.03	18.6
1985	63,260	5.84	10.8
1986	43,236	4.77	9.1
1987	32,667	3.32	9.8
1988	33,351	3.38	9.9
1989	36,855	3.50	9.1
1990	32,028	3.01	9.5
1991	25,748	2.26	11.4
1992	13,314	1.47	9.1
1993 <sup>1</sup>	11,609	1.0	11.6
1994 <sup>1</sup>	33,426	1.24	26.9
1995 <sup>1</sup>	25,000	-	-

<sup>1</sup>Estimated.

**Table 3.6.1F** Swedish effort data in Sub-divisions 25-29.

Year	Logbook records			Relative CPUE	Total catch	Index of total effort
	Catch sampled (tonnes)	Effort (hours)	CPUE			
1982	12,027	25,587	0.470	1.00	38	38.0
1983	18,360	38,923	0.472	1.00	47	47.0
1984	30,064	66,837	0.450	0.96	60	62.5
1985	29,184	59,309	0.492	1.05	50	48.1
1986	27,912	82,869	0.337	0.72	46	63.9
1987	24,020	77,068	0.312	0.66	43	65.2
1988	28,788	99,460	0.289	0.61	49	80.3
1989	30,273	107,247	0.282	0.60	51	84.5
1990	23,983	99,157	0.242	0.51	51	99.2
1991	14,557	70,981	0.205	0.44	36	82.7
1992	2,916	29,115	0.100	0.21	13.7	65.2
1993	3,678	24,424	0.151	0.32	10.1	31.6
1994	6,952	25,658	0.271	0.57	21.2	36.9
1995	11,796	34,966	0.337	0.72	24.7	34.3

**Table 3.6.2** Cod in Sub-divisions 25-32. Relative index of total effort (trawl) by countries (1987 f = 1.00). All unallocated catches included.

Year	Denmark	Finland	Germany	Latvia	Poland	Sweden
1982		1.44	0.55	1.90	-	0.58
1983		1.71	0.88	1.75	1.59	0.72
1984		1.86	1.29	2.01	1.89	0.96
1985		1.48	1.35	1.35	1.10	0.74
1986		1.14	1.05	1.25	0.93	0.98
1987	1.00	1.00	1.00	1.00	1.00	1.00
1988	0.97	0.83	0.94	0.79	1.01	1.23
1989	0.84	0.69	0.80	0.58	0.93	1.30
1990	1.03	0.63	0.49	0.95	0.97	1.52
1991	1.32	0.49	0.83	0.57	1.16	1.27
1992	0.70	0.38	-	0.57	0.93	1.00
1993	0.30	0.21	-	0.23	1.18	0.48
1994	0.22	0.27	-	0.31	2.74	0.57
1995	0.30	0.01	-	0.57	-	0.53

Table 3.7.1

COD-2532: Cod in Baltic Fishing Areas 25 to 32

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CANUM: Catch in Numbers (Thousands)

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1966	1.0	29009.4	91230.5	34140.8	11945.8	2657.6	921.6	100.7	1.0	1.0
1967	1.0	36344.9	132299.0	50122.3	14595.3	5014.3	1329.5	457.7	121.5	1.0
1968	1.0	30047.4	107518.0	70397.5	23021.9	4786.8	652.5	32.8	51.6	1.0
1969	254.4	37487.8	102497.0	49727.6	23943.5	5570.0	1189.9	179.1	32.8	1.0
1970	3027.6	24763.9	80159.1	51571.3	22735.2	5248.1	1439.2	486.3	13.0	13.0
1971	179.8	20026.1	47605.8	38630.5	21669.3	4606.4	947.6	370.2	30.1	5.0
1972	1094.9	32989.9	69783.0	42759.1	18436.8	6002.5	1841.3	330.9	215.4	89.9
1973	667.4	28189.6	64705.2	42778.6	18294.6	5636.7	1137.5	985.5	299.3	101.9
1974	363.2	23241.9	93448.3	49775.5	16163.0	4662.5	1509.7	1026.3	228.8	70.1
1975	91.3	21923.1	135537.0	70356.4	18751.4	5326.8	1256.1	562.1	353.8	180.1
1976	74.0	8541.0	62790.0	86375.0	38326.0	13043.0	1936.0	802.0	298.0	239.0
1977	1431.0	6102.0	42363.0	46109.0	35583.0	13214.0	3250.0	1075.0	267.0	67.0
1978	1069.0	40773.0	72169.0	46560.0	22749.0	7982.0	2467.0	599.0	192.0	76.0
1979	2092.0	50464.0	143205.0	76948.0	26478.0	8697.0	3857.0	1450.0	351.0	205.0
1980	1826.0	20285.0	111509.0	160282.0	62205.0	18267.0	4990.0	1864.0	323.0	19.0
1981	1082.0	21825.0	52669.0	101889.0	83499.0	25397.0	7393.0	1887.0	942.0	535.0
1982	1126.0	37718.0	119568.0	81157.0	53499.0	25122.0	7759.0	3354.0	871.0	240.0
1983	193.0	36901.0	108259.0	122532.0	46146.0	19729.0	8458.0	1678.0	425.0	296.0
1984	5761.0	22161.0	103672.0	144308.0	33822.0	21340.0	7373.0	3904.0	873.0	776.0
1985	2042.0	32236.0	62632.0	74177.0	57154.0	23214.0	5643.0	2095.0	1128.0	473.0
1986	257.0	11798.0	40119.0	58468.0	43020.0	34113.0	9802.0	2543.0	1197.0	440.0
1987	930.0	41863.0	55696.0	44253.0	23504.0	11387.0	5836.0	1889.0	872.0	341.0
1988	268.0	21428.0	84337.0	52156.0	17299.0	6741.0	3166.0	1380.0	509.0	269.0
1989	78.0	4526.0	59026.0	69293.0	23041.0	8703.0	2414.0	937.0	568.0	172.0
1990	281.0	16974.0	30322.0	39775.0	20868.0	6850.0	2095.0	985.0	262.0	395.0
1991	65.0	5902.0	39296.0	31400.0	13406.0	3854.0	1732.0	1047.0	349.0	190.0
1992	78.0	7619.0	14556.0	13343.0	6103.0	1906.0	982.0	280.0	152.0	93.0
1993	306.0	8909.0	17344.0	8306.0	3403.0	818.0	217.0	91.0	42.0	5.0
1994	116.0	9363.0	36380.0	23876.0	10454.0	2256.0	483.0	189.0	61.0	67.0
1995	82.0	7554.0	22030.0	30966.0	16944.0	3817.0	1138.0	332.0	191.0	199.0

COD-2532: Cod in Baltic Fishing Areas 25 to 32

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CATON: Landings (Tonnes)

Year	Total
1965	102478
1966	134867
1967	152378
1968	164472
1969	169909
1970	154492
1971	118217
1972	143833
1973	143164
1974	147815
1975	194649
1976	203303
1977	164692
1978	154009
1979	227699
1980	345843
1981	325618
1982	314475
1983	329146
1984	394941
1985	316019
1986	251802
1987	217123
1988	194478
1989	179177
1990	153546
1991	122489
1992	54886
1993	38117
1994	90102
1995	107474

Table 3.7.1 (continued)

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COD-2532: Cod in Baltic Fishing Areas 25 to 32

MATPROP: Proportion Mature at Year Start

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1966	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1967	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1968	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1969	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1970	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1971	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1972	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1973	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1974	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1975	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1976	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1977	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1978	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1979	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1980	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1981	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1982	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1983	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1984	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1985	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1986	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1987	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1988	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1989	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1990	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1991	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1992	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1993	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1994	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00
1995	0.00	0.27	0.69	0.91	0.97	0.99	1.00	1.00	1.00	1.00

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COD-2532: Cod in Baltic Fishing Areas 25 to 32

WECA: Mean Weight in Catch (Kilograms)

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1966	0.075	0.210	0.391	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1967	0.075	0.210	0.391	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1968	0.075	0.210	0.391	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1969	0.075	0.210	0.391	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1970	0.075	0.210	0.391	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1971	0.075	0.210	0.391	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1972	0.075	0.210	0.391	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1973	0.075	0.210	0.391	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1974	0.075	0.210	0.391	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1975	0.075	0.210	0.391	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1976	0.075	0.210	0.391	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1977	0.075	0.210	0.391	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1978	0.075	0.210	0.391	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1979	0.075	0.210	0.391	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1980	0.075	0.210	0.391	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1981	0.079	0.395	0.716	0.902	1.201	2.011	2.460	4.158	5.227	7.068
1982	0.081	0.356	0.622	0.937	1.327	1.859	2.664	3.639	5.078	6.332
1983	0.074	0.452	0.658	0.916	1.361	1.799	2.410	4.272	5.195	6.486
1984	0.082	0.351	0.574	0.888	1.357	1.921	2.558	3.716	4.602	7.969
1985	0.159	0.465	0.729	1.080	1.575	2.104	2.426	3.484	5.206	6.953
1986	0.219	0.508	0.682	0.994	1.458	1.967	2.325	3.210	5.261	7.309
1987	0.297	0.567	0.806	1.175	1.750	2.508	2.972	3.559	4.494	6.090
1988	0.587	0.616	0.734	1.147	1.766	2.536	3.371	3.963	4.751	6.369
1989	0.277	0.498	0.696	1.002	1.526	2.104	2.941	3.526	4.526	6.814
1990	0.436	0.639	0.753	1.214	1.753	2.390	3.219	4.473	5.027	5.085
1991	0.377	0.578	0.912	1.166	1.697	2.525	3.815	4.295	5.351	5.898
1992	0.294	0.765	0.849	1.111	1.682	2.797	3.662	4.440	5.330	7.741
1993	0.228	0.533	0.848	1.139	1.703	2.345	3.482	4.676	5.121	6.376
1994	0.170	0.641	0.851	1.161	1.591	2.195	3.926	5.255	6.183	8.252
1995	0.519	0.734	0.947	1.206	1.545	2.477	3.459	4.966	5.796	6.780

Table 3.7.1 (continued)

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COD-2532: Cod in Baltic Fishing Areas 25 to 32

NAIMOR: Natural Mortality

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1966	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1967	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1968	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1969	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1970	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1971	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1972	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1973	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1974	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1975	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1976	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1977	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1978	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1979	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1980	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1981	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1982	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1983	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1984	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1985	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1986	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1987	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1988	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1989	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1990	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1991	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1992	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1993	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1994	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
1995	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

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COD-2532: Cod in Baltic Fishing Areas 25 to 32

WEIS: Mean Weight in Stock (Kilograms)

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1966	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1967	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1968	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1969	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1970	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1971	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1972	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1973	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1974	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1975	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1976	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1977	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1978	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1979	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1980	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1981	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1982	0.044	0.203	0.671	0.874	1.413	2.206	3.696	5.460	6.000	7.400
1983	0.044	0.203	0.671	0.917	1.360	1.794	2.400	4.276	5.187	6.474
1984	0.044	0.203	0.671	0.888	1.357	1.921	2.558	3.716	4.602	7.969
1985	0.044	0.203	0.671	1.080	1.575	2.104	2.426	3.484	5.206	6.953
1986	0.044	0.203	0.671	0.994	1.458	1.967	2.325	3.210	5.261	7.309
1987	0.044	0.203	0.671	1.175	1.750	2.508	2.972	3.559	4.494	6.090
1988	0.044	0.203	0.671	1.147	1.766	2.536	3.371	3.963	4.751	6.369
1989	0.044	0.203	0.671	1.002	1.526	2.104	2.941	3.526	4.526	6.814
1990	0.044	0.203	0.671	1.214	1.753	2.390	3.219	4.473	5.027	5.085
1991	0.044	0.203	0.671	1.164	1.696	2.521	3.828	4.279	5.363	6.503
1992	0.044	0.203	0.671	1.164	1.696	2.521	3.828	4.279	5.363	6.503
1993	0.044	0.203	0.671	1.166	1.908	2.690	3.427	4.738	5.704	8.186
1994	0.057	0.293	0.670	1.166	1.908	2.690	3.427	4.738	5.704	8.186
1995	0.061	0.284	0.654	1.142	1.868	2.658	3.413	4.576	5.597	7.680

Table 3.7.1 (continued)

COD-2532: Cod in Baltic Fishing Areas 25 to 32

13:19 Tuesday, April 23, 1996

FLT13: mean of all fleets (Catch: Number)

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
1982	1000	5916.34	29663.60	14300.51	5193.50	3506.89	2314.90	724.73	288.14	93.92	23.29
1983	1000	1270.59	16921.10	21700.62	13811.89	3910.68	1666.83	747.36	196.59	104.23	42.25
1984	1000	2612.32	3720.38	7459.41	11545.37	4911.98	1908.42	514.69	433.32	156.07	147.02
1985	1000	1412.83	8399.01	10181.65	5789.72	3982.13	1738.24	418.68	192.32	102.64	93.82
1986	1000	320.90	5432.04	5301.28	3016.53	2021.52	1388.43	407.46	142.38	25.48	35.94
1987	1000	1803.25	13080.92	8334.34	4033.33	930.29	195.00	148.97	63.93	39.99	32.36
1988	1000	448.78	8022.69	7839.75	3982.99	1236.52	352.53	125.73	56.20	52.90	24.07
1989	1000	1413.28	1176.70	4674.03	3820.41	1126.12	299.22	126.23	48.56	28.35	6.62
1990	1000	949.56	3410.03	6000.47	2200.71	1173.66	279.01	93.08	26.41	10.86	8.86
1991	1000	379.65	1047.01	2203.56	1698.05	989.99	276.45	83.90	43.44	13.49	11.47
1992	1000	1545.16	1270.75	1071.36	327.08	193.01	127.16	67.02	24.32	3.13	9.90
1993	1000	1035.15	6912.74	3535.20	594.64	320.28	126.46	18.28	7.55	0.97	52.96
1994	1000	1711.23	6212.03	7711.89	3041.43	1244.17	254.53	83.42	23.20	22.52	35.04
1995	1000	2544.75	7504.30	4455.82	2040.58	955.88	358.83	184.93	48.65	44.08	51.97
1996	1000	338.17	6677.29	7009.68	3574.40	1999.66	592.87	199.31	75.25	34.58	34.34

Table 3.7.2

Lowestoft VPA Version 3.1

23-Apr-96 13:22:36

Extended Survivors Analysis

Cod in 25 to 32 (run: XSAPAL10/X10)

CPUE data from file /users/fish/ifad/ifapwork/wgbras/ccu\_2532/FLEET.X10

Catch data for 20 years. 1976 to 1995. Ages 2 to 8.

Fleet,	First,	Last,	First,	Last,	Alpha,	Beta
	year,	year,	age,	age,		
FLT13: mean of all f,	1982,	1995,	2,	7,	.000,	.250

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 5 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 29 iterations

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

Fishing mortalities	Age,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995
2,	.055,	.150,	.124,	.044,	.177,	.086,	.070,	.058,	.073,	.049	
3,	.331,	.392,	.510,	.589,	.454,	.789,	.317,	.223,	.355,	.246	
4,	.828,	.751,	.798,	1.102,	1.081,	1.299,	.690,	.300,	.547,	.585	
5,	1.108,	1.003,	.765,	1.074,	1.346,	1.621,	1.001,	.371,	.774,	.996	
6,	1.468,	1.065,	.928,	1.225,	1.202,	1.026,	1.221,	.331,	.451,	.736	
7,	1.161,	1.197,	1.037,	1.104,	1.226,	1.270,	.813,	.404,	.333,	.433	



Table 3.7.2 (continued)

XSA population numbers (Thousands)

YEAR ,	2,	AGE 3,		4,	5,	6,	7,
1986 ,	2.45E+05,	1.57E+05,	1.15E+05,	7.10E+04,	4.90E+04,	1.58E+04,	
1987 ,	3.31E+05,	1.90E+05,	9.26E+04,	4.10E+04,	1.92E+04,	9.24E+03,	
1988 ,	2.03E+05,	2.33E+05,	1.05E+05,	3.58E+04,	1.23E+04,	5.42E+03,	
1989 ,	1.17E+05,	1.46E+05,	1.15E+05,	3.87E+04,	1.36E+04,	3.99E+03,	
1990 ,	1.16E+05,	9.18E+04,	6.65E+04,	3.12E+04,	1.08E+04,	3.28E+03,	
1991 ,	7.89E+04,	7.96E+04,	4.77E+04,	1.85E+04,	6.64E+03,	2.66E+03,	
1992 ,	1.25E+05,	5.93E+04,	2.96E+04,	1.07E+04,	2.99E+03,	1.95E+03,	
1993 ,	1.74E+05,	9.57E+04,	3.54E+04,	1.21E+04,	3.21E+03,	7.22E+02,	
1994 ,	1.47E+05,	1.35E+05,	6.27E+04,	2.14E+04,	6.86E+03,	1.89E+03,	
1995 ,	1.75E+05,	1.12E+05,	7.73E+04,	2.97E+04,	8.10E+03,	3.58E+03,	

Estimated population abundance at 1st Jan 1996

, .00E+00, 1.37E+05, 7.14E+04, 3.53E+04, 8.99E+03, 3.18E+03,

Taper weighted geometric mean of the VPA populations:

, 1.90E+05, 1.51E+05, 8.91E+04, 3.67E+04, 1.28E+04, 4.62E+03,

Standard error of the weighted Log(VPA populations) :

, .5697, .6251, .7257, .8446, .9762, .9941,

Log catchability residuals.

Fleet : FLT13: mean of all f

Age ,	1982,	1983,	1984,	1985
2 ,	-.13,	-.07,	-.58,	.14
3 ,	-.29,	.17,	-.44,	.29
4 ,	-.21,	.36,	.22,	.13
5 ,	.09,	.28,	.14,	.08
6 ,	.39,	.34,	.51,	.27
7 ,	.27,	.19,	.16,	.08

Age ,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995
2 ,	-.21,	.04,	.22,	-.44,	.25,	-.11,	-.45,	.28,	.38,	.32
3 ,	-.09,	.19,	-.07,	-.11,	.59,	-.23,	-.71,	-.01,	.45,	.07
4 ,	-.11,	.38,	.25,	.16,	.15,	.24,	-1.00,	-.62,	.47,	-.14
5 ,	.00,	-.24,	.15,	.02,	.31,	.69,	-.47,	-.17,	.67,	.11
6 ,	.04,	-1.04,	-.02,	-.25,	-.09,	.37,	.41,	.23,	.18,	.40
7 ,	-.09,	-.56,	-.21,	.10,	.01,	.12,	.15,	-.20,	.35,	.51

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,	-10.1474,	-10.3068,	-10.3068,	-10.3068,	-10.3068,
S.E(Log q),	.3608,	.4402,	.3654,	.4173,	.2840,

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, .63, 1.822, 11.11, .72, 14, .34, -10.53,

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,	.93,	.398,	10.27,	.76,	14,	.35,	-10.15,
4,	.74,	2.054,	10.58,	.87,	14,	.28,	-10.31,
5,	.96,	.299,	10.20,	.85,	14,	.34,	-10.19,
6,	1.08,	-.553,	10.26,	.84,	14,	.45,	-10.20,
7,	1.02,	-.258,	10.29,	.92,	14,	.30,	-10.25,

Table 3.7.2 (continued)

Terminal year survivor and F summaries :

Age 2 Catchability dependent on age and year class strength

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, Weights,	Estimated F
FLT13: mean of all f,	188427.,	.357,	.000,	.00,	1, .532,	.036
P shrinkage mean ,	151059.,	.63,...			.182,	.044
F shrinkage mean ,	70116.,	.50,...			.285,	.093

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
136524.,	.26,	.38,	3,	1.439,	.049

Age 3 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
FLT13: mean of all f,	90081.,	.258,	.154,	.60,	2, .738,	.200
F shrinkage mean ,	37026.,	.50,...			.262,	.431

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
71390.,	.23,	.33,	3,	1.448,	.246

Age 4 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
FLT13: mean of all f,	43134.,	.229,	.172,	.75,	3, .675,	.501
F shrinkage mean ,	23223.,	.50,...			.325,	.791

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
35270.,	.22,	.23,	4,	1.044,	.585

Age 5 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
FLT13: mean of all f,	9368.,	.212,	.163,	.77,	4, .594,	.970
F shrinkage mean ,	8454.,	.50,...			.406,	1.034

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
8986.,	.24,	.11,	5,	.475,	.996

Table 3.7.2 (continued)

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

Year class = 1989

Fleet,	Estimated,	Int,	Ext,	Var,	N,	Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	, Weights,	F	
FLT13: mean of all f,	3643.,	.214,	.258,	1.21,	5,	.614,	.667
F shrinkage mean ,	2555.,	.50,,,,				.386,	.855

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	, Ratio,		
3177.,	.23,	.21,	6,	.883,	.736

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

Year class = 1988

Fleet,	Estimated,	Int,	Ext,	Var,	N,	Scaled,	Estimated
,	Survivors,	s.e,	s.e,	Ratio,	, Weights,	F	
FLT13: mean of all f,	2421.,	.195,	.176,	.90,	6,	.763,	.354
F shrinkage mean ,	872.,	.50,,,,				.237,	.780

Weighted prediction :

Survivors,	Int,	Ext,	N,	Var,	F
at end of year,	s.e,	s.e,	, Ratio,		
1901.,	.19,	.25,	7,	1.299,	.433

Table 3.7.3

Run title : Cod in 25 to 32 (run: XSAPAL10/X10)

At 23-Apr-96 13:23:41

Terminal Fs derived using XSA (With F shrinkage)

Table 8	Fishing mortality (F) at age									
YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
2,	.0340,	.0145,	.0589,	.1028,	.0566,	.0374,	.0663,	.0991,	.0915,	.1700,
3,	.3999,	.2349,	.2369,	.3012,	.3455,	.2040,	.2948,	.2748,	.4422,	.4014,
4,	.7772,	.5816,	.4391,	.4279,	.6549,	.6173,	.5549,	.5606,	.7235,	.6654,
5,	.9286,	.8950,	.6451,	.4828,	.7492,	.8881,	.7933,	.7239,	.9889,	.7206,
6,	1.0562,	1.0348,	.5050,	.5501,	.7400,	.8124,	.7458,	.7880,	.9166,	.8466,
7,	.9308,	.8459,	.5340,	.4907,	.7216,	.7803,	.6304,	.6083,	.7926,	.6630,
+gp,	.9308,	.8459,	.5340,	.4907,	.7216,	.7803,	.6304,	.6083,	.7926,	.6630,
FBAR 4- 7,	.9232,	.8393,	.5308,	.4879,	.7164,	.7745,	.6811,	.6702,	.8554,	.7239,

Table 8	Fishing mortality (F) at age										
YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	FBAR 93-95
AGE											
2,	.0548,	.1505,	.1243,	.0436,	.1765,	.0862,	.0696,	.0582,	.0732,	.0489,	.0601,
3,	.3308,	.3924,	.5102,	.5894,	.4542,	.7894,	.3165,	.2235,	.3548,	.2463,	.2748,
4,	.8283,	.7514,	.7975,	1.1024,	1.0815,	1.2988,	.6902,	.3004,	.5466,	.5847,	.4772,
5,	1.1075,	1.0027,	.7651,	1.0738,	1.3464,	1.6212,	1.0014,	.3706,	.7738,	.9956,	.7133,
6,	1.4678,	1.0650,	.9277,	1.2246,	1.2025,	1.0256,	1.2205,	.3312,	.4513,	.7358,	.5061,
7,	1.1608,	1.1968,	1.0370,	1.1044,	1.2256,	1.2695,	.8134,	.4038,	.3329,	.4330,	.3899,
+gp,	1.1608,	1.1968,	1.0370,	1.1044,	1.2256,	1.2695,	.8134,	.4038,	.3329,	.4330,	
FBAR 4- 7,	1.1411,	1.0040,	.8818,	1.1263,	1.2140,	1.3038,	.9314,	.3515,	.5262,	.6873,	

Run title : Cod in 25 to 32 (run: XSAPAL10/X10)

At 23-Apr-96 13:23:41

Terminal Fs derived using XSA (With F shrinkage)

Table 10	Stock number at age (start of year)					Numbers*10**-3					
YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	
AGE											
2,	282634,	468605,	788322,	571007,	407709,	656313,	649865,	432396,	280192,	227893,	
3,	210532,	223673,	378140,	608531,	421840,	315449,	517595,	497936,	320626,	209350,	
4,	176680,	115554,	144796,	244294,	368645,	244475,	210611,	315582,	309719,	168700,	
5,	70024,	66498,	52887,	76420,	130385,	156792,	107967,	99000,	147505,	123001,	
6,	22100,	22652,	22247,	22716,	38609,	50465,	52818,	39988,	39299,	44921,	
7,	3532,	6292,	6589,	10992,	10729,	15082,	18337,	20512,	14888,	12866,	
+gp,	2402,	2686,	2292,	5661,	4679,	6764,	10426,	5750,	11049,	8322,	
TOTAL,	767905,	905961,	1395274,	1535620,	1382597,	1445340,	1567618,	1411163,	1123278,	795053,	

Table 10	Stock number at age (start of year)					Numbers*10***-3						
YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	GMST
AGE												
2,	244695,	331156,	202583,	117128,	115932,	78941,	125316,	174273,	146584,	175097,	0,	2797
3,	157415,	189664,	233248,	146472,	91801,	79559,	59291,	95706,	134621,	111541,	136524,	2160
4,	114729,	92579,	104888,	114656,	66512,	47724,	29581,	35373,	62664,	77301,	71390,	1288
5,	71002,	41028,	35756,	38682,	31174,	18466,	10661,	12145,	21445,	29701,	35270,	551
6,	48990,	19205,	12324,	13622,	10822,	6641,	2988,	3207,	6865,	8099,	8986,	197
7,	15774,	9243,	5421,	3990,	3278,	2662,	1950,	722,	1885,	3579,	3177,	66
+gp,	6590,	4811,	3627,	2718,	2514,	2384,	1027,	455,	1228,	2251,	3096,	
TOTAL,	659194,	687685,	597846,	437269,	322033,	236377,	230813,	321880,	375293,	407568,	258441,	

Table 3.7.3 (continued)

Run title : Cod in 25 to 32 (run: XSAPAL10/X10)

At 23-Apr-96 13:23:41

Terminal Fs derived using XSA (With F shrinkage)

Table 12	Stock biomass at age (start of year)					Tonnes				
YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
2,	57375,	95127,	160029,	115914,	82765,	133232,	131923,	87776,	56879,	46262,
3,	141267,	150085,	253732,	408324,	283054,	211666,	347307,	334115,	215140,	140473,
4,	154419,	100994,	126552,	213513,	322196,	213671,	184074,	289388,	275030,	182196,
5,	98944,	93962,	74729,	107982,	184235,	221547,	152557,	134640,	200164,	193727,
6,	48753,	49970,	49078,	50111,	85172,	111326,	116516,	71738,	75494,	94515,
7,	13055,	23257,	24354,	40627,	39654,	55743,	67774,	49229,	38082,	31214,
+gp,	14235,	15189,	13177,	32569,	25998,	40043,	59114,	27078,	49169,	37057,
TOTALBIO,	528047,	528584,	701651,	969040,	1023073,	987228,	1059264,	993965,	909959,	725444,

Table 12	Stock biomass at age (start of year)					Tonnes				
YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
AGE										
2,	49673,	67225,	41124,	23777,	23534,	16025,	25439,	35377,	42949,	49727,
3,	105625,	127264,	156509,	98283,	61599,	53384,	39784,	64219,	90196,	72948,
4,	114041,	108781,	120306,	114885,	80746,	55551,	34432,	41174,	73066,	88277,
5,	103521,	71799,	63145,	59029,	54647,	31318,	18082,	20598,	40918,	55481,
6,	96363,	48167,	31253,	28660,	25864,	16741,	7533,	8084,	18466,	21526,
7,	36674,	27469,	18273,	11735,	10550,	10191,	7463,	2764,	6460,	12215,
+gp,	27870,	19723,	16136,	11422,	11840,	11407,	5121,	2135,	6944,	12833,
TOTALBIO,	533767,	470429,	446747,	347792,	268781,	194616,	137854,	174350,	278999,	313008,

Run title : Cod in 25 to 32 (run: XSAPAL10/X10)

At 23-Apr-96 13:23:41

Terminal Fs derived using XSA (With F shrinkage)

Table 13	Spawning stock biomass at age (spawning time)					Tonnes				
YEAR,	1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE										
2,	15491,	25684,	43208,	31297,	22347,	35973,	35619,	23700,	15357,	12491,
3,	97474,	103558,	175075,	281744,	195307,	146050,	239641,	230540,	148447,	96927,
4,	140521,	91905,	115162,	194297,	293198,	194441,	167507,	263344,	250278,	165799,
5,	95976,	91143,	72487,	104742,	178708,	214901,	147980,	130600,	194159,	187915,
6,	48266,	49471,	48587,	49610,	84320,	110213,	115350,	71020,	74739,	93570,
7,	13055,	23257,	24354,	40627,	39654,	55743,	67774,	49229,	38082,	31214,
+gp,	14235,	15189,	13177,	32569,	25998,	40043,	59114,	27078,	49169,	37057,
TOTSPBIO,	425017,	400207,	492050,	734886,	839532,	797362,	832987,	795511,	770231,	624971,

Table 13	Spawning stock biomass at age (spawning time)					Tonnes				
YEAR,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,
AGE										
2,	13412,	18151,	11104,	6420,	6354,	4327,	6869,	9552,	11596,	13426,
3,	72882,	87812,	107992,	67815,	42503,	36835,	27451,	44311,	62235,	50334,
4,	103777,	98990,	109479,	104546,	73479,	50551,	31333,	37468,	66490,	80332,
5,	100415,	69645,	61250,	57258,	53008,	30378,	17539,	19981,	39690,	53817,
6,	95399,	47685,	30940,	28373,	25606,	16574,	7458,	8003,	18281,	21311,
7,	36674,	27469,	18273,	11735,	10550,	10191,	7463,	2764,	6460,	12215,
+gp,	27870,	19723,	16136,	11422,	11840,	11407,	5121,	2135,	6944,	12833,
TOTSPBIO,	450429,	369476,	355174,	287569,	223340,	160262,	103234,	124213,	211697,	244269,

Table 3.7.3 (continued)

Run title : Cod in 25 to 32 (run: XSAPAL10/x10)

At 23-Apr-96 13:23:41

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS, Age 2	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR 4- 7,
1976,	282634,	528047,	425017,	203303,	.4783,	.9232,
1977,	468605,	528584,	400207,	164692,	.4115,	.8393,
1978,	788322,	701651,	492050,	154009,	.3130,	.5308,
1979,	571007,	969040,	734885,	227699,	.3098,	.4879,
1980,	407709,	1023073,	839532,	345843,	.4119,	.7164,
1981,	656313,	987228,	797363,	325618,	.4084,	.7745,
1982,	649866,	1059264,	832987,	314475,	.3775,	.6811,
1983,	432396,	993964,	795510,	329146,	.4138,	.6702,
1984,	280192,	909959,	770232,	394941,	.5128,	.8554,
1985,	227893,	725444,	624971,	316019,	.5057,	.7239,
1986,	244695,	533767,	450429,	251802,	.5590,	1.1411,
1987,	331156,	470428,	369477,	217123,	.5877,	1.0040,
1988,	202583,	446747,	355174,	194478,	.5476,	.8818,
1989,	117128,	347792,	287569,	179177,	.6231,	1.1263,
1990,	115932,	268781,	223340,	153546,	.6875,	1.2140,
1991,	78941,	194616,	160262,	122489,	.7643,	1.3038,
1992,	125316,	137854,	103234,	54886,	.5317,	.9314,
1993,	174273,	174350,	124213,	38117,	.3069,	.3515,
1994,	146584,	278999,	211697,	90102,	.4256,	.5262,
1995,	175097,	313008,	244269,	107474,	.4400,	.6873,
Arith.						
Mean	323832,	579630,	462121,	209247,	.4808,	.8185,
Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),		

Table 3.7.4

Cod SD 25-32

Comparison of SSB from surveys and XSA with varying assumption of catch options in 1993-1995

Year	Low catch	Medium cat	High catch	Survey indices
1982	826374	832987	837577	73381
1983	790772	795510	798838	81790
1984	765898	770232	773301	72011
1985	621362	624971	627515	53747
1986	448660	450429	451685	28401
1987	368160	369477	370394	21454
1988	353867	355174	356059	23527
1989	286297	287569	288370	16446
1990	221329	223340	224431	17774
1991	155324	160262	162779	13486
1992	89662	103234	110824	3418
1993	93420	124213	143475	5940
1994	167677	211697	252669	17319
1995	219706	244269	273097	14367
1996				24414

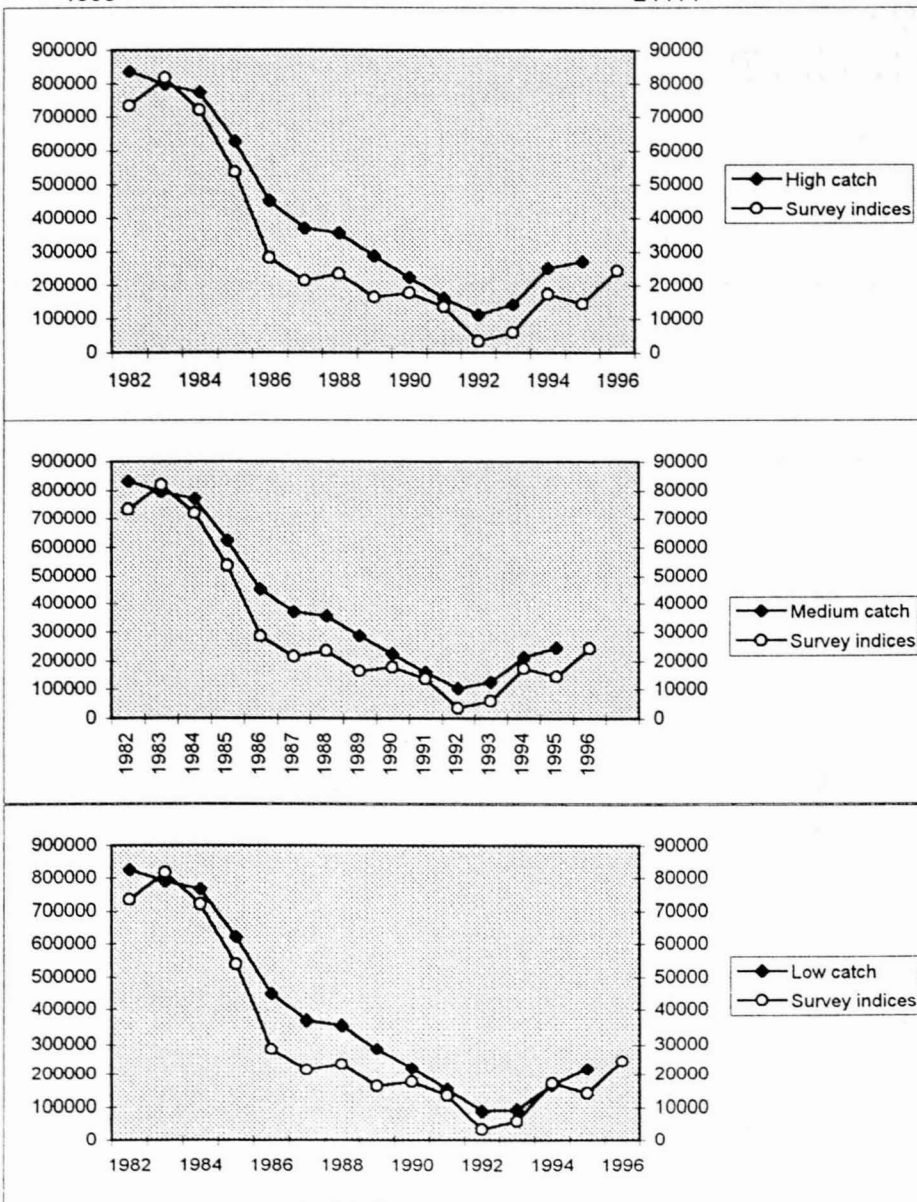


Table 3.8.1

CATCH NUMBERS AT AGE (Millions)															
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
2	9.	6.	41.	50.	20.	22.	33.	37.	22.	32.	12.	42.	21.	5.	17.
3	63.	42.	72.	143.	112.	53.	120.	108.	104.	63.	40.	56.	84.	59.	30.
4	86.	46.	47.	77.	160.	102.	81.	123.	144.	74.	58.	44.	52.	69.	40.
5	38.	36.	23.	26.	62.	83.	53.	46.	84.	57.	43.	24.	17.	23.	21.
6	13.	13.	8.	9.	18.	25.	25.	20.	21.	23.	34.	11.	7.	9.	7.
7	2.	3.	2.	4.	5.	7.	8.	8.	7.	6.	10.	6.	3.	2.	2.
8	1.	1.	1.	2.	2.	3.	4.	2.	6.	4.	4.	3.	2.	2.	2.

# INDICES OF SPAWNING STOCK BIOMASS 0

## AGE - STRUCTURED INDICES

INDEX : 1 from 1982 to 1996

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
2	.297E+02	.169E+02	.372E+01	.840E+01	.543E+01	.131E+02	.802E+01	.118E+01	.341E+01	.105E+01	.127E+01	.691E+01
3	.143E+02	.217E+02	.746E+01	.102E+02	.530E+01	.833E+01	.784E+01	.467E+01	.600E+01	.220E+01	.107E+01	.354E+01
4	.519E+01	.138E+02	.115E+02	.579E+01	.302E+01	.403E+01	.398E+01	.382E+01	.220E+01	.170E+01	.327E+00	.595E+00
5	.351E+01	.391E+01	.491E+01	.398E+01	.202E+01	.930E+00	.124E+01	.113E+01	.117E+01	.990E+00	.193E+00	.320E+00
6	.231E+01	.167E+01	.191E+01	.174E+01	.139E+01	.195E+00	.353E+00	.299E+00	.279E+00	.276E+00	.127E+00	.126E+00
7	.725E+00	.747E+00	.515E+00	.419E+00	.407E+00	.149E+00	.126E+00	.126E+00	.931E-01	.839E-01	.670E-01	.183E-01
8	.288E+00	.197E+00	.433E+00	.192E+00	.142E+00	.639E-01	.562E-01	.486E-01	.264E-01	.434E-01	.243E-01	.755E-02

## FISHING MORTALITY

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
2	.0341	.0148	.0599	.1045	.0577	.0377	.0666	.0998	.0925	.1704	.0556	.1485	.1213	.0375	.1153
3	.4036	.2352	.2416	.3063	.3511	.2082	.2956	.2753	.4434	.4049	.3307	.3968	.4969	.5636	.5355
4	.7910	.5882	.4381	.4381	.6676	.6298	.5673	.5596	.7180	.6654	.8328	.7435	.8061	1.0231	1.0396
5	.9380	.9296	.6577	.4805	.7763	.9206	.8228	.7522	.9741	.7095	1.0936	1.0117	.7481	1.0955	1.1939
6	1.0354	1.0600	.5494	.5710	.7293	.8776	.8122	.8552	.9973	.8189	1.3680	1.0284	.9512	1.1387	1.1428
7	.9570	.8092	.5683	.5658	.7719	.7562	.7454	.7255	.9572	.8079	1.0541	.9561	.9439	1.1791	1.1939
8	.9570	.8092	.5683	.5658	.7719	.7562	.7454	.7255	.9572	.8079	1.0541	.9561	.9439	1.1791	1.1939

## NUMBERS AT AGE (Millions)

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
2	281.	458.	773.	560.	399.	651.	645.	428.	276.	226.	241.	334.	207.	136.	107.
3	207.	222.	369.	596.	413.	308.	513.	494.	317.	206.	156.	186.	236.	150.	107.
4	172.	113.	144.	238.	359.	238.	205.	313.	307.	167.	113.	92.	103.	117.	70.
5	68.	64.	52.	76.	126.	151.	104.	95.	146.	123.	70.	40.	36.	38.	35.
6	22.	22.	21.	22.	38.	47.	49.	37.	37.	45.	49.	19.	12.	14.	10.
7	3.	6.	6.	10.	10.	15.	16.	18.	13.	11.	16.	10.	6.	4.	4.
8	2.	2.	3.	4.	7.	6.	8.	9.	11.	7.	7.	7.	5.	3.	2.

## STOCK SUMMARY

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Year	Recruits x10 <sup>6</sup>	Total B tonnes	Spawn B tonnes	Landings tonnes	YLB/SSB	Ref. F Fbar 4- 7
1976	281.	513724.	412093.	203303.	.4933	.9304
1977	458.	512238.	386046.	164692.	.4266	.8467
1978	773.	688454.	483142.	154009.	.3188	.5534
1979	560.	937099.	707757.	227699.	.3217	.5139
1980	399.	1007707.	828265.	345843.	.4176	.7363
1981	651.	957698.	771006.	325618.	.4223	.7960
1982	645.	1015765.	791857.	314475.	.3971	.7369
1983	428.	988795.	792270.	329146.	.4154	.7231
1984	276.	891974.	753889.	394941.	.5239	.9116
1985	226.	712768.	613394.	316019.	.5152	.7504
1986	241.	531676.	449385.	251802.	.5603	1.0871
1987	334.	476890.	376327.	217123.	.5770	.9349
1988	207.	453847.	361431.	194478.	.5381	.8623
1989	136.	357816.	293977.	179177.	.6095	1.1091
1990	107.	283673.	235844.	153546.	.6510	1.1425
1991	80.	201117.	166314.	122439.	.7365	1.5739
1992	132.	133864.	98872.	54886.	.5551	.9367
1993	229.	185298.	126819.	38117.	.3006	.3056
1994	185.	326794.	240756.	95102.	.3742	.4462
1995	229.	417351.	325624.	107474.	.2300	.4279



Table 3.8.1 (continued)

## PARAMETER ESTIMATES +/- SD

## Separable Model: Reference F by year

1	1990	1.1938	1.0359	1.3759
2	1991	1.6446	1.4594	1.8534
3	1992	.8743	.7495	1.0200
4	1993	.3193	.2661	.3833
5	1994	.4662	.3905	.5566
6	1995	.4471	.3698	.5406

## Separable Model: Selection (S) by age

7	2	.0965	.0797	.1169
8	3	.4485	.3791	.5307
9	4	.8708	.7475	1.0145
	5	1.0000	Fixed : Reference age	
10	6	.9572	.8180	1.1202
	7	1.0000	Fixed : last true age	

## Separable Model: Populations in year 1995

11	2	228388.	183485.	285526.
12	3	144972.	120788.	173999.
13	4	120735.	103943.	140241.
14	5	38354.	33257.	44233.
15	6	9884.	8581.	11385.
16	7	3653.	3139.	4251.

## Separable Model: Populations at age 7

17	1990	3634.8923	2809.5072	4702.7612
18	1991	2680.9157	2160.4615	3326.7469
19	1992	1452.9701	1183.5165	1783.7707
20	1993	1131.2715	940.9693	1360.0605
21	1994	2062.5523	1762.7161	2413.3902

## Recruitment in Year 1996

22	2	265692.8174	149810.4429	471213.3002
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## Age-structured index catchabilities

## Age-Structured Index 1

## Linear model fitted. Slopes at age:

23	2 Q	.25999E-04	.22352E-04	.30240E-04
24	3 Q	.37341E-04	.34411E-04	.40522E-04
25	4 Q	.33356E-04	.29824E-04	.37306E-04
26	5 Q	.36811E-04	.33773E-04	.40122E-04
27	6 Q	.36615E-04	.32922E-04	.40722E-04
28	7 Q	.36318E-04	.32560E-04	.40511E-04
29	8 Q	.24052E-04	.20832E-04	.27770E-04

## Parameters of the B.-H. stock-recruit relationship

30	a	.4478973E+06	.2941732E+06	.6819518E+06
31	b	.2510936E+06	.9028722E+05	.6983047E+06

## RESIDUALS ABOUT THE MODEL FIT

## Separable Model Residuals

(log(Observed Catch)-log(Expected Catch))  
and weights (W) used in the analysis.

Age	1990	1991	1992	1993	1994	1995	
2	.47006E+00	-.59672E+00	-.23900E+00	.34593E+00	.23603E+00	-.14941E+00	.10000E+01
3	-.29035E+00	.47398E-01	-.13193E+00	.36706E+00	.15370E+00	-.83926E-01	.10000E+01
4	-.44427E-01	-.14152E+00	-.11663E+00	.19101E+00	.10914E+00	-.13725E+00	.10000E+01
5	-.64162E-01	-.12325E+00	.12817E+00	.15324E+00	.46751E+00	.29407E+00	.10000E+01
6	.58820E-01	-.49403E+00	.13593E+00	-.36021E-02	-.15841E-01	.19467E+00	.10000E+01
7	-.11124E+00	-.15042E+00	.23137E+00	-.26214E+00	-.37441E+00	-.55402E-01	.10000E+01
Wts	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	.10000E+01	

Table 3.8.1 (continued)

Aged Index Residuals:  $\log(\text{Observed Index}) - \log(\text{Expected Index})$ 

Aged Index 1

Age	1982	1983	1984	1985	1986	1987	1988	1989	1990
2	.60365E+00	.45694E+00	-.62109E+00	.40179E+00	-.10938E+00	.45351E+00	.44182E+00	-.10675E+01	.24015E+00
3	-.23046E+00	.22171E+00	-.38143E+00	.35519E+00	-.30008E-01	.25485E+00	-.28458E-01	-.83878E-01	.49934E+00
4	-.17861E+00	.37622E+00	.23416E+00	.14923E+00	-.90022E-01	.39185E+00	.27736E+00	.12827E+00	.98865E-01
5	.41617E-01	.22954E+00	.55187E-01	-.11908E-01	-.82698E-01	-.30978E+00	.55080E-01	-.42158E-01	.93874E-01
6	.37767E+00	.32998E+00	.50030E+00	.17641E+00	-.68425E-01	-.11305E+01	-.70652E-01	-.36149E+00	-.13068E+00
7	.33324E+00	.25658E+00	.23094E+00	.16507E+00	-.21786E+00	-.77595E+00	-.34345E+00	.90117E-01	-.17549E+00
8	.49092E+00	-.30346E-01	.65334E+00	.19111E+00	.21010E-01	-.76354E+00	-.67878E+00	-.37409E+00	-.33562E+00

PARAMETERS OF THE DISTRIBUTION OF  $\ln$  CATCHES AT AGE

Separable model fitted from 1990 to 1995

Variance : .1449  
 Skewness test statistic : -.3966  
 Kurtosis test statistic : -.2101  
 Partial chi-square : .2517  
 Probability of chi-square : 1.0000  
 Degrees of freedom : 15

PARAMETERS OF THE DISTRIBUTION OF THE AGE-STRUCTURED INDICES

DISTRIBUTION STATISTICS FOR  $\ln$  AGED INDEX 1

Linear catchability relationship assumed.

Age	2	3	4	5	6	7	8
Variance	.3030	.0816	.1677	.0920	.1470	.1419	.2380
Skewness test stat.	-1.3867	-.4275	-2.0514	.8356	-2.6247	-1.6084	-.4983
Kurtosis test stat.	-.5574	-.2097	.5206	.0546	2.5267	-.0908	-.9165
Partial chi-square	3.1964	.9922	21.3626	2.7841	5.5151	1.3867	1.3730
Prob. of chi-square	.9987	1.0000	.0927	.9994	.9773	1.0000	1.0000
Number of data	15	15	15	15	15	15	15
Degrees of freedom	14	14	14	14	14	14	14
Weight in analysis	.4781	1.7755	.8636	1.5738	.9856	1.0208	.6088

**Table 3.9.1** GLM estimates of cod age group 2 in SD 25-32. First quarter only.

The SAS System 25  
16:02 Sunday, April 21, 1996

General Linear Models Procedure  
Class Level Information

Class	Levels	Values
YEAR	15	1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996
COUNTRY	6	DENMARK GERMANY LATVIA POLAND RUSSIA SWEDEN
SUBDIV	3	25 26 28
DSTR	5	1 2 3 4 5

Number of observations in data set = 2686

The SAS System 26  
16:02 Sunday, April 21, 1996

General Linear Models Procedure

Dependent Variable: AG2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	25	3756.99900	150.27996	42.72	0.0001
Error	2660	9357.04981	3.51769		
Corrected Total	2685	13114.04881			
	R-Square	C.V.	Root MSE		AG2 Mean
	0.286487	75.14496	1.87555		2.49591

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	14	1549.33793	110.66700	31.46	0.0001
COUNTRY	5	1024.48969	204.89794	58.25	0.0001
SUBDIV	2	61.69344	30.84672	8.77	0.0002
DSTR	4	1121.47793	280.36948	79.70	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	14	1551.26928	110.80495	31.50	0.0001
COUNTRY	5	568.88906	113.77781	32.34	0.0001
SUBDIV	2	22.35057	11.17528	3.18	0.0419
DSTR	4	1121.47793	280.36948	79.70	0.0001

Table 3.9.1 (continued)

Parameter	Estimate	T for H0: Parameter=0	Pr >  T	Std Error of Estimate
INTERCEPT	1.296922955 B	4.83	0.0001	0.26846100
YEAR	1982	2.098427138 B	10.60	0.0001
	1983	1.094420901 B	5.55	0.0001
	1984	0.676055633 B	3.40	0.0007
	1985	0.806057043 B	3.89	0.0001
	1986	-0.084926355 B	-0.36	0.7219
	1987	0.426918105 B	2.06	0.0395
	1988	0.884408639 B	4.88	0.0001
	1989	-0.753728941 B	-4.12	0.0001
	1990	-0.058397513 B	-0.31	0.7542
	1991	-1.013145356 B	-5.82	0.0001
	1992	-0.566245961 B	-2.76	0.0058
	1993	0.646605315 B	3.58	0.0004
	1994	0.018605395 B	0.10	0.9185
	1995	0.555487173 B	3.28	0.0011
	1996	0.000000000 B	.	.
COUNTRY	DENMARK	-0.462483486 B	-3.19	0.0015
	GERMANY	-1.079872555 B	-7.13	0.0001
	LATVIA	-0.791322506 B	-4.69	0.0001
	POLAND	-1.350870028 B	-7.97	0.0001
	RUSSIA	-2.547058248 B	-10.38	0.0001
	SWEDEN	0.000000000 B	.	.
SUBDIV	25	0.306102635 B	2.13	0.0331
	26	0.323832888 B	2.37	0.0177
	28	0.000000000 B	.	.
DSTR	1	0.328132347 B	1.41	0.1600
	2	2.110666427 B	9.38	0.0001
	3	2.192706346 B	9.54	0.0001
	4	1.677653003 B	7.81	0.0001
	5	0.000000000 B	.	.

NOTE: The X'X matrix has been found to be singular and a generalized inverse was used to solve the normal equations. Estimates followed by the letter 'B' are biased, and are not unique estimators of the parameters.

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General Linear Models Procedure  
Least Squares Means

YEAR	AG2 LSMEAN	Std Err LSMEAN	Pr >  T  H0:LSMEAN=0
1982	3.82855909	0.16462005	0.0001
1983	2.82455285	0.16234384	0.0001
1984	2.40618758	0.16405137	0.0001
1985	2.53618899	0.17423628	0.0001
1986	1.64520560	0.20973352	0.0001
1987	2.15705005	0.17709090	0.0001
1988	2.61454059	0.14411170	0.0001
1989	0.97640301	0.14664444	0.0001
1990	1.67173444	0.15064200	0.0001
1991	0.71698659	0.13362568	0.0001
1992	1.16388599	0.17128469	0.0001
1993	2.37673727	0.14315509	0.0001
1994	1.74873735	0.14421531	0.0001
1995	2.28561912	0.12952994	0.0001
1996	1.73013195	0.12370556	0.0001

Table 3.9.1 (continued)

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General Linear Models Procedure  
Class Level Information

Class	Levels	Values
YEAR	15	1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996
COUNTRY	6	DENMARK GERMANY LATVIA POLAND RUSSIA SWEDEN
SUBDIV	3	25 26 28
DSTR	5	1 2 3 4 5

Number of observations in data set = 2686

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## General Linear Models Procedure

Dependent Variable: AG2

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	53	4490.29162	84.72248	25.86	0.0001
Error	2632	8623.75719	3.27650		
Corrected Total	2685	13114.04881			
	R-Square	C.V.	Root MSE		AG2 Mean
	0.342403	72.52313	1.81011		2.49591

Source	DF	Type I SS	Mean Square	F Value	Pr > F
YEAR	14	1549.33793	110.66700	33.78	0.0001
COUNTRY	5	1024.48969	204.89794	62.54	0.0001
SUBDIV	2	61.69344	30.84672	9.41	0.0001
DSTR	4	1121.47793	280.36948	85.57	0.0001
YEAR*SUBDIV	28	733.29263	26.18902	7.99	0.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
YEAR	14	1232.40803	88.02914	26.87	0.0001
COUNTRY	5	661.38635	132.27727	40.37	0.0001
SUBDIV	2	15.29500	7.64750	2.33	0.0971
DSTR	4	1123.22720	280.80680	85.70	0.0001
YEAR*SUBDIV	28	733.29263	26.18902	7.99	0.0001

Table 3.9.1 (continued)

Parameter		Estimate	T for H0: Parameter=0	Pr >  T	Std Error of Estimate
INTERCEPT		0.643200623 B	1.71	0.0872	0.37591541
YEAR	1982	4.008380410 B	7.98	0.0001	0.50209023
	1983	3.940411792 B	8.48	0.0001	0.46455712
	1984	1.802911522 B	3.78	0.0002	0.47742229
	1985	2.289923974 B	4.52	0.0001	0.50705073
	1986	3.553767709 B	4.97	0.0001	0.71557739
	1987	0.839458518 B	1.11	0.2666	0.75553566
	1988	2.110952258 B	4.94	0.0001	0.42740340
	1989	1.019312419 B	2.04	0.0414	0.49943430
	1990	1.445789759 B	2.50	0.0126	0.57912214
	1991	0.705338999 B	1.58	0.1146	0.44692996
	1992	-0.304500891 B	-0.60	0.5482	0.50702660
	1993	0.448469691 B	0.94	0.3483	0.47808906
	1994	-0.457065743 B	-0.82	0.4139	0.55926236
	1995	0.226058621 B	0.52	0.6022	0.43359229
	1996	0.000000000 B	.	.	.
COUNTRY	DENMARK	-0.594108648 B	-4.17	0.0001	0.14246355
	GERMANY	-1.107317276 B	-7.41	0.0001	0.14945071
	LATVIA	-1.073990320 B	-6.33	0.0001	0.16969664
	POLAND	-1.582780817 B	-9.45	0.0001	0.16742696
	RUSSIA	-3.155366575 B	-12.14	0.0001	0.25994289
	SWEDEN	0.000000000 B	.	.	.
SUBDIV	25	1.668359127 B	4.34	0.0001	0.38420363
	26	1.506281521 B	4.05	0.0001	0.37180638
	28	0.000000000 B	.	.	.
DSTR	1	0.083831279 B	0.37	0.7137	0.22844900
	2	1.912657859 B	8.70	0.0001	0.21990867
	3	2.020210433 B	9.01	0.0001	0.22427332
	4	1.501838766 B	7.16	0.0001	0.20966457
	5	0.000000000 B	.	.	.
YEAR*SUBDIV	1982 25	-3.161137592 B	-5.29	0.0001	0.59775041
	1982 26	-1.721813901 B	-3.04	0.0024	0.56711611
	1982 28	0.000000000 B	.	.	.
	1983 25	-3.268674024 B	-5.92	0.0001	0.55171252
	1983 26	-3.869563062 B	-7.04	0.0001	0.54982929
	1983 28	0.000000000 B	.	.	.
	1984 25	-1.488301539 B	-2.65	0.0082	0.56232147
	1984 26	-1.373458807 B	-2.45	0.0145	0.56165337
	1984 28	0.000000000 B	.	.	.
	1985 25	-1.801987321 B	-2.97	0.0030	0.60623890
	1985 26	-1.810157044 B	-3.11	0.0019	0.58136746
	1985 28	0.000000000 B	.	.	.
	1986 25	-4.474971797 B	-5.73	0.0001	0.78057420
	1986 26	-3.777772771 B	-4.53	0.0001	0.83438506
	1986 28	0.000000000 B	.	.	.
	1987 25	-0.866606507 B	-1.06	0.2883	0.81601752
	1987 26	-0.483799004 B	-0.60	0.5496	0.80846478
	1987 28	0.000000000 B	.	.	.
	1988 25	-1.928347501 B	-3.67	0.0002	0.52475498

Table 3.9.1 (continued)

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## General Linear Models Procedure

Dependent Variable: AG2

Parameter	Estimate	T for H0: Parameter=0	Pr >  T	Std Error of Estimate
YEAR*SUBDIV 1988 26	-1.267624100 B	-2.57	0.0104	0.49419669
1988 28	0.000000000 B	.	.	.
1989 25	-3.224022039 B	-5.54	0.0001	0.58199462
1989 26	-1.471509810 B	-2.64	0.0082	0.55647732
1989 28	0.000000000 B	.	.	.
1990 25	-1.909559688 B	-2.95	0.0032	0.64759848
1990 26	-1.742269677 B	-2.75	0.0059	0.63246932
1990 28	0.000000000 B	.	.	.
1991 25	-2.001975198 B	-3.80	0.0002	0.52738178
1991 26	-2.141505872 B	-4.22	0.0001	0.50780006
1991 28	0.000000000 B	.	.	.
1992 25	-0.703424600 B	-1.19	0.2352	0.59237838
1992 26	-0.191111120 B	-0.32	0.7457	0.58927087
1992 28	0.000000000 B	.	.	.
1993 25	0.456904248 B	0.83	0.4054	0.54904607
1993 26	-0.335510189 B	-0.61	0.5394	0.54657149
1993 28	0.000000000 B	.	.	.
1994 25	0.265402161 B	0.43	0.6704	0.62347758
1994 26	0.364733959 B	0.59	0.5528	0.61435484
1994 28	0.000000000 B	.	.	.
1995 25	-0.312900708 B	-0.61	0.5403	0.51088209
1995 26	1.074235899 B	2.17	0.0298	0.49417666
1995 28	0.000000000 B	.	.	.
1996 25	0.000000000 B	.	.	.
1996 26	0.000000000 B	.	.	.
1996 28	0.000000000 B	.	.	.

NOTE: The X'X matrix has been found to be singular and a generalized inverse was used to solve the normal equations. Estimates followed by the letter 'B' are biased, and are not unique estimators of the parameters.

Table 3.9.1 (continued)

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General Linear Models Procedure  
Least Squares Means

YEAR	AG2 LSMEAN	Std Err LSMEAN	Pr >  T  H0:LSMEAN=0
1982	3.93359115	0.17989638	0.0001
1983	3.11386066	0.16686888	0.0001
1984	2.40185264	0.17097547	0.0001
1985	2.63873709	0.18509377	0.0001
1986	2.35571409	0.26702167	0.0001
1987	1.94218458	0.25997777	0.0001
1988	2.59848962	0.14768100	0.0001
1989	1.00699637	0.16852062	0.0001
1990	1.78137454	0.19336525	0.0001
1991	0.87703988	0.14542372	0.0001
1992	0.95018177	0.18126808	0.0001
1993	2.04179561	0.15807073	0.0001
1994	1.30584086	0.18397215	0.0001
1995	2.03269825	0.13566677	0.0001
1996	1.55286123	0.13746822	0.0001



**Table 3.9.2** Input data for RCT3 analysis.

Baltic Sea cod Sd 25-32 as 2-group

	1	15	2
'Year'	'VPA'	'GLMest'	
1980	649866	3.934	
1981	432369	3.114	
1982	280192	2.402	
1983	227893	2.634	
1984	244695	2.356	
1985	331156	1.942	
1986	202583	2.598	
1987	117128	1.007	
1988	115932	1.781	
1989	78941	0.877	
1990	125316	0.95	
1991	174273	2.041	
1992	146584	1.306	
1993	175097	2.03	
1994	-11	1.55	

Baltic Sea cod Sd 25-32 as 2-group

	1	15	2
'Year'	'VPA'	ScMean'	
1980	649866	29663.62	
1981	432369	16921.1	
1982	280192	3720.38	
1983	227893	8399.01	
1984	244695	5432.04	
1985	331156	13080.92	
1986	202583	8022.69	
1987	117128	1176.7	
1988	115932	3410.03	
1989	78941	1047.01	
1990	125316	1270.75	
1991	174273	6912.74	
1992	146584	6212.03	
1993	175097	7504.3	
1994	-11	6677.29	

Table 3.9.3

Analysis by RCT3 ver3.1 of data from file :

j:\rct3\age2rc1.csv

Baltic Sea cod Sd 25-32 as 2-group,,

Data for 1 surveys over 15 years : 1980 - 1994

Regression type = C

Tapered time weighting not applied

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 = 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
GLMest	.72	10.72	.30	.812	13	2.03	12.19	.335	.757
VPA Mean =							12.22	.591	.243

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
GLMest	.73	10.71	.29	.810	14	1.55	11.83	.325	.754
VPA Mean =							12.21	.569	.246

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1993	198585	12.20	.29	.01	.00	175097	12.07
1994	151306	11.93	.28	.16	.33		

Table 3.9.3 (continued)

Analysis by RCT3 ver3.1 of data from file :

j:\rct3\age2rc2.csv

Baltic Sea cod Sd 25-32 as 2-group,,

Data for 1 surveys over 15 years : 1980 - 1994

Regression type = C

Tapered time weighting not applied

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 = 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
ScMean	.65	6.68	.33	.777	13	8.92	12.46	.374	.714
						VPA Mean =	12.22	.591	.286

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
ScMean	.66	6.58	.34	.754	14	8.81	12.36	.379	.695
						VPA Mean =	12.21	.569	.307

Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA
1993	240699	12.39	.32	.11	.11	175097	12.07
1994	222564	12.31	.32	.07	.05		

Table 3.10.1

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Cod in Baltic Fishing Areas 25 to 32

Prediction with management option table: Input data

Year: 1996								
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	151306.00	0.2000	0.2700	0.0000	0.0000	0.284	0.0489	0.636
3	136524.00	0.2000	0.6900	0.0000	0.0000	0.654	0.2463	0.882
4	71390.000	0.2000	0.9100	0.0000	0.0000	1.142	0.5847	1.168
5	35270.000	0.2000	0.9700	0.0000	0.0000	1.868	0.9956	1.613
6	8986.000	0.2000	0.9900	0.0000	0.0000	2.658	0.7359	2.339
7	3177.000	0.2000	1.0000	0.0000	0.0000	3.413	0.4330	3.622
8	3096.000	0.2000	1.0000	0.0000	0.0000	4.576	0.4330	4.966
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1997								
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	130000.00	0.2000	0.2700	0.0000	0.0000	0.284	0.0489	0.636
3	.	0.2000	0.6900	0.0000	0.0000	0.654	0.2463	0.882
4	.	0.2000	0.9100	0.0000	0.0000	1.142	0.5847	1.168
5	.	0.2000	0.9700	0.0000	0.0000	1.868	0.9956	1.613
6	.	0.2000	0.9900	0.0000	0.0000	2.658	0.7359	2.339
7	.	0.2000	1.0000	0.0000	0.0000	3.413	0.4330	3.622
8	.	0.2000	1.0000	0.0000	0.0000	4.576	0.4330	4.966
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1998								
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	130000.00	0.2000	0.2700	0.0000	0.0000	0.284	0.0489	0.636
3	.	0.2000	0.6900	0.0000	0.0000	0.654	0.2463	0.882
4	.	0.2000	0.9100	0.0000	0.0000	1.142	0.5847	1.168
5	.	0.2000	0.9700	0.0000	0.0000	1.868	0.9956	1.613
6	.	0.2000	0.9900	0.0000	0.0000	2.658	0.7359	2.339
7	.	0.2000	1.0000	0.0000	0.0000	3.413	0.4330	3.622
8	.	0.2000	1.0000	0.0000	0.0000	4.576	0.4330	4.966
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANPAL02  
Date and time: 25APR96:14:38

Table 3.10.2a

Cod in Baltic Fishing Areas 25 to 32

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Prediction with management option table

Year: 1996					Year: 1997					Year: 1998	
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
0.8000	0.7965	328565	259964	95803	0.0000	0.0000	345005	282070	0	489647	426084
.	.	.	.	.	0.1000	0.0996	.	282070	16168	467845	404946
.	.	.	.	.	0.2000	0.1991	.	282070	31339	447489	385227
.	.	.	.	.	0.3000	0.2987	.	282070	45586	428471	366820
.	.	.	.	.	0.4000	0.3982	.	282070	58975	410689	349625
.	.	.	.	.	0.5000	0.4978	.	282070	71567	394052	333552
.	.	.	.	.	0.6000	0.5974	.	282070	83420	378475	318518
.	.	.	.	.	0.7000	0.6969	.	282070	94585	363880	304445
.	.	.	.	.	0.8000	0.7965	.	282070	105112	350194	291263
.	.	.	.	.	0.9000	0.8960	.	282070	115043	337353	278907
.	.	.	.	.	1.0000	0.9956	.	282070	124420	325294	267317
.	.	.	.	.	1.1000	1.0952	.	282070	133281	313963	256437
.	.	.	.	.	1.2000	1.1947	.	282070	141661	303307	246218
.	.	.	.	.	1.3000	1.2943	.	282070	149592	293278	236612
.	.	.	.	.	1.4000	1.3938	.	282070	157105	283834	227575
.	.	.	.	.	1.5000	1.4934	.	282070	164226	274932	219069
.	.	.	.	.	1.6000	1.5930	.	282070	170981	266537	211057
.	.	.	.	.	1.7000	1.6925	.	282070	177394	258613	203504
.	.	.	.	.	1.8000	1.7921	.	282070	183487	251128	196378
.	.	.	.	.	1.9000	1.8916	.	282070	189281	244053	189652
.	.	.	.	.	2.0000	1.9912	.	282070	194793	237360	183298
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

(cont.)

Table 3.10.2b

Cod in Baltic Fishing Areas 25 to 32

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Prediction with management option table

(cont.)

Year: 1996					Year: 1997					Year: 1998	
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	0.9956	328565	259964	113584	0.0000	0.0000	322806	260849	0	464359	401184
.	.	.	.	.	0.1000	0.0996	.	260849	14859	444355	381822
.	.	.	.	.	0.2000	0.1991	.	260849	28815	425659	363741
.	.	.	.	.	0.3000	0.2987	.	260849	41935	408173	346847
.	.	.	.	.	0.4000	0.3982	.	260849	54277	391807	331051
.	.	.	.	.	0.5000	0.4978	.	260849	65898	376479	316270
.	.	.	.	.	0.6000	0.5974	.	260849	76848	362112	302429
.	.	.	.	.	0.7000	0.6969	.	260849	87174	348635	289461
.	.	.	.	.	0.8000	0.7965	.	260849	96919	335986	277301
.	.	.	.	.	0.9000	0.8960	.	260849	106123	324103	265891
.	.	.	.	.	1.0000	0.9956	.	260849	114823	312932	255176
.	.	.	.	.	1.1000	1.0952	.	260849	123054	302424	245109
.	.	.	.	.	1.2000	1.1947	.	260849	130845	292531	235641
.	.	.	.	.	1.3000	1.2943	.	260849	138228	283210	226733
.	.	.	.	.	1.4000	1.3938	.	260849	145228	274421	218343
.	.	.	.	.	1.5000	1.4934	.	260849	151871	266129	210438
.	.	.	.	.	1.6000	1.5930	.	260849	158179	258300	202982
.	.	.	.	.	1.7000	1.6925	.	260849	164175	250901	195947
.	.	.	.	.	1.8000	1.7921	.	260849	169877	243904	189303
.	.	.	.	.	1.9000	1.8916	.	260849	175304	237283	183024
.	.	.	.	.	2.0000	1.9912	.	260849	180474	231013	177086
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

(cont.)

Table 3.10.2c

Cod in Baltic Fishing Areas 25 to 32

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Prediction with management option table

(cont.)

Year: 1996					Year: 1997					Year: 1998	
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	1.1947	328565	259964	129534	0.0000	0.0000	303137	242097	0	441849	379042
.	.	.	.	.	0.1000	0.0996	.	242097	13701	423436	361249
.	.	.	.	.	0.2000	0.1991	.	242097	26583	406208	344619
.	.	.	.	.	0.3000	0.2987	.	242097	38706	390079	329063
.	.	.	.	.	0.4000	0.3982	.	242097	50123	374968	314504
.	.	.	.	.	0.5000	0.4978	.	242097	60884	360798	300866
.	.	.	.	.	0.6000	0.5974	.	242097	71034	347503	288083
.	.	.	.	.	0.7000	0.6969	.	242097	80617	335019	276093
.	.	.	.	.	0.8000	0.7965	.	242097	89670	323287	264838
.	.	.	.	.	0.9000	0.8960	.	242097	98230	312255	254266
.	.	.	.	.	1.0000	0.9956	.	242097	106330	301872	244328
.	.	.	.	.	1.1000	1.0952	.	242097	114001	292094	234980
.	.	.	.	.	1.2000	1.1947	.	242097	121271	282878	226180
.	.	.	.	.	1.3000	1.2943	.	242097	128167	274185	217890
.	.	.	.	.	1.4000	1.3938	.	242097	134713	265980	210075
.	.	.	.	.	1.5000	1.4934	.	242097	140931	258229	202702
.	.	.	.	.	1.6000	1.5930	.	242097	146842	250903	195742
.	.	.	.	.	1.7000	1.6925	.	242097	152466	243971	189167
.	.	.	.	.	1.8000	1.7921	.	242097	157821	237410	182950
.	.	.	.	.	1.9000	1.8916	.	242097	162923	231193	177069
.	.	.	.	.	2.0000	1.9912	.	242097	167788	225299	171501
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANPAL02  
Date and time : 25APR96:14:38  
Computation of ref. F: F at age 5  
Basis for 1996 : F factors

Table 3.10.3

Cod in Baltic Fishing Areas 25 to 32

09:30 Thursday, April 25, 1996

## Yield per recruit: Summary table

F Factor	Reference F	Catch in numbers	Catch in weight	Stock size	Stock biomass	1 January		Spawning time	
						Sp.stock size	Sp.stock biomass	Sp.stock size	Sp.stock biomass
0.0000	0.0000	0	0	540314	836978	401852	773940	401852	773940
0.1000	0.0996	18534	34515	499994	711429	362201	649359	362201	649359
0.2000	0.1991	32529	57618	467188	612415	330025	551231	330025	551231
0.3000	0.2987	43198	72893	440270	533857	303701	473488	303701	473488
0.4000	0.3982	51418	82824	417988	471121	281982	411504	281982	411504
0.5000	0.4978	57829	89126	399374	420667	263902	361747	263902	361747
0.6000	0.5974	62892	92984	383678	379784	248715	321513	248715	321513
0.7000	0.6969	66948	95211	370315	346392	235839	288726	235839	288726
0.8000	0.7965	70244	96361	358832	318890	224821	261791	224821	261791
0.9000	0.8960	72962	96813	348870	296041	215305	239475	215305	239475
1.0000	0.9956	75239	96822	340149	276889	207013	220825	207013	220825
1.1000	1.0952	77173	96560	332447	260689	199724	205100	199724	205100
1.2000	1.1947	78839	96141	325588	246863	193264	191724	193264	191724
1.3000	1.2943	80294	95638	319432	234957	187493	180245	187493	180245
1.4000	1.3938	81581	95100	313866	224615	182299	170309	182299	170309
1.5000	1.4934	82730	94557	308799	215553	177594	161636	177594	161636
1.6000	1.5930	83767	94027	304158	207551	173303	154004	173303	154004
1.7000	1.6925	84712	93520	299883	200429	169368	147238	169368	147238
1.8000	1.7921	85579	93042	295924	194045	165740	141195	165740	141195
1.9000	1.8916	86380	92594	292241	188284	162379	135762	162379	135762
2.0000	1.9912	87125	92177	288800	183053	159252	130846	159252	130846
-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : YLDPAL03  
Date and time : 25APR96:11:03  
Computation of ref. F: F at age 5  
F-0.1 factor : 0.5327  
F-max factor : 0.9507  
F-0.1 reference F : 0.5304  
F-max reference F : 0.9465  
Recruitment : 130000 (Thousands)

Figure 3.4.1

WEST95EB Chart 3

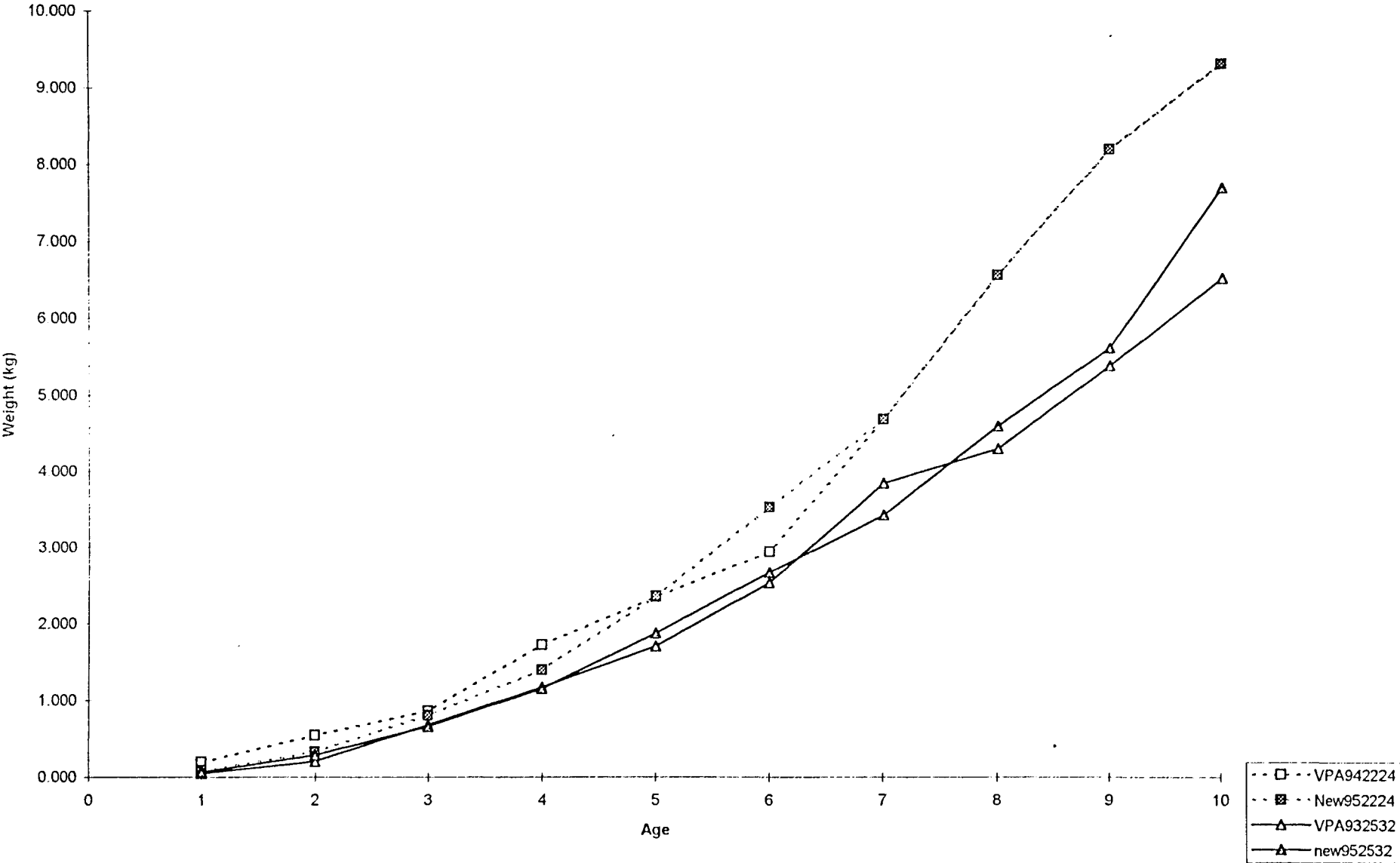




Figure 3.4.1 (continued)

WEST95EB Chart 1

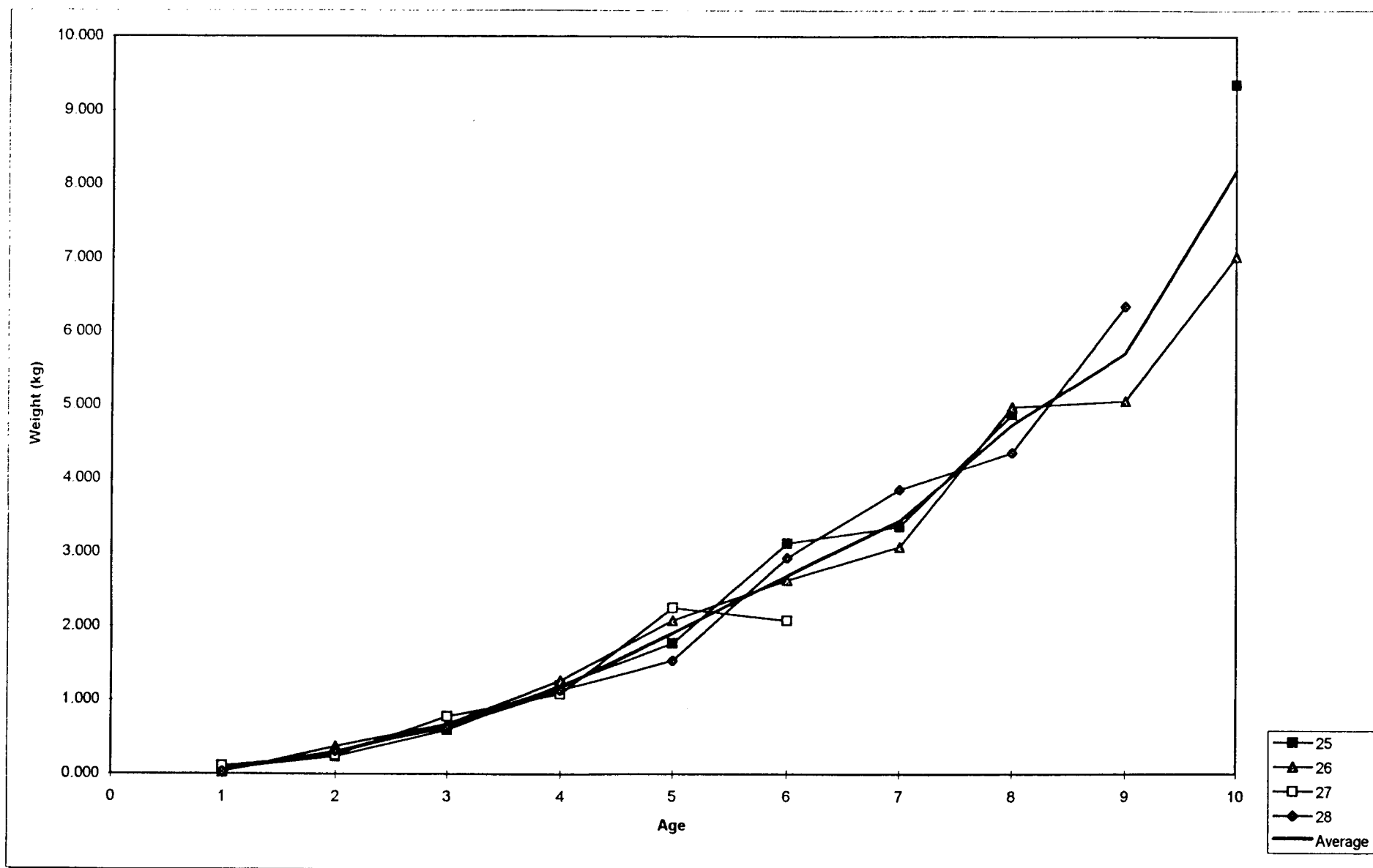
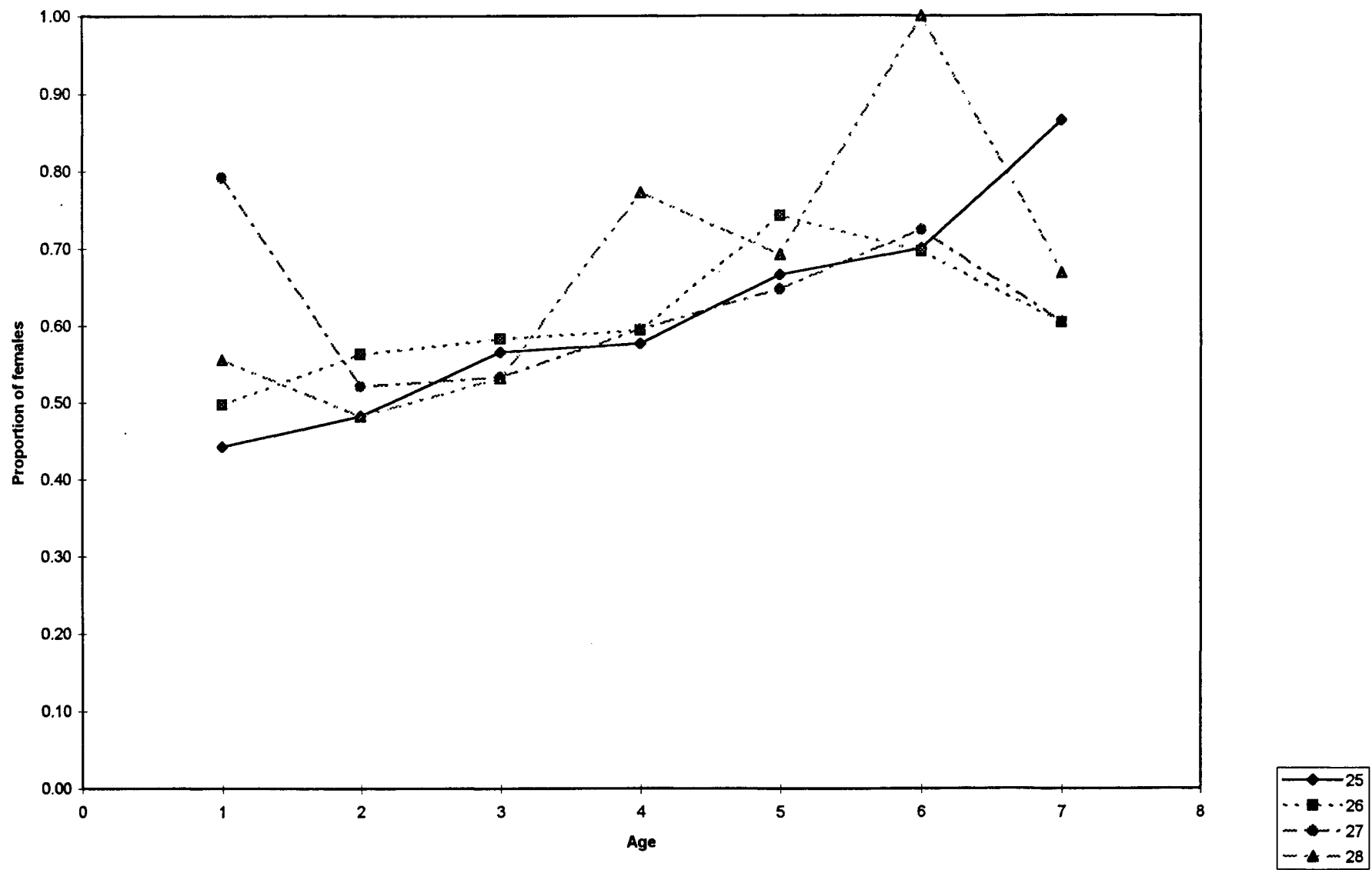


Figure 3.5.1 Cod 25–32. Sex ratio by age.

Averages Chart 3



## Averages Chart 7

Figure 3.5.2 Cod 25–32. Maturity ogives. Females.

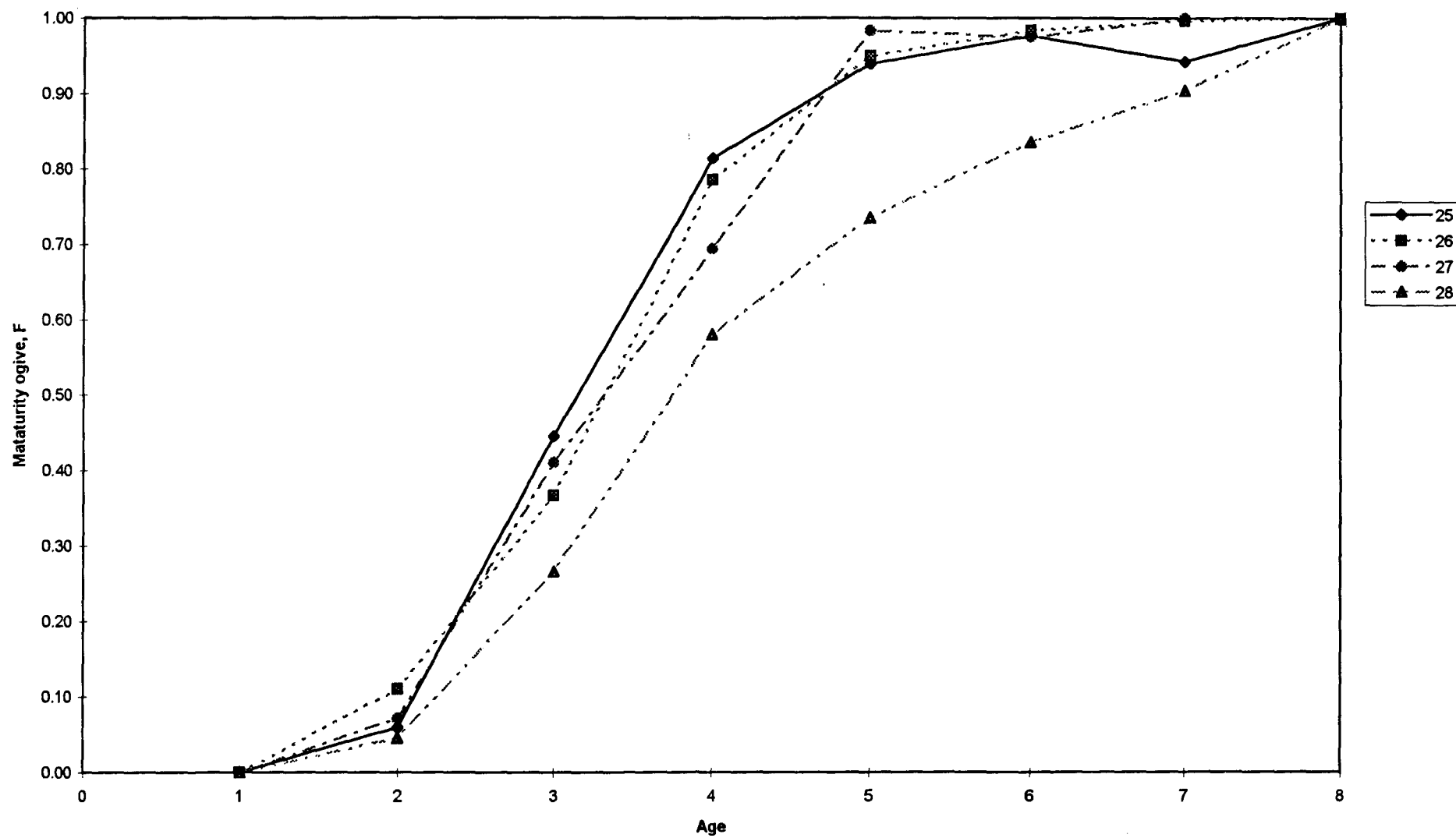


Figure 3.5.3 Cod 25–32. Maturity ogives. Males.

Averages Chart 9

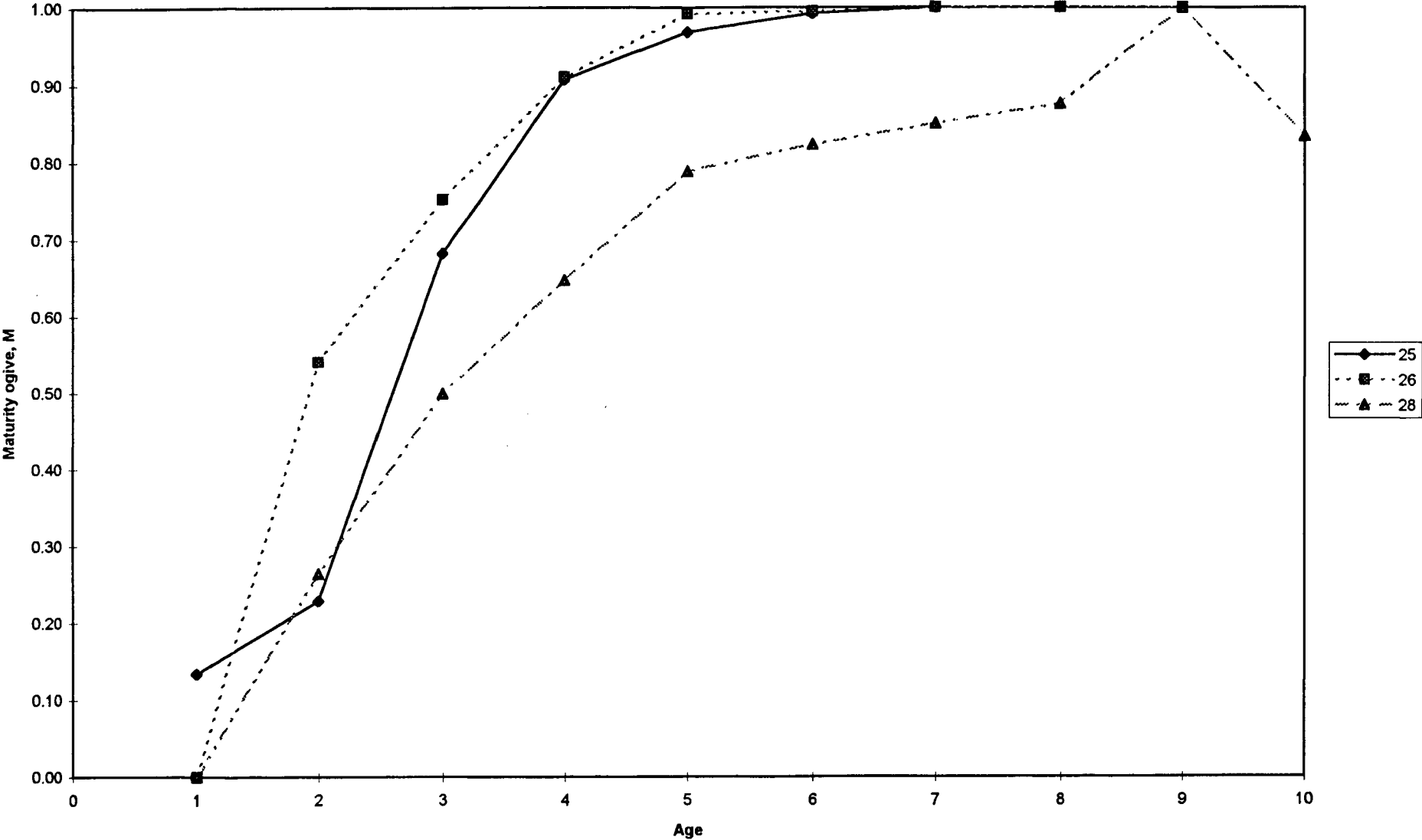


Figure 3.6.1 Cod in Subdivisions 25 - 32. Relative CPUE from commercial bottom trawling 1987 - 1995. (1987 = 1.0). Data for 1995 were submitted by Latvia, Sweden and Denmark.

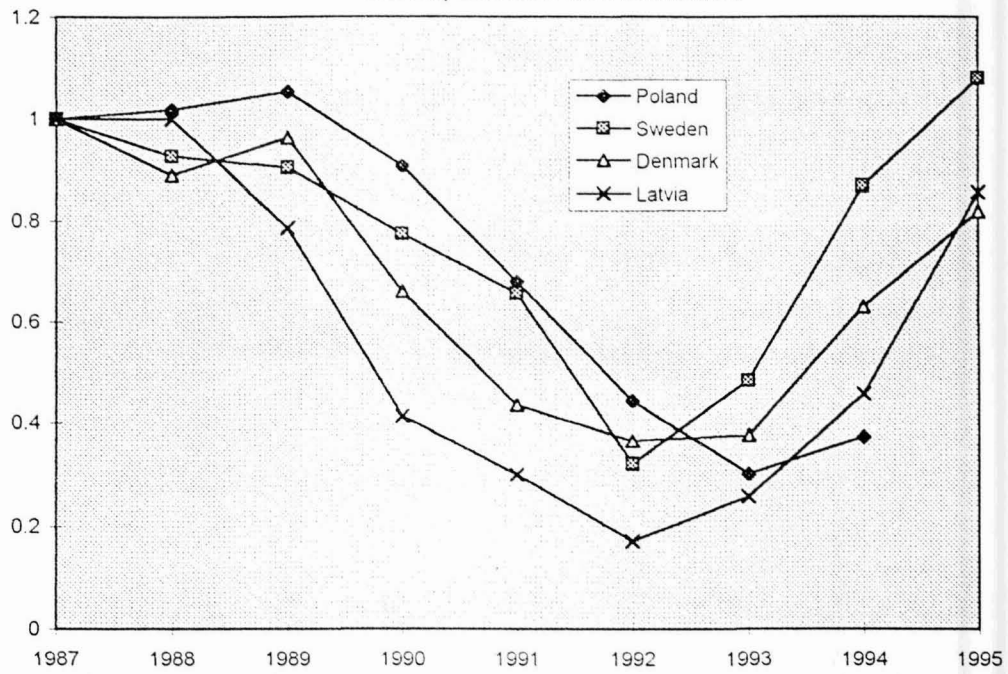


Figure 3.7.1

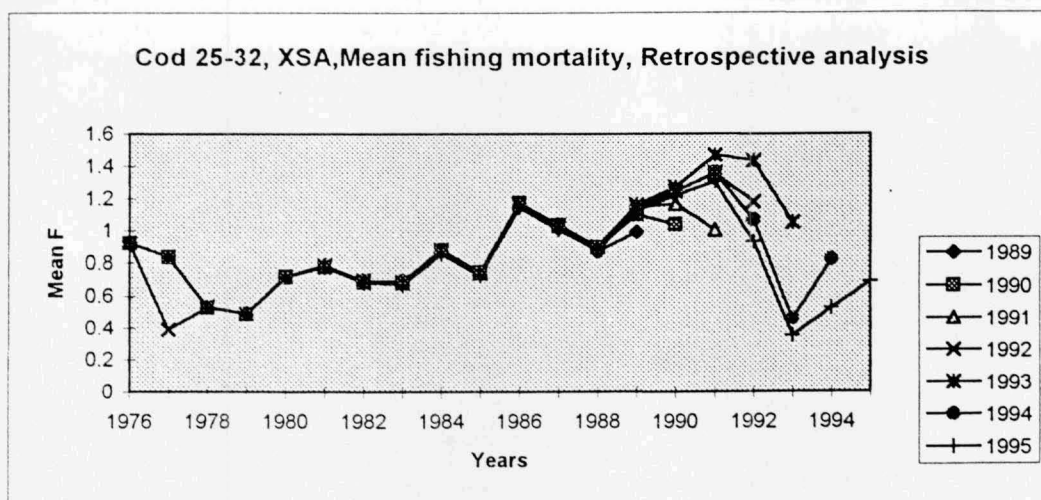
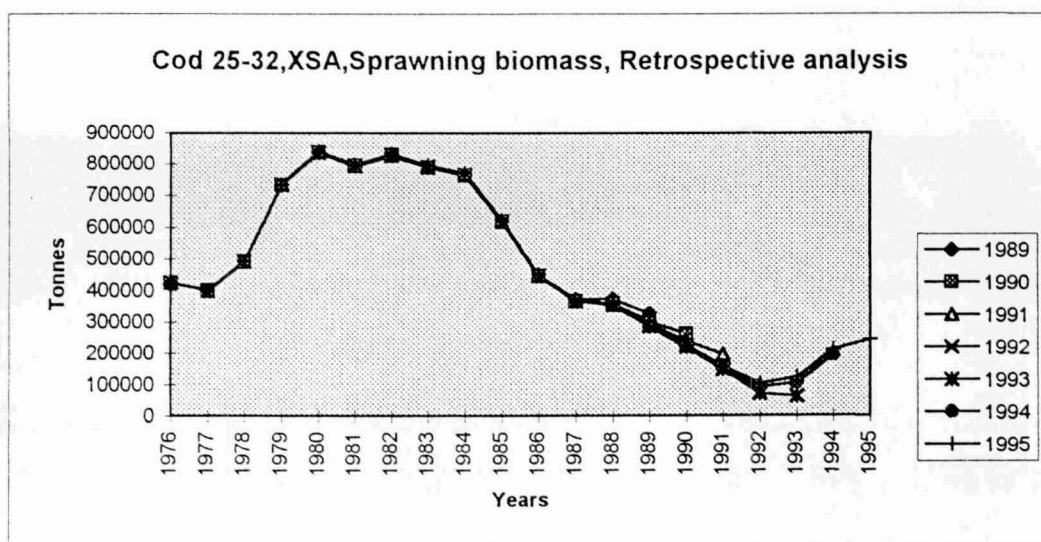
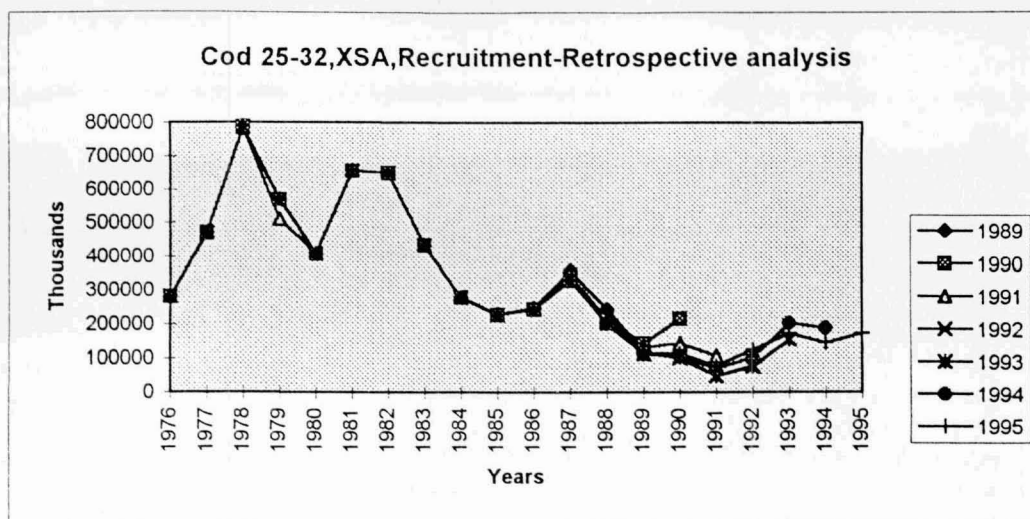


Figure 3.8.1a

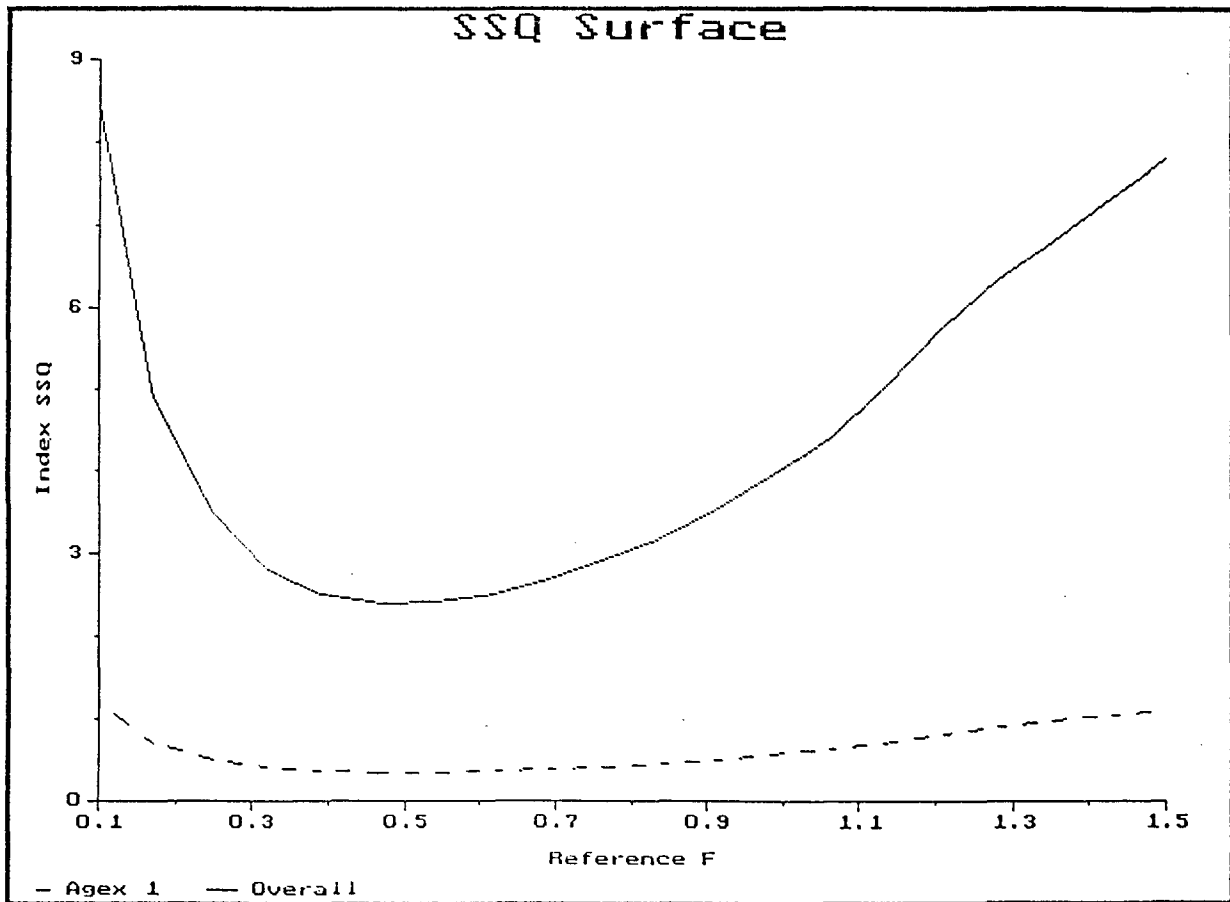


Figure 3.8.1b

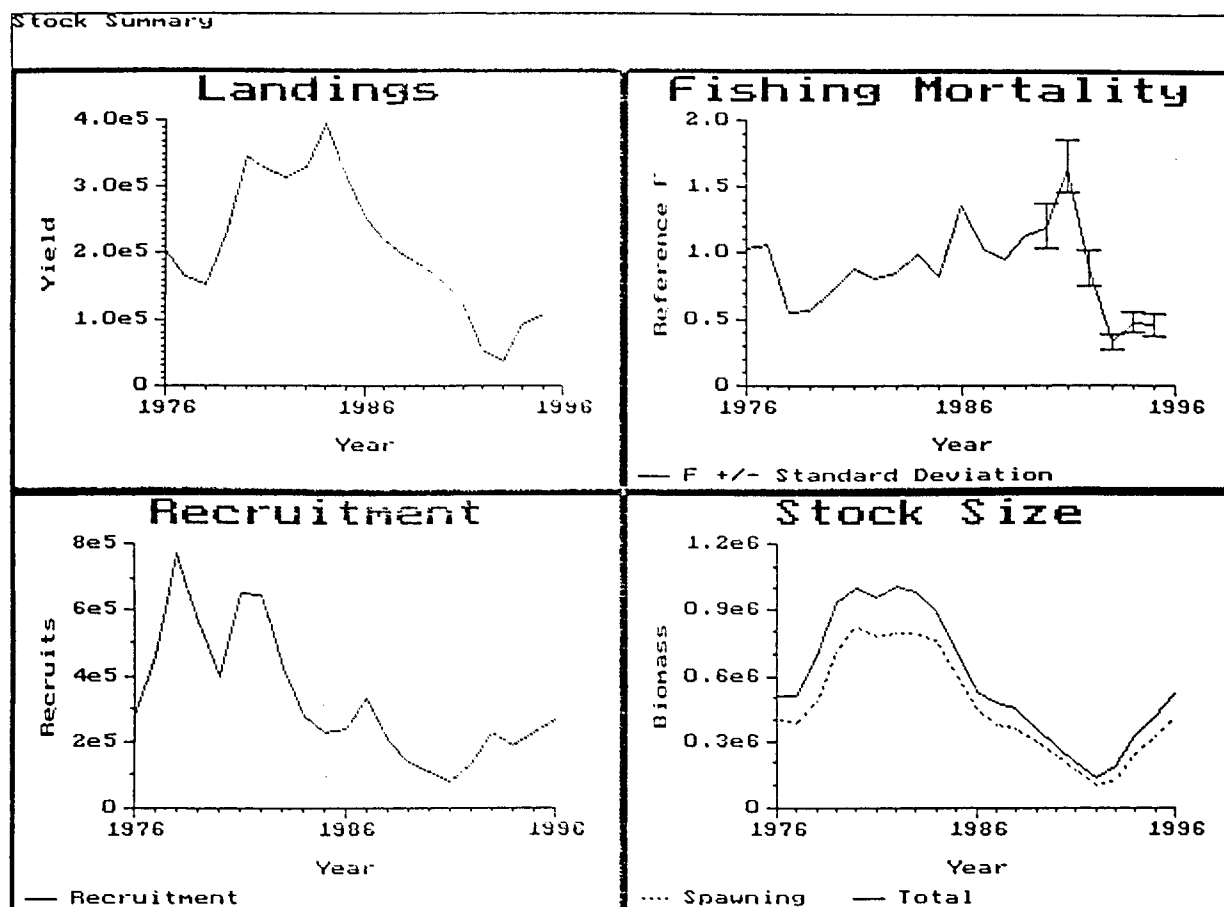




Figure 3.8.1c

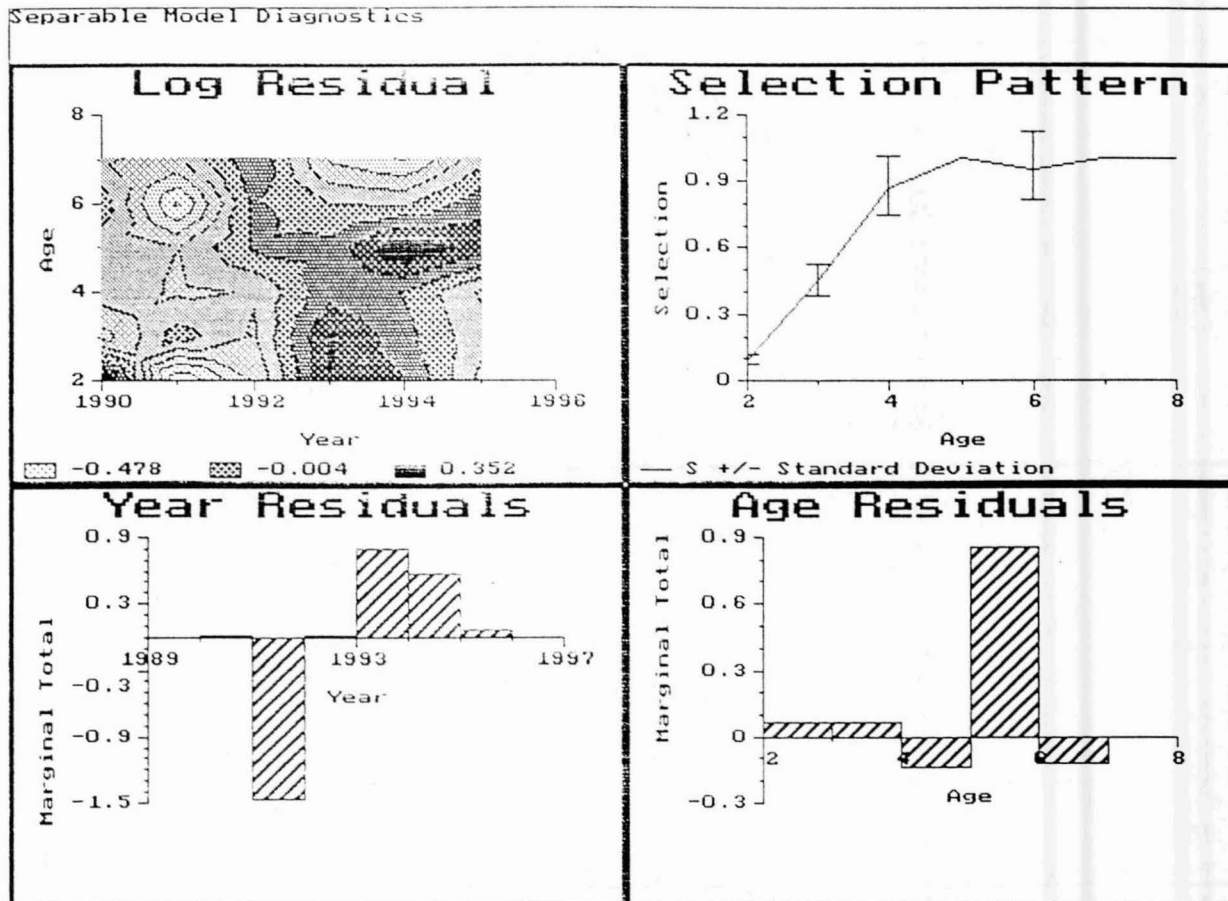


Figure 3.8.1d

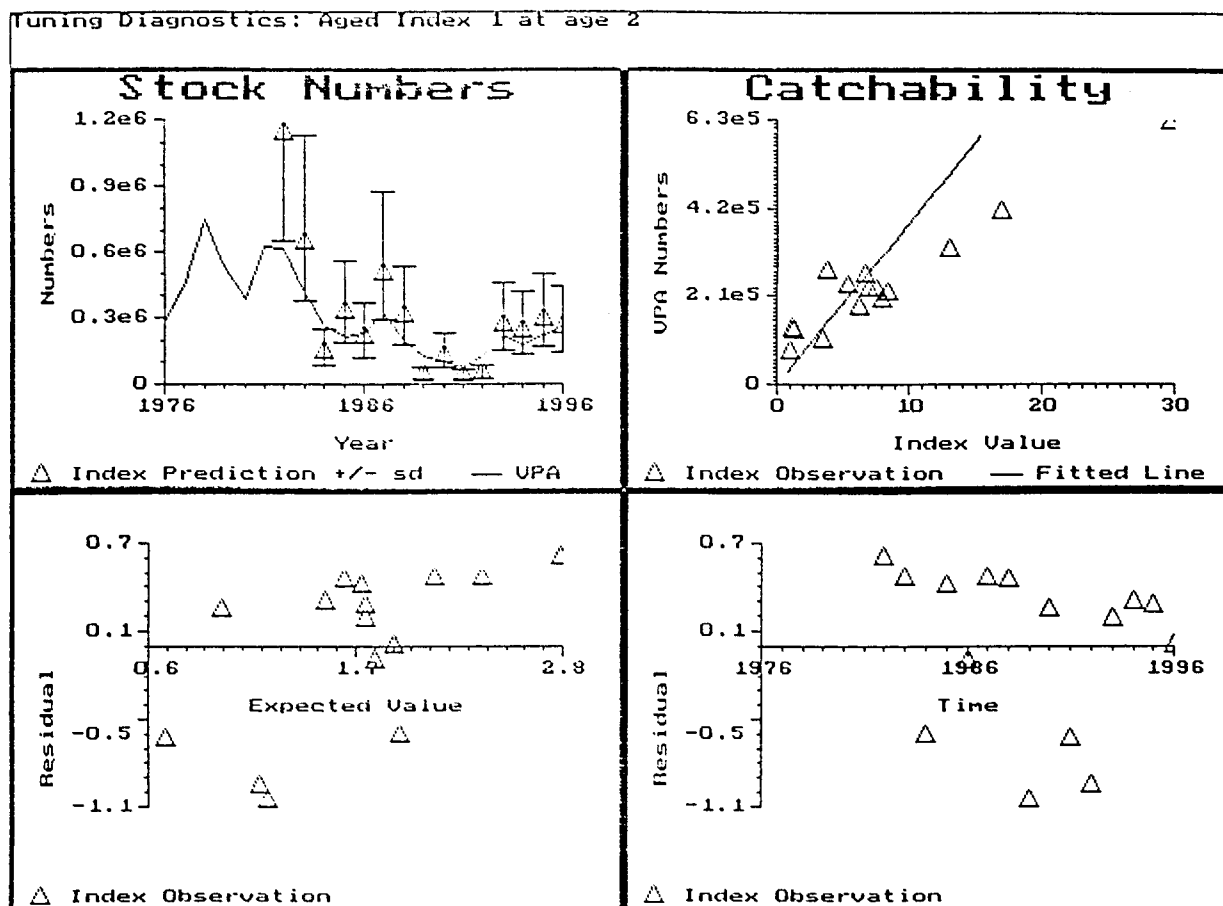


Figure 3.8.1e

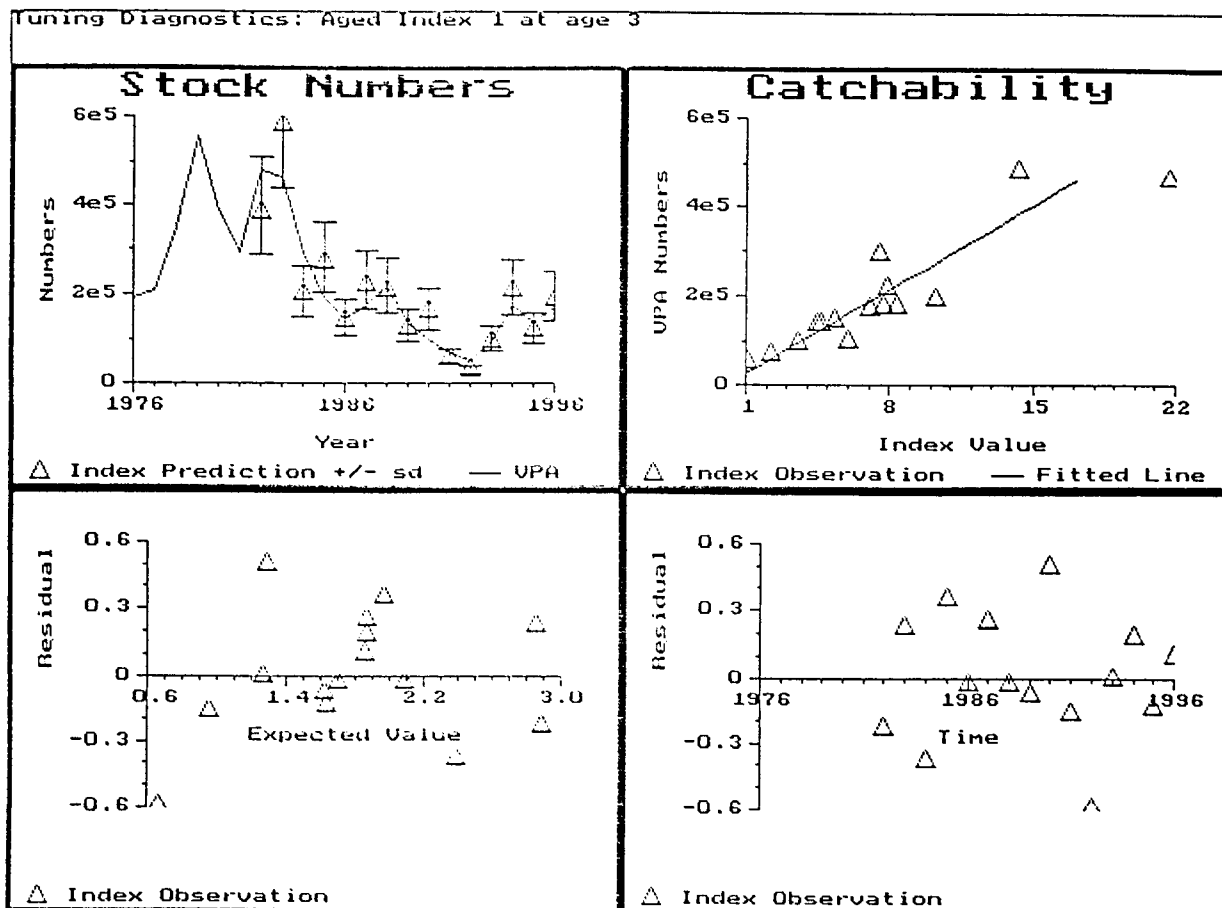


Figure 3.8.1f

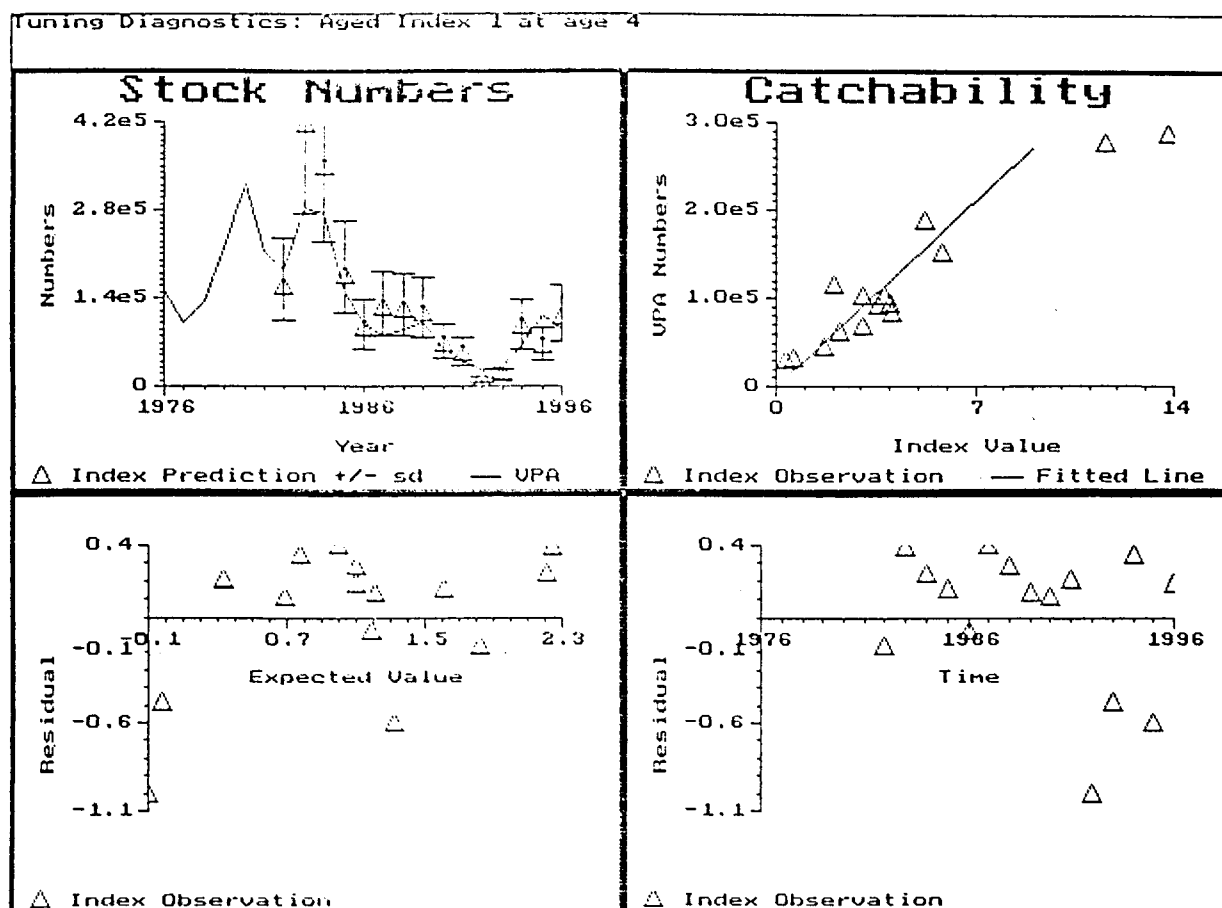


Figure 3.8.1g

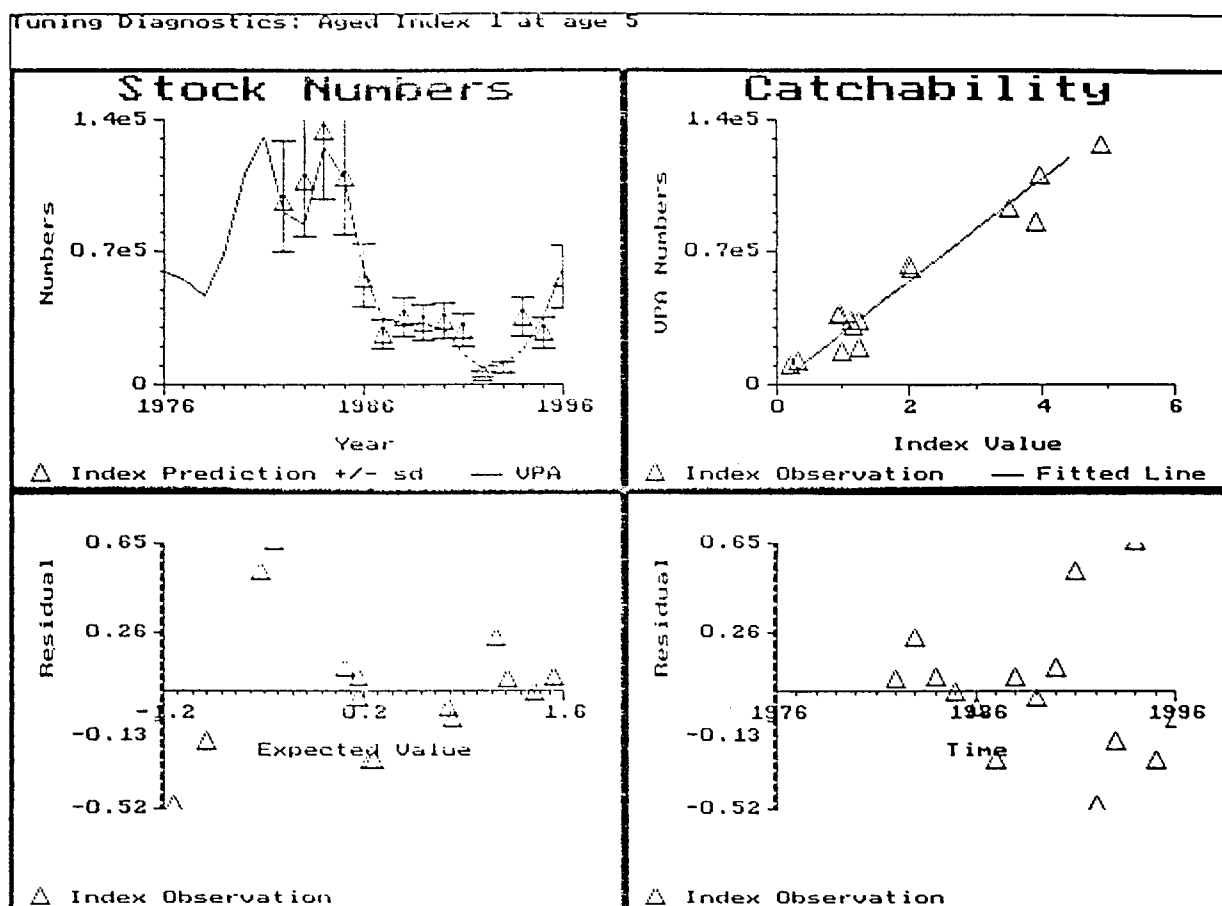


Figure 3.8.1h

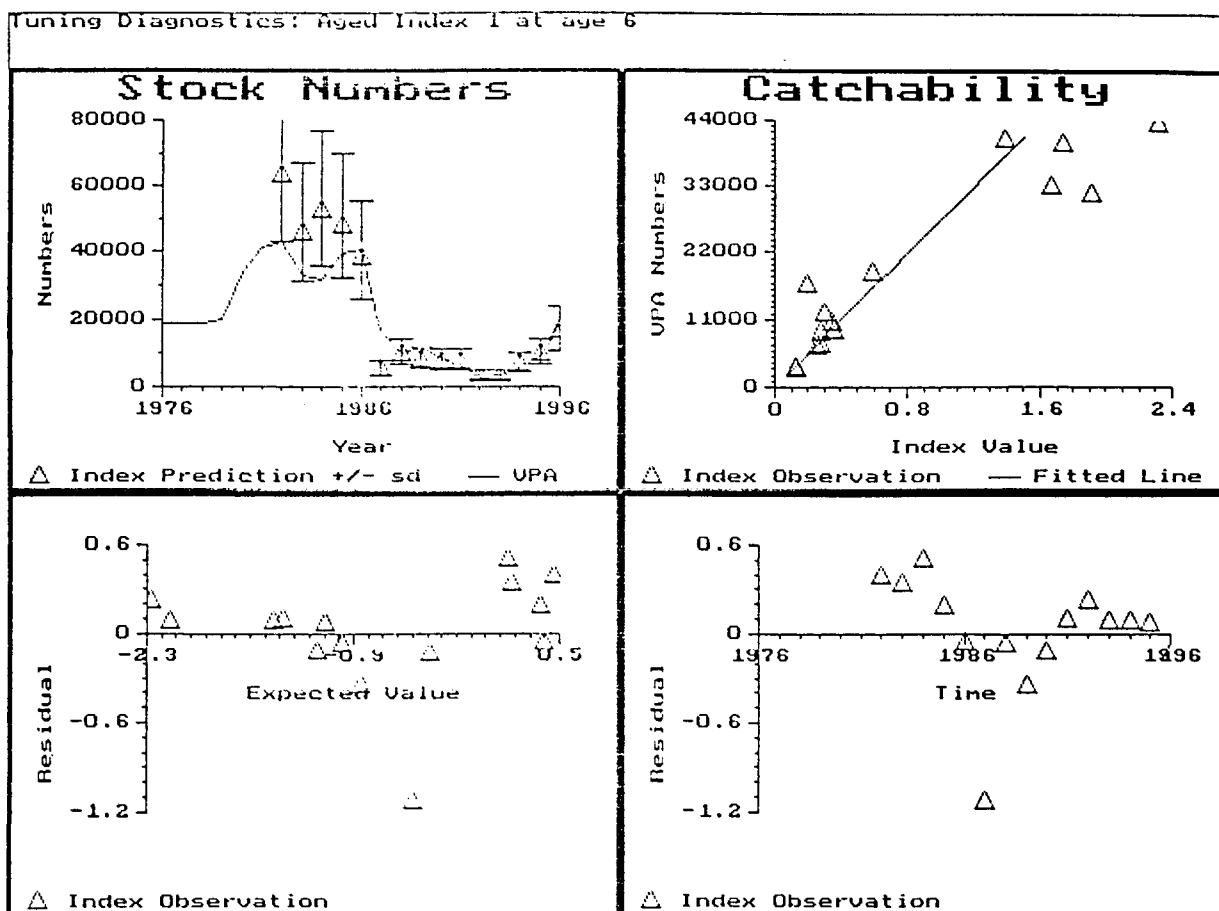


Figure 3.8.1i

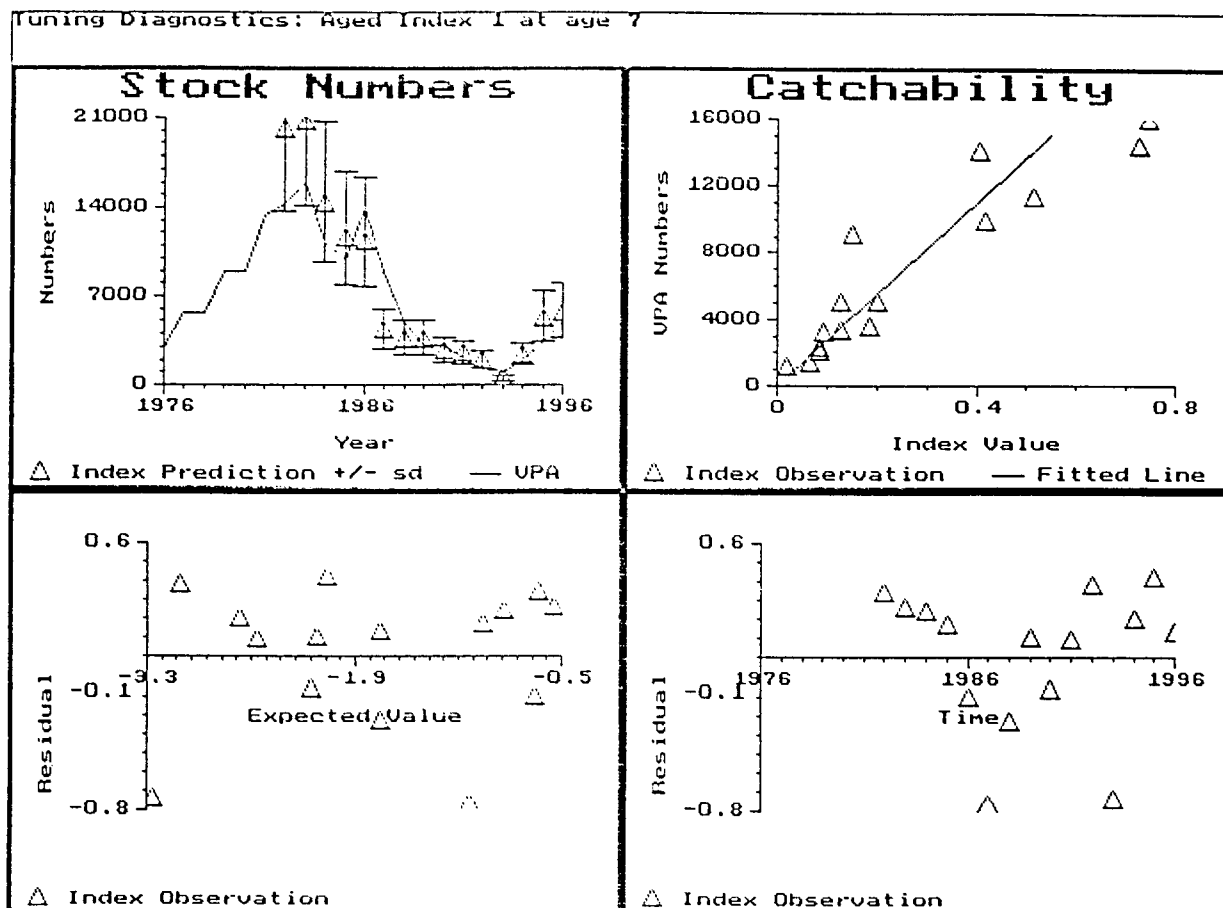
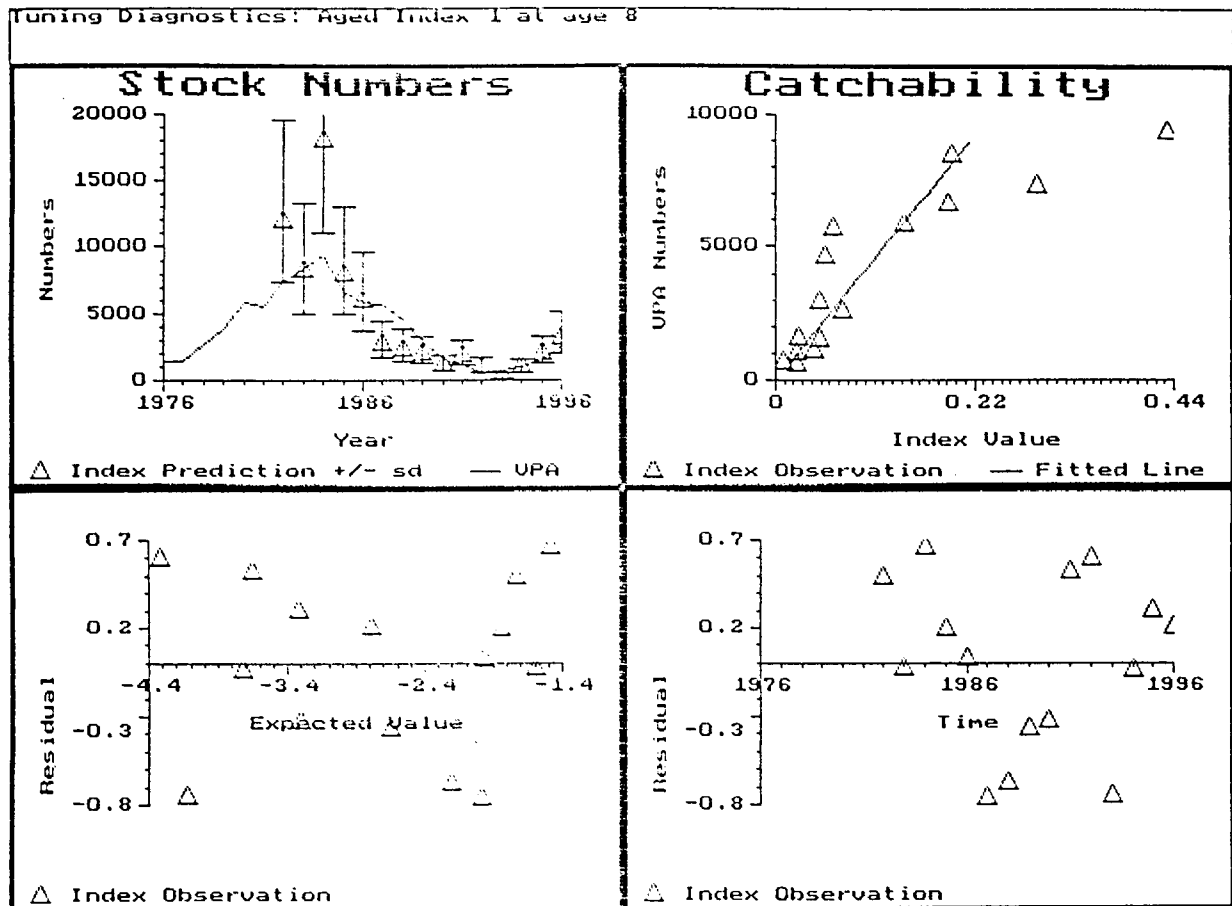


Figure 3.8.1j





**Figure 3.9.1** Cod in DS 25–32. Age group 2 strength estimates by GLM and by scaled arithmetic means (Sparholt *et al.*, 1996). YFS data for 1st quarter.

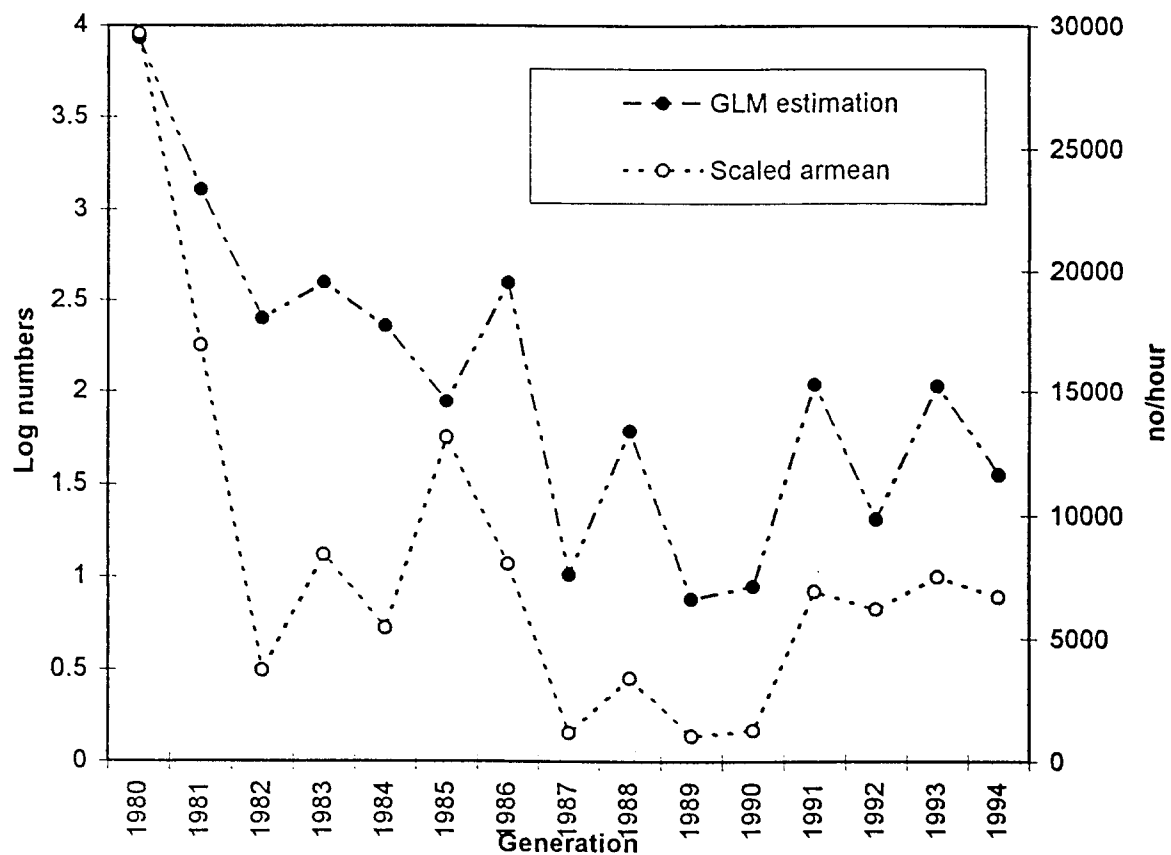
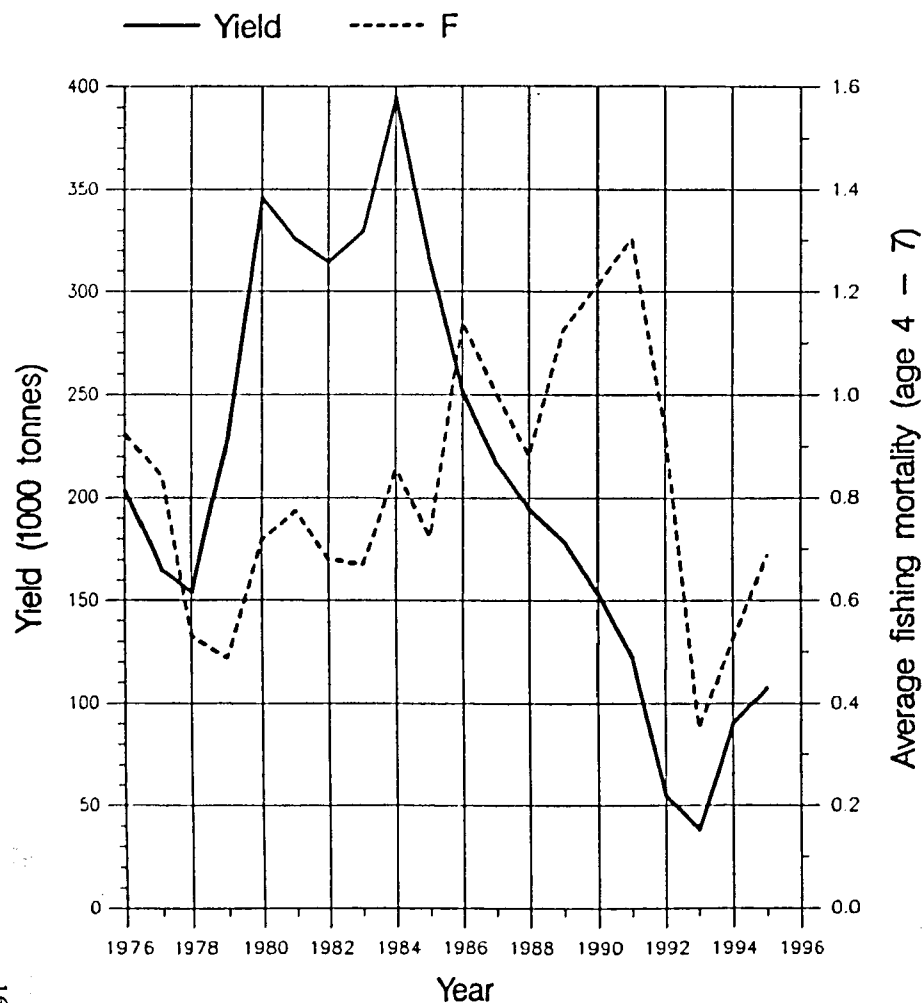


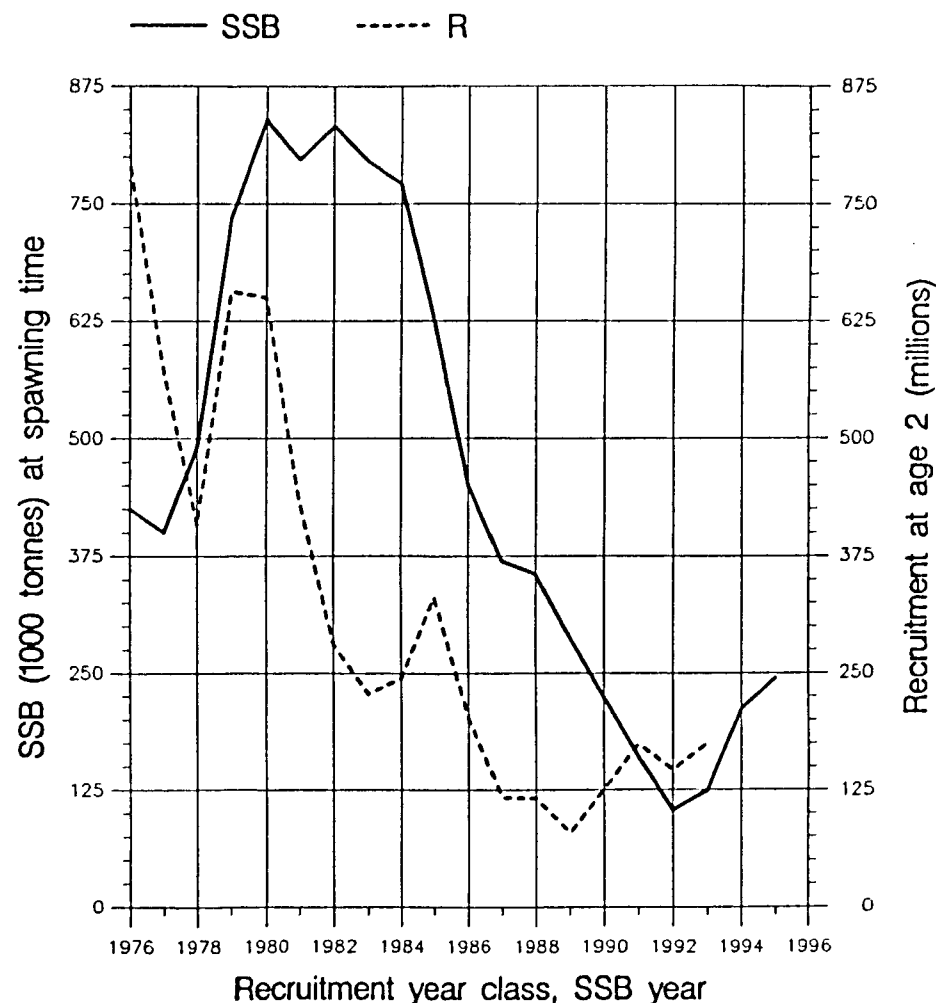
Figure 3.10.1

# Fish Stock Summary Cod in Baltic Fishing Areas 25 to 32 23 - 4 - 1996

Yield and fishing mortality



Spawning stock and recruitment



(run: XSAPAL10)

A

(run: XSAPAL10)

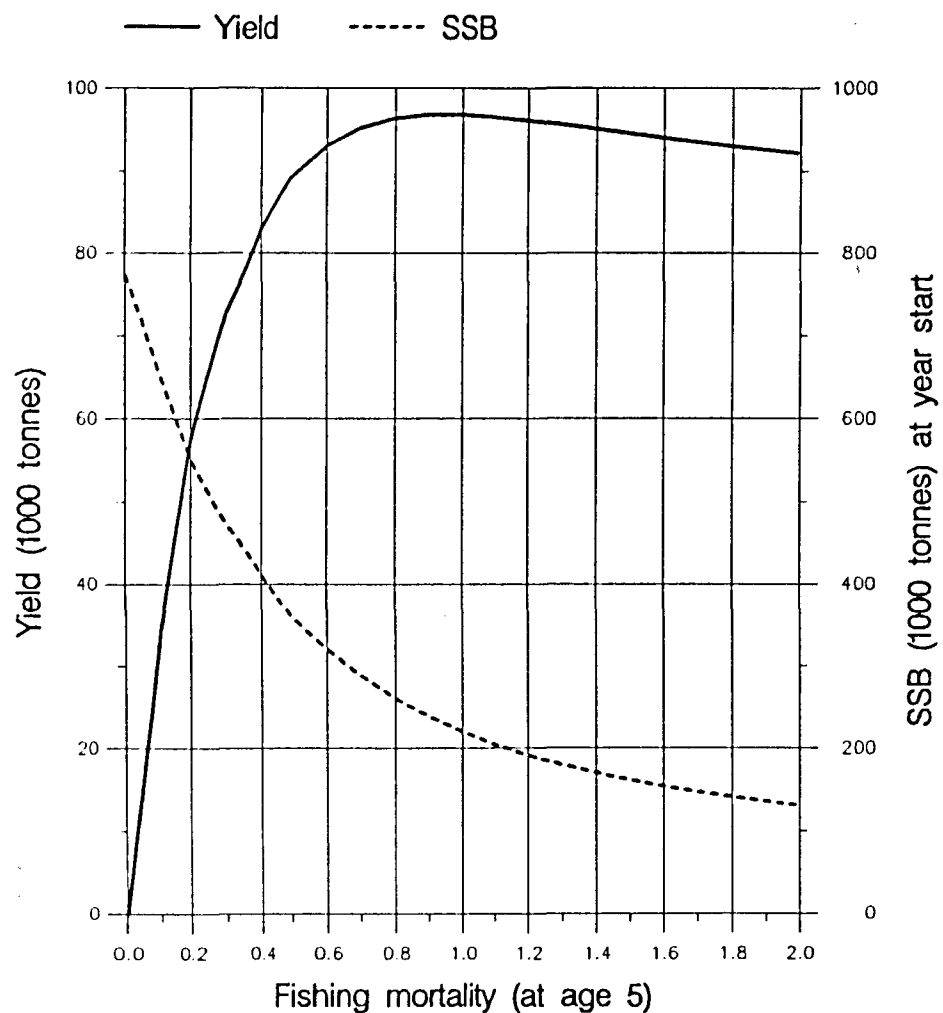
B

# Fish Stock Summary

## Cod in Baltic Fishing Areas 25 to 32

### 25-4-1996

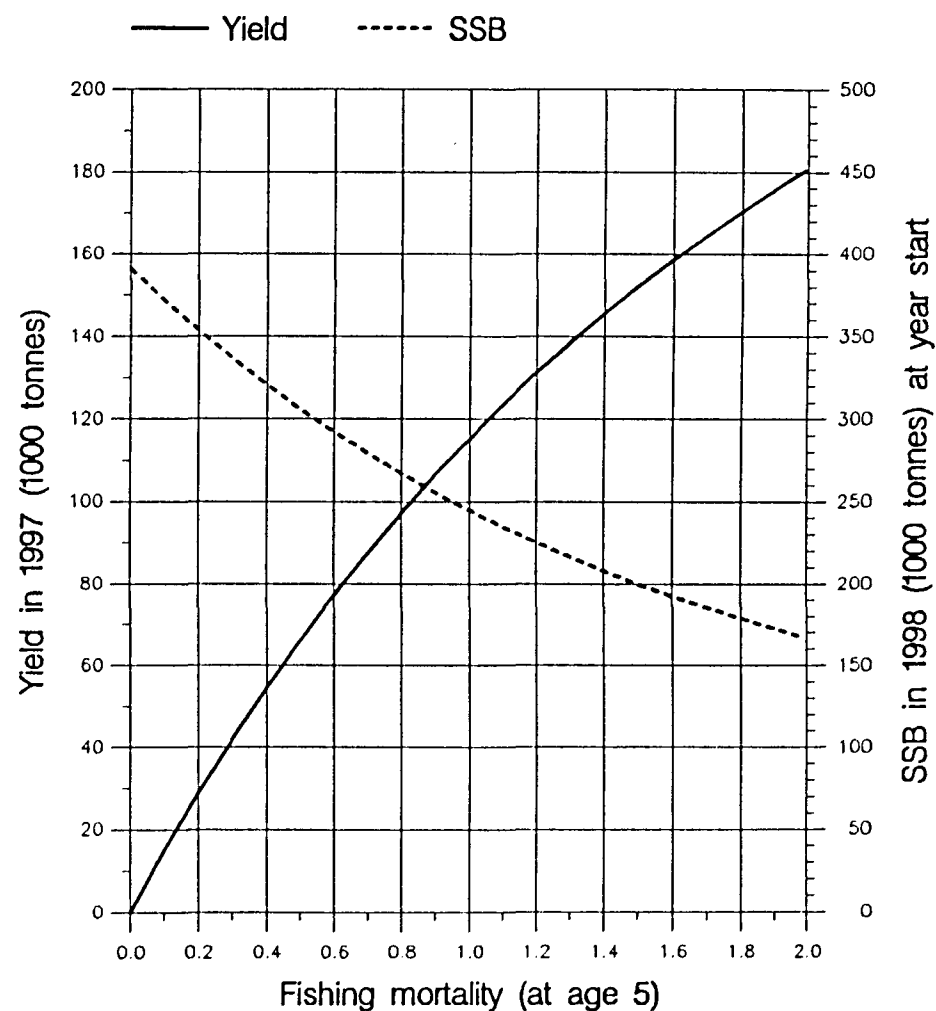
Long term yield and spawning stock biomass



(run: YLDPAL03)

C

Short term yield and spawning stock biomass



(run: MANPAL02)

D

Figure 3.11.1a

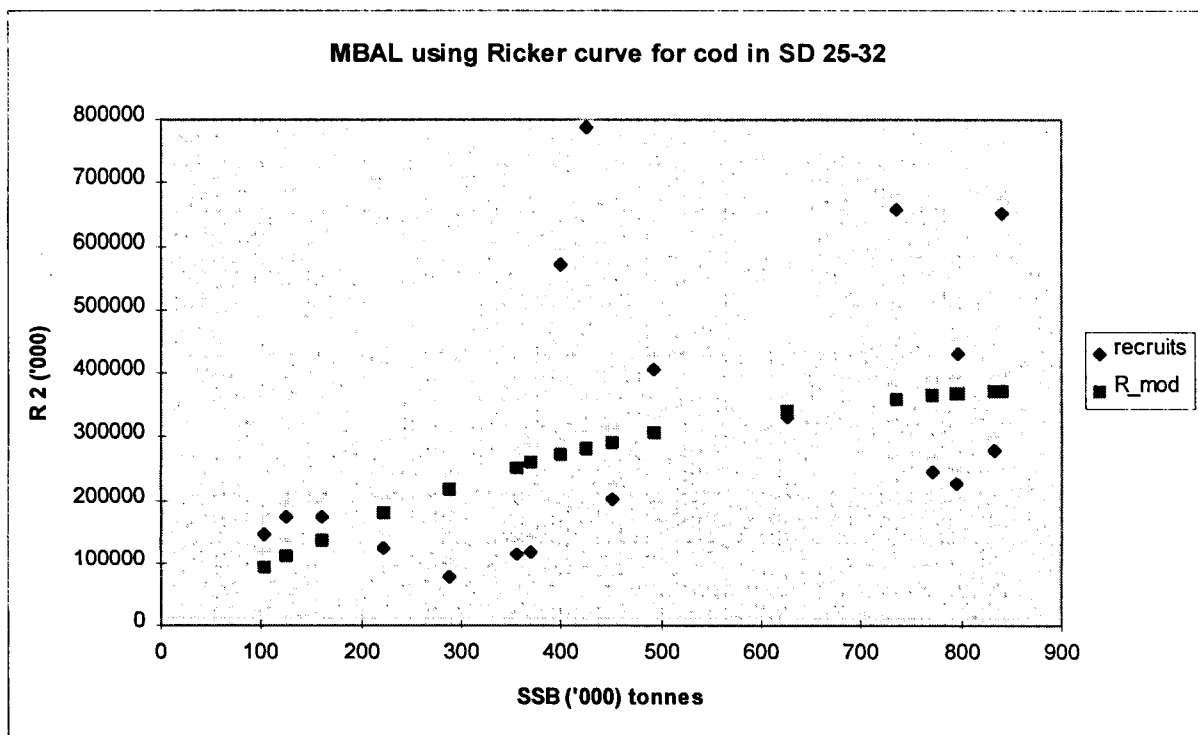


Figure 3.11.1b

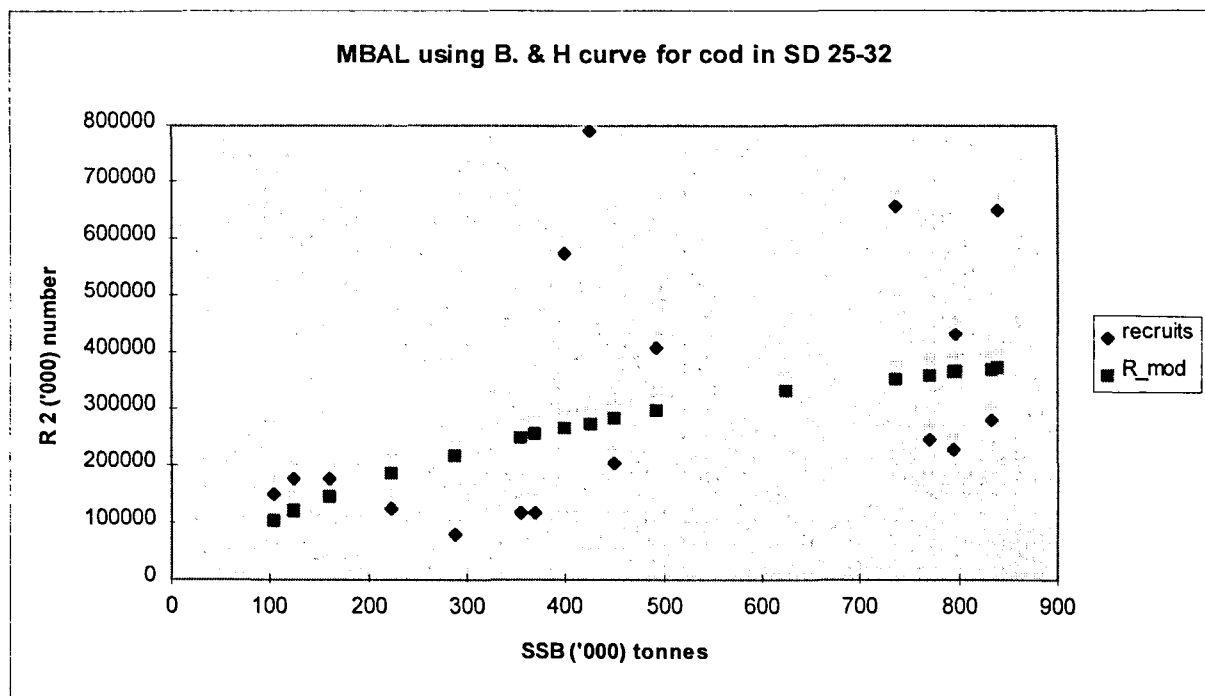


Figure 3.11.2

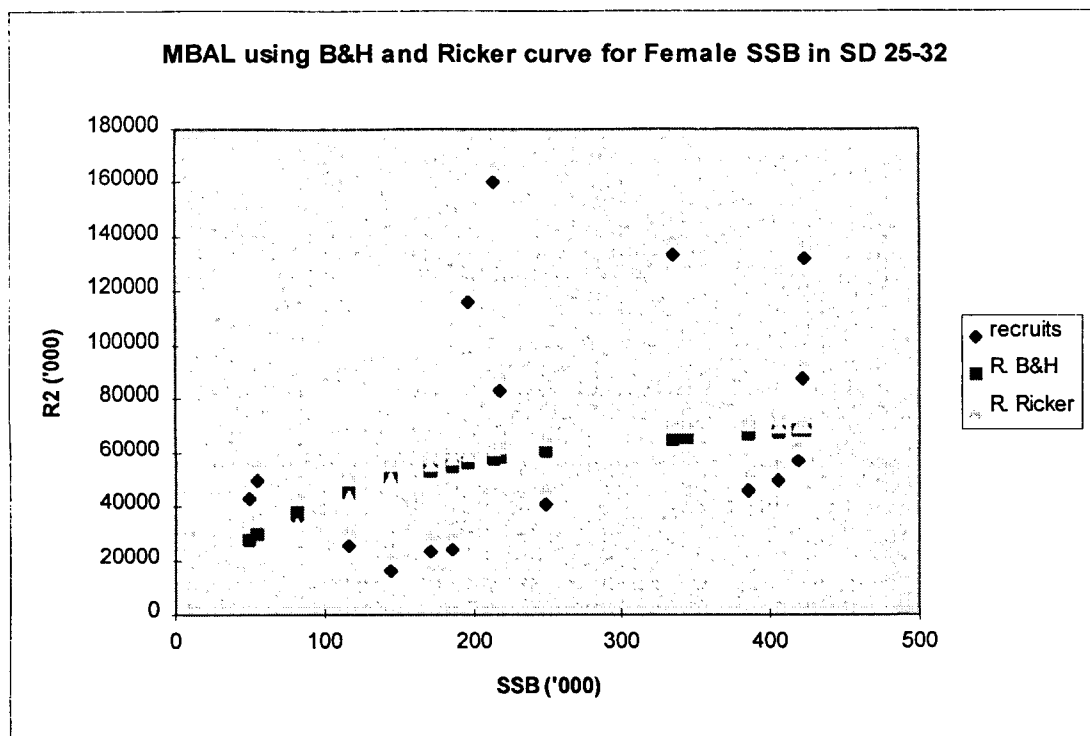
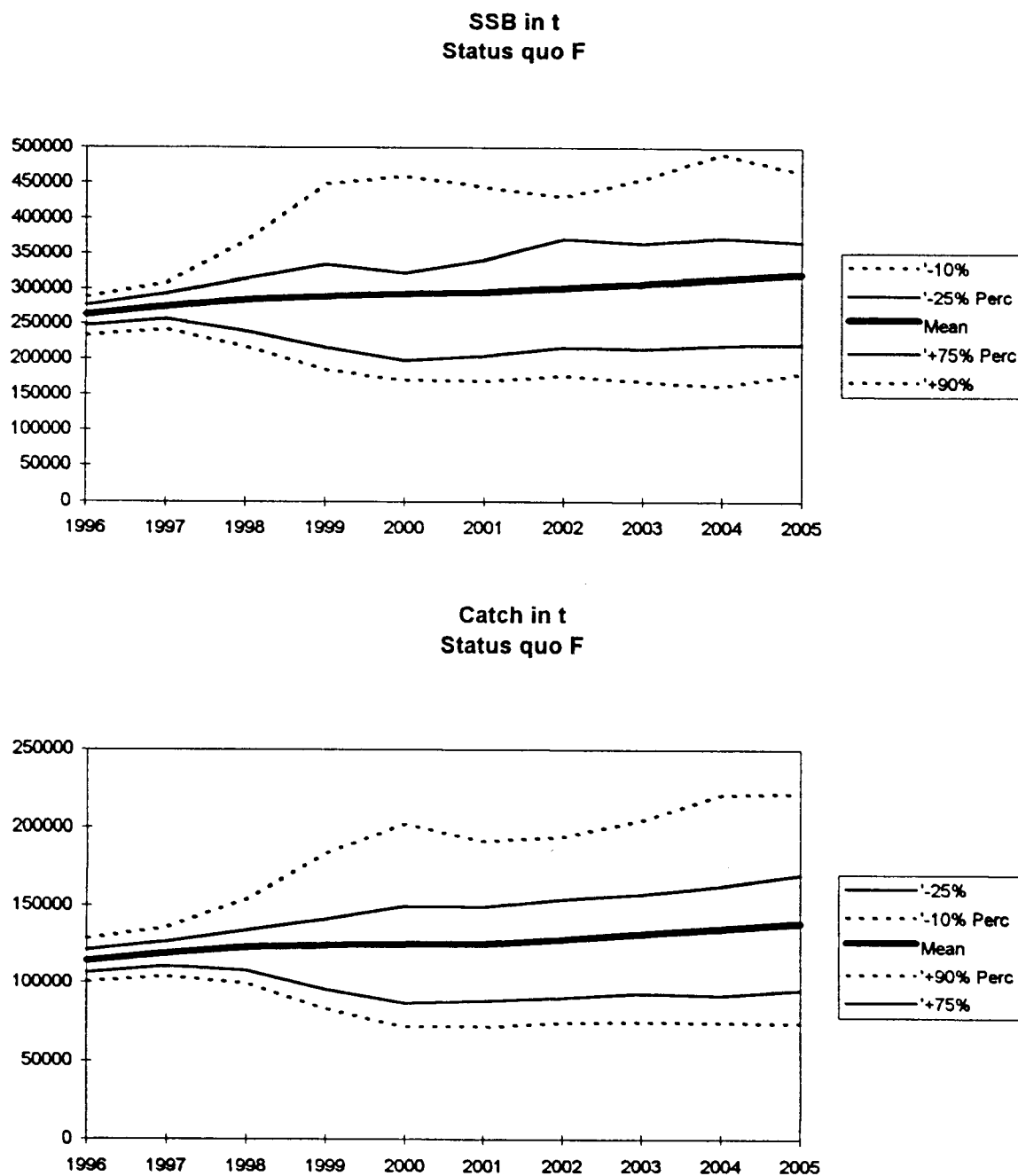


Figure 3.12.1 Medium-term prediction yield and SSB for cod in SD 25–32.



## **4 COD IN THE KATTEGAT**

### **4.1 Changes in Fisheries, Landings, Effort and CPUE**

Three fisheries take significant amounts of cod in Kattegat. A mixed demersal trawl fishery mainly being dependent on sole and cod using mesh sizes between 90 and 110 mm in the cod end, a *Nephrops* fishery with 70 mm mesh size and a gill-net fishery using mesh sizes of 90 mm and above. Overall the effort in Kattegat is estimated to have slightly declined in most recent years. A more detailed description of the fisheries is given in Section 10.

Total landings have been at a low level since 1988 and were reported at about 6,500 tonnes in 1995. The reported landings by country (Table 4.1) remained at the same levels as in 1994. The trends in the reported landings are shown in Figure 4.1.

The catch statistics have in recent years been unreliable as discussed in previous Working Group reports. Especially the catches for the years from 1991 and up to 1994 are believed to be significantly underestimated due to non-reporting and misreporting by area. Control and enforcement measures have been tightened from 1994 and onwards and the 1995 catch data are therefore believed to be more reliable. However, a significant amount of misreporting by area still occurs. The Working Group thus estimates that 1,800 t reported to Skagerrak were actually taken in Kattegat. Moreover, a catch of 200 t reported in Kattegat is estimated to being taken in Sub-division 22.

The Working Group therefore considers that the catch data are of doubtful use for assessment purposes but nevertheless the Working Group has attempted to carry out a standard assessment.

### **4.2 CPUE in Commercial Fisheries**

CPUE data for the two main Swedish fisheries (*Nephrops* trawling and cod bottom trawling) are given in Table 4.2 and Figure 4.2. The series are based on logbook records and start in 1979, representing close to 70% of the total Swedish landings in the Kattegat. Over the years available the CPUE have shown a decrease to less than half the value found in the early 1980s. However, an increase in commercial CPUE is seen in the cod bottom trawl in 1995.

### **4.3 Discards**

Data from a recently initiated EU programme to quantify the level of discarding were available from Danish samplings in the autumn of 1995, where discarding was observed on 3 trips. The recordings indicated that little discarding took place in the gillnet fishery whereas undersized cod were discarded in the human consumption trawl fishery. The restricted sampling effort and the unbalanced coverage over the year do not allow for any reliable estimate of the discarding pattern. Continuation of this project is expected to lead to a better sampling coverage of discards for the Kattegat in coming years.

### **4.4 Age Compositions**

Catch at age information was available from Danish port samplings by quarter and from the Swedish samplings on board commercial vessels in the autumn. The catch in tonnes was available on a quarterly basis by nation. The Swedish catches taken in the second half of the year (380 t) were raised by the Swedish age compositions whereas all other catches were raised by the Danish age compositions. The Danish sampling level appears from Table 4.3. Total catch in numbers by age and year are given in Table 4.4.

### **4.5 Mean Weight at Age**

The mean weights by year and age in the catches are given in Table 4.5. The mean weight in the stock is assumed equal to the mean weight in the catch.

### **4.6 Maturity Ogive**

Maturity at age information was sampled on the R/V "Havfiske" survey in March 1996 but has not yet been worked up. The maturity ogive estimated in 1995 from Sub-division 22 and used in last years assessment is given in Table 4.6.



#### 4.7 Recruitment and Survey Results

IBTS (1st quarter) bottom trawl survey data are available since 1983. Ageing of cod from this survey has been done somewhat unsystematically and therefore a reanalysis was initiated at the 1994 Working Group meeting. The fractions of age 1 and age 2 cod were calculated by numerical separation of the strikingly bi-modal length distribution of the smallest cod. The larger cod were converted to age groups by age-length keys available from the commercial Danish fisheries in the first quarter (Hovgaard, 1995). In general the indices derived by this procedure differ little from the original survey age distributions. However, for 1991 and 1995 the splitting of the length distributions could indicate some errors in the original survey age readings. IBTS surveys for the 2nd, 3rd and 4th quarter were initiated in 1991. Except for the survey covering the 4th quarter in 1995 the CPUE indices from these surveys were available to the Working Group meeting. The various IBTS indices are shown in the XSA tuning input (Table 4.7). The year-class indices from 1982 to 1995 from the IBTS 1st quarter are given in Figure 4.3.

All surveys agree in that the 1994 year class is large. In the IBTS February survey this year class is found at the same size as the 1985 year class which in previous VPAs are estimated as about 18 mill recruits at age 1. The 1995 year class is estimated as a medium to small year class from both the IBTS 1st quarter (1996) and the IBTS 3 quarter (1995).

In the autumn of 1994 Denmark initiated a new bottom trawl survey using the small (20 GT) side trawler R/V "Havfisken". This survey covers both Kattegat and the western Baltic and includes the shallow grounds inaccessible to the larger research vessels R/V "Argos" and R/V "Dana". At present this survey is conducted twice a year (February and November). A time series will be required before these data will be of any use to the cod assessment.

#### 4.8 Commercial Tuning Fleets

CPUE information for the commercial fisheries was extracted from the Danish logbook database. This database provides information on vessel size, fishing gear and mesh size, effort measured as days at sea and catches separated into five size groups (i.e. the market categories) on a trip by trip basis. Different fisheries (defined by gear and mesh size - see Section 10.1) exhibit marked differences in the composition of the size groups (Figure 10.1.2). Catch rates generally increase by vessel size (Figure 10.1.2). The age composition in the catches is derived by linking the catch in each market category with information on age composition by market category.

Three tuning fleets were created from the logbook data: The human consumption fish trawlers (>90 mm mesh size), the *Nephrops* fishery (70 mm mesh size), and the Danish seine fleet. The various gillnet fisheries were not used since only a small part of those vessels are submitting logbook information. CPUE indices were calculated by quarter. To avoid problems connected to annual variations in the size composition of the vessels taking part in the fisheries, an average CPUE for four vessel size categories (12–13m, 14–15 m, 16–17m and 18–19 m) was used. The annual mean CPUE was finally derived by weighting with the quarterly effort. The CPUE of the commercial fleets are given in Table 4.7.

The CPUE from the Swedish fleets (Figure 4.2) are not available on an age disaggregated basis and could therefore not be included in the tunings.

#### 4.9 Catch Curve Analysis

Catch curves for 5 year periods are shown in Figure 4.4. The total mortality rate for age 3 to 7 seems to have been increasing from about 1 per year in the 1970s to about 1.5 in the 1990s.

Catch curve analysis was also conducted on the IBTS 1st quarter abundance indices for individual year classes from 1982 to 1991. The analysis shows that age 1 cod is not fully recruited to the survey (Figure. 4.5.a). The plot shows a considerable noise in the relations which is to be expected due to annual survey variability. Performing regression analysis on the average  $\ln$  (survey indices) using age 2 to age 5 estimates  $Z$  at 1.06 per year (Figure 4.5.b). The plot of the mean survey indices suggests that age 2 to age 6 cod are fully available to the survey. The age 1 mean index is found to be 1.31  $\ln$  units below the regression line. This implies that if total mortality on age 1 cod is equal to the older cod then the age 1 cod is only available by 27%. However, fishing mortality on age 1 is low and total mortality may therefore be expected as less than on the older ages. In that case the availability of age 1 cod will be higher than 27%.

#### 4.10 Extended Survivor Analysis

XSA tuning was carried out using the 4 IBTS series and the 3 commercial fleets. The default F-shrinkage was applied and the natural mortality was set at the conventional value of 0.2 per year.

The run settings, the log residuals, and the basic statistics on the catchabilities are shown in Table 4.8 and the residuals are shown in Figure 4.6. A clear pattern of negative residuals appears for the years 1992–1994 for all the fleets. Moreover, the FBAR (3-5) of 1995 of 1.41 is found to be considerably above the value for the two previous years where it was estimated to be 0.81 and 0.94, respectively (Table 4.8). This seems unrealistic considering the relative stability in effort in the same period. Attempts to exclude some tuning fleets (e.g. by either using the commercial fleets or the IBTS indices) resulted in similar results. The fishing mortalities, the stock numbers and the summary statistics of the stock (Tables 4.9–4.11) are therefore not considered reliable.

The period of large negative residuals coincides with the period for which the data quality is disputed. XSA runs were therefore carried out by raising the catches considerably between 1991 and 1994. The results from such runs could produce a flat level of fishing mortality for the most recent years but the negative residuals in the catchabilities remained similar for the 1992–1994 period. Correcting previous catch figures in a reliable way is however difficult as it may well be that non-reporting has occurred selectively on particular size groups. For instance, both size-grading at sea and the selling of the more valuable larger cod outside the official market system would tend to increase the mortality estimates.

#### **4.11 Estimating Stock Trends and F from the IBTS 4th Q Data**

As an alternative approach it was attempted to estimate the trends in stock and fishing mortalities from the IBTS February survey indices by using the RCCPUE5 analysis (Cook, 1995). The key input parameter for this analysis is the availability of the year classes not fully recruited to the survey gear. The catch curve analysis on the survey indices suggested that only age 1 cod was not fully available (Figure 4.5.b). The lower possible level of availability of age 1 cod was taken to be 0.27 as indicated from the catch curve analysis. However using this value results in an almost flat exploitation pattern. Using values around 0.7 resulted in negative values of F for age 1. The final attempt was therefore conducted using a relative availability of 0.5 for age 1 cod. Mean weight in the catch was taken as the average of the 1990–1995 period and maturity at age was taken from Table 4.6.

The input and the main results are given in Table 4.12. The analysis showed a marked reduction in F since 1993 which is difficult to accept considering the relative stability in effort. Further, scrutinising the exploitation pattern indicated an almost full recruitment from age 2. Compared to the catch curve information from the landings (Figure 4.4) this seems as being rather early. The total stock biomass in 1995 was found at its highest level since the start of the IBTS surveys in 1983. This, however, is entirely caused by the 1994 year class. Comparing SSB between the VPA and the RCCPUE5 analyses indicates a reasonable correspondence except for the last three years (Figure 4.7).

#### **4.12 Conclusions**

Although it has not been possible to carry out an analytical assessment, the available information clearly indicates that the stock is overexploited.

The age composition in the catches and in the IBTS February survey indicates a high level of fishing mortality of more than 1 per year and cod older than age four are rarely seen in the catches from the more recent years. The yield in the 1990s is found to be at a level about half of that experienced in the 1970s (Figure 4.1). The two Swedish CPUE indices (Figure 4.2) which may be taken as indicative for the stock size show a similar decline. Scrutinising the SSB from the VPA for the years insensitive to choice of terminal F's indicate an even more dramatic decline from about 30,000 t in the early 1970s to less than 10,000 t around 1990 (Figure 4.8).

In the present situation the fishery is very dependent on the strength of the incoming year classes. The available IBTS survey information indicates that the 1994 year class is large but the year class has not yet appeared in the commercial catches. The surveys indicate that the 1995 year class is about average. The immediate prospects for the Kattegat cod stock and fisheries will be critically dependent on the strength of the 1994 year class.

**Table 4.1** Cod landings (in tonnes) from the Kattegat. 1971–1995.

Year	Kattegat			Total
	Denmark	Sweden	Gemany <sup>2</sup>	
1971	11,748	3,962	22	15,732
1972	13,451	3,957	34	17,442
1973	14,913	3,850	74	18,837
1974	17,043	4,717	120	21,880
1975	11,749	3,642	94	15,485
1976	12,986	3,242	47	16,725
1977	16,668	3,400	51	20,119
1978	10,293	2,893	204	13,390
1979	11,045	3,763	22	14,830
1980	9,265	4,206	38	13,509
1981	10,693	4,380	284	15,337
1982	9,320	3,087	58	12,465
1983	9,149	3,625	54	12,828
1984	7,590	4,091	205	11,886
1985	9,052	3,640	14	12,706
1986	6,930	2,054	112	9,096
1987	9,396	2,006	89	11,491
1988	4,054	1,359	114	5,527
1989	7,056	1,483	51	8,590
1990	4,715	1,186	35	5,936
1991	4,664	2,006	104	6,834
1992	3,406	2,771	94	6,271
1993	4,464	2,549	157	7,170
1994	3,968	2,836	98	7,802 <sup>3</sup>
1995	3,789	2,704	71	8,164 <sup>4</sup>

<sup>1</sup>Preliminary.

<sup>2</sup>Landings statistics incompletely split on the Kattegat and Skagerrak.

The figures are estimated by the Working Group members.

<sup>3</sup>Including 900 t reported in Skagerrak.

<sup>4</sup>Including 1,600 t misreported by area.

Table 4.2

Catch and effort data for the Swedish cod and Nephrops fisheries in the Kattegat by gear type.

Year	Cod Bottom Trawl				Nephrops Trawl		
	Catch (t)	Effort (hrs)	CPUE (kg/hr)		Catch (t)	Effort (hrs)	CPUE (kg/hr)
1978	1,151		85.6		726		63.3
1979	1,771		144.8		1,142		83.2
1980	1,715	14,866	115.4		972	14,137	68.8
1981	1,750	12,454	140.5		884	13,875	63.7
1982	1,579	10,443	151.2		603	14,270	42.3
1983	2,371	17,321	136.9		485	11,739	41.3
1984	1,829	19,168	95.4		398	13,718	29.0
1985	1,193	14,112	84.5		558	13,090	42.6
1986	933	13,157	70.9		367	16,420	22.4
1987	1,082	14,448	74.9		426	19,421	21.9
1988	720	13,458	53.5		291	16,802	17.3
1989	874	13,508	64.7		355	15,565	22.8
1990	628	13,843	45.4		309	14,211	21.7
1991	1,298	20,271	64.0		261	10,209	25.6
1992	1,577	28,170	56.0		292	11,667	25.0
1993	1,076	24,051	44.7		251	14,929	16.8
1994	1,276	20,143	63.3		279	16,243	17.2
1995	1,378	15,001	91.9		268	9,795	27.4

Table 4.3 Sampling of cod in the Kattegat 1995				
Quarter	Landings in '000 t	Number of sampled	Number of cod measured	Number of cod aged
1	1,616	21	625	625
2	373	12	254	254
3	743	8	166	166
4	1,053	5	165	165
total	3,785	46	1,210	1,210

**Table 4.4 Cod in Kattegat**  
**Catch in numbers ('000) by year and age**

age	1	2	3	4	5	6	7	8+
year								
1971	15049	7937	6936	1918	887	207	30	30
1972	38	3811	6422	2427	809	433	94	38
1973	5	623	2167	3954	2280	780	212	160
1974	591	4250	6943	4543	1538	349	68	31
1975	188	3610	2906	3251	661	429	47	19
1976	166	4431	6983	1835	1039	287	189	52
1977	1	2218	7078	4942	492	376	137	102
1978	88	6015	2551	2100	913	83	99	71
1979	213	3161	6116	991	1039	230	11	47
1980	552	1317	5434	3347	358	380	120	35
1981	328	3918	2378	4026	1388	146	93	78
1982	340	3196	3229	2143	677	435	113	36
1983	653	5194	4770	1221	204	200	56	25
1984	127	4328	4763	1749	281	84	27	19
1985	685	3132	6293	2182	387	75	8	15
1986	430	1764	2901	1414	360	118	12	10
1987	168	7635	2440	892	381	103	10	19
1988	179	1203	2434	610	155	39	15	3
1989	247	3122	1653	1159	169	48	22	10
1990	606	1135	1584	485	330	32	12	8
1991	275	4199	731	352	95	72	1	3
1992	263	2147	3115	147	50	7	11	2
1993	137	2752	1139	1200	31	8	3	8
1994	22	1136	3078	715	329	2	4	8
1995	37	1579	2163	1609	349	170	5	9

**Table 4.5 Cod in Kattegat**  
**Mean weight (Kg) in the catches by year and age**

age	1	2	3	4	5	6	7	8+
year								
1971	0.699	0.88	1.069	1.673	2.518	3.553	5.34	6.635
1972	0.699	0.88	1.069	1.673	2.518	3.553	5.34	6.635
1973	0.699	0.88	1.069	1.673	2.518	3.553	5.34	6.635
1974	0.699	0.88	1.069	1.673	2.518	3.553	5.34	6.635
1975	0.699	0.88	1.069	1.673	2.518	3.553	5.34	6.635
1976	0.699	0.88	1.069	1.673	2.518	3.553	5.34	6.635
1977	0.699	0.88	1.069	1.673	2.518	3.553	5.34	6.635
1978	0.699	0.88	1.17	1.69	2.86	4.12	5.18	6.9
1979	0.708	0.868	1.086	1.89	2.215	3.382	7.314	6.101
1980	0.691	0.893	0.951	1.44	2.478	3.157	3.526	6.903
1981	0.604	0.799	1.123	1.432	2.076	3.532	4.42	4.644
1982	0.6	0.784	1.233	1.391	2.078	2.911	3.698	6.48
1983	0.595	0.752	1.129	1.943	3.348	3.141	5.301	6.325
1984	0.711	0.745	1.133	1.687	2.798	3.022	5.273	7.442
1985	0.606	0.839	0.986	1.614	2.575	4.09	6.847	7.133
1986	0.671	0.705	1.253	1.955	2.956	4.038	7.1	7.29
1987	0.483	0.716	1.118	1.972	2.868	4.2	5.185	8.288
1988	0.541	0.784	1.099	1.792	2.88	4.283	5.852	7.073
1989	0.621	0.921	1.269	2.296	3.856	5.733	5.166	6.527
1990	0.618	0.973	1.584	2.323	3.288	5.383	6.412	10.337
1991	0.578	0.861	1.533	2.986	4.548	4.179	9.127	12.055
1992	0.61	0.707	1.291	2.662	4.048	5.888	7.067	7.895
1993	0.567	0.862	1.583	2.321	4.97	7.566	9.391	8.705
1994	0.549	0.783	1.276	2.652	3.526	7.279	9.793	10.13
1995	0.598	0.799	1.121	1.947	2.404	3.537	9.973	10.708

**Table 4.6** Maturity ogive for cod in  
the Baltic Subdivision 22  
Females from March 1995

Age	% mature
1	0
2	19
3	77
4	80
5+	100



**Table 4.7** Commercial Fleets and IBTS data used for tuning VPA

Cod in the Kattegat (part of Fishing Area IIIa) (run name: XSAHOH08)  
107

FLT01: Fish trawl >90 mm (Catch: Unknown) (Effort: Unknown)

1987 1995

1 1 0.00 1.00

1 7

1	5.99	357.36	233.93	105.80	49.67	10.42	1.08
1	9.80	70.18	274.31	63.56	17.69	4.67	1.10
1	11.38	211.22	117.48	103.79	15.69	4.58	2.51
1	15.86	56.88	122.67	43.57	32.14	3.07	1.08
1	10.98	237.52	52.23	22.48	6.99	6.25	0.11
1	15.37	83.68	185.80	8.19	2.82	0.57	0.54
1	8.29	123.00	49.40	46.36	0.88	0.14	0.05
1	1.21	55.87	117.29	26.26	15.01	0.05	0.19
1	2.64	81.67	108.47	98.72	19.10	7.90	0.09

FLT02: Nephrops trawl (Catch: Unknown) (Effort: Unknown)

1987 1995

1 1 0.00 1.00

1 7

1	3.66	53.34	9.26	1.46	0.55	0.12	0.02
1	3.46	15.08	17.00	2.57	0.55	0.15	0.05
1	3.98	55.95	13.49	4.69	0.55	0.10	0.03
1	12.67	19.43	19.34	3.20	1.87	0.09	0.04
1	9.13	60.10	7.16	2.25	0.49	0.44	0.02
1	4.40	22.10	23.05	1.34	0.23	0.06	0.06
1	2.50	33.45	10.13	7.37	0.10	0.02	0.01
1	0.74	24.84	32.33	4.73	1.83	0.02	0.02
1	0.89	24.85	24.73	19.79	4.09	1.45	0.02

FLT03: Danish Seine (Catch: Unknown) (Effort: Unknown)

1987 1995

1 1 0.00 1.00

1 7

1	8.25	400.15	141.06	38.22	17.14	3.13	0.42
1	8.73	68.27	159.82	27.32	6.57	1.61	0.46
1	5.22	124.08	56.13	38.04	5.46	1.27	0.64
1	6.36	27.12	63.49	21.19	14.60	1.26	0.33
1	6.38	149.92	27.59	8.59	2.37	2.48	0.05
1	5.04	54.11	123.20	4.71	1.39	0.28	0.27
1	4.43	99.52	40.32	38.32	0.72	0.12	0.02
1	0.51	36.04	91.63	19.87	10.61	0.07	0.30
1	0.95	36.42	62.51	49.92	9.72	4.09	0.10

**Table 4.7 (continued)**

**FLT05: IBTS 2nd quarter** (Catch: Unknown) (Effort: Unknown)

1991 1995

1 1 0.25 0.50

1 6

1	8.4	77.8	53.1	1.6	0.3	0.7
1	34.5	11.9	10.7	1.8	0.2	0.2
1	20.9	25.0	4.1	5.3	1.6	0.3
1	20.6	3.9	3.3	1.5	1.0	0.3
1	294.5	12.8	9.6	6.4	0.7	0.7

**FLT06: IBTS 3rd quarter** (Catch: Unknown) (Effort: Unknown)

1991 1995

1 1 0.50 0.75

1 6

1	14.4	23.6	11.1	0.9	0.0	0.1
1	68.2	5.3	2.7	0.5	0.0	0.1
1	16.0	5.7	1.6	0.9	0.4	0.0
1	169.6	2.5	1.6	0.3	0.2	0.0
1	259.7	11.7	0.7	0.5	0.1	0.0

**FLT07: IBTS 4th quarter** (Catch: Unknown) (Effort: Unknown)

1991 1995

1 1 0.75 1.00

1 6

1	9.1	5.9	0.3	0.0	0.0	0.0
1	59.6	6.8	7.6	1.1	0.0	0.0
1	24.1	6.3	1.6	1.6	0.0	0.0
1	456.7	11.0	12.2	2.4	1.6	0.4
1	0.0	0.0	0.0	0.0	0.0	0.0

**FLT08: Revised IBTS Feb** (Catch: Number) (Effort: Unknown)

1983 1995

1 1 0.17 0.25

1 6

1	77.13	150.44	29.95	10.81	2.55	1.67
1	57.42	97.75	37.77	16.02	5.91	3.55
1	6.93	107.42	58.23	14.89	2.89	1.13
1	210.24	47.65	16.17	11.13	3.73	0.71
1	1.05	372.78	52.17	7.34	2.28	0.76
1	80.77	20.15	58.55	12.64	3.45	0.95
1	11.84	43.32	17.14	20.38	3.19	1.06
1	97.67	12.21	14.86	6.02	5.02	0.28
1	40.73	131.08	11.34	4.03	3.08	1.19
1	54.04	11.65	27.82	1.74	0.39	0.16
1	40.17	32.12	14.65	15.42	0.31	0.03
1	19.53	9.23	9.30	2.64	2.10	0.01
1	292.70	2.00	25.56	17.54	14.18	2.05

Table 4.8 Tuning Diagnostics, Cod in Kattegat

g:\acfm\wgbfas\cod-kat\tables96\tab4-8

Lowestoft VPA Version 3.1

19-Apr-96 15:18:43

## Extended Survivors Analysis

Cod Kattegat (run: XSAHOH08/X08)

CPUE data from file /users/fish/ifad/ifapwork/wgbfas/cod\_kat/FLEET.X08

Catch data for 25 years. 1971 to 1995. Ages 1 to 8.

Fleet,	First, Last, First, Last, Alpha, Beta
	year, year, age, age
FLT01: Fish trawl	, 1987, 1995, 1, 7, .000, 1.000
FLT02: Neprops trawl	, 1987, 1995, 1, 7, .000, 1.000
FLT03: Danish Seine	, 1987, 1995, 1, 7, .000, 1.000
FLT05: IBTS 2nd quar	, 1991, 1995, 1, 6, .250, .500
FLT06: IBTS 3rd quar	, 1991, 1995, 1, 6, .500, .750
FLT07: IBTS 4th quar	, 1991, 1995, 1, 6, .750, 1.000
FLT08: Revised IBTS	, 1983, 1995, 1, 6, .170, .250

## 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 &gt;= 5

## 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 17 iterations

## Regression weights

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

## Fishing mortalities

Age,	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995
1,	.026,	.033,	.025,	.083,	.045,	.041,	.022,	.023,	.006,	.018
2,	.346,	.869,	.343,	.791,	.670,	.487,	.505,	.335,	.266,	.665
3,	1.103,	1.195,	.775,	1.158,	1.376,	1.387,	.841,	.555,	.786,	1.231
4,	1.236,	1.409,	1.217,	1.144,	1.524,	1.626,	1.336,	.970,	.843,	1.438
5,	1.168,	1.630,	1.069,	1.630,	1.361,	1.961,	1.234,	1.282,	.795,	1.552
6,	2.098,	1.489,	.720,	1.283,	2.976,	1.483,	.798,	.646,	.230,	1.457
7,	1.202,	1.346,	.944,	1.296,	1.593,	1.238,	1.010,	1.020,	.807,	1.553

Taper weighted geometric mean of the VPA populations:

, 8.13E+03, 7.46E+03, 4.22E+03, 1.37E+03, 3.17E+02, 7.52E+01, 1.63E+01,

Standard error of the weighted Log(VPA populations) :

, .6794, .5899, .6323, .8422, .9845, 1.2033, 1.2273,

1

Table 4.8 continued Log catchability residuals.

Fleet : FLT01: Fish trawl >

Age	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995
1	99.99,	-.07,	.10,	1.12,	-.07,	.26,	.03,	.10,	-1.41,	.02
2	99.99,	.46,	-.24,	.73,	.27,	.07,	-.26,	-.53,	-.67,	.29
3	99.99,	.59,	.33,	.26,	.52,	.44,	-.23,	-.96,	-.74,	-.03
4	99.99,	.70,	.42,	.21,	.50,	.22,	-.11,	-.79,	-.98,	.06
5	99.99,	.84,	.29,	.50,	.37,	.45,	-.27,	-.92,	-.92,	-.08
6	99.99,	.50,	-.05,	.29,	1.12,	.34,	-.33,	-2.08,	-2.75,	-.30
7	99.99,	.46,	-.27,	.48,	.44,	.40,	-.61,	-1.68,	-.86,	-1.19

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,	-6.6872,	-3.6753,	-2.7807,	-2.5099,	-2.4133,	-2.4133,
-2.4133,						
S.E(Log q),	.6572,	.4716,	.5656,	.5737,	.6279,	1.3472,
.9024,						

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,	1.04,	-.092,	6.60,	.45,	9,	.73,	-6.69,
2,	1.05,	-.158,	3.40,	.57,	9,	.53,	-3.68,
3,	1.77,	-1.213,	-1.33,	.27,	9,	.97,	-2.78,
4,	1.20,	-.598,	1.64,	.58,	9,	.72,	-2.51,
5,	.84,	.775,	2.90,	.78,	9,	.54,	-2.41,
6,	.59,	2.009,	3.27,	.78,	9,	.63,	-2.82,
7,	.83,	.616,	2.69,	.68,	9,	.72,	-2.76,

1

Table 4.8 continued

Fleet : FLT02: Neprops trawl

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	99.99	.22	-.15	.86	.49	.86	-.44	-.32	-1.12	-.28
2	99.99	-.14	-.48	.71	.50	.00	-.29	-.53	-.18	.41
3	99.99	-.62	-.44	.11	.69	.47	-.30	-.53	-.02	.51
4	99.99	-1.14	-.34	-.44	.33	.36	.52	-.19	-.25	.89
5	99.99	-.92	-.44	-.11	.27	.53	-.04	-.35	-.28	1.12
6	99.99	-1.22	-.74	-.79	.33	.43	.16	-1.28	-.92	.75
7	99.99	-.78	-.62	-1.20	-.11	1.44	-.06	-.54	-.37	.05

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,	-7.4712,	-4.9776,	-4.7953,	-4.9543,	-5.1580,	-5.1580,
-5.1580,						
S.E(Log q),	.6632,	.4426,	.4871,	.6041,	.5972,	.8657,
.7847,						

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	.88	.319	7.62	.53	9	.62	-7.47
2	1.53	-1.275	2.99	.47	9	.65	-4.98
3	1.93	-1.681	1.73	.33	9	.84	-4.80
4	1.31	-.831	4.35	.53	9	.81	-4.95
5	.95	.206	5.17	.74	9	.61	-5.16
6	.81	.886	5.20	.77	9	.65	-5.50
7	2.64	-3.397	10.34	.40	9	1.27	-5.38

1

Table 4.8 continued

Fleet : FLT03: Danish Seine

Age	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995
1	.99.99,	.90,	.64,	1.00,	-.33,	.37,	-.43,	.12,	-1.62,	-.34
2	.99.99,	.98,	.13,	.61,	-.07,	.02,	-.29,	-.34,	-.70,	-.11
3	.99.99,	.58,	.28,	.02,	.35,	.30,	-.14,	-.66,	-.49,	-.08
4	.99.99,	.36,	.26,	-.11,	.46,	-.06,	.02,	-.30,	-.58,	.06
5	.99.99,	.53,	.05,	.20,	.34,	.12,	-.23,	-.37,	-.51,	.00
6	.99.99,	.05,	-.36,	-.24,	.98,	.17,	-.29,	-1.48,	-1.66,	-.21
7	.99.99,	.27,	-.39,	-.13,	.01,	.36,	-.55,	-1.84,	.35,	-.33

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,	-7.3401,	-4.0814,	-3.2760,	-3.1924,	-3.1684,	-3.1684,
-3.1684,						
S.E(Log q),	.8258,	.4946,	.4104,	.3274,	.3325,	.9057,
.7507,						

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,	1.03,	-.064,	7.29,	.35,	9,	.92,	-7.34,
2,	.78,	.907,	5.13,	.71,	9,	.39,	-4.08,
3,	1.35,	-.952,	1.60,	.54,	9,	.56,	-3.28,
4,	1.12,	-.692,	2.74,	.83,	9,	.38,	-3.19,
5,	.89,	.930,	3.41,	.92,	9,	.30,	-3.17,
6,	.72,	1.594,	3.63,	.83,	9,	.54,	-3.52,
7,	1.01,	-.030,	3.44,	.65,	9,	.76,	-3.43,

1

Table 4.8 Continued

Fleet : FLT05: IBTS 2nd quar

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	99.99	99.99	99.99	99.99	99.99	-1.62	-.77	-.59	-.19	3.13
2	99.99	99.99	99.99	99.99	99.99	1.01	-.16	-.06	-1.26	.48
3	99.99	99.99	99.99	99.99	99.99	3.03	-.50	-.85	-1.73	.12
4	99.99	99.99	99.99	99.99	99.99	.28	1.08	-.25	-1.12	.03
5	99.99	99.99	99.99	99.99	99.99	-.11	-.33	2.26	-1.02	-.80
6	99.99	99.99	99.99	99.99	99.99	.74	1.22	1.29	1.68	-.14
7	No data for this fleet at this age									

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

Age	1	2	3	4	5	6
Mean Log q	-5.0994	-5.7979	-5.4488	-5.3174	-5.1020	-5.1020
S.E(Log q)	1.8327	.8472	1.8058	.8032	1.3207	1.2817

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	-.75	-2.637	11.35	.43	5	.87	-5.10
2	.65	.587	6.87	.48	5	.60	-5.80
3	-.77	-3.700	10.16	.60	5	.68	-5.45
4	2.30	-1.785	3.33	.39	5	1.48	-5.32
5	11.17	-2.274	4.66	.02	5	10.30	-5.10
6	1.96	-5.691	4.65	.92	5	.46	-4.14

1

Table 4.8 continued

Fleet : FLT06: IBTS 3rd quar

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	99.99	99.99	99.99	99.99	99.99	-1.66	-.68	-1.44	1.33	2.41
2	99.99	99.99	99.99	99.99	99.99	.63	-.15	-.77	-.95	1.25
3	99.99	99.99	99.99	99.99	99.99	3.01	-.46	-.45	-1.05	-.99
4	99.99	99.99	99.99	99.99	99.99	1.36	1.39	-.52	-1.27	-.91
5	99.99	99.99	99.99	99.99	99.99	99.99	99.99	2.40	-1.23	-1.16
6	99.99	99.99	99.99	99.99	99.99	.36	1.93	99.99	99.99	99.99
7	No data for this fleet at this age									

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

Age	1	2	3	4	5	6
Mean Log q,	-4.4564,	-6.4357,	-6.6041,	-6.5200,	-6.2519,	-6.2519,
S.E(Log q),	1.7983,	.9330,	1.6933,	1.2745,	2.0742,	1.9834,

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	-.82	-2.408	12.11	.37	5	.99	-4.46
2	2.21	-.532	3.53	.06	5	2.28	-6.44
3	-.91	-3.239	9.48	.49	5	.84	-6.60
4	-8.97	-3.427	9.83	.04	5	5.93	-6.52
5	-2.31	-11.500	3.82	.92	3	.59	-6.25
6	.00	.000	.00	.00	0	.00	.00

1



Table 4.8 Continued

Fleet : FLT07: IBTS 4th quar

Age	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1	99.99	99.99	99.99	99.99	99.99	-1.72	-.41	-.63	2.71	99.99
2	99.99	99.99	99.99	99.99	99.99	-.54	.32	-.49	.70	99.99
3	99.99	99.99	99.99	99.99	99.99	-.60	.43	-.66	.82	99.99
4	99.99	99.99	99.99	99.99	99.99	99.99	1.24	-.98	-.25	99.99
5	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
6	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
7	No data for this fleet at this age									

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

Age	1	2	3	4	5	6
Mean Log q	-4.8031	-6.4814	-6.2010	-5.1994	.0000	.0000
S.E(Log q)	1.9099	.6103	.7459	1.1287	.0000	.0000

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	-.61	-1.135	11.43	.20	4	1.12	-4.80
2	-2.07	-8.113	14.17	.78	4	.26	-6.48
3	.57	2.108	7.02	.92	4	.29	-6.20
4	13.47	-6.664	-14.38	.22	3	3.18	-5.20
5	.00	.000	.00	.00	0	.00	.00
6	.00	.000	.00	.00	0	.00	.00

1

Table 4.8 Continued

Fleet : FLT08: Revised IBTS (IBTS 1st Quarter)

Age	1983,	1984,	1985
1	-.32,	-.03,	-1.87
2	.68,	.25,	.94
3	-.50,	-.35,	.11
4	-.15,	-.10,	-.29
5	-.30,	.38,	-.66
6	-.32,	1.43,	.21
7	No data for this fleet at this age		

Age	1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995
1	.82,	-3.33,	.70,	-.37,	.23,	.05,	-.23,	.16,	-.14,	3.22
2	.44,	1.83,	-.05,	.49,	.10,	.89,	-.83,	-.43,	-1.00,	-2.05
3	-.51,	.90,	.67,	.15,	.18,	.69,	-.25,	-.24,	-1.39,	.33
4	-.28,	-.14,	.67,	.46,	.33,	.30,	.19,	.02,	-1.34,	.16
5	-.36,	-.66,	.34,	.49,	.14,	1.17,	-.60,	-.32,	-1.15,	1.22
6	-.47,	-.52,	.11,	.47,	.17,	.29,	.13,	-1.86,	-2.50,	-.04
7	No data for this fleet at this age									

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

Age	1,	2,	3,	4,	5,	6
Mean Log q,	-5.2323,	-5.2650,	-4.9102,	-4.7053,	-4.3954,	-4.3954,
S.E(Log q),	1.5168,	1.0382,	.6421,	.5279,	.7622,	1.0783,

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,	2.40,	-.788,	.07,	.03,	13,	3.71,	-5.23,
2,	.49,	2.202,	7.11,	.67,	13,	.43,	-5.27,
3,	2.07,	-1.727,	1.30,	.22,	13,	1.21,	-4.91,
4,	1.23,	-.875,	4.15,	.62,	13,	.66,	-4.71,
5,	1.10,	-.335,	4.27,	.54,	13,	.88,	-4.40,
6,	.66,	1.986,	4.50,	.79,	13,	.60,	-4.69,

1

Tables 4.9 Cod in Kattegat Fisheries mortalities

G:\acfm\wgbfas\cod\_Kat\tables96\tab9-11

Run title : Cod Kattegat (run: XSAHOH08/X08)

At 19-Apr-96 15:19:01

Terminal Fs derived using XSA (With F shrinkage)

Table 8		Fishing mortality (F) at age									
YEAR,		1971,	1972,	1973,	1974,	1975,					
AGE											
1,		.5803,	.0018,	.0004,	.0214,	.0079,					
2,		.3574,	.2788,	.0370,	.4522,	.1761,					
3,		.6729,	.5527,	.2527,	.7183,	.6491,					
4,		.5962,	.5280,	.8094,	1.3321,	.9189,					
5,		.6123,	.5447,	1.6002,	.8972,	.6844,					
6,		.5519,	.7004,	1.9159,	1.3441,	.6830,					
7,		.5628,	.5251,	.9332,	.9593,	.6278,					
+gp,		.5628,	.5251,	.9332,	.9593,	.6278,					
0	FBAR 3- 5,	.6271,	.5418,	.8874,	.9825,	.7508,					
YEAR,		1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,
AGE											
1,		.0164,	.0000,	.0041,	.0215,	.0425,	.0210,	.0181,	.0351,	.0122,	.0888,
2,		.2594,	.3140,	.3159,	.1981,	.1797,	.4723,	.2916,	.4175,	.3408,	.4640,
3,		.6070,	.8626,	.7304,	.6186,	.6161,	.5693,	.9355,	.9602,	.8683,	1.2769,
4,		1.2199,	1.2794,	.6856,	.7143,	.8497,	1.4730,	1.8596,	1.2558,	1.2802,	1.4860,
5,		.8868,	1.5215,	.8804,	.9044,	.6164,	1.1336,	1.1731,	.9950,	1.2231,	1.2106,
6,		.7362,	.9967,	1.3373,	.5700,	1.0695,	.5525,	1.6425,	1.6368,	1.9478,	1.5216,
7,		.7492,	1.0061,	.7979,	.6063,	.6724,	.8489,	1.1949,	1.0653,	1.1469,	1.2022,
+gp,		.7492,	1.0061,	.7979,	.6063,	.6724,	.8489,	1.1949,	1.0653,	1.1469,	1.2022,
0	FBAR 3- 5,	.9046,	1.2211,	.7655,	.7458,	.6941,	1.0587,	1.3227,	1.0703,	1.1239,	1.3245,

Table 8		Fishing mortality (F) at age										
YEAR,		1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	FBAR 93-95
AGE												
	1,	.0264,	.0326,	.0253,	.0834,	.0446,	.0408,	.0220,	.0228,	.0055,	.0180,	.0154,
	2,	.3456,	.8694,	.3426,	.7913,	.6696,	.4873,	.5054,	.3353,	.2658,	.6651,	.4221,
	3,	1.1027,	1.1954,	.7754,	1.1577,	1.3762,	1.3867,	.8415,	.5554,	.7859,	1.2314,	.8575,
	4,	1.2364,	1.4093,	1.2167,	1.1437,	1.5243,	1.6264,	1.3364,	.9701,	.8425,	1.4378,	1.0835,
	5,	1.1682,	1.6302,	1.0686,	1.6299,	1.3612,	1.9614,	1.2337,	1.2822,	.7954,	1.5525,	1.2100,
	6,	2.0977,	1.4894,	.7199,	1.2835,	2.9756,	1.4831,	.7981,	.6456,	.2297,	1.4570,	.7774,
	7,	1.2025,	1.3464,	.9438,	1.2961,	1.5932,	1.2379,	1.0098,	1.0198,	.8074,	1.5535,	1.1269,
	+gp,	1.2025,	1.3464,	.9438,	1.2961,	1.5932,	1.2379,	1.0098,	1.0198,	.8074,	1.5535,	
0	FBAR 3- 5,	1.1691,	1.4116,	1.0203,	1.3104,	1.4206,	1.6581,	1.1372,	.9359,	.8079,	1.4072,	
1												

**Table 4.10 Cod in Kattegat. Stock Numbers**

Run title : Cod Kattegat (run: XSAH08/X08)

At 19-Apr-96 15:19:01

Terminal Fs derived using XSA (With F shrinkage)

Table 10		Stock number at age (start of year)					Numbers*10**-3					
YEAR,		1971,	1972,	1973,	1974,	1975,						
AGE												
	1,	37778,	23223,	15777,	30827,	26381,						
	2,	29189,	17313,	18979,	12913,	24704,						
	3,	15651,	16716,	10726,	14975,	6726,						
	4,	4720,	6538,	7875,	6821,	5978,						
	5,	2141,	2129,	3157,	2870,	1474,						
	6,	539,	950,	1011,	522,	958,						
	7,	77,	254,	386,	122,	111,						
	+gp,	76,	102,	287,	55,	44,						
0	TOTAL,	90171,	67225,	58198,	69104,	66378,						

Table 10		Stock number at age (start of year)					Numbers*10**-3					
YEAR,		1976,	1977,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	
AGE												
	1,	11293,	29978,	23842,	11045,	14661,	17419,	20919,	20952,	11528,	8906,	
	2,	21429,	9096,	24543,	19440,	8850,	11504,	13965,	16819,	16563,	9323,	
	3,	16960,	13535,	5440,	14652,	13056,	6054,	5873,	8541,	9071,	9645,	
	4,	2878,	7567,	4677,	2146,	6462,	5773,	2805,	1887,	2677,	3117,	
	5,	1953,	696,	1724,	1929,	860,	2262,	1083,	358,	440,	609,	
	6,	609,	659,	124,	585,	639,	380,	596,	274,	108,	106,	
	7,	396,	239,	199,	27,	271,	180,	179,	94,	44,	13,	
	+gp,	107,	175,	141,	113,	78,	148,	56,	41,	30,	23,	
0	TOTAL,	55624,	61944,	60690,	49937,	44878,	43720,	45477,	48968,	40461,	31742,	

Table 10		Stock number at age (start of year)					Numbers*10**-3							
YEAR,		1986,	1987,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	GMST 71-93	AMST 71-93
AGE														
	1,	18220,	5783,	7906,	3412,	15365,	7609,	13329,	6721,	4412,	2299,	0,	14247,	16647,
	2,	6672,	14528,	4583,	6311,	2570,	12032,	5981,	10675,	5379,	3592,	1848,	11932,	13825,
	3,	4799,	3867,	4986,	2664,	2342,	1077,	6051,	2954,	6250,	3376,	1512,	6904,	8537,
	4,	2202,	1305,	958,	1880,	685,	484,	220,	2136,	1388,	2332,	807,	2578,	3556,
	5,	577,	524,	261,	232,	490,	122,	78,	47,	663,	489,	453,	694,	1131,
	6,	149,	147,	84,	73,	37,	103,	14,	19,	11,	245,	85,	215,	378,
	7,	19,	15,	27,	33,	17,	2,	19,	5,	8,	7,	47,	56,	119,
	+gp,	15,	28,	5,	15,	11,	5,	3,	14,	16,	12,	3,		
0	TOTAL,	32654,	26196,	18810,	14620,	21517,	21433,	25696,	22571,	18126,	12352,	4756,		
1														

**Table 4.11 Cod in Kattegat. Stock Summary**

Run title : Cod Kattegat (run: XSAHQH08/X08)

At 19-Apr-96 15:19:01

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,
1971,	37778,	84944,	32305,	15732,	.4870,		.6271,
1972,	23223,	71045,	36175,	17442,	.4822,		.5418,
1973,	15777,	67876,	38047,	18837,	.4951,		.8874,
1974,	30827,	70424,	33707,	21880,	.6491,		.9825,
1975,	26381,	65377,	25674,	15485,	.6031,		.7508,
1976,	11293,	59604,	31303,	16275,	.5199,		.9046,
1977,	29978,	62612,	29314,	20119,	.6863,		1.2211,
1978,	23842,	59976,	22771,	13390,	.5880,		.7655,
1979,	11045,	51798,	25839,	14830,	.5739,		.7458,
1980,	14661,	45399,	24150,	13509,	.5594,		.6941,
1981,	17419,	42300,	21116,	15337,	.7263,		1.0587,
1982,	20919,	39654,	15789,	12465,	.7895,		1.3227,
1983,	20952,	41246,	15583,	12828,	.8232,		1.0703,
1984,	11528,	37343,	15884,	11886,	.7483,		1.1239,
1985,	8906,	30014,	15088,	12706,	.8421,		1.3245,
1986,	18220,	29803,	11523,	9096,	.7894,		1.1691,
1987,	5783,	22517,	9789,	11491,	1.1738,		1.4116,
1988,	7906,	16374,	7583,	5527,	.7289,		1.0203,
1989,	3412,	17214,	8747,	8590,	.9821,		1.3104,
1990,	15365,	19329,	6637,	5936,	.8944,		1.4206,
1991,	7609,	18909,	5451,	6834,	1.2536,		1.6581,
1992,	13329,	21318,	7849,	6271,	.7990,		1.1372,
1993,	6721,	23189,	9858,	7013,	.7114,		.9359,
1994,	4412,	20942,	12538,	7802,	.6223,		.8079,
1995,	2299,	14813,	9336,	8165,	.8746,		1.4072,
Arith.							
Mean	15583,	41361,	18882,	12378,	.7361,		1.0520,
0 Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),			
1							

**Table 4.12** Analysis of RCCPUE5 for cod in Kattegat g:\acfm\wgbfar\cod\_kat\tables96\tab4-12.wp4

Source data

Age	M	Prop.mat.	cat.wt	stk.wt
1	.20	.00	.5900	.5900
2	.20	.19	.8300	.8300
3	.20	.77	1.4000	1.4000
4	.20	.80	2.4800	2.4800
5	.20	1.00	3.8000	3.8000
6	.20	1.00	5.6400	5.6400
7	.20	1.00	8.6300	8.6300

Abundance index data

Age	1983	1984	1985	1986	1987	1988
1	77.1	57.4	17.8	194.6	6.7	78.2
2	150.4	97.8	91.3	63.2	413.0	22.8
3	30.0	37.8	67.9	14.3	9.6	62.0
4	10.8	16.0	9.5	14.1	6.0	10.6
5	2.6	5.9	3.8	2.6	1.0	2.4
6	1.7	3.6	1.1	.9	.1	.5
7	.6	7.6	.3	.4	.1	.1

Age	1989	1990	1991	1992	1993	1994
1	11.3	98.8	40.7	49.9	35.2	19.1
2	51.0	11.0	131.1	14.6	38.3	11.3
3	11.3	19.0	11.3	28.0	12.6	7.1
4	18.8	3.9	4.0	1.5	15.2	1.6
5	4.0	2.0	3.1	1.4	1.5	3.3
6	.9	.9	1.2	.5	.3	.4
7	.6	.3	.1	-99.0	-99.0	-99.0

Age	1995	1996
1	227.1	52.5
2	93.8	264.2
3	19.6	48.0
4	10.3	16.5
5	1.7	3.2
6	.5	2.3
7	-99.0	-99.0

Relative weight applied by age

Age	Rel.wt
1	1.0000
2	1.0000
3	1.0000
4	1.0000
5	1.0000
6	1.0000
7	1.0000

Value for smoother set to 3.0000

IFAIL on exit from E04FDF = 5

Residual sum of squares= 31.5265

Number of observations= 105

Number of parameters = 38

Residual mean square = .4705

Coefficient of determination = .9146

Adj. coeff. of determination = .8674

IFAIL from E04YCF= 0

Table 4.12 continued

	Parameter	s.d.
year effects		
	1.0599	.2103
	1.2236	.1587
	1.3254	.1491
	1.2745	.1490
	1.0398	.1478
	.9426	.1464
	1.0319	.1469
	1.0104	.1504
	1.0388	.1526
	.9870	.1521
	.9051	.1515
	.6689	.1621
age effects		
	.1635	.2584
	.8041	.2572
	.7965	.2571
	1.0246	.2580
	1.1351	.2601
	.6243	.2996
y/c effects		
	-.5621	.6860
	1.7000	.5120
	1.6006	.4590
	2.8343	.4350
	3.6184	.4084
	4.3347	.3972
	5.2237	.3578
	4.8624	.3601
	4.4759	.3657
	5.4656	.3692
	3.7530	.3479
	4.1891	.3426
	3.3988	.3516
	4.8100	.3512
	3.7596	.3579
	4.0202	.3667
	3.8924	.3843
	4.4238	.4138
	5.9879	.4895
	4.6540	.6860

## F-at-age

Age	1983	1984	1985	1986	1987	1988
1	.1732	.2000	.2166	.2083	.1700	.1541
2	.8523	.9840	1.0658	1.0249	.8361	.7580
3	.8442	.9746	1.0557	1.0151	.8282	.7508
4	1.0860	1.2538	1.3581	1.3059	1.0654	.9658
5	1.2031	1.3890	1.5046	1.4467	1.1803	1.0699
6	.6617	.7639	.8275	.7956	.6491	.5884
7	.6617	.7639	.8275	.7956	.6491	.5884

Age	1989	1990	1991	1992	1993	1994
1	.1687	.1652	.1698	.1613	.1479	.1093
2	.8298	.8125	.8353	.7937	.7278	.5379
3	.8219	.8048	.8274	.7861	.7209	.5328
4	1.0573	1.0353	1.0644	1.0113	.9274	.6853
5	1.1713	1.1470	1.1791	1.1204	1.0274	.7593
6	.6442	.6308	.6485	.6162	.5650	.4176
7	.6442	.6308	.6485	.6162	.5650	.4176

Age	1995
1	.0805
2	.3959
3	.3921
4	.5044
5	.5588
6	.3073
7	.3073

Table 4.12 continued

## Log fitted Index

Age	1983	1984	1985	1986	1987	1988
1	5.2237	4.8624	4.4759	5.4656	3.7530	4.1891
2	4.3347	4.8505	4.4624	4.0593	5.0572	3.3830
3	3.6184	3.2824	3.6665	3.1965	2.8344	4.0211
4	2.8343	2.5742	2.1078	2.4108	1.9814	1.8062
5	1.6006	1.5483	1.1204	.5497	.9049	.7160
6	1.7000	.1975	-.0407	-.5841	-1.0970	-.4754
7	-.5621	.8383	-.7663	-1.0681	-1.5798	-1.9461

Age	1989	1990	1991	1992	1993	1994
1	3.3988	4.8100	3.7596	4.0202	3.8924	4.4238
2	3.8350	3.0302	4.4448	3.3898	3.6589	3.5445
3	2.4251	2.8052	2.0176	3.4095	2.3961	2.7311
4	3.0703	1.4032	1.8004	.9903	2.4233	1.4752
5	.6404	1.8130	.1678	.5360	-.2211	1.2960
6	-.5540	-.7309	.4660	-1.2113	-.7843	-1.4484
7	-1.2638	-1.3982	-1.5617	-.3825	-2.0275	-1.5494

Age	1995	1996
1	5.9879	4.6540
2	4.1144	5.7075
3	2.8066	3.5186
4	1.9983	2.2145
5	.5899	1.2939
6	.3367	-.1689
7	-2.0660	-.1706

## Fitted index

Age	1983	1984	1985	1986	1987	1988
1	185.6	129.3	87.9	236.4	42.6	66.0
2	76.3	127.8	86.7	57.9	157.2	29.5
3	37.3	26.6	39.1	24.4	17.0	55.8
4	17.0	13.1	8.2	11.1	7.3	6.1
5	5.0	4.7	3.1	1.7	2.5	2.0
6	5.5	1.2	1.0	.6	.3	.6
7	.6	2.3	.5	.3	.2	.1

Age	1989	1990	1991	1992	1993	1994
1	29.9	122.7	42.9	55.7	49.0	83.4
2	46.3	20.7	85.2	29.7	38.8	34.6
3	11.3	16.5	7.5	30.2	11.0	15.3
4	21.5	4.1	6.1	2.7	11.3	4.4
5	1.9	6.1	1.2	1.7	.8	3.7
6	.6	.5	1.6	.3	.5	.2
7	.3	.2	.2	.7	.1	.2

Age	1995	1996
1	398.6	105.0
2	61.2	301.1
3	16.6	33.7
4	7.4	9.2
5	1.8	3.6
6	1.4	.8
7	.1	.8

## fitted catch-at-age

Age	1983	1984	1985	1986	1987	1988	1989	1990
1	26.8	21.3	15.6	40.4	6.1	8.6	4.2	17.0
2	40.2	73.7	52.4	34.2	81.8	14.4	24.0	10.6
3	19.5	15.3	23.5	14.4	8.8	27.0	5.8	8.4
4	10.4	8.7	5.7	7.5	4.4	3.5	13.0	2.4
5	3.2	3.3	2.2	1.2	1.6	1.2	1.2	3.9
6	2.4	.6	.5	.3	.1	.3	.2	.2
7	.3	1.1	.2	.2	.1	.1	.1	.1

Age	1991	1992	1993	1994	1995
1	6.1	7.5	6.1	7.8	28.0
2	44.3	14.9	18.4	13.2	18.3
3	3.9	15.1	5.2	5.8	4.9
4	3.7	1.6	6.3	2.0	2.7
5	.8	1.1	.5	1.8	.7
6	.7	.1	.2	.1	.3
7	.1	.3	.1	.1	.0



Table 4.12 continued

Log Population residuals

Age	1983	1984	1985	1986	1987	1988
1	-.1851	-.1188	-.9053	.4984	-1.1622	.8629
2	.6789	-.2681	.0519	.0872	.9661	-.2545
3	-.2189	.3491	.5513	-.5384	-.5706	.1062
4	-.4538	.1996	.1477	.2361	-.1913	.5547
5	-.6645	.2284	.2198	.3864	-.9251	.1427
6	-1.1872	1.0694	.0989	.5222	-1.2056	-.1786
7	.0000	1.1872	-.4049	.1265	-.7228	-.3564

Age	1989	1990	1991	1992	1993	1994
1	-.2809	.4758	.6405	.5834	.3604	-.7794
2	.0966	-.6314	.4310	-.7067	-.0140	-1.1197
3	-.0038	.1366	.4107	-.0759	.1344	-.7696
4	-.1386	-.0345	-.4066	-.5650	.2980	-.9990
5	.7558	-1.1401	.9571	-.2359	.6398	-.0990
6	.4597	.6366	-.2921	.4980	-.4535	.4268
7	.7695	.1942	-.5585	.0000	.0000	.0000

Age	1995	1996
1	.1308	.0000
2	.4267	-.1308
3	.1704	.3526
4	.3309	.5888
5	-.0711	-.1308
6	-1.0299	1.0018
7	.0000	.0000

Year,	TSS,	SSB,	Yield,	Fbar,	RECS
1983,	321,	140,	130,	1.044,	185
1984,	296,	119,	142,	1.206,	129
1985,	220,	93,	112,	1.306,	87
1986,	262,	70,	98,	1.256,	236
1987,	210,	70,	102,	1.025,	42
1988,	169,	89,	70,	.929,	65
1989,	138,	75,	69,	1.017,	29
1990,	150,	57,	53,	.996,	122
1991,	136,	48,	62,	1.024,	42
1992,	120,	56,	49,	.973,	55
1993,	111,	47,	44,	.892,	49
1994,	127,	47,	36,	.659,	83
1995,	343,	57,	49,	.485,	398
1996,	407,	127,	0,	.000,	104

Figure 4.1 Cod Kattegat. Landings 1971-1995, official reported statistics

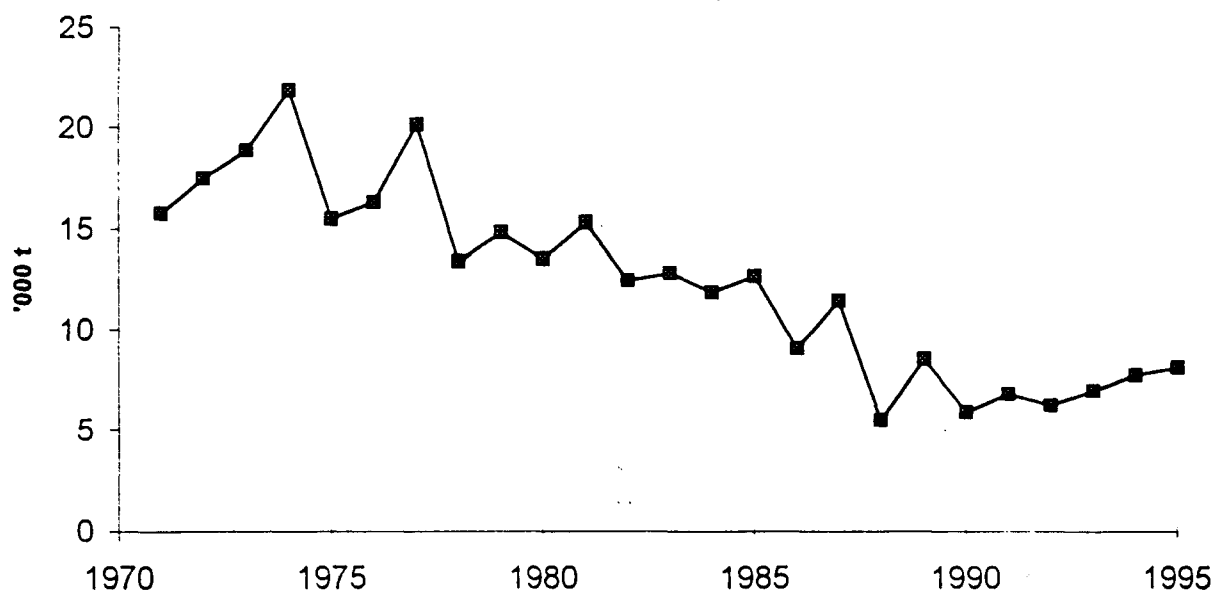


Figure 4.2 Cod Kattegat: Swedish CPUE in commercial trawl fisheries

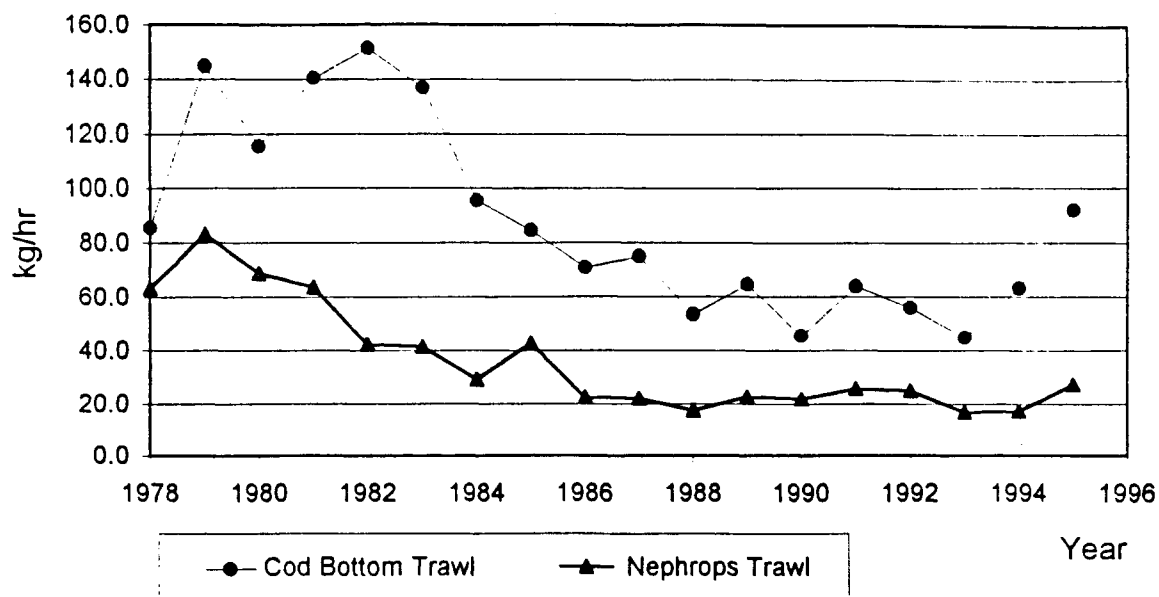
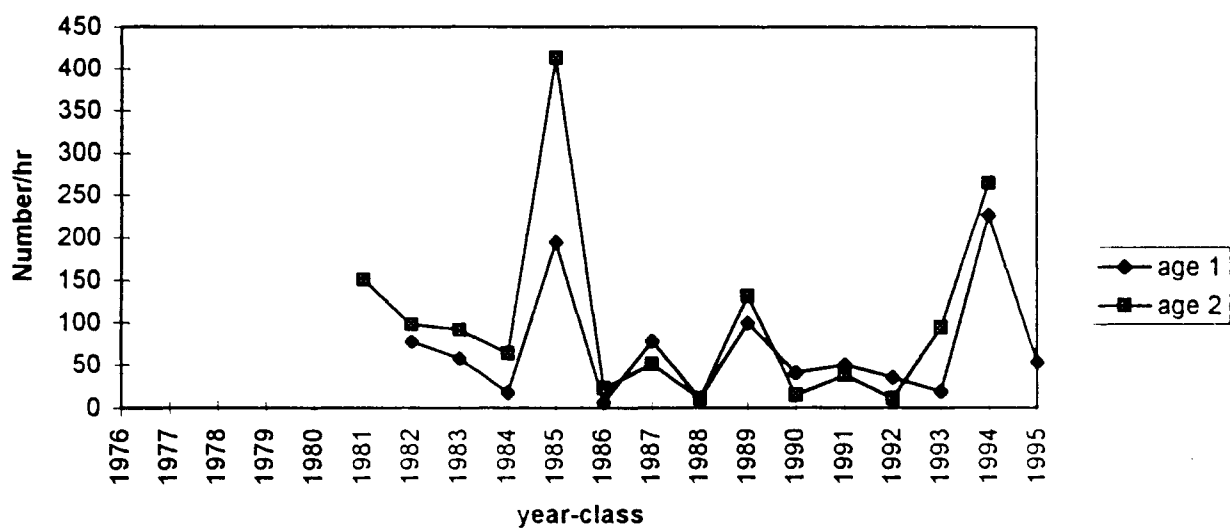


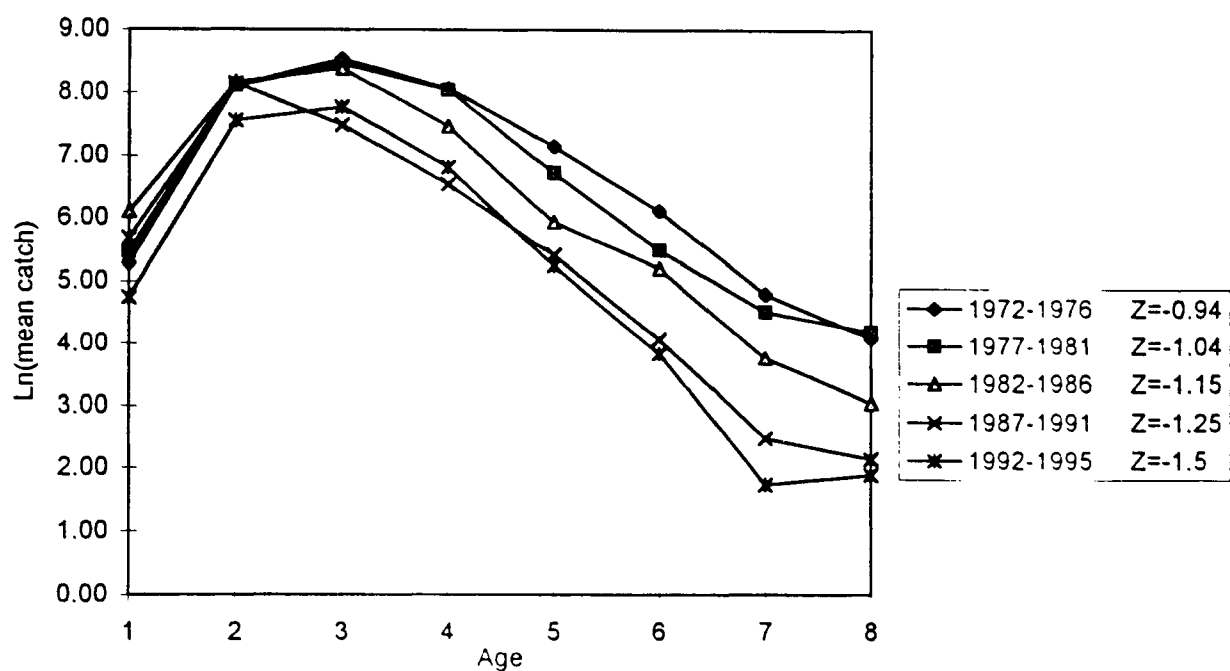
Figure 4.3 IBTS (Feb) Cod Kattegat



G:\acfm\wgbfas\cod\_kat\figs96\FIG43.XLS\IBTS cod\_kat 76-95

24/04/96

Fig 4.4 Cod in kattegat, catch curves by 5 year groups



G:\acfm\wgbfas\cod\_kat\figs96\FIG44.XLS\Catch curves

24/04/96

Figure 4.5.a Catch curve IBTS 1st. Quarter, by year-class

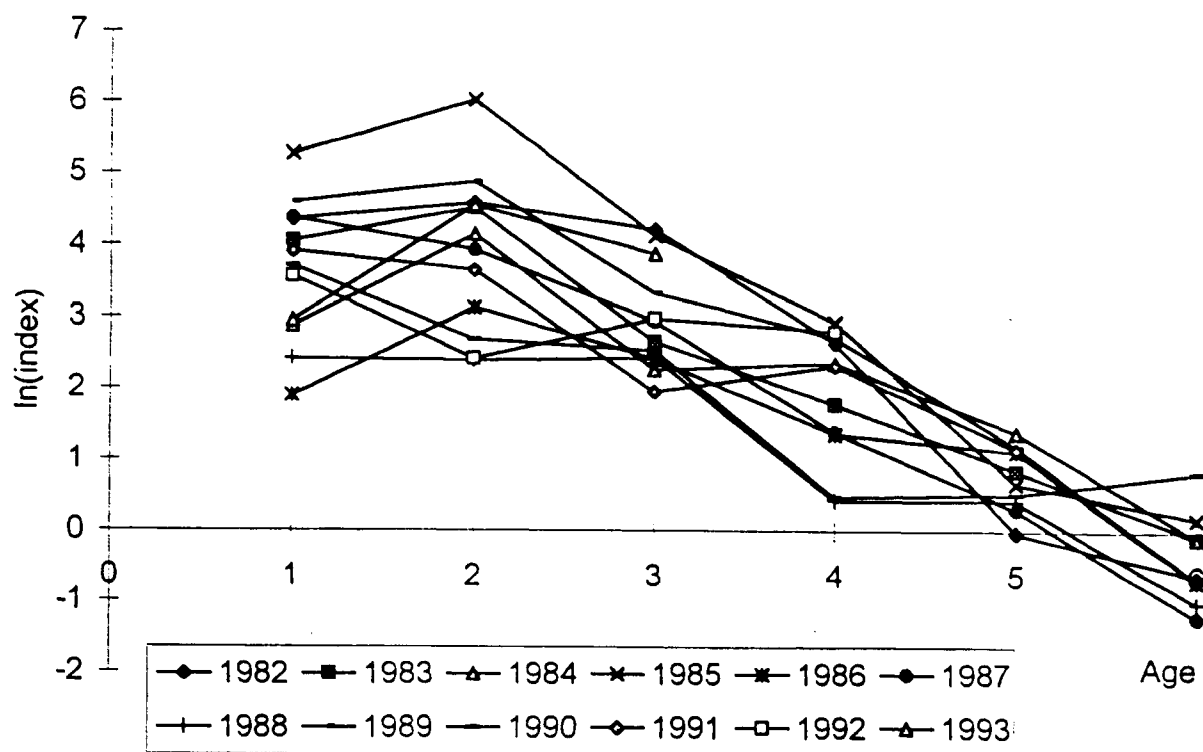


Figure 4.5.b Catch curve, average of 1982-1991 year-classes (ages 2 to 5)

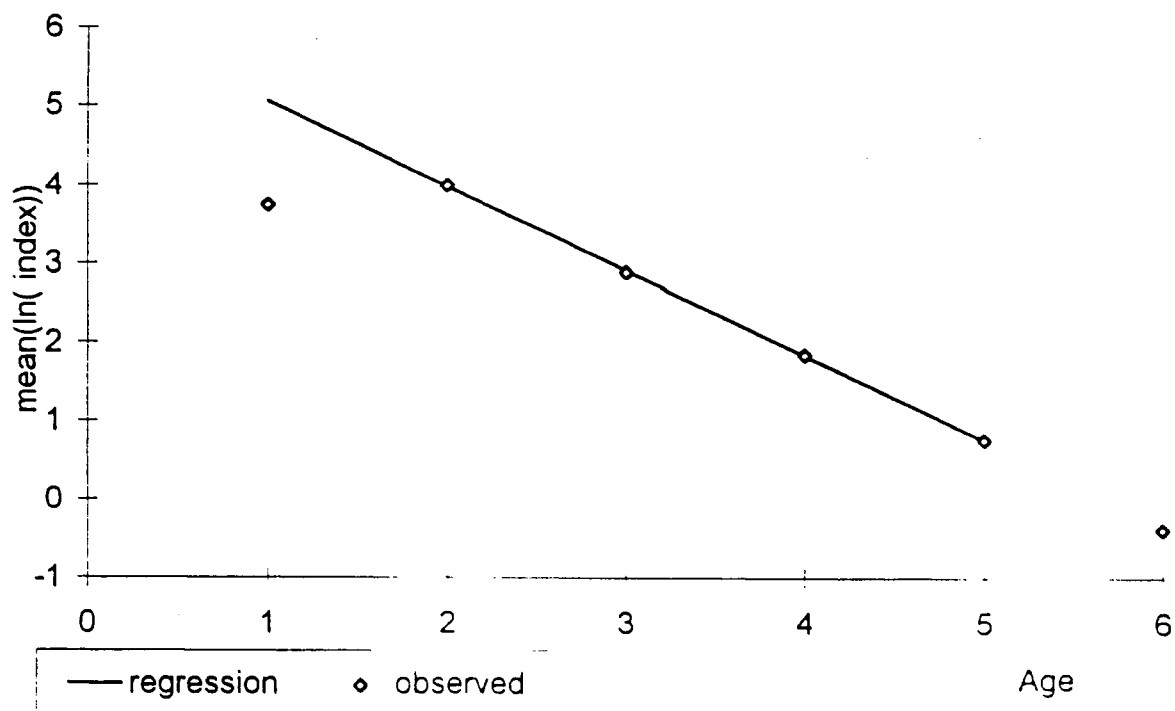


Figure 4.6a Cod in Kattegat: residuals from XSA F-estimates  
Fleet: Fish trawl

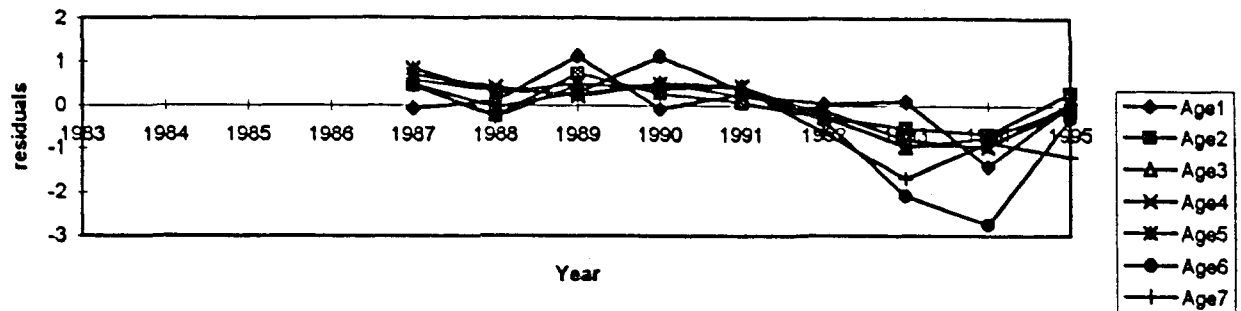


Figure 4.6b Cod in Kattegat: residuals from XSA F-estimates  
Fleet: *Nephrops* trawl

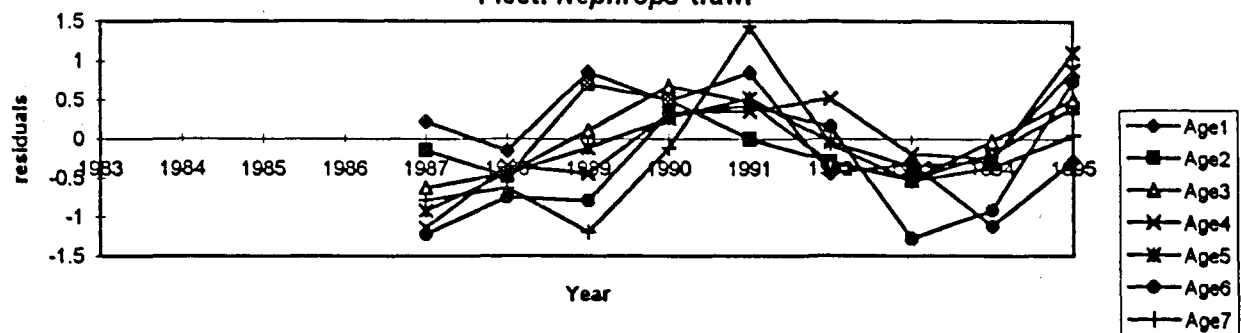


Figure 4.6c Cod in Kattegat: residuals from XSA F-estimates  
Fleet: Danish Seine

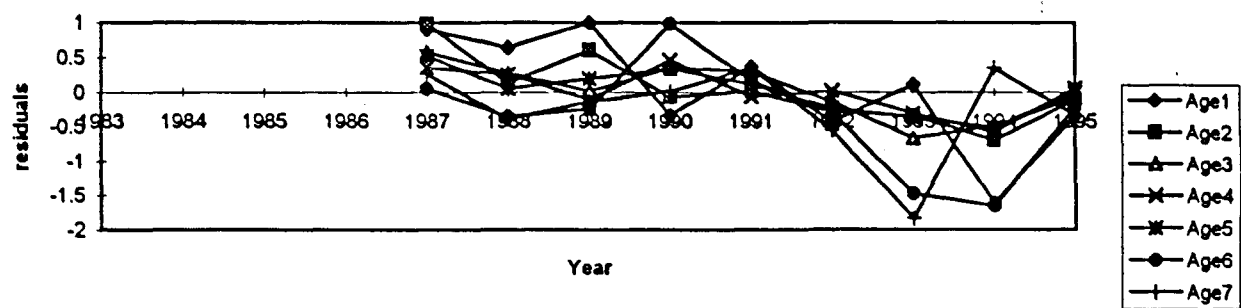


Figure 4.6d Cod in Kattegat: residuals from XSA F-estimates  
Fleet: IBTS 2nd quarter

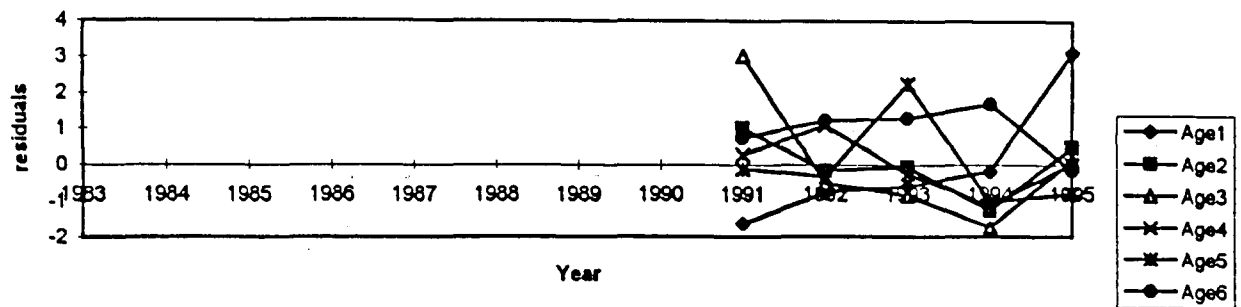


Figure 4.6e Cod in Kattegat: residuals from XSA F-estimates  
Fleet: IBTS 3rd quarter

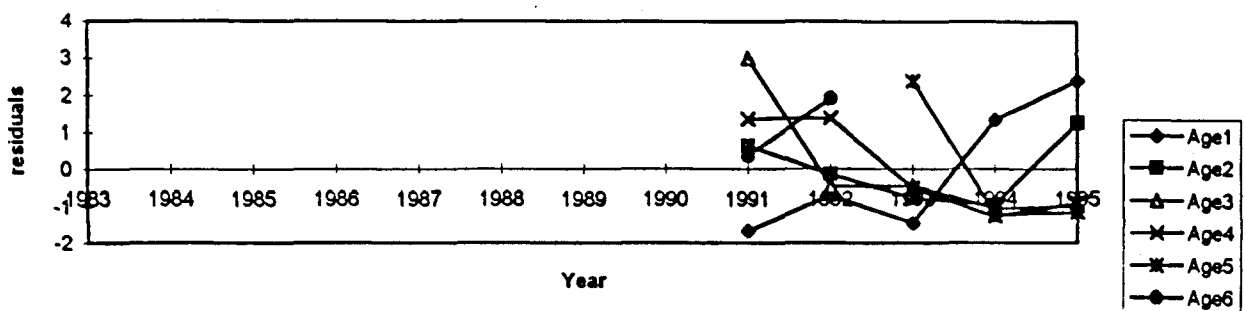


Figure 4.6f Cod in Kattegat: residuals from XSA F-estimates  
Fleet: IBTS 4th quarter

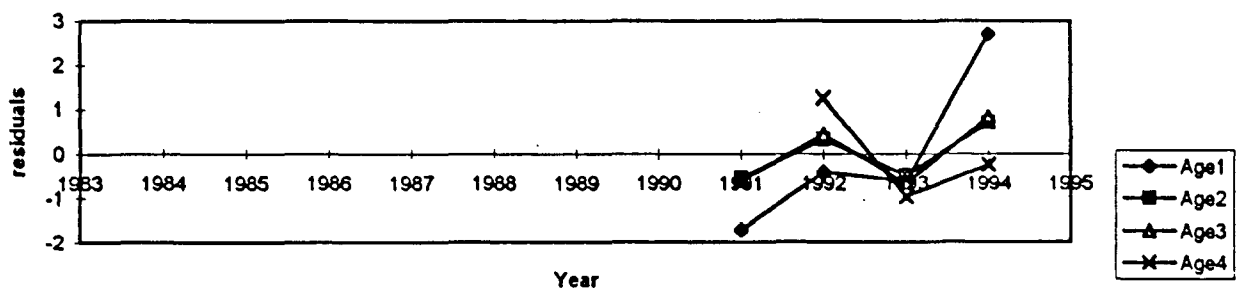
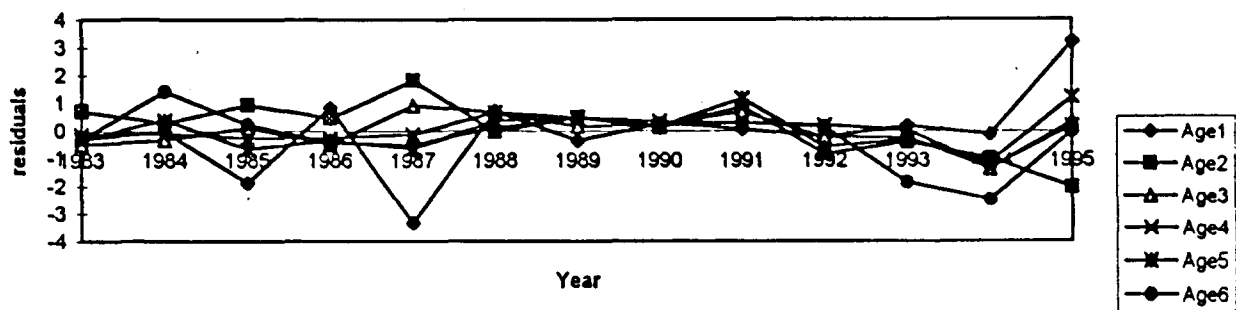
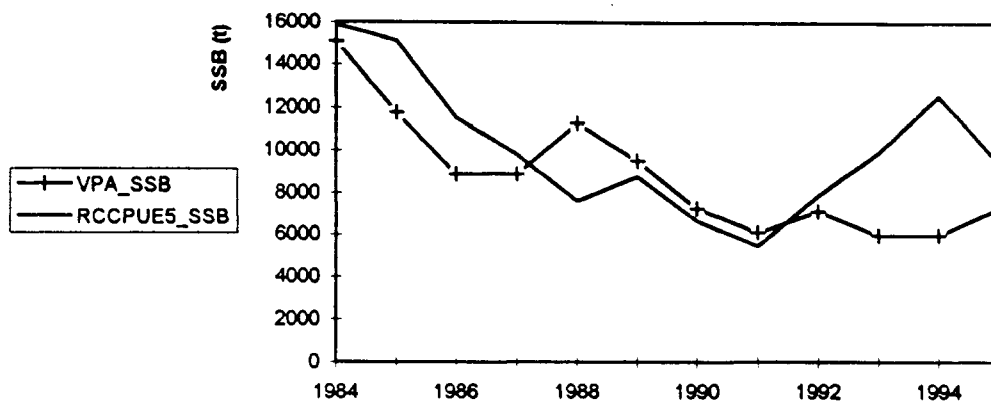


Figure 4.6g Cod in Kattegat: residuals from XSA F-estimates  
Fleet: IBTS revised



**Figure 4.7 Comparison of estimated SSB (t) from VPA and RCCPUE5 (scaled to VPA)**



**Figure 4.8 Estimates of Spawning stock biomass from VPA**

