

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

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PART 1 ¹/₂

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1 INTRODUCTION

1.1 List of Participants

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Kornilovs, G.	Latvia
Lassen, H.	Denmark
MacKenzie, B.	Denmark
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Neuenfeldt, S.	Denmark
Plikshs, M.	Latvia
Pönni, J.	Finland
Rahikainen, M.	Finland
Raid, T. (Chairman)	Estonia
Shvetsov, F.	Latvia
Sjöstrand, B.	Sweden
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Walther, Y.	Sweden

H. Sparholt, ICES Fisheries Assessment Scientist and M. Vinther from Danish Institute for Fishery Research participated in part of the meeting.

1.2 Terms of Reference

According to resolutions adopted at 1997 Annual Science Conference, 85th Statutory Meeting (C.Res.1997/2:11:7), the Baltic Fisheries Assessment Working Group met at ICES Headquarters from 15-24 April 1998 to:

- a) assess the status of cod, herring and sprat stocks in the Baltic by appropriate areas and stock components including Gulf of Riga herring as a separate component, taking into account the biological interactions between species, and providing separate information for coastal herring, northern Baltic and Gulf of Finland herring;
- b) consider the reference points proposed by the SGBFS, adopting those reference points or presenting alternatives with reasons for the alternative selection;
- c) consider the harvest control rules proposed by the SGBFS, taking into account the uncertainties in the data, in the assessments and in the biological processes, and assuming the stock-recruitment relationship, to estimate the probability of avoiding limit reference points;
- d) update the information on quantities of discards by gear type for the stocks and fisheries considered by this group using the format proposed by the WGECCO with a view to establishing the time series;
- e) provide the catch options for cod, herring and sprat in 1999 that are consistent with the medium-term strategies identified by the SGBFS according to IBSFC management areas². Catch options for the Gulf of Riga herring should be shown separately;
- f) assess and provide catch options for 1999 for the cod stock in Kattegat and the sloe stock in the in Division IIIa. A combined assessment of the cod stocks in the Kattegat and Sub-divisions 22-24 should be considered;
- g) explore the possibilities of re-establishment, at least in the northern Baltic, the management system of herring used prior to 1990 (request from the Government of Estonia);

h) provide information on the state of flatfish stocks in the Baltic.

² At present the IBSFC management areas are:

Baltic herring:

The western Baltic, the main Basin and Gulf of Finland (Sub-divisions 22-29S including Gulf of Riga and 32).
Management unit III (Sub-divisions 29N, 30 and 31).

Sprat:

The whole Baltic (Sub-divisions 22-32).

Baltic cod:

The whole Baltic (Sub-divisions 22-32).

The above Terms of Reference were set up to provide ACFM with the information required to respond to requests for advice from NEAFC, IBSFC, the EC and the Government of Estonia.

1.3 Description and Results from Study Group on Baltic Acoustic Data

1.3.1 Description of 1997 Surveys

The participating vessels, time periods and surveyed areas in 1997 are summarised in text table below:

Country	Vessel	Period	Survey Area (Sub-division)
Russia/Latvia	Atlantniro	12 October - 31 October 1997	26, 28
Poland	Baltica	04 October - 14 October 1997	25, 26
Germany/Denmark	Solea	12 September - 02 October 1997	22, 23, 24, 21 S

The joint Russian-Latvian acoustic survey was carried out aboard Russian R/V "Atlantniro" in sub-divisions 26 and 28. The integration covered 16,419 sq. nm and the integrated track was 1,280 nm. Totally 60 sample hauls were made.

The Polish acoustic survey was carried out by R/V "Baltica" in sub-divisions 25 and 26. The integration covered 10,426 sq. nm. Totally 14 sample hauls were made.

The joint German-Danish acoustic survey was carried out with R/V "Solea". The survey covered all of the sub-divisions 22, 23, 24 and the southern part of the Kattegat. The integration covered 13,269 sq. nm, the cruise track was 1,035 nm long and 48 trawl hauls were carried out.

The total coverage of the area was 37,613 sq. nm (excluding overlapped area) and that is less than in the 1996 survey (52,746 sq. nm). However, the coverage of sub-divisions 26,28 was in 1997 better.

1.3.2 Overlapping areas

Totally 3 rectangles were overlapped in comparison with 17 rectangles in the 1996 survey. The results from the overlapping areas are presented in Table 1.3.3.

1.3.3 Application of acoustic results for the analytical assessment

The results of different vessels were compiled, discussed and presented to the Working Group. The estimated number and mean weights of herring and sprat in the Baltic Sea by sub-divisions and age groups are given in Tables 1.3.1–1.3.5.

It was concluded that the results of the 1997 October Survey are representative for use in VPA tuning at least for Sprat stock in Sub-divisions 22-32.

The Working Group discussed the necessity to carry out the acoustic surveys every year. To solve this problem it has been decided to perform trial runs with catch at age analysis using three tuning data sets which were available from Latvian-Russian acoustic survey in 1983–1997 (with lacking data for 1993):

- the first run was carried out with data set for all years,
- the second run was carried out with acoustic data for even years only,
- the third run was carried out with acoustic data for odd years only.

The results of these exercises were as follows:

- using the data sets for all years gives estimates of F and SSB which are very close to the main assessment based on all the available tuning data sets;
- using the data from even years only gives the estimates of SSB by 27 % higher and F by 27 % lower for 1997 than the first run;
- using the data from odd years only gives the estimates of SSB by 56 % higher and F by 41 % lower for 1997 than in the first run.

The question of possible causes of these deviations observed in the latest years and frequency of acoustic surveys should be addressed to the Study Group on Baltic Acoustic Data.

1.4 Assessment Methods and Software Used

1.4.1 Analysis of catch-at-age data

The main tool for the assessment of the state of stocks and catch-at-age was VPA tuned with the XSA method and ICA software package. For herring in Sub-divisions 30 and 31, due to poor performance of VPA-XSA, two different biomass models were applied (see section 9.4.).

1.4.2 Catch predictions and medium-term projections

In most cases the short-term predictions were run using IFAP software.

For most stocks, the Working Group applied the medium-term projections, performed by the Study Group on Management Strategies for Baltic Fish Stocks (ICES, 1998).

For sprat stock and cod in Sub-divisions 25-32, the TBASIC program developed by J. Horbowy was applied. In this approach uncertainties in survivors estimates and in the stock-recruitment model (Beverton-Holt model) were taken into account. When fitting a stock-recruitment model log-normal errors were assumed. Weights at age and natural mortalities were kept constant. Also for some stocks (e.g., herring in the Gulf of Riga) an estimation of MBAL, based on the Myers *et al.* (1994) approach was applied. The approach 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.

1.5 Reference points and harvest control rules

The Working Group was asked to evaluate the biological reference points and harvest control rules derived by the Study Group on Management Strategies for Baltic Stocks (SGBFS) (ToR's b and c). The SGBFS based the estimation of reference points on MBAL estimates derived earlier by Baltic Fisheries Assessment Working Group and medium term projections. For the estimation of B_{lim} , B_{pa} , and F_{pa} the SGBFS used the following approach:

- 1) First B_{lim} and B_{pa} were derived as:

B_{lim} = MBAL when no or few observations were located on left-hand side of estimated MBAL on S-R plot,
 B_{pa} = MBAL when there were observations located on left-hand side of estimated MBAL on S-R plot.

If B_{pa} was available then B_{lim} was estimated as $B_{lim} = B_{pa} \exp(-1.65 \text{ s.e.})$, where s.e. stands for standard error of the biomass estimate.

- 2) Next medium-term projections were performed, in which the uncertainty in S-R relationship, initial stock numbers, and for some stocks uncertainty in weight at age and maturity were accounted for. In the medium term projections different option for mean weight at age and natural mortality were used.
- 3) Finally the F_{pa} was estimated as the fishing mortality for which there is higher than 10 % probability of SSB to decrease below B_{lim} in medium term.

The text table below presents results of the SGBFS simulations

Stock	Option	Blim	Bpa	Fpa	medium B
cod 22-24		15.5	23	1.3	42
cod 25-32	mean w(92-96)	160	240	0.75	242
	mean w(83-87)			0.65	236
herring 25-29,32	low w, low M	840	1270	0.27	1077
	low w, med. M			0.14	1042
	low w, high M			0	1107
	high w, high M			0.27	1111
sprat 22-32	low M	200	275	0.54	460
	medium M			0.26	390
	high M			0	263

For the harvest control rules the SGBFS proposed approach similar to the one applied by ACFM in its advice on harvest control rules for North Sea Herring. The standard HCR proposed is based on:

- 1) if $B \geq B_{pa}$ then $TAC \leq$ catch resulting from F_{pa} ,
- 2) if $B_{lim} < B < B_{pa}$ then $F = F_{pa}(B - B_{lim}) / (B_{pa} - B_{lim})$
- 3) if $B \leq B_{lim}$ then $F = 0$

The derivation of F_{pa} performed by the SGBFAS is different, however, from the one described in the ACFM Guidance to WG on selection of Reference points, where F_{pa} is defined as fishing mortality for which there is higher than 10 % probability of SSB to decrease below B_{pa} in contrast to B_{lim} criterion.

used by the SGBFS. So the F_{pa} estimates derived in accordance with the Guidance to WG will be much lower than the F_{pa} derived by the SGBFS. It should be mentioned, also, that in some medium term projections performed by SGBFS stock biomass did not attain equilibrium as the used time span for the simulation (10 years) was probably too short. Thus

for these stocks for which time allowed the working group attempted to reestimate F_{pa} to be in accordance with the ACFM Guidance to Working Groups.

1.6 Discards

Discards have been sampled on board commercial vessels fishing in the Kattegat and Baltic Sea, since August 1995. The sampling was carried out by observers employed at the national laboratories as part of the EU-project: Improvement of the cod stock assessment in the Baltic (Study programme no. 94/058) until 1st. of August 1997 and after this date no.96/002: The International Baltic Sea Sampling Programme (IBSSP). This project ends on 1st of August 1999. Two different sampling strategies are used: Sweden and Denmark sample commercial vessels randomly between a large number of vessels representing the major fisheries, where discards are expected. All other countries sample a few representative vessels. The number of hauls/set sampled is given in Table 1.6.1 by Sub-division, year, quarter, country, and gear.

The data have been included in a database, i.e., the IBSSP database, which currently consists of app. 140,000 records, however, not all national data were made available for the Working Group. Prior to the meeting the database was established and programs for analysis of data were prepared. Unfortunately, a substantial number of strata showed missing values because the IBSSP database either did not contain data for establishing the age-length key (ALK) and/or did not contain individual mean weights. Some other irregularities were discovered. It was obvious that more effort in national checking of the data is needed before they are included in the IBSSP database. It is therefore recommended that all participating countries in IBSSP provide a fully worked up and validated national database in the agreed format.

The samples should be raised to total discards by fleet(gear), Sub-division, year and quarter and presented as numbers and mean weight per age group as this will allow inclusion in the assessment. The agreed raising procedure is to calculate the discards as percentage of the landing based on the total landings and discards in the sampled catches within strata (i.e., Sub-division, quarter, gear/fleet). The age distribution and mean weight at age in the discard is obtained by applying the stratum specific age-length key to the length distribution of the discard (exemplified in Table 1.6.2).

The total discard can be raised to the total landings from estimates above, if the sampling scheme selects representative vessels within the particular fleet(gear) (See Table 1.6.2). In cases where the sampling unit is journeys (i.e., Denmark and Sweden) the raising factor could either be based on the landings or the number of journeys conducted by the commercial fishing fleet. This issue should be further analysed and clarified in due time before the next Working Group meeting. Table 1.6.3 shows an example of the format in which the data should be prepared. This format is identical to that applied for the landing data (see Table 1.6.4) and facilitates the inclusion of the discard in the assessment.

The inclusion of discard data will provide an improvement of future assessments. However, a time series of a minimum of four years is regarded as necessary for applying discard data in the assessment. Time series needs to be as long as possible in order to model the discard pattern and compilation of comparable data from discard sampling carried out in the 1980s (Bagge ICES CM and Weber ICES CM) covering the period 1978–1988 based on Danish and German sampling could be beneficial for validation of such a model. The Working Group did not have the full database at its disposition at this meeting and a reliable analysis of the impact of discards on the analytical assessment of stock size could not be determined. It is the intention of the Group to continue the efforts in this area to establish a time series to be included in the assessment as soon as possible.

Table 1.3.1 Estimated number (millions) of herring (Hydroacoustic surveys, October 1997)

SD	Total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8	age 9	age 10
21	1009	104	558	297	48	2	0	0	0	0	0	0
22	1717	937	716	58	2	0	2	1	1	0	0	0
23	644	16	41	136	193	106	58	47	17	21	10	0
24	3367	1988	758	297	170	46	49	42	10	8	0	0
25	3307	1310	384	205	675	390	192	77	43	30	0	0
26	6128	1095	532	820	1357	911	674	415	207	79	12	17
28	4241	81	54	220	1622	998	739	345	101	47	13	19

Table 1.3.2 Estimated number (millions) of sprat (Hydroacoustic surveys, October 1997)

SD	Area,nm ²	Total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8+
21	3116	15	0	1	3	6	4	1	0	0	0
22	5179	811	469	64	99	129	41	9	0	0	0
23	251	123	84	4	11	11	8	5	0	0	0
24	4723	12420	5168	2243	1986	2258	529	165	70	0	0
25	5514	11950	132	566	4030	4566	1788	670	178	19	0
26	10139	40869	25060	2311	21346	12682	2608	1167	527	211	16
28	8676	49012	9872	2080	18004	22488	736	3252	1116	982	355

Table 1.3.3 Survey statistics for overlapping area

Vessel	ICES SD	ICES Rect.	Area (nm ²)	Sa (m ² /nm ²)	σ (cm ²)	N total (million)	herring (%)	sprat (%)	USED
Atlantniro	26	3864	450	1097	0.81	6093	2.6	97.4	Atlantniro +1/2 Baltica
Baltica	26	3864	931	913	0.92	9239	7.6	92.4	
Atlantniro	26	3964	1032	659	1.57	4334	16.0	84.0	Atlantniro
Baltica	26	3964	1032	812	1.32	6350	5.1	94.9	
Atlantniro	26	4063	1019	918	1.62	5771	16.4	83.6	Average
Baltica	26	4063	1019	568	1.55	3735	13.0	87.0	

Table 1.3.4 Estimated mean weight (g) of herring (Hydroacoustic surveys, October 1997)

SD	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8	age 9	age 10
21	48.8	14.9	49.5	57.1	69.7	54.3						
22	23.8	12.6	37.6	45.7	70.4		77.9	139.0	85.7	77.3		
23	93.6	10.2	45.1	70.4	91.7	110.8	173.1	186.7	136.4	145.9	240.2	
24	25.9	9.6	33.7	55.8	64.0	85.3	73.9	88.0	130.1	205.0	252.0	
25	24.0	10.5	24.3	36.2	29.8	30.9	40.4	44.6	51.6	53.9	0.0	0.0
26	32.0	7.2	22.4	32.3	31.1	35.1	40.6	46.9	57.4	75.5	82.0	114.1
28	23.7	7.3	22.6	19.1	19.9	22.8	24.9	27.9	40.1	44.8	138.0	168.9

Table 1.3.5 Estimated mean weight (g) of sprat (Hydroacoustic surveys, October 1997)

SD	total	age 0	age 1	age 2	age 3	age 4	age 5	age 6	age 7	age 8
21	21.3	7.5	14.2	20.8	20.6	23.1	24.8			
22	9.1	2.7	15.8	17.4	18.5	19.6	18.2	0.0	0.0	0.0
23	9.2	4.4	11.4	16.2	23.4	22.2	22.7	0.0	0.0	0.0
24	9.5	3.6	11.9	13.9	14.6	15.6	16.4	17.6	0.0	0.0
25	12.8	3.5	11.8	11.8	13.0	14.1	15.6	16.9	19.7	0.0
26	6.4	1.9	6.5	8.5	9.3	10.2	11.0	11.6	12.5	11.9
28	7.8	2.4	6.9	8.5	9.0	9.8	10.4	10.4	11.5	12.3

Table 1.6.1. The number of hauls/set by year, quarter, Sub-division and country and gear.

1997	Sub-division	Denmark		Sweden			Total			
		GNS	OTB	OTB	OTM	TBN	OTB	GNS	OTM	TBN
Quarter 1.	21	8	9	10			9	8		
Quarter 2.	21	18	2	11			2	18		
Quarter 3.	21	6	5		1	5	6	6	1	5
Quarter 4.	21	5	6			18	6	5		18
1996										
Quarter 1.	21	1	19	15			19	1		
Quarter 2.	21	3		9			0	3		
Quarter 3.	21	5	5	23			5	5		
Quarter 4.	21	7	6	4			6	7		
1995										
Quarter 1.	21									
Quarter 2.	21									
Quarter 3.	21			23						
Quarter 4.	21	2	10				10	2		

1997	Sub-division	Denmark		Germany		Total		
		GNS	OTB	OTB	OTM	GNS	OTB	OTM
Quarter 1.	22	6	29			6	29	
Quarter 2.	22	3	7			3	7	
Quarter 3.	22	1	26	10		1	36	
Quarter 4.	22	2	6	2		2	8	
1996								
Quarter 1.	22	4	10			4	10	
Quarter 2.	22	22	17		1	22	17	1
Quarter 3.	22	6	11			6	11	
Quarter 4.	22	7	11	3		7	14	
1995								
Quarter 1.	22							
Quarter 2.	22							
Quarter 3.	22							
Quarter 4.	22	3	13	5		3	18	

1997	Sub-division	Denmark		Germany		Poland		Sweden		Total	
		GNS	OTB	OTB	OTM	GNS	OTB	GNS	OTB	GNS	OTB
Quarter 1.	24		18	17				7	8	7	43
Quarter 2.	24		7	2				10	7	10	16
Quarter 3.	24		7	13				7	28	7	48
Quarter 4.	24		17	18			7	6	10	6	52
1996											
Quarter 1.	24	14	13					9	11	23	24
Quarter 2.	24	8	12	1				3	6	11	19
Quarter 3.	24	5	8	24				3	11	8	43
Quarter 4.	24		22	23				5	7	5	52
1995											
Quarter 1.	24										
Quarter 2.	24										
Quarter 3.	24										
Quarter 4.	24	4	15					4	14	8	29

GNS= gilnet, set. OTB = otterboard trawl, bottom. OTM= otter board trawl, midwater. PTB= pair trawl, bottom. BTM= pair trawl, midwater.TBN Nephrops trawl

Table 1.6.1. Cont.

1997		Denmark		Germany		Latvia		Poland			Russia		Sweden		Total		
Quarter	Sub-division	GNS	OTB	OTB	OTM	GNS	OTM	GNS	OTB	OTM	OTB	OTM	GNS	OTB	GNS	OTB	OTM
Quarter 1.	25	5	29	5	40	3							4	6	12	40	40
Quarter 2.	25	1	27	17	22				1				4	10	5	55	22
Quarter 3.	25	3	13	6				7	1	5		3	4	23	14	43	8
Quarter 4.	25	2						3	2	5			19	31	24	33	5
1996																	
Quarter 1.	25	5	30		24								13	18	18	48	24
Quarter 2.	25	1	1		24	4	1	2	51				14	7	21	59	25
Quarter 3.	25	7	21	2					4				11	9	18	36	
Quarter 4.	25	3	4	1		3		1	28				6	38	13	71	
1995																	
Quarter 1.	25																
Quarter 2.	25																
Quarter 3.	25								2				3	10	3	12	
Quarter 4.	25	5	9					2	7				2	21	9	37	

1997		Germany		Latvia			Poland					Russia			Sweden		Total				
Quarter	Sub-division	OTB	OTM	GNS	OTB	OTM	GNS	OTB	OTM	PTB	PTM	GNS	OTB	OTM	GNS	OTB	GNS	OTB	OTM	PTB	PTM
Quarter 1.	26			5				1									5	1			
Quarter 2.	26				1			33	4									34	4		
Quarter 3.	26			33			10	4			1	16	14	143			59	18	143		1
Quarter 4.	26				13		2	11	6	3		9	17	149			11	41	155	3	
1996																					
Quarter 1.	26			4				10								1	4	11			
Quarter 2.	26			17	10	4		16							1		18	26	4		
Quarter 3.	26			45	4	18		14									45	18	18		
Quarter 4.	26	2		12	9			3								4	12	18			
1995																					
Quarter 1.	26																				
Quarter 2.	26																				
Quarter 3.	26			10													10				
Quarter 4.	26	12			2	1		2								3		19	1		

1997		Sweden	
Quarter	Sub-division	GNS	OTB
Quarter 1.	27	5	5
Quarter 2.	27	11	
Quarter 3.	27		
Quarter 4.	27	5	2
1996			
Quarter 1.	27	12	7
Quarter 2.	27	11	9
Quarter 3.	27	9	
Quarter 4.	27	15	5
1995			
Quarter 1.	27		
Quarter 2.	27		
Quarter 3.	27		
Quarter 4.	27	6	1

1997		Latvia			Sweden		Total		
Quarter	Sub-division	GNS	OTB	OTM	GNS	OTB	GNS	OTB	OTM
Quarter 1.	28				2	2	2	2	
Quarter 2.	28		7			7		14	
Quarter 3.	28	7		6			7		6
Quarter 4.	28	6	11	6	2		8	11	6
1996									
Quarter 1.	28				1	5	1	5	
Quarter 2.	28	10	7	3	1		11	7	3
Quarter 3.	28	2	4		5	2	7	6	
Quarter 4.	28	2	4		1	9	3	13	
1995									
Quarter 1.	28								
Quarter 2.	28								
Quarter 3.	28	5	4				5	4	
Quarter 4.	28	13	8		1	2	14	10	

GNS= glnet, set. OTB = otterboard trawl, bottom. OTM= otter board trawl, midwater. PTB= pair trawl, bottom. BTM= pair trawl, midwater. TBN= nephrops trawl.

Table 1.6.2 Proportion of discard in the catch, estimated amount of total discard per Sub-division, quarter and type of gear. Data provided by Sweden from sampling from EU project 'IBSSP International Baltic Sea Sampling Programme).

GEAR COD TRAWL					Sample composition			
Country	SD	Quarter	Number of samples	Tot. Landing (t)	Landing (t)	Discard (t)	Mean discard of landing	Estimated tot. Disc. (t)
Sweden	21	1	10	2433.7	10.8	0.3	3.0%	72.1
	21	2	11	345.6	4.2	0.1	2.6%	8.9
	21	3	5	200.6	0.1	0.1	52.2%	104.7
	21	4	18	320.3	1.4	0.8	57.6%	184.6
Sweden	24	1	7	225	2.1	0.0	1.2%	2.7
	24	2	7	210	3.9	0.0	0.9%	1.9
	24	3	28	585	22.7	3.8	16.7%	97.5
	24	4	9	111	7.1	1.1	15.0%	16.6
Sweden	25	1	6	4225	5.0	0.2	4.4%	187
	25	2	10	3128	6.0	0.2	2.8%	87
	25	3	22	862	7.3	0.4	5.3%	46
	25	4	31	1853	27.8	0.7	2.7%	50
Sweden	27	1	5	1005	0.9	0.0	1.0%	10
	27	2	0	441				
	27	3	0	7				
	27	4	0	62				
Sweden	28-31	1	2	250.8	2.1	0.0	1.6%	4
	28-31	2	7	63	1.1	0.2	14.8%	9
	28-31	3	0	9.9				
	28-31	4	0	58.4				
GEAR GILLNET								
Sweden	24	1	7	437	2.9	0.0	1%	4
	24	2	10	322	5.1	0.1	2%	7
	24	3	7	264	2.7	0.1	2%	5
	24	4	6	133	1.8	0.1	5%	7
Sweden	25	1	4	3074	2.2	0.0	0.2%	7
	25	2	4	1678	1.9	0.0	0.1%	2
	25	3	4	1563	1.4	0.0	1.0%	16
	25	4	16	3456	7.5	0.1	0.7%	24
Sweden	27	1	6	337	2.0	0.0	0.7%	2
	27	2	11	413	3.1	0.0	1.3%	5
	27	3	0	33				
	27	4	3	119	1.0	0.0	2.9%	3
Sweden	28-31	1	2	41	0.1	0.0	2.1%	1
	28-31	2	0	27				
	28-31	3	0	128				
	28-31	4	2	202	0.6	0.0	4.1%	8

Table 1.6.3. Numbers at age and mean weight at age of discards in commercial catches per quarter and gear (trawl and gillnet) provided by Sweden from International Baltic Sea Sampling Programme (IBSSP). Subdivision 25 SWEDEN

Quarter 1						
Age	Gear				Tot discard	
	Trawl		Gillnet		numbers *10 ⁻³	mean weight (g)
	numbers *10 ⁻³	mean weight (g)	numbers *10 ⁻³	mean weight (g)		
0						
1	2.717	159			2.717	159
2	344.983	323	5.835	411	350.818	325
3	199.984	374	10.637	452	210.622	378
4	0.786	440	0.102	418	0.888	437
5						
6						
7						
8						
9						
10+						
SOP (t)	187.0		7.3		194.2	
Tot discard	186.7		7.3		194.0	
Quarter 2						
Age	Gear				Tot discard	
	Trawl		Gillnet		numbers *10 ⁻³	mean weight (g)
	numbers *10 ⁻³	mean weight (g)	numbers *10 ⁻³	mean weight (g)		
0						
1						
2	193.711	279	5.055	219	198.766	278
3	78.964	402	2.061	449	81.024	403
4	2.417	569	0.063	629	2.480	570
5						
6						
7						
8						
9						
10+						
SOP (t)	87.3		2.1		89.3	
Tot discard	86.9		2.4		89.3	
Quarter 3						
Age	Gear				Tot discard	
	Trawl		Gillnet		numbers *10 ⁻³	mean weight (g)
	numbers *10 ⁻³	mean weight (g)	numbers *10 ⁻³	mean weight (g)		
0	1.334	140	0.843	152	2.177	144
1	81.074	223	15.501	204	96.575	220
2	68.384	310	17.377	409	85.761	330
3	16.614	332	7.433	553	24.047	400
4	1.095	564	2.097	585	3.192	578
5	0.195	721				
6	0.040	597	0.102	675		
7						
8						
9						
10+						
SOP (t)	45.8		15.8		61.4	
Tot discard	46.0		16.0		62.0	
Quarter 4						
Age	Gear				Tot discard	
	Trawl		Gillnet		numbers *10 ⁻³	mean weight (g)
	numbers *10 ⁻³	mean weight (g)	numbers *10 ⁻³	mean weight (g)		
0						
1	174.502	221	56.446	208	230.948	218
2	15.445	396	7.576	530	23.022	440
3	6.958	447	7.048	575	14.005	511
4	4.572	405	3.225	604	7.797	487
5	0.146	757	0.547	717	0.694	726
6			0.430	2274	0.430	2274
7			0.196	4176	0.196	4176
8						
9						
10+						
SOP (t)	49.8		23.9		73.7	
Tot discard	49.9		23.9		73.8	
Quarter All						
Age	Gear				Tot discard	
	Trawl		Gillnet		numbers *10 ⁻³	mean weight (g)
	numbers *10 ⁻³	mean weight (g)	numbers *10 ⁻³	mean weight (g)		
0	1.334	140	0.843	152	2.177	144
1	258.293	221	71.947	207	330.240	218
2	622.523	310	35.844	408	658.367	315
3	302.520	381	27.179	512	329.698	391
4	8.870	472	5.488	593	14.358	519
5	0.341	736	0.547	717	0.694	726
6	0.040	597	0.532	1969	0.430	2274
7						
8						
9						
10+						
SOP (t)	369.9		48.2		417.9	
Tot discard	369.5		49.5		419.1	

2 COD IN THE KATTEGAT

2.1 Catch Trends

The Kattegat cod catches has been steadily declining from average yearly values above 15,000 t in the 1970s to a level of 6,000–9,000 t in the 1990s (Table 2.1 and Figure 2.1). In 1997 the landings were amounted to 9,000 tons. Most of the catches are taken by Denmark and Sweden. In 1997 these countries accounted for 64 % and 35 % of the total catch.

Kattegat cod are mainly taken by trawl, gill-nets and seine. A standardisation of the Danish effort between gears (analysing $\log(\text{CPUE})$) by an ANOVA approach and expressing all effort by the unit of a standard vessel) show that trawl is by far the most important gear. Within the trawling group, three fleets are of importance, viz. the *Nephrops* fleet (mesh size 70–89 mm), the flat fish fleet (mesh sizes 90–104 mm) and a cod directed fleet (mesh sizes >105 mm) accounting for 12 %, 36 % and 23 % of the standardised effort, respectively. Other Danish Kattegat fleets of some importance in the cod fisheries are a gill-net fishery targeting plaice and cod (mesh sizes 120–160 mm) and the Danish seine fishery (mesh sizes 100–120mm) which account for 9 % and 8 % of the total standardised effort. Although detailed evaluations of the importance of the various Swedish fleets are not available, the information available suggest a rather similar gear pattern for Sweden.

2.2 Unallocated Landings

From late 1994, where control and enforcement measures were tightened considerable, the catch data are believed to be reliable. In contrast, the catch statistics are unreliable from the period 1991 and up to 1994 where a considerable amount of the catches is believed to be non-reported or mis-reported by area or species. At present some mis-reporting by area occurs due to differences in weekly rations in Kattegat and in the adjacent areas. For 1997 the Working Group estimates that 1740 t taken in Sub-division 23 were actually fished in Kattegat.

2.3 Discards

Discard information from Kattegat are available from an ongoing EU programme to quantify discard levels. The available data to this working group did not allow an analysis of the total amount of discarding due to unbalanced samplings and uncertainties to the strata size on which to apply the observed ratios of discarding. The information suggest that the discarding levels clearly differs by fleets and is highest for the small mesh trawlers (the *Nephrops* fleet). In the *Nephrops* fishery the discarding level may be up to 35 % (measured in weight). However, the cod catches in the *Nephrops* fisheries are typically low. For the fish trawlers the discard levels are significantly smaller - about 3-5 %. For gill-nets the discard levels are generally found as being low. Discarding primarily affects the age 1 and 2 cod. The discards have not been included in the catch at age data.

2.4 Effort and CPUE Data

CPUE data for the two main Swedish fisheries (*Nephrops* trawling and cod bottom trawling) are given in Table 2.2 and Figure 2.2. The series are based on logbook records and start in 1979, representing close to 70 % of the total Swedish landings in the Kattegat. The CPUE for both fleets have declined significantly over the time series leading to present time CPUE of less than 50 % of what was found in the late 1970s.

2.5 Age Composition

Catch at age information was available from Danish port samplings and from the Swedish samplings on board commercial vessels. For both countries the catch at age data was available on a quarterly level. The sampling levels appear from Tables 2.3 –2.4. The German catch was broken down on ages on a quarterly basis by using the aggregated Danish-Swedish age information. The 1997 catch in numbers by age and country are given in Table 2.5. Historical catch in numbers by age and year are given in Table 2.6.

2.6 Mean Weight at Age

The catch mean weights by age were available from Denmark and Sweden on a quarterly basis. The total international catch mean weight at age was derived by weighing the quarterly mean weight by the respective catch in numbers. The mean weight in the catches by year and age are given in Table 2.7.

Information on stock weight are available from the February IYFS survey since 1991. Catches of the older cod are generally scarce in the survey and the mean weight is hence estimated with a poor precision (in a number of cases no mean weight are available for the ages above 5). Comparing the mean weight of the ages 1-5 show that the survey mean weight are below the mean weight in the catches for ages 1-3 whereas no differences are seen for age 4 and 5 (Figure 2.3).

The mean weight in the stock are derived as follows: For the ages 4-8 the mean weight in the catch is used. For the ages 1-3 the observed survey mean weights are used for the period covered by the survey. The mean weight of age 1-3, from the period before 1991, are derived by correcting the catch mean weight by the average ratio between survey and stock catch weight observed during 1991-1997. The ratios used to transform the catch mean weight to the stock mean weight were estimated as 0.085, 0.409 and 0.864, for the ages 1 to 3, respectively. The mean weight in the stock is shown in Table 2.8.

2.7 Maturity Ogive

Data on maturity ogives were available from the 1st quarter IBTS surveys in Kattegat 1991-1998. Scrutinising the maturity information indicated that the data from 1994 were not reliable. Maturity ogives for 1994 and for the period prior to 1991 were derived as the arithmetic mean of the reliable information from 1991-98 period. The maturity ogive is presented in Table 2.9.

2.8 Natural Mortality

The natural mortality was set to 0.2 per year.

2.9 Catch at age analysis

Tuning fleets used for XSA

Survey information covering Kattegat are available from then IBTS surveys and from the Danish cutter survey conducted by R/V Havfisker. The IBTS 2nd quarter surveys were not continued in 1996 and the surveys from the 3rd and 4th quarters have not been updated with the 1997 information. Considering that these surveys were excluded in the final runs for last years assessment it was not attempted to use them for the present tuning. The Havfisker survey was initiated in autumn 1994 and the time series is therefore restricted to four years.

CPUE information for the commercial fisheries was extracted from the Danish log-book database. This database provides information by vessel size, fishing gear and mesh-size, effort measured as days at sea and catches separated into five market categories (i.e., size groups) on a trip-by-trip basis. The age composition in the catches is derived by linking the catch in each market category with information on age composition by market category (a market category-age key).

An analyse of the Kattegat fisheries showed that most of the Danish cod catches could be attributed to five fleets as described in section 2.1. CPUE were standardised by fleets by the ANOVA $\ln(\text{CPUE}) = \text{Year} * \text{month} + \text{Vessel size}$. The estimated vessel size effect were re-transformed and used to correct the fishing power of different vessel sizes to a common size standard.

The CPUE from the Swedish fleets (Figure 2.2) are not available on an age disaggregated basis and could therefore not be included in the tunings.

Extended Survivor Analysis

An initial XSA tuning was carried out using the February IBTS and the RV Havfisker surveys and the five most important commercial fleets. For two of the commercial fleets (gill-net fleet and the Trawler fleet (90-104 mm mesh size) systematic trends were seen in the residuals and these two fleets were therefore removed before the final run. For the three remaining commercial tuning fleets the information on age group 1 were found poor as indicated by large standard errors on the catchability coefficients. This is not surprising as catches of age 1 cod is small and fluctuating (age 1 cod is recruited to the fisheries in the 3rd or 4th quarter).

The final XSA run included the two surveys and three commercial fleets where the age 1 information from the commercial fleets were ignored (Table 2.10). The run settings, the log residuals, and the basic statistics on the catchabilities are shown in Table 2.11 and the residuals are shown in Figure 2.4. Scrutinising the residual plots show a clear pattern of negative

residuals for the years 1992–1994 for the commercial fleets. The largest residuals are found for the age groups poorly represented in the catches vis. and age 6-7.

The FBAR (3–5) of 1997 is found higher than in 1996 (1.25 and 0.90, respectively) but about equal to the value found in 1995 (1.19). Some of these apparent between year differences are caused by the fact that the FBAR is a simple average over three age groups.

Comparing the F of the most important age group (age group 3) the differences are found considerable smaller. The fishing mortalities found in 1993 and 1994 were generally below the adjacent periods which may be due to the underreporting taking place in these years.

The 1994 year class is estimated at 18 mill individuals at age 1 which is the largest seen in the last decade. This year class is found as the highest on record in the IBTS time series. The 1995 year class is estimated to be weak, whereas the 1996 estimates is close to an average found in the latest decade. The latter estimate is shaky as it relies on the few recruited cod seen in the 3rd and 4th quarter of 1997.

The fishing mortalities, the stock numbers and the summary statistics of the stock derived from the VPA are presented in Tables 2.12–2.14.

The 1993–1994 period, characterised by low fishing mortality and negative residuals, coincides with the period for which the data quality is disputed and the anomalies found are most likely caused by a significant underreporting of catches. Underreporting of catches affects the estimated abundances through the VPA while at the same time compromising the CPUE information based on log-books information from the commercial fisheries.

The result of retrospective XSAs (Figure 2.5) shows identical trends for FBAR(3–5) and SSB for the runs starting in 1995 to 1997 whereas these differs from the 1994 run. In contrast, the retrospective patterns in recruitment show wide variability between all years.

2.10 Recruitment Estimates

The 1997 year class were found in great numbers in the IBTS 1st quarter survey in 1998, indicated that the 1997 year class is strong - the 3rd highest in record being estimated as 60 % of the size of the 1994 year class. The IBTS survey indicate that the 1996 year class is found at about average.

2.11 Historical Stock Trends

The spawning stock has shown a continuous decline from levels of 40 thousand tonnes experienced in the early 1970s to the level of approximately 10 thousand tonnes in the 1990s (Figure 2.6). A similar trend is found for the recruitment (age 1) which is in average estimated at approx. 20 mill. individuals in the 1970s as compared to approx. 10 mill. in the 1990s. The fishing mortality has been increasing substantially over the same period. The apparent reduction in F during 1992–1994 should be attributed to under-reportings of catches. (Figure 2.6).

2.12 Short-Term Forecast and Management Options

The input to the forecast is given in Table 2.15. The maturity at age is taken as the average for 1995–1998. The weight at age used is the average over the years 1995–1997. The exploitation pattern is taken from the average fishing mortality (1995–1997) scaled to the level of 1997. For age 2 and older the stock numbers are derived from the VPA. The abundance of age 1 was therefore derived from the RCT3 regressions (Table 2.16-2.17) using the IBTS 1st quarter survey. Age 1 abundance in 1999 and 2000 is taken as the geometric average over the year span 1988–1995 this period being characterised by an SSB equivalent to that presently found.

The forecast shows that maintaining the present fishing mortality will lead to yields of 8,418 t and 7,335 t for 1998 and 1999, respectively (Table 2.18). This catch level is similar to that encountered in the latest decade. The forecast options are plotted in Figure 2.7.

2.13 Long-Term Projections (Yield per Recruit)

The input for the yield per recruit analysis are given in Table 2.19 and the results are presented in Table 2.20 and Figure 2.7. F_{\max} is found at 0.24 equivalent to a maximal yield per recruit of 1.07 kg.

2.14 Medium-Term Projections

The medium-term projections were carried out by using Monte Carlo simulations formulated in an Excel spreadsheet. Stochastic noise were included on the initial population size, the mean weight at age, the maturity ogive and the stock recruitment relation. The projections were carried out for a 10 year period using 200 runs for each scenario considered.

The stock abundance at 1998 were taken as the survivors from the XSA with a variability as given by the internal std. errors from the tuning. Average maturity at age and the variation on the maturity was taken as the average for 1991–1998, excluding the observations from 1994. Mean weight at age in the catch and the associated variability was taken from the mean weights from 1991–1997. Mean weight in the stock for ages above 3 were assumed equal to that of the stock - for the younger ages the stock mean weight were derived by multiplying the catch mean weight by the average ratio of observed mean weight in the IBTS survey and the stock mean weight. The input for initial stock size, mean weight and maturity are presented in Table 2.21. The stock-recruitment relation were described by a Ricker curve assuming log-distributed errors and are shown in Figure 2.8.

The medium-term projections using *status quo* exploitation ($F_{\text{bar}}=1.22$) indicate that over a 10-year period the 50 % percentile of SSB declines to 5.7 thousand tons, i.e. at a median level below stock sizes seen historically (Figure 2.9, table 2.22). Even applying a reduced fishing mortality of $F_{\text{bar}}=1$ leads to a 25 % chance of SSB in 2007 being at or below the SSB seen historically.

2.15 Reference Points and harvest control rules

The F reference points based on the stock recruitment relation are shown in Figure 2.10 and the F-reference points are summarised below.

F-max	= 0.24
F-med	= 0.85
F-high	= 1.54
F-low	= 0.50
F-loss	= 0.83

SSB reference points are found by the procedure used by the SGBMFS. B-lim is taken as the lowest SSB seen historically i.e., as B-loss at 6,455 tonnes. B-pa is calculated as $B\text{-loss} * \exp(1.65 \text{ SE})$ where the SE is taken as 0.2 as the uncertainty of the estimates of the important age groups were found at SE values close to 0.2. By this procedure B-pa is found at 9000 tons.

F-pa is derived in accordance with the procedure chosen at the SGBMFS, i.e., by finding an exploitation level that results in a low chance of exceeding the B-pa level in a 10 years medium term projection. Using the B-pa given above and the lower 10 % percentile in the projected SSB in 2007 as the target leads to an estimate of F-pa at 0.83.

The SGBMFS established a harvest control law stipulating that

- a) $SSB > B\text{-pa} \Rightarrow F = F\text{-pa}$
- b) $B\text{-lim} < SSB < B\text{-pa} \Rightarrow F = F\text{-pa} * (SSB - B\text{-lim}) / (B\text{-pa} - B\text{-lim})$
- c) $SSB < B\text{-lim} \Rightarrow F = 0$

At present, the SSB in Kattegat is found at 13,000 tons i.e., above B-pa. According to the suggested harvest control law this implies that F should be reduced to the value of $F\text{-pa}=0.83$. This implies a reduction in fishing mortality of about 32 %.

2.16 Comments to the Assessment

All indicators suggest that the cod stock in Kattegat is presently overexploited.

- The present exploitation level is estimated at a high value significantly above the fishing mortality based on a precautionary approach.
- The yield in the 1990s is found to be less than half of that experienced in the 1970s.
- The two Swedish CPUE indices which may be taken as indicative for the stock size show a clear decline over the period.
- Scrutinising the SSB from the VPA for the years insensitive to choice of terminal F_s indicates a decline from about 30,000 t in the early 1970s to less than 10,000 t around 1990 (Figure 2.8).

With the existing level of fishing mortality the fishery is very dependent on the strength of the incoming year classes. The available IBTS survey information indicates that the 1997 year class is large. The immediate prospects for the Kattegat cod stock and fisheries will be critically dependent on the strength of these year classes.

Table 2.1 Cod landings (in tonnes) from the Kattegat. 1971–1997.

Year	Kattegat			Total
	Denmark	Sweden	Germany ²	
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 ³
1995	3,789	2,704	71	8,164 ⁴
1996	4,028	2,334	64	6,126 ⁵
1997	6,099	3,303	58	9,460 ⁶

¹Preliminary.

²Landings statistics incompletely split on the Kattegat and Skagerrak.

The figures are estimated by the Working Group members.

³Including 900 t reported in Skagerrak.

⁴Including 1,600 t misreported by area.

⁵Excluding 300 t taken in Sub-divisions 22–24.

⁶Including 1,700t reported in Sub-division 23.

Table 2.2

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
1996	1,273	16,934	75.2	344	24,460	14.1
1997	1,744	20,486	85.1	409	30,434	13.4

Table 2.3 Danish sampling levels for cod in Kattegat, 1997					
Quarter	Landings in '000 t	# Samples	# of cod aged	# of cod weighted	# of cod measured
1	3687		700	700	700
2	453		274	274	274
3	834		251	251	251
4	1125		321	321	321
Total	6099		1546	1546	1546

Table 2.4 Swedish sampling levels for cod in Kattegat, 1997					
Quarter	Landings in '000 t	# Samples	# of cod aged	# of cod weighted	# of cod measured
1	2440	10	287	287	4834
2	344	11	517	517	3359
3	199	9			574
4	321	18	300	300	2723
Total	3303	48	1104	1104	11490

Table 2.5 : Cod in Kattegat. Catch at age and mean weight (catches), 1997.

Danish catch at age

Quarter	1		2		3		4		total	
Age	Nos.	M-weight	Nos.	M-weight	Nos.	M-weight	Nos.	M-weight	Nos.	M-weight
1					6	0.355	38	0.475	44	0.458
2	83	0.595	25	0.581	141	0.535	146	0.729	395	0.622
3	2127	0.993	247	0.899	474	1.031	397	1.486	3244	1.052
4	358	2.202	50	2.680	48	3.706	93	3.085	549	2.526
5	142	3.054	7	2.856	11	3.790	27	3.254	186	3.118
6	68	3.639	10	4.200	9	4.421	3	6.673	91	3.888
7	6	6.379	1	7.088	1	8.804	1	7.747	9	6.897
8	2	8.972	2	6.619	0	11.554	1	7.703	5	8.210
total	2786		342		690		706		4523	
SOP		3687.150		452.896		834.430		1124.658		6102.183

Swedish Catch at age

Quarter	1		2		3		4		total	
Age	Nos.	M-weight	Nos.	M-weight	Nos.	M-weight	Nos.	M-weight	Nos.	M-weight
1	0	0.000	0	0.000	13	0.456	17	0.424	30	0.438
2	0	0.000	23	0.416	61	0.623	104	0.659	188	0.617
3	2068	0.778	257	0.872	91	1.407	156	1.327	2573	0.843
4	449	1.277	37	1.529	12	2.133	13	2.014	511	1.335
5	87	2.120	14	2.832	0	0.000	1	3.786	102	2.237
6	10	3.246	1	11.267	1	2.393	1	2.642	12	3.869
7	7	4.313	0	0.000	0	0.000	0	7.592	8	4.477
8	1	5.719	0	2.248	0	0.000	0	7.592	2	5.675
SOP	2623	2439.820	333	344.338	165	198.757	275	320.531	3397	3303.447

Total catch at age : Denmark, Sweden, Germany

Quarter	1		2		3		4		total	
Age	Nos.	M-weight	Nos.	M-weight	Nos.	M-weight	Nos.	M-weight	Nos.	M-weight
1	0	0.000	0	0.000	19	0.424	55	0.459	74	0.450
2	84	0.595	48	0.502	203	0.562	250	0.700	584	0.621
3	4234	0.887	504	0.885	566	1.092	553	1.441	5857	0.959
4	814	1.688	87	2.189	60	3.399	107	2.949	1068	1.950
5	231	2.699	21	2.840	11	3.790	28	3.272	291	2.806
6	79	3.588	11	4.881	10	4.304	4	6.018	103	3.877
7	14	5.233	1	7.088	1	8.804	1	7.703	17	5.756
8	3	7.743	2	6.157	0	0.000	1	7.671	7	7.213
total	5458		675		868		999		8001	
SOP		6182.770		797.434		1033.887		1446.489		9460.581

Table 2.6 Cod in Kattegat
Catch in numbers ('000) by year and age

Year	Age							
	1	2	3	4	5	6	7	8+
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
1996	7	1910	2237	759	301	62	31	1
1997	74	584	5857	1068	291	103	17	7

Table 2.7 Cod in Kattegat Mean weight (kg) in the catches by year and age.								
Year	Age							
	1	2	3	4	5	6	7	8+
1971	0.699	0.880	1.069	1.673	2.518	3.553	5.340	6.635
1972	0.699	0.880	1.069	1.673	2.518	3.553	5.340	6.635
1973	0.699	0.880	1.069	1.673	2.518	3.553	5.340	6.635
1974	0.699	0.880	1.069	1.673	2.518	3.553	5.340	6.635
1975	0.699	0.880	1.069	1.673	2.518	3.553	5.340	6.635
1976	0.699	0.880	1.069	1.673	2.518	3.553	5.340	6.635
1977	0.699	0.880	1.069	1.673	2.518	3.553	5.340	6.635
1978	0.699	0.880	1.170	1.690	2.860	4.120	5.180	6.900
1979	0.708	0.868	1.086	1.890	2.215	3.382	7.314	6.101
1980	0.691	0.893	0.951	1.440	2.478	3.157	3.526	6.903
1981	0.604	0.799	1.123	1.432	2.076	3.532	4.420	4.644
1982	0.600	0.784	1.233	1.391	2.078	2.911	3.698	6.480
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	4.090	6.847	7.133
1986	0.671	0.705	1.253	1.955	2.956	4.038	7.100	7.290
1987	0.483	0.716	1.118	1.972	2.868	4.200	5.185	8.288
1988	0.541	0.784	1.099	1.792	2.880	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	0.610	0.707	1.291	2.662	4.048	5.888	7.067	7.895
1993	0.567	0.862	1.583	2.321	4.970	7.566	9.391	8.705
1994	0.549	0.783	1.276	2.652	3.526	7.279	9.793	10.130
1995	0.598	0.799	1.121	1.947	2.404	3.537	9.973	10.708
1996	0.469	0.669	1.088	1.771	2.638	3.773	4.677	7.871
1997	0.450	0.621	0.959	1.950	2.806	3.877	5.756	7.213

Table 2.8 Cod in Kattegat
Mean weight (kg) in the stock by year and age.

Year	Age							
	1	2	3	4	5	6	7	8+
1971	0.059	0.355	0.919	1.673	2.518	3.553	5.340	6.635
1972	0.059	0.355	0.919	1.673	2.518	3.553	5.340	6.635
1973	0.059	0.355	0.919	1.673	2.518	3.553	5.340	6.635
1974	0.059	0.355	0.919	1.673	2.518	3.553	5.340	6.635
1975	0.059	0.355	0.919	1.673	2.518	3.553	5.340	6.635
1976	0.059	0.355	0.919	1.673	2.518	3.553	5.340	6.635
1977	0.059	0.355	0.919	1.673	2.518	3.553	5.340	6.635
1978	0.059	0.355	1.006	1.690	2.860	4.120	5.180	6.900
1979	0.059	0.350	0.934	1.890	2.215	3.382	7.314	6.101
1980	0.058	0.361	0.817	1.440	2.478	3.157	3.526	6.903
1981	0.051	0.323	0.965	1.432	2.076	3.532	4.420	4.644
1982	0.050	0.317	1.060	1.391	2.078	2.911	3.698	6.480
1983	0.050	0.304	0.971	1.943	3.348	3.141	5.301	6.325
1984	0.060	0.301	0.974	1.687	2.798	3.022	5.273	7.442
1985	0.051	0.339	0.848	1.614	2.575	4.090	6.847	7.133
1986	0.056	0.285	1.077	1.955	2.956	4.038	7.100	7.290
1987	0.041	0.289	0.961	1.972	2.868	4.200	5.185	8.288
1988	0.045	0.317	0.945	1.792	2.880	4.283	5.852	7.073
1989	0.052	0.372	1.091	2.296	3.856	5.733	5.166	6.527
1990	0.052	0.393	1.362	2.323	3.288	5.383	6.412	10.337
1991	0.061	0.405	1.551	2.986	4.548	4.179	9.127	12.055
1992	0.055	0.328	1.187	2.662	4.048	5.888	7.067	7.895
1993	0.061	0.355	1.049	2.321	4.970	7.566	9.391	8.705
1994	0.046	0.534	1.359	2.652	3.526	7.279	9.793	10.130
1995	0.040	0.146	1.260	1.947	2.404	3.537	9.973	10.708
1996	0.027	0.221	0.491	1.771	2.638	3.773	4.677	7.871
1997	0.034	0.177	0.751	1.950	2.806	3.877	5.756	7.213

Table 2.9 Cod in Kattegat Maturity ogive (combined of both sexes).								
Year	Age							
	1	2	3	4	5	6	7	8+
1971	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1972	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1973	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1974	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1975	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1976	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1977	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1978	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1979	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1980	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1981	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1982	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1983	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1984	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1985	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1986	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1987	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1988	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1989	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1990	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1991	0.02	0.62	0.69	0.90	1.00	1.00	1.00	1.00
1992	0.07	0.49	0.99	1.00	1.00	1.00	1.00	1.00
1993	0.03	0.49	0.73	0.96	1.00	1.00	1.00	1.00
1994	0.02	0.37	0.78	0.97	1.00	1.00	1.00	1.00
1995	0.00	0.11	0.98	1.00	1.00	1.00	1.00	1.00
1996	0.00	0.31	0.54	0.94	1.00	1.00	1.00	1.00
1997	0.00	0.20	0.90	1.00	1.00	1.00	1.00	1.00
1998	0.00	0.38	0.66	1.00	1.00	1.00	1.00	1.00

Table 2.10 Cod in Kattegat. Tuning input data

Cod in the Kattegat (part of Fishing area IIIa) (run name: XSAMAH02)

105

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

1983	1997						
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	9.3	2.64	2.1	0.01
	1	292.7	2	25.56	17.54	14.18	2.05
	1	52.5	264.2	48	16.5	3.2	2.3
	1	175.8	54.2	109	6.2	1.5	0.9

FLT12: Havfisker SD21 (Catch: Unknown) (Effort: Unknown)

1994	1997						
1	1	0.83	0.92				
1	5						
	1	159.783	3.6736	3.2732	0.5172	0.1312	
	1	57.512	3.3417	1.21739	0.86957	0.08696	
	1	20.588	13.979	0.31381	0	0.09524	
	1	47.157	2.6919	1.35815	0	0	

FLT15: Seine 100-120m (Catch: Unknown) (Effort: Unknown)

1987	1997						
1	1	0	1				
1	7						
	4202	-1	1503969	456825	117260	55464	10862
	2243	-1	99471	275206	57337	13740	3359
	3303	-1	348721	153277	112565	15934	3610
	1963	-1	46510	106757	36896	25562	2373
	2116	-1	308734	59959	15477	4848	4734
	1735	-1	106354	181201	7389	1774	505
	1229	-1	93677	61607	59727	1131	186
	1241	-1	33639	111426	21778	11439	39
	1162	-1	40065	78940	61613	12161	4688
	1256	-1	72201	79249	33182	11327	2501
	1111	-1	11225	149572	27033	6347	4450

FLT16: trawl 70-89 mm (Catch: Unknown) (Effort: Unknown)

1987	1997						
1	1	0	1				
1	7						
	2089	-1	315082	82169	20986	8433	2094
	1287	-1	54644	78549	14633	2964	704
	3078	-1	422145	100863	41828	5111	915
	4797	-1	229439	271138	54725	32964	1774
	3941	-1	564887	69923	19750	4861	4425
	2762	-1	133614	150545	8646	1410	441
	1781	-1	100117	36827	29016	445	74
	1719	-1	56208	87724	13692	5573	55
	1771	-1	61279	74323	53747	11163	4103
	1994	-1	98254	74515	28847	10304	2619
	1979	-1	50094	215726	26490	6434	2830

FLT17: trawl 105-120m (Catch: Unknown) (Effort: Unknown)

1987	1997						
1	1	0	1				
1	7						
	962	-1	58601	38516	14975	6367	1646
	744	-1	11789	52446	13024	3379	896
	1561	-1	122186	49211	40002	5863	1557
	2967	-1	56825	104955	41007	34780	3777
	3308	-1	354925	79609	27714	10455	8911
	2257	-1	120938	220191	10754	3161	941
	4839	-1	375224	131258	115019	2493	373
	3817	-1	111596	212251	42862	22840	294
	2910	-1	154570	199293	174683	34478	13187
	4669	-1	780452	402774	118298	42702	10736
	3650	-1	128829	620535	75200	18289	10669

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Table 2.11 **Tuning diagnostics, Cod Kattegat**

Lowestoft VPA Version 3.1

21-Apr-98 14:59:26

Extended Survivors Analysis

Cod Kattegat (run: XSAMAH02/X02)

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

Catch data for 27 years. 1971 to 1997. Ages 1 to 8.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
FLT08: Revised IBTS	1983	1997	1	6	0.17	0.25
FLT12: Havfisker SD2	1994	1997	1	5	0.83	0.92
FLT15: Seine 100-120	1987	1997	1	7	0	1
FLT16: trawl 70-89 m	1987	1997	1	7	0	1
FLT17: trawl 105-120	1987	1997	1	7	0	1

Time series weights :

Tapered time weighting applied
Power = 3 over 20 years

Catchability analysis :

Catchability independent of stock size for all ages

Catchability independent of age for ages >= 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 19 iterations

1										
Regression weights										
	0.751	0.82	0.877	0.921	0.954	0.976	0.99	0.997	1	1
Fishing mortalities										
Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	0.025	0.083	0.044	0.04	0.022	0.02	0.003	0.002	0.002	0.008
2	0.343	0.791	0.669	0.486	0.501	0.329	0.226	0.281	0.145	0.208
3	0.775	1.158	1.377	1.386	0.836	0.547	0.758	0.891	0.827	0.878
4	1.217	1.144	1.526	1.633	1.333	0.956	0.817	1.287	0.956	1.385
5	1.066	1.63	1.361	1.974	1.256	1.269	0.768	1.401	0.913	1.386
6	0.715	1.273	2.988	1.48	0.817	0.674	0.225	1.307	1.089	0.977
7	0.948	1.273	1.539	1.27	1.003	1.082	0.886	1.471	0.916	1.079

Estimated population abundance at 1st Jan 1998

0 7970 2290 3770 323 88 56

Taper weighted geometric mean of the VPA populations:

9330 7540 4390 1290 310 72 16

Standard error of the weighted Log(VPA populations) :

0.5402 0.5743 0.6302 0.7627 0.9127 1.122 1.1181

1

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Cont. Table 2.11

Log catchability residuals.

Fleet : FLT08: Revised IBTS

Age	1983	1984	1985	1986	1987
1	-0.31	-0.02	-1.86	0.83	-3.32
2	0.61	0.18	0.88	0.37	1.76
3	-0.57	-0.42	0.04	-0.58	0.83
4	-0.14	-0.1	-0.28	-0.27	-0.13
5	-0.18	0.5	-0.54	-0.24	-0.54
6	-0.2	1.55	0.34	-0.35	-0.39
7	No data for this fleet at this age				

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	0.7	-0.36	0.23	0.05	-0.24	0.03	-0.82	1.1	0.9	1.26
2	-0.11	0.43	0.03	0.82	-0.9	-0.51	-1.22	-2.88	1.19	1.13
3	0.6	0.08	0.11	0.62	-0.33	-0.32	-1.49	0	0.54	0.45
4	0.68	0.47	0.34	0.31	0.19	0.01	-1.36	0.08	0.54	-0.49
5	0.45	0.61	0.26	1.29	-0.47	-0.21	-1.06	1.27	-0.41	-0.81
6	0.22	0.58	0.29	0.41	0.27	-1.7	-2.39	0	0.98	-0.55
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	-5.2411	-5.1999	-4.8419	-4.7122	-4.5168	-4.5168
S.E(Log q)	1.159	1.2574	0.6382	0.5495	0.7686	1.0389

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	0.63	0.862	6.66	0.36	15	0.74	-5.24
2	0.67	0.714	6.42	0.33	15	0.86	-5.2
3	1.42	-0.961	3.34	0.35	15	0.91	-4.84
4	1.25	-0.873	4.11	0.56	15	0.69	-4.71
5	1.18	-0.56	4.3	0.49	15	0.94	-4.52
6	0.67	1.824	4.52	0.76	15	0.63	-4.67
1							

Fleet : FLT12: Havfisker SD2

Age	1994	1995	1996	1997
1	1.12	-0.69	-0.2	-0.22
2	-0.11	-0.29	0.24	0.16
3	0.91	0.5	-0.99	-0.41
4	-0.19	0.19	99.99	99.99
5	-0.14	0.28	-0.14	99.99
6	No data for this fleet at this age			
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
Mean Log q	-4.9403	-6.9538	-7.6552	-6.835	-7.5606
S.E(Log q)	0.7769	0.2414	0.8639	0.2685	0.243

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	1.57	-0.428	2.55	0.22	4	1.43	-4.94
2	0.93	0.275	7.08	0.89	4	0.27	-6.95
3	1.14	-0.091	7.51	0.18	4	1.2	-7.66
4	0	0	0	0	0	0	0
5	-4.35	-1.069	1.13	0.04	3	1.02	-7.56
1							

Cont. Table 2.11

Fleet : FLT15: Seine 100-120

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
2	1.4	0.23	0.98	0.33	0.52	0.36	-0.09	-0.61	-0.48	-0.82	-1.02
3	0.54	0.24	0.05	0.42	0.55	-0.09	-0.24	-0.33	-0.1	-0.28	-0.42
4	0.18	0.32	-0.09	0.47	-0.09	0.04	0.05	-0.6	0.14	-0.1	-0.16
5	0.44	0.16	0.25	0.39	0.27	-0.34	0.04	-0.51	0.15	-0.27	-0.29
6	0.03	-0.27	-0.22	1.12	0.24	-0.06	-1.03	-2.31	-0.15	-0.03	0.05
7	0.64	-0.27	0.01	0.11	0.48	-0.63	-1.92	0.36	-0.33	-0.12	-0.41

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	0	-4.6138	-3.4951	-3.3224	-3.3421	-3.3421	-3.3421
S.E(Log q)	0	0.7428	0.3524	0.2842	0.3254	0.9202	0.7425

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	0	0	0	0	0	0	0
2	0.85	0.392	5.25	0.46	11	0.66	-4.61
3	1.68	-2.943	0.23	0.7	11	0.44	-3.5
4	1.07	-0.505	3.05	0.86	11	0.32	-3.32
5	1.03	-0.199	3.28	0.88	11	0.35	-3.34
6	0.71	1.718	3.75	0.81	11	0.56	-3.61
7	0.99	0.057	3.55	0.7	11	0.74	-3.56
1							

Fleet : FLT16: trawl 70-89 m

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
2	0.47	0.13	1.18	0.97	0.44	0.06	-0.46	-0.49	-0.54	-1.04	-0.17
3	0.04	0.06	0.22	0.98	0.6	-0.23	-0.61	-0.38	-0.06	-0.29	-0.12
4	-0.17	0.19	-0.33	0.65	0.21	0.41	-0.36	-0.72	0.26	-0.02	-0.08
5	0.07	-0.01	0	0.57	0.46	-0.22	-0.45	-0.74	0.46	-0.01	-0.03
6	-0.1	-0.46	-0.71	0.75	0.36	0.16	-1.51	-1.47	0.11	0.37	-0.16
7	0.11	-0.69	-0.71	0.21	1	-0.28	-1.19	-0.74	-0.64	0.03	-0.5

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	0	-4.5502	-4.0121	-3.9985	-4.1587	-4.1587	-4.1587
S.E(Log q)	0	0.6813	0.4556	0.3975	0.4063	0.8017	0.6993

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	0	0	0	0	0	0	0
2	1.88	-1.23	0.76	0.2	11	1.25	-4.55
3	1.73	-2.007	0.91	0.49	11	0.68	-4.01
4	1.44	-1.944	2.67	0.71	11	0.5	-4
5	0.93	0.515	4.26	0.86	11	0.39	-4.16
6	0.75	1.623	4.33	0.84	11	0.52	-4.41
7	1.16	-0.67	4.77	0.7	11	0.73	-4.48
1							

Cont. Table 2.11

Fleet : FLT17: trawl 105-120

Age	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
2	-0.38	-0.8	0.68	0.11	0.21	0.22	-0.08	-0.54	-0.06	0.24	0.23
3	-0.2	-0.06	-0.09	0.24	0.64	0.09	-0.6	-0.56	0.16	0.29	0.06
4	-0.19	0.16	-0.16	0.38	0.27	0.38	-0.44	-0.83	0.48	0.08	-0.11
5	-0.11	0	0.14	0.43	0.73	0.11	-0.4	-0.8	0.41	-0.12	-0.28
6	-0.24	-0.35	-0.17	1.31	0.56	0.44	-1.57	-1.27	0.1	0.25	-0.12
7	0.09	-0.51	0.13	0.82	0.02	-0.08	-1.4	-0.99	-1.07	0.05	-0.48

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	0	-4.61	-3.7477	-3.5405	-3.4803	-3.4803	-3.4803
S.E(Log q)	0	0.4031	0.3729	0.4111	0.4405	0.8336	0.7528

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	0	0	0	0	0	0	0
2	0.98	0.063	4.67	0.68	11	0.42	-4.61
3	1.3	-1.199	2.37	0.66	11	0.47	-3.75
4	1.32	-1.354	2.44	0.7	11	0.52	-3.54
5	1.07	-0.404	3.33	0.8	11	0.5	-3.48
6	0.79	1.094	3.69	0.77	11	0.64	-3.59
7	0.82	1.067	3.6	0.81	11	0.54	-3.82
1							

Table 2.12 Cod Kattegat. Fishing mortalities

Run title : Cod Kattegat (run: XSAMAH02/X02)

At 21-Apr-98 14:59:45

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age

YEAR	1971	1972	1973	1974	1975	1976	1977				
AGE											
1	0.5803	0.0018	0.0004	0.0214	0.0079	0.0164	0				
2	0.3574	0.2788	0.037	0.4522	0.1761	0.2594	0.314				
3	0.6729	0.5527	0.2527	0.7183	0.6491	0.607	0.8626				
4	0.5962	0.528	0.8094	1.3321	0.9189	1.2199	1.2794				
5	0.6123	0.5447	1.6002	0.8972	0.6844	0.8868	1.5215				
6	0.5519	0.7004	1.9159	1.3441	0.683	0.7362	0.9967				
7	0.5628	0.5251	0.9332	0.9593	0.6278	0.7492	1.0061				
+gp	0.5628	0.5251	0.9332	0.9593	0.6278	0.7492	1.0061				
0 FBAR 3- 5	0.6271	0.5418	0.8874	0.9825	0.7508	0.9046	1.2211				
YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	
AGE											
1	0.0041	0.0215	0.0425	0.021	0.0181	0.035	0.0122	0.0888	0.0264	0.0326	
2	0.3159	0.1981	0.1797	0.4723	0.2916	0.4175	0.3408	0.464	0.3456	0.8694	
3	0.7304	0.6186	0.6161	0.5693	0.9354	0.9601	0.8683	1.2767	1.1024	1.1954	
4	0.6856	0.7143	0.8496	1.473	1.8596	1.2557	1.2797	1.4862	1.2358	1.4083	
5	0.8804	0.9044	0.6164	1.1336	1.1731	0.995	1.2228	1.2088	1.1686	1.6267	
6	1.3373	0.57	1.0695	0.5525	1.6425	1.6364	1.9478	1.5203	2.0797	1.4915	
7	0.7979	0.6063	0.6724	0.8489	1.1949	1.0652	1.146	1.2023	1.1985	1.2902	
+gp	0.7979	0.6063	0.6724	0.8489	1.1949	1.0652	1.146	1.2023	1.1985	1.2902	
0 FBAR 3- 5	0.7655	0.7458	0.694	1.0586	1.3227	1.0703	1.1236	1.3239	1.169	1.4102	
1											
YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	FBAR 95-97
AGE											
1	0.0253	0.0834	0.0445	0.0405	0.0217	0.0198	0.0028	0.0021	0.0018	0.0084	0.0041
2	0.3427	0.7915	0.6695	0.4858	0.5009	0.3285	0.2259	0.2815	0.145	0.2076	0.2114
3	0.7754	1.1581	1.3775	1.3856	0.8364	0.5471	0.7578	0.8905	0.8266	0.8782	0.8651
4	1.2168	1.1435	1.5259	1.6335	1.3326	0.9558	0.8171	1.2865	0.9561	1.3851	1.2092
5	1.066	1.6304	1.3605	1.9743	1.2555	1.2688	0.768	1.4006	0.913	1.3862	1.2333
6	0.7154	1.2732	2.9876	1.4799	0.8167	0.6742	0.225	1.3066	1.089	0.9769	1.1242
7	0.9482	1.273	1.5391	1.2696	1.0025	1.0823	0.8862	1.4711	0.9161	1.0794	1.1555
+gp	0.9482	1.273	1.5391	1.2696	1.0025	1.0823	0.8862	1.4711	0.9161	1.0794	
0 FBAR 3- 5	1.0194	1.3107	1.4213	1.6645	1.1415	0.9239	0.781	1.1925	0.8986	1.2165	
1											

Table 2.13 Cod in Kattegat. Stock numbers

Run title : Cod Kattegat (run: XSAMAH02/X02)

At 21-Apr-98 14:59:45

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	1976	1977							
AGE															
0		1	37778	23223	15777	30827	26381	11293	29978						
		2	29189	17313	18979	12913	24704	21429	9096						
		3	15651	16716	10726	14975	6726	16960	13535						
		4	4720	6538	7875	6821	5978	2878	7567						
		5	2141	2129	3157	2870	1474	1953	696						
		6	539	950	1011	522	958	609	659						
		7	77	254	386	122	111	396	239						
	+gp		76	102	287	55	44	107	175						
	TOTAL		90171	67225	58198	69104	66378	55624	61944						
	YEAR														
		1978	1979	1980	1981	1982	1983	1984	1985	1986	1987				
AGE															
0		1	23842	11045	14661	17420	20919	20953	11529	8906	18220	5783			
		2	24543	19440	8850	11504	13966	16819	16564	9324	6672	14528			
		3	5440	14652	13056	6054	5873	8542	9071	9645	4800	3867			
		4	4677	2146	6462	5773	2805	1887	2678	3117	2203	1305			
		5	1724	1929	860	2262	1083	358	440	610	577	524			
		6	124	585	639	380	596	274	108	106	149	147			
		7	199	27	271	180	179	94	44	13	19	15			
	+gp		141	113	78	148	56	41	30	23	15	28			
	TOTAL		60690	49937	44878	43721	45477	48969	40463	31744	32656	26197			
	1														
YEAR															
		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	GMST 71-95	AMST 71-95	
AGE															
0		1	7904	3412	15400	7659	13557	7734	8713	19141	4212	9812	0	14230	16482
		2	4583	6310	2570	12060	6022	10862	6208	7113	15638	3442	7966	11398	13262
		3	4986	2663	2341	1077	6074	2988	6403	4055	4395	11075	2290	6743	8275
		4	958	1880	685	483	221	2155	1415	2457	1363	1574	3768	2513	3427
		5	261	232	491	122	77	48	678	512	556	429	323	685	1088
		6	84	74	37	103	14	18	11	258	103	183	88	192	358
		7	27	34	17	2	19	5	8	7	57	28	56	48	110
	+gp		5	15	11	5	3	13	15	13	2	11	11		
	TOTAL		18809	14620	21551	21511	25987	23821	23450	33555	26326	26555	14502		
	1														

Table 2.14 Cod in Kattegat. Stock Summary

Run title : Cod Kattegat (run: XSAMAH02/X02)

At 21-Apr-98 14:59:45

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 3-5
Age 1						
1971	37778	43095	30981	15732	0.5078	0.6271
1972	23223	44586	35664	17442	0.4891	0.5418
1973	15777	46205	38485	18837	0.4895	0.8874
1974	30827	41669	33629	21880	0.6506	0.9825
1975	26381	34515	25804	15485	0.6001	0.7508
1976	11293	38582	29563	16275	0.5505	0.9046
1977	29978	36620	29736	20119	0.6766	1.2211
1978	23842	30940	22631	13390	0.5917	0.7655
1979	11045	32332	24275	14830	0.6109	0.7458
1980	14661	29661	24189	13509	0.5585	0.694
1981	17420	26235	21490	15337	0.7137	1.0586
1982	20919	20612	15311	12465	0.8141	1.3227
1983	20953	20943	14761	12828	0.8691	1.0703
1984	11529	21043	15145	11886	0.7848	1.1236
1985	8906	19081	14694	12706	0.8647	1.3239
1986	18220	14954	11490	9096	0.7917	1.169
1987	5783	13159	9387	11491	1.2242	1.4102
1988	7904	9547	7195	5527	0.7682	1.0194
1989	3412	11337	8916	8590	0.9634	1.3107
1990	15400	8625	6455	5936	0.9196	1.4213
1991	7659	9519	6543	6834	1.0445	1.6645
1992	13557	11076	9303	6271	0.6741	1.1415
1993	7734	12997	9527	7013	0.7361	0.9239
1994	8713	18865	14357	7802	0.5434	0.781
1995	19141	14045	12253	8165	0.6664	1.1925
1996	4212	10278	6642	6126	0.9223	0.8986
1997	9812	14488	12835	9461	0.7371	1.2165
Arith. Mean 0 Units	15781 (Thousands)	23519 (Tonnes)	18195 (Tonnes)	12038 (Tonnes)	0.7319	1.0433

1

Table 2.15

The SAS System

08:35 Wednesday, April 29, 1998

Cod in the Kattegat (part of Fishing Area IIIa)

Prediction with management option table: Input data

Year: 1998								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	13802.000	0.2000	0.0000	0.0000	0.0000	0.034	0.0045	0.506
2	7966.000	0.2000	0.2067	0.0000	0.0000	0.181	0.2332	0.696
3	2290.000	0.2000	0.8067	0.0000	0.0000	0.834	0.9545	1.056
4	3768.000	0.2000	0.9800	0.0000	0.0000	1.889	1.3342	1.889
5	323.000	0.2000	1.0000	0.0000	0.0000	2.616	1.3608	2.616
6	88.000	0.2000	1.0000	0.0000	0.0000	3.729	1.2400	3.729
7	56.000	0.2000	1.0000	0.0000	0.0000	6.802	1.2745	6.802
8+	11.000	0.2000	1.0000	0.0000	0.0000	8.597	1.2745	8.597
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1999								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	10440.000	0.2000	0.0000	0.0000	0.0000	0.034	0.0045	0.506
2	.	0.2000	0.2067	0.0000	0.0000	0.181	0.2332	0.696
3	.	0.2000	0.8067	0.0000	0.0000	0.834	0.9545	1.056
4	.	0.2000	0.9800	0.0000	0.0000	1.889	1.3342	1.889
5	.	0.2000	1.0000	0.0000	0.0000	2.616	1.3608	2.616
6	.	0.2000	1.0000	0.0000	0.0000	3.729	1.2400	3.729
7	.	0.2000	1.0000	0.0000	0.0000	6.802	1.2745	6.802
8+	.	0.2000	1.0000	0.0000	0.0000	8.597	1.2745	8.597
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 2000								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	10440.000	0.2000	0.0000	0.0000	0.0000	0.034	0.0045	0.506
2	.	0.2000	0.2067	0.0000	0.0000	0.181	0.2332	0.696
3	.	0.2000	0.8067	0.0000	0.0000	0.834	0.9545	1.056
4	.	0.2000	0.9800	0.0000	0.0000	1.889	1.3342	1.889
5	.	0.2000	1.0000	0.0000	0.0000	2.616	1.3608	2.616
6	.	0.2000	1.0000	0.0000	0.0000	3.729	1.2400	3.729
7	.	0.2000	1.0000	0.0000	0.0000	6.802	1.2745	6.802
8+	.	0.2000	1.0000	0.0000	0.0000	8.597	1.2745	8.597
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANMAH04
Date and time: 22APR98:18:48

Table 2.16 Cod Kattegat RCT3 Inputdata

Cod in Kattegat age 1

1 16 2

'Y-class'	'VPA'	'IBTS 1Q'
1982	20953	77.13
1983	11529	57.42
1984	8906	6.93
1985	18220	210.24
1986	5783	1.05
1987	7904	80.77
1988	3412	11.84
1989	15400	97.67
1990	7659	40.73
1991	13557	54.04
1992	7734	40.17
1993	8713	19.53
1994	19141	292.7
1995	-11	52.5
1996	-11	175.8
1997	-11	199.4

Table 2.17 Cod in Kattegat. RCT3 analysis results

Analysis by RCT3 ver3.1 of data from file :

codkatin.prn

Cod in Kattegat age 1

Data for 1 surveys over 16 years : 1982 - 1997

Regression type = C

Tapered time weighting applied

power = 3 over 20 years

Survey weighting not applied

Final estimates shrunk towards mean Minimum S.E. for any survey taken as .20

Minimum of 3 points used for regression Forecast/Hindcast variance correction

used. Yearclass = 1995

I-----Regression-----I				I-----Prediction-----I								
Survey/ Series	Slope	Inter- cept	Error	Std	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	Weights	Std	WAP
IBTS 1	.52	7.26		.49	.556		13	3.98			9.33	.571
								VPA Mean =			9.20	.525

Yearclass = 1996

I-----Regression-----I				I-----Prediction-----I								
Survey/ Series	Slope	Inter- cept	Error	Std	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	Weights	Std	WAP
IBTS 1	.52	7.25		.49	.563		13	5.18			9.94	.601
								VPA Mean =			9.19	.524

Yearclass = 1997

I-----Regression-----I				I-----Prediction-----I								
Survey/ Series	Slope	Inter- cept	Error	Std	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	Weights	Std	WAP
IBTS 1	.52	7.25		.48	.571		13	5.30			9.99	.608
								VPA Mean =			9.19	.524
Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA					
1995	10499	9.26	.39	.07	.03							
1996	13594		9.52	.40		.37			.88			
1997	13802		9.53	.40		.40			1.00			

Table 2.18

Cod in the Kattegat (part of Fishing Area IIIa)

The SAS System

08:35 Wednesday, April 29, 1998

Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	1.2165	12587	10464	8418	0.6000	0.7299	10715	7885	5154	15171	12212
.	.	.	.	.	0.8000	0.9732	.	7885	6336	13592	10708
.	.	.	.	.	1.0000	1.2165	.	7885	7335	12278	9465
.	.	.	.	.	1.2000	1.4598	.	7885	8185	11178	8430
.	.	.	.	.	1.4000	1.7031	.	7885	8914	10251	7564
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANMAH04
 Date and time : 22APR98:18:48
 Computation of ref. F: Simple mean, age 3 - 5
 Basis for 1998 : F factors

Table 2.19

The SAS System

08:35 Wednesday, April 29, 1998

Cod in the Kattegat (part of Fishing Area IIIa)

Yield per recruit: Input data

Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	1.000	0.2000	0.0000	0.0000	0.0000	0.034	0.0045	0.506
2	.	0.2000	0.2067	0.0000	0.0000	0.181	0.2332	0.696
3	.	0.2000	0.8067	0.0000	0.0000	0.834	0.9545	1.056
4	.	0.2000	0.9800	0.0000	0.0000	1.889	1.3342	1.889
5	.	0.2000	1.0000	0.0000	0.0000	2.616	1.3608	2.616
6	.	0.2000	1.0000	0.0000	0.0000	3.729	1.2400	3.729
7	.	0.2000	1.0000	0.0000	0.0000	6.802	1.2745	6.802
8+	.	0.2000	1.0000	0.0000	0.0000	8.597	1.2745	8.597
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDMAH01
 Date and time: 21APR98:15:33

Table 2.20

The SAS System

08:35 Wednesday, April 29, 1998

Cod in the Kattegat (part of Fishing Area IIIa)

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	0.000	0.000	5.517	18069.786	3.727	17789.518	3.727	17789.518
0.0500	0.0608	0.164	677.070	4.702	12102.782	2.915	11825.018	2.915	11825.018
0.1000	0.1217	0.264	946.066	4.204	8720.932	2.419	8445.587	2.419	8445.587
0.1500	0.1825	0.332	1043.984	3.868	6615.271	2.085	6342.265	2.085	6342.265
0.2000	0.2433	0.381	1065.323	3.625	5218.663	1.844	4947.918	1.844	4947.918
0.2500	0.3041	0.418	1052.128	3.442	4248.443	1.662	3979.888	1.662	3979.888
0.3000	0.3649	0.448	1024.269	3.297	3549.669	1.520	3283.235	1.520	3283.235
0.3500	0.4258	0.472	991.392	3.181	3031.352	1.406	2766.973	1.406	2766.973
0.4000	0.4866	0.491	958.157	3.085	2637.197	1.312	2374.809	1.312	2374.809
0.4500	0.5474	0.508	926.714	3.004	2330.914	1.233	2070.459	1.233	2070.459
0.5000	0.6082	0.522	897.935	2.935	2088.324	1.166	1829.745	1.166	1829.745
0.5500	0.6691	0.535	872.046	2.875	1892.864	1.108	1636.106	1.108	1636.106
0.6000	0.7299	0.546	848.954	2.823	1732.921	1.057	1477.933	1.057	1477.933
0.6500	0.7907	0.555	828.427	2.777	1600.187	1.013	1346.920	1.013	1346.920
0.7000	0.8516	0.564	810.186	2.735	1488.611	0.973	1237.017	0.973	1237.017
0.7500	0.9124	0.572	793.944	2.698	1393.714	0.938	1143.749	0.938	1143.749
0.8000	0.9732	0.579	779.438	2.665	1312.136	0.906	1063.756	0.906	1063.756
0.8500	1.0340	0.586	766.432	2.634	1241.319	0.877	994.483	0.877	994.483
0.9000	1.0949	0.592	754.719	2.606	1179.292	0.850	933.962	0.850	933.962
0.9500	1.1557	0.597	744.122	2.580	1124.523	0.826	880.661	0.826	880.661
1.0000	1.2165	0.602	734.492	2.556	1075.802	0.804	833.372	0.804	833.372
1.0500	1.2773	0.607	725.702	2.534	1032.170	0.783	791.138	0.783	791.138
1.1000	1.3382	0.612	717.644	2.513	992.855	0.764	753.187	0.764	753.187
1.1500	1.3990	0.616	710.228	2.494	957.232	0.746	718.897	0.746	718.897
1.2000	1.4598	0.620	703.378	2.475	924.789	0.729	687.757	0.729	687.757
1.2500	1.5206	0.624	697.029	2.458	895.106	0.714	659.347	0.714	659.347
1.3000	1.5815	0.627	691.126	2.442	867.833	0.699	633.319	0.699	633.319
1.3500	1.6423	0.630	685.621	2.427	842.677	0.685	609.382	0.685	609.382
1.4000	1.7031	0.634	680.474	2.413	819.391	0.672	587.289	0.672	587.289
1.4500	1.7639	0.637	675.651	2.399	797.766	0.660	566.832	0.660	566.832
1.5000	1.8248	0.640	671.121	2.386	777.623	0.648	547.833	0.648	547.833
1.5500	1.8856	0.642	666.859	2.373	758.809	0.637	530.140	0.637	530.140
1.6000	1.9464	0.645	662.840	2.361	741.191	0.626	513.620	0.626	513.620
1.6500	2.0072	0.648	659.045	2.350	724.653	0.616	498.160	0.616	498.160
1.7000	2.0681	0.650	655.456	2.339	709.096	0.606	483.659	0.606	483.659
1.7500	2.1289	0.652	652.056	2.328	694.430	0.597	470.030	0.597	470.030
1.8000	2.1897	0.655	648.832	2.318	680.577	0.588	457.195	0.588	457.195
1.8500	2.2505	0.657	645.770	2.309	667.469	0.580	445.087	0.580	445.087
1.9000	2.3114	0.659	642.859	2.299	655.045	0.572	433.644	0.572	433.644
1.9500	2.3722	0.661	640.088	2.290	643.250	0.564	422.812	0.564	422.812
2.0000	2.4330	0.663	637.448	2.282	632.035	0.556	412.544	0.556	412.544
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDMAH01
Date and time : 21APR98:15:33
Computation of ref. F: Simple mean, age 3 - 5
F-0.1 factor : 0.1205
F-max factor : 0.1992
F-0.1 reference F : 0.1466
F-max reference F : 0.2424
Recruitment : Single recruit

Table 2.21 Input parameters for medium term projection, Cod in Kattegat

Stock input for 1998

Age	Stock No.	Log SE(int)
1	13802	0.41
2	7966	0.19
3	2290	0.15
4	3768	0.17
5	323	0.18
6	88	0.19
7	56	0.28
8	11	0.28

Mean weight in the catch

age	1	2	3	4	5	6	7	8
Mean	0.546	0.757	1.264	2.327	3.563	5.157	7.969	9.225
Std.dev.	0.062	0.094	0.231	0.456	0.997	1.731	2.131	1.777

Correction factors to derive Stock mean weight from Catch mean weight

Age	1	2	3
Factor	0.084795	0.408525	0.864083

Maturity information

age	1	2	3	4	5	6	7	8
mean	0.017143	0.371429	0.784286	0.971429	1	1	1	1
std.dev.	0.026277	0.178646	0.173672	0.039761	0	0	0	0

Table 2.22: Medium term SSB's by various levels of fishing mortalities. Cod in Kattegat.

F(3-5) 1.2165

Percentile	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	9.65	4.76	4.66	5.11	4.11	3.26	3.18	2.78	2.46	2.27
0.1	10.77	5.22	5.20	5.64	4.98	3.84	3.61	3.31	2.98	2.65
0.25	11.98	6.06	6.34	6.85	6.51	4.84	4.48	4.35	4.28	3.78
0.5	13.67	7.01	7.61	8.40	8.22	6.64	5.80	5.66	5.56	5.09
0.75	15.25	8.06	9.03	10.58	11.00	8.72	8.25	8.33	7.40	7.35
0.9	17.03	9.10	10.81	12.89	14.07	11.48	10.92	10.88	12.19	10.63
0.95	18.06	9.82	12.26	14.91	18.03	12.69	12.27	12.49	13.87	12.98

F(3-5) 1

Percentile	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	10.33	5.59	6.24	6.58	5.85	5.79	4.99	4.78	4.46	4.76
0.1	10.91	6.15	6.83	7.30	6.50	6.39	6.01	5.80	5.47	5.74
0.25	12.22	7.17	7.79	8.70	8.47	7.82	7.25	7.80	7.15	6.90
0.5	13.60	8.21	9.73	11.24	10.39	9.87	9.68	10.36	9.95	9.44
0.75	15.19	9.33	11.62	13.89	13.89	12.40	12.93	13.33	14.27	13.77
0.9	16.99	10.71	13.50	16.28	17.32	16.47	17.24	17.67	18.73	18.61
0.95	17.75	11.30	14.50	17.95	19.28	20.25	22.07	20.85	21.07	22.13

F(3-5) 0.83

Percentile	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	9.89	6.07	7.91	9.26	8.70	8.02	7.71	8.46	8.57	8.73
0.1	10.58	6.97	8.36	10.09	9.93	8.75	8.76	9.47	10.60	9.99
0.25	12.21	8.18	9.29	11.22	11.46	10.87	10.56	11.39	13.22	13.12
0.5	13.62	9.47	11.20	13.13	13.82	13.62	13.87	15.11	16.60	16.42
0.75	15.08	10.81	13.32	16.07	17.70	16.80	18.84	20.52	21.56	22.48
0.9	16.57	12.23	15.57	20.04	21.87	22.13	23.38	25.95	28.23	32.72
0.95	17.34	12.70	17.17	23.12	25.74	25.76	29.95	30.00	32.20	35.77

F(3-5) 0.8

Percentile	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	10.31	6.25	7.47	9.02	8.98	8.17	8.19	7.69	8.28	8.08
0.1	11.09	6.90	8.32	9.80	10.17	9.43	9.52	8.62	9.55	10.31
0.25	11.98	8.20	9.67	11.71	11.41	11.23	11.54	11.57	13.32	13.09
0.5	13.36	9.52	11.60	14.14	14.28	14.30	14.92	16.00	16.57	16.75
0.75	15.05	10.96	13.44	17.98	17.72	18.17	19.80	21.15	20.30	23.64
0.9	16.48	12.21	15.60	20.78	24.69	24.19	24.89	27.68	27.31	28.32
0.95	18.53	13.26	17.01	26.16	29.26	28.07	30.28	33.33	33.72	32.81

Figure 2.1 Cod Kattegat. Landings 1971-1997, official reported statistics

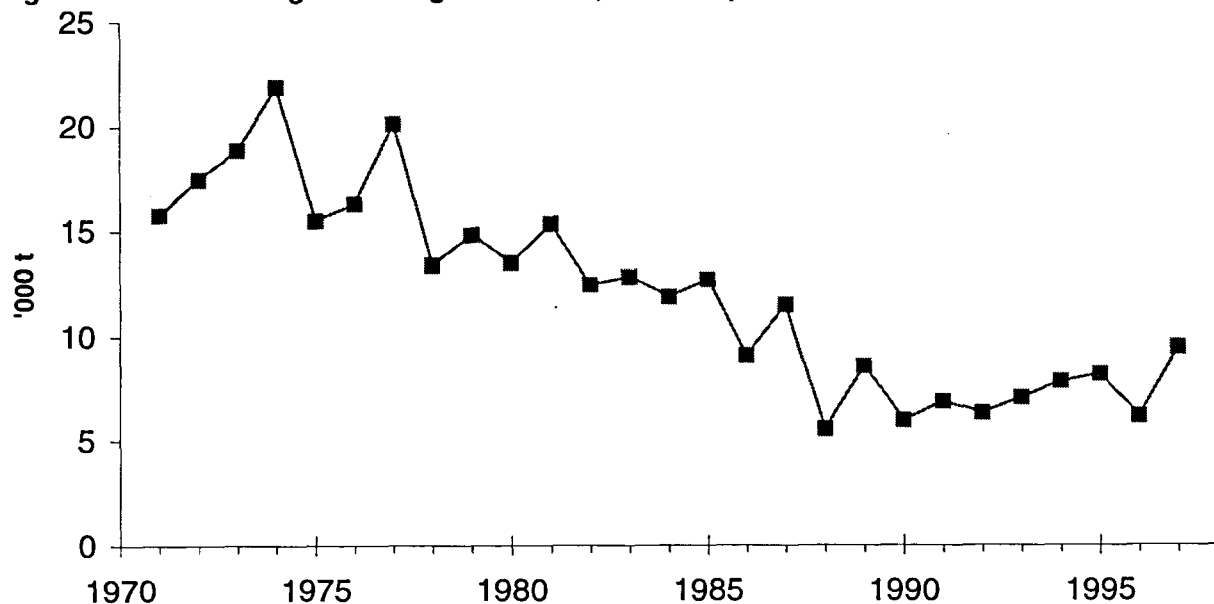
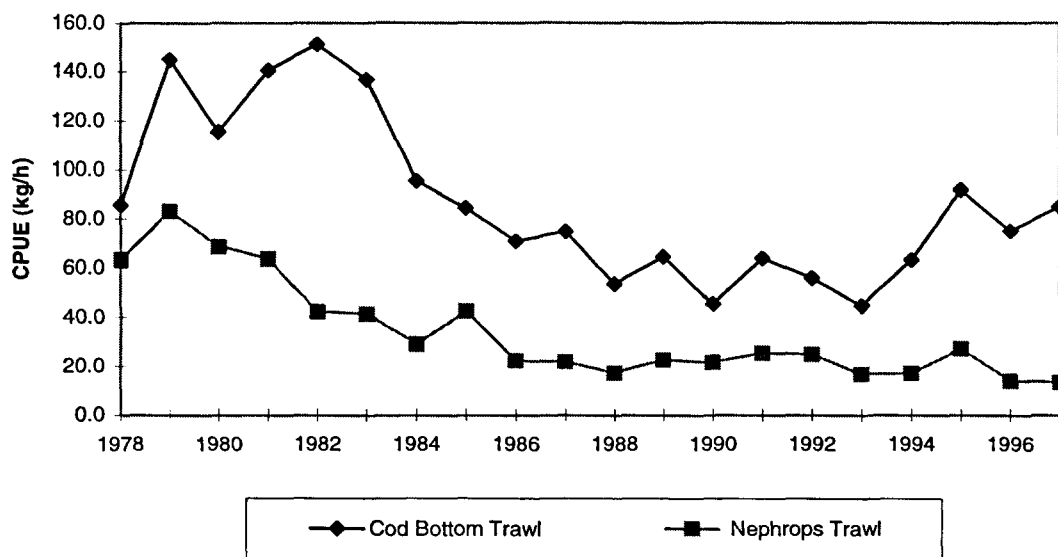


Figure 2.2 Cod Kattegat: Swedish CPUE in commercial trawl fisheries



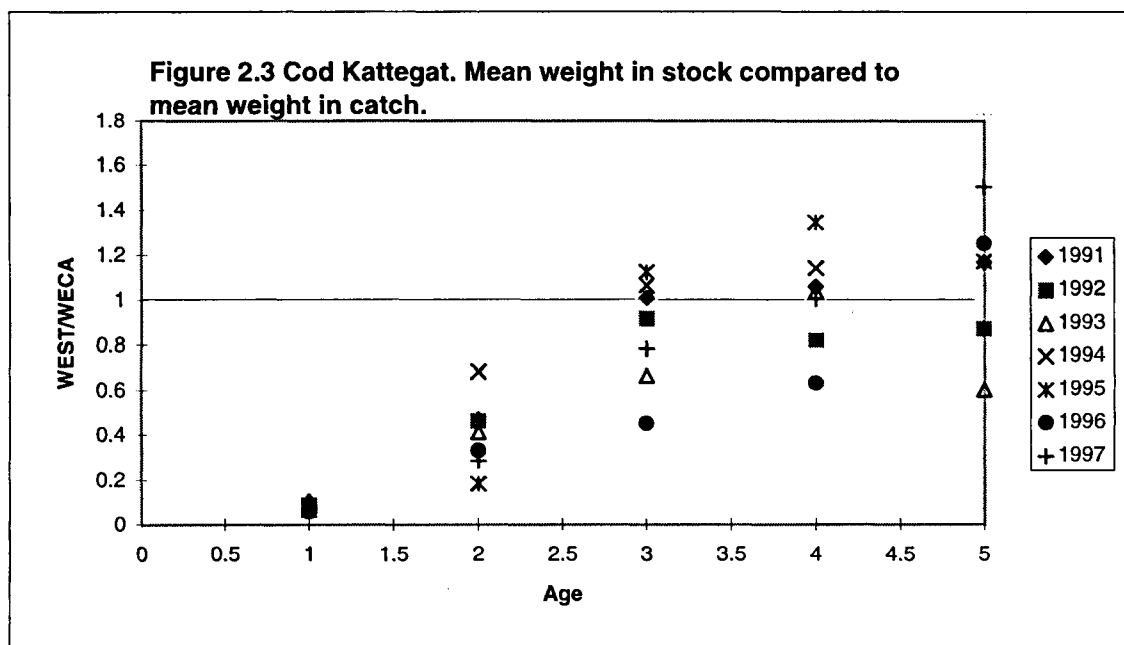


Figure 2.4a Fleet: Revised IBTS

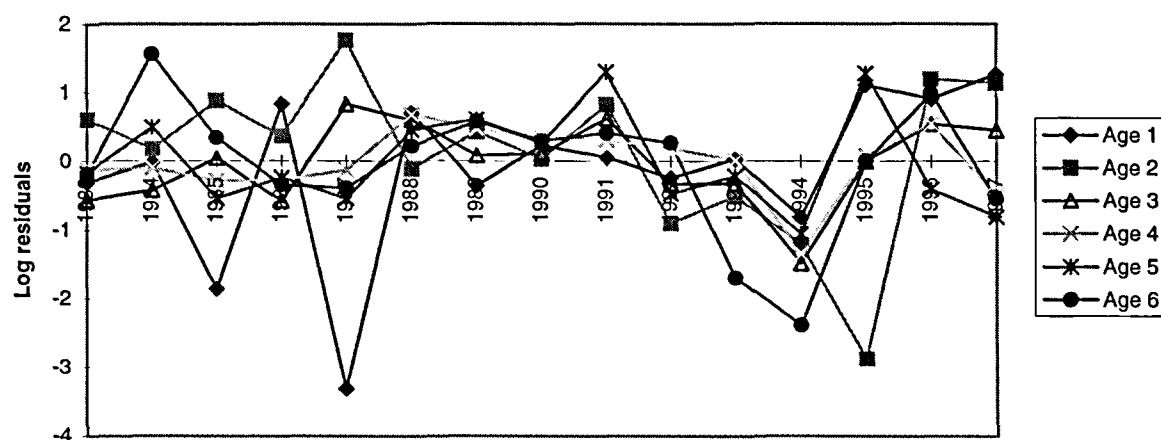


Figure 2.4b Fleet: Havfisken

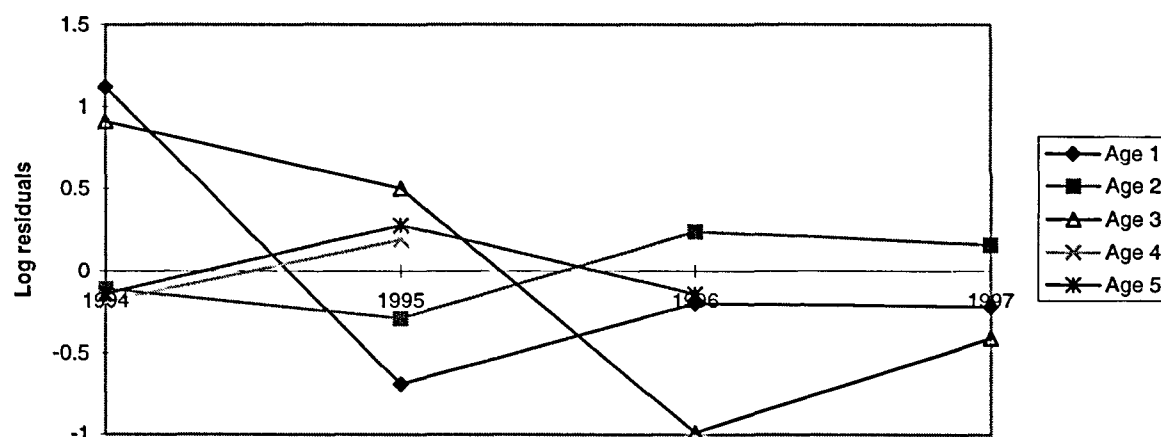


Figure 2.4c Fleet: Seine 100-120

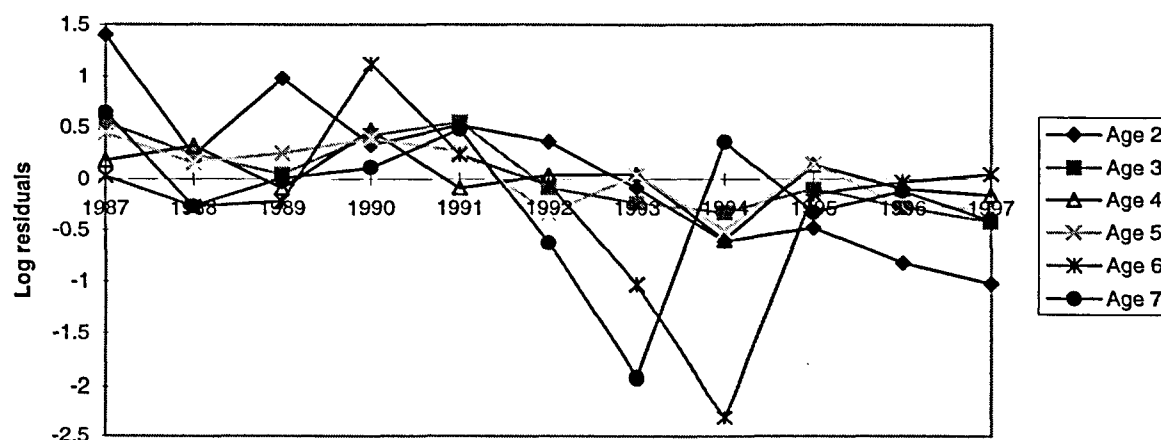


Figure 2.4 a-e. Cod in Kattegat: Log residuals from XSA F-estimates for the tuning fleets.

Figure 2.4d Fleet: Trawl 70-89

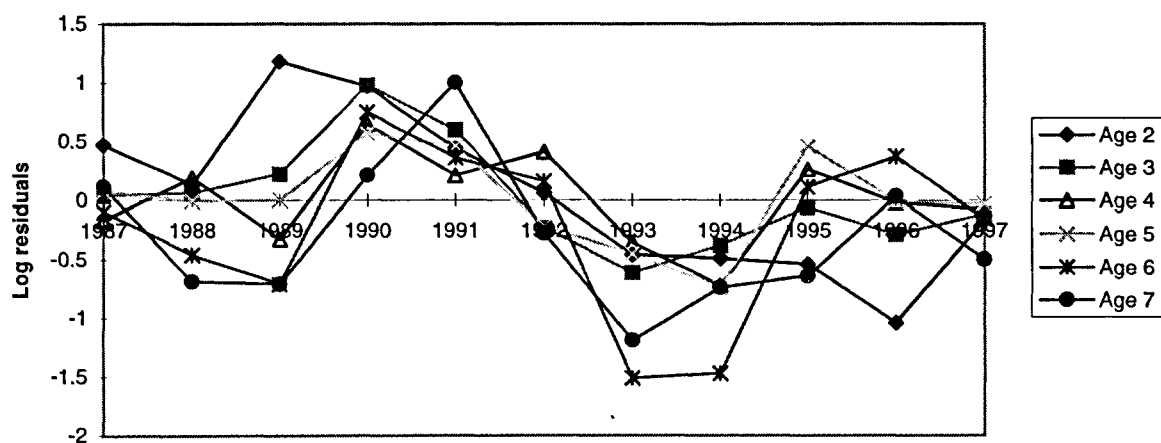
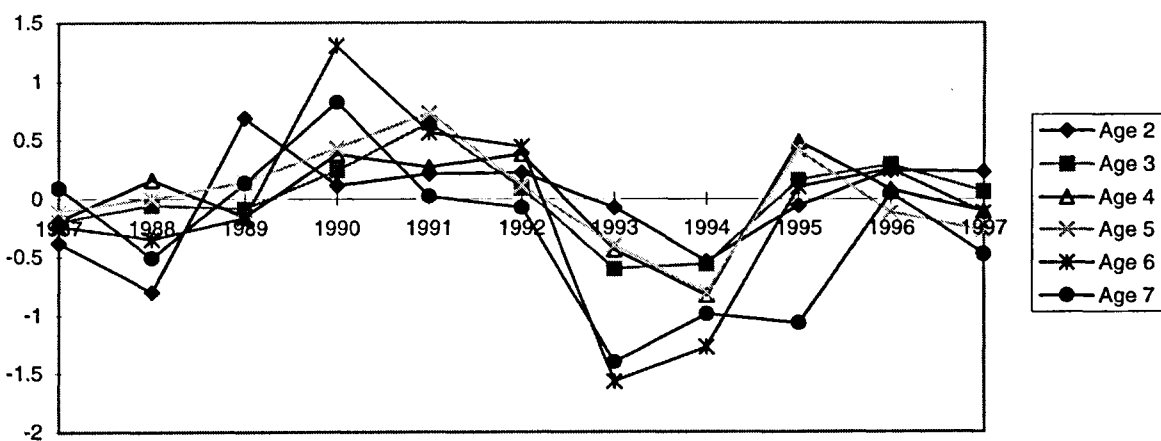


Figure 2.4e Fleet: Trawl 105-120



Cont. Figure 2.4 d-e. Cod in Kattegat: Residuals from XSA F-estimates for the tuning fleets.

Fig. 2.5a Cod Kattegat, Average (3-5) fishing mortality - Retrospective analysis

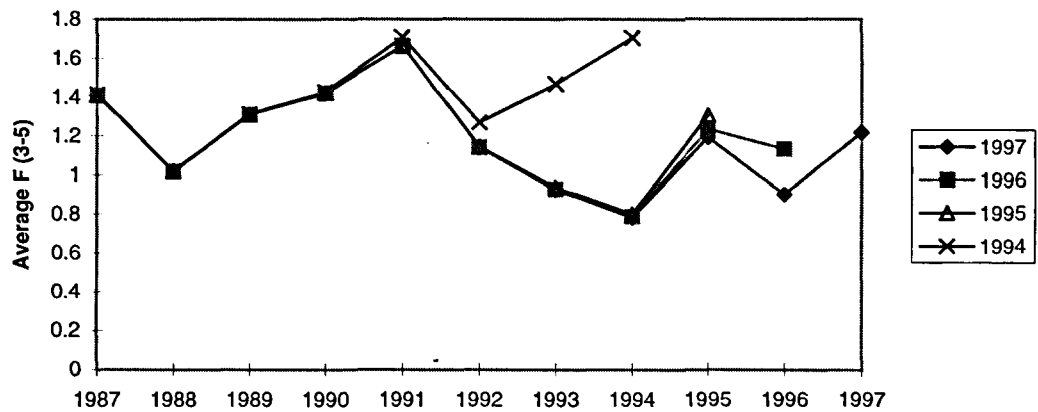


Fig. 2.5b Cod Kattegat, SSB - Retrospective analysis

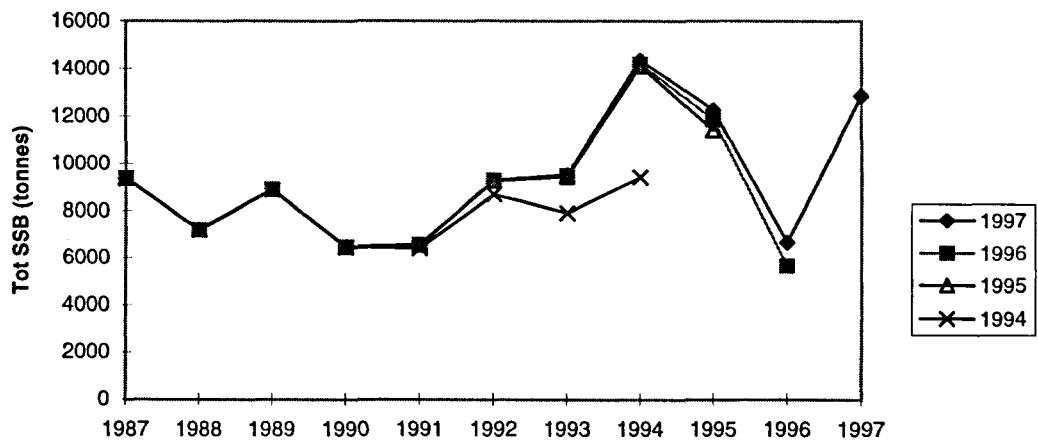


Fig. 2.5c Cod Kattegat, Recruits age 1- Retrospective analysis

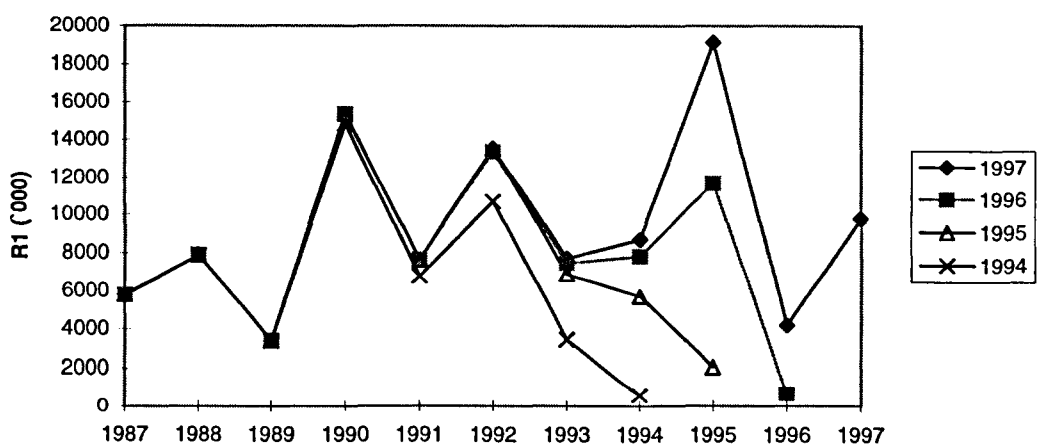


Figure 2.6

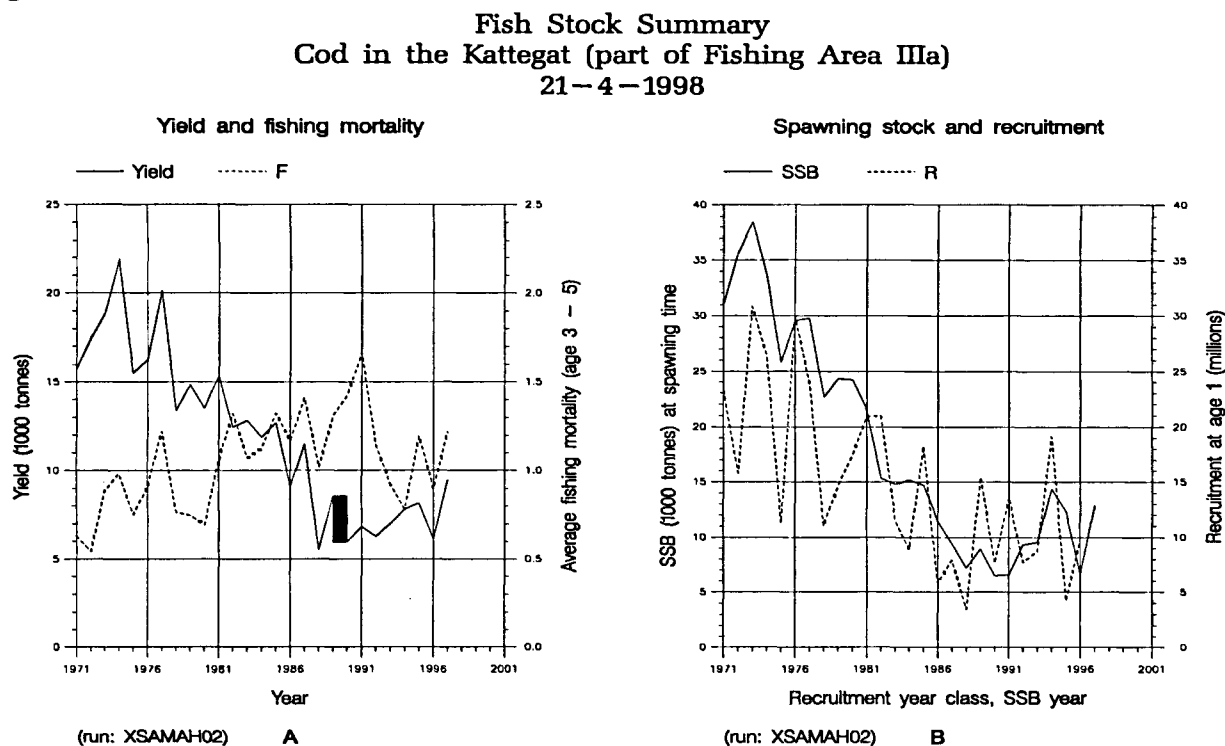


Figure 2.7

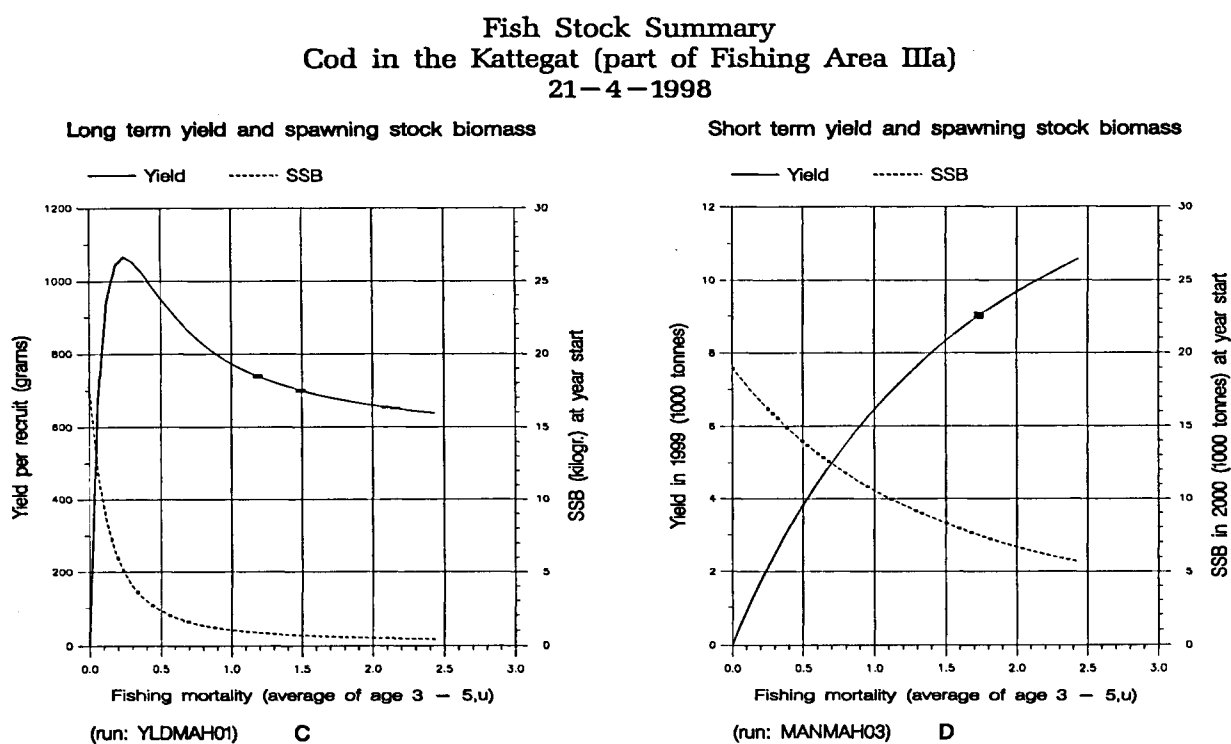


Figure 2.8 Cod Kattegat. Estimation of stock recruitment using the Ricker function on the log scale

ar 1.087771 Model: Rec= $a \cdot \text{SSB} \cdot \exp(-b \cdot \text{SSB})$
 br 1.56E-05
 max recr. Max R= $(a/b) \cdot \exp(-1) = 25721$

Y of Rec.	VPA SSB(y-1)	log(SSB)	VPA Recruits	Model Recruits	Model Log (rec)	observed Log(rec)	Residuals Log Scale	Res**2 Log Scale
1972	30981	10.3411	23223	20812	9.943261	10.0529	0.109637	0.01202
1973	35664	10.4819	15777	22274	10.01117	9.666308	-0.34486	0.11893
1974	38485	10.5580	30827	23004	10.04341	10.33615	0.292737	0.085695
1975	33629	10.4231	26381	21679	9.984079	10.1804	0.196321	0.038542
1976	25804	10.1583	11293	18788	9.84096	9.331938	-0.50902	0.259103
1977	29563	10.2943	29978	20302	9.918472	10.30822	0.389747	0.151903
1978	29736	10.3001	23842	20366	9.921615	10.0792	0.157589	0.024834
1979	22631	10.0271	11045	17311	9.759116	9.309733	-0.44938	0.201945
1980	24275	10.0972	14661	18100	9.803665	9.592946	-0.21072	0.044403
1981	24189	10.0937	17420	18060	9.801454	9.765374	-0.03608	0.001302
1982	21490	9.9753	20919	16733	9.725135	9.948413	0.223279	0.049853
1983	15311	9.6363	20953	13125	9.482251	9.950037	0.467787	0.218824
1984	14761	9.5997	11529	12762	9.454224	9.352621	-0.1016	0.010323
1985	15145	9.6254	8906	13016	9.473932	9.09448	-0.37945	0.143983
1986	14694	9.5952	18220	12717	9.450717	9.810275	0.359558	0.129282
1987	11490	9.3492	5783	10453	9.254603	8.662678	-0.59192	0.350375
1988	9387	9.1471	7904	8823	9.08517	8.975124	-0.11005	0.01211
1989	7195	8.8811	3412	6998	8.853333	8.135054	-0.71828	0.515925
1990	8916	9.0956	15400	8442	9.041019	9.642123	0.601104	0.361326
1991	6455	8.7726	7659	6351	8.756315	8.943637	0.187322	0.03509
1992	6543	8.7862	13557	6428	8.768486	9.514658	0.746172	0.556773
1993	9303	9.1381	7734	8756	9.077488	8.953381	-0.12411	0.015402
1994	9527	9.1619	8713	8936	9.097796	9.072571	-0.02522	0.000636
1995	14357	9.5720	19141	12491	9.432759	9.859588	0.426829	0.182183
1996	12253	9.4135	4212	11015	9.307026	8.345693	-0.96133	0.924161
1997	6642	8.8012	9812	6516	8.781963	9.191361	0.409398	0.167607

SSQ= 4.61253
 Var= 0.384378
 sr 0.619982

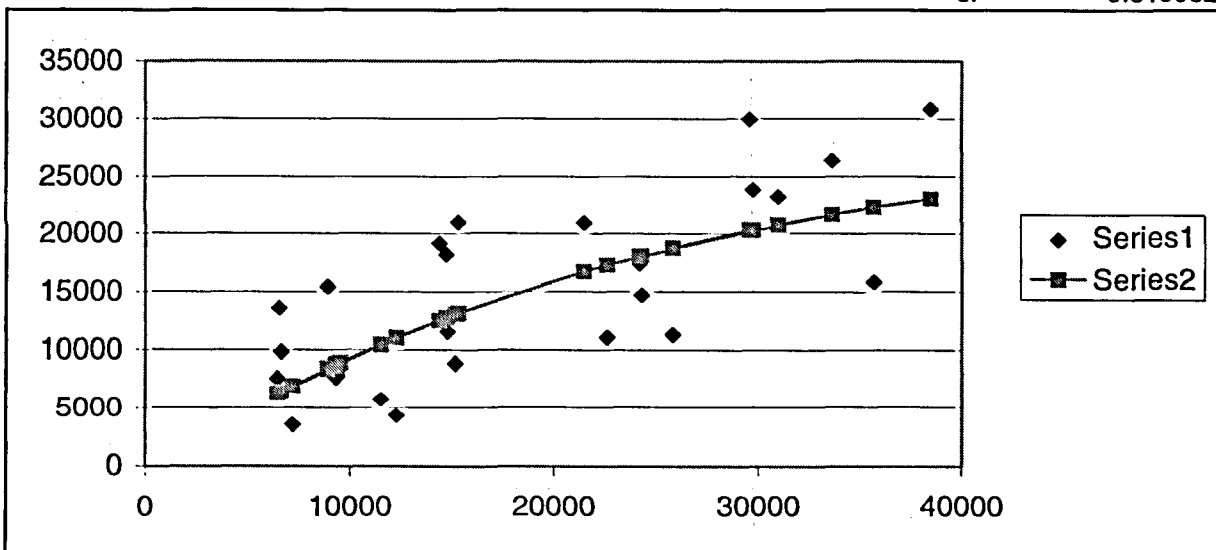


Figure 2.9 Cod in Kattegat. Medium term prediction

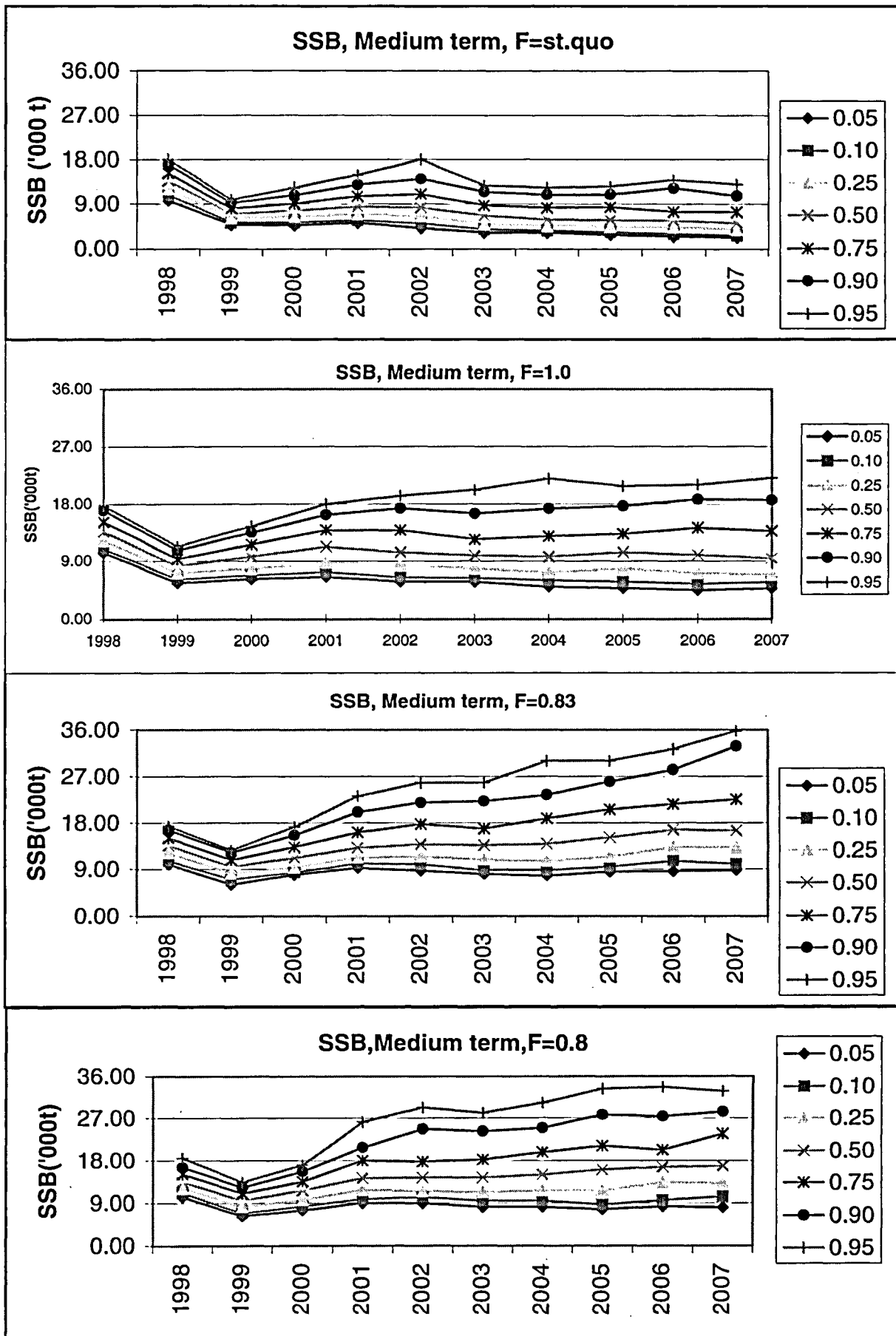
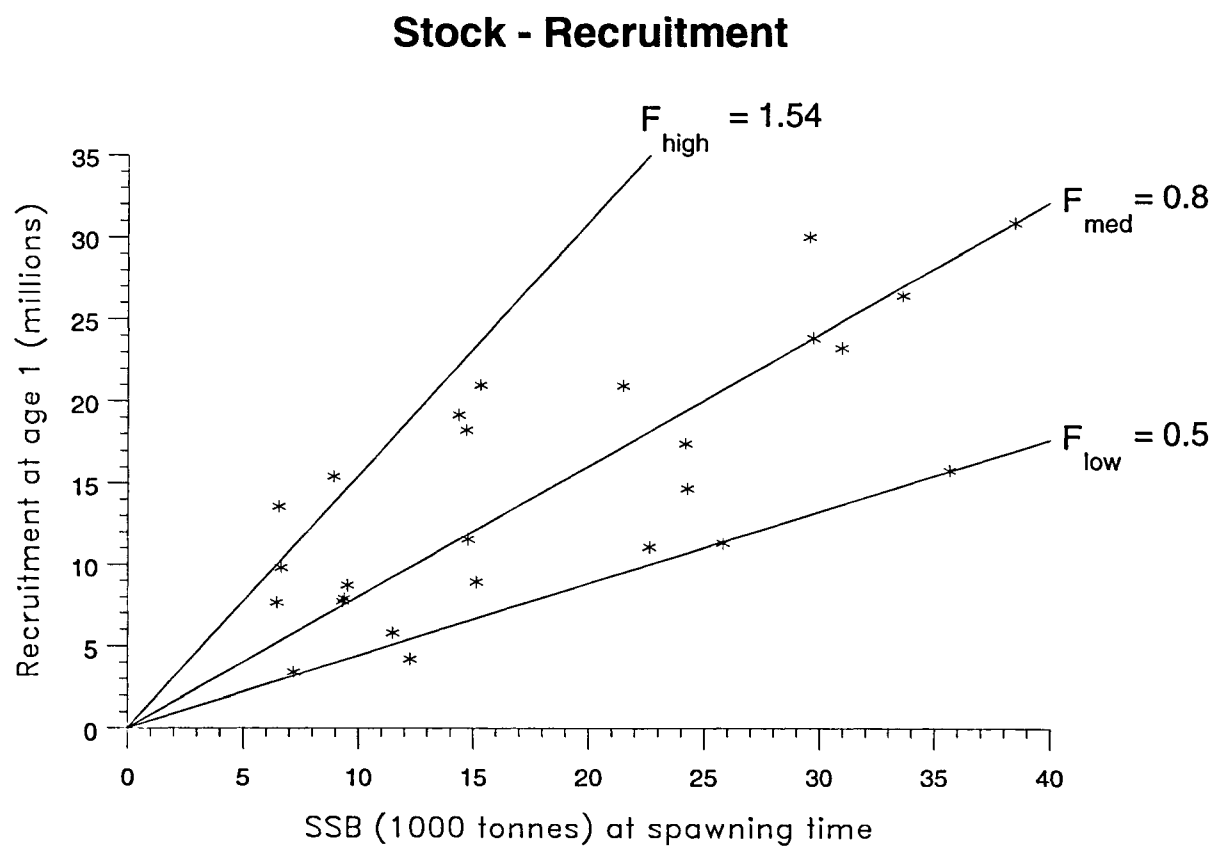


Figure 2.10 Cod in Kattegat.



(run: XSAMAH02)

3 COD IN SUB-DIVISIONS 22-24

3.1 Catch Trends

The landings of cod from Sub-divisions 22-32 are shown in Table 3.1.1 and 3.1.2 and for each Sub-division separately in Table 3.1.3 and 3.1.4. The reported total landings in Sub-divisions 22 and 24 have slightly decreased from about 45,000 tons in 1996 to 41,000 tons in 1997. In contrast to the rise of about 15,000 t (+50 %) from 1995 to 1996, the landings remained relatively stable. Both Sub-divisions 22 and 24 contributed nearly equal percentages to the total amount. Sub-division 23 is contributing about 5 % to the reported landings (2,663 t).

3.2 Unallocated Landings

There were no unallocated landings reported to the Working group. All landings for 1997 are provisional.

The catch figures for 1992 to 1994 are considered unreliable.

3.3 Discards

Data on discards from trawl catches in 1997 were provided by Germany for Sub-division 22 and 24 and from trawl and gill net separately by Sweden for Sub-division 24 (Table 1.6.2). The status of available discard data is presented in Section 1.6. Based on preliminary data, the discard percentage of the total catch in the first half of 1997 for bottom trawl (105 mm mesh size) in Sub-division 22 was about 2 % by weight. In the 3rd quarter of 1997 the discard percentage increased to app. 20 % as age group 1 recruited to the fishery. Discards exceeded 100 % in December in German trawl catches. No data were available for gill net but little discards are expected for these fisheries. In Sub-division 24 the discard percentage in bottom trawl catches in the first half of the year was on average about 4 % and increased to 12 % towards the end of 1997. For gill net, the percentage remained relatively constant at about 3 % throughout the year, with a slight increase towards the end of the year.

Discard data were not included in the assessment, because the available data were not representative of the total cod fishery. Furthermore, there were problems in the database as well as in the data processing. However, data on age composition and mean weights are now collected on a regular basis and discard data are expected to be included in the assessment.

The data base can be extended by data on discard from trawl catches especially in Sub-division 22. These have been published (Bagge ICES CM and Weber ICES CM) covering the period 1978-1988 based on Danish and German sampling. These data include detailed information on the discard, i.e., discard as percentage of landing per journey, age distribution and mean weight in the discard. These data will be valuable in the attempt to establish a time series in this area.

3.4 Effort and CPUE Data

Young Fish Survey data including survey data from 1998 January-March are available from Denmark (1982-1998) and Germany (1980-1998) and Sweden (1989-1998). German data include both Sub-divisions 22 and 24 (separately) and Danish and Swedish data for Sub-division 24 only. The database includes the former German Democratic Republic surveys covering period 1978-1991 in both Sub-divisions. In total, the data from Germany cover the period 1978-1996 in Sub-divisions 22 and 24. The database includes a total of 2,974 hauls. All data are standardised to a towing time of one hour.

Within this year's assessment, commercial catch and effort data from the Danish commercial trawl fleet (mesh size 105 to 120 mm) and gillnet fleet (mesh size 120 to 159 mm) have been applied.

3.5 Age Composition

Quarterly data on the age composition in the landings are listed in Table 3.1.5. Information by Sub-division, quarter and nation is provided in Table 3.1.6.

3.6 Mean Weight at Age

Weight at age in catches (WECA)

Estimates of weight at age in the landings by Sub-division, quarter were provided by Denmark, Germany and Sweden for trawl and gillnet separately. Estimates of quarterly landings in Sub-division 24 was provided by Denmark, Sweden, Germany, Poland, Finland and Estonia.

The mean weight at age in the catch by Sub-division, country, quarter is given in Table 3.1.6. The mean weight at age from age group 2 to 7 showed relatively little variation between countries, whereas age groups 8 to 10+ showed substantial variation as would be expected from the relatively low number in the CANUM and sampling. However, some systematic differences between national WECA were observed. This may reflect discrepancies in the age determination of cod, but could also be due to differences in fishing pattern (gear, vessel sizes, spatial effects etc.)

Table 3.1.5 gives the WECA by Sub-division and quarter as well as in the total landings. The WECA by Sub-division and quarter generally showed a consistent pattern. The estimates of the mean weight at age has improved considerably in the most recent years reflecting the improved sampling.

Weight at age in the stock (WEST)

Estimates of the mean weight at age in the stock (WEST) by Sub-division from surveys in 1 Quarter were presented by Denmark, Germany and Sweden for 1998. Denmark and Sweden had also revised their data from previous years (1995–1998 and 1989–1998, respectively). Data on sex specific mean weights at age were presented by Denmark and Sweden (Table 3.6.1). These data showed that the mean weight at age of females generally exceeded the mean weights of males. The difference in weight at age between sexes increased with age. This may be important in the estimation of stock-recruitment relations, where the spawning stock biomass is used as an indicator of the egg production. At present, the measure of the spawning stock biomass applied in this assessment is the combined female and male spawning stock biomass. The differences in mean weight at age combined with the sex specific differences in timing of sexual maturation and the increasing proportion of females at age (Section 3.7) indicate that the stock-recruitment relationship may be improved by using the female spawning stock or population fecundity in this relationship. However, sex specific data were only available from Denmark and Sweden for part of the period and did not allow an establishment of a sex specific time series at present.

Since the WEST has not been updated on a regular basis, new mean weights at age for the sexes combined were estimated for each of the years 1995–1998. Data including information on the numbers sampled at age were applied to calculate the weighted average weight at age by Sub-division and year. The national data showed substantial variation within and between Sub-divisions, but with no systematic difference between countries (Table 3.6.2). The number of cod sampled in Sub-division 22 was very low and from one year and country only. The annual WEST for cod in Sub-divisions 22–24 were calculated using the relative stock abundance between Sub-division 22 and 24 as weighting factors to account for differences in the size of the stock components (see Table 3.7.1). The contribution of Sub-division 23 was set constant to 5 % of the total based on the relative proportion of landings, because this area is not covered by the surveys. The data showed yearly variations in the mean weight at age, but the average for the period 1995–98 was at a level similar to the WEST applied in previous years (Table 3.6.3). Due to the low number of specimens sampled in age groups 8 to 10+ (Table 3.6.2), these age groups were combined into an 8+ group.

In the assessment, the average WEST for the period 1995 to 1997 was applied for age groups 1 to 7+. The forecast utilised the average WEST of the period 1995–1998. A revision of historical data and collection of new data from different national laboratories is planned.

3.7 Maturity Ogives

The existing database on sex specific maturity ogives, sex ratios and number sampled at age per Sub-division (ICES, 1997; Tomkiewicz *et al.* 1997) was updated with data provided by Denmark for 1995 in Sub-division 22, by Sweden for 1998 in Sub-division 23, and by Denmark, Germany, and Sweden in Sub-division 24 for 1998. The existing Swedish data had been recompiled due to revision of age-length keys and replaced previous data. Only data from surveys in the first quarter of the year (BITS) were applied in this analysis. This database includes most existing data from Denmark, Germany and Sweden. Data for Sub-division 22 has been collected by Denmark in 1996, 1997 and 1998 and will be compiled and will included in the time series next year. Sampling has been irregular in the western Baltic, especially Sub-division 22, which poorly covered also in recent years due to lack of surveys. An improvement of sampling in this

area is planned by both Denmark and Germany. Tables 3.7.2.D and 3.7.3.D show the number of cod staged and sexed by Sub-division during different time periods.

Average maturity ogives for females and males as well as sex ratios were established by Sub-division and intervals of ten years for the period 1970–1997 (Table 3.7.2) and for the period 1995–1998 separately (Table 3.7.3). The averages were calculated using the inverse variance to the numbers sampled at age as weighting factors for the different data sets within Sub-divisions and time periods as described in Tomkiewicz et al. (1997). The combined maturity ogives per Sub-division were calculated based on the sex specific ogives weighted with the sex ratios. Since sexual maturation of both sexes differ substantially between Sub-divisions (Tables 3.7.3 A and B), the estimation of maturity ogives and sex ratios for the entire stock considered differences in size of the stock components in the various Sub-divisions. Weighting factors for the different Sub-divisions were derived from the survey abundance for all age groups calculated during the 1997 assessment (ICES, 1997) and were applied on an age specific level (Table 5.7.1 and 3). The sex specific and combined ogives, sex ratio and number sampled at age per 10 year period for the stock is given in Table 3.7.2 and the estimates from 1995–1998 in Table 5.7.3. The data confirmed previous results, i.e., the average female maturity ogives for the stock are considerably lower than the combined due to earlier sexual maturation of males in all areas and the sex ratio becomes skewed towards an increasing proportion of females with increasing age.

In the assessment, the estimate of the combined ogives per period were applied for the respective years within periods. The average combined maturity ogive for the period 1995–1998 was used in the forecast.

3.8 Natural Mortality

The natural mortality values for age 1 cod incorporate predation mortalities derived by the Study Group on multispecies model implementation in the Baltic (ICES CM 1997/J:2) (see VPA input).

From age 2 onwards a constant value of 0.2 was used.

3.9 Catch at Age Analysis

Tuning fleets

Stock indices were derived from survey data applying a stratified sampling design using Sub-division and depth as strata.

The stratified mean CPUE and the variation in the means were calculated according to Cochran (1977) by:

$$E(\bar{y}_{st}) = \sum_{i=1}^L W_i \bar{Y}_i$$

$$V(\bar{y}_{st}) = \sum \frac{W_i^2 S_i^2}{n_i}$$

where \bar{Y}_i and S_i are the estimated means and standard deviations found in stratum i , W_i is the stratum weight (stratum area/total area) and n_i is the number of hauls in the stratum. The strata areas were calculated using topographical data from the Institute of Baltic Sea Research in Warnemünde. In a few cases where only one observation was found within a stratum the variance was estimated, using the relationship between the CPUEs and their standard errors in other strata.

CPUE information for the commercial fisheries was extracted from the Danish log-book database. This database provides information by vessel size, fishing gear and mesh-size, effort measured as days at sea and catches separated into five market categories (i.e., size groups) on a trip-by-trip basis. The age composition in the catches is derived by linking the catch in each market category with information on age composition by market category (a market category-age key). CPUE were standardised by fleets by the ANOVA $\ln(\text{CPUE}) = \text{Year} * \text{month} + \text{Vessel size}$. The estimated vessel size effect were re-transformed and used to correct the fishing power of different vessel sizes to a common size standard.

The resulting CPUE data are presented in Table 3.9.1.

XSA runs

The XSA was run with population shrinkage for age 2 cod. The older age groups were combined as a plus group (+7) because the catches of old age groups are small and sampling is poor.

The standard errors of the estimated log-catchabilities are found very high, especially for the older ages. A comparative run, limiting the year range from 1978–1997 to 1978–1996 revealed that the problem is created by the 1997 survey data for the age-groups 2+. The commercial fleet did not show these very high standard errors of estimated log catchabilities for ages 2+, but here age-group 1 showed very high residuals. For this reason it was decided by the Working Group, to use the survey data for the age 1 and 2, respectively 1 to 3 for the Sonderburg trawl, and to use the commercial fleet CPUE data for the ages 2 to 7. The residuals for the tuning fleets and ages used are presented in Figure 3.9.1.

The input data for the analysis are given in Table 3.9.2. The XSA diagnostics are presented in Table 3.9.3. The mean fishing mortality calculated has been kept to $F(3-6)$ as in last year's report. The VPA output, including a summary, is listed in Table 3.9.4.

A retrospective analysis based on the results from XSA (Figure 3.9.2) underlined the data problems in 1994.

In general, the output of the catch at age analysis was, that in 1997 the landings continue to be on the top level of the time series. The spawning stock biomass increased to a level of 42,000 t, compared to 37,000 t in 1996.

3.10 Recruitment Estimates

The 1997 year class was estimated with the RCT3 model using the XSA output and survey data (see Sections 3.4 and 3.9). It was estimated to $117\,684 \times 10^3$ individuals. In- and output of the RCT3 analysis are documented in Tables 3.10.1 and 3.10.2. This very high value is consistently indicated by both survey indices used.

3.11 Historical Stock Trends

The historical developments in Recruitment at age 1, spawning stock biomass, landings and fishing mortality at age are documented in Figure 3.11.1. The landings have been increasing since the beginning of the 1990s, remaining on a stable level in the last two years. Year classes have been high in 1994, 1996 and 1997.

3.12 Short-Term Forecast and Management Options

Short-term predictions

For the prediction the estimated value of 117.7 million specimens derived from RCT3 analysis for the year class 1997 at age 1 was used at the beginning of 1998. For 1999 and 2000 the geometric mean between 1985 and 1994 at age 1 (35.8 millions) was used. Mean weights at age in the catch and in the stock have been taken from the VPA. The mean 1995–1997 exploitation pattern was scaled to the 1997 exploitation level and used for prediction. Stock numbers for ages 2+ in 1998 were taken from the VPA.

The standard catch prediction calculations and yield per recruit analysis were performed using the input data shown in Tables 3.12.1 and 3.12.2. The results are summarised in Tables 3.12.3 and 3.12.4 and Figure 3.12.1. The current level of F_{3-6} exceeds $F_{0.1}$ (0.17) and F_{max} (0.32).

Table 3.12.3 shows short-term predictions for 1998 to 2000. The predictions indicate an increase of the spawning stock from 30,000 t in 1998 to about 36,000 t in 1999 and 48,000 t in 2000 with *status quo* fishery and a catch of about 40,000 t in 1998 and 52,000 t in 1999. The latter is higher than what has been seen historically since 1981.

3.13 Medium-Term Projections

The medium term projections were carried out using the same technique applied for the Kattegat (see Section 2.14).

The input data for initial stock size, mean weight and maturity are presented in Table 3.13.1. The stock recruitment relation was described using a Ricker-curve assuming log-distributed errors and is shown in Table 3.13.2. The recruitment at SSB plot is very coarse and the determined relationship is weak. A plot of the time series of recruits and SSB indicates furthermore, that the hydrographic regime might have a serious impact on recruitment, because in the inflow-stagnation period between 1977 and 1991, a higher SSB than the SSB before SSB did not result in a high

recruitment, but recruitment was lower than before 1977. In contrast, SSB and recruitment seem to be correlated in the time span with limiting hydrographic conditions, whereas before 1997 and after 1991 recruitment is varying heavily a stable respectively increasing SSB.

The results of the medium term projection are shown in Table 3.13.3 and Figure 3.13.1. The Study Group on the Precautionary Approach to Fishery Management set F_{pa} for the Western Baltic cod stock to 1.3, giving the Fishing mortality for which the probability of a spawning stock biomass less than 23,000 t is less than 10 %.

The medium term projection has shown that this precautionary criterion would hold for an F of 1.4 (Table 3.13.6). Applying *status quo* fishery lead to a SSB of 39.93 in 2007. However, the connected recruitment figures which in the final end generate this SSB show even at the 50 % percentile values which are higher than the highest recruitment on record ($172 \cdot 10^6$ in 1972).

3.14 Biological Reference Points

The following text table gives an overview over several reference points for the fishing mortality and their estimates for the Western Baltic cod. The yields per recruit analysis input is documented in Table 3.12.2 and the summary is given in Table 3.12.4. Y/R graph is presented in Figure 3.14.1.

Reference point	Definition	Estimate	Comment
$F_{0.1}$	F at which the slope of the Y/R curve is 10 % of its value near the origin, where the positive slope is maximal)	0.17	conservative
F_{max}	F giving the maximum yield on a Y/R curve	0.32	limiting
F_{low}	F corresponding to a SSB/R equal to the inverse of the 10 % percentile of the observed R/SSB	0.39	conservative
F_{med}	F corresponding to a SSB/R equal to the inverse of the 50 % percentile of the observed R/SSB	1.19	limiting
F_{high}	F corresponding to a SSB/R equal to the inverse of the 90 % percentile of the observed R/SSB	2.13	limiting, close to collapsing

The SSB/R plot is presented in Figure 3.14.2.

3.15 Comment to the Assessment

Survey data document strong year classes in 1994, 1996 and 1997. These data indicate a fairly stable development of the stock and especially a movement towards an even age structure with stronger older age-groups in the near future. However, the estimates of the size of the two latter year classes is still uncertain as they have not by 1997 appeared in quantities in the commercial fisheries

Furthermore, the spatial allocation of the stock between the Central Baltic and the Kattegat-Skagerrak might be the basis for extensive migratory movements which are at present not incorporated in the assessment. These migration makes also the determination of weight at age in the stock difficult, because the apparent, i.e., observed weights at age, might not represent the stock specific weights at age, if the larger fish migrate out of the area. Finally, the downlying tuning data performed very weak in determining age dependent catchability coefficients. Adding up to the migration problem, the different surveys did not have the same spatial coverage.

In the forecast, 30 % of the yield in 1998 was due to the two above mentioned high estimates for the year classes 1996 and 1997. In 1999 even 80 % of the yield will be driven by these year classes.

In conclusion, the downlying database has been unreliable and the stock dynamics might be too complicated to be assessed properly. Therefore, increasing the fishing mortality is not recommended, because the optimistic projections are too insecure.

In the forecast, 30 % of the yield in 1998 was due to the two above mentioned high estimates for the year classes 1996 and 1997. In 1999 even 80 % of the yield will be driven by these year classes.

In conclusion, the downlying database has been unreliable and the stock dynamics might be too complicated to be assessed properly. Therefore, increasing the fishing mortality is not recommended, because the optimistic projections are too insecure.

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

Year	Denmark	Estonia	Finland	German Dem. Rep. ²	Germany, Fed. Rep.	Latvia	Lithuania	Poland	Russia	Sweden	USSR	Faroe Islands ⁴	Norway	Unallo- cated ³	Total
1965	15,856		23	975	2,183			41,498		19,523	22,420				102,478
1966	16,570		26	2,196	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	3,203			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			120,001		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	30,483			93,429		59,685	100,761	6,354			391,952
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			194,787
1989	57,240		2,254	3	12,844			36,855		50,740	14,722	4,520			179,178
1990	47,394		1,731		4,691			32,028		50,683	13,461	3,558			153,546
1991	39,792	1,810	1,711		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		593			54,882
1993	8,000	70	225		1,042	1,333	605	8,909	892	10,099		558		13,450	45,183
1994	9,901	952	594		3,056	2,831	1,887	14,335	1,257	21,264		779		36,498	93,354
1995	16,895	1,049	1,729		5,496	6,638	4,513	25,000	1,612	24,723		777	293	18,993	107,718
1996	17,549	1,338	3,089		7,340	8,709	5,524	34,855	3,306	30,669		706	289	8,515	121,889
1997 ¹	9,776	1,414	1,677		5,215	6,187	4,601	31,396	2,803	25,072		600			88,741

¹Provisional data. ²Includes landings from Oct.-Dec. 1990 of Fed.Rep.Germany.

³Working group estimates. No information available for years prior to 1993. ⁴ For 1997 landings not officially reported, estimated by the WG.

Table 3.1.2 Total landings (t) of COD in Sub-divisions 22-32 by country.

Year	Denmark	Estonia	Finland	German Dem.Rep. ²	Germany, Fed. Rep.	Latvia	Lithuania	Poland	Russia	Sweden	USSR	Faroe Islands ⁴	Norway	Unallo- cated ³	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				195,446
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	10,976	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			197,694
1990	56,700		1,731	1,629	7,745			32,028		54,474	13,461	3,558			171,326
1991	50,606	1,810	1,711		9,443	2,627	1,865	25,748	3,299	39,490		2,611			139,210
1992	30,420	1,368	485		6,449	1,250	1,266	13,314	1,793	15,940		593			72,878
1993	17,667	70	225		5,126	1,333	605	8,909	892	12,048		558		18,978	66,411
1994	24,805	952	594		7,079	2,831	1,887	14,335	1,257	25,530		779		44,000	124,049
1995	38,204	1,049	1,861		14,692	6,653	4,513	25,000	1,612	27,966		777	293	18,993	141,613
1996	48,494	1,388	3,139		19,358	8,741	5,524	34,855	3,306	36,119		706	289	10,815	172,734
1997 ¹	40,549	1,420	1,687		14,484	6,187	4,601	31,659	2,803	28,374		600			132,364

¹Provisional data. ²Includes landings from Oct.-Dec. 1990 of Fed.Rep.Germany.³Working group estimates. No information available for years prior to 1993.⁴For 1997 landings not officially reported, estimated by the WG.

Table 3.1.3 Total landings (t) of COD in Sub-divisions 22-32 by sub-division and country.

Year	Denmark				Faroe Island ⁶	Finland						Federal Republic of Germany					
	22	23	24	25-28		24	25-28	29	30 ²	31	32	22	24	25	26	27	28
1972	17,717		7,928	34,072					76			10,531	1,782	3,193	10		
1973	21,400		9,195	35,455					95			12,833	900	9,100	5,200		673
1974	18,300		7,482	32,028					160			9,998	395	5,242	5,769		820
1975	15,981		7,500	39,043				270	8		20	12,415	497	8,809	1,975		1,184
1976	19,764	712	9,682	47,412				81	24		182	12,312	581	7,526	4,490		1,717
1977	17,726	1,166	10,213	44,400				85	26		199	10,807	879	3,649	13,803		1,668
1978	12,641	1,177	6,527	30,266				249	323	6	859	9,972	880	2,178	1,793		299
1979	16,093	2,029	7,232	34,350	3,850			707	518	16	1,697	8,910	688	7,616	2,149		12
1980	16,033	2,425	7,367	49,704	1,250			2,163	880	45	2,874	5,968	689	10,985	673		92
1981	15,502	1,473	7,152	68,521	2,765			3,036	684	11	1,950	9,095	2,165	7,021			
1982	11,669	1,638	7,469	71,151	4,300			4,557	1,368	42	2,159	7,394	666	13,069	662		69
1983	14,100	1,257	7,861	84,406	6,065			5,322	2,013	36	1,556	8,937	323	14,179	1,599		116
1984	13,867	1,703	8,042	90,089	6,354			5,433	2,741	7	1,177	11,340	208	21,948	7,926		609
1985	15,563	1,076	7,461	83,527	5,890			4,646	1,706	7	865	4,992	531	12,733	11,572		1,970
1986	8,914	748	7,281	81,521	4,596			3,571	1,306	2	754	2,236	666	10,545	8,399		576
1987	7,990	1,503	5,470	68,881	5,567			1,389	1,143	2	473	3,611	645	7,757	5,009		1,794
1988	5,680	1,121	7,505	60,436	6,915		614	998	1,257	1	34	3,670	547	11,321	2,577		180
1989	3,422	636	4,637	57,240	4,520		392	603	1,097	1	161	2,099	399	12,201	640		3
1990	3,235	722	5,349	47,394	3,558		833	187	685		26	1,997	1,057	3,232	1,427		32
1991	5,536	1,431	3,847	39,792	2,611		1,061	228	404		18	1,648	1,231	5,419	1,114	8	23
1992	7,567	2,449	2,379	18,025	593		253	48	174		10	2,320	1,336	2,187	586		20
1993	4,901	1,001	3,765	8,000	558		61	11	142	2	9	2,395	1,689	902	140		
1994	6,078	1,073	7,753	9,901	779		232	240	108		14	2,151	1,872	2,858	134		64
1995	11,851	2,547	6,911	16,895	777	132	1,704	3	18		4	5,085	4,111	4,960	225		311
1996	15,380	2,999	12,566	17,549	706	50	3,081		4		4	6,037	5,981	6,520	582		238
1997 ¹	15,196	1,886	13,691	9,776	600	10	1,652	2	15	1	7	6,770	2,499	4,632	393		190

continued

Table 3.1.3 (continued)

Year	German Democratic Republic ⁵								Poland			Sweden								
	22	24	25	26	27	28	29		24	25 ⁴	26	23	24	25	26	27 ³	28	29	30	31
1972	4,560	5,105	1,950	2,072		33			24,926	32,167			1,277	13,842		876	440		36	
1973	4,004	4,370	4,065	1,912		57			29,010	20,780			1,655	15,224		971	485		54	
1974	3,028	5,431	1,469	996		52			25,221	23,429			1,937	11,950		1,682	825		41	
1975	3,471	2,571	3,320	5,250	50	60	20		35,373	33,945			1,932	12,511		2,052	1,367	103		
1976	1,292	3,290	800	3,150	10	10			26,082	44,384			1,800	14,109		1,979	2,180	115	5	
1977	977	2,471	324	5,996	73	1,119	7		18,172	29,530		550	1,516	11,775		2,584	1,560	120	22	
1978	1,619	5,466	414	1,714	1	131			31,161	32,952		600	1,730	9,017	26	3,207	1,740	417	55	1
1979	1,024	6,570	54	1,301	1	46	1		40,146	39,608		700	1,800	13,628	50	3,458	2,665	641	145	6
1980	880	4,700	5	1,818		3			50,832	72,654		1,300	2,610	18,694	88	6,014	3,185	790	516	4
1981	1,743	9,916	2	1,275					50,698	70,203		900	5,700	24,600	260	7,200	4,450	712	500	8
1982	1,908	8,707		728		25			41,830	50,711		140	7,933	20,429	2,279	4,109	9,264	687	1,669	38
1983	1,441	7,656		1,402		22			35,153	41,321		120	6,910	27,630	1,810	6,490	9,200	1,260	320	
1984	1,851	6,242		1,793					35,261	58,168		228	6,014	33,493	4,413	8,223	11,947	1,338	271	
1985	1,508	3,870		1,215					19,332	43,928		263	4,895	22,737	8,170	7,068	9,523	1,115	929	23
1986	825	2,173	1	180					18,297	24,939		227	3,622	19,214	7,764	7,554	9,606	1,233	298	54
1987	504	4,392	1	217					12,254	20,413		137	4,314	15,173	7,833	5,708	7,507	903	5,817	37
1988	330	4,302	1	1					14,910	18,441		155	5,849	20,893	7,453	6,674	7,946	535	5,456	7
1989	217	1,927	3						20,819	16,036		192	4,987	28,068	6,742	7,703	6,829	440	927	31
1990	129	1,500							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									18,761	6,239		611	2,632	18,699	2,765	2,180	992	56	29	2
1996									22,806	12,049		1,032	4,418	22,645	2,871	3,622	1,512	17	2	
1997 ¹								263	18,884	12,512		777	2,525	19,838	2,035	2,417	770	12		

continued

Table 3.1.3 (continued)

Year	USSR						Estonia						Latvia						Lithuania			Russia			Norway	Unallo-	Total
	25	26	27	28	29	32	24	25	26	28	29	32	24	25	26	27	28	29	25	26	28	26	28	32	26	cated	
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																					171,326
1991								1,537	273					1,190		1,432	5		1,854	11	3,034	264	1				139,210
1992								1,011	352	5				383		867			1,266		1,793						72,878
1993								61	8		1			761		572			605		892				18,978		66,411
1994								147	579	208	17	1		630	1,619	582			1,887		1,257				44,000		124,049
1995								338	246	465			15	1,124	3,649	1	1,864		4,513		1,612			293	18,993		141,613
1996							50	1,020	113	205			32	1,217	6,268		1,224		5,524		3,306			289	10,815		172,734
1997 ¹							6	1,189	138	87				1,354	4,052		781		1,871	2,730	2,803						132,364

¹Provisional. ²Finland: 1972-1974 sub-divisions combined. ³Sweden: 1972-1974 sub-divisions combined.

⁴Poland: Some catches from Sub-divisions 24 included. ⁵Includes landings from Oct.-Dec. 1990 of Fed. Rep. of Germany.

⁶Faroe Islands: For 1997 landings not officially reported, landings estimated by WG

Table 3.1.4 Total landings (t) of COD in Sub-divisions 22, 23, 24.

Year	Denmark		Finland	German Dem.Rep. ²	Germany, Fed. Rep.	Estonia	Latvia	Sweden		Total				22-24 + Unalloc.
	23	22+24	24	22+24	22+24	24	24	23	24	22	23	24	Unalloc.	
1965		19,457		9,705	13,350				2,182	27,867		7,007		34,874
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	6,657			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	14,821		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		2,144	2,498			192	4,987	5,738	828	11,950		17,688
1990	722	8,584		1,629	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	7,296	1,275	7,129	5,528	19,953
1994	1,073	13,831			4,023			555	3,711	8,229	1,628	13,336	7,502	29,067
1995	2,547	18,762	132		9,196		15	611	2,632	16,936	3,158	13,801		30,737
1996	2,999	27,946	50		12,018	50	32	1,032	4,418	21,417	4,031	23,097	2,300	46,814
1997 ¹	1,886	28,887	10		9,269	6		777	2,525	21,966	2,663	18,994		40,960

¹Provisional data. ²Includes landings from Oct.-Dec. 1990 of Fed.Rep.Germany.

Table 3.1.5: Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches of western Baltic cod (Sub-div. 22-24) by Sub-division and quarter.

Year: 1997		Quarter: 1						
Sub-div.	Sub-div. 22		Sub-div. 23		Sub-div. 24		Sub-div. 22-24	
Age	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]
1	0.000	0	0.000	0	0.622	135	0.622	135
2	222.414	593	12.228	606	367.568	724	602.210	673
3	13374.963	912	478.517	947	3945.490	910	17798.970	913
4	1043.252	1773	270.782	1229	1859.939	1172	3173.974	1374
5	52.189	3638	79.321	1437	416.213	1407	547.723	1624
6	109.263	5400	37.560	1706	200.377	1673	347.200	2849
7	34.204	8245	5.870	2254	22.719	2261	62.792	5520
8	0.000	0	0.000	0	0.000	0	0.000	0
9	0.000	0	0.000	0	0.000	0	0.000	0
10	0.000	0	0.050	6593	0.650	6912	0.700	6890
11+	0.000	0	0.000	0	0.000	0	0.000	0
SOP (t)	15243		985		7012		23240	
Landings (t)	14699		985		6669		22353	

Year:		Quarter: 2							
Sub-div.	Sub-div. 22		Sub-div. 23		Sub-div. 24		Sub-div. 22-24		
Age	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	
1	0.000	0	0.000	0	0.000	0	0.000	0	
2	91.398	526	12.931	663	603.674	750	708.003	719	
3	1938.029	916	134.801	1096	3471.318	1121	5544.148	1049	
4	150.853	1604	49.663	1309	1104.304	1330	1304.821	1361	
5	29.018	3510	9.875	1821	207.061	1847	245.954	2042	
6	34.069	3973	8.192	2481	169.071	2306	211.333	2581	
7	0.000	0	1.212	3426	20.083	3044	21.295	3065	
8	0.000	0	1.151	2805	25.755	2621	26.906	2628	
9	0.000	0	0.000	0	0.177	5902	0.177	5902	
10	0.000	0	0.204	4751	5.235	4751	5.439	4751	
11+	0.000	0	0.000	0	0.000	0	0.000	0	
SOP [t]	2303		268		6740		9311		
Landings (t)	2284		268		6566		9118		

Year: 1997		Quarter: 3							
Sub-div.	Sub-div. 22		Sub-div. 23		Sub-div. 24		Sub-div. 22-24		
Age	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	
1	202.671	481	0.905	437	218.342	452	421.918	466	
2	370.043	691	22.057	779	459.321	720	851.421	709	
3	1162.938	1199	64.023	1151	1109.974	1159	2336.935	1179	
4	73.256	2149	15.800	1542	269.007	1513	358.062	1644	
5	7.134	2692	6.500	1945	104.610	1852	118.244	1908	
6	9.283	6094	3.336	2526	56.054	2406	68.673	2910	
7	0.000	0	1.794	2609	25.150	2353	26.944	2370	
8	0.000	0	0.348	3132	5.436	3021	5.785	3027	
9	0.000	0	0.000	0	0.000	0	0.000	0	
10	0.000	0	0.059	4751	0.923	4751	0.982	4751	
11+	0.000	0	0.000	0	0.000	0	0.000	0	
SOP [t]	1981		143		2532		4656		
Landings (t)	1950		143		2540		4633		

Table 3.1.5: Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches of western Baltic cod (Sub-div. 22-24) by Sub-division and quarter.

Year:		1997		Quarter:		4			
Sub-div.		Sub-div. 22		Sub-div. 23		Sub-div. 24		Sub-div. 22-24	
Age		Numbers	Mean	Numbers	Mean	Numbers	Mean	Numbers	Mean
		*10 ⁻³	weight [g]	*10 ⁻³	weight [g]	*10 ⁻³	weight [g]	*10 ⁻³	weight [g]
	1	822.391	516	153.554	507	2208.246	542	3184.191	533
	2	431.139	910	141.458	854	962.656	791	1535.252	830
	3	1160.741	1771	152.861	1565	618.838	1572	1932.440	1691
	4	50.904	3695	22.047	1566	121.102	1404	194.053	2023
	5	8.646	2563	6.879	1997	34.816	1895	50.342	2024
	6	6.304	3095	0.769	3393	21.465	2657	28.538	2774
	7	3.175	8199	0.260	4672	2.874	4361	6.309	6305
	8	0.000	0	0.000	0	0.876	6048	0.876	6048
	9	0.000	0	0.000	0	0.154	8268	0.154	8268
	10	0.000	0	0.000	0	0.000	0	0.000	0
11+	0.000	0	0.000	0	0.000	0	0.000	0	
SOP [t]		3128		490		3243		6860	
Landings (t)		3033		490		3216	0	6739	

Year:		1997		Quarter:		All			
Sub-div.		Sub-div. 22		Sub-div. 23		Sub-div. 24		Sub-div. 22-24	
Age		Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]
1		1025.062	509	154.459	507	2427.210	534	3606.730	525
2		1114.994	743	188.674	816	2393.219	757	3696.887	756
3		17636.671	988	830.204	1101	9145.619	1065	27612.493	1017
4		1318.265	1849	358.292	1275	3354.352	1259	5030.909	1415
5		96.987	3434	102.575	1544	762.701	1610	962.264	1786
6		158.919	5043	49.858	1914	446.967	2051	655.744	2766
7		37.379	8241	9.136	2548	70.825	2601	117.340	4394
8		0.000	0	1.499	2881	32.068	2782	33.567	2786
9		0.000	0	0.000	0	0.331	7002	0.331	7002
10		0.000	0	0.313	5043	6.809	4957	7.121	4961
11+		0.000	0	0.000	0	0.000	0	0.000	0
SOP [t]		22654		1886		19526		44066	
Landings (t)		21966		1886		18990		42842	

Table xx: Total landings (t) of the western Baltic cod stock (Sub-div. 22-24) by Sub-division and country. (Landings in SD23 are age distributed according to Danish and Swedish agedistribution for gillnet in sd24.

Sub-div.	22	23	24	22-24
Country:				
Denmark	15196	1886	13691	30772
Germany	6770		2499	9269
Sweden			2522	2522
Poland			263	263
Estonia			6	6
Finland			10	10
Total	21966	1886	18990	42842

¹⁾Data in Quarter 1,2 and 3 are age distributed according to Danish, Swedish and German data for trawl and according to Sweden and Denmark for gillnet

Table 3.1.6. Numbers at age (CANUM) and mean weight at age (WECA) in commercial landings of western Baltic cod (Sub-div. 22-24) by Sub-division, country and quarter.

Sub-div. 22

Year: 1997		Quarter: 1				Total Numbers *10 ⁻³	ALL Mean weight [g]
Country	Denmark	Germany					
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]			
1	0.000	0	0.000	0	0.000		
2	34.962	621	187.452	588	222.414	593	
3	10230.719	908	3144.244	926	13374.963	912	
4	848.726	1739	194.526	1922	1043.252	1773	
5	48.652	3476	3.537	5860	52.189	3638	
6	105.726	5335	3.537	7340	109.263	5400	
7	30.667	8023	3.537	10170	34.204	8245	
8	0.000	0	0.000	0	0.000	0	
9	0.000	0	0.000	0	0.000	0	
10	0.000	0	0.000	0	0.000	0	
11+	0.000	0	0.000	0	0.000	0	
SOP [t]	11764.391		3478.330		15242.721		
Landings (t)	11236.912		3462.000		14698.912		

Year:	1997		Quarter:		2			
Country	Denmark		Germany				Total Numbers *10 ³	ALL Mean weight [g]
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]				
1	0.000	0	0.000	0.000		0.000	0	
2	40.356	526	51.042	526.000		91.398	526	
3	945.550	1035	992.479	803.000		1938.029	916	
4	64.649	2032	86.204	1283.000		150.853	1604	
5	29.018	3510	0.000	0.000		29.018	3510	
6	29.532	4583	4.537	0.000		34.069	3973	
7	0.000	0	0.000	0.000		0.000	0	
8	0.000	0	0.000	0.000		0.000	0	
9	0.000	0	0.000	0.000		0.000	0	
10	0.000	0	0.000	0.000		0.000	0	
11+	0.000	0	0.000	0.000		0.000	0	
SOP (t)	1368.146		934.408			2302.554		
Landings (t)	1372.982		911.000			2283.982		

Year:	1997		Quarter:		3			
Country	Denmark		Germany				Total Numbers *10 ³	ALL Mean weight [g]
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]				
1	22.543	432	180.128	487			202.671	481
2	210.478	604	159.565	806			370.043	691
3	698.225	1186	464.713	1219			1162.938	1199
4	55.161	2854	18.095	0			73.256	2149
5	7.134	2692	0.000	0			7.134	2692
6	9.283	6094	0.000	0			9.283	6094
7	0.000	0	0.000	0			0.000	0
8	0.000	0	0.000	0			0.000	0
9	0.000	0	0.000	0			0.000	0
10	0.000	0	0.000	0			0.000	0
11+	0.000	0	0.000	0			0.000	0
SOP (t)	1198.180		782.817				1980.997	
Landings (t)	1155.902		794.000				1949.902	

Year: 1997		Quarter: 4				Total Numbers *10 ³	ALL Mean weight [g]
Country	Denmark	Germany					
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]			
1	220.143	520	602.248	514	822.391	516	
2	201.316	726	229.823	1071	431.139	910	
3	640.177	1703	520.564	1854	1160.741	1771	
4	24.599	4400	26.305	3035	50.904	3695	
5	5.877	3771	2.769	0	8.646	2563	
6	3.535	5519	2.769	0	6.304	3095	
7	3.175	8199	0.000	0	3.175	8199	
8	0.000	0	0.000	0	0.000	0	
9	0.000	0	0.000	0	0.000	0	
10	0.000	0	0.000	0	0.000	0	
11+	0.000	0	0.000	0	0.000	0	
SOP [t]	1526.883		1600.657		3127.541		
Landings (t)	1430.175		1603.000		3033.175		

Year :	1997	Quarter: All				Total Numbers *10 ³	ALL Mean weight [g]
Country	Denmark	Germany					
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]			
1	242.686	512	782.376	508	1025.062	508	
2	487.112	649	627.882	815	1114.994	743	
3	12514.671	974	5122.000	1023	17636.671	988	
4	993.135	1886	325.130	1736	1318.265	1849	
5	90.681	3444	6.306	3287	96.987	3434	
6	148.076	5237	10.843	2394	158.919	5043	
7	33.842	8040	3.537	10170	37.379	8241	
8	0.000	0	0.000	0	0.000	0	
9	0.000	0	0.000	0	0.000	0	
10	0.000	0	0.000	0	0.000	0	
11+	0.000	0	0.000	0	0.000	0	
SOP [t]	15857.600		6796.213		22653.813		
Landings (t)	15195.971		6770.000		21965.971		

Deviation
SOP/landing
0.031

Table 3.1.6. Numbers at age (CANUM) and mean weight at age (WECA) in commercial landings of western Baltic cod (Sub-div. 22-24) by Sub-division, country and quarter.

Sub-div. 23

Year: 1997		Quarter: 1				Total Numbers *10 ³	ALL Mean weight [g]
Country	Age	Denmark		Sweden			
		Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]		
	1	0.000	0	0.000	0	0.000	0
	2	12.228	606	0.000	0	12.228	606
	3	478.517	947	0.000	0	478.517	947
	4	270.782	1229	0.000	0	270.782	1229
	5	79.321	1437	0.000	0	79.321	1437
	6	37.560	1706	0.000	0	37.560	1706
	7	5.870	2254	0.000	0	5.870	2254
	8	0.000	0	0.000	0	0.000	0
	9	0.000	0	0.000	0	0.000	0
	10	0.050	6593	0.000	0	0.050	6593
	11+	0.000	0	0.000	0	0.000	0
SOP (t)		985.037		0.000		985.037	
Landings (t)		985.037		0.000		985.037	

Year: 1997		Quarter: 2				Total Numbers *10 ³	ALL Mean weight [g]
Country	Age	Denmark		Sweden			
		Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]		
	1	0.000	0	0.000	0	0.000	0
	2	12.931	663	0.000	0	12.931	663
	3	134.801	1096	0.000	0	134.801	1096
	4	49.663	1309	0.000	0	49.663	1309
	5	9.875	1821	0.000	0	9.875	1821
	6	8.192	2481	0.000	0	8.192	2481
	7	1.212	3426	0.000	0	1.212	3426
	8	1.151	2805	0.000	0	1.151	2805
	9	0.000	0	0.000	0	0.000	0
	10	0.204	4751	0.000	0	0.204	4751
	11+	0.000	0	0.000	0	0.000	0
SOP (t)		268.017		0.000		268.017	
Landings (t)		268.017		0.000		268.017	

Year:	1997	Quarter: 3				Total Numbers *10 ³	ALL Mean weight [g]
Country	Denmark	Sweden					
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]			
1	0.905	437	0.000	0	0.905	437	
2	22.057	779	0.000	0	22.057	779	
3	64.023	1151	0.000	0	64.023	1151	
4	15.800	1542	0.000	0	15.800	1542	
5	6.500	1945	0.000	0	6.500	1945	
6	3.336	2526	0.000	0	3.336	2526	
7	1.794	2609	0.000	0	1.794	2609	
8	0.348	3132	0.000	0	0.348	3132	
9	0.000	0	0.000	0	0.000	0	
10	0.059	4751	0.000	0	0.059	4751	
11+	0.000	0	0.000	0	0.000	0	
SOP (t)	142.751		0.000		142.751		
Landings (t)	142.751		0.000		142.751		

Year: 1997		Quarter: 4				Total Numbers *10 ³	ALL Mean weight [g]
Country	Denmark	Sweden					
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]			
1	153.554	507	0.000	0	153.554	507	
2	141.458	854	0.000	0	141.458	854	
3	152.861	1565	0.000	0	152.861	1565	
4	22.047	1566	0.000	0	22.047	1566	
5	6.879	1997	0.000	0	6.879	1997	
6	0.769	3393	0.000	0	0.769	3393	
7	0.260	4672	0.000	0	0.260	4672	
8	0.000	0	0.000	0	0.000	0	
9	0.000	0	0.000	0	0.000	0	
10	0.000	0	0.000	0	0.000	0	
11+	0.000	0	0.000	0	0.000	0	
SOP (t)		489.975	0.000		489.975		
Landings (t)		489.975	0.000		489.975		

Year : 1997		Quarter: All					
Country	Denmark	Sweden				Total	ALL
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	
1	154.459	507	0.000	0	154.459	507	
2	188.674	816	0.000	0	188.674	816	
3	830.204	1101	0.000	0	830.204	1101	
4	358.292	1275	0.000	0	358.292	1275	
5	102.575	1544	0.000	0	102.575	1544	
6	49.858	1914	0.000	0	49.858	1914	
7	9.136	2548	0.000	0	9.136	2548	
8	1.499	2881	0.000	0	1.499	2881	
9	0.000	0	0.000	0	0.000	0	
10	0.313	5043	0.000	0	0.313	5043	Deviation
11+	0.000	0	0.000	0	0.000	0	SOP/landing
SOP [t]	1885.780		0.000		1885.780		0.000
Landings (t)	1885.780		0.000		1885.780		

Deviation
SOP/landing
0.000

Table 3.1.6. Numbers at age (CANUM) and mean weight at age (WECA) in commercial landings of western Baltic cod (Sub-div. 22-24) by Sub-division, country and quarter.

Sub-div. 24

Year:	1997 Quarter: 1														Total Numbers *10 ³	ALL Mean weight [g]
Country	Denmark		Germany		Sweden		Poland		Estonia		Finland					
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]				
1	0.000	0	0.621	135	0.000	0	0.001	135.000	0.001	135	0.000	135	0.622	135		
2	142.005	611	215.400	812	9.531	422	0.632	695.050	0.331	732	0.133	732	367.568	724		
3	3135.682	910	351.344	1067	447.290	786	11.173	929.905	2.947	899	1.179	899	3945.490	910		
4	1632.812	1170	45.315	1545	175.973	1094	5.839	1205.497	1.310	1151	0.524	1151	1859.939	1172		
5	313.447	1412	6.828	2237	94.395	1327	1.544	1426.692	0.260	1390	0.104	1390	416.213	1407		
6	161.904	1615	1.241	3501	36.496	1868	0.735	1694.332	0.126	1655	0.051	1655	200.377	1673		
7	12.792	2401	0.000	0	9.823	2080	0.104	2256.112	0.011	2267	0.005	2267	22.719	2261		
8	0.000	0	0.000	0	0.000	0	0.000	0.000	0.000	0	0.000	0	0.000	0		
9	0.000	0	0.000	0	0.000	0	0.000	0.000	0.000	0	0.000	0	0.000	0		
10	0.000	0	0.000	0	0.649	6913	0.001	6776.292	0.001	6964	0.000	6964	0.650	6912		
11+	0.000	0	0.000	0	0.000	0	0.000	0.000	0.000	0	0.000	0	0.000	0		
SOP [t]	5584.174		639.503		766.585		21.560		5.000		2.000		7011.823			
Landings (t)	5233.996		640.000		766.000		21.56		5.00		2.00		6668.556			

Year:	1997 Quarter: 2														Total Numbers *10 ³	ALL Mean weight [g]
Country	Denmark		Germany		Sweden		Poland		Estonia		Finland					
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]				
1	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
2	333.507	660	258.405	870	7.496	632	4.266	698	0.000	0	0.616	763	603.674	750	603.674	750
3	2824.204	1145	317.752	1193	292.878	817	36.484	1103	0.000	0	3.113	1129	3471.318	1121	3471.318	1121
4	906.586	1351	34.001	1794	150.770	1099	12.947	1314	0.000	0	0.942	1337	1104.304	1330	1104.304	1330
5	167.820	1911	3.091	1966	33.612	1519	2.539	1827	0.000	0	0.173	1858	207.061	1847	207.061	1847
6	128.704	2299	4.946	0	33.323	2664	2.099	2441	0.000	0	0.140	2232	169.071	2306	169.071	2306
7	13.477	2518	0.000	0	6.309	4152	0.296	3352	0.000	0	0.015	2823	20.083	3044	20.083	3044
8	22.451	2395	0.000	0	3.004	4292	0.300	2760	0.000	0	0.022	2552	25.755	2621	25.755	2621
9	0.000	0	0.000	0	0.177	5902	0.001	5902	0.000	0	0.000	5902	0.177	5902	0.177	5902
10	5.180	4751	0.000	0	0.000	0	0.055	4751	0.000	0	0.005	4751	5.235	4751	5.235	4751
11+	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
SOP [t]	5407.107		670.965		589.776		72.080		0.000		6.000		6739.929		6739.929	
Landings (t)	5222.475		676.000		589.000		72.08		0.00		6.00		6565.555		6565.555	

Year:	1997 Quarter: 3														Total Numbers *10 ³	ALL Mean weight [g]
Country	Denmark		Germany		Sweden		Poland		Estonia		Finland					
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]				
1	0.000	0	146.635	491	70.878	371	0.829	451	0.089	452	0.000	0	218.342	452		
2	156.699	695	89.243	859	210.610	680	2.769	744	0.152	705	0.000	0	459.321	720		
3	636.117	1108	61.599	1667	405.021	1163	7.237	1155	0.348	1162	0.000	0	1109.974	1159		
4	191.095	1425	2.704	3467	73.439	1670	1.768	1526	0.084	1503	0.000	0	269.007	1513		
5	73.684	1680	0.000	0	30.220	2270	0.706	1896	0.032	1819	0.000	0	104.610	1852		
6	36.155	2410	0.300	0	19.229	2434	0.371	2461	0.017	2366	0.000	0	56.054	2406		
7	22.459	2172	0.000	0	2.509	3961	0.181	2482	0.007	2243	0.000	0	25.150	2353		
8	3.972	2395	0.000	0	1.427	4760	0.037	3074	0.002	2979	0.000	0	5.436	3021		
9	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0		
10	0.917	4751	0.000	0	0.000	0	0.006	4751	0.000	4751	0.000	0	0.923	4751		
11+	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0		
SOP [t]	1359.590		260.718		895.230		16.340		0.800		0.000		2531.878			
Landings (t)	1368.310		260.000		895.000		16.34		0.80		0.00		2540.450			

Year:	1997 Quarter: 4														Total Numbers *10 ³	ALL Mean weight [g]
Country	Denmark		Germany		Sweden		Poland		Estonia		Finland					
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]				
1	1093.145	521	1049.727	570	65.374	431	0.000	0	0.000	0	1.568	544	2208.246	542		
2	788.462	766	121.073	1002	52.082	690	1.039	268	0.000	0	0.630	782	962.656	791		
3	383.985	1643	105.617	1713	117.539	1300	11.697	717	0.000	0	0.353	1596	618.838	1572		
4	34.038	1537	10.304	2697	24.702	1451	52.058	1039	0.000	0	0.037	1727	121.102	1404		
5	10.329	2419	0.000	0	6.901	1885	17.586	1591	0.000	0	0.008	2327	34.816	1895		
6	1.278	3545	1.288	2838	1.151	3893	17.748	2500	0.000	0	0.002	3411	21.465	2657		
7	0.000	0	0.000	0	0.334	4032	2.540	4404	0.000	0	0.000	2374	2.874	4361		
8	0.000	0	0.000	0	0.000	0	0.876	6048	0.000	0	0.000	0	0.876	6048		
9	0.000	0	0.000	0	0.000	0	0.154	8268	0.000	0	0.000	0	0.154	8268		
10	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0		
11+	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0		
SOP [t]	1886.100		932.027		271.596		152.866		0.000		2.000		3242.588			
Landings (t)	1865.920		923.000		272.000		152.790		0.00		2.00		3215.790			

Year :	1997 Quarter: All														Total Numbers *10 ³	ALL Mean weight [g]
Country	Denmark		Germany		Sweden		Poland		Estonia		Finland					
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]				
1	1093.145	521	1196.983	560	136.252	400	0.829	451	0.089	450	1.568	544	2428.867	534		
2	1420.673	718	684.121	874	279.719	671	8.706	661	0.483	723	1.379	768	2395.081	757		
3	6979.988	1063	836.312	1241	1262.728	962	66.591	1012	3.295	927	4.645	1106	9153.558	1065		
4	2764.531	1251	92.324	1822	424.885	1216	72.612	1114	1.394	1172	1.503	1282	3357.248	1259		
5	565.280	1614	9.919	2153	165.128	1562	22.374	1616	0.292	1437	0.285	1701	763.278	1610		
6	328.041	1978	7.775	1029	90.199	2308	20.953	2465	0.144	1741	0.193	2095	447.304	2051		
7	48.728	2328	0.000	0	18.975	3052	3.122	4121	0.019	2258	0.020	2691	70.863	2601		
8	26.423	2395	0.000	0	4.431	4443	1.214	5143	0.002	2979	0.022	2552	32.092	2782		
9	0.000	0	0.000	0	0.177	5902	0.155	8260	0.000	0	0.000	5902	0.331	7001		
10	6.097	4751	0.000	0	0.649	6913	0.063	4798	0.001	6207	0.005	4848	8.614	4957		
11+	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0		
SOP (t)	14236.971		2503.213		2523.187		262.846		5.800		10.000		19542.017			
Landings (t)	13690.701		2499.000		2522.000		262.850		5.800		10.000		18990.351			

Table 3.6.1. Sex specific and combined mean weight at age in the stock (WEST) and numbers sampled by Sub-division for the years 1995-98. Data provided by Denmark and Sweden from surveys in the 1 Quarter of each year.

Year	Country	SD	Sex		1	2	3	4	5	6	7	8+
1995	DEN	22	F	Mean weight	73	483	1350	6062	4295			
				Number	95	256	39	62	2			
			M	Mean weight	77	448	1090	1600	4900			
				Number	95	188	66	64	1			
1995	SWE	23	F	Mean weight	53	318	1037	2818	5380	6051		
				Number	39	58	65	105	19	23	1	
			M	Mean weight	54	421	922	1861	4548	3247		
				Number	45	122	90	72	5	7		
1995	SWE	24	F	Mean weight	57	206	513	1353	1688	2610		
				Number	38	31	18	27	6	1		
			M	Mean weight	75	264	660	1175	1962			
				Number	25	38	26	22	5			
1995	DEN	24	F	Mean weight	84	266	675	1397	2670	875		
				Number	85	108	86	52	16	1		
			M	Mean weight	90	230	655	1012	1126			
				Number	95	114	68	41	12			
1996	SWE	23	F	Mean weight	29	232	516	1383	3601	4495	5685	6895
				Number	19	35	32	34	31	12	2	1
			M	Mean weight	30	272	575	1372	1887	4547		
				Number	17	60	41	27	14	5		
1996	SWE	24	F	Mean weight	58	333	546	960	1607	2337	3549	5849
				Number	2	39	23	29	20	21	9	4
			M	Mean weight	29	303	526	811	1454	2255	3670	
				Number	2	41	24	16	24	7	1	
1996	DEN	24	F	Mean weight	96	406	720	1287	1369	3399		
				Number	4	110	56	20	12	8		
			M	Mean weight	52	385	673	1042	1407	2535		
				Number	1	83	30	12	13	3		
1997	SWE	23	F	Mean weight	36	182	882	1788	3997	4491		6200
				Number	34	26	64	17	13	3		2
			M	Mean weight	35	189	782	1279	2949	4560	4985	
				Number	26	22	79	21	8	2	1	
1997	SWE	24	F	Mean weight	71	313	984	1789	1922	1957	2732	
				Number	35	20	58	23	1	1	1	
			M	Mean weight	64	490	839	983	2471			
				Number	41	15	43	4	1			
1997	DEN	24	F	Mean weight	99	110	1057	1380	4715		7185	
				Number	23	28	42	15	1		2	
			M	Mean weight	95	114	829	737				
				Number	26	30	38	9				
1998	SWE	23	F	Mean weight	35	311	780	2298	4464	5075	8502	
				Number	24	39	17	62	14	13	7	
			M	Mean weight	39	375	713	1567	2233	3174		
				Number	26	68	21	47	6	4		
1998	SWE	24	F	Mean weight	70	447	729	1434	2606	1159		14400
				Number	33	33	28	17	5	1		1
			M	Mean weight	62	276	577	1390	1540			6600
				Number	36	44	19	8	2			1
1998	DEN	24	F	Mean weight	125	443	429	3836				
				Number	72	103	8	4				
			M	Mean weight	146	804	817	1248				
				Number	80	88	2	2				

Table 3.6.2. Available data on mean weight in stock (WEST) per Country, Sub-division and year including number of fishes measured. Mean weight based on females and males and weighted according to sexratio (see table 3.6.1)

Year	Country	SD		1	2	3	4	5	6	7	8	9	10+
1995	DEN	22	m.w (g)	57	463	1184	1843	4418					
			n.o	284	444	105	126	3					
1995	SWE	23	m.w (g)	54	389	997	2349	5197	5294				
			n.o	84	180	155	177	24	30				
1995	SWE	24	m.w (g)	64	235	594	1271	1817	2610				
			n.o	63	69	44	49	11	1				
1995	DEN	24	m.w (g)	77	246	666	1204	1822	875				
			n.o	296	223	154	93	28	1				
1995	GER	24	m.w (g)	61	109	951	1583	2943	3516				
			n.o	76	34	28	13	1					
1996	SWE	23	m.w (g)	29	257	549	1378	2830	4510	5685	6895		
			n.o	17	60	41	27	14	5				
1996	SWE	24	m.w (g)	45	319	535	894	1514	2317	3561	5849		
			n.o	4	80	47	45	44	28	10	4		
1996	DEN	24	m.w (g)	85	396	704	1169	1388	3085				
			n.o	6	195	86	32	25	11				
1996	GER	24	m.w (g)	63	434	739	1613	2155	3428		8180		
			n.o	31	282	109	100	60	17		1		
1997	SWE	23	m.w (g)	36	186	818	1442	3578	4514	4985	6200		
			n.o	26	22	79	21	8	2	1			
1997	SWE	24	m.w (g)	67	394	922	1604	2169	1957	2732			
			n.o	76	35	101	27	2	1	1			
1997	DEN	24	m.w (g)	87	108	933	1083	4715		7185			
			n.o	77	64	80	24	1		2			
1998	SWE	23	m.w (g)	37	351	747	1940	3639	4315	8502			
			n.o	26	68	21	47	6	4	1			
1998	SWE	24	m.w (g)	67	348	660	1420	2233	1159		10500		
			n.o	69	77	47	25	7	1		2		
1998	DEN	24	m.w (g)	131	425	478	2714						
			n.o	174	191	10	6						

Table 3.6.3 'WEST, mean weight in stock/year from data provided by Denmark, Germany, Latvia and Sweden (see table 3.6.2). Average mean weights for Sub-division 25-28 combined are calculated based on survey indices of stock abundance for each age group. Values for 1995-97 are the arithmetic mean of the years included.

Year	1	2	3	4	5	6	7	8+
1995	71	251	740	1321	2414	1920		
1996	63	397	680	1351	1840	2890	3667	6344
1997	73	198	730	1212	3046	2085	2054	6200
1998	109	400	634	1684	2303	1317	8502	9975
1995-1998	80	332	747	1386	1981	2845	2937	7135

Table 3.7.1. Distribution of the western Baltic stock in relation to Sub-division in different decades:

Period	Sub-div. 22	Sub-div. 23	Sub-div. 24
1970-1979	0.25	0.05	0.70
1980-1989	0.19	0.05	0.76
1990-1997	0.17	0.05	0.78
1995-1998	0.17	0.05	0.78

Table 3.7.2. Female and male maturity ogives, sex ratios and numbers sampled for the western Baltic cod stock during different time periods.

A. Female maturity ogives.

Period	Age groups							
	1	2	3	4	5	6	7	8+
1970-1979	0.01	0.10	0.46	0.86	0.98	1.00	1.00	1.00
1980-1989	0.00	0.09	0.70	0.94	0.97	1.00	1.00	1.00
1990-1997	0.00	0.09	0.60	0.85	0.94	0.95	0.99	0.91

B. Male maturity ogives.

Period	Age groups							
	1	2	3	4	5	6	7	8+
1970-1979	0.09	0.31	0.68	0.90	0.97	0.99	1.00	1.00
1980-1989	0.01	0.37	0.91	0.98	0.98	0.99	1.00	1.00
1990-1997	0.02	0.21	0.81	0.90	0.96	0.96	1.00	0.61

C. Sex ratios (female proportion).

Period	Age groups							
	1	2	3	4	5	6	7	8+
1970-1979	0.52	0.55	0.58	0.66	0.80	0.85	0.88	1.00
1980-1989	0.44	0.44	0.46	0.55	0.60	0.84	0.83	0.95
1990-1997	0.46	0.46	0.53	0.60	0.73	0.79	0.77	0.98

D. Number of cod sampled (sexed and staged).

Period	Age groups								Sum
	1	2	3	4	5	6	7	8+	
1970-1979									5656
1980-1989									14892
1990-1997	1530	3774	3408	1476	571	177	34	21	10991

D. Combined maturity ogives.

Period	Age groups							
	1	2	3	4	5	6	7	8+
1970-1979	0.05	0.20	0.55	0.88	0.98	1.00	1.00	1.00
1980-1989	0.00	0.25	0.82	0.95	0.97	1.00	1.00	1.00
1990-1997	0.01	0.16	0.69	0.87	0.94	0.95	0.99	0.91

Table 3.7.3. Female and male maturity ogives, sex ratios and numbers sampled for the western Baltic cod stock during the most recent time period.

A. Average female ogive 1995-1998.

Period		Age groups							
		1	2	3	4	5	6	7	8+
Sub-div.	22	0.00	0.10	0.74	0.66	0.92	1.00	1.00	1.00
Sub-div.	23	0.00	0.20	0.74	0.99	1.00	1.00	1.00	1.00
Sub-div.	24	0.00	0.05	0.51	0.88	0.92	0.89	0.98	0.83
Sub-div.	22-24	0.00	0.07	0.56	0.85	0.92	0.91	0.98	0.87

B. Average male ogive 1995-1998.

Period		Age groups							
		1	2	3	4	5	6	7	8+
Sub-div.	22	0.00	0.13	0.69	0.71	0.86	1.00	1.00	1.00
Sub-div.	23	0.00	0.52	0.88	0.98	1.00	1.00	1.00	1.00
Sub-div.	24	0.02	0.12	0.75	0.92	0.98	0.87	1.00	1.00
Sub-div.	22-24	0.02	0.14	0.75	0.89	0.96	0.90	1.00	1.00

C. Average proportion of females 1995-1998.

Period		Age groups							
		1	2	3	4	5	6	7	8+
Sub-div.	22	0.46	0.38	0.42	0.51	0.61	0.75	0.00	0.98
Sub-div.	23	0.49	0.36	0.38	0.50	0.64	0.69	0.91	1.00
Sub-div.	24	0.49	0.52	0.57	0.63	0.73	0.81	0.95	0.96
Sub-div.	22-24	0.48	0.49	0.54	0.60	0.71	0.79	0.79	0.97

D. Number of cod sampled 1995-1998.

Period		Age groups							Sum
		1	2	3	4	5	6	7	
Sub-div.	22	255	584	324	141	11		1	1316
Sub-div.	23	230	430	409	358	110	69	11	1620
Sub-div.	24	895	1974	1081	566	221	79	15	4838
Sub-div.	22-24	1380	2988	1814	1065	342	148	27	7774

E. Average combined ogive 1995-1998.

Period		Age groups							
		1	2	3	4	5	6	7	8+
Sub-div.	22	0.00	0.12	0.71	0.69	0.89	1.00	1.00	1.00
Sub-div.	23	0.00	0.40	0.83	0.99	1.00	1.00	1.00	1.00
Sub-div.	24	0.01	0.08	0.61	0.90	0.94	0.89	0.99	0.84
Sub-div.	22-24	0.01	0.10	0.64	0.87	0.93	0.91	0.99	0.88

Table 3.9.1: Cod in the Western Baltic, Tuning data. The tuning fleets are 1) Solea survey in the 1st quarter with HG20/25 trawl (FLT08:HGQ198), 2) Solea survey in the 4th quarter with HG20/25 trawl (FLT13:HGQ498), 3) Clupea survey with Sonderburg trawl in the 1st quarter (FLT14:son98) 4) Danish commercial trawl with meshsize 105-120 mm (TR98:T105_120).

Cod in Baltic Fishing Areas 22 - 24 (run name: XSASTN07)

104
FLT08: HGQ198: HGQ198:HG20/25/Q1 (Catch:Thousands) (Effort:Unknown) (Catch: Thousands) (Effort: Unknown)
1979 1997

1	1	0.00	0.25
1	2		
1	1	48.71	128.12
1	1	0.00	0.00
1	1	332.86	669.88
1	1	0.00	0.00
1	1	0.00	0.00
1	1	43.71	83.95
1	1	12.98	188.03
1	1	25.45	81.50
1	1	20.70	670.26
1	1	1.51	143.15
1	1	1.28	24.67
1	1	2.63	78.45
1	1	6.58	21.36
1	1	3.99	60.15
1	1	45.06	425.87
1	1	14.96	84.45
1	1	111.94	842.81
1	1	2.23	222.60
1	1	214.85	40.87

FLT13: HGQ498: HGQ498:HG20/25Q4 (Catch:Thousands) (Effort:Unknown) (Catch: Thousands) (Effort: Unknown)
1978 1997

1	1	0.75	1.00
1	2		
1	1	208.09	75.32
1	1	143.44	153.85
1	1	0.00	0.00
1	1	327.33	131.11
1	1	119.76	190.16
1	1	200.60	80.51
1	1	55.79	77.38
1	1	51.82	60.52
1	1	234.99	90.18
1	1	0.00	0.00
1	1	0.00	0.00
1	1	62.98	42.49
1	1	0.00	0.00
1	1	49.91	58.05
1	1	266.25	91.13
1	1	150.55	36.34
1	1	137.44	99.63
1	1	489.89	191.84
1	1	32.49	95.64
1	1	330.78	17.58

FLT14: SON98: SON98:Sonderb (Catch:Thousands) (Effort:Unknown) (Catch: Thousands) (Effort: Unknown)
1980 1997

1	1	0.00	0.25
1	3		
1	1	37.54	8.32
1	1	10.51	95.33
1	1	19.17	39.54
1	1	84.54	59.51
1	1	2.63	84.71
1	1	0.56	10.59
1	1	6.34	2.71
1	1	4.54	119.15
1	1	0.04	8.48
1	1	0.07	0.70
1	1	0.07	0.31
1	1	1.86	0.32
1	1	35.36	2.85

Table 3.9.1, continued:

1	3.66	7.93	10.06
1	6.99	7.33	17.59
1	11.74	53.12	9.59
1	0.15	22.40	2.39
1	9.79	1.66	16.15

FLT15: TR98: T105_120 (Catch:Thousands) (Effort:Unknown) (Catch: Thousands) (Effort: Unknown)

1987 1997

1 1 0.00 1.00

2 7

1454.71	90860.82	77794.99	19046.01	7672.66	2408.87	777.67
2231.25	48236.97	104534.39	22675.26	4146.60	2513.78	826.05
6013.57	64035.64	175112.89	81742.18	6183.48	891.63	485.98
38546.47	1341621.13	371809.43	308949.31	141641.88	19490.76	4486.84
40327.24	1391753.29	1184501.83	330810.74	156368.31	75707.49	4594.41
39845.74	2074024.43	624366.64	67417.83	8166.44	6934.70	5625.81
16998.62	1523725.25	522998.14	50713.73	3972.73	0.00	940.06
37399.72	773107.12	2063969.19	264656.65	10756.68	1326.74	0.00
70768.90	2590392.70	3017495.38	2361295.36	195059.76	78406.59	9295.18
96144.69	12288667.13	6323041.72	731764.22	649815.58	117234.69	12604.65
88280.85	1203511.41	13333559.57	1952918.62	324841.32	210805.14	54143.75

Table 3.9.2

Western Baltic cod - Input data to the XSA

Catch numbers at age		Numbers*10**-3								
YEAR	1970	1971	1972	1973	1974	1975	1976	1977		
AGE										
1	19405	14844	20932	3846	13668	2985	3865	7611		
2	51528	54628	38631	53659	23462	49230	33621	30006		
3	11152	17162	18247	15956	22905	8425	29163	13148		
4	3643	2638	4667	4552	5327	4974	2490	5544		
5	903	1157	1030	974	1302	786	1383	561		
6	248	461	487	142	472	318	289	253		
+gp	112	216	207	143	122	178	117	109		
Total	86991	91106	84201	79272	67258	66896	70928	57232		
Landings	43959	46623	48900	54357	46571	44367	49433	46305		
YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
1	3456	684	4446	904	9491	12316	3338	1233	2419	2513
2	47799	28769	9654	43130	29032	30953	36139	8295	6362	25444
3	9678	19843	20011	12275	17310	14325	9893	15791	7896	5369
4	2247	2444	5578	5727	1657	4675	3722	4307	4025	1306
5	731	580	794	2083	824	771	1192	1496	1241	505
6	109	264	250	393	406	330	318	680	492	105
+gp	51	68	251	187	179	172	166	187	163	84
Total	64071	52652	40984	64699	58899	63542	54768	31989	22598	35326
Landings	40612	45046	41972	53646	47524	48605	49495	40159	26692	28566
YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
AGE										
1	669	669	766	1101	3003	134	812	2208	395	3607
2	13549	2415	6654	4854	7978	16720	12545	13963	28610	3697
3	13912	8404	3167	4824	4227	6521	14980	7307	20584	27612
4	1986	3944	2315	1619	539	1199	1840	6541	3647	5031
5	250	570	1032	436	96	141	84	1379	2217	962
6	137	127	206	226	68	15	12	119	306	656
+gp	77	63	70	56	63	40	19	10	42	158
Total	30580	16192	14210	13116	15974	24770	30292	31527	55801	41723
Landings	29159	18516	17780	16693	17996	21228	30695	33895	50849	42842
Catch weights at age (kg)										
YEAR	1970	1971	1972	1973	1974	1975	1976	1977		
AGE										
1	0.288	0.288	0.288	0.288	0.288	0.288	0.288	0.288		
2	0.561	0.561	0.561	0.561	0.561	0.561	0.561	0.561		
3	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96		
4	1.626	1.626	1.626	1.626	1.626	1.626	1.626	1.626		
5	2.406	2.406	2.406	2.406	2.406	2.406	2.406	2.406		
6	3.362	3.362	3.362	3.362	3.362	3.362	3.362	3.362		
+gp	6.794	6.671	6.622	6.412	6.923	6.173	6.374	6.426		
YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
1	0.288	0.288	0.288	0.288	0.306	0.402	0.358	0.434	0.443	0.362
2	0.561	0.561	0.561	0.561	0.549	0.608	0.701	0.791	0.668	0.713
3	0.96	0.96	0.96	0.96	1.225	1.031	1.263	1.229	1.141	1.132
4	1.626	1.626	1.626	1.626	1.715	1.68	1.737	1.879	1.841	1.899
5	2.406	2.406	2.406	2.406	2.949	2.445	2.287	2.237	1.92	3.202
6	3.362	3.362	3.362	3.362	3.598	3.465	2.539	3.118	2.651	4.104
+gp	6.61	6.837	6.217	6.357	5.77	5.278	5.631	5.562	4.929	5.849
YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
AGE										
1	0.555	0.442	0.594	0.57	0.578	0.494	0.414	0.464	0.528	0.525

Table 3.9.2, continued.

Western Baltic cod - Input data to the XSA

2	0.736	0.694	0.889	0.946	0.926	0.741	0.98	0.794	0.675	0.756
3	1.072	1.018	1.027	1.317	1.614	1.294	1.262	1.058	1.026	1.017
4	1.466	1.489	1.993	1.542	2.335	2.457	2.189	1.172	1.348	1.415
5	3.089	2.125	2.576	2.972	3.088	3.923	4.203	2.697	2.49	1.786
6	4.757	3.356	3.148	4.503	6.059	3.494	6.362	5.429	3.1	2.766
+gp	6.524	5.866	6.133	8.082	7.303	9.463	7.303	7.891	2.707	4.073
Stock weights at age (kg)										
YEAR	1970	1971	1972	1973	1974	1975	1976	1977		
AGE										
1	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.092		
2	0.422	0.422	0.422	0.422	0.422	0.422	0.422	0.422		
3	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06		
4	1.738	1.738	1.738	1.738	1.738	1.738	1.738	1.738		
5	2.442	2.442	2.442	2.442	2.442	2.442	2.442	2.442		
6	3.387	3.387	3.387	3.387	3.387	3.387	3.387	3.387		
+gp	6.501	6.293	6.278	6.045	6.669	5.738	6.033	6.051		
YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
1	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.147	0.045	0.09
2	0.422	0.422	0.422	0.422	0.422	0.422	0.422	0.594	0.604	0.522
3	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.155	1.115	0.919
4	1.738	1.738	1.738	1.738	1.738	1.738	1.738	1.764	1.822	1.579
5	2.442	2.442	2.442	2.442	2.442	2.442	2.442	2.103	1.912	3.048
6	3.387	3.387	3.387	3.387	3.387	3.387	3.387	2.968	2.651	3.922
+gp	6.205	6.478	5.738	6.106	5.902	5.905	6.176	5.555	4.846	5.874
YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
AGE										
1	0.09	0.159	0.194	0.194	0.194	0.194	0.194	0.078	0.078	0.078
2	0.451	0.596	0.539	0.539	0.539	0.539	0.539	0.363	0.363	0.363
3	0.935	1.003	0.854	0.854	0.854	0.854	0.854	0.825	0.825	0.825
4	1.441	1.625	1.718	1.718	1.718	1.718	1.718	1.464	1.464	1.464
5	3.006	2.433	2.339	2.339	2.339	2.339	2.339	2.392	2.392	2.392
6	4.542	3.768	2.931	2.931	2.931	2.931	2.931	2.381	2.381	2.381
+gp	6.491	6.07	5.576	5.99	5.286	5.887	6.097	3.144	1.994	3.695
Natural Mortality (M) at age										
YEAR	1970	1971	1972	1973	1974	1975	1976	1977		
AGE										
1	0.332	0.359	0.365	0.361	0.374	0.327	0.368	0.319		
2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2		
3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2		
4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2		
5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2		
6	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2		
+gp	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2		
YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
1	0.343	0.4	0.352	0.362	0.344	0.315	0.324	0.32	0.261	0.259
2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
6	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
+gp	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
AGE										
1	0.274	0.263	0.25	0.235	0.228	0.245	0.266	0.286	0.286	0.286
2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Table 3.9.2, continued.

Western Baltic cod - Input data to the XSA

4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
6	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
+gp	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Proportion mature at age										
YEAR	1970	1971	1972	1973	1974	1975	1976	1977		
AGE										
1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		
2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2		
3	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55		
4	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88		
5	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98		
6	1	1	1	1	1	1	1	1		
+gp	1	1	1	1	1	1	1	1		
YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
1	0.05	0.05	0	0	0	0	0	0	0	0
2	0.2	0.2	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
3	0.55	0.55	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
4	0.88	0.88	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
5	0.98	0.98	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
6	1	1	1	1	1	1	1	1	1	1
+gp	1	1	1	1	1	1	1	1	1	1
YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
AGE										
1	0	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
2	0.25	0.25	0.16	0.16	0.16	0.16	0.16	0.1	0.1	0.1
3	0.82	0.82	0.69	0.69	0.69	0.69	0.69	0.64	0.64	0.64
4	0.95	0.95	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
5	0.97	0.97	0.94	0.94	0.94	0.94	0.94	0.93	0.93	0.93
6	1	1	0.95	0.95	0.95	0.95	0.95	0.91	0.91	0.91
+gp	1	1	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99

Table 3.9.3 Western Baltic cod, XSA diagnostics output

Lowestoft VPA Version 3.1

23-Apr-98 11:25:24

Extended Survivors Analysis

Cod in 22 - 24 (run: XSASTN07/X07)

CPUE data from file /users/fish/ifad/ifapwork/wgbfas/cod_2224/FLEET.X07

Catch data for 28 years. 1970 to 1997. Ages 1 to 7.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
FLT08: HGQ198: HGQ19	1979	1997	1	2	0	0.25
FLT13: HGQ498: HGQ4	1978	1997	1	2	0.75	1
FLT14: SON98: SON98:	1980	1997	1	3	0	0.25
FLT15: TR98: T105_12	1987	1997	2	6	0	1

Time series weights :

Tapered time weighting applied
Power = 3 over 20 years

Catchability analysis :

Catchability dependent on stock size for ages < 2

Regression type = C
Minimum of 5 points used for regression
Survivor estimates shrunk to the population mean for ages < 2

Catchability independent of age for ages >= 3

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 17 iterations

Regression weights

0.751 0.82 0.877 0.921 0.954 0.976 0.99 0.997 1 1

Fishing mortalities

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	0.057	0.038	0.048	0.039	0.047	0.004	0.013	0.021	0.03	0.041
2	0.653	0.316	0.667	0.498	0.446	0.398	0.556	0.328	0.435	0.443
3	1.11	1.196	0.903	1.836	1.162	0.823	0.765	0.753	1.201	1.029
4	1.023	1.219	1.495	2.483	1.271	1.431	0.58	0.95	1.157	1.183
5	0.752	0.979	1.436	1.589	1.583	1.708	0.318	1.27	1.068	1.211
6	0.92	1.19	1.324	1.948	1.356	1.341	0.635	1.044	1.184	1.171

Table 3.9.3, continued.

Western Baltic cod, XSA diagnostics output

XSA population numbers (Thousands)

YEAR	AGE	1	2	3	4	5	6
1988		1.37E+04	3.12E+04	2.29E+04	3.43E+03	5.23E+02	2.52E+02
1989		2.04E+04	9.86E+03	1.33E+04	6.19E+03	1.01E+03	2.02E+02
1990		1.84E+04	1.51E+04	5.88E+03	3.30E+03	1.50E+03	3.10E+02
1991		3.22E+04	1.37E+04	6.34E+03	1.95E+03	6.06E+02	2.91E+02
1992		7.41E+04	2.45E+04	6.80E+03	8.28E+02	1.34E+02	1.01E+02
1993		4.17E+04	5.63E+04	1.29E+04	1.74E+03	1.90E+02	2.25E+01
1994		7.29E+04	3.25E+04	3.10E+04	4.62E+03	3.41E+02	2.82E+01
1995		1.22E+05	5.52E+04	1.53E+04	1.18E+04	2.12E+03	2.03E+02
1996		1.57E+04	8.96E+04	3.25E+04	5.88E+03	3.73E+03	4.87E+02
1997		1.05E+05	1.14E+04	4.75E+04	8.01E+03	1.51E+03	1.05E+03

Estimated population abundance at 1st Jan 1998

0.00E+00	7.55E+04	6.01E+03	1.39E+04	2.01E+03	3.69E+02
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Taper weighted geometric mean of the VPA populations:

4.33E+04	2.96E+04	1.58E+04	3.99E+03	8.95E+02	2.25E+02
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Standard error of the weighted Log(VPA populations) :

0.7584	0.7343	0.6804	0.7607	1.0364	1.2101
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Log catchability residuals.

Fleet : FLT08: HGQ198: HGQ19

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	99.99	0.56	99.99	1.01	99.99	99.99	0.84	0.42	-0.21	0.24
2	99.99	-0.81	99.99	0.71	99.99	99.99	-1.18	0.7	0.02	1.09
3	No data for this fleet at this age									
4	No data for this fleet at this age									
5	No data for this fleet at this age									
6	No data for this fleet at this age									

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	-0.03	-0.52	-0.03	-0.09	-1.19	0.69	-0.46	0.11	0.05	0.62
2	0.13	-0.52	0.26	-0.96	-0.52	0.6	-0.45	1.3	-0.51	-0.14
3	No data for this fleet at this age									
4	No data for this fleet at this age									
5	No data for this fleet at this age									
6	No data for this fleet at this age									

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

Age	2
Mean Log q	-5.4115
S.E(Log q)	0.7252

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	0.54	1.926	9.25	0.65	16	0.58	-8.08

Table 3.9.3,continued.

Western Baltic cod, XSA diagnostics output

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
2	0.75	1.091	6.61	0.67	16	0.54	-5.41

Fleet : FLT13: HGQ498: HGQ4

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	-0.29	0.17	99.99	0.23	-0.56	-0.31	-0.26	-0.13	0.08	99.99
2	-0.76	0.05	99.99	-0.05	0.52	-0.12	-0.38	0.18	0.69	99.99
3	No data for this fleet at this age									
4	No data for this fleet at this age									
5	No data for this fleet at this age									
6	No data for this fleet at this age									

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	99.99	0.3	99.99	-0.37	0.18	0.27	-0.35	0.22	0.02	0.06
2	99.99	0.5	99.99	0.64	0.46	-1.33	0.37	0.3	-0.79	-0.42
3	No data for this fleet at this age									
4	No data for this fleet at this age									
5	No data for this fleet at this age									
6	No data for this fleet at this age									

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

Age	2
Mean Log q	-5.4957
S.E(Log q)	0.6727

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	0.83	1.285	6.57	0.88	16	0.28	-5.69

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
2	1.8	-1.673	1.63	0.36	16	1.1	-5.5

Fleet : FLT14: SON98: SON98:

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	99.99	99.99	0	-0.13	0.06	0.41	0.32	0.01	-0.13	0.31
2	99.99	99.99	0.26	1.82	1.23	1.73	1.89	0.88	-0.33	2.42
3	99.99	99.99	0.24	0.62	0.62	-0.01	0.4	1.03	-0.19	0.68
4	No data for this fleet at this age									
5	No data for this fleet at this age									
6	No data for this fleet at this age									

Table 3.9.3,continued.

Western Baltic cod, XSA diagnostics output

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	-0.2	-0.4	-0.3	0.29	0.49	0.27	-0.06	-0.39	0.13	-0.3
2	0.36	-1.02	-2.22	-2.11	-0.51	-0.32	0.17	1.59	0.25	-0.29
3	0.34	-0.59	-0.16	0.43	0.02	0.49	0.16	0.26	-1.83	-0.32
4	No data for this fleet at this age									
5	No data for this fleet at this age									
6	No data for this fleet at this age									

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

Age	2	3
Mean Log q	-8.47	-7.5179
S.E(Log q)	1.3337	0.6978

Regression statistics :

Ages with q dependent on year class strength

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Log q
1	0.35	5.085	10.44	0.86	18	0.32	-10.01

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
2	0.44	3.08	9.49	0.75	18	0.44	-8.47
3	1.44	-0.994	6.57	0.33	18	1.01	-7.52

Fleet : FLT15: TR98: T105_12

Age	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
1	No data for this fleet at this age									
2	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	-0.03
3	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	0.67
4	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	0.96
5	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	0.87
6	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	1.23

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	No data for this fleet at this age									
2	-0.52	-0.23	0.68	0.7	0.51	0.2	-0.65	-0.71	0.1	-0.07
3	-0.19	-0.09	-0.49	0.89	-0.05	-0.15	-0.47	-0.02	-0.17	0.22
4	0.15	-0.08	0.13	1	-0.13	-0.24	-0.7	0.07	-0.63	0.14
5	0.22	-0.94	0.12	1.13	-0.3	-0.48	-1.41	-0.58	-0.33	0.02
6	0.52	-1.18	-0.33	1.26	-0.27	99.99	-0.87	0.77	0.04	-0.06

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

Age	2	3	4	5	6
Mean Log q	-6.3552	-5.4183	-5.4183	-5.4183	-5.4183
S.E(Log q)	0.5108	0.4226	0.5347	0.7606	0.8179

Table 3.9.3, continued.

Western Baltic cod, XSA diagnostics output

Regression statistics :

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
2	1.25	-0.866	5.4	0.61	11	0.65	-6.36
3	1.17	-0.719	4.72	0.7	11	0.51	-5.42
4	1.19	-0.684	4.87	0.63	11	0.65	-5.39
5	0.93	0.316	5.68	0.71	11	0.72	-5.61
6	0.8	0.886	5.35	0.73	10	0.66	-5.34

Terminal year survivor and F summaries :

Age 1 Catchability dependent on age and year class strength

Year class = 1996

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT08: HGQ198: HGQ	140427	0.674	0	0	0	1 0.081	0.022
FLT13: HGQ498: HGQ	79816	0.309	0	0	0	1 0.383	0.038
FLT14: SON98: SON98	55694	0.343	0	0	0	1 0.312	0.055
FLT15: TR98: T105_1	1	0	0	0	0	0 0	0
P shrinkage mean	29645	0.73				0.071	0.1
F shrinkage mean	135494	0.5				0.153	0.023

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
75460	0.19	0.21	5	1.091	0.041

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

Year class = 1995

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT08: HGQ198: HGQ	5823	0.484	0.094	0.19	2	0.126	0.454
FLT13: HGQ498: HGQ	5674	0.297	0.17	0.57	2	0.332	0.463
FLT14: SON98: SON98	6679	0.341	0.101	0.3	2	0.251	0.406
FLT15: TR98: T105_1	5592	0.536	0	0	1	0.104	0.469
F shrinkage mean	6126	0.5				0.187	0.436

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
6007	0.18	0.05	8	0.281	0.443

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

Year class = 1994

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT08: HGQ198: HGQ	11927	0.492	0.308	0.63	2	0.073	1.13
FLT13: HGQ498: HGQ	14411	0.295	0.384	1.3	2	0.203	1.006
FLT14: SON98: SON98	9826	0.31	0.094	0.3	3	0.21	1.265
FLT15: TR98: T105_1	16698	0.349	0.054	0.15	2	0.203	0.915
F shrinkage mean	15721	0.5				0.31	0.951

Weighted prediction :

Table 3.9.3, continued.

Western Baltic cod, XSA diagnostics output

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
13884	0.2	0.1	10	0.492	1.029

Age 4 Catchability constant w.r.t. time and age (fixed at the value for age) 3

Year class = 1993

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT08: HGQ198: HGQ198	2535	0.474	0.859	1.81	2	0.039	1.028
FLT13: HGQ498: HGQ498	1571	0.277	0.232	0.84	2	0.112	1.36
FLT14: SON98: SON98	1361	0.305	0.601	1.97	3	0.101	1.469
FLT15: TR98: T105_1	1886	0.357	0.206	0.58	3	0.22	1.228
F shrinkage mean	2305	0.5				0.527	1.09

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
2009	0.28	0.14	11	0.487	1.183

Age 5 Catchability constant w.r.t. time and age (fixed at the value for age) 3

Year class = 1992

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT08: HGQ198: HGQ198	464	0.484	0.56	1.16	2	0.019	1.056
FLT13: HGQ498: HGQ498	490	0.279	0.037	0.13	2	0.056	1.021
FLT14: SON98: SON98	480	0.311	0.014	0.05	3	0.054	1.034
FLT15: TR98: T105_1	296	0.393	0.178	0.45	4	0.185	1.372
F shrinkage mean	373	0.5				0.687	1.204

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
369	0.35	0.06	12	0.176	1.211

Age 6 Catchability constant w.r.t. time and age (fixed at the value for age) 3

Year class = 1991

Fleet	Estimated Survivors	Int s.e	Ext s.e	Var Ratio	N	Scaled Weights	Estimated F
FLT08: HGQ198: HGQ198	171	0.487	0.884	1.82	2	0.01	1.499
FLT13: HGQ498: HGQ498	250	0.284	0.559	1.97	2	0.03	1.215
FLT14: SON98: SON98	383	0.324	0.149	0.46	3	0.026	0.935
FLT15: TR98: T105_1	235	0.46	0.093	0.2	5	0.165	1.259
F shrinkage mean	273	0.5				0.77	1.155

Weighted prediction :

Survivors at end of year	Int s.e	Ext s.e	N	Var Ratio	F
267	0.39	0.06	13	0.144	1.171

Table 3.9.4

Western Baltic cod - VPA output

Fishing mortality (F) at age

Relative Mortality (%) at age										
YEAR	1970	1971	1972	1973	1974	1975	1976	1977		
AGE										
1	0.1576	0.1521	0.1578	0.0721	0.1021	0.0409	0.0587	0.0662		
2	0.9767	0.986	0.833	0.8705	0.9251	0.7253	0.9454	0.9777		
3	1.1499	1.1194	1.157	1.0668	1.2861	1.1013	1.4731	1.3934		
4	0.9211	0.9768	1.1558	1.0918	1.5019	1.1861	1.2904	1.5176		
5	0.7013	0.8832	1.5592	0.8093	1.1765	0.9915	1.4799	1.2905		
6	0.9343	1.0044	1.307	1.0006	1.3384	1.1059	1.4329	1.4187		
+gp	0.9343	1.0044	1.307	1.0006	1.3384	1.1059	1.4329	1.4187		
FBAR 3- 6	0.9266	0.996	1.2948	0.9921	1.3257	1.0962	1.419	1.405		
Relative F at age										
YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
1	0.04	0.0169	0.0437	0.0121	0.13	0.141	0.1167	0.0528	0.0371	0.0683
2	0.8154	0.591	0.3915	0.8458	0.728	0.9017	0.8555	0.5104	0.4503	0.6951
3	1.0594	1.0185	1.1537	1.3637	1.0552	1.0368	0.8474	1.2796	1.4889	0.8827
4	1	0.8706	0.935	1.4211	0.6537	0.9615	0.8619	1.2349	1.6501	1.182
5	0.8522	0.7803	0.8005	1.2232	0.8032	0.7431	0.6995	1.113	1.9518	1.0351
6	0.9814	0.8994	0.9739	1.3531	0.8461	0.9238	0.8104	1.223	1.7196	0.979
+gp	0.9814	0.8994	0.9739	1.3531	0.8461	0.9238	0.8104	1.223	1.7196	0.979
FBAR 3- 6	0.9733	0.8922	0.9658	1.3403	0.8396	0.9163	0.8048	1.2126	1.7026	1.0197
Relative F at age										
YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997 FBAR 95-97
AGE										
1	0.0575	0.0381	0.0483	0.0392	0.0465	0.0036	0.0128	0.0211	0.0295	0.0406 0.0304
2	0.6527	0.3158	0.6674	0.4984	0.4458	0.3979	0.5562	0.3281	0.4352	0.4427 0.402
3	1.1101	1.1956	0.9033	1.8359	1.1621	0.8227	0.7653	0.7535	1.2012	1.0294 0.9947
4	1.0229	1.2193	1.495	2.4826	1.2705	1.4313	0.5797	0.9498	1.1566	1.1834 1.0966
5	0.7521	0.9792	1.4364	1.5885	1.5829	1.7084	0.3181	1.2698	1.0678	1.211 1.1828
6	0.9201	1.19	1.3236	1.9477	1.3559	1.341	0.6347	1.0443	1.1836	1.1708 1.1329
+gp	0.9201	1.19	1.3236	1.9477	1.3559	1.341	0.6347	1.0443	1.1836	1.1708 1.1329
FBAR 3- 6	0.9513	1.1461	1.2896	1.9637	1.3429	1.3259	0.5745	1.0043	1.1523	1.1486
Relative F at age										
YEAR	1970	1971	1972	1973	1974	1975	1976	1977		
AGE										
1	0.1701	0.1527	0.1219	0.0726	0.077	0.0373	0.0414	0.0471		
2	1.054	0.99	0.6433	0.8774	0.6978	0.6616	0.6662	0.6959		
3	1.241	1.1239	0.8936	1.0753	0.9701	1.0046	1.0381	0.9917		
4	0.994	0.9808	0.8927	1.1005	1.1329	1.082	0.9093	1.0801		
5	0.7568	0.8868	1.2042	0.8157	0.8874	0.9045	1.0429	0.9185		
6	1.0082	1.0085	1.0095	1.0085	1.0095	1.0089	1.0098	1.0097		
+gp	1.0082	1.0085	1.0095	1.0085	1.0095	1.0089	1.0098	1.0097		
REFMEAN	0.9266	0.996	1.2948	0.9921	1.3257	1.0962	1.419	1.405		
Relative F at age										
YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
1	0.0411	0.0189	0.0452	0.009	0.1548	0.1539	0.145	0.0435	0.0218	0.067
2	0.8378	0.6624	0.4054	0.631	0.8671	0.9841	1.063	0.4209	0.2645	0.6817
3	1.0885	1.1416	1.1946	1.0174	1.2568	1.1315	1.0529	1.0553	0.8745	0.8657
4	1.0275	0.9758	0.9681	1.0603	0.7786	1.0494	1.071	1.0184	0.9692	1.1592
5	0.8756	0.8746	0.8289	0.9127	0.9567	0.8109	0.8691	0.9179	1.1464	1.0151
6	1.0084	1.0081	1.0084	1.0096	1.0078	1.0082	1.007	1.0085	1.01	0.9601
+gp	1.0084	1.0081	1.0084	1.0096	1.0078	1.0082	1.007	1.0085	1.01	0.9601
REFMEAN	0.9733	0.8922	0.9658	1.3403	0.8396	0.9163	0.8048	1.2126	1.7026	1.0197
Relative F at age										
YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
1	0.0604	0.0333	0.0374	0.0199	0.0346	0.0027	0.0223	0.021	0.0256	0.0353 0.0273
2	0.6861	0.2755	0.5176	0.2538	0.3319	0.3001	0.9682	0.3267	0.3777	0.3854 0.3633
3	1.167	1.0433	0.7005	0.9349	0.8654	0.6205	1.3323	0.7502	1.0424	0.8962 0.8963
4	1.0753	1.0639	1.1593	1.2642	0.9462	1.0796	1.0092	0.9457	1.0038	1.0302 0.9932
5	0.7906	0.8544	1.1138	0.809	1.1788	1.2885	0.5538	1.2643	0.9266	1.0543 1.0817
6	0.9672	1.0384	1.0264	0.9918	1.0097	1.0114	1.1048	1.0398	1.0272	1.0193 1.0288
+gp	0.9672	1.0384	1.0264	0.9918	1.0097	1.0114	1.1048	1.0398	1.0272	1.0193
REFMEAN	0.9513	1.1461	1.2896	1.9637	1.3429	1.3259	0.5745	1.0043	1.1523	1.1486

Table 3.9.4, continued

Western Baltic cod - VPA output

Stock number at age (start of year)			Numbers*10**-3								
YEAR	1970	1971	1972	1973	1974	1975	1976	1977			
AGE											
1	157127	125916	172095	66253	169799	87785	81450	139282			
2	91343	96300	75531	102028	42966	105481	60766	53158			
3	18036	28161	29414	26885	34980	13948	41815	19329			
4	6689	4676	7527	7572	7574	7914	3797	7848			
5	1980	2180	1441	1940	2080	1381	1979	855			
6	451	804	738	248	707	525	419	369			
+gp	200	370	307	245	179	288	166	155			
TOTAL	275827	258407	287054	205171	258285	217323	190392	220995			
YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	
AGE											
1	104512	49964	124046	90193	92488	109607	35631	28151	75624	43334	
2	94752	71254	32932	83510	62045	57576	69469	22932	19391	56128	
3	16371	34326	32307	18227	29347	24529	19132	24176	11269	10120	
4	3928	4647	10149	8344	3816	8365	7121	6712	5506	2082	
5	1409	1183	1593	3262	1649	1625	2618	2462	1599	866	
6	193	492	444	586	786	605	633	1065	662	186	
+gp	89	125	438	272	341	310	325	287	213	146	
TOTAL	221253	161990	201908	204394	190473	202617	134929	85785	114263	112861	
YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
AGE											
1	13731	20407	18418	32247	74067	41674	72914	121820	15660	104607	0
2	31238	9857	15101	13668	24515	56287	32500	55173	89605	11422	75460
3	22931	13316	5885	6343	6798	12852	30955	15257	32538	47475	6007
4	3427	6186	3298	1952	828	1741	4622	11789	5880	8014	13884
5	523	1009	1496	606	134	190	341	2119	3734	1514	2009
6	252	202	310	291	101	22	28	203	487	1051	369
+gp	139	98	103	70	92	58	44	17	66	248	330
0 TOTAL	72241	51074	44611	55177	106534	112826	141404	206379	147969	174332	98060
AGE	GMST 70-95	AMST 70-95									
1	67309	82636									
2	46091	55227									
3	18541	21027									
4	4909	5697									
5	1197	1482									
6	326	436									

Spawning stock number at age (spawning time)			Numbers*10**3							
YEAR	1970	1971	1972	1973	1974	1975	1976	1977		
AGE										
1	7856	6296	8605	3313	8490	4389	4073	6964		
2	18269	19260	15106	20406	8593	21096	12153	10632		
3	9920	15489	16178	14787	19239	7672	22998	10631		
4	5886	4115	6624	6663	6665	6965	3341	6906		
5	1940	2136	1413	1901	2039	1353	1939	838		
6	451	804	738	248	707	525	419	369		
+gp	200	370	307	245	179	288	166	155		
YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
AGE										
1	5226	2498	0	0	0	0	0	0	0	0
2	18950	14251	8233	20878	15511	14394	17367	5733	4848	14032
3	9004	18879	26492	14946	24064	20114	15688	19824	9241	8298
4	3457	4089	9641	7927	3625	7946	6765	6377	5230	1978
5	1380	1160	1545	3164	1600	1576	2540	2389	1551	840
6	193	492	444	586	786	605	633	1065	662	186
+gp	89	125	438	272	341	310	325	287	213	146
YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
AGE										
1	0	0	184	322	741	417	729	1218	157	1046
2	7810	2464	2416	2187	3922	9006	5200	5517	8960	1142

Table 3.9.4, continued

Western Baltic cod - VPA output

	3	18804	10919	4060	4377	4691	8868	21359	9765	20824	30384
	4	3256	5877	2869	1699	720	1515	4021	10257	5116	6973
	5	507	979	1407	569	126	179	320	1971	3472	1408
	6	252	202	295	277	96	21	27	185	444	956
	+gp	139	98	102	69	91	58	44	17	65	245
Stock biomass at age (start of year) Tonnes											
	YEAR	1970	1971	1972	1973	1974	1975	1976	1977		
	AGE										
	1	14456	11584	15833	6095	15621	8076	7493	12814		
	2	38547	40639	31874	43056	18132	44513	25643	22432		
	3	19118	29851	31179	28498	37079	14785	44324	20489		
	4	11625	8127	13083	13160	13164	13755	6598	13639		
	5	4835	5323	3520	4738	5081	3372	4833	2089		
	6	1529	2723	2499	841	2395	1779	1421	1249		
	+gp	1303	2328	1925	1484	1191	1654	1000	939		
	TOTALBIO	91413	100575	99913	97871	92662	87935	91312	73651		
	YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
	AGE										
	1	9615	4597	11412	8298	8509	10084	3278	4138	3403	3900
	2	39985	30069	13897	35241	26183	24297	29316	13621	11712	29299
	3	17353	36385	34245	19321	31108	26001	20280	27924	12565	9300
	4	6828	8076	17639	14502	6632	14538	12376	11841	10031	3287
	5	3440	2889	3890	7966	4028	3968	6394	5178	3056	2638
	6	653	1666	1504	1984	2662	2049	2143	3161	1756	729
	+gp	550	807	2513	1662	2014	1831	2010	1592	1033	858
	TOTALBIO	78424	84490	85100	88973	81136	82767	75797	67456	43557	50011
	YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
	AGE										
	1	1236	3245	3573	6256	14369	8085	14145	9502	1221	8159
	2	14088	5875	8139	7367	13214	30339	17517	20028	32527	4146
	3	21441	13356	5026	5417	5806	10976	26436	12587	26844	39167
	4	4938	10053	5666	3354	1423	2991	7941	17260	8608	11733
	5	1571	2455	3500	1416	312	445	797	5070	8931	3622
	6	1143	760	909	854	297	66	83	483	1161	2502
	+gp	903	595	574	419	484	344	269	53	131	916
	TOTALBIO	45321	36338	27388	25083	35904	53246	67188	64982	79422	70246
Spawning stock biomass at age (spawning time) Tonnes											
	YEAR	1970	1971	1972	1973	1974	1975	1976	1977		
	AGE										
	1	723	579	792	305	781	404	375	641		
	2	7709	8128	6375	8611	3626	8903	5129	4486		
	3	10515	16418	17149	15674	20394	8132	24378	11269		
	4	10230	7152	11513	11581	11584	12104	5807	12002		
	5	4738	5217	3450	4643	4979	3305	4736	2047		
	6	1529	2723	2499	841	2395	1779	1421	1249		
	+gp	1303	2328	1925	1484	1191	1654	1000	939		
	TOTSPBIO	36748	42545	43702	43138	44950	36281	42845	32633		
	YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
	AGE										
	1	481	230	0	0	0	0	0	0	0	0
	2	7997	6014	3474	8810	6546	6074	7329	3405	2928	7325
	3	9544	20012	28081	15843	25508	21321	16630	22897	10303	7626
	4	6008	7107	16757	13777	6301	13811	11758	11249	9529	3123
	5	3371	2832	3773	7727	3907	3849	6202	5023	2965	2559
	6	653	1666	1504	1984	2662	2049	2143	3161	1756	729
	+gp	550	807	2513	1662	2014	1831	2010	1592	1033	858
	TOTSPBIO	28604	38667	56102	49803	46937	48934	46071	47328	28515	22220
	YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
	AGE										
	1	0	0	36	63	144	81	141	95	12	82
	2	3522	1469	1302	1179	2114	4854	2803	2003	3253	415
	3	17581	10952	3468	3738	4006	7573	18241	8056	17180	25067

Table 3.9.4, continued

Western Baltic cod - VPA output

4	4692	9550	4929	2918	1238	2603	6908	15016	7489	10208
5	1524	2381	3290	1331	294	418	749	4715	8306	3369
6	1143	760	864	811	282	63	79	440	1056	2277
+gp	903	595	569	415	479	341	266	52	129	907
TOTSPBIO	29365	25707	14458	10454	8557	15933	29187	30376	37425	42323

Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)						
	RECRUITS	TOTSPBIO		YIELD/SSB		
		TOTALBIO		LANDINGS		FBAR 3- 6
Age 1						
1970	157127	91413	36748	43959	1.1962	0.9266
1971	125916	100575	42545	46623	1.0959	0.996
1972	172095	99913	43702	48900	1.119	1.2948
1973	66253	97871	43138	54357	1.2601	0.9921
1974	169799	92662	44950	46571	1.0361	1.3257
1975	87785	87935	36281	44367	1.2229	1.0962
1976	81450	91312	42845	49433	1.1538	1.419
1977	139282	73651	32633	46305	1.4189	1.405
1978	104512	78424	28604	40612	1.4198	0.9733
1979	49964	84490	38667	45046	1.165	0.8922
1980	124046	85100	56102	41972	0.7481	0.9658
1981	90193	88973	49803	53646	1.0772	1.3403
1982	92488	81135	46937	47524	1.0125	0.8396
1983	109607	82767	48934	48605	0.9933	0.9163
1984	35631	75797	46071	49495	1.0743	0.8048
1985	28151	67456	47328	40159	0.8485	1.2126
1986	75624	43557	28515	26692	0.9361	1.7026
1987	43334	50011	22220	28566	1.2856	1.0197
1988	13731	45321	29366	29159	0.993	0.9513
1989	20407	36338	25707	18516	0.7203	1.1461
1990	18418	27388	14458	17780	1.2298	1.2896
1991	32247	25083	10454	16693	1.5968	1.9637
1992	74067	35904	8557	17996	2.1032	1.3429
1993	41674	53246	15933	21228	1.3324	1.3259
1994	72914	67188	29187	30695	1.0517	0.5745
1995	121820	64982	30376	33895	1.1158	1.0043
1996	15660	79422	37426	50849	1.3587	1.1523
1997	104607	70246	42323	42842	1.0123	1.1486
Arith. Mean Units	81029 (Thousands)	70649 (Tonnes)	34993 (Tonnes)	38660 (Tonnes)	1.1635	1.1436

Table 3.10.1 Western Baltic cod - Input data to RCT3 model.

"Cod WB survey and VPA"

4	21	2				
1977	104512	-11	208.09	-11	-11	-11
1978	49963.9	48.71	143.44	-11	-11	138.77
1979	124046	-11	-11	37.54	-11	84.51
1980	90192.9	332.86	327.33	10.51	-11	-11
1981	92488.1	-11	119.76	19.17	39.30	52.16
1982	109607	-11	200.6	84.54	19.46	230.13
1983	35631.2	43.71	55.79	2.63	6.17	32.34
1984	28151	12.98	51.82	0.56	-11	22.96
1985	75623.5	25.45	234.99	6.34	1.91	50.76
1986	43333.8	20.7	-11	4.54	-11	35.83
1987	13730.7	1.51	-11	0.04	0.09	-11
1988	20406.7	1.28	62.98	0.07	1.82	-11
1989	18418	2.63	-11	0.07	1.95	5.25
1990	32247.3	6.58	49.91	1.86	0.08	-11
1991	74066.8	3.99	266.25	35.36	2.00	-11
1992	41674	45.06	150.55	3.66	0.27	77.47
1993	72913.9	14.96	137.44	6.99	11.75	101.91
1994	121820	111.94	489.89	11.74	88.57	665.41
1995	-11	2.23	32.49	0.15	244.95	8.64
1996	-11	214.85	330.78	9.79	27.26	410.64
1997	-11	432.18	-11	-11	66.72	1687.81
hgq1_1	-Solea survey, 1st quarter with HG20/25 trawl gear, agegroup1					
hgq4_1	-Solea survey, 4th quarter with HG20/25 trawl gear, agegroup1					
son_1	-Clupea survey, 1st quarter with Sonderburg trawl gear, agegroup 1					
dana_1	-Dana survey, 1st quarter with Granton tyrawl gear, age group 1					
hgq4_0	- Solea survey, 4th quarter with HG20/25 trawl gear, 0-group					

Table 3.10.2 Analysis by RCT3 ver3.1 of data from file : RCT3IN.PRN
"Cod WB survey and VPA"

Data for 4 surveys over 21 years : 1977 - 1997

Regression type = C

Tapered time weighting applied

power = 3 over 20 years

Survey weighting not applied

Final estimates shrunk towards mean

Minimum S.E. for any survey taken as .20

Minimum of 3 points used for regression

Forecast/Hindcast variance correction used.

Yearclass = 1992

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

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare Pts	No. Value	Index Value	Predicted Error	Std Weights	WAP
hgq1_1	.65	8.91	.71	.470	11	3.83	11.38	.881	.074
hgq4_1	.95	6.33	.39	.742	11	5.02	11.09	.478	.252
son_1	.52	9.79	.29	.877	13	1.54	10.58	.331	.524
dana_1	1.00	9.25	.94	.439	9	.24	9.49	1.202	.040

VPA Mean = 10.67 .720 .111

Yearclass = 1993

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

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare Pts	No. Value	Index Value	Predicted Error	Std Weights	WAP
hgq1_1	.65	8.86	.71	.442	12	2.77	10.65	.831	.079
hgq4_1	.97	6.18	.41	.700	12	4.93	10.95	.493	.223
son_1	.52	9.79	.27	.876	14	2.08	10.86	.314	.551
dana_1	1.06	9.33	1.01	.365	10	2.55	12.03	1.319	.031

VPA Mean = 10.64 .685 .116

Yearclass = 1994

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

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare Pts	No. Value	Index Value	Predicted Error	Std Weights	WAP
hgq1_1	.75	8.68	.79	.398	13	4.73	12.22	1.044	.060
hgq4_1	.99	6.07	.40	.687	13	6.20	12.23	.591	.187
son_1	.54	9.78	.29	.858	15	2.54	11.15	.335	.579
dana_1	.99	9.36	.91	.403	11	4.50	13.81	1.488	.029

VPA Mean = 10.65 .669 .145

Table 3.10.2, continued

Analysis by RCT3 ver3.1 of data from file : RCT3IN.PRN
"Cod WB survey and VPA"

Yearclass = 1995

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

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare Pts	No. Value	Index Value	Predicted Error	Std Weights	WAP
hgq1_1	.69	8.83	.69	.519	14	1.17	9.63	.838	.103
hgq4_1	.87	6.62	.36	.763	14	3.51	9.67	.495	.294
son_1	.60	9.73	.35	.818	16	.14	9.81	.422	.406
dana_1	.71	9.61	.76	.522	12	5.51	13.50	1.177	.052

VPA Mean = 10.72 .705 .145

Yearclass = 1996

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

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare Pts	No. Value	Index Value	Predicted Error	Std Weights	WAP
hgq1_1	.70	8.82	.70	.520	14	5.37	12.57	.969	.073
hgq4_1	.86	6.67	.35	.772	14	5.80	11.64	.457	.328
son_1	.61	9.72	.36	.814	16	2.38	11.16	.419	.390
dana_1	.70	9.63	.77	.520	12	3.34	11.98	.981	.071

VPA Mean = 10.70 .707 .137

Yearclass = 1997

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

Survey/ Series	Slope	Inter- cept	Std Error	Rsquare Pts	No. Value	Index Value	Predicted Error	Std Weights	WAP
hgq1_1	.71	8.81	.71	.521	14	6.07	13.13	1.096	.227
hgq4_1									
son_1									
dana_1	.70	9.65	.77	.519	12	4.22	12.58	1.093	.229

VPA Mean = 10.69 .709 .544

Year Class	Weighted Average Prediction	Log WAP Error	Int Std Error	Ext Std Error	Var Std Ratio	VPA	Log VPA
1992	45919	10.73	.24	.19	.60	41675	10.64
1993	52841	10.88	.23	.12	.25	72914	11.20
1994	91012	11.42	.26	.34	1.76	121821	11.71
1995	23750	10.08	.27	.44	2.66		
1996	90870	11.42	.26	.24	.85		
1997	117684	11.68	.52	.77	2.19		

Table 3.12.1

The SAS System

13:47 Wednesday, April 29, 1998

Cod in Baltic Fishing Areas 22 - 24

Prediction with management option table: Input data

Year: 1998								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	117684.00	0.2860	0.0100	0.0000	0.0000	0.078	0.0317	0.525
2	75460.000	0.2000	0.1000	0.0000	0.0000	0.363	0.4191	0.756
3	6007.000	0.2000	0.6400	0.0000	0.0000	0.825	1.0370	1.017
4	13884.000	0.2000	0.8700	0.0000	0.0000	1.464	1.1432	1.415
5	2009.000	0.2000	0.9300	0.0000	0.0000	2.392	1.2331	1.786
6	369.000	0.2000	0.9100	0.0000	0.0000	2.381	1.1811	2.766
7+	330.000	0.2000	0.9900	0.0000	0.0000	3.287	1.1811	4.394
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1999								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	35795.000	0.2860	0.0100	0.0000	0.0000	0.078	0.0317	0.525
2	.	0.2000	0.1000	0.0000	0.0000	0.363	0.4191	0.756
3	.	0.2000	0.6400	0.0000	0.0000	0.825	1.0370	1.017
4	.	0.2000	0.8700	0.0000	0.0000	1.464	1.1432	1.415
5	.	0.2000	0.9300	0.0000	0.0000	2.392	1.2331	1.786
6	.	0.2000	0.9100	0.0000	0.0000	2.381	1.1811	2.766
7+	.	0.2000	0.9900	0.0000	0.0000	3.287	1.1811	4.394
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 2000								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	.	0.2860	0.0100	0.0000	0.0000	0.078	0.0317	0.525
2	.	0.2000	0.1000	0.0000	0.0000	0.363	0.4191	0.756
3	.	0.2000	0.6400	0.0000	0.0000	0.825	1.0370	1.017
4	.	0.2000	0.8700	0.0000	0.0000	1.464	1.1432	1.415
5	.	0.2000	0.9300	0.0000	0.0000	2.392	1.2331	1.786
6	.	0.2000	0.9100	0.0000	0.0000	2.381	1.1811	2.766
7+	.	0.2000	0.9900	0.0000	0.0000	3.287	1.1811	4.394
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANSTN02
Date and time: 21APR98:19:01

Table 3.12.2

The SAS System

13:47 Wednesday, April 29, 1998

Cod in Baltic Fishing Areas 22 - 24

Yield per recruit: Input data

Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	1.000	0.2860	0.0100	0.0000	0.0000	0.078	0.0317	0.525
2	.	0.2000	0.1000	0.0000	0.0000	0.363	0.4191	0.756
3	.	0.2000	0.6400	0.0000	0.0000	0.825	1.0370	1.017
4	.	0.2000	0.8700	0.0000	0.0000	1.464	1.1432	1.415
5	.	0.2000	0.9300	0.0000	0.0000	2.392	1.2331	1.786
6	.	0.2000	0.9100	0.0000	0.0000	2.381	1.1811	2.766
7+	.	0.2000	0.9900	0.0000	0.0000	3.287	1.1811	4.394
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDSTN01
Date and time: 21APR98:18:30

Table 3.12.3

The SAS System

13:47 Wednesday, April 29, 1998

Cod in Baltic Fishing Areas 22 - 24

Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	1.1486	68622	30029	39427	0.6000	0.6892	80343	36482	36142	86668	58020
.	.	.	.	.	0.8000	0.9189	.	36482	44903	76823	50261
.	.	.	.	.	1.0000	1.1486	.	36482	52464	68457	43738
.	.	.	.	.	1.2000	1.3783	.	36482	59020	61318	38231
.	.	.	.	.	1.4000	1.6080	.	36482	64733	55199	33565
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANSTN04
 Date and time : 21APR98:18:56
 Computation of ref. F: Simple mean, age 3 - 6
 Basis for 1998 : F factors

Table 3.12.4

The SAS System

13:47 Wednesday, April 29, 1998

Cod in Baltic Fishing Areas 22 - 24

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	0.000	0.000	5.144	8396.926	3.117	7604.259	3.117	7604.259
0.0500	0.0574	0.150	362.936	4.400	6151.065	2.398	5410.132	2.398	5410.132
0.1000	0.1149	0.244	532.302	3.930	4787.523	1.949	4086.074	1.949	4086.074
0.1500	0.1723	0.310	612.598	3.605	3884.812	1.642	3215.306	1.642	3215.306
0.2000	0.2297	0.358	648.658	3.367	3250.804	1.420	2608.037	1.420	2608.037
0.2500	0.2872	0.395	661.913	3.185	2785.804	1.252	2165.921	1.252	2165.921
0.3000	0.3446	0.425	663.321	3.040	2433.178	1.121	1833.189	1.121	1833.189
0.3500	0.4020	0.449	658.720	2.922	2158.527	1.015	1576.039	1.015	1576.039
0.4000	0.4594	0.469	651.293	2.824	1939.850	0.928	1372.904	0.928	1372.904
0.4500	0.5169	0.486	642.785	2.741	1762.486	0.856	1209.451	0.856	1209.451
0.5000	0.5743	0.501	634.140	2.670	1616.332	0.794	1075.833	0.794	1075.833
0.5500	0.6317	0.514	625.849	2.608	1494.226	0.741	965.094	0.741	965.094
0.6000	0.6892	0.525	618.147	2.553	1390.973	0.695	872.203	0.695	872.203
0.6500	0.7466	0.535	611.123	2.505	1302.723	0.655	793.447	0.655	793.447
0.7000	0.8040	0.544	604.787	2.462	1226.573	0.619	726.035	0.619	726.035
0.7500	0.8615	0.553	599.105	2.423	1160.299	0.587	667.838	0.587	667.838
0.8000	0.9189	0.560	594.025	2.387	1102.173	0.559	617.205	0.559	617.205
0.8500	0.9763	0.567	589.485	2.355	1050.833	0.533	572.845	0.533	572.845
0.9000	1.0337	0.573	585.425	2.325	1005.198	0.510	533.732	0.510	533.732
0.9500	1.0912	0.579	581.785	2.298	964.394	0.488	499.043	0.488	499.043
1.0000	1.1486	0.585	578.515	2.273	927.715	0.469	468.112	0.469	468.112
1.0500	1.2060	0.590	575.565	2.249	894.579	0.451	440.398	0.451	440.398
1.1000	1.2635	0.595	572.896	2.227	864.508	0.435	415.451	0.435	415.451
1.1500	1.3209	0.599	570.470	2.207	837.102	0.419	392.900	0.419	392.900
1.2000	1.3783	0.603	568.258	2.187	812.027	0.405	372.435	0.405	372.435
1.2500	1.4358	0.607	566.233	2.169	788.999	0.392	353.796	0.392	353.796
1.3000	1.4932	0.611	564.371	2.152	767.779	0.380	336.761	0.380	336.761
1.3500	1.5506	0.615	562.653	2.136	748.162	0.368	321.141	0.368	321.141
1.4000	1.6080	0.618	561.062	2.121	729.972	0.357	306.777	0.357	306.777
1.4500	1.6655	0.621	559.583	2.106	713.058	0.347	293.530	0.347	293.530
1.5000	1.7229	0.624	558.205	2.092	697.287	0.337	281.279	0.337	281.279
1.5500	1.7803	0.627	556.917	2.079	682.547	0.328	269.921	0.328	269.921
1.6000	1.8378	0.630	555.709	2.067	668.736	0.320	259.366	0.320	259.366
1.6500	1.8952	0.633	554.573	2.055	655.766	0.312	249.535	0.312	249.535
1.7000	1.9526	0.635	553.502	2.043	643.562	0.304	240.358	0.304	240.358
1.7500	2.0101	0.638	552.491	2.032	632.054	0.297	231.773	0.297	231.773
1.8000	2.0675	0.640	551.534	2.021	621.181	0.290	223.727	0.290	223.727
1.8500	2.1249	0.643	550.626	2.011	610.891	0.283	216.171	0.283	216.171
1.9000	2.1823	0.645	549.764	2.001	601.134	0.277	209.064	0.277	209.064
1.9500	2.2398	0.647	548.943	1.992	591.869	0.271	202.366	0.271	202.366
2.0000	2.2972	0.649	548.160	1.983	583.057	0.265	196.044	0.265	196.044
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDSTN01
 Date and time : 21APR98:18:30
 Computation of ref. F: Simple mean, age 3 - 6
 F-0.1 factor : 0.1506
 F-max factor : 0.2825
 F-0.1 reference F : 0.1730
 F-max reference F : 0.3245
 Recruitment : Single recruit

Table 3.13.1

Western Baltic cod - medium term projection, input data

Stock input for 1998

Age	Stock No.	Log SE(int)
1	117684	0.52
2	75460	0.19
3	6007	0.18
4	13884	0.2
5	2009	0.28
6	369	0.35
7	330	0.39

Mean weight in the catch

age	1	2	3	4	5	6	7
Mean	0.510429	0.831143	1.226857	1.779714	3.022714	4.530429	6.688857
Std.dev.	0.058252	0.118238	0.214727	0.529117	0.829634	1.456759	2.399101

Correction factors to derive Stock mean weight from Catch mean weight

Age	1	2	3
Factor	0.283	0.558	0.686

Maturity information

age	1	2	3	4	5	6	7
mean	0.010143	0.134286	0.668571	0.87	0.935714	0.932857	0.99
std.dev.	0.000378	0.032071	0.026726	1.22E-08	0.005345	0.021381	0

Table 3.13.2 SSB-R relation for Western baltic cod to be used in the medium term Projections.

Estimation of stock recruitment using the Ricker function on the log scale

ar 3.1 1.08777 Model: Rec= $a \cdot \text{SSB} \cdot \exp(-b \cdot \text{SSB})$
 br 7.85E-06 1.56E-05
 SSQ= 13.98562 max recr. Max R= $(a/b) \cdot \exp(-1) =$ 145277
 Var= 1.165469
 sr 1.079569

Y of Rec.	VPA SSB(y-1)	log(SSB)	VPA Recruits	Model Recruits	Model Log (rec)	observed Log(rec)	Residuals Log Scale	Res**2 Log Scale
1971	36748	10.5118	125916	85372	11.35477	11.74337	0.388601	0.151011
1972	42545	10.6583	172095	94442	11.45574	12.0558	0.60006	0.360073
1973	43702	10.6851	66253	96133	11.47349	11.10124	-0.37225	0.138573
1974	43138	10.6722	169799	95314	11.46493	12.04237	0.577442	0.33344
1975	44950	10.7133	87785	97915	11.49185	11.38265	-0.1092	0.011926
1976	36281	10.4990	81450	84596	11.34565	11.30774	-0.0379	0.001436
1977	42845	10.6653	139282	94884	11.46041	11.84426	0.383843	0.147335
1978	32633	10.3931	104512	78301	11.26831	11.55706	0.288745	0.083374
1979	28604	10.2613	49964	70839	11.16816	10.81906	-0.3491	0.121874
1980	38667	10.5627	124046	88487	11.39061	11.72841	0.3378	0.114109
1981	56102	10.9349	90193	111963	11.62593	11.40971	-0.21622	0.046752
1982	49803	10.8158	92488	104431	11.55628	11.43483	-0.12144	0.014749
1983	46937	10.7566	109607	100660	11.51951	11.60466	0.085148	0.00725
1984	48934	10.7982	35631	103311	11.5455	10.48097	-1.06453	1.133217
1985	46071	10.7379	28151	99477	11.50768	10.24534	-1.26235	1.593516
1986	47328	10.7649	75624	101188	11.52473	11.23353	-0.29121	0.084801
1987	28515	10.2582	43334	70668	11.16574	10.67669	-0.48905	0.239172
1988	22220	10.0087	13731	57857	10.96572	9.527411	-1.43831	2.068741
1989	29366	10.2876	20407	72292	11.18847	9.923633	-1.26484	1.599817
1990	25707	10.1545	18418	65129	11.08412	9.821084	-1.26304	1.595263
1991	14458	9.5790	32247	40011	10.59691	10.38118	-0.21573	0.046539
1992	10454	9.2547	74067	29854	10.30408	11.21273	0.908647	0.82564
1993	8557	9.0545	41674	24803	10.11873	10.63763	0.518898	0.269255
1994	15933	9.6761	72914	43585	10.68248	11.19704	0.51456	0.264772
1995	29187	10.2815	121820	71953	11.18376	11.71103	0.526537	0.277241
1996	30376	10.3214	15660	74188	11.21436	9.658865	-1.55549	2.41956
1997	37426	10.5301	104607	86485	11.36773	11.55797	0.190237	0.03619

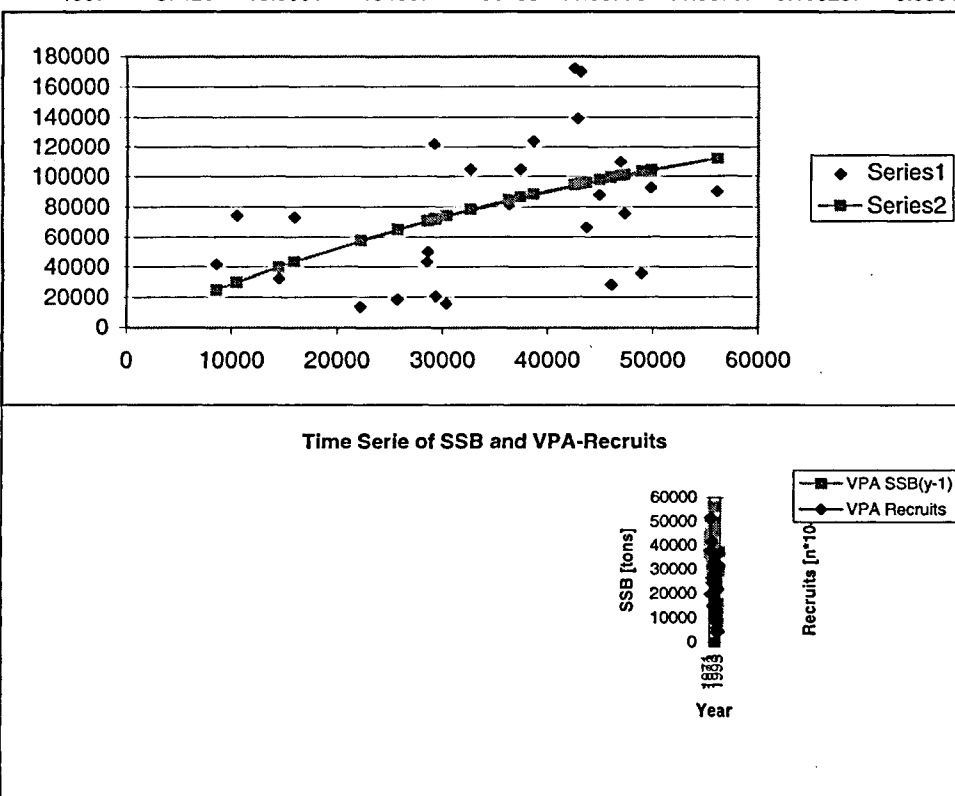


Table 3.13.3

Medium term projection for Western Baltic cod.

F=1.1

SSB

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	27.08	37.06	39.85	36.07	34.98	37.67	35.13	37.86	44.96	43.79
0.10	28.94	39.47	43.96	41.66	41.07	45.72	44.48	54.44	51.98	53.78
0.25	33.65	43.04	51.09	52.57	57.35	65.81	72.89	73.51	74.17	77.34
0.50	39.36	46.34	62.32	73.81	81.81	104.75	113.50	111.47	110.68	113.44
0.75	46.22	50.99	76.43	108.20	140.58	150.86	175.42	176.95	176.10	171.32
0.90	49.76	58.01	89.78	168.85	210.38	216.22	248.98	272.70	270.96	270.17
0.95	54.75	61.32	112.05	217.14	251.28	261.74	307.79	359.61	361.21	364.61

Recruitment

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	50.13511	14.94796	18.6595	23.07934	19.07658	13.55201	20.00788	13.29949	19.04812	18.08457
0.1	59.0101	20.80764	30.93436	36.02762	32.9632	25.85037	31.11198	23.40635	27.017	26.62341
0.25	89.15568	45.53923	49.0889	59.95552	60.0444	51.51318	58.29879	46.61669	43.36853	58.98577
0.5	117.2068	90.44742	96.31333	112.3684	135.1511	119.836	117.3018	104.6011	116.8099	101.1874
0.75	159.0666	213.0611	223.7223	243.3923	325.952	247.0595	239.6184	253.473	296.6693	252.4324
0.9	206.4728	403.9042	393.1833	400.3078	553.8651	474.342	521.7451	502.3882	528.1324	445.3048
0.95	276.1396	590.5077	660.1657	529.8814	746.8254	757.7116	709.1792	727.3734	803.7422	570.2232

Yield

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	35418.28	49233.95	47075.85	41518.72	42850.48	45769.89	42347.33	47162.45	53420.23	51157.09
0.1	37655.03	51774.73	51192.92	47778.35	49101.7	56129.25	57461.69	59794.01	60494.38	62836.1
0.25	41428.25	58533.28	61760.7	60309.4	70586.21	84175.6	90735.91	89571.7	88073.32	85581.03
0.5	46964.63	66676.12	80032.82	87835.49	115668.4	130536.9	127669.9	129609.7	127939.2	137275.9
0.75	52040.19	77617.01	110012.8	146978.1	164994	188289.6	209419.6	202693.9	199756.3	210929.4
0.9	57661.84	92862.84	150494.6	236983.1	238776.3	275614.1	325317.2	305565.8	317943.2	348719.8
0.95	60583.49	97851.01	186398.3	296715.2	295255.4	322063.3	410005.3	456630.5	387379	468617.5

Table 3.13.4 Medium term projection for Western Baltic cod.

F=1.2

SSB

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	26.87	33.47	35.28	29.51	28.36	30.16	31.36	32.73	33.53	31.20
0.10	29.09	36.29	37.99	33.96	34.01	39.37	42.08	41.51	38.63	44.64
0.25	33.64	39.50	48.66	46.16	48.91	54.92	59.80	59.34	65.62	71.09
0.50	38.48	44.08	58.63	64.22	74.06	87.67	92.18	98.62	110.16	109.46
0.75	44.74	50.18	73.38	100.72	123.94	141.04	144.21	158.09	170.79	169.39
0.90	48.96	55.55	97.38	169.93	211.89	227.50	252.53	225.38	258.41	298.01
0.95	51.42	59.59	120.87	215.75	276.79	283.23	307.67	282.81	352.82	399.58

Recruitment

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	48.31793	12.94926	17.01516	23.98483	19.151	18.16107	20.46723	14.34854	16.56983	16.28014
0.1	57.89117	18.92792	22.54321	30.42799	30.19172	26.90964	29.85959	23.45842	28.64533	25.97265
0.25	84.03016	35.02848	45.39946	61.84037	55.77021	47.70867	68.78205	54.05776	58.42516	53.41592
0.5	120.4599	74.05717	106.2074	111.4549	123.218	115.7075	137.9223	132.0891	124.929	119.0593
0.75	166.4547	186.9489	267.3403	235.9765	246.3102	242.8572	275.5197	247.0402	261.513	213.6923
0.9	225.5761	439.7674	503.4251	433.48	499.0734	518.2549	531.9844	573.4004	560.8272	452.185
0.95	281.641	601.544	773.1146	596.1587	625.6046	709.2955	799.7075	1096.219	896.413	628.4363

Yield

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	36685.29	49282.34	43388.5	35448.34	39111.07	44314.4	39044.13	44067.81	45969.84	43939.77
0.1	39349.28	51832.56	47897.31	40305.18	48209.71	51092.18	54473.93	51172.21	56104.11	58302.12
0.25	43959.93	59583.41	61517.28	59412.94	72103.34	78068.91	80036.32	80360.61	93772.42	91744.88
0.5	49305.54	68869.83	83344.83	95447.82	112050.7	117275.8	120390.9	133196.5	138598.8	135352.3
0.75	54499.59	82016.69	113242.1	154032.6	176675.6	193680.3	200969.1	207156.8	218309.2	226044.5
0.9	59146.02	93103.97	167114.7	266235.6	278043.2	294742.8	298768.1	342049.6	411593.1	376901.1
0.95	61986.25	108064.3	212322.8	410002.9	372483.8	378608.8	444180.3	422491.2	481918.2	534110.6

Table 3.13.5

Medium term projection for Western Baltic cod.

F=1.3

SSB

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	29.62	31.90	29.30	24.33	22.45	24.06	23.40	23.52	28.89	28.21
0.10	31.30	33.54	33.20	31.27	27.03	29.68	31.89	32.90	34.10	35.85
0.25	34.29	38.09	43.49	41.78	41.50	40.42	44.86	49.16	51.53	56.19
0.50	39.24	42.18	55.46	60.82	62.38	64.21	72.18	78.30	74.05	78.48
0.75	45.89	46.68	68.97	84.48	92.95	117.81	123.62	116.53	117.85	122.07
0.90	51.31	52.12	93.46	114.23	164.64	199.74	198.05	187.09	203.31	180.69
0.95	54.36	55.48	105.99	162.34	205.59	280.63	246.59	275.39	267.06	272.22

Recruitment

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	48.01221	18.0134	11.45928	20.30992	13.13788	15.90701	13.88701	18.21437	16.02239	22.14605
0.1	58.27538	24.76068	19.83959	25.82774	22.28116	22.56644	28.33267	23.12238	26.96975	30.30273
0.25	83.94125	39.08249	45.19385	53.6791	45.04693	47.96046	52.78591	44.0926	54.5807	53.12141
0.5	121.4806	85.20983	85.77334	99.13708	95.84088	94.46803	112.8929	102.5774	112.1369	123.7625
0.75	165.2902	163.6735	180.7457	272.2041	212.2419	229.186	218.8089	216.1174	255.2338	228.1513
0.9	245.5868	340.4512	341.6665	455.2888	413.8549	445.5485	355.6521	429.3401	514.1751	371.1444
0.95	292.5695	527.5937	643.2672	657.7911	610.996	577.6348	655.7594	495.6242	790.5678	614.6956

Yield

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	40565.73	47107.53	38944.05	31819.28	35516.65	33246.65	34545.7	33682.74	41461.14	40325.88
0.1	42199.88	51981.67	44808.02	41675.9	40332.22	40600.59	47077.21	47069.3	53839.28	50511.62
0.25	47242.85	60554.39	63236.19	59689.5	59858.58	60027.87	69513.9	73970.98	78693.79	71654.91
0.5	52797.71	69151.31	83620.76	85149.27	94045.12	107421.4	107243.3	110424.2	110151.1	113745.8
0.75	59112.09	81121.43	113484	126362.6	148430.3	167737.3	166695.6	172922.7	155562.9	184920.7
0.9	63816.07	96858.58	150975.6	211560.9	250791.3	277793.6	254476	275679.9	292132.6	268561.5
0.95	66634.69	118579.7	183070.8	260012.5	358616.3	378859	387499.9	455954.6	387180.4	398466.2

Table 3.13.6 Medium term projection for Western Baltic cod.

F=1.4

SSB

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	28.37	30.34	28.21	23.68	23.64	23.90	23.05	23.13	23.87	23.83
0.10	30.10	31.81	31.66	28.38	27.74	28.29	29.61	27.51	30.11	28.98
0.25	33.49	34.87	38.87	35.54	38.18	41.23	40.57	41.25	46.00	47.68
0.50	39.39	39.74	47.47	51.94	58.09	66.19	65.55	67.79	71.92	72.12
0.75	45.07	44.98	61.98	75.42	88.42	104.58	109.18	113.03	111.05	117.49
0.90	50.03	51.34	79.37	111.42	130.77	162.53	185.85	181.59	184.47	173.22
0.95	52.09	54.61	96.61	160.19	176.89	216.06	243.50	217.80	230.36	226.15

Recruitment

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	49.92164	11.8439	13.25844	17.4953	19.26282	16.14791	20.26252	19.21398	18.36998	18.38423
0.1	65.5222	19.49264	25.23599	26.53873	24.83403	26.73231	30.06233	25.73181	26.49562	25.82546
0.25	84.22223	37.19016	48.2084	55.51289	54.43342	43.04017	55.26222	50.96702	53.00916	55.30966
0.5	108.2886	82.49305	99.20325	112.0016	95.83434	94.86081	119.3417	96.52502	111.3782	111.9343
0.75	158.5137	197.3102	194.1736	239.9471	211.2016	219.5794	234.426	186.7098	263.1429	221.2905
0.9	230.1063	325.1811	356.9684	476.8629	436.7873	467.5623	521.0618	339.653	526.0908	412.069
0.95	279.1142	448.236	649.1681	612.3236	590.4045	646.3478	731.6936	478.9465	710.1927	631.3748

Yield

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	43852.38	47837.82	39695.44	35893.14	38060.43	37718.66	38178.53	34536.53	39159.86	38213.47
0.1	45384.2	50951.52	49037.9	42130.57	49977.1	45786.66	43541.82	46183.41	47192.17	45783.29
0.25	49485.64	59395.93	59862.56	55397.85	64935.78	62388.23	68027.02	66415.32	68264.12	73902.38
0.5	55176.21	68089.6	78709.82	83178.36	101833	102830	100203.4	112504.2	106888.4	113761.7
0.75	60576.37	81660.62	104951.3	127591.5	152802.6	175601	179893.8	181246.2	174937.2	179939.1
0.9	65212.95	98779.61	153826.7	198721.6	215344.3	268857.2	275074.1	274428.8	275638.5	295108.7
0.95	68865.23	120981.9	186774.3	279564.4	321834.9	316897.9	325549.9	344810.2	313547	340945

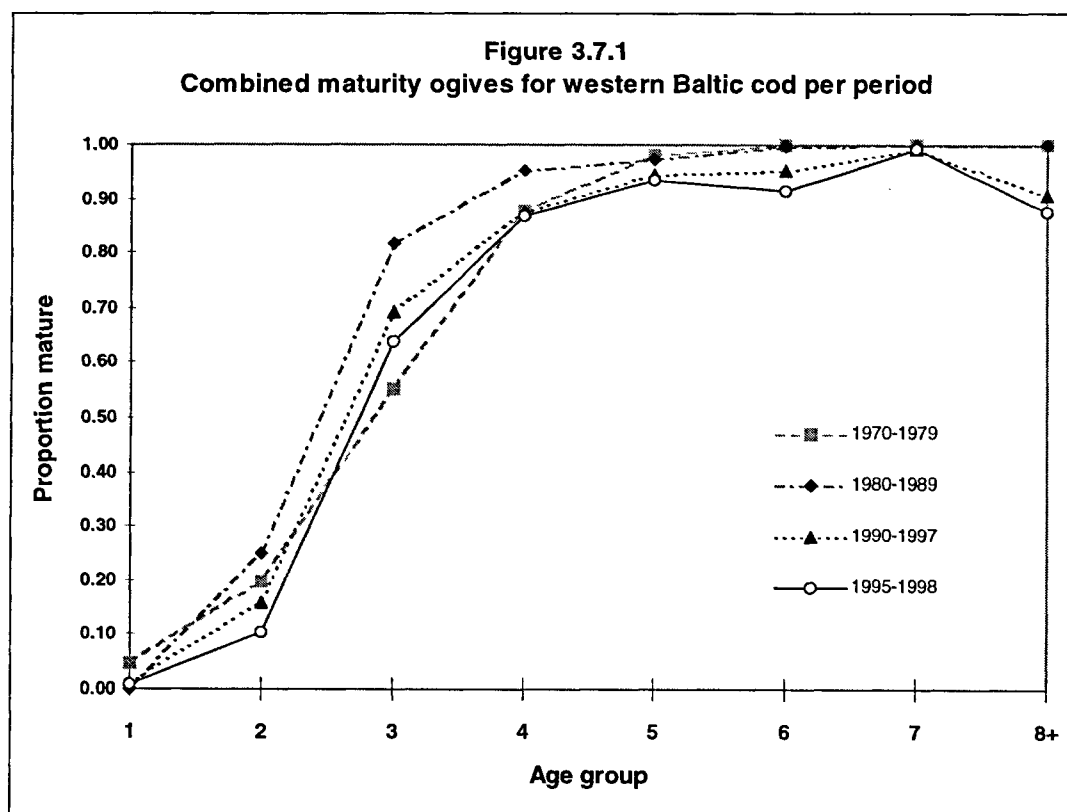


Figure 3.9.1

Western Baltic cod tunin data - log catchability residuals

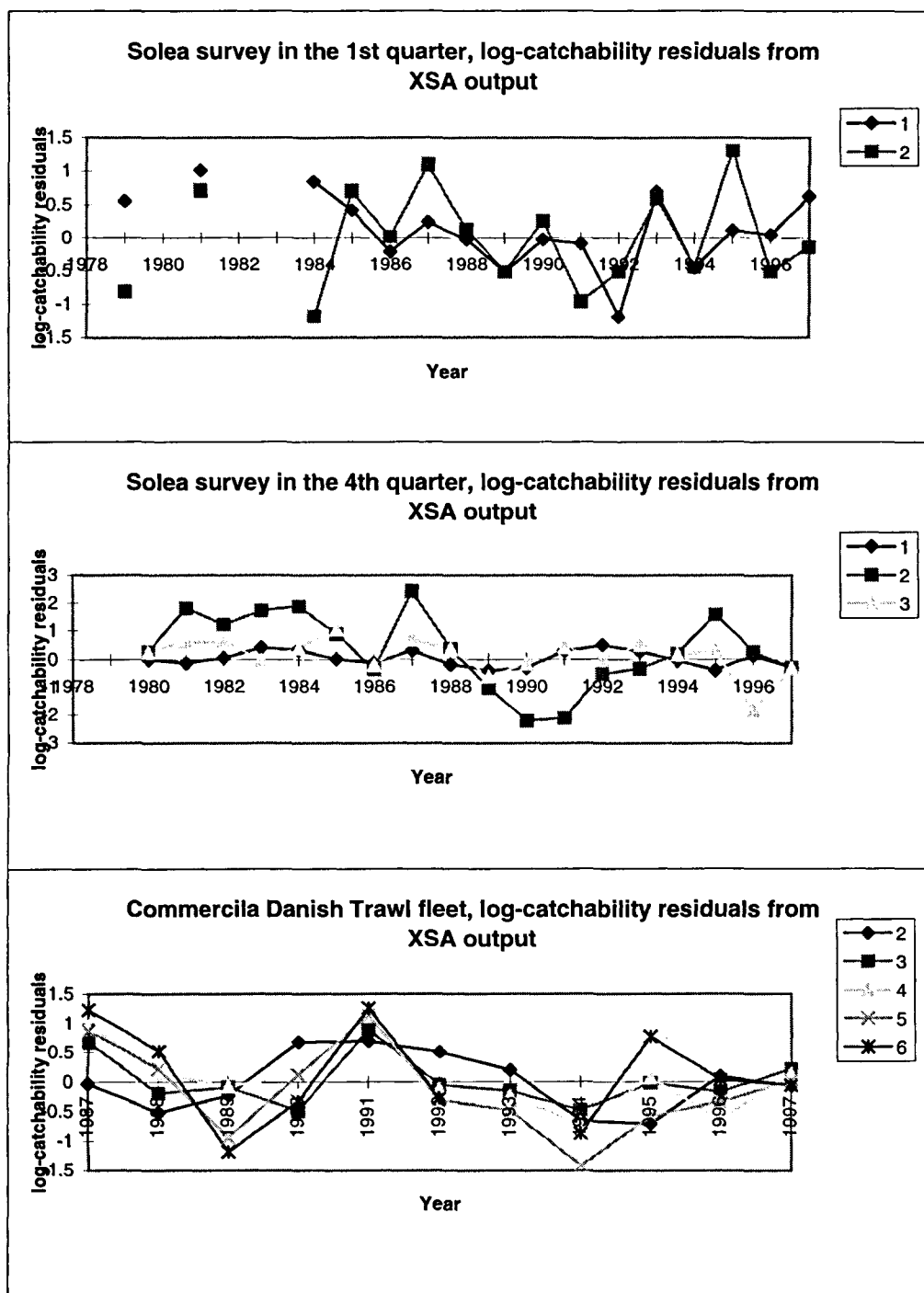
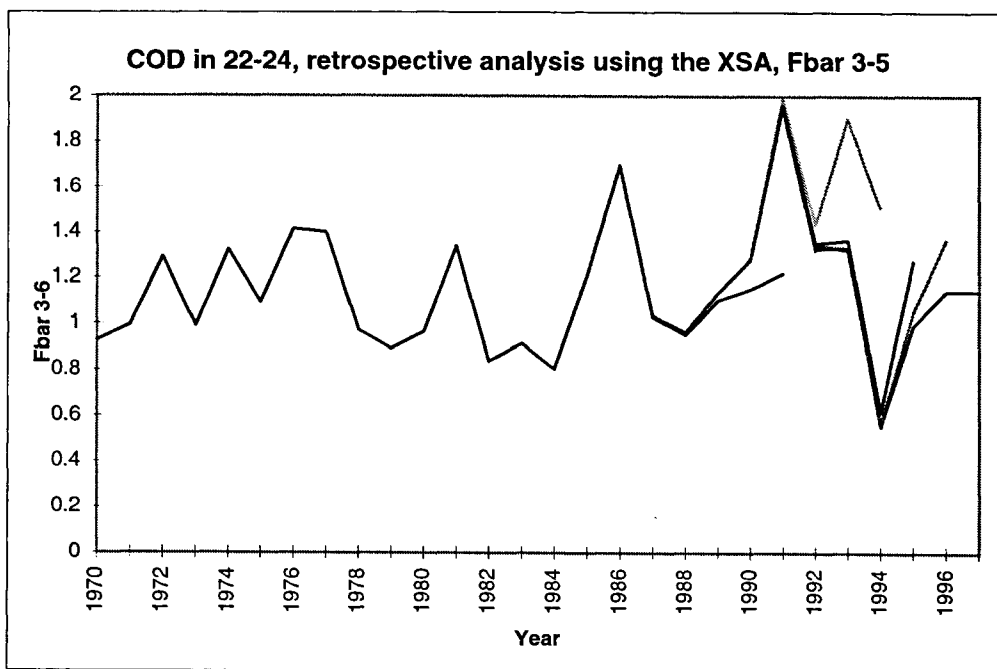


Figure 3.9.2

Western Baltic cod - retrospective analysis



Cod in Baltic Fishing Areas 22-24 23-4-1998

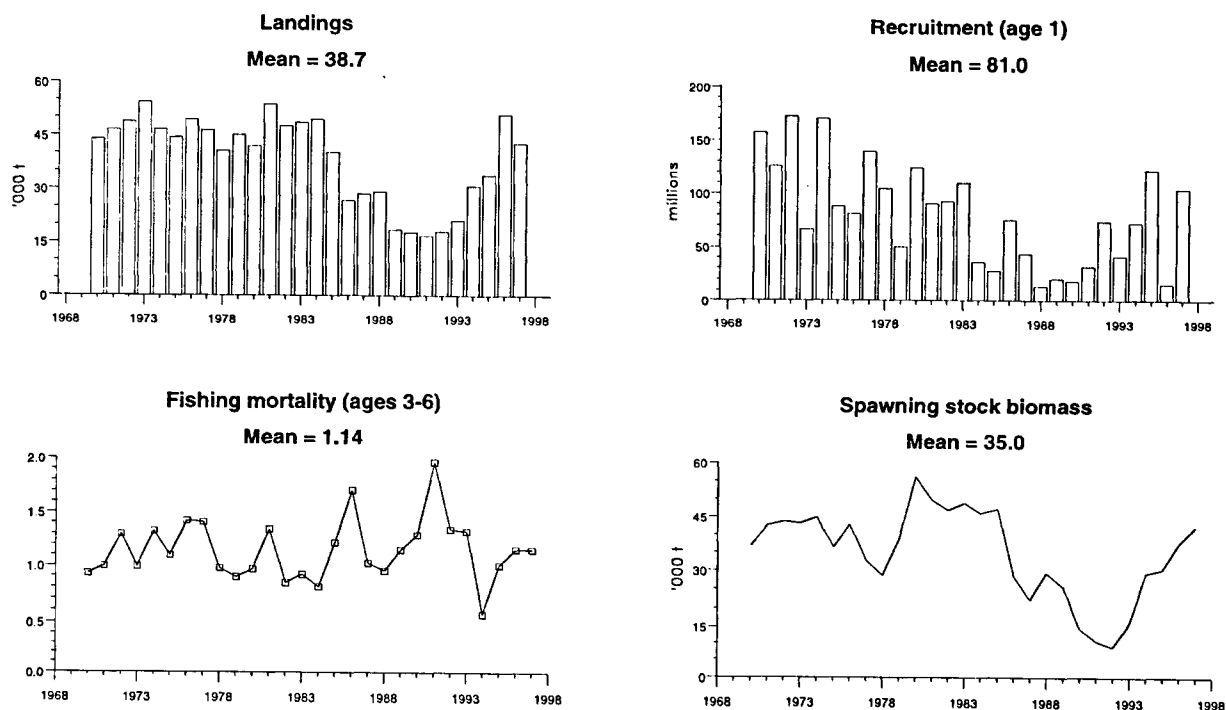


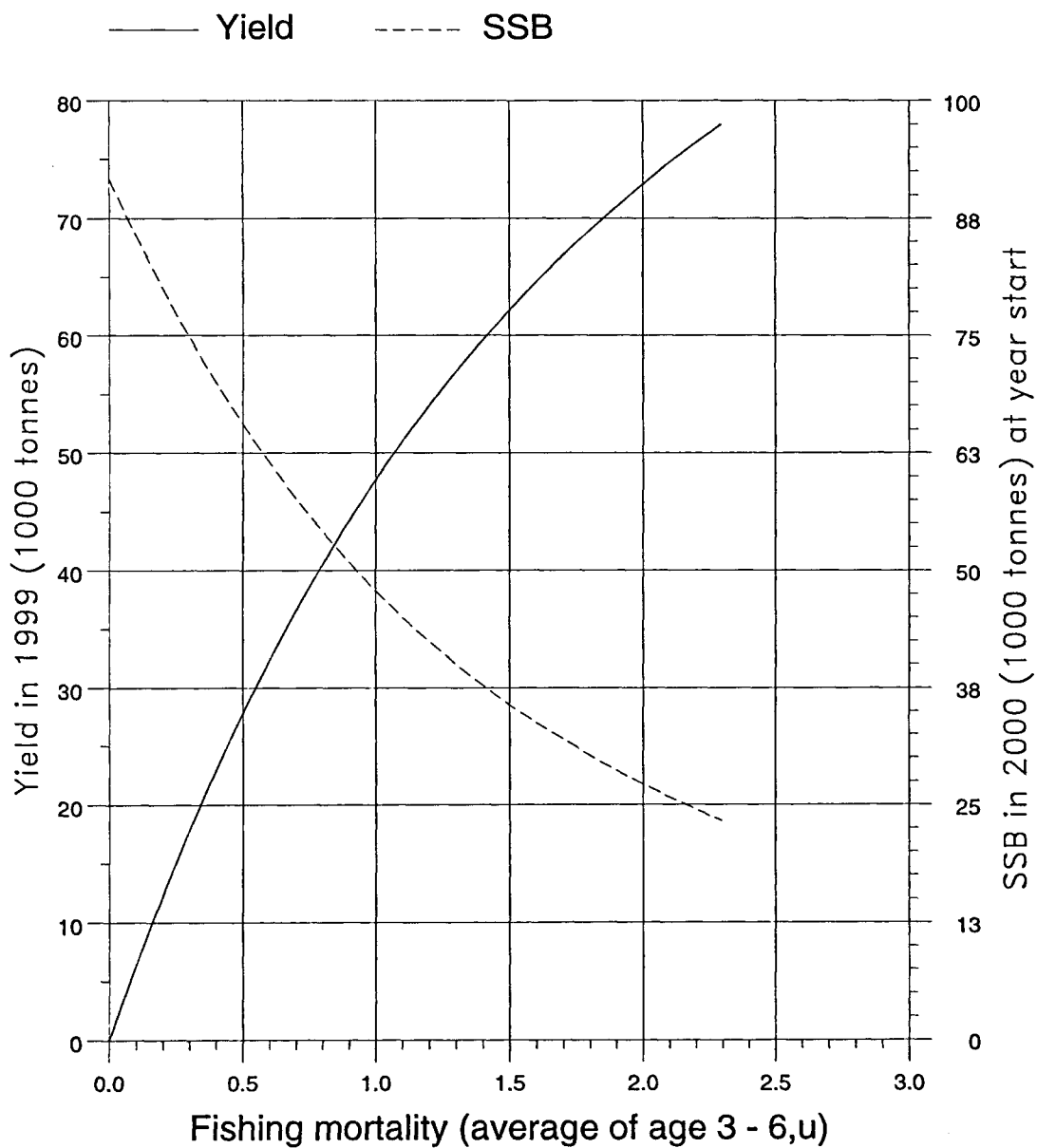
Figure 3.11.1

Fish Stock Summary

Cod in Baltic Fishing Areas 22-24

21-4-1998

Short term yield and spawning stock biomass



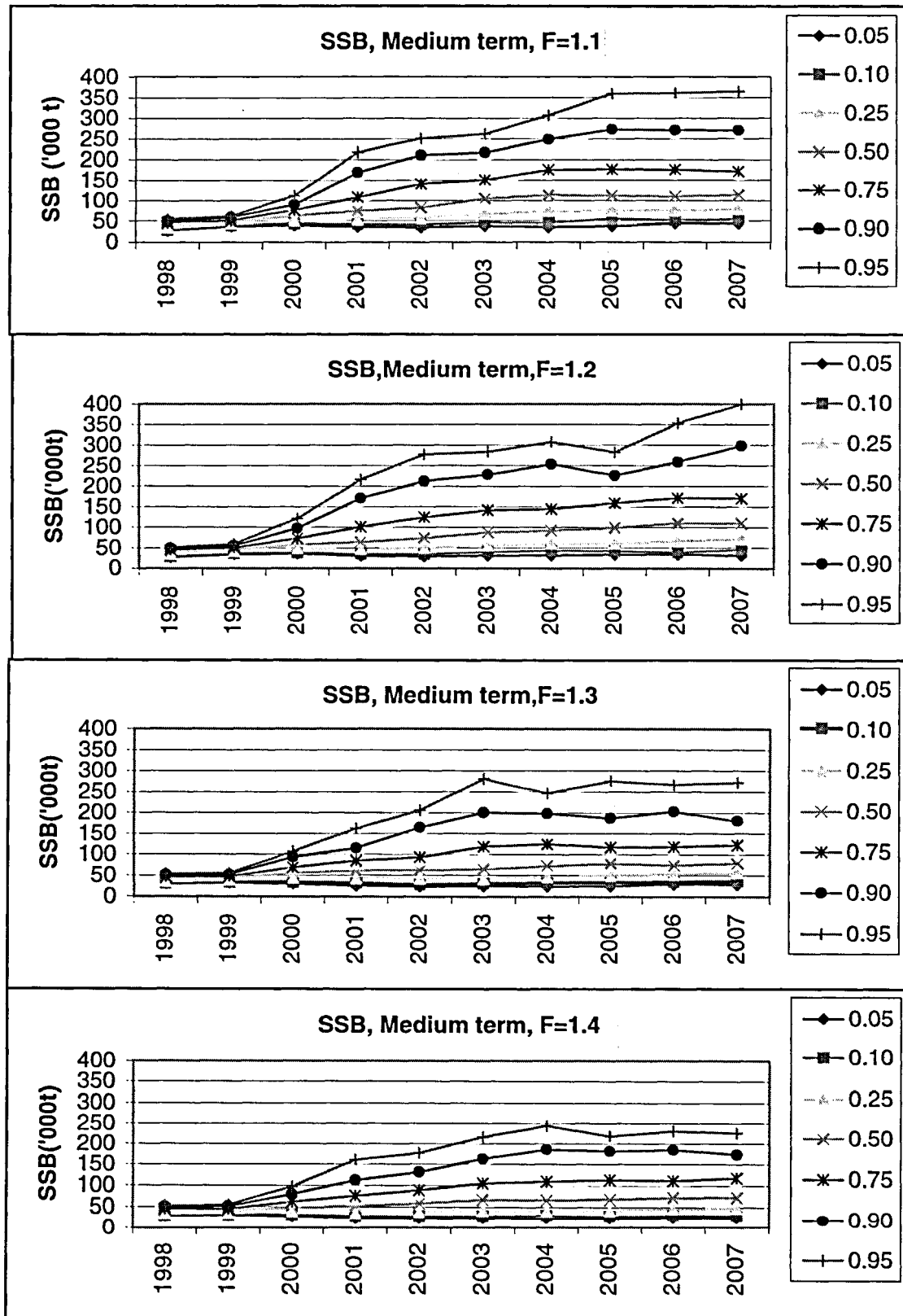
(run: MANSTN02)

D

Figure 3.12.1

Figure 3.13.1

Medium term projections for Western Baltic cod.

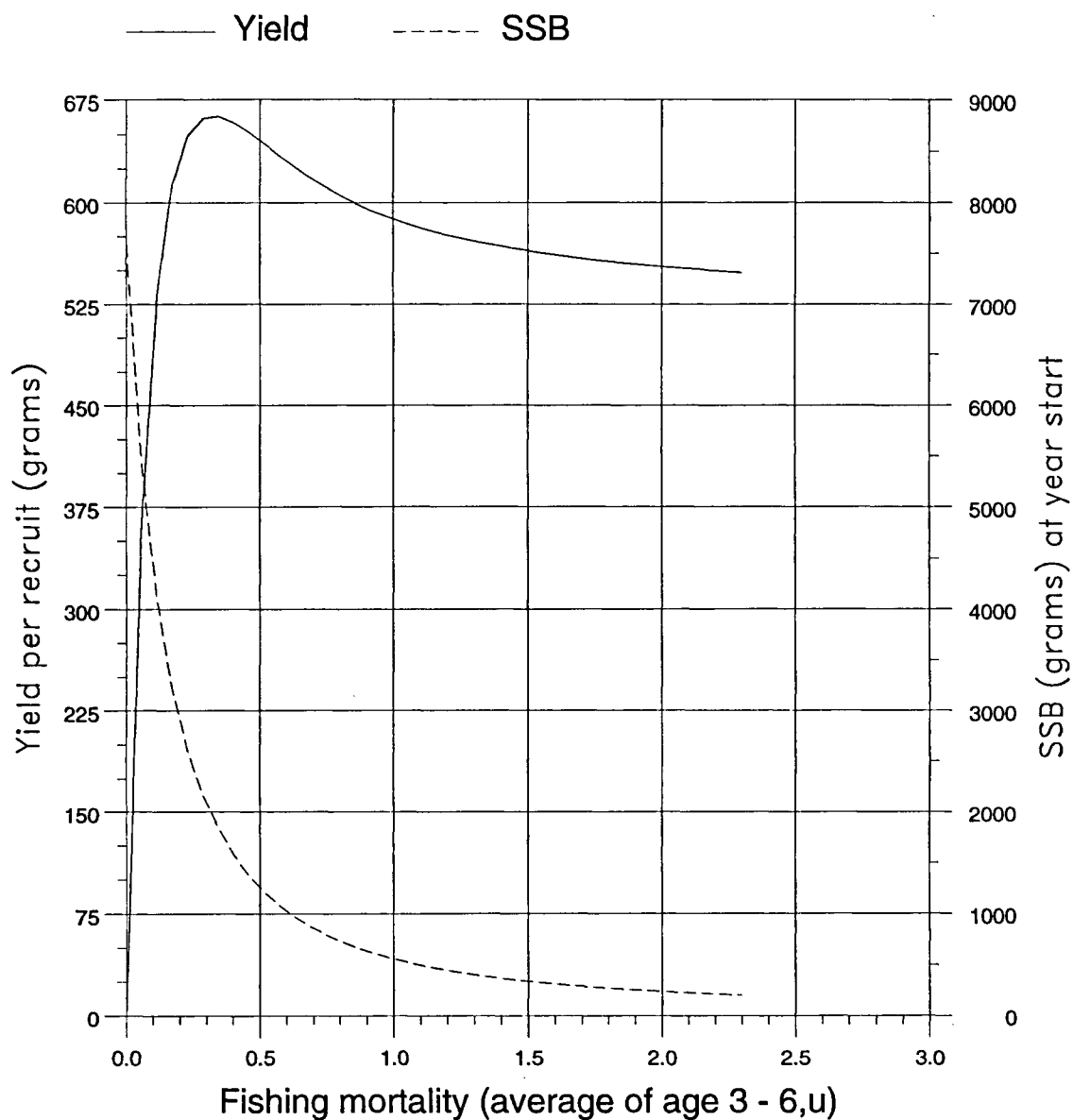


Fish Stock Summary

Cod in Baltic Fishing Areas 22-24

21-4-1998

Long term yield and spawning stock biomass



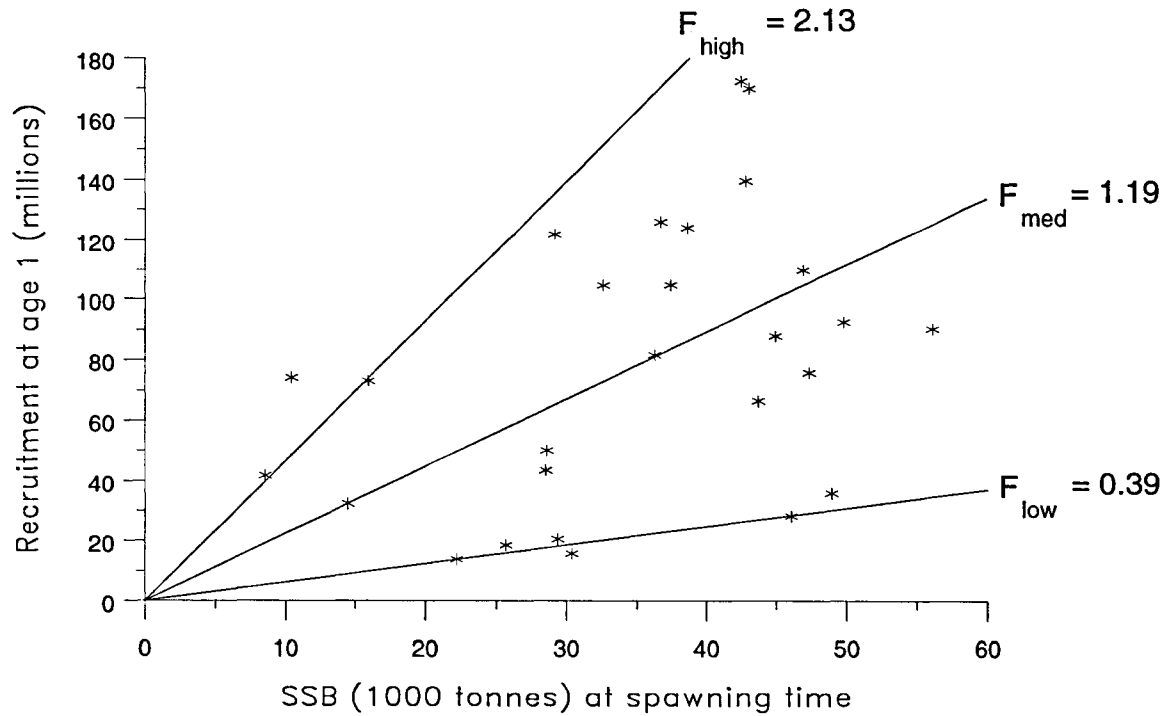
(run: YLDSTN01)

C

Figure 3.14.1

Cod in Baltic Fishing Areas 22-24
23-4-1998

Stock - Recruitment



(run: XSASTN07)

Figure 3.14.2

Available information indicate significant interactions between the cod stocks in Kattegat and in the Western Baltic. Spawning occurs more or less continuous from the Southern Kattegat, through the Danish Belts (Sub-division 23 and Sub-division 22), in the North German Bays (Sub-division 22) and in the Arkona Deep (Sub-division 24). Eggs and larvae may easily be carried by currents from Kattegat to Sub-divisions 22-24 or vice versa. Tagging studies have shown extensive migrations within the same areas (Aro, 1989).

The Cod stocks in Kattegat do however also interact with the cod in Skagerrak as indicated by a larval flow down into Kattegat and migration of mature cod from Northern Kattegat into Skagerrak. Similar interactions take place between the Western Baltic cod and the Central Baltic cod (the cod in Sub-divisions 25-32).

Selecting appropriate geographical borders for defining biologically based stock units are therefore difficult for the transition area between the North Sea and the Baltic Sea proper. An optimal area definition will require a thorough evaluation of available material on spawning, migration patterns and genetics of the cod population in the area. The work load on the present assessment working groups does not allow such work to be carried out during meetings.

The Working Group acknowledge that a fusion of the existing management units of Kattegat and The Western Baltic cod may facilitate annual assessments by reducing the number of stocks that are assessed. There are, however, marked hydrographical and biological differences between Kattegat and the Western Baltic. These differences are reflected in the fisheries which are found much more diverse in Kattegat than in the Western Baltic.

4.1 Input parameters to the assessment

The development in the fisheries and in the yields and the compiling of the various annual input parameters are described for Kattegat (Sub-division 21) and the Western Baltic (Sub-divisions 22-24) in Sections 2 and 3, respectively.

For the combined assessment the mean weight in the catch and in the stock and the maturity ogives were derived by weighting the values from Sub-division 21 and Sub-divisions 22-24 by the annual landing weights taken in the two areas. The input parameters used for the assessment are presented in Tables 4.1-4.4.

4.2 Catch at age analysis

Tuning fleet information

There are no surveys that provides a coverage of the combined area. Scrutinising the tuning results from Kattegat and Sub-divisions 22-24 moreover showed that the survey catchabilities coefficients were all determined with large standard errors. The surveys having the lowest standard errors in the two assessments were selected for the attempts to carry out a combined assessment. These were the German Sonderborg trawl survey (Sub-division 22) and the IBTS 1st quarter survey in Kattegat.

Commercial tuning fleets were compiled from the Danish log-book data base. This database provides information on the effort (days at sea) and the catch composition given in market categories. The age composition is derived by merging this information with information on the age composition within each market category (a market category-age key). The merging of the catch and the age information were done by quarter and separately for Kattegat and the Western Baltic.

Two tuning fleets were worked up for the analysis, a gill-net fleet using mesh-sizes between 120 and 159 mm and a trawl fleet consisting of trawlers using mesh sizes above 105 mm. These fleets are both targeting cod and are found important in the Danish fisheries in both Kattegat and in the Western Baltic. For both fleet the effort were standardised by the ANOVA $\ln(\text{CPUE}) = \text{Year} * \text{month} + \text{vessel size}$ thereby enabling effort to be standardised to common vessel size units.

Extended Survivor analysis

Initial XSA runs were carried out including the two survey fleets and the two commercial fleet. These runs showed that the Sonderborg survey provided little information relevant to the tuning (large SE on the catchabilities) and that the gill net fleet were characterised by having large negative residuals for the most recent years. These fleets were therefore omitted in the XSA tunings.

The final run included the trawl fleet and the IBTS Kattegat Survey (Table 4.5) The run settings and the tuning diagnostics appears in Table 4.6. Evaluating the residuals (Figure 4.1) show pronounced negative residuals in 1993 to 1994, i.e., in the period when the catches are assumed being under reported. The residuals of age group 1 cod in the commercial fleet. are found very high. Age group 1 is taken in low quantities and only during the second half of the year.

The retrospective runs show good agreements between VPA runs initiated in 1997–1995 whereas the 1994 run differs (Figure 4.2).

The VPA results are presented in Tables 4.7-4.9. The fishing mortalities have remained at level of about 1.1 for the most recent years. The VPA indicate that the 1994 and the 1996 year classes are both very strong whereas the 1995 year class is the lowest on record.

4.3 Recruitment estimates

The 1997 year class is estimated as very strong in both Kattegat and in the Western Baltic (see Sections 2 and 3).

4.4 Historical stock trends

Until the mid 1980's the spawning stock remained at a level of about 70,000 t (Figure 4.3, Table 4.9). This was followed by a substantial decline reaching a low of 18,000 t in 1992. Since the SSB have increased to present levels of ca. 60,000 t. Recruitment have fluctuated considerable while at the same time following a declining trend until the late 1980's. Since then the recruitment have improved yielding large year classes in 1994, 1996 and in 1997. The fishing mortality have remained relatively stable since 1973 at a level around 1 per year.

4.5 Short time Forecast and management options

The input to the forecast is presented in Table 4.10. The maturity was taken as the average of 1995–1997. The exploitation pattern was taken as the average over 1995–1997 scaled to the level of 1997. For ages 2 and above the stock numbers were taken from the VPA. The numbers at age 1 were taken as the sum of the values used in the Kattegat and in the Western Baltic these totalling about 130 million fish. The age 1 abundance in 1999 and 2000 were assumed as the long time geometric average.

The forecast shows that when maintaining a *status quo* fishing level the catches will amount to 64,000 tons in 1998 and 88,000 tons in 1999 (Table 4.11). These estimates implies an substantial increase in the expected catch as compared to the 1997 catch at 52,000 t. This increase is caused by the large year-classes recruiting in the most recent years, i.e., of the total projected yield in 1998, 50 % derives from the year classes 1996 and 1997 which are poorly estimated in the assessment. For the yield projections in 1999, 84 % of the catch are attributed to the year classes 1996–1998.

4.6 Long time projections (yield per recruit)

The input for the yield per recruit analysis is given in Table 4.12. and the result are shown in Table 4.13 and in Figure 4.4. F max is estimated at 0.29 per year equivalent to a maximal yield per recruit of 0.83 kg.

4.7 Medium term projections

Medium term projections were carried out by the spread-sheet programme also used in Kattegat and the Western Baltic (see Section 2). The values for average weights and maturity were derived from the available data from 1991–1997. The input to the analysis are given in Table 4.14 and the Ricker stock recruitment used are shown in Figure 4.5.

The medium term analysis carried out at the present F indicate that the SSB may be maintained at the present exploitation level (Table 4.15 and Figure 4.6). As for the predicted median recruitment it may be observed that this is maintained at a high level (i.e., at annual levels at about 100 mill. individuals).

4.8 Reference points

The F reference points derived from the stock recruitment data are shown in Figure 4.7.

SSB reference points was calculated as suggested by the SGMBFS. B_{lim} is taken as B_{loss} equivalent to 17,000 t and B_{pa} as $B_{loss} * \exp(1.65 * 0.2) = 24,000$ t.

Applying the procedure of the SGMBFS group to compute the F_{pa} , i.e., to derive the precautionary level of the fishing mortality from the medium term projections, will lead to a F_{pa} value above the present F .

4.9 Comments to the assessment

The cod in Sub-divisions 21-24 have been exploited by a high fishing mortality of about 1 per year throughout the period covered by the catch statistics. In spite of the high exploitation level the stock has been able to produce three good year classes in the most recent years, viz. the 1994, the 1996 and the 1997 year classes. The estimates of the size of the two latter year classes is still uncertain as they have not by 1997 appeared in quantities in the commercial fisheries. The estimated importance of the 1996 year class is not reflected in the fisheries in 1998 where the fishing effort have been below average with many vessels being engaged in fisheries targeting other species or having moved to other areas.

Table 4.1 Cod in sd 21 -24
Mean weight (kilograms) in the catch by year and age.

Year	Age						
	1	2	3	4	5	6	7+
1971	0.392	0.641	0.988	1.638	2.434	3.41	6.499
1972	0.396	0.645	0.989	1.638	2.435	3.412	6.383
1973	0.394	0.643	0.988	1.638	2.435	3.411	6.279
1974	0.419	0.663	0.995	1.641	2.442	3.423	6.547
1975	0.394	0.644	0.988	1.638	2.435	3.411	6.054
1976	0.39	0.64	0.987	1.638	2.434	3.409	6.187
1977	0.412	0.658	0.993	1.64	2.44	3.42	6.264
1978	0.39	0.64	1.012	1.642	2.519	3.55	6.434
1979	0.392	0.637	0.991	1.691	2.359	3.367	6.712
1980	0.386	0.642	0.958	1.581	2.424	3.312	5.747
1981	0.358	0.614	0.996	1.583	2.333	3.4	5.949
1982	0.367	0.598	1.227	1.648	2.768	3.455	5.479
1983	0.442	0.638	1.051	1.735	2.634	3.397	5.349
1984	0.426	0.71	1.238	1.727	2.386	2.633	5.735
1985	0.475	0.803	1.171	1.815	2.318	3.352	5.916
1986	0.501	0.677	1.169	1.87	2.183	3.004	5.503
1987	0.397	0.714	1.128	1.92	3.106	4.132	6.242
1988	0.553	0.744	1.076	1.518	3.056	4.681	6.449
1989	0.499	0.766	1.098	1.745	2.674	4.109	5.779
1990	0.6	0.91	1.166	2.076	2.754	3.707	6.596
1991	0.572	0.921	1.38	1.961	3.43	4.409	9.023
1992	0.586	0.869	1.531	2.42	3.336	6.015	7.275
1993	0.512	0.771	1.366	2.423	4.183	4.505	9.321
1994	0.441	0.94	1.265	2.283	4.066	6.548	7.853
1995	0.49	0.795	1.07	1.322	2.64	5.062	8.387
1996	0.522	0.674	1.033	1.393	2.506	3.172	2.93
1997	0.511	0.732	1.007	1.512	1.971	2.967	4.454

Table 4.2 Mean weight (kilograms) in the stock by year and age.

Year	Age						
	1	2	3	4	5	6	7+
1971	0.084	0.405	1.024	1.722	2.461	3.429	6.216
1972	0.083	0.404	1.023	1.721	2.462	3.431	6.129
1973	0.084	0.405	1.024	1.721	2.462	3.43	6.007
1974	0.081	0.401	1.015	1.717	2.466	3.44	6.374
1975	0.083	0.405	1.024	1.721	2.462	3.43	5.731
1976	0.084	0.405	1.025	1.722	2.461	3.428	5.931
1977	0.082	0.402	1.017	1.718	2.465	3.437	6.003
1978	0.084	0.405	1.047	1.726	2.546	3.569	6.129
1979	0.084	0.404	1.029	1.776	2.386	3.386	6.442
1980	0.084	0.407	1.001	1.665	2.451	3.331	5.385
1981	0.083	0.4	1.039	1.67	2.361	3.419	5.754
1982	0.083	0.4	1.06	1.666	2.366	3.288	5.584
1983	0.083	0.397	1.041	1.781	2.631	3.336	5.845
1984	0.086	0.399	1.043	1.728	2.511	3.316	6.175
1985	0.124	0.533	1.081	1.728	2.216	3.238	5.91
1986	0.048	0.523	1.105	1.856	2.177	3.004	5.441
1987	0.076	0.455	0.931	1.692	2.996	4.002	6.26
1988	0.083	0.43	0.937	1.497	2.986	4.501	6.422
1989	0.125	0.525	1.031	1.838	2.884	4.391	5.918
1990	0.158	0.502	0.981	1.869	2.577	3.545	6.178
1991	0.155	0.5	1.056	2.086	2.981	3.294	7.539
1992	0.158	0.484	0.94	1.962	2.781	3.695	5.779
1993	0.161	0.493	0.902	1.868	2.992	4.082	6.633
1994	0.164	0.538	0.956	1.907	2.58	3.812	6.892
1995	0.071	0.321	0.909	1.558	2.394	2.605	4.561
1996	0.073	0.348	0.789	1.497	2.418	2.531	2.293
1997	0.07	0.329	0.812	1.552	2.467	2.652	4.145

Table 4.3 Cod in sd 21-24
Maturity data (combined of both sexes)

Year	Age						
	1	2	3	4	5	6	7+
1971	0.04	0.24	0.61	0.90	0.99	1.00	1.00
1972	0.04	0.25	0.61	0.90	0.99	1.00	1.00
1973	0.04	0.24	0.61	0.90	0.99	1.00	1.00
1974	0.04	0.25	0.62	0.91	0.99	1.00	1.00
1975	0.04	0.24	0.61	0.90	0.99	1.00	1.00
1976	0.04	0.24	0.61	0.90	0.98	1.00	1.00
1977	0.04	0.25	0.62	0.91	0.99	1.00	1.00
1978	0.04	0.24	0.61	0.90	0.98	1.00	1.00
1979	0.04	0.24	0.61	0.90	0.98	1.00	1.00
1980	0.00	0.28	0.81	0.96	0.98	1.00	1.00
1981	0.00	0.28	0.81	0.95	0.98	1.00	1.00
1982	0.00	0.28	0.81	0.95	0.98	1.00	1.00
1983	0.00	0.28	0.81	0.95	0.98	1.00	1.00
1984	0.00	0.27	0.81	0.95	0.98	1.00	1.00
1985	0.00	0.28	0.81	0.96	0.98	1.00	1.00
1986	0.00	0.28	0.81	0.96	0.98	1.00	1.00
1987	0.00	0.28	0.81	0.96	0.98	1.00	1.00
1988	0.00	0.27	0.81	0.95	0.97	1.00	1.00
1989	0.01	0.29	0.81	0.96	0.98	1.00	1.00
1990	0.01	0.21	0.71	0.90	0.96	0.96	0.99
1991	0.01	0.29	0.69	0.88	0.96	0.96	0.99
1992	0.03	0.25	0.77	0.90	0.96	0.96	0.99
1993	0.01	0.24	0.70	0.89	0.95	0.96	0.99
1994	0.01	0.20	0.71	0.89	0.95	0.96	0.99
1995	0.01	0.10	0.71	0.90	0.94	0.93	0.99
1996	0.01	0.12	0.63	0.88	0.94	0.92	0.99
1997	0.01	0.12	0.69	0.89	0.94	0.93	0.99

Table 4.4 Cod in Sd 21-24
Catch in numbers (000)

Year	Age						
	1	2	3	4	5	6	7+
1971	29893	62565	24098	4556	2044	668	276
1972	20970	42442	24669	7094	1839	920	339
1973	3851	54282	18123	8506	3254	922	515
1974	14259	27712	29848	9870	2840	821	221
1975	3173	52840	11331	8225	1447	747	244
1976	4031	38052	36146	4325	2422	576	358
1977	7612	32224	20226	10486	1053	629	348
1978	3544	53814	12229	4347	1644	192	221
1979	897	31930	25959	3435	1619	494	126
1980	4998	10971	25445	8925	1152	630	406
1981	1232	47048	14653	9753	3471	539	358
1982	9831	32228	20539	3800	1501	841	328
1983	12969	36147	19095	5896	975	530	253
1984	3465	40467	14656	5471	1473	402	212
1985	1918	11427	22084	6489	1883	755	210
1986	2849	8126	10797	5439	1601	610	185
1987	2681	33079	7809	2198	886	208	113
1988	848	14752	16346	2596	405	176	95
1989	916	5537	10057	5103	739	175	95
1990	1372	7789	4751	2800	1362	238	90
1991	1376	9053	5555	1971	531	298	60
1992	3266	10125	7342	686	146	75	76
1993	271	19472	7660	2399	172	23	51
1994	834	13681	18058	2555	413	14	31
1995	2245	15542	9470	8150	1728	289	24
1996	402	30520	22821	4406	2518	368	74
1997	3681	4281	33469	6099	1253	759	182

Table 4.5 Tuning input data

Cod in the Baltic Fishing area 21-24 (run name: XSAMAH08)

IBTS:	IBTS	SD21	(Catch:	Unknown)	(Effort:	Unknown)		
	1983	1997						
	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	9.3	2.64	2.1	0.01
		1	292.7	2	25.56	17.54	14.18	2.05
		1	52.5	264.2	48	16.5	3.2	2.3
		1	175.8	54.2	109	6.2	1.5	0.9
T98:	T98:T105_	(Catch:	Thousands)	(Effort:	Unknown)			
	1987	1997						
	1	1	0	1				
	1	7						
		3896.2	4394.5	149428.4	116296.0	34029.8	13713.0	3872.6
		3859.0	1835.9	60024.7	156973.5	35676.2	7437.9	3363.7
		10276.2	34499.8	186195.4	224324.0	121649.1	11972.4	2269.6
		46852.1	252976.8	1432384.1	481433.4	349878.4	173112.7	23264.7
		50277.7	260198.7	1746241.7	1263824.1	357329.6	164938.7	84416.2
		46511.0	642032.2	2194904.6	844505.2	78113.9	10694.9	8037.4
		30235.1	57176.9	1898878.1	653821.7	163604.0	6148.1	876.7
		47720.7	48642.1	883079.4	2273903.1	306135.3	32349.1	1902.9
		79017.7	59399.9	2744653.1	3215971.0	2532246.7	226124.1	93280.1
		108457.2	87971.5	13069109.5	6725781.3	849510.3	691357.2	127883.4
		97815.7	580954.2	1332340.4	13954046.0	2027480.3	342220.1	220876.0
								55444.7

Table 4.6 Cod in sd 21-24 Tuning diagnostics

Lowestoft VPA Version 3.1

23-Apr-98 12:23:08

Extended Survivors Analysis

Cod in 21 - 24 (run: XSAMAH08/X08)

CPUE data from file /users/fish/ifad/ifapwork/wgbfas/cod_2124/FLEET.X08

Catch data for 27 years. 1971 to 1997. Ages 1 to 7.

Fleet	First year	Last year	First age	Last age	Alpha	Beta
IBTS: IBTS SD21 (Cat	1983	1997	1	6	0.17	0.25
T98: T98:T105_120 (C	1987	1997	1	6	0	1

Time series weights :

Tapered time weighting applied

Power = 3 over 20 years

Catchability analysis :

Catchability independent of stock size for all ages

Catchability independent of age for ages ≥ 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 15 iterations

Regression weights

0.751 0.82 0.877 0.921 0.954 0.976 0.99 0.997 1 1

Fishing mortalities

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
1	0.046	0.046	0.047	0.04	0.043	0.006	0.012	0.018	0.023	0.021
2	0.607	0.476	0.669	0.49	0.455	0.387	0.498	0.321	0.348	0.358
3	1.041	1.189	1.02	1.77	0.984	0.761	0.766	0.789	1.137	0.815
4	1.059	1.2	1.501	2.282	1.328	1.105	0.626	1.008	1.148	1.174
5	0.835	1.063	1.412	1.648	1.587	1.892	0.553	1.266	1.069	1.374
6	0.896	1.165	1.37	1.768	1.288	1.379	0.822	0.998	1.086	1.217
7										

Estimated population abundance at 1st Jan 1998

0 154000 8990 24100 2470 384

Taper weighted geometric mean of the VPA populations:

54300 38600 20800 5430 1260 305

Standard error of the weighted Log(VPA populations) :

0.7463 0.659 0.647 0.7208 0.9643 1.2373

Log catchability residuals.

Fleet : IBTS: IBTS SD21 (Cat

Age		1983	1984	1985	1986	1987					
	1	-0.27	0.44	-1.44	1	-3.64					
	2	0.81	0.23	1.25	0.64	1.76					
	3	-0.37	-0.01	0.33	-0.19	1.04					
	4	-0.43	-0.01	-0.01	-0.01	0.34					
	5	-0.53	-0.1	-0.77	-0.05	-0.16					
	6	-0.17	0.78	-0.69	-0.78	0.09					
Age		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
	1	1.51	-0.5	1.23	0.19	-0.31	-0.03	-1.24	0.86	1.13	0.05
	2	-0.5	1.03	-0.28	1.67	-0.92	-0.71	-1.38	-3.43	0.85	1.26
	3	0.48	-0.16	0.33	0.32	0.49	-0.4	-1.71	-0.03	0.01	0.19
	4	0.58	0.48	0.03	0.29	0.1	0.89	-1.4	-0.27	0.38	-0.9
	5	0.72	0.24	0.3	0.86	0.06	-0.2	-0.14	1.01	-0.98	-0.85
	6	0.32	0.65	-0.87	0.54	-0.32	-0.76	-1.77	0.68	0.62	-0.95

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	-7.0028	-6.813	-6.386	-6.169	-5.941	-5.941
S.E(Log q)	1.2784	1.5056	0.6507	0.6429	0.6395	0.8486

Regression statistics :

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

Age	Slope	t-value	Intercept	RSquar	No Pts	Reg s.e	Mean Q
1	1.27	-0.387	5.97	0.18	15	1.69	-7
2	2.17	-0.753	2.45	0.04	15	3.34	-6.81
3	1.51	-1.111	4.59	0.33	15	0.97	-6.39
4	1.42	-1.086	5.17	0.41	15	0.9	-6.17
5	1.19	-0.757	5.72	0.63	15	0.77	-5.94
6	0.77	1.555	6.04	0.83	15	0.59	-6.15
1							

Fleet : T98: T98:T105_120 (C

Age		1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
	1	-0.55	-0.61	1.26	1.35	1.14	1.34	-0.08	-1.18	-2.1	-0.04	-0.33
	2	-0.37	-0.65	0.24	0.76	0.43	0.55	0.02	-0.6	-0.53	0.12	-0.07
	3	0.21	-0.14	-0.14	-0.3	0.98	-0.2	-0.32	-0.38	0.13	0.04	0.16
	4	0.4	0.12	-0.18	0.18	0.89	-0.03	-0.29	-0.74	0.17	-0.49	0.18
	5	0.54	0.33	-0.53	0.29	1.26	-0.14	-0.26	-1.14	-0.31	-0.05	0.29
	6	0.6	0.44	-0.67	0	1.24	0.03	-0.5	-0.2	0.36	0.2	0.23

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	-9.948	-6.716	-5.836	-5.724	-5.877	-5.877
S.E(Log q)	1.1658	0.4818	0.3883	0.4526	0.6341	0.5461

Regression statistics :

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

Age	Slope	t-value	Intercept	RSquar	No Pts	Reg s.e	Mean Q
1	2.8	-1.359	8.31	0.07	11	3.12	-9.95
2	1.39	-1.199	5.25	0.55	11	0.65	-6.72
3	1.16	-0.724	5.17	0.71	11	0.46	-5.84
4	1.17	-0.697	5.25	0.68	11	0.55	-5.72
5	0.99	0.035	5.89	0.71	11	0.67	-5.88
6	0.82	1.668	5.68	0.92	11	0.39	-5.73

Table 4.7 Cod in sd 21- 24. Fishing mortalities.

Run title : Cod in 21 - 24 (run: XSAMAH08/X08)

At 23-Apr-98 12:25:25

Terminal Fs derived using XSA (With F shrinkage)

Table 8 Fishing mortality (F) at age											
YEAR	1971	1972	1973	1974	1975	1976	1977				
AGE											
1	0.2563	0.1458	0.0604	0.0947	0.0342	0.0572	0.056				
2	0.8042	0.7066	0.6861	0.7925	0.597	0.714	0.8548				
3	0.9325	0.9032	0.7671	1.0851	0.9258	1.1468	1.129				
4	0.7059	0.8075	0.9624	1.4581	1.0775	1.2393	1.432				
5	0.6994	0.7045	1.1906	1.0784	0.8929	1.1934	1.3074				
6	0.7871	0.8133	0.9843	1.2221	0.9762	1.2078	1.3058				
+gp	0.7871	0.8133	0.9843	1.2221	0.9762	1.2078	1.3058				
0 FBAR 3-	0.7792	0.8051	0.9734	1.2072	0.9654	1.1932	1.2894				
YEAR	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	
AGE											
1	0.0347	0.0192	0.0465	0.0145	0.1129	0.1279	0.0927	0.0644	0.0358	0.0655	
2	0.6883	0.4915	0.342	0.7927	0.6311	0.7695	0.7338	0.4965	0.4222	0.7285	
3	0.9839	0.8758	0.9621	1.0943	1.0351	1.0124	0.8529	1.2798	1.3552	0.9588	
4	0.7969	0.8547	0.8873	1.4151	0.9927	1.012	0.9498	1.3025	1.5184	1.2569	
5	0.9424	0.8082	0.8057	1.1352	0.8816	0.7599	0.7644	1.0978	1.6458	1.2353	
6	0.9176	0.8551	0.8946	1.2299	0.9807	0.9421	0.8513	1.2676	1.5624	1.0909	
+gp	0.9176	0.8551	0.8946	1.2299	0.9807	0.9421	0.8513	1.2676	1.5624	1.0909	
0 FBAR 3-	0.9077	0.8462	0.8851	1.2149	0.9698	0.9281	0.8557	1.2267	1.5064	1.1503	
1											
YEAR	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	FBAR 95-97
AGE											
1	0.0464	0.0459	0.0469	0.0399	0.0431	0.0063	0.012	0.0175	0.0229	0.0214	0.0206
2	0.6073	0.4762	0.6691	0.49	0.4554	0.387	0.498	0.3211	0.3479	0.3582	0.3424
3	1.0412	1.1895	1.0196	1.7703	0.9844	0.7615	0.7664	0.789	1.1367	0.8149	0.9135
4	1.0589	1.2	1.5011	2.2816	1.328	1.1055	0.6255	1.0079	1.1476	1.1738	1.1098
5	0.8345	1.0634	1.4118	1.6483	1.5869	1.8925	0.5532	1.266	1.0688	1.3745	1.2364
6	0.8961	1.1649	1.3701	1.7681	1.2883	1.3791	0.8216	0.9981	1.0859	1.2169	1.1003
+gp	0.8961	1.1649	1.3701	1.7681	1.2883	1.3791	0.8216	0.9981	1.0859	1.2169	
0 FBAR 3-	0.9782	1.1509	1.3108	1.9001	1.2997	1.2531	0.6484	1.021	1.1177	1.1211	
1											

Table 4.8 Cod in sd 21-24. Stock numbers

Run title : Cod in 21 - 24 (run: XSAMAH08/X08)

At 23-Apr-98 12:25:25

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	1976	1977						
AGE														
	1	146110	170772	72605	174422	104156	80154	154406						
	2	125136	92577	120842	55959	129902	82404	61977						
	3	43917	45841	37392	49820	20741	58543	33036						
	4	9945	14151	15210	14216	13782	6728	15225						
	5	4490	4020	5167	4757	2708	3841	1595						
	6	1355	1827	1627	1286	1325	908	954						
	+gp	552	663	893	339	425	552	516						
0	TOTAL	331504	329850	253736	300799	273039	233132	267709						
YEAR		1978	1979	1980	1981	1982	1983	1984	1985	1986	1987			
AGE														
	1	114911	52117	121548	94314	101768	119393	43242	33967	89456	46713			
	2	119529	90874	41858	94993	76103	74425	86016	32268	26075	70663			
	3	21585	49169	45510	24343	35203	33147	28227	33808	16079	13995			
	4	8746	6607	16768	14237	6672	10237	9861	9849	7697	3395			
	5	2977	3228	2301	5653	2831	2024	3046	3123	2192	1381			
	6	353	950	1178	842	1487	960	775	1161	853	346			
	+gp	400	239	747	547	570	450	402	316	252	184			
0	TOTAL	268502	203183	229909	234929	224634	240637	171570	114493	142605	136677			
1														
YEAR		1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	GMST 71-95	AMST 71-95
AGE														
	1	20665	22565	33063	38882	85511	47378	77305	142690	19637	192300	0	74112	87525
	2	35819	16152	17645	25828	30588	67056	38545	62538	114794	15714	154111	57165	67031
	3	27923	15978	8214	7399	12955	15882	37282	19179	37138	66369	8992	25698	29407
	4	4393	8071	3982	2426	1032	3963	6072	14184	7134	9757	24055	7651	9098
	5	791	1247	1990	727	203	224	1074	2660	4238	1854	2470	1986	2570
	6	329	281	353	397	114	34	28	506	614	1192	384	561	809
	+gp	175	149	130	78	113	74	60	41	121	280	357		
0	TOTAL	90094	64443	65378	75737	130517	134611	160366	241798	183676	287466	190368		
1														

Table 4.9 Cod in sd 21-24. Stock summary

Run title : Cod in 21 - 24 (run: XSAMAH08/X08)

At 23-Apr-98 12:25:25

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS	TOTALBIO	TOTSPBIO	LANDINGS	YIELD/SSB	FBAR 3-5
Age 1						
1971	146110	144175	74642	62355	0.8354	0.7792
1972	170772	143053	80540	66342	0.8237	0.8051
1973	72605	143171	82693	73194	0.8851	0.9734
1974	174422	129859	78216	68451	0.8752	1.2072
1975	104156	119859	61157	59852	0.9787	0.9654
1976	80154	127542	71007	65708	0.9254	1.1932
1977	154406	107636	61650	66424	1.0774	1.2894
1978	114911	107050	50720	54002	1.0647	0.9077
1979	52117	115874	62765	59876	0.954	0.8462
1980	121548	114304	81873	55481	0.6776	0.8851
1981	94314	114266	72865	68983	0.9467	1.2149
1982	101768	102090	63957	59989	0.938	0.9698
1983	119393	103356	64645	61433	0.9503	0.9281
1984	43242	97224	62127	61381	0.988	0.8557
1985	33967	87524	63097	52865	0.8378	1.2267
1986	89456	58690	40503	35788	0.8836	1.5064
1987	46713	61152	31816	40057	1.259	1.1503
1988	20665	54818	36615	34686	0.9473	0.9782
1989	22565	48324	35624	27106	0.7609	1.1509
1990	33063	36766	21264	23716	1.1153	1.3108
1991	38882	35875	17631	23527	1.3344	1.9001
1992	85511	44160	16758	24267	1.4481	1.2997
1993	47378	63712	26004	28241	1.086	1.2531
1994	77305	83928	43088	38497	0.8935	0.6484
1995	142690	77611	41634	42060	1.0102	1.021
1996	19637	93443	44052	56975	1.2934	1.1177
1997	192300	96559	59669	52303	0.8766	1.1211
Arith. Mean 0 Units	88891 (Thousand	93038 (Tonnes)	53578 (Tonnes)	50502 (Tonnes)	0.9876	1.0928

1

Table 4.10

The SAS System

13:47 Wednesday, April 29, 1998

Cod in Baltic Fishing Areas 21 - 24

Prediction with management option table: Input data

Year: 1998								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	131486.00	0.2000	0.0080	0.0000	0.0000	0.071	0.0210	0.508
2	154111.00	0.2000	0.1140	0.0000	0.0000	0.333	0.3530	0.734
3	8992.000	0.2000	0.6740	0.0000	0.0000	0.837	0.9420	1.037
4	24055.000	0.2000	0.8890	0.0000	0.0000	1.536	1.1450	1.409
5	2470.000	0.2000	0.9420	0.0000	0.0000	2.427	1.2760	2.372
6	384.000	0.2000	0.9240	0.0000	0.0000	2.596	1.1350	3.734
7+	357.000	0.2000	0.9920	0.0000	0.0000	3.666	1.1350	5.257
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1999								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	131486.00	0.2000	0.0080	0.0000	0.0000	0.071	0.0210	0.508
2	.	0.2000	0.1140	0.0000	0.0000	0.333	0.3530	0.734
3	.	0.2000	0.6740	0.0000	0.0000	0.837	0.9420	1.037
4	.	0.2000	0.8890	0.0000	0.0000	1.536	1.1450	1.409
5	.	0.2000	0.9420	0.0000	0.0000	2.427	1.2760	2.372
6	.	0.2000	0.9240	0.0000	0.0000	2.596	1.1350	3.734
7+	.	0.2000	0.9920	0.0000	0.0000	3.666	1.1350	5.257
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 2000								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	131486.00	0.2000	0.0080	0.0000	0.0000	0.071	0.0210	0.508
2	.	0.2000	0.1140	0.0000	0.0000	0.333	0.3530	0.734
3	.	0.2000	0.6740	0.0000	0.0000	0.837	0.9420	1.037
4	.	0.2000	0.8890	0.0000	0.0000	1.536	1.1450	1.409
5	.	0.2000	0.9420	0.0000	0.0000	2.427	1.2760	2.372
6	.	0.2000	0.9240	0.0000	0.0000	2.596	1.1350	3.734
7+	.	0.2000	0.9920	0.0000	0.0000	3.666	1.1350	5.257
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANMAH01
Date and time: 23APR98:19:50

Table 4.11

The SAS System

13:47 Wednesday, April 29, 1998

Cod in Baltic Fishing Areas 21 - 24

Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	1.1210	113370	51693	64469	0.6000	0.6726	140379	74372	61043	176683	109359
.	.	.	.	.	0.8000	0.8968	.	74372	75690	159461	94916
.	.	.	.	.	1.0000	1.1210	.	74372	88261	144859	82766
.	.	.	.	.	1.2000	1.3452	.	74372	99101	132436	72514
.	.	.	.	.	1.4000	1.5694	.	74372	108492	121824	63836
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANMAH01
Date and time : 23APR98:19:50
Computation of ref. F: Simple mean, age 3 - 5
Basis for 1998 : F factors

Table 4.12

The SAS System

13:47 Wednesday, April 29, 1998

Cod in Baltic Fishing Areas 21 - 24

Yield per recruit: Input data

Age	Recruit- ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
1	1.000	0.2000	0.0084	0.0000	0.0000	0.071	0.0210	0.508
2	.	0.2000	0.1142	0.0000	0.0000	0.333	0.3530	0.734
3	.	0.2000	0.6741	0.0000	0.0000	0.837	0.9420	1.037
4	.	0.2000	0.8888	0.0000	0.0000	1.536	1.1450	1.409
5	.	0.2000	0.9413	0.0000	0.0000	2.427	1.2670	2.372
6	.	0.2000	0.9245	0.0000	0.0000	2.596	1.1350	3.734
7+	.	0.2000	0.9916	0.0000	0.0000	3.666	1.1350	5.257
Unit	Numbers	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDMAH01

Date and time: 23APR98:14:56

Table 4.13

The SAS System

13:47 Wednesday, April 29, 1998

Cod in Baltic Fishing Areas 21 - 24

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	0.000	0.000	5.517	9884.410	3.452	9108.867	3.452	9108.867
0.0500	0.0559	0.157	458.997	4.735	7263.543	2.692	6536.322	2.692	6536.322
0.1000	0.1118	0.257	675.796	4.237	5655.408	2.212	4965.006	2.212	4965.006
0.1500	0.1677	0.327	777.911	3.891	4585.047	1.881	3924.374	1.881	3924.374
0.2000	0.2236	0.379	821.687	3.636	3831.436	1.641	3195.613	1.641	3195.613
0.2500	0.2795	0.418	834.751	3.440	3278.300	1.457	2663.731	1.457	2663.731
0.3000	0.3354	0.450	831.575	3.285	2858.961	1.313	2262.866	1.313	2262.866
0.3500	0.3913	0.476	820.060	3.159	2532.645	1.197	1952.805	1.197	1952.805
0.4000	0.4472	0.497	804.625	3.054	2273.150	1.102	1707.757	1.102	1707.757
0.4500	0.5031	0.516	787.757	2.965	2062.962	1.022	1510.512	1.022	1510.512
0.5000	0.5590	0.531	770.843	2.888	1889.988	0.954	1349.216	0.954	1349.216
0.5500	0.6149	0.545	754.632	2.822	1745.649	0.895	1215.478	0.895	1215.478
0.6000	0.6708	0.557	739.500	2.763	1623.718	0.844	1103.226	0.844	1103.226
0.6500	0.7267	0.568	725.601	2.711	1519.585	0.799	1007.973	0.799	1007.973
0.7000	0.7826	0.578	712.964	2.664	1429.779	0.759	926.351	0.759	926.351
0.7500	0.8385	0.587	701.547	2.622	1351.641	0.723	855.789	0.723	855.789
0.8000	0.8944	0.595	691.272	2.584	1283.111	0.691	794.300	0.691	794.300
0.8500	0.9503	0.602	682.043	2.549	1222.571	0.662	740.327	0.662	740.327
0.9000	1.0062	0.609	673.758	2.517	1168.734	0.635	692.636	0.635	692.636
0.9500	1.0621	0.615	666.320	2.488	1120.570	0.611	650.241	0.611	650.241
1.0000	1.1180	0.621	659.635	2.460	1077.242	0.589	612.345	0.589	612.345
1.0500	1.1739	0.626	653.618	2.435	1038.066	0.569	578.298	0.569	578.298
1.1000	1.2298	0.631	648.191	2.411	1002.478	0.550	547.566	0.550	547.566
1.1500	1.2857	0.636	643.285	2.389	970.011	0.532	519.705	0.532	519.705
1.2000	1.3416	0.641	638.840	2.368	940.272	0.516	494.346	0.516	494.346
1.2500	1.3975	0.645	634.800	2.349	912.931	0.500	471.179	0.500	471.179
1.3000	1.4534	0.649	631.120	2.330	887.708	0.486	449.941	0.486	449.941
1.3500	1.5093	0.653	627.756	2.312	864.365	0.473	430.410	0.473	430.410
1.4000	1.5652	0.656	624.674	2.296	842.697	0.460	412.393	0.460	412.393
1.4500	1.6211	0.660	621.840	2.280	822.528	0.448	395.727	0.448	395.727
1.5000	1.6770	0.663	619.226	2.265	803.705	0.437	380.270	0.437	380.270
1.5500	1.7329	0.666	616.810	2.251	786.094	0.426	365.899	0.426	365.899
1.6000	1.7888	0.669	614.569	2.237	769.580	0.416	352.505	0.416	352.505
1.6500	1.8447	0.672	612.484	2.224	754.060	0.406	339.996	0.406	339.996
1.7000	1.9006	0.675	610.539	2.211	739.445	0.397	328.288	0.397	328.288
1.7500	1.9565	0.677	608.720	2.199	725.656	0.388	317.308	0.388	317.308
1.8000	2.0124	0.680	607.014	2.187	712.620	0.380	306.992	0.380	306.992
1.8500	2.0683	0.682	605.410	2.176	700.277	0.372	297.282	0.372	297.282
1.9000	2.1242	0.685	603.898	2.166	688.569	0.365	288.128	0.365	288.128
1.9500	2.1801	0.687	602.469	2.155	677.447	0.357	279.482	0.357	279.482
2.0000	2.2360	0.689	601.116	2.145	666.865	0.350	271.305	0.350	271.305
-	-	Numbers	Grams	Numbers	Grams	Numbers	Grams	Numbers	Grams

Notes: Run name : YLDMAH01

Date and time : 23APR98:14:56

Computation of ref. F: Simple mean, age 3 - 5

F=0.1 factor : 0.1505

F-max factor : 0.2610

F=0.1 reference F : 0.1683

F-max reference F : 0.2918

Recruitment : Single recruit

Table 4.14 Input values used for the medium term forecast for cod in SD 21-24

Stock input for 1998

Age	Stock No.	Log SE(int)
1	131486	0.44
2	154111	0.44
3	8992	0.33
4	24055	0.26
5	2407	0.3
6	384	0.34
7	359	0.34

Mean weight in the catch

age	1	2	3	4	5	6	7
Mean	0.519	0.815	1.236	1.902	3.162	4.668	7.047
Std.dev.	0.049	0.099	0.203	0.489	0.825	1.337	2.409

Correction factors to derive Stock mean weight from Catch mean weight

Age	1	2	3
Factor	0.234	0.528	0.736

Maturity information

age	1	2	3	4	5	6	7
mean	0.013	0.189	0.700	0.890	0.949	0.946	0.990
std.dev.	0.008	0.075	0.041	0.008	0.009	0.018	0

**Table 4.15 : Medium term SSB's , Recruitment and Yield at st. gou F
Cod in Subdivisions 21-24**

SSB

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	46.95	62.97	65.46	58.49	52.61	47.14	48.34	45.45	43.15	45.15
0.10	50.61	68.41	72.18	65.41	58.68	57.30	56.24	55.56	53.04	52.64
0.25	57.97	79.48	87.35	76.55	76.31	75.08	71.40	73.30	70.83	65.57
0.50	69.91	94.39	106.33	96.24	102.29	107.22	102.91	103.51	102.51	102.43
0.75	82.31	117.66	131.54	136.20	135.32	131.49	143.58	157.49	149.94	155.35
0.90	95.19	143.06	160.46	185.98	199.78	190.27	176.58	214.03	211.19	196.94
0.95	106.53	162.28	190.70	214.86	263.74	248.98	249.81	248.78	259.06	230.36

Recruitment

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	65.48	21.07	25.30	22.96	19.04	28.63	19.97	20.85	22.36	24.56
0.10	74.64	27.46	30.57	31.80	28.73	37.55	32.41	31.09	29.61	28.70
0.25	94.24	46.94	64.96	53.55	46.12	51.42	53.46	46.85	47.72	55.94
0.50	125.47	85.10	112.74	107.03	90.25	102.69	105.59	81.41	95.59	93.19
0.75	180.37	147.20	213.55	201.27	175.64	223.37	176.21	179.79	195.50	188.92
0.90	239.21	294.77	309.52	303.82	329.83	358.76	350.11	380.55	341.95	380.44
0.95	280.86	480.13	424.94	341.21	469.95	501.95	437.84	521.39	466.79	525.77

Yield

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.05	55585	69111	63756	55852	51441	49949	49847	50340	44225	43966
0.10	59244	77166	69338	65892	60880	59576	57588	55348	54140	53571
0.25	68153	91735	87858	81265	79382	77515	81110	75970	75303	67700
0.50	80434	109834	105066	100302	108766	109809	104125	109120	106483	106259
0.75	92242	134643	132365	137866	140109	139889	151948	161071	159405	157243
0.90	110958	167340	173997	192637	198144	199507	205406	218411	200866	212642
0.95	120806	187281	205296	239949	275323	261633	259086	268296	255747	243760

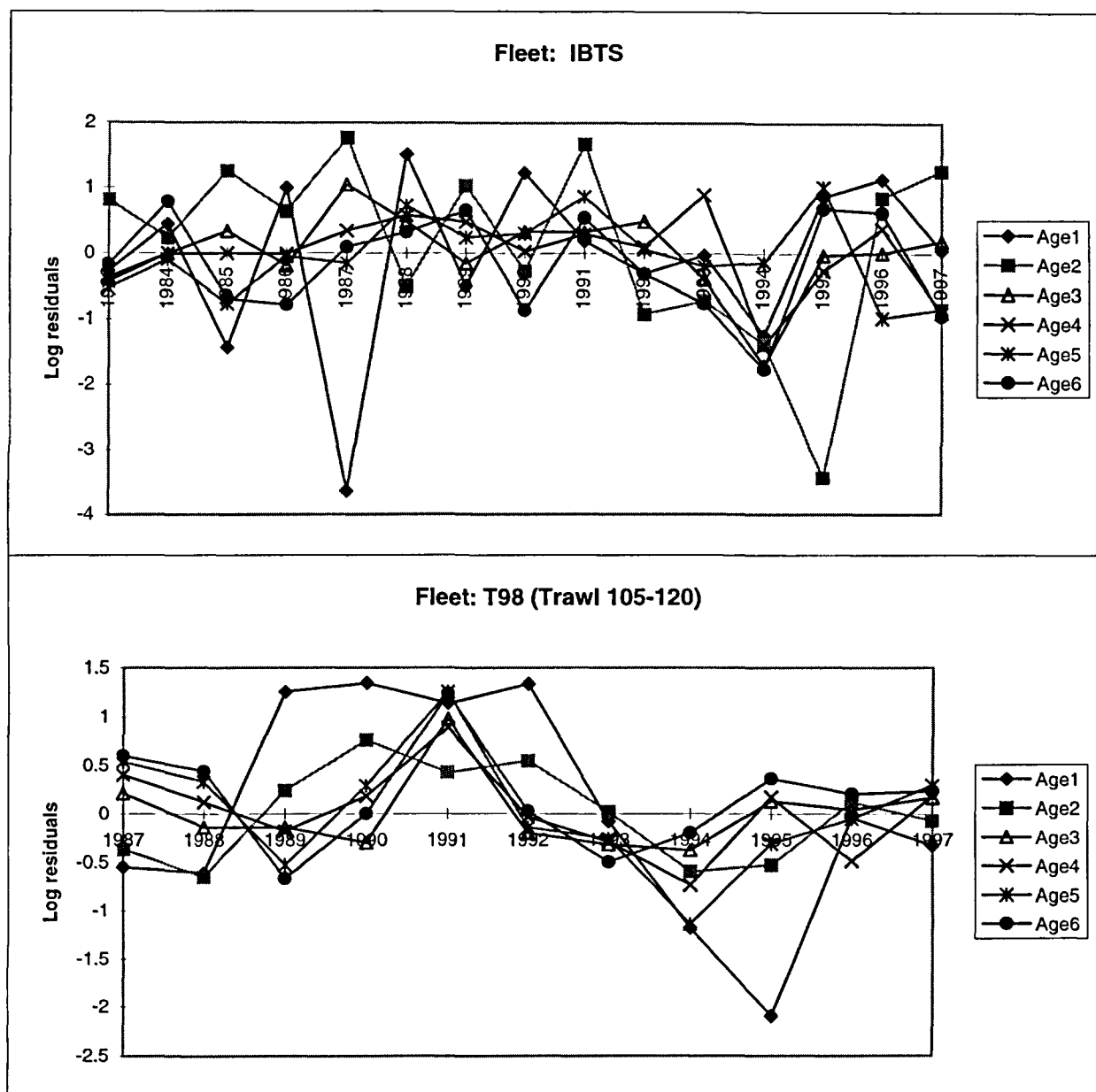


Figure 4.1 Cod in sd 21-24. Residuals from XSA F-estimates for the two fleets.

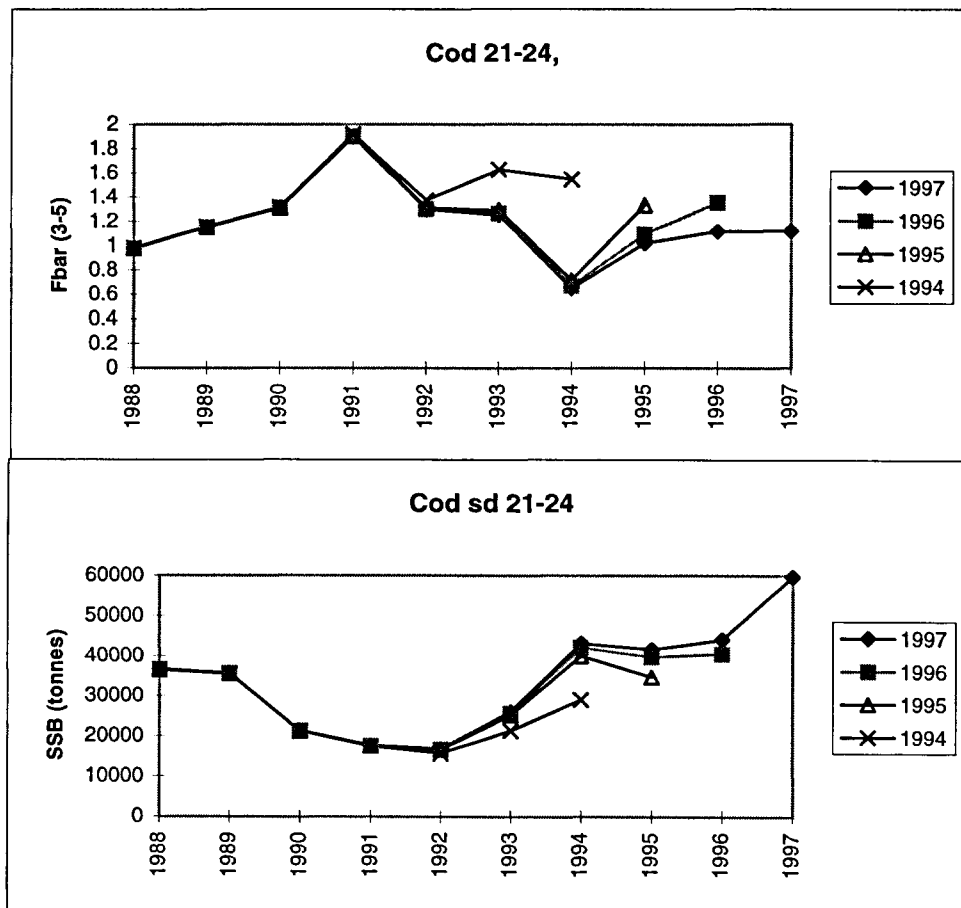
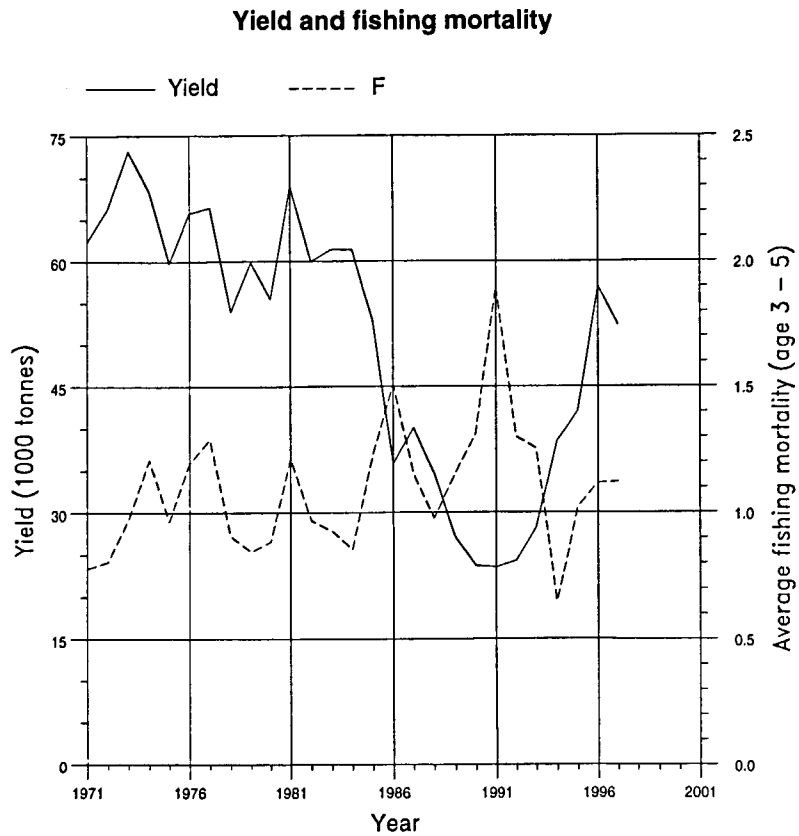


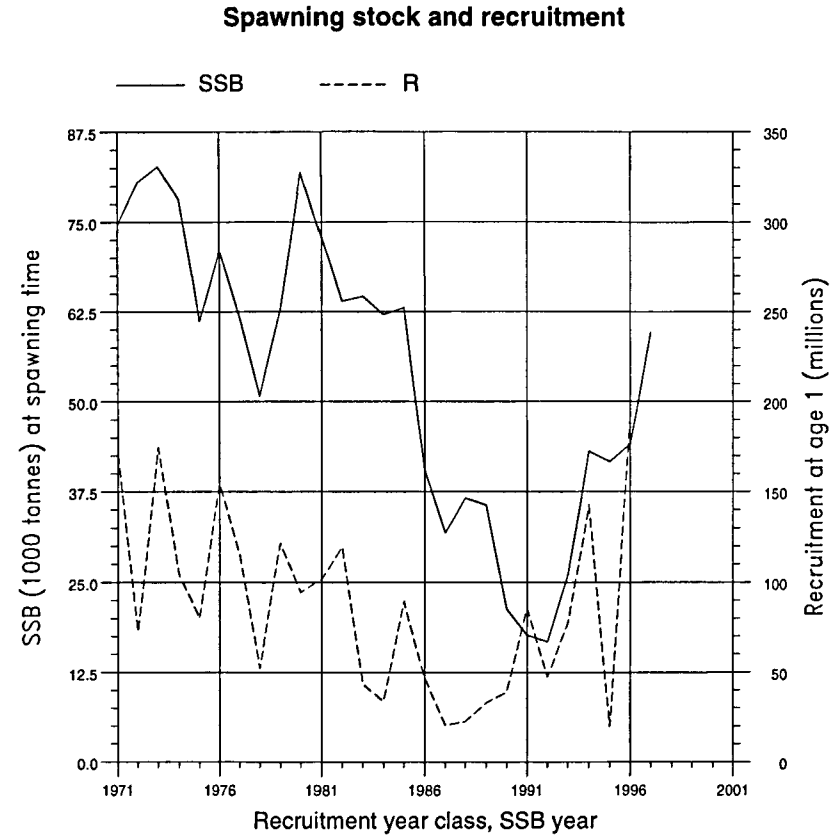
Figure 4.2 Cod in SD 21-24 Retrospective analysis

Fish Stock Summary **Cod in Baltic Fishing Areas 21-24** **23-4-1998**



(run: XSAMAH08)

A



(run: XSAMAH08)

B

Figure 4.3

Fish Stock Summary

Cod in Baltic Fishing Areas 21-24

23-4-1998

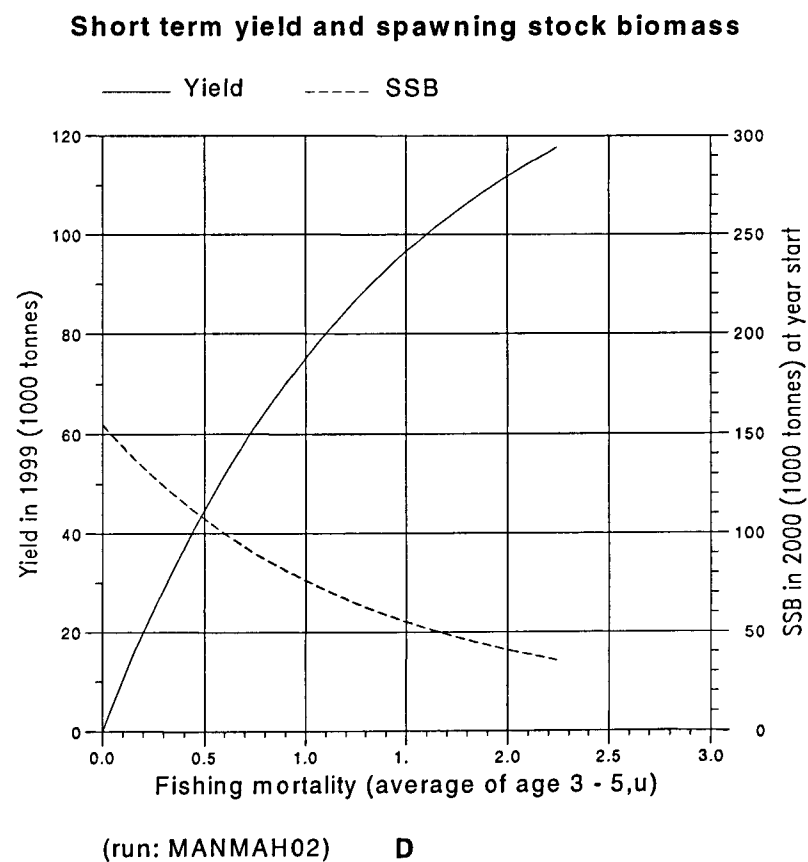
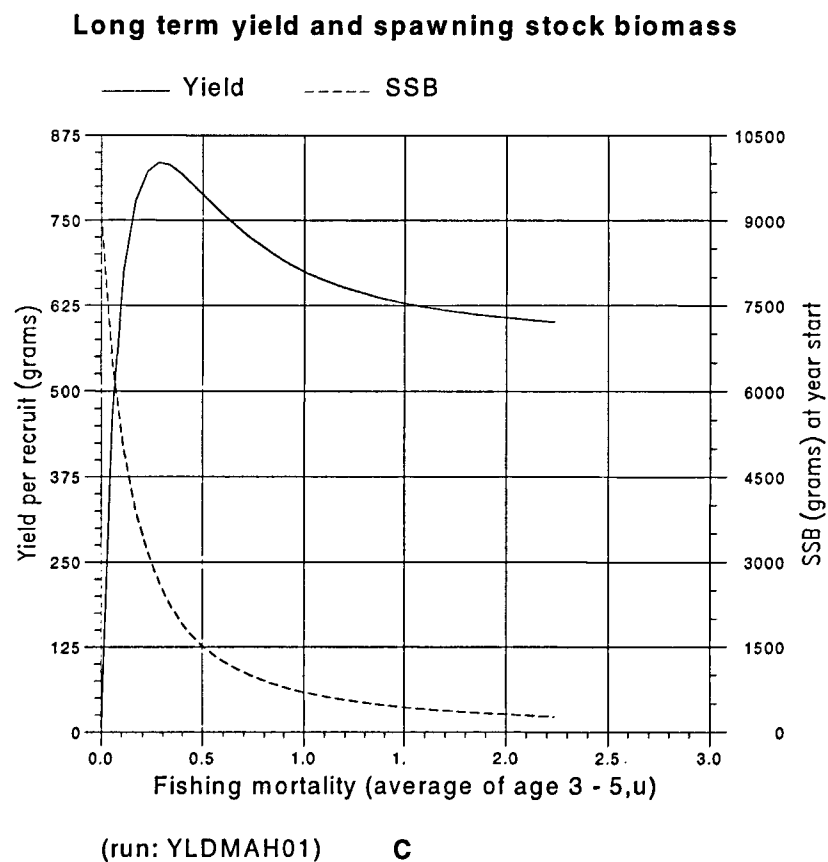


Figure 4.4

Figure 4.5

Western Baltic cod - Estimation of stock recruitment using the Ricker function on the log scale

ar	2	1.08777	Model:	Rec=	a*SSB*exp(-b*SSB)			
br	6.01E-06	7.85E-06						
	SSQ=	10.06764	max recr.	Max R=	(a/b)*exp(-1)=	122422		
	Var=	0.83897						
	sr	0.915953						
Y of Rec.	VPA	log(SSB)	VPA	Model	Model	observed	Residuals	Res**2
	SSB(y-1)		Recruits	Recruits	Log (rec)	Log(rec)	Log Scale	Log Scale
1971	51561	10.8505	146699	75643	11.23378	11.89614	0.662354	0.438713
1972	78156	11.2665	171358	97723	11.48989	12.05151	0.561622	0.315419
1973	84884	11.3490	72864	101929	11.53203	11.19635	-0.33568	0.112682
1974	87370	11.3779	175262	103358	11.54596	12.07404	0.52808	0.278869
1975	81520	11.3086	105259	99889	11.51181	11.56418	0.052367	0.002742
1976	64373	11.0724	80690	87440	11.37871	11.29837	-0.08034	0.006455
1977	73855	11.2099	155397	94763	11.45913	11.95374	0.494604	0.244633
1978	64631	11.0764	115456	87655	11.38116	11.65664	0.275483	0.075891
1979	53937	10.8956	52550	78007	11.26456	10.86952	-0.39504	0.156053
1980	66419	11.1037	122470	89117	11.3977	11.71562	0.317917	0.101071
1981	86417	11.3669	94992	102818	11.54072	11.46155	-0.07917	0.006268
1982	76135	11.2403	102060	96359	11.47584	11.53332	0.05748	0.003304
1983	67492	11.1198	119713	89975	11.40728	11.69285	0.285571	0.081551
1984	67648	11.1221	43299	90098	11.40865	10.67588	-0.73277	0.536949
1985	65000	11.0821	34180	87960	11.38464	10.4394	-0.94524	0.893481
1986	65877	11.0955	90410	88678	11.39277	11.41211	0.019342	0.000374
1987	42318	10.6530	46777	65630	11.09178	10.75315	-0.33864	0.114674
1988	33294	10.4131	20674	54512	10.90618	9.936632	-0.96955	0.940026
1989	38288	10.5529	22568	60835	11.01593	10.02429	-0.99164	0.983347
1990	37012	10.5190	33335	59261	10.9897	10.41436	-0.57534	0.331014
1991	22834	10.0360	39277	39812	10.59192	10.57839	-0.01353	0.000183
1992	19406	9.8733	86009	34539	10.44985	11.36221	0.912353	0.832389
1993	17167	9.7507	47559	30968	10.34072	10.76973	0.429009	0.184049
1994	26533	10.1861	74455	45244	10.71983	11.21795	0.498123	0.248126
1995	44024	10.6925	133336	67579	11.12105	11.80063	0.679576	0.461824
1996	42771	10.6636	16731	66152	11.09971	9.725019	-1.37469	1.889769
1997	44814	10.7103	170062	68466	11.13409	12.04392	0.909829	0.827789

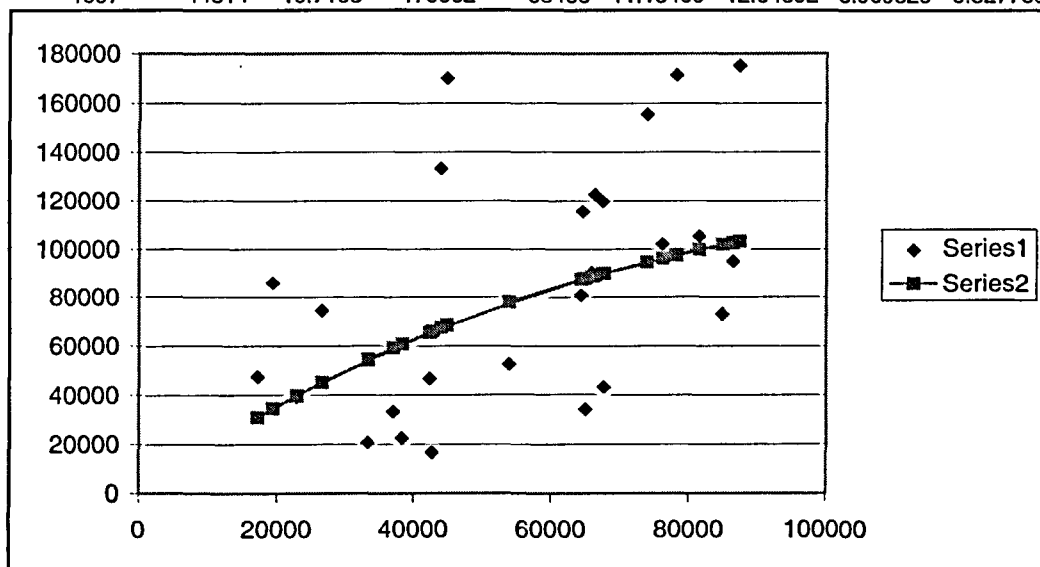
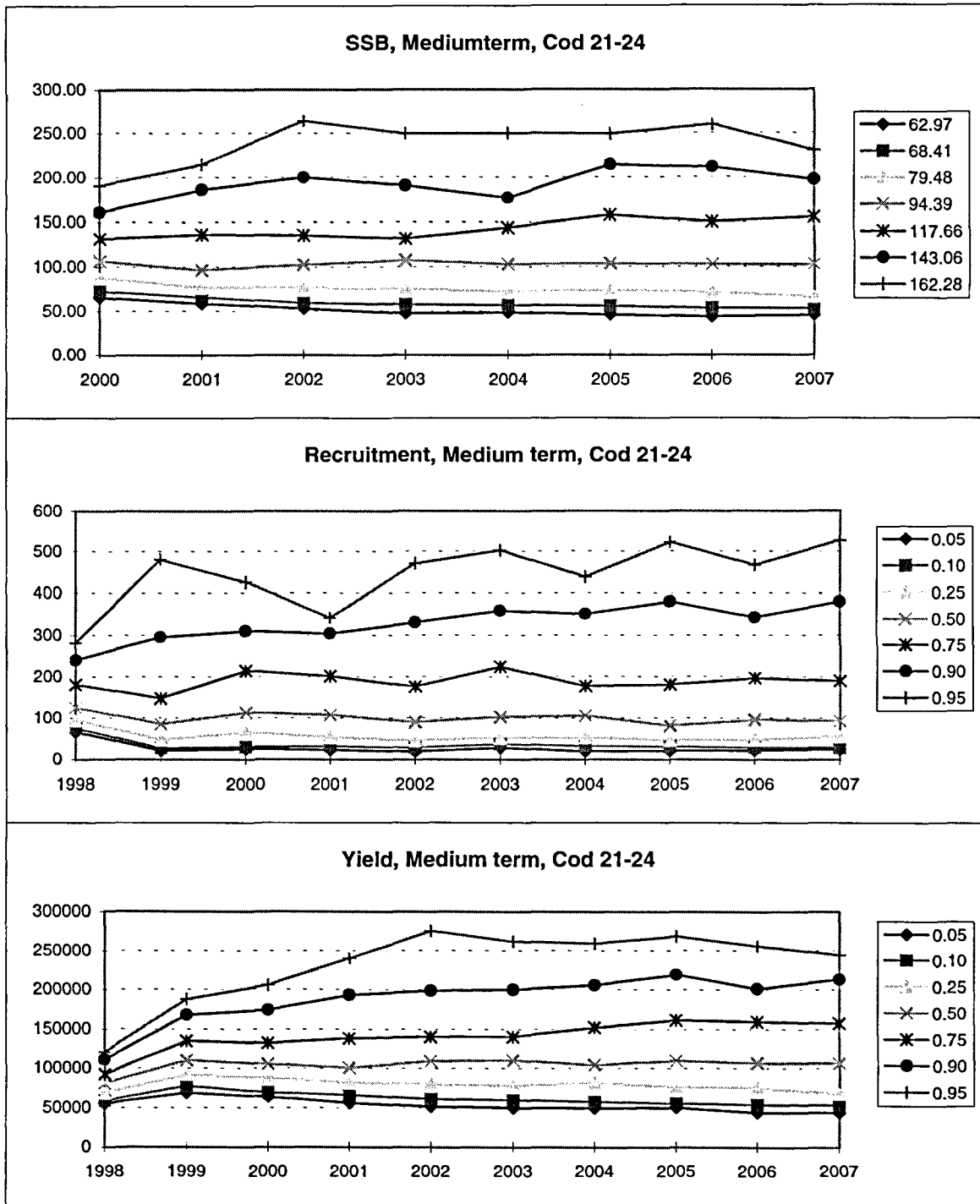


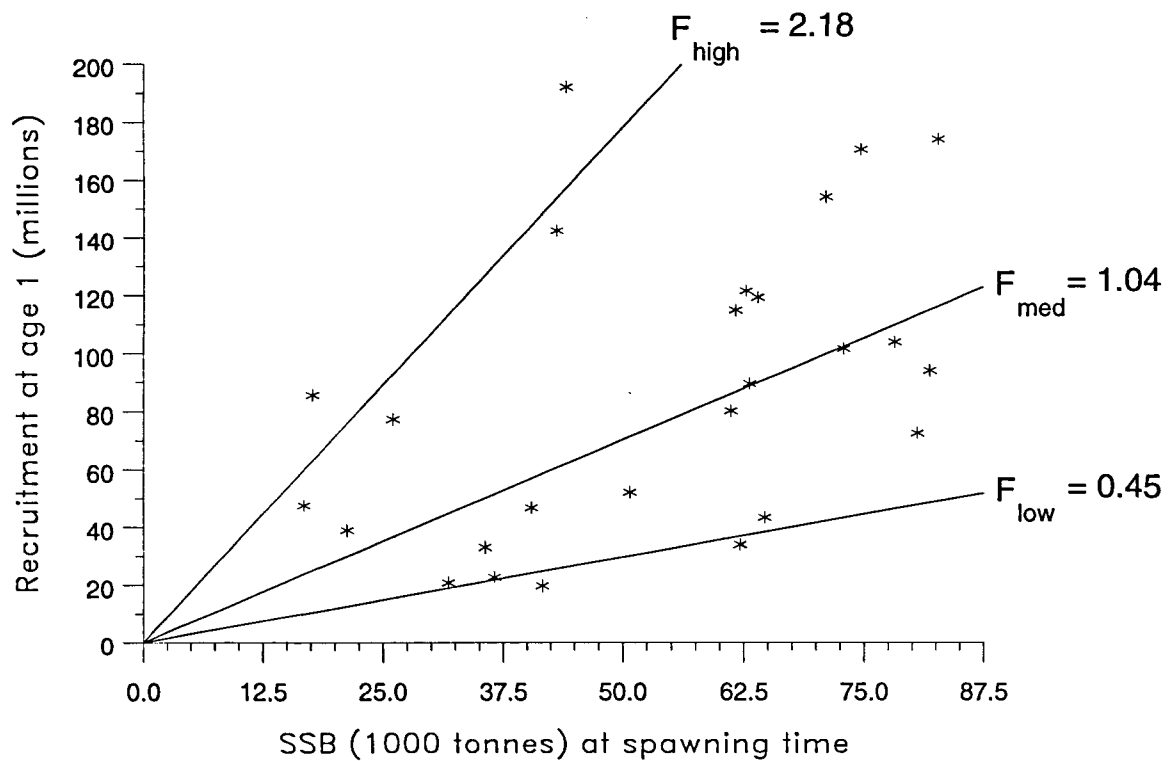
Figure 4.6

Medium term projections for Cod in SD 21-24



Cod in Baltic Fishing Areas 21-24
23-4-1998

Stock - Recruitment



(run: XSAMAH08)

Figure 4.7

5 COD IN SUB-DIVISIONS 25-32

5.1 Catch Trends

National landings of cod from the eastern Baltic stock (Sub-divisions 25-32) are given in Table 5.1.1. National landing statistics were provided by Working Group members. For the Faroe Islands landings were estimated based on transfers from Estonia and Lithuania as official statistics were not available. The total landings in 1997 were estimated to 88,741 t. The total landings were substantially lower than in 1996, i.e., 121,888 t and in 1995, i.e., 107,718 (Table 5.1.1). The reporting of landings has improved further in 1997 and the landing statistics is this year perceived to be a reliable estimate of the amount of cod landed. The reduction in the amounts landed applied to all countries, but especially the Danish landings were substantially lower than in 1996.

Landings distributed by Quarter and Sub-division are given in Table 5.1.2 and the national landings by Sub-division in Table 5.1.3. All countries except the Faroe Island provided landing statistics by Quarter and Sub-division. The cod fishery by Faeroe Islands were assumed to be mainly in 1 and 2 Quarter in Sub-division 26 and their estimated landings were distributed on 1 and 2 Quarter proportional to the total landings in these two quarters in Sub-division 26. Most cod were landed in 1 Quarter (33 %) and 2 (33 %), and least in quarter 3 (14 %). This distribution of the fishing effort is comparable to 1996. The main part of the landings were reported from Sub-division 25 (65 %) and 26 (30 %), while the amount of cod landed from Sub-divisions 27-32 was negligible (5 %). The quarterly landings were reported by gear (trawl and gillnet) by Denmark, Germany, Poland, Russia and Sweden.

A minor revision of landing statistics for 1996 was made based on corrected landing statistics from Finland. Table 5.1.4 shows the updated landing figures by country and quarter for 1996.

5.2 Unallocated Landings

There were no unallocated landings in 1998.

5.3 Discards

Data on discards separated by trawl and gill net was provided by Sweden (Table 1.6.2) and for trawl by Germany for 1997. A review of discard data from Denmark, Estonia, Finland, Germany, Latvia, Poland, Russia and Sweden was made based on the at-sea sampling carried out during the EU-projects: Improvement of the Cod Stock Assessment in the Baltic and the International Baltic Sea Sampling Programme. The status of available discard data is presented in Section 1.6 including a table showing the number of samples obtained from 1995-1997 by Sub-division, country, year, quarter and gear (Table 1.6.1). Discard data were not included in the assessment this year, because the available data at present were not representative of the total fishery on cod and problems in the database and processing has to be solved. However, data on age composition and mean weights are now collected on a regular basis by the above project and the inclusion of data is expected to be feasible in near future.

5.4 Effort and CPUE Data

CPUE data from national fisheries were submitted by Sweden only. Danish effort figures based on logbook data are under revision to establish a new time series. The available information is presented in Tables 5.4.1 A-F. The relative indices of total effort by country are given in Table 5.4.2. CPUE data from commercial fleets are not applied in the assessment at present.

5.5 Age Composition (CANUM)

Estimated age distributions in the landings by Sub-division, quarter and gear (trawl and gillnet) were provided by Denmark, Finland, Germany, Poland, Russia, Sweden and Latvia (trawl and gillnet combined). Table 5.5.1 shows the age composition in the national and total landings by Sub-division and quarter. The data were applied to the national landings, representing 91 % of the total landings. Swedish age distributions for Sub-divisions 26 and 28-31 were obtained from combined samples. Danish samples by landing category from Sub-division 25 were applied to national landings from Sub-divisions 26-29 as well as from Sub-division 25. Estimates of the quarterly landings by Estonia, Lithuania and Faeroe Islands were disaggregated into numbers utilising the average age distributions and mean weights for the particular Sub-division and quarter. The landings mainly included age group 3 and 4 independent of Sub-division and quarter, however, the distribution on age groups differed somewhat between Sub-divisions. Estimates of the age composition in the total landings are given in Table 5.1.2. The age distribution of age group 3 and 4 constituted 67 % of

the catches, which is slightly higher than last year (59 %) while the landings of age group 2 was lower (4 % compared with 11 % in 1996).

Data on age composition and mean weight in the landings were based on samples from the commercial fisheries mainly from the at sea sampling program. The sampling intensity is shown in Table 5.5.2 by Sub-division and country including Denmark, Finland, Germany, Poland, Russia and Sweden. The sampling intensity has increased considerably in most seasons and areas in relation to the ongoing at sea sampling program funded by the European Union.

5.6 Mean Weight at Age

Weight at age in catches (WECA)

Estimates weight at age in the landings by Sub-division and quarter were provided by Denmark, Finland, Germany, Poland, Russia and Sweden for trawl and gillnet separately and combined by Latvia. Swedish WECA for Sub-divisions 26 and 28-31 were obtained from combined samples. Danish samples by landing category from Sub-division 25 were applied to national landings from Sub-divisions 26-29 as well as from Sub-division 25. The WECA applied to the quarterly landings by Estonia, Lithuania and Faroe Island was the average for the given Sub-division and quarter. The WECA in the total landings was calculated as the weighted average (applying the numbers at age by gear, quarter and Sub-division, respectively as weighting factors). The mean weight at age by Sub-division, country, quarter is given in Table 5.5.1 and Figure 5.6.1. The mean weight at age from age group 2 to 7 showed relatively little variation between countries, whereas age groups 8 to 10+ showed substantial variation as would be expected from the low number in the catches and consequently in the sampling. However, some systematic differences between national WECA were observed. This may reflect discrepancies in the age determination of cod, but could also be due to differences in fishing pattern (gear, vessel sizes, spatial effects etc.). The national WECA by gear showed consistently higher mean weight at age in samples from gill net compared with trawl data.

Table 5.1.2 gives the WECA by Sub-division and quarter as well as in the total landings. The WECA by Sub-division and quarter generally showed a consistent pattern. The precision of estimates of the mean weight at age has improved considerably in the most recent years reflecting the improved sampling.

Weight at age in the stock (WEST)

Estimates mean weight at age in the stock (WEST) by Sub-division from surveys in 1 Quarter (BITS) were presented by Denmark, Germany, Latvia, Russia and Sweden for 1997 and by Denmark, Germany and Sweden for 1998. Denmark and Sweden had also revised their data from previous years (1995-1998 and 1989-1998, respectively). In analysis of these data, sex specific mean weights by length and age had been raised by the length distribution to estimate mean weight at age in the population (Table 5.6.1). The data showed that the female mean weight at age in general exceeded the male with the difference increasing with age. This may be important for the calculation of the female spawning stock biomass used in stock-recruitment relations as an indicator of the egg production. However, these data were only available from Denmark and Sweden for part of the period and did not allow establishment of a sex specific time series at present. Since the WEST has not been updated on a regular basis and it was decided to estimate new combined WESTs for each of the years 1995-1998. Data including information on the numbers sampled at age were applied to calculate the weighted average weight at age by Sub-division and year. These data were available from Sweden, Denmark, Germany and Latvia. The national data showed substantial variation within and between Sub-divisions, but with no systematical difference between countries and a relatively high number of cod sampled (Table 5.6.2). The annual WEST for cod in Sub-divisions 25-28 were calculated utilizing the relative stock abundance between Sub-divisions as weighting factors to account for changes in stock distribution (see Table 5.7.3). The weighting factors were derived from the BITS abundance indices (see Section 5.9) and applied on age group level. The data showed yearly variations in the mean weight at age, but the average for the period 1995-97 was at a level similar to the WEST applied in previous years (Table 5.6.3). The variation was especially high in age group 8-10+, due to the low number of specimens sampled in these age groups.

In the assessment, yearly data from 1995 to 1997 were applied for the age groups 1 to 7, while the average for the period 1995-1997 was used for the age groups 8-10+. The forecast utilized the average WEST of the period 1995-1997. Data from 1998 were not included, since they relied on samples from Denmark and Sweden only. A revision of historical data and collection of new data from different national laboratories is planned.

5.7 Maturity Ogives and Sex Ratios

The existing database on sex specific maturity ogives, sex ratios and number sampled at age per Sub-division (ICES, 1997; Tomkiewicz *et al.* 1997) was updated with data provided by Russia for 1997 and by Denmark, Germany, Poland and Sweden for 1998. Swedish data had been recompiled due to revision of age-length keys and replaced previous data. Only data from surveys in the first quarter of the year (BITS) and Sub-divisions 25-28 were applied in this analysis. This database includes now all existing data from Denmark, Germany, Latvia, Russia and Sweden and the only remaining time series of data from Polish surveys is being compiled at present. Sampling has been irregular in former times, but sampling intensity has increased substantially during the last 4 years with a good coverage of the main cod distribution area (Sub-divisions 25, 26 and 28). Average maturity ogives for females and males as well as sex ratios were therefore established by Sub-division and intervals of five years for the period 1980–1997 (Figure 5.7.1), but also yearly for the period 1995–1998 (Figure 5.7.2). The averages were calculated using the inverse variance based on the numbers sampled at age as weighting factors for the different data sets within Sub-divisions and time periods as described in Tomkiewicz *et al.* (1997). The combined maturity ogive per Sub-division was calculated based on the sex specific ogives weighted with the sex ratio. Since sexual maturation of both sexes generally is later in the north-eastern regions, the estimation of maturity ogives and sex ratios for the entire stock considered differences in the spatial distribution of the stock. Weighting factors for combining data from different Sub-divisions were derived from the BIT survey abundance indices calculated this year (see section 5.10) and were applied on an age specific level (Tables 5.7.1 and 3). The sex specific and combined ogives, sex ratio and number sampled at age per five year period for the stock is given in Table 5.7.2 and the yearly estimates from 1995–1998 in Table 5.7.4. The data confirmed previous results, i.e., the average female proportion mature at age is considerably lower than the combined for the sexes due to earlier sexual maturation of males in all areas and the skewed sex ratio with proportion of females increasing with age. Both factors may influence the accuracy of the combined spawning stock biomass as an indicator of the egg production.

In the assessment, the estimates of the combined ogive for the period 1980–1984 were used for the years from 1966 to 1984. For the period 1985–1994 the estimates per 5 years period were used for the respective years, while yearly estimates were used for the period 1995–1997. A similar time series of female ogives and sex ratios were established for a comparison of the female and total spawning stock biomass (Section 5.13). The average combined maturity ogive for the period 1995–1997 was used in the forecast. Data for 1998 was not included in this average, because data from Latvia and Russia are not available yet reducing the reliability of data representing Sub-divisions 26 and 28.

5.8 Natural Mortality

The natural mortality was assumed 0.2 per year for all age groups as in previous years.

5.9 Catch at Age Analysis

5.9.1 Abundance indices from bottom trawl surveys

Indices of abundance by age have been calculated using a model proposed by Sparholt, Munch-Petersen and Tomkiewicz (1996). This model was slightly modified for this meeting and the abundance indices recalculated. Only survey results using demersal trawl for subdivisions 25, 26 and 28 are included in the calculations and only data for the first four months of each year.

The results are presented in Table 5.9.1.

The basic data are the haul by haul observations presented as CPUE in units of No./hr by age. The CPUE data are provided by 7 different vessels with different fishing power. There are therefore two steps in the calculation 1) to estimate the relative fishing powers of these vessels and 2) to calculate an appropriate weighted sum by year.

The fishing power by country (research vessel) was estimated by a special procedure. The procedure is described in details by Sparholt *et al.* (opt. cit.).

The first step in the procedure is to construct an index of the spawning stock biomass for each haul $ssb_h = \sum_{a \in age} mat_a * w_a * Cpue_{h,a}$. For this purpose it is the maturity ogive (mat_a) and mean weights (w_a) by age (subscript a) for the whole stock that is used (Table 5.9.1.) and not those estimated by Sub-division.

This spawning stock biomass index is then analysed using the SAS GLM procedure by the model

$$\log(ssb + 0.5) = Country + SD * Depthstratum + Year * SD$$

The assumptions involved are:

- Fishing power (Country) is the same for all age groups and all years independent of the subdivision/depth combination in which the effort is exerted
- The depth distribution of the stock differs between subdivisions but is within a subdivision the same throughout the time series
- The stock distribution between subdivisions differs between years

The text table below shows the estimated fishing power by country based on survey data 1982–1998 including data from subdivisions 25, 26 and 28 only and only data from the depth strata 40-60, 60-80 and 80–100 m

	AtlantNiro 1997–1998	Denmark	Former GDR	Germany	Latvia include. Russia - up to 1996	Poland	Sweden GOV trawl	Sweden Foto
Fishing power	0.885257	0.537068	0.826215	0.553931	0.419338	0.323406	0.948443	1

Latvia and Russia used the same vessel until and including 1996. Latvia has continued to use a bottom trawl with the same gear characteristics after 1996 on the new and smaller vessel introduced. Russia has used the R/V AtlantNiro in 1997 and in 1998. This ship has a higher fishing power than the vessels previously used and the vessel currently used by Latvia

The estimation procedure does not include the 2 group as this age group is largely immature. Preliminary analysis suggests that the fishing power for age group 2 is actually different from that of the older fish and hence the analysis should be refined by separate estimation of the fishing power by vessel for this age group following a similar procedure as described above. This will be done intersessionally before the next working group meeting.

When the fishing powers have been derived the next step is to calculate weighted summed densities.

The mean densities are in units of numbers per hr for each combination of subdivision and depth stratum (20 m intervals). These mean densities are then summed over all strata to provide the final index presented in Table 5.9.1.

The abundance index is calculated as
$$\sum_{SD, Depthstrata} \left[\frac{Cpue_{a,y,h,v}}{fp_v} * A_{SD, Depthstratum} \right]$$
 where the mean is taken over

all hauls (h) by all vessels (v) after correction for the fishing power fp_v where the hauls are made in the same subdivision (SD) and depth stratum. The subscript a is the age and y is the year. The weight A is the area for each subdivision and depth stratum combination. The weight factors A are given below:

Area ('000 sq km) by subdivision and depth strata used as weight factors A.

Subdivision	20-40	40-60	60-80	80-100	100-120	120-	Total
25	11.8	10.2	9.4	4.3	0.08	0	35.845
26	6.7	5.4	6.8	10.1	5.3	2	36.394
28	6.8	5.8	4.1	5.0	4	12.7	38.412

5.9.2 XSA analysis

The survey index of abundance derived as described above was used for tuning. The abundance indices for age groups 3 and older cod were considered to represent the survivors at 31 December of the previous year. This procedure allowed the inclusion of abundance estimates from the 1998 survey (FLEET 14). Abundance estimates of age group 2 were included as a separate fleet (FLEET 15) representing this age group in the first quarter. These data are presented in Table 5.9.1.

Two XSA runs were performed where catchability depends on stock size for age 2 and where catchability depends on stock size for both age groups 2 and 3. The diagnostics (slope and R-square values) suggested that the option with catchability depends on stock size for ages 2 and 3 was to be preferred. The main input data (CATON, CANUM, WECA, WEST, NATMOR, MATPRO) are presented in Table 5.9.1.

The following settings were used for final XSA run:

- catchability dependent on stock size for age 2 and 3;
- catchability independent of age for ages from 4 to 8;
- mean fishing mortality for shrinkage is calculated as average of fishing mortality coefficients for 4-6 age groups and for the 5 last years.

The XSA diagnostics and results are presented in Table 5.9.2. Residuals of log catchability coefficients for both tuning fleets in general have small absolute values (<0.50), only in some cases these values exceed 1.0. Positive residuals for age group 2 for both tuning fleets since 1993 suggest that the survey systematically overestimates by the abundance of this age group as compared with XSA stock estimates.

Estimated stock size, recruitment and fishing mortality from the final XSA run are shown in Table 5.9.3. The total and spawning stock biomass' increased from 1993 to 1995, but decreased subsequently. The recruitment were in 1992-1996 between 130-175 mil. individuals, but was in 1997 (year class 1995) at a very low level (97 mill. ind.). Compared with previous estimates of total stock biomass and SSB, these are on lower level especially for 1996. This is obviously caused by the re-evaluation of the tuning input data (see section 5.9.1). The recruitment estimates correlates well with corresponding indices from surveys (Figure 5.9.1). The yield, F, SSB and recruitment trends are shown in Figure 5.9.2.

Results from retrospective analysis are presented in Figure 5.9.3. This analysis indicates that recruitment are initially overestimated but downscaled when more data become available next year. There is a similar tendency for the SSB. Such a tendency was not observed in the fishing mortality estimates.

5.10 Recruitment Estimates

In previous years a specific GLM analysis of the age 2 data was presented. This procedure provided recruitment estimates (age group 2) that differed from the abundance estimates derived from the procedure described in Section 5.9.1 although the data base is identical. The density estimation in the GLM analysis is based on the assumption that the geographical distribution of cod did not change over time. The summing procedure used in Section 5.9.1 was therefore considered better as this procedure did not make this restrictive assumption. The GLM procedure was therefore not used in this year's assessment.

The survey abundance indices given in Table 5.9.1 were regressed against VPA estimates with the RCT3 program (Tables 5.10.1-2). The year classes 1992-1995 based on the survey abundance indices are estimated higher than by the VPA, e.g., the 1992 and 1993 year classes are almost twice as high than in XSA analyses. The 1996 year class is predicted to 163 mill. individuals at age 2. The retrospective pattern suggests that last year estimates are on average

overestimated by approx. 25 %. Therefore the Working Group reduced the 1996 estimate from RCT3 analysis by 25 %. The year class 1996 was assumed to be 122 mill. individuals as age group 2.

5.11 Historical Stock Trends

Cod total and spawning stock biomasses increased by the end of the 1970s due to the extremely abundant generations in 1976, 1977 and 1980 and favourable reproduction conditions in the southern and central Baltic. The spawning stock declined from the historically highest level of around 700,000 t during 1982–1983 to the lowest recorded level in 1992. The decrease was a result of increasing traditional fishing effort (i.e., trawl fishery), introduction of gillnet fishery and stagnation processes causing poor reproduction conditions caused by irregularity of water exchange with Northern sea during last decades. Due to this since mid of 80s the successful cod stock reproduction was observed only in the southern spawning grounds. After 1987 all year classes were estimated to be below the long-term average. The year class 1991, 1993 and 1994 were more abundant but substantially below the long term average (310 mil. ind). Nevertheless these generations had contributed to the recent increase in the stock size in beginning of 90s. After 1995 the spawning stock has decreased below 200,000 t. The present level of the spawning stock biomass and total stock biomass are substantially below the long-term average.

5.12 Short-Term Forecast and Management Options

The standard catch projections and yield per recruit estimates were based on the input data given in Table 5.12.1. Input for recruitment at age 2 in 1998 (year class 1996) was set to 122,288 thousand individuals (see section 5.10). Stock sizes at ages 3–8 in 1998 were derived from the XSA output. Recruitment in 1999 and 2000 was assumed equal to the arithmetic mean of the XSA analyses for 1993–1997 - 142,087 thousand, assuming that there is no significant improvement of cod reproduction conditions in the Baltic. Thus, the recruitment in 1999 and 2000 was considered to be about half of the long-term average (1966–1997: 309,000 thousand). The mean weights at age in the stock and catch and maturity ogives were derived from XSA input data as an arithmetic mean for 1995–1997. The fishing pattern was taken as an arithmetic mean fishing mortality at ages for 1995–1997.

The outputs from a standard short-term prediction are presented in Table 5.12.2. The prediction assuming *status quo* fishing mortality in 1998 (catch 105,000 t) keeps the SSB below 200,000 t in 1998 and 1999, which is also significantly below the long-term average (1966–1997: 325,000 t). In *status quo* situation the catch level constitutes in 1998 approximately 100 thousand tons.

As discussed in section 5.14 the relevant biological reference point for a precautionary approach to management of this stock is the $MBAL = B_{pa} = 240,000$ t. This means that the assessment suggests that the stock is outside safe biological limits at present and that the stock therefore as soon as possible should be brought to higher SSB level inside such limits.

Reduction of fishing mortality by 40 % in 1999 and corresponding catch 67 thousand tons provides an increase of SSB at the B_{pa} level already in year 2000. The *status quo* projection suggests a SSB in year 2000 of 200,000 t leaving the stock outside safe biological limits.

5.13 Medium-Term Projections

Medium term projections for a 10 year period were calculated based on single species computer simulation models. The simulations were based on the average 1995–1997 situation supplemented by a revised estimate of the stock-recruitment relationship based on the 1983–1997 period.

Previously the stock-recruitment relation was calculated as a Ricker type relation: $R = a \cdot SSB \cdot \exp(-SSB/K)$.

This was based on considerations on the cannibalistic nature of cod. However the available data did not reveal the predicted decline in recruitment at high spawning stock biomasses and hence the Beverton and Holt type: $(R = A \cdot SSB / (B + SSB))$ was used for this assessment. The influence of the environment on the recruitment anyway makes this type of simulation a rather theoretical exercise. The choice of the most recent period accounts to some extent for the long term influence of the environment while short term environmental effects are not considered. The estimate is based on the year classes 1981–1995 ignoring the previous period where some very strong year classes were observed.

The stock-recruitment relation was established by regressing the recruitment at age 2 years versus the spawning stock biomass (combined female and male) as calculated from the assessment for 1983–1997, Table 5.9.3. (Figure 5.13.2).

The combined female and male spawning stock has been used traditionally as an indicator of the egg production in stock recruitment relations in the assessment of this stock. The analysis of sex specific maturity ogives and the sex ratio at age (Section 5.7, Tomkiewicz *et al.* 1997), however, has revealed that the timing of sexual maturation is later for females than for males and the proportion of females is exceeding male with increasing age. To investigate potential bias between the two estimates of the spawning stock, the female spawning stock biomass was computed. The estimation applied the time series of female maturity ogives and sex ratio at age in the stock (Section 5.7) and the mean weight at age used in the input data combined with the stock in numbers from this years assessment. The plot of the female SSB versus the total SSB is given in Figure 5.13.1 with regression statistics. The plot showed a high correlation between two estimates, however, a slight bias was observed. The intercept was significantly different from 0 ($t=-3.96$, $P<0.001$) and the slope differed from 0.5 as would be assumed if the contribution of females and males was similar. The higher relative estimate of the combined spawning stock biomass compared with the female at low spawning stock sizes is probably a result of the earlier maturation of males provided that younger age classes (age group 2-4) dominate the stock at low stock size. The relatively higher estimate of the female spawning stock biomass at high abundance is likely to be caused by the increasing proportion of females in the older age classes. This assumes that older age classes age more abundance at higher stock densities, which may not generally be that case, but fits well with the observations in the case. The bias will probably increase, if sex specific mean weights at age (WEST) was applied, since the mean weight at age of females in the stock appear to be substantially higher than it is for males especially in the older age groups. In combination with estimates of the size (weight) specific fecundity it implies that the spawning stock biomass applied in stock recruitment estimates at present underestimate the egg production in the stock at high stock sizes, but overestimate it at low stock sizes. However, taken the overall trend in the stock sizes of eastern Baltic cod into consideration, the application of the potential population fecundity would probably reduce the scatter in the stock recruitment relation and improve the precision, but it would not change the general trend.

Log-normal simulation occasionally produces year classes much stronger than ever observed and therefore the simulated recruitment are often confined to be within the range observed. This was not done in this case as such trimming would have little effect since some very strong year classes, e.g., the 1976 year class have actually been observed (more than twice the asymptote from the Beverton & Holt Stock-Recruitment relation).

The medium term projections are based on mean weights and exploitation patterns that in all cases were calculated as the average for the 1995–1997 period.

The uncertainty in the estimated stock size for 1 January 1998 was taken from the output of the XSA and assumed to be the maximum of the external and the internal standard error as given in the XSA output.

Medium term projection for 10 years starting from the most recent estimate of the survivors are presented for fixed fishing mortality levels in Table 5.13.1 and Figure 5.13.3.

As discussed in section 5.14 the biological reference target points are linked through the MBAL taken to be equal to B_{pa} . The medium term projections therefore should be evaluated in this light, i.e., that the stock as soon as possible should be brought to a state where the $SSB > B_{pa}$ (240,000 t) with a 90 % probability. Just as indicated by B_{pa} also the F_{pa} (0.65) suggests that the current level of fishing mortality (0.68) is outside sustainable limits. Based on the simulations presented in Figure 5.13.3 bringing the SSB above 240,000 t before year 2003 with 90 % probability would require that the fishing mortality level be reduced by 20 % compared to the present situation. Figure 5.13.3 indicates how fast the spawning stock is expected to recover under a 20 % and a 50 % reduction of the fishing pressure. Such reductions should be compared with the variation in the fishing mortality seen in recent years, see Table 5.9.3 that suggests that this variability is more than the indicated 20 % reduction.

5.14 Biological Reference Points

The Study Group on Management Strategies for Baltic Fish Stocks (SGMBFS) (ICES 1998) investigated the biological reference points B_{pa} , F_{pa} , B_{lim} and MBAL based on single species model computer simulations. SGMBFS also investigated biological reference points in the context of multispecies models for the Baltic fish assemblage.

5.14.1 Single species considerations

The SGMBFS investigated the biological reference points B_{pa} , F_{pa} , B_{lim} , and MBAL. The calculation procedures for these biological reference points as used by the SGMBFS are given below

Biological Reference point	Calculated as
MBAL	Equal 240,000 tons based on a Ricker-type stock recruitment relation. (ICES CM 1996/Assess:7 Report of the Baltic Fisheries Assessment Working Group April 1996).
B_{pa} , F_{pa}	Equal MBAL Computer Simulation with variables as explained below. 10 % lower fractile of calculated $SSB \geq B_{pa}$. The SGMBFS seems to have miscalculated this reference point. It is recalculated to be approximately 0.65 (see Table 5.13.1)
B_{lim}	$B_{pa} * \exp(-1.645 * \sigma)$ where σ is the standard deviation around the stock-recruitment relationship expressed in logarithmic units for the period 1976–1996

SGMBFS included the following elements as source of the variability in the stock development

- Recruitment
 - Log normal noise around a stock-recruitment relationship expressed in logarithmic units. The same stock recruitment relation as used for medium term projections was used. This standard deviation was recalculated by BFASWG as 0.166.
- Mean weight at age (stock)
 - Based on variation in the assessment weights-at-age for 1992–1996. SGMBFS gives no details on how this calculation was done.
 - BFAWG comments

The procedure is probably not valid. The reasons are

1. The characteristic development of the mean-weight-at-age is trends (possibly cycles) and not white noise. The noise model is therefore too optimistic as there will be periods of consistent low weight-at-age rather than white noise in these weights around some mean.
2. The estimation of the noise cannot be done reliable on an age-by-age consideration there are only six observations to estimate the variance. It may be considered to assume a constant Coefficient of Variation (CV) for the entire data set based on an ANOVA analysis $\log(w) = \text{age}$. This however would include the trend in the estimation of the CV.
3. The data themselves are somewhat doubtful even for the most recent period and inspection of the mean-weight-at-age table indicates that data may be lacking in some years and the mean weight represent data from other years copied for the purpose of assessment

- Maturity ogive
 - The simulations are based on binomial distribution based on the number of fish inspected for maturity.
 - BFASWG comment:

The procedure probably underestimate the true variability of the maturity ogive. The number of fish inspected in recent years is high and hence the simulated variability is small and within the uncertainty in how well other parameters are determined notably the standard deviation around the stock-recruitment relation. This is illustrated for age group 3 where for the years 1995–1998 the following number of fish were inspected for maturity in the surveys.

	25	26	28	Total
1995–1998	2473	1545	504	4522
Average per year	618	385	126	1131

The upper limit on the standard deviation of the frequency is then $\sqrt{(0.25/n)}$ or less than 0.016 or as CV for the age group 3 0.8 %. Based on such considerations the Group did not find that the source of variability was warranted. Inspection of the actual maturity ogives, see Table 5.9.1. suggests a year to year variability that is substantially above the sampling variability level.

5.14.2 Multispecies considerations

The SGMBFS concluded based on computer simulation studies using single and multispecies models

- Biomass limits reference points may differ in single and multispecies models
- Biomass limit reference points change dynamically in response to changes in the interaction between predators and prey. If predation is increased the prey stock can sustain less fishing mortality before dropping below a given B_{lim} .

5.15 The 1998 assessment in the light of the 1997 assessment

The 1998 assessment procedure was changed on several points compared to the previous assessment. This includes the calculation of the survey indices used for tuning the VPA and the way the tuning fleets were applied in the tuning procedure. Minor changes included a review of the mean weight at age for the stock and of the maturity ogive.

The survey index is calculated as described by Sparholt, Munch-Petersen and Tomkiewicz (1996) with some modifications. These modifications are described in Section 5.9.1 and include in particular that the fishing power for the Russian survey vessel used in 1997 and 1998 have been estimated separately. This analysis is based on the assumption that the fishing power of the survey vessels is the same across the entire age range. This is probably not the case and this will be analysed for next year's assessment. A change of the fishing power for the younger age groups will change the abundance estimates from BITS for age groups 2 and younger.

The separate analysis of abundance data for age group 2 years for estimating the most recent year class strength presented in 1997 was not repeated. The relations estimated in the XSA assessment were used together with RCT3 analysis.

The application of the abundance data from the standardised survey (BITS) was changed. Abundance of age groups 3 and older are taken to represent the survivors of the fishery the preceding year while the abundance index for age group 2 is taken to represent the abundance in the first quarter. This allows the use of also the 1998 survey in the tuning procedure together with the entire age range 2-8.

Compared to the 1997 assessment the 1994 and older year classes are estimated at a slightly lower level. The year class 1995 is evaluated to be quite weak. The average recruitment used for the projections has been decreased based on the recruitment as observed in recent years (in the 1997 assessment 160 mill now 142 mill). The 1996 year class is now assumed to be on 122 mill compared to the 160 mill used in the previous projections.

In conclusion, this assessment paints a somewhat bleak picture for the immediate future of the Eastern Baltic Cod.

Biological reference points for the Eastern Baltic Cod were presented by the ACFM study Group and by the Study Group for Management Strategies for Baltic Fish Stocks. These estimates differ, e.g., the B_{lim} is given as 79,000 t by the ACFM study group while the SGMBFS suggests that 160,000 t is appropriate. This Working group largely followed the approach taken by the SGMBFS. This is further discussed in Section 5.14.

Table 5.1.1 Total landings (t) of COD in Sub-divisions 25-32 by country.

Year	Denmark	Estonia	Finland	German Dem.Rep. ²	Germany, Fed. Rep.	Latvia	Lithuania	Poland	Russia	Sweden	USSR	Faroe Islands ⁴	Norway	Unallo- cated ³	Total
1965	15,856		23	975	2,183			41,498		19,523	22,420				102,478
1966	16,570		26	2,196	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	3,203			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			120,001		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	30,483			93,429		59,685	100,761	6,354			391,952
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			194,787
1989	57,240		2,254	3	12,844			36,855		50,740	14,722	4,520			179,178
1990	47,394		1,731		4,691			32,028		50,683	13,461	3,558			153,546
1991	39,792	1,810	1,711		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		593			54,882
1993	8,000	70	225		1,042	1,333	605	8,909	892	10,099		558		13,450	45,183
1994	9,901	952	594		3,056	2,831	1,887	14,335	1,257	21,264		779		36,498	93,354
1995	16,895	1,049	1,729		5,496	6,638	4,513	25,000	1,612	24,723		777	293	18,993	107,718
1996	17,549	1,338	3,089		7,340	8,709	5,524	34,855	3,306	30,669		706	289	8,515	121,889
1997 ¹	9,776	1,414	1,677		5,215	6,187	4,601	31,396	2,803	25,072		600			88,741

¹Provisional data. ²Includes landings from Oct.-Dec. 1990 of Fed.Rep.Germany.

³Working group estimates. No information available for years prior to 1993. ⁴ For 1997 landings not officially reported, estimated by the WG.

Year: 1997 BFAS WG Revised 17.04.98

Table 5.1.2. Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches of eastern Baltic cod (Sub-div. 25-32) by Sub-division and quarter.

Year: 1997		Quarter: 1																	
Sub-div.	Sub-div. 25		Sub-div. 26		Sub-div. 27		Sub-div. 28		Sub-div. 29		Sub-div. 30		Sub-div. 31		Sub-div. 32		Sub-div. 25-32		
Age	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weights [g]	
1	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	
2	1024.841	504	34.155	670	88.700	613	18.579	670	0.094	670	0.000	0	0.027	670	0.133	670	1166.528	520	
3	8997.837	781	939.609	787	1079.644	789	329.299	860	1.294	870	0.000	0	0.473	860	2.365	860	11350.521	785	
4	5393.466	1075	2025.275	1013	218.138	1181	158.056	1141	0.290	1206	0.000	0	0.227	1141	1.135	1141	7796.586	1063	
5	2865.326	1419	1724.404	1320	69.800	1968	63.309	1691	0.073	1914	0.000	0	0.091	1691	0.455	1691	4723.458	1394	
6	747.372	2143	498.096	1892	31.311	2570	31.805	2240	0.028	2786	0.000	0	0.046	2240	0.228	2240	1308.885	2060	
7	227.147	3119	143.380	3117	7.592	2972	9.383	3000	0.008	3583	0.000	0	0.013	3000	0.067	3000	387.592	3112	
8	54.891	3291	53.879	3638	1.162	3477	2.199	3600	0.001	4576	0.000	0	0.003	3600	0.016	3600	112.152	3466	
9	12.933	5579	26.690	4912	1.009	4008	0.589	5627	0.001	4698	0.000	0	0.001	5627	0.004	5627	41.227	5110	
10	10.160	8450	17.670	6919	1.572	3774	0.481	5805	0.002	4584	0.000	0	0.001	5805	0.003	5805	29.889	7256	
11+	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	
SOP (t)	20056		6930		1419		696		2		0		1		5		29109		
Landings (t)	20056		6930		1419		696		2		0		1		5		29109		

Year: 1997		Quarter: 2																
Sub-div.	Sub-div. 25		Sub-div. 26		Sub-div. 27		Sub-div. 28		Sub-div. 29		Sub-div. 30		Sub-div. 31		Sub-div. 32		Sub-div. 25-32	
Age	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weights [g]
1	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
2	219.421	510	31.818	543	16.970	610	2.024	515	0.105	525	0.054	515	0.000	0	0.004	515	270.396	520
3	6296.434	798	655.260	774	523.223	827	173.236	908	3.408	821	4.588	908	0.000	0	0.382	908	7656.531	800
4	4822.637	1061	911.831	1105	195.290	1059	84.402	1218	1.477	1109	2.235	1218	0.000	0	0.186	1218	6018.058	1070
5	2386.850	1569	1606.503	1565	54.769	1821	51.445	1599	0.538	1968	1.362	1599	0.000	0	0.114	1599	4101.581	1572
6	817.874	2631	816.733	2461	29.389	2673	26.958	2324	0.317	2891	0.714	2324	0.000	0	0.059	2324	1692.046	2545
7	552.998	3573	335.160	3560	15.771	3141	9.384	3275	0.228	3745	0.249	3275	0.000	0	0.021	3275	913.811	3558
8	232.927	4460	195.813	4514	3.602	3418	3.877	3537	0.068	4164	0.103	3537	0.000	0	0.009	3537	436.398	4467
9	45.240	6682	41.662	6291	1.328	5145	0.460	4013	0.017	4608	0.012	4013	0.000	0	0.001	4013	88.720	6461
10	18.110	7991	8.847	7284	0.738	5520	0.077	7300	0.004	6945	0.002	7300	0.000	0	0.000	7300	27.778	7698
11+	0.467	10719	0.031	10719	0.000	10719	0.018	10719	0.001	10719	0.000	10719	0.000	0	0.000	10719	0.517	10719
SOP (t)	19616		8461		901		453		8		12		0		1		29451	
Landings (t)	19616		8461		901		453		8		12		0		1		29451	

Table 5.1.2. Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches of eastern Baltic cod (Sub-div. 25-32) by Sub-division and quarter.

Year: 1997		Quarter: 3																	
Sub-div.	Sub-div. 25	Sub-div. 26		Sub-div. 27		Sub-div. 28		Sub-div. 29		Sub-div. 30		Sub-div. 31		Sub-div. 32		Sub-div. 25-32			
Age	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weights [g]	
1	10.083	541	0.722	646	0.076	583	0.422	646	0.006	645	0.003	645	0.000	0	0.002	645	11.316	552	
2	432.393	699	44.635	697	4.146	797	18.027	822	0.270	821	0.145	822	0.000	0	0.073	822	499.689	705	
3	1816.532	981	370.755	845	21.550	1041	81.216	1025	1.068	1076	0.654	1025	0.000	0	0.327	1025	2292.102	961	
4	1944.558	1183	828.651	1058	11.585	1320	50.969	1281	0.597	1318	0.410	1281	0.000	0	0.205	1281	2836.977	1149	
5	645.733	1698	677.076	1461	2.608	1920	28.249	1574	0.270	1630	0.227	1574	0.000	0	0.114	1574	1354.277	1577	
6	382.776	2627	344.002	2320	1.179	3149	12.106	2100	0.111	2185	0.097	2100	0.000	0	0.049	2100	740.320	2477	
7	195.849	3651	170.300	3392	0.539	3667	3.076	3018	0.031	3113	0.025	3018	0.000	0	0.012	3018	369.833	3526	
8	57.828	5041	49.622	4636	0.130	4060	0.884	4314	0.009	4317	0.007	4314	0.000	0	0.004	4314	108.483	4848	
9	35.804	6574	37.889	6458	0.009	3987	0.126	6159	0.001	5686	0.001	6159	0.000	0	0.001	6159	73.831	6513	
10	9.056	8634	11.515	9067	0.055	4338	0.199	5067	0.003	4567	0.002	5067	0.000	0	0.001	5067	20.831	8827	
11+	0.435	14433	0.447	14433	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.882	14433	
SOP [t]	7818		4172		53		248		3		2		0		1		12297		
Landings (t)	7818		4172		53		248		3		2		0		1		12297		

Year: 1997		Quarter: 4																	
Sub-div.		Sub-div. 25		Sub-div. 26		Sub-div. 27		Sub-div. 28		Sub-div. 29		Sub-div. 30		Sub-div. 31		Sub-div. 32		Sub-div. 25-32	
Age		Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weights [g]
1		20.003	761	28.345	532	2.838	575	8.812	532	0.072	532	0.011	532	0.000	0	0.000	0	60.081	610
2		470.947	682	151.362	604	15.390	771	35.558	693	0.272	716	0.043	693	0.000	0	0.000	0	673.573	667
3		2624.694	985	1000.616	889	76.972	1130	243.534	808	0.987	1092	0.296	808	0.000	0	0.000	0	3947.099	953
4		3134.023	1119	1928.285	1084	41.273	1190	290.583	1006	0.521	1106	0.354	1006	0.000	0	0.000	0	5395.039	1101
5		1116.255	1519	949.191	1620	15.302	1569	112.954	1414	0.184	1532	0.137	1414	0.000	0	0.000	0	2194.022	1558
6		466.435	2455	436.015	2462	3.754	2743	27.025	1991	0.041	2710	0.033	1991	0.000	0	0.000	0	933.302	2446
7		129.407	3829	183.774	3043	1.813	3845	16.754	2929	0.019	3901	0.020	2929	0.000	0	0.000	0	331.786	3348
8		36.041	5272	55.930	5091	0.307	3797	4.068	4424	0.003	4424	0.005	4424	0.000	0	0.000	0	96.355	5126
9		15.866	5821	25.534	6598	0.333	4448	2.871	4561	0.004	4878	0.003	4561	0.000	0	0.000	0	44.612	6174
10		7.266	5790	10.184	6436	0.223	4352	1.411	6941	0.003	5316	0.002	6941	0.000	0	0.000	0	19.088	6203
11+		0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0
SOP [t]		10089		6776		194		822		2		1		0		0		17884	
Landings (t)		10089		6776		194		822		2		1		0		0		17884	

Table 5.1.2. Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches of eastern Baltic cod (Sub-div. 25-32) by Sub-division and quarter.

Year:	1997		Quarter:		All													
Sub-div.	Sub-div. 25		Sub-div. 26		Sub-div. 27		Sub-div. 28		Sub-div. 29		Sub-div. 30		Sub-div. 31		Sub-div. 32		Sub-div. 25-32	
Age	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weights [g]
1	31.041	687	27.958	535	3.065	575	9.447	538	0.077	542	0.014	559	0.000	0	0.002	644	71.604	603
2	2187.411	584	254.591	620	125.929	639	75.939	717	0.733	721	0.242	731	0.027	670	0.210	719	2645.082	594
3	19749.127	833	2963.596	824	1698.536	821	820.713	872	6.755	909	5.538	916	0.473	860	3.074	883	25247.811	832
4	15325.875	1094	5671.719	1058	466.392	1135	585.481	1097	2.884	1161	2.999	1202	0.227	1141	1.527	1169	22057.104	1086
5	7009.901	1510	5002.374	1474	142.642	1866	257.221	1534	1.064	1805	1.727	1581	0.091	1691	0.682	1656	12415.703	1500
6	2415.821	2441	2100.827	2299	65.487	2637	97.718	2173	0.498	2716	0.844	2285	0.046	2240	0.337	2234	4681.578	2375
7	1092.426	3522	828.647	3338	25.634	3155	38.630	3036	0.288	3683	0.294	3229	0.013	3000	0.100	3059	1986.033	3431
8	373.955	4458	358.845	4478	5.178	3472	11.037	3951	0.083	4197	0.115	3623	0.003	3600	0.028	3671	749.244	4453
9	109.471	6383	129.769	6095	2.679	4622	4.075	4700	0.023	4716	0.017	4258	0.001	5627	0.006	5389	246.040	6184
10	44.407	7862	47.827	7350	2.591	4330	2.189	6527	0.011	5652	0.005	6516	0.001	5805	0.004	5728	97.035	7485
11+	0.892	12589	0.430	14155	0.000	10719	0.017	10719	0.001	10719	0.000	10719	0.000	0	0.000	10719	1.341	13064
SOP [t]	57579		26338		2567		2220		15		15		1		7		88741	
Landings (t)	57579		26338		2567		2220		15		15		1		7		88741	

Table 5.1.3. Total landings (t) of the eastern Baltic cod stock (Sub-div. 25-32) by Sub-division and country.

Sub-div.	25	26	27	28	29	30	31	32	25-32
Country:									
Denmark	8749	646	44	336	1	0	0	0	9776
Finland	1061	429	106	56	2	15	1	7	1677
Germany	4632	393	0	190	0	0	0	0	5215
Latvia	1354	4052	0	781	0	0	0	0	6187
Poland	18884	12512	0	0	0	0	0	0	31396
Russia	0	2803	0	0	0	0	0	0	2803
Sweden	19838	2035	2417	770	12	0	0	0	25072
Estonia	1189	138	0	87	0	0	0	0	1414
Lithuania	1871	2730	0	0	0	0	0	0	4601
Faroe	0	600	0	0	0	0	0	0	600
Total	57579	26338	2567	2220	15	15	1	7	88741

Finland catches for Sd 29-32 disaggregated according to the total WECA and age distribution of Sd 28

Sweden data for SD 26,28-31 disaggregated according to combined WECA and age distribution of Sub-divisions 26+28

Estonian catches in Swedish and Danish fishery zones included in Sd 25

Lithuanian catches in European Union zone included in Sd 25

Faroe Island landings - preliminary estimate by WG

Table 5.4.1 A 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	1.55	0.48	16,895	11
1996 ¹	-	-	17,549	-
1997	-	-	-	-

Table 5.4.1 B 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	1,042	-
1994	3,056	-
1995	5,496	-
1996	7,339	-
1997	-	-

Table 5.4.1 C Cod in Sub-divisions 29-32. 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
1996	1	69	0	0	70	0.04
1997	-	-	-	-	-	-

Table 5.4.1 D 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	2.42	0.74	3.2	1.655	0.52	6.6	1.925	0.61	10.8
1996	3.9	2.82	0.90	4.8	2.252	0.72	8.7	2.507	0.80	10.9
1997	-	-	-	-	-	-	-	-	-	-

CPUE - catch (t) per fishing cruise.

Table 5.4.1 E Cod in Sub-divisions 25–32. Polish effort data, CPUE from cutter fisheries.
Estimates based on logbook data.

Year	Total Catch (t)	CPUE	Index of total effort
1983	76,474	4.46	17.1
1984	93,429	5.00	18.7
1985	63,260	5.22	12.1
1986	43,236	3.78	11.4
1987	32,667	2.48	13.2
1988	33,351	2.34	14.3
1989	36,855	2.2	16.8
1990	32,028	1.60	20.0
1991	25,748	1.52	16.9
1992	13,314	0.97	13.7
1993	8,909	1.05	8.50
1994	14,335	1.07	13.4
1995	25,000	1.64	15.2
1996	34,855	1.58	22.1
1997	-	-	-

Table 5.4.1 F Swedish effort data in Sub-divisions 25–29.

Year	Logbook records			Relative CPUE	Total catch (1000 t)	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
1996	27,730	53,422	0.519	1.10	30.7	27.9
1997	11,295	60,893	0.185	0.394	25.1	63.5

Year: 1997 BFAS WG

Table 5.5.1. Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches of eastern Baltic cod (Sub-div. 25-32) by Sub-division and quarter.

Sub-div. 25

Year: 1997		Quarter: 1																									
Country	Denmark		Finland		Germany		Latvia		Poland		Russia		Sweden		Estonia		Lithuania		Total		Faroe	Grand Total	ALL				
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10-3	Mean weight [g]				Numbers *10 ³	Mean weight [g]		
1	0.000	0			0.000	0					0.000	0								0.000	0		0.000	0			
2	0.000	0			53.271	759					0.000	0			904.318	489				957.589	504		1024.841	504			
3	1530.982	887			337.736	804					495.031	688			6043.632	761				8407.381	781		8997.837	781			
4	1217.909	1151			453.866	1071					2250.804	978			1116.958	1189				5039.536	1075		5393.466	1075			
5	327.627	1799			184.317	1627					1892.533	1266			272.821	1881				2677.298	1419		2865.326	1419			
6	160.705	2497			25.570	2554					411.962	1843			100.091	2707				698.328	2143		747.372	2143			
7	67.681	2661			9.589	3383					109.035	3284			25.937	3518				212.241	3119		227.147	3119			
8	28.309	2456			1.065	6052					17.520	4016			4.395	5111				51.289	3291		54.891	3291			
9	0.669	5948			0.000	3407					9.315	5684			2.101	4999				12.084	5579		12.933	5579			
10	0.318	9069			0.000	0					5.181	10700			3.994	5483				9.493	8450		10.160	8450			
11+	0.000	0			0.000	0					0.000	0								0.000	0		0.000	0			
SOP [t]	4007		0		1202		0			0			0		7299		0		0	18740			20056				
Landings (t)	3978		428		1199		372			6232					7299		294		256	20056		0	20056				

Year: 1997		Quarter: 2																							
Country	Denmark		Finland		Germany		Latvia		Poland		Russia		Sweden		Estonia		Lithuania		Total		Faroe	Grand Total	ALL		
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10-3	Mean weight [g]				Numbers *10 ³	Mean weight [g]
1	0 000	0			0.000	0													0.000	0		0.000	0		
2	7.022	478			36.257	596			2.768	263			144.343	494					190.390	510		219.421	510		
3	1498 167	955			359 979	771			450.202	675			3155.027	744					5463.375	798		6296.434	798		
4	608 189	1299			1320.787	1086			1213 482	966			1042.113	1000					4184 571	1061		4822 637	1061		
5	145.311	2211			634 496	1589			1012.561	1420			278.686	1734					2071.054	1569		2386.850	1569		
6	67 849	3091			157.977	2340			343.716	2593			140.122	2832					709 664	2631		817.874	2631		
7	64 609	3950			72.517	3496			259 856	3506			82 851	3558					479 833	3573		552 998	3573		
8	27.672	3992			7.769	5268			144.702	4593			21.965	3888					202.109	4460		232 927	4460		
9	5 045	4167							23.874	7553			10.336	5896					39.254	6682		45.240	6682		
10	0 827	8733							10 837	8830			4 050	5593					15.714	7991		18.110	7991		
11+	0 405	10719							0.000	0									0.405	10719		0 467	10719		
SOP [t]	3153		0		3406		0		5657		0		4804		0		0		17021				19616		
Landings (t)	2869		321		3324		604		5657				4805		716		1320		19616		0		19616		

Year: 1997		Quarter: 3		3																							
Country	Denmark	Finland		Germany		Latvia		Poland		Russia		Sweden		Estonia		Lithuania		Total		Faroe	Grand Total	ALL					
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]					
1	0.000	0							0.000	0					9.523	541			9.523	541		10.083	541				
2	21.564	889			9.686	714			18.922	262			358.208	711					408.380	699		432.393	699				
3	340.374	1150			22.671	1016			227.421	787			1125.182	968					1715.648	981		1816.532	981				
4	264.925	1604			10.750	1270			1045.734	1074			515.155	1185					1836.565	1183		1944.558	1183				
5	58.408	2368			5.960	2179			421.867	1565			123.636	1809					609.871	1698		645.733	1698				
6	40.995	3376			3.619	2879			279.433	2454			37.472	3074					361.518	2627		382.776	2627				
7	28.304	3834			0.479	3147			137.719	3548			18.470	4154					184.972	3651		195.849	3651				
8	4.752	3950							42.845	5172			7.020	4978					54.616	5041		57.828	5041				
9	1.066	5118							32.133	6668			0.617	4194					33.815	6574		35.804	6574				
10	0.348	6491							5.726	10319			2.479	5044					8.554	8634		9.056	8634				
11+	0.000	0							0.411	14433									0.411	14433		0.435	14433				
SOP (t)	1247		0		69		0		3643		0		2425		0		0		7384			7817.748					
Landings (t)	1125		136		67		101		3656				2425		128		180		7818		0	7818					

Table 5.5.1 (continued). Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches of eastern Baltic cod (Sub-div. 25-32) by Sub-division and quarter.

Sub-div. 25

Year: 1997		Quarter: 4																				Faroe	Grand Total		ALL
Country	Denmark	Finland		Germany		Latvia		Poland		Russia		Sweden		Estonia		Lithuania		Total					Numbers		
Age	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³		Mean weight [g]		
1	0.000	0							0.000	0			18.866	761					18.866	761			20.003	761	
2	15.711	905							20.630	257			407.834	695					444.175	682			470.947	682	
3	254.437	1171							241.412	812			1979.637	982					2475.486	985			2624.694	985	
4	202.478	1611							1334.546	1069			1418.839	1096					2955.861	1119			3134.023	1119	
5	42.947	2238							385.775	1612			624.076	1412					1052.798	1519			1116.255	1519	
6	25.076	3015							289.808	2457			125.035	2338					439.919	2455			466.435	2455	
7	14.716	3352							51.817	4186			55.518	3622					122.050	3829			129.407	3829	
8	2.581	3345							21.150	5963			10.262	4333					33.993	5272			36.041	5272	
9	0.358	4492							3.943	8548			10.664	4857					14.964	5821			15.866	5821	
10	0.087	6464							0.000	0			6.766	5781					6.853	5790			7.266	5790	
11+	0.000	0							0.000	0									0.000	0			0.000	0	
SOP (t)	870		0		0		0		3338		0		5307		0		0		9515				10089		
Landings (t)	778		178		42		277		3338				5309		51		115		10089		0		10089		

Year : 1997		Quarter: all																				Total		Faroe	Grand Total		ALL
Country	Denmark	Finland		Germany		Latvia		Poland		Russia		Sweden		Estonia		Lithuania		Numbers	Mean								
Age	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]							
1	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	28.389	687	0.000	0	0.000	0	28.389	687			31.041	687			
2	44.297	830	0.000	0	99.214	695	0.000	0	42.320	260	0.000	0	1814.702	580	0.000	0	0.000	0	2000.533	584			2187.411	584			
3	3623.960	960	0.000	0	720.386	794	0.000	0	1414.066	721	0.000	0	12303.478	811	0.000	0	0.000	0	18061.890	833			19749.127	833			
4	2293.499	1283	0.000	0	1785.403	1083	0.000	0	5844.568	1013	0.000	0	4093.064	1108	0.000	0	0.000	0	14016.533	1094			15325.875	1094			
5	574.293	1994	0.000	0	824.773	1602	0.000	0	3712.736	1378	0.000	0	1299.219	1617	0.000	0	0.000	0	6411.021	1510			7009.901	1510			
6	294.625	2800	0.000	0	187.166	2380	0.000	0	1324.918	2301	0.000	0	402.720	2670	0.000	0	0.000	0	2209.429	2441			2415.821	2441			
7	175.310	3384	0.000	0	82.585	3481	0.000	0	558.426	3536	0.000	0	182.775	3632	0.000	0	0.000	0	999.097	3522			1092.426	3522			
8	63.314	3276	0.000	0	8.834	5363	0.000	0	226.217	4786	0.000	0	43.642	4291	0.000	0	0.000	0	342.007	4458			373.955	4458			
9	7.138	4492	0.000	0	0.000	3407	0.000	0	69.264	6948	0.000	0	23.717	5305	0.000	0	0.000	0	100.119	6383			109.471	6383			
10	1.580	8182	0.000	0	0.000	0	0.000	0	21.744	9668	0.000	0	17.289	5563	0.000	0	0.000	0	40.813	7862			44.407	7862			
11+	0.405	10719	0.000	0	0.000	0	0.000	0	0.411	14433	0.000	0	0.000	0	0.000	0	0.000	0	0.816	12589			0.892	12589			
SOP (t)	9278		0		4677		0		18871		0		19834		0		0		52659				57579				
Landings (t)	8749		1061		4632		1354		18884		0		19838		1189		1871		57579		0		57579				

Year: 1997 BFAS WG

Table 5.5.1 (continued). Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches of eastern Baltic cod (Sub-div. 25-32) by Sub-division and quarter.

Sub-div. 26

Year: 1997		Quarter: 1																		Total		Faroe	Grand Total	ALL
Country	Denmark	Finland		Germany		Latvia		Poland		Russia		Sweden		Estonia		Lithuania				Numbers	Mean		Numbers	Mean
Age	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]
1	0.000	0				0.000	0													0.000	0		0.000	0
2	0.000	0				0.000	0	0.000	0	0.000	0	30.036	670							30.036	670		34.155	670
3	61.704	863				35.571	675	297.473	688	15.900	447	415.655	870							828.303	787		939.609	787
4	45.890	1119				246.080	1123	1352.551	978	43.500	977	93.030	1206							1781.052	1013		2025.275	1013
5	13.840	2102				172.608	1595	1137.259	1266	169.400	1258	23.357	1914							1516.462	1320		1724.404	1320
6	9.748	2958				96.216	2023	247.556	1843	75.600	1646	8.911	2786							438.031	1892		498.096	1892
7	4.241	3246				25.658	2902	65.521	3284	28.100	2862	2.571	3583							126.091	3117		143.380	3117
8	1.764	3217				4.665	4313	10.528	4016	30.000	3412	0.425	4576							47.382	3638		53.879	3638
9	0.088	5987				1.749	5900	5.597	5684	15.800	4527	0.237	4698							23.471	4912		26.690	4912
10	0.047	9069				0.583	6500	3.113	10700	11.300	5992	0.496	4584							15.539	6919		17.670	6919
11+	0.000	0						0.000	0											0.000	0		0.000	0
SOP [t]	183		0		0	879		3745		709		578		0		0				6094			6930	
Landings (t)	182		62		74	879		3745		709		578		9		693				6930		0	6930	

Year: 1997		Quarter: 2																		Total		Faroe	Grand Total	ALL
Country	Denmark	Finland		Germany		Latvia		Poland		Russia		Sweden		Estonia		Lithuania				Numbers	Mean		Numbers	Mean
Age	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]
1	0.000	0				0.000	0													0.000	0		0.000	0
2	0.583	478				0.000	0	0.114	249	18.880	555	8.239	525							27.816	543		31.818	543
3	118.300	839				72.278	394	87.719	818	31.940	595	262.613	812							572.850	774		655.260	774
4	45.654	1280				179.884	857	435.991	1197	23.783	1018	111.840	1094							797.152	1105		911.831	1105
5	10.309	2149				353.923	1302	814.596	1734	186.750	1246	38.880	1812							1404.458	1565		1606.503	1565
6	4.684	3042				128.702	2070	431.120	2741	127.642	1870	21.867	2567							714.015	2461		816.733	2461
7	4.241	3814				19.494	3282	214.873	3806	42.742	2629	11.657	2797							293.008	3580		335.160	3580
8	1.818	3881				2.812	4229	137.910	4624	25.490	4198	3.158	2880							171.186	4514		195.813	4514
9	0.308	4083				2.308	7567	21.247	6846	11.859	5214	0.700	4438							36.422	6291		41.662	6291
10	0.048	8733				2.577	8133	0.000	0	4.944	6894	0.166	5300							7.735	7284		8.847	7284
11+	0.027	10719						0.000	0											0.027	10719		0.031	10719
SOP [t]	231		0		0	1024		4789		840		512		0		0				7397			8461	
Landings (t)	210		104		92	1024		4789		826		512		129		501				8186		275	8461	

Year: 1997		Quarter: 3																		Total		Faroe	Grand Total	ALL
Country	Denmark	Finland		Germany		Latvia		Poland		Russia		Sweden		Estonia		Lithuania				Numbers	Mean		Numbers	Mean
Age	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]
1	0.000	0				0.000	0					0.538	646							0.538	646		0.722	646
2	2.212	970				0.000	0	5.052	292	3.460	310	22.534	820							33.257	697		44.635	697
3	39.784	1255				52.413	493	92.509	676	16.691	520	74.855	1156							276.252	845		370.755	845
4	36.479	1749				94.682	960	417.785	1001	34.704	948	33.783	1400							617.433	1058		828.651	1058
5	10.179	2484				179.614	1373	233.180	1475	73.777	1438	7.763	1926							504.493	1461		677.076	1461
6	8.077	3437				73.308	1995	136.788	2485	35.723	2073	2.422	2809							256.318	2320		344.002	2320
7	5.784	3791				11.144	3375	93.033	3460	15.749	2851	1.182	3475							126.892	3392		170.300	3392
8	0.936	3499				2.082	4258	24.742	4887	8.875	4157	0.339	4332							36.974	4636		49.622	4636
9	0.191	4667				1.254	7600	24.403	6515	2.333	5454	0.050	3947							28.231	6458		37.889	6458
10	0.068	6453				1.398	8133	4.646	10319	2.298	7575	0.170	3712							8.580	9067		11.515	9067
11+	0.000	0						0.333	14433											0.333	14433		0.447	14433
SOP [t]	195		0		0	577		1820		335		181		0		0				3108			4172	
Landings (t)	177		145		206	577		1831		335		181				395				3847		325	4172	

Table 5.5.1 (continued). Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches of eastern Baltic cod (Sub-div. 25-32) by Sub-division and quarter.

Sub-div. 26

SUB-CH: 20

Year: 1997		Quarter: 4																				Faroe	Grand Total	ALL
Country	Denmark	Finland		Germany		Latvia		Poland		Russia		Sweden		Estonia		Lithuania		Total						
Age	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]				
1	0.000	0				0.000	0					22.890	532					22.890	532			28.345	532	
2	0.355	1395				11.478	304	14.212	270	9.457	412	86.733	716					122.235	604			151.362	604	
3	10.451	1547				243.525	746	163.513	701	75.983	820	314.590	1092					808.062	889			1000.616	889	
4	13.351	1962				381.390	1064	724.471	1030	271.971	1201	166.032	1106					1557.216	1084			1928.285	1084	
5	4.742	2554				272.881	1721	250.302	1579	180.051	1528	58.557	1532					766.533	1620			949.191	1620	
6	4.069	3565				39.476	2294	255.698	2505	39.899	2160	12.969	2710					352.111	2462			436.015	2462	
7	3.017	4031				81.325	2348	35.698	4437	22.456	2981	5.912	3901					148.409	3043			183.774	3043	
8	0.498	4147				20.881	4994	11.761	6071	10.950	4332	1.078	4424					45.168	5091			55.930	5091	
9	0.129	5215				12.268	6900	2.090	8192	4.932	5628	1.202	4878					20.621	6598			25.534	6598	
10	0.045	6492				6.303	6500	0.000	0	0.939	7122	0.937	5316					8.224	6436			10.184	6436	
11+	0.000	0						0.000	0									0.000	0			0.000	0	
SOP [t]	85		0		0	1572		2147		903		765		0		0		5472				6776		
Landings (t)	77		118		22	1572		2147		934		765				1141		6776		0		6776		

Year: 1997		Quarter: all																				Total		Faroe	Grand Total	ALL
Country	Denmark	Finland		Germany		Latvia		Poland		Russia		Sweden		Estonia		Lithuania										
Age	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]						
1	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	23.429	535	0.000	0	0.000	0	23.429	535			27.958	535		
2	3.150	927	0.000	0	0.000	0	11.478	304	19.378	275	31.796	486	147.542	712	0.000	0	0.000	0	213.345	620			254.591	620		
3	230.239	1001	0.000	0	0.000	0	403.787	644	641.215	707	140.514	691	1067.714	941	0.000	0	0.000	0	2483.468	824			2963.596	824		
4	141.374	1413	0.000	0	0.000	0	902.036	1028	2930.799	1026	373.958	1140	404.686	1150	0.000	0	0.000	0	4752.852	1058			5671.719	1058		
5	39.070	2269	0.000	0	0.000	0	979.024	1483	2435.318	1475	609.977	1356	128.557	1710	0.000	0	0.000	0	4191.947	1474			5002.374	1474		
6	26.578	3211	0.000	0	0.000	0	337.702	2067	1071.162	2444	278.863	1877	46.169	2662	0.000	0	0.000	0	1760.475	2299			2100.827	2299		
7	17.283	3705	0.000	0	0.000	0	137.621	2667	409.125	3699	109.047	2794	21.322	3236	0.000	0	0.000	0	694.399	3338			828.647	3338		
8	5.016	3603	0.000	0	0.000	0	30.440	4769	184.942	4716	75.314	3899	4.997	3456	0.000	0	0.000	0	300.709	4478			358.845	4478		
9	0.716	4677	0.000	0	0.000	0	17.579	6938	53.337	6625	34.925	4978	2.188	4696	0.000	0	0.000	0	108.745	6095			129.769	6095		
10	0.208	7579	0.000	0	0.000	0	10.860	7098	7.760	10472	19.482	6462	1.768	4955	0.000	0	0.000	0	40.078	7350			47.827	7350		
11+	0.027	10719	0.000	0	0.000	0	0.000	0	0.333	14433	0.000	0	0.000	0	0.000	0	0.000	0	0.360	14155			0.430	14155		
SOP [t]	694	0	0	0	4052	12502	2787	2036	0	0	2036	0	0	0	0	0	22071					26338				
Landings (t)	646	429	393	4052	12512	2803	2035	138	2730		25738	600					26338									

Year: 1997 BFAS WG

Table 5.5.1 (continued). Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches of eastern Baltic cod (Sub-div. 25-32) by Sub-division and quarter.

Sub-div. 27

Year: 1997		Quarter: 1																		Total		Unallocated	Grand Total		ALL	
Country	Denmark	Finland		Germany		Latvia		Poland		Russia		Sweden		Unspecified		Unspecified		Numbers	Mean				Numbers	Mean		
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10-3	Mean weight [g]	Numbers *10 ³	Mean weight [g]				
1	0.000	0																0.000	0		0.000	0				
2	0.000	0											85.013	613				85.013	613		88.700	613				
3	7.148	879											1027.618	789				1034.766	789		1079.644	789				
4	5.546	1138											203.524	1182				209.070	1181		218.138	1181				
5	1.444	1791											65.455	1972				66.899	1968		69.800	1968				
6	0.703	2495											29.307	2572				30.010	2570		31.311	2570				
7	0.296	2650											6.981	2986				7.277	2972		7.592	2972				
8	0.125	2447											0.989	3608				1.114	3477		1.162	3477				
9	0.002	5812											0.965	4004				0.967	4008		1.009	4008				
10	0.001	9069											1.505	3770				1.506	3774		1.572	3774				
11+	0.000	0																0.000	0		0.000	0				
SOP [t]	18		0		0		0		0		0		1342		0		0	1360			1419					
Landings (t)	18		59										1342					1419		0		1419				

Year: 1997		Quarter: 2																				Total		Unallocated	Grand Total	ALL
Country		Denmark		Finland		Germany		Latvia		Poland		Russia		Sweden		Unspecified		Unspecified								
Age		Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10-3	Mean weight [g]	Numbers *10 ³	Mean weight [g]			
1		0.000	0																	0.000	0		0.000	0		
2		0.000	0											16.083	610					16.083	610		16.970	610		
3		0.025	1273											495.859	827					495.884	827		523.223	827		
4		0.021	1518											185.065	1059					185.088	1059		195.290	1059		
5		0.016	3668											51.891	1821					51.907	1821		54.769	1821		
6		0.013	5026											27.841	2672					27.854	2673		29.389	2673		
7		0.027	5424											14.920	3137					14.947	3141		15.771	3141		
8		0.010	5848											3.404	3411					3.414	3418		3.602	3418		
9		0.003	4769											1.256	5146					1.259	5145		1.328	5145		
10		0.001	8733											0.698	5515					0.699	5520		0.738	5520		
11+		0.000	10719																	0.000	10719		0.000	10719		
SOP (t)		0		0		0		0		0		0		853		0		0		854			901			
Landings (t)		0		47										854						901		0	901			

Year: 1997		Quarter: 3																		3																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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Table 5.5.1 (continued). Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches of eastern Baltic cod (Sub-div. 25-32) by Sub-division and quarter.

Sub-div. 27

SUP-GR: 27

Year: 1997		Quarter: 4																Total		Unallocated	Grand Total		ALL	
Country	Denmark	Finland		Germany		Latvia		Poland		Russia		Sweden		Unspecified		Unspecified		Numbers	Mean		Numbers	Mean		
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]				
1	0.000	0											2.863	575			2.863	575		2.838	575			
2	0.089	1398											15.438	767			15.527	771		15.390	771			
3	2.604	1543											75.052	1116			77.656	1130		76.972	1130			
4	3.199	1901											38.442	1131			41.641	1190		41.273	1190			
5	0.952	2259											14.486	1524			15.438	1569		15.302	1569			
6	0.564	2889											3.223	2718			3.787	2743		3.754	2743			
7	0.306	3177											1.523	3979			1.829	3845		1.813	3845			
8	0.056	3186											0.253	3933			0.309	3797		0.307	3797			
9	0.006	4154											0.330	4454			0.336	4448		0.333	4448			
10	0.001	6448											0.224	4342			0.225	4352		0.223	4352			
11+	0.000	0															0.000	0		0.000	0			
SOP [t]	15		0		0		0		0		0		181		0		0	196			194			
Landings (t)	13												181					194		0	194			

Year :		1997 Quarter: all																		Total		Unallocated	Grand Total		ALL	
Country		Denmark		Finland		Germany		Latvia		Poland		Russia		Sweden		Unspecified		Unspecified								
Age		Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]					
1		0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	2.942	575	0.000	0	0.000	0	2.942	575					
2		0.450	945	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	120.430	638	0.000	0	0.000	0	120.880	639					
3		14.919	1057	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	1615.512	818	0.000	0	0.000	0	1630.431	821					
4		12.176	1425	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	435.515	1127	0.000	0	0.000	0	447.691	1135					
5		2.953	2018	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	133.970	1863	0.000	0	0.000	0	136.923	1866					
6		1.560	2740	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	61.301	2635	0.000	0	0.000	0	62.861	2637					
7		0.791	3064	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	23.815	3158	0.000	0	0.000	0	24.606	3155					
8		0.219	2881	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	4.752	3499	0.000	0	0.000	0	4.971	3472					
9		0.014	4522	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	2.558	4622	0.000	0	0.000	0	2.572	4622					
10		0.004	7671	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	2.483	4325	0.000	0	0.000	0	2.487	4330					
11+		0.000	10719	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	10719					
SOP (t)		47		0		0		0		0		0		2417		0		0		2464						
Landings (t)		44		106				0		0		0		2417		0		0		2567						

Year: 1997 BFAS WG

Table 5.5.1 (continued). Numbers at age (CANUM) and mean weight at age (WECA) in commercial catches of eastern Baltic cod (Sub-div. 25-32) by Sub-division and quarter.

Sub-div. 28

Year: 1997		Quarter: 1																		Total		Unallocated	Grand Total	ALL
Country	Denmark	Finland		Germany		Latvia		Poland		Russia		Sweden		Estonia		Unspecified		Numbers	Mean					
Age	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]
1	0.000	0					0.000	0											0.000	0			0.000	0
2	0.000	0					0.000	0					15.070	670					15.070	670			18.579	670
3	52.005	842					6.551	675					208.547	870					267.103	860			329.299	860
4	36.207	1078					45.320	1123					46.676	1206					128.203	1141			158.056	1141
5	7.844	1744					31.788	1595					11.719	1914					51.351	1691			63.309	1691
6	3.607	2626					17.720	2023					4.471	2786					25.798	2240			31.805	2240
7	1.596	2817					4.725	2902					1.290	3583					7.611	3000			9.383	3000
8	0.711	2445					0.859	4313					0.213	4576					1.783	3600			2.199	3600
9	0.037	6234					0.322	5900					0.119	4698					0.478	5627			0.589	5627
10	0.034	9069					0.107	7600					0.249	4584					0.390	5805			0.481	5805
11+	0.000	0																	0.000	0			0.000	0
SOP [t]	113		0		0		162		0		0		290		0		0		565				696	
Landings (t)	111		0		128		162						290		5				696		0		696	

Year: 1997		Quarter: 2																									
Country	Denmark	Finland		Germany		Latvia		Poland		Russia		Sweden		Estonia		Unspecified		Total		Unallocated	Grand Total	ALL					
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³				Mean weight [g]				
1	0.000	0					0.000	0											0.000	0		0.000	0				
2	0.369	478					0.000	0					1.352	525					1.721	515		2.024	515				
3	94.180	1006					9.999	394					43.085	812					147.264	908		173.236	908				
4	44.257	1346					9.143	849					18.349	1094					71.748	1218		84.402	1218				
5	11.101	2148					26.252	1316					6.379	1812					43.732	1599		51.445	1599				
6	5.090	2835					14.239	2080					3.588	2567					22.917	2324		26.958	2324				
7	3.879	3481					2.186	3328					1.913	2797					7.977	3275		9.384	3275				
8	1.819	3453					0.959	4050					0.518	2880					3.296	3537		3.877	3537				
9	0.276	3836					0.000	0					0.115	4438					0.391	4013		0.460	4013				
10	0.038	8733					0.000	0					0.027	5300					0.065	7300		0.077	7300				
11+	0.015	10719																	0.015	10719		0.018	10719				
SOP [t]	214		0		0		87		0		0		84		0		0		385			453					
Landings (t)	195		17		60		87						84		10				453		0	453					

Year: 1997		Quarter: 3		3																						
Country	Denmark	Finland		Germany		Latvia		Poland		Russia		Sweden		Estonia		Unspecified		Total		Unallocated	Grand Total	ALL				
Age	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10 ³	Mean weight [g]	Numbers *10-3	Mean weight [g]	Numbers *10 ³	Mean weight [g]				
1	0.000	0					0.000	0					0.407	646					0.407	646		0.422	646			
2	0.332	912					0.000	0					17.056	820					17.388	822		18.027	822			
3	5.452	1185					16.227	516					56.658	1156					78.337	1025		81.216	1025			
4	4.606	1703					18.986	1020					25.571	1400					49.163	1281		50.969	1281			
5	1.285	2604					20.087	1405					5.876	1926					27.247	1574		28.249	1574			
6	1.248	3627					8.595	1727					1.833	2809					11.677	2100		12.106	2100			
7	0.896	3949					1.177	1960					0.894	3475					2.967	3018		3.076	3018			
8	0.142	3632					0.454	4517					0.257	4332					0.853	4314		0.884	4314			
9	0.033	4777					0.051	8700					0.038	3947					0.122	6159		0.126	6159			
10	0.013	6457					0.051	8133					0.128	3712					0.192	5067		0.199	5067			
11+	0.000	0																	0.000	0		0.000	0			
SOP (t)	27		0		0		76		0		0		137		0		0		240			248				
Landings (t)	24		9		2		76						137						248		0	248				

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Year :		1997		Quarter: all																											
Country	Denmark	Finland		Germany		Latvia		Poland		Russia		Sweden		Estonia		Unspecified		Total Numbers *10 ⁻³	Mean weight [g]	Unallocated	Grand Total Numbers *10 ³	ALL Mean weight [g]									
Age	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³	Mean weight [g]	Numbers *10 ⁻³						Mean weight [g]								
1	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	8.127	538	0.000	0	0.000	0	8.127	538		9.447	538								
2	0.763	716	0.000	0	0.000	0	1.839	304	0.000	0	0.000	0	62.729	729	0.000	0	0.000	0	65.331	717		75.939	717								
3	152.921	960	0.000	0	0.000	0	138.752	515	0.000	0	0.000	0	414.387	960	0.000	0	0.000	0	706.060	872		820.713	872								
4	86.371	1260	0.000	0	0.000	0	270.728	997	0.000	0	0.000	0	146.591	1188	0.000	0	0.000	0	503.690	1097		585.481	1097								
5	20.575	2025	0.000	0	0.000	0	156.991	1416	0.000	0	0.000	0	43.722	1728	0.000	0	0.000	0	221.288	1534		257.221	1534								
6	10.153	2861	0.000	0	0.000	0	59.648	1928	0.000	0	0.000	0	14.268	2711	0.000	0	0.000	0	84.067	2173		97.718	2173								
7	6.490	3380	0.000	0	0.000	0	20.652	2814	0.000	0	0.000	0	6.091	3425	0.000	0	0.000	0	33.233	3036		38.630	3036								
8	2.693	3196	0.000	0	0.000	0	5.451	4353	0.000	0	0.000	0	1.351	3839	0.000	0	0.000	0	9.495	3951		11.037	3951								
9	0.349	4184	0.000	0	0.000	0	2.480	4768	0.000	0	0.000	0	0.677	4720	0.000	0	0.000	0	3.505	4700		4.075	4700								
10	0.086	8507	0.000	0	0.000	0	1.078	7540	0.000	0	0.000	0	0.720	4777	0.000	0	0.000	0	1.884	6527		2.189	6527								
11+	0.015	10719	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.000	0	0.015	10719		0.017	10719								
SOP [t]	360	0	0	0	0	0	781	0	0	0	0	769	0	0	0	0	0	1910	0	0	2220	0									
Landings (t)	336	56	190	781	0	0	770	87	2220	0	0	2220	87	2220	0	0	0	2220	0	0	2220	0									

Table 5.5.2. International sampling of cod commercial and research catches in 1997, (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	25-29	Landings (t)	4289	3274	1338	873	9774
		Samples(n)	29	15	14	2	60
		Measured(n)	4993	4083	2638	173	11887
		Aged (n)	475	396	349	64	1284
SWEDEN COMMERCIAL							
Species	Sub-div.		1.Quarter	2.Quarter	3.Quarter	4.Quarter	Total
Cod	25	Landings (t)	7299	4805	2425	5309	19838
		Samples(n)	36	36	47	70	189
		Measured(n)	10411	10056	12079	19574	52120
		Aged (n)	663	662	621	490	2436
	26+28	Landings (t)	870	602	319	1026	2817
		Samples(n)	12	17	5	9	43
		Measured(n)	3183	3730	1246	2999	11158
		Aged (n)	448	459	48	200	1155
	27	Landings (t)	1342	854	41	181	2417
		Samples(n)	24	22	5	11	62
		Measured(n)	4621	5074	668	1579	11942
		Aged (n)	407	409	200	235	1251
GERMANY-COMMERCIAL							
Species	Sub-div.		1.Quarter	2.Quarter	3.Quarter	4.Quarter	Total
Cod	25	Landings (t)	1199	3324	67	42	4632
		Samples(n)	51	41	7		99
		Measured(n)	11750	12312	1965		26027
		Aged (n)	447	805	140		1392
GERMANY-RESEARCH							
Species	Sub-div.		1.Quarter	2.Quarter	3.Quarter	4.Quarter	Total
Cod	25	Landings (t)	1199	3324	67	42	4632
		Samples(n)	4				4
		Measured(n)	235				235
		Aged (n)	188				188
RUSSIA-COMMERCIAL AND RESEARCH							
Species	Sub-div.		1.Quarter	2.Quarter	3.Quarter	4.Quarter	Total
Cod	26	Landings (t)	709	826	335	1610	3480
		Samples(n)	16	17	60	25	118
		Measured(n)	3197	3436	11892	4872	23397
		Aged (n)	1076	351	689	519	2635
LATVIA-COMMERCIAL AND RESEARCH							
Species	Sub-div.		1.Quarter	2.Quarter	3.Quarter	4.Quarter	Total
Cod	25	Landings (t)	372	604	101	277	1354
		Samples(n)	3				3
		Measured(n)	1820				1820
		Aged (n)					0
Cod	26	Landings (t)	879	1024	577	1572	4052
		Samples(n)	5	3	34	16	58
		Measured(n)	1194	1757	12545	3260	18756
		Aged (n)	120	148	731	416	1415
Cod	28	Landings (t)	162	87	76	456	781
		Samples(n)		7	12	7	26
		Measured(n)		1250	1473	4164	6887
		Aged (n)		281	230	840	1351
POLAND-COMMERCIAL AND RESEARCH							
Species	Sub-div.		1.Quarter	2.Quarter	3.Quarter	4.Quarter	Total
Cod	25	Landings (t)	6232	5657	3656	3338	18883
		Samples(n)	52	8		8	68
		Measured(n)	1276	6575		2546	10397
		Aged (n)	705	315		212	1232
	26	Landings (t)	3745	4789	1831	2147	12512
		Samples(n)	7	39	8	24	78
		Measured(n)	5117	13719	3168	4555	26559
		Aged (n)	1403	546	535	158	2642

Table 5.6.1 Sex specific and combined mean weight at age in the stock (WEST) and numbers sampled by Sub-division for the years 1995-98. Data provided by Denmark and Sweden from surveys in the 1 Quarter of each year.

Year	Country	SD	Sex		1	2	3	4	5	6	7	8+
1995	SWE	25	F	Mean weight	44	219	593	1198	1537	5240		
				Number	43	71	126	116	26	1		
			M	Mean weight	47	212	586	965	1037	1345	6545	
				Number	58	81	109	65	6	1	1	
1995	DEN	25	F	Mean weight	70	296	842	1595	2147	3640	3215	7417
				Number	13	91	116	99	49	9	2	6
			M	Mean weight	69	292	703	1117	1771			
				Number	12	79	68	37	11			
1995	SWE	26	F	Mean weight		362	716	1652	3043		4245	
				Number		9	23	28	14		1	
			M	Mean weight		308	613	1524	2699			
				Number		14	27	12	10			
1995	DEN	26	F	Mean weight		325	898	1540	2425	3088	3129	9392
				Number		65	101	64	29	20	6	4
			M	Mean weight		321	680	1258	2107	2503		4107
				Number		70	51	31	5	6		5
1995	SWE	27	F	Mean weight	111	261	974	1277	2733	6090		3514
				Number	1	21	33	16	9	2		3
			M	Mean weight	126	292	947	1308	1926	2118	2690	
				Number	1	18	19	8	4	3	1	
1995	SWE	28	F	Mean weight	27	237	388	1680	2607	3470		4663
				Number	5	24	12	5	6	1		2
			M	Mean weight	24	239	735	1393	1561		4590	
				Number	2	30	5	3	3		1	
1995	DEN	28	F	Mean weight		294	904	1400	2401	4747	4650	
				Number		62	47	35	12	5	1	
			M	Mean weight		293	767	1291	1896	1984	1991	
				Number		62	37	21	8	2	2	
1996	SWE	25	F	Mean weight	94	182	374	857	1374	1849	3335	3941
				Number	2	73	76	64	71	58	26	3
			M	Mean weight	83	190	389	865	1190	1812	2677	4768
				Number	1	87	82	77	45	29	3	2
1996	DEN	25	F	Mean weight	43	328	957	1519	2154	2772	2781	7592
				Number	1	127	95	64	70	38	9	12
			M	Mean weight		311	859	1245	1701	2077	2632	
				Number		105	72	48	30	10	3	
1996	SWE	26	F	Mean weight		176	458	1062	1658	2283	2887	3944
				Number		7	12	12	23	19	14	7
			M	Mean weight	10	415	517	1012	1480	2053	2740	
				Number	1	12	18	42	19	7	7	
1996	DEN	26	F	Mean weight		4337	1147	1831	2164	3655	3666	8562
				Number		47	79	43	34	20	4	12
			M	Mean weight		449	934	1257	2964	2612	3637	
				Number		34	41	16	6	3	4	
1996	SWE	27	F	Mean weight	114	265	1076	1967	2337	3242	3770	
				Number	2	30	27	19	14	9	6	
			M	Mean weight		452	848	1348	2209	3133	2516	3823
				Number		26	29	13	8	8	2	2
1996	SWE	28	F	Mean weight	136	256	523	1843	2501	1780	2530	1445
				Number	5	52	27	20	11	3	1	1
			M	Mean weight	134	245	850	1289	1816	1437	2278	
				Number	2	32	8	5	3	2	2	
1996	DEN	28	F	Mean weight		337	900	1421	2349	3118		1985
				Number		30	23	7	3	4		1
			M	Mean weight		307	630	1328		3498	3230	12100
				Number		44	42	13		2	1	1

Table 5.6.1 Sex specific and combined mean weight at age in the stock (WEST) and numbers sampled by Sub-division for the years 1995-98. Data provided by Denmark and Sweden from surveys in the 1 Quarter of each year.

Year	Country	SD	Sex		1	2	3	4	5	6	7	8+
1997	SWE	25	F	Mean weight	59	254	725	937	1784	3425	4710	4213
				Number	34	64	143	63	24	14	3	2
			M	Mean weight	60	238	664	912	1635	2315	3134	
				Number	37	62	101	37	10	4	1	
1997	DEN	25	F	Mean weight	55	204	861	1199	2009	3786	9520	7422
				Number	2	61	267	80	20	12	2	3
			M	Mean weight	66	241	794	1003	1691	4160	2885	4288
				Number	3	66	239	71	12	7	1	2
1997	SWE	26	F	Mean weight		223	437	1025	1550	2674	3194	3855
				Number		20	28	18	9	6	3	3
			M	Mean weight		225	430	916	1391	2538	3131	3350
				Number		16	22	26	12	8	3	1
1997	DEN	26	F	Mean weight		314	835	2141	2198	3355	4653	6490
				Number		40	47	15	5	7	5	1
			M	Mean weight		242	518	1987	1207	2856	3900	3615
				Number		55	40	6	2	3	1	1
1997	SWE	27	F	Mean weight		252	573	889	1823	2322	3176	4572
				Number		5	1	34	13	12	5	3
			M	Mean weight		298	627	979	1546	2124	2768	3803
				Number		4	12	19	16	13	7	5
1997	SWE	28	F	Mean weight	50	169	267	824	1591	1941	2650	3565
				Number	1	26	20	13	7	3	1	1
			M	Mean weight		181	324	745	1285	1804	2129	3654
				Number		25	14	10	4	2	7	1
1997	DEN	28	F	Mean weight		261	785	1101	1944		3740	
				Number		39	67	20	3		1	
			M	Mean weight		275	678	1182	2730	1918		
				Number		35	46	11	1	4		
1998	SWE	25	F	Mean weight	45	232	448	1436	1733	4579	5173	8874
				Number	22	109	71	55	25	7	4	8
			M	Mean weight	46	241	420	1161	1745	3284	4734	7405
				Number	25	103	73	55	14	6	2	4
1998	DEN	25	F	Mean weight	75	239	603	1658	3073	4059	7198	7058
				Number	50	222	129	62	11	6	7	2
			M	Mean weight	72	260	554	1369	2373		2840	3125
				Number	58	269	135	77	11		1	1
1998	SWE	26	F	Mean weight	17	174	362	974	1609	2460	3479	3860
				Number	4	2	1	2	4	5	2	1
			M	Mean weight	15	162	894	1102	1304	2230	2840	
				Number	1	2	1	19	9	4	1	
1998	DEN	26	F	Mean weight		259	657	1074	1514	3249	4423	7684
				Number		72	125	108	48	28	19	6
			M	Mean weight	45	259	696	1046	1322	2174	3878	4718
				Number	2	101	165	112	37	11	16	4
1998	SWE	27	F	Mean weight		223	363	1354	1621			
				Number		15	6	3	2			
			M	Mean weight		217	390	1080	1492	2849		
				Number		12	4	6	2	1		
1998	SWE	28	F	Mean weight	99	204	376	1035	1492	2120		2779
				Number	11	42	14	21	6	3		1
			M	Mean weight	72	182	447	933	1575	2141		4489
				Number	21	23	13	9	3	2		2
1998	DEN	28	F	Mean weight		224	310	602	2175	2688	6885	
				Number		27	47	16	1	2	1	
			M	Mean weight		225	323	788	2170	1250		
				Number		28	35	18	3	2		

Table 5.6.2. Available data on mean weight in stock (WEST) per Country, Sub-division and year including number of fishes measured. Mean weight based on females and males and weighted according to sexratio (see table 5.6.1)

Year	Country	SD		1	2	3	4	5	6	7	8	9	10+
1995	SWE	25	m.w (g)	46	215	590	1088	1382	3215	6545			
			n.o	101	152	235	181	32	2	1			
1995	DEN	25	m.w (g)	45	294	783	1379	2027	3640	3215	5825	5565	9095
			n.o	1	135	184	136	60	9	2	2	1	3
1995	GER	25	m.w (g)	96	165	437	883	1359	2387	3205			
			n.o	56	228	101	53	116	31	11			
1995	SWE	26	m.w (g)		329	660	1612	2851		4245			
			n.o	0	23	50	40	24	0	1			
1995	DEN	26	m.w (g)	40	423	812	1435	2376	2965	3129	4826	5649	8515
			n.o	1	135	152	95	34	26	6	2	4	3
1995	SWE	27	m.w (g)	115	275	964	1287	2418	4223	2690			
			n.o	2	39	52	24	13	5	1			
1995	SWE	28	m.w (g)	26	239	461	1585	2345	3470	4590			
			n.o	7	54	17	8	9	1	1			
1995	DEN	28	m.w (g)		294	840	1374	2191	4104	3173			
			n.o		124	84	57	20	7	3			
1996	SWE	25	m.w (g)	90	186	382	861	1287	1835	3276			
			n.o	3	160	158	141	116	87	29			
1996	DEN	25	m.w (g)	22	320	914	1387	1965	2522	2739	4136		
			n.o	4	232	167	112	100	48	12	7		
1996	GER	25	m.w (g)	121	255	569	1009	1510	2644	3667			
			n.o	12	179	130	170	141	53	10			
1996	SWE	26	m.w (g)	10	271	478	1033	1574	2210	2834			
			n.o	1	19	30	54	42	26	21			
1996	DEN	26	m.w (g)		442	1073	1571	2259	3479	3654	4500	4770	14556
			n.o		81	120	59	40	23	8	6	1	5
1996	SWE	27	m.w (g)	114	351	960	1694	2292	3187	3394			
			n.o	2	56	56	32	22	17	8			
1996	SWE	28	m.w (g)	135	251	706	1488	2199	1666	2437			
			n.o	7	84	35	25	14	5	3			
1996	DEN	28	m.w (g)		327	753	1373	2349	3056	3230	1985		12100
			n.o		44	42	13	3	6	1	1		1
1997	SWE	25	m.w (g)	46	215	590	1088	1382	3215	6545			
			n.o	101	152	235	181	32	2	1			
1997	DEN	25	m.w (g)	21	217	830	1095	1865	3895	7861	9310	4288	3645
			n.o	44	134	506	151	32	19	3	2	2	1
1997	SWE	26	m.w (g)		224	434	960	1455	2596	3162			
			n.o		36	50	44	21	14	6			
1997	DEN	26	m.w (g)		274	696	2044	1875	3275	4492	3615		
			n.o		96	88	35	9	11	6	1		
1997	LAT	26	m.w (g)		102	309	1191	1418	2586	4324	4206	7015	9100
			n.o		7	56	25	23	18	7	5	2	2
1997	SWE	27	m.w (g)		272	604	920	1657	2217	2927			
			n.o		9	22	53	29	25	12			
1997	SWE	28	m.w (g)	50	175	293	791	1481	1867	2197			
			n.o	1	51	34	23	11	5	8			
1997	DEN	28	m.w (g)		268	743	1127	2140	1918	3740			
			n.o		75	113	31	4	4	1			
1997	LAT	28	m.w (g)		145	195	605	1206	2275	5085			
			n.o		15	94	26	29	2	8	5		
1998	SWE	25	m.w (g)	45	237	434	1296	1737	3996	5010			
			n.o	47	212	144	110	39	13	6			
1998	DEN	25	m.w (g)	69	250	577	1499	2711	4059	6653	5747		
			n.o	151	492	264	139	22	6	8	3		
1998	SWE	26	m.w (g)	16	168	628	1091	1392	2359	3204			
			n.o	5	4	2	21	13	9	3			
1998	DEN	26	m.w (g)	15	259	679	1096	1430	2931	4154	7236		6196
			n.o	15	173	290	220	85	39	35	6		4
1998	SWE	27	m.w (g)		221	375	1170	1556	2849				
			n.o		27	10	9	4	1				
1998	SWE	28	m.w (g)	81	198	407	1003	1519	2128				
			n.o	32	65	27	30	9	5				
1998	DEN	28	m.w (g)		224	315	683	2173	1969	6885			
			n.o		55	82	34	4	4	1			

Table 5.6.3 'WEST, mean weight in stock/year from data provided by Denmark, Germany, Latvia and Sweden (see table 5.6.2). Average mean weights for Sub-division 25-28 combined are calculated based on survey indices of stock abundance for each age group. Values for 1995-97 are the arithmetic mean of the years included.

Year	Age									
	1	2	3	4	5	6	7	8	9	10+
1995	43.4	343.5	691.8	1284.2	2224.2	3016.3	3347.3	4844.9	5647.5	8526.2
1996	64.6	241.1	699.8	932.1	1511.0	2325.9	2954.7	4400.4	4770.0	14556.0
1997	40.5	241.5	562.6	1198.8	1528.4	2912.4	4214.3	7005.5	5904.0	3645.0
1998	62.2	244.1	547.9	1229.9	1595.0	2963.1	4624.1	6848.3	0.0	6196.3
1995-97	49.5	275.4	651.4	1138.3	1754.5	2751.6	3505.4	5417.0	5440.5	8909.1

Table 5.7.1. Distribution of the eastern Baltic cod stock between Sub-division 25, 26 and 28 during different time periods - based on abundance indices from the Baltic International Trawl Survey.

Period	Subdiv.	Age							
		1	2	3	4	5	6	7	8+
1980-1984	25	0.06	0.10	0.23	0.29	0.21	0.12	0.10	0.08
	26	0.80	0.32	0.26	0.23	0.35	0.38	0.42	0.35
	28	0.14	0.58	0.50	0.47	0.44	0.50	0.47	0.57
1985-1989	25	0.11	0.32	0.46	0.46	0.28	0.15	0.12	0.07
	26	0.83	0.40	0.32	0.36	0.43	0.43	0.49	0.50
	28	0.06	0.28	0.22	0.18	0.30	0.41	0.39	0.43
1990-1994	25	0.33	0.64	0.62	0.62	0.39	0.21	0.07	0.06
	26	0.65	0.25	0.29	0.30	0.51	0.60	0.67	0.82
	28	0.02	0.10	0.09	0.07	0.10	0.18	0.26	0.13
1995-1997	25	0.17	0.44	0.46	0.59	0.38	0.22	0.09	0.06
	26	0.82	0.46	0.46	0.39	0.60	0.72	0.78	0.87
	28	0.01	0.10	0.08	0.02	0.02	0.06	0.13	0.08

Table 5.7.2. Female and male maturity ogives, sex ratios and numbers sampled for the eastern Baltic cod stock during different time periods.

A. Female maturity ogives for the eastern Baltic cod stock.

Period	Age groups							
	1	2	3	4	5	6	7	8+
1980-1984	0.00	0.01	0.29	0.75	0.92	0.94	0.99	1.00
1985-1989	0.00	0.01	0.33	0.62	0.87	0.94	0.99	1.00
1990-1994	0.01	0.06	0.30	0.83	0.96	1.00	1.00	1.00
1995-1997	0.00	0.02	0.35	0.90	0.96	0.97	0.98	0.99

B. Male maturity ogives.

Period	Age groups							
	1	2	3	4	5	6	7	8+
1980-1984	0.01	0.11	0.62	0.85	0.95	0.97	0.97	0.98
1985-1989	0.01	0.18	0.67	0.84	0.97	0.97	0.96	0.98
1990-1994	0.03	0.50	0.86	0.92	0.99	1.00	1.00	0.95
1995-1997	0.02	0.24	0.70	0.93	0.97	0.97	0.97	0.97

C. Sex ratios (female proportion).

Period	Age groups							
	1	2	3	4	5	6	7	8+
1980-1984	0.49	0.39	0.49	0.60	0.69	0.71	0.59	0.65
1985-1989	0.51	0.39	0.50	0.51	0.55	0.66	0.54	0.64
1990-1994	0.27	0.51	0.47	0.57	0.58	0.75	0.68	0.81
1995-1997	0.43	0.50	0.54	0.50	0.61	0.70	0.72	0.86

D. Number of cod sampled.

Period	Age groups								Sum
	1	2	3	4	5	6	7	8+	
1980-1984									3965
1985-1989	138	781	858	578	309	176	78	63	2981
1990-1994	256	1127	1974	1431	862	406	177	198	6431
1995-1997	404	2881	3160	2156	1522	739	378	235	11475

E. Combined maturity ogives.

Period	Age groups							
	1	2	3	4	5	6	7	8+
1980-1984	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99
1985-1989	0.00	0.12	0.50	0.72	0.91	0.95	0.98	1.00
1990-1994	0.02	0.27	0.60	0.88	0.97	1.00	1.00	1.00
1995-1997	0.02	0.13	0.51	0.91	0.97	0.97	0.98	0.98

Table 5.7.3. Distribution of the eastern Baltic cod stock between Sub-division 25, 26 and 28 in the years 1995-1998 - based on abundance indices from the Baltic International Trawl Survey.

Year	Subdiv.	Age							
		1	2	3	4	5	6	7	8+
1995	25	0.14	0.31	0.57	0.63	0.33	0.08	0.06	0.02
	26	0.85	0.65	0.40	0.35	0.64	0.85	0.73	0.89
	28	0.00	0.04	0.03	0.02	0.03	0.07	0.21	0.10
1996	25	0.11	0.65	0.51	0.58	0.43	0.35	0.14	0.08
	26	0.82	0.19	0.46	0.40	0.55	0.60	0.79	0.87
	28	0.07	0.15	0.04	0.02	0.02	0.05	0.07	0.05
1997	25	0.59	0.40	0.27	0.54	0.30	0.15	0.09	0.11
	26	0.39	0.38	0.53	0.41	0.67	0.80	0.86	0.81
	28	0.02	0.22	0.20	0.05	0.03	0.05	0.06	0.08
1998	25	0.70	0.69	0.72	0.48	0.25	0.17	0.24	0.25
	26	0.10	0.20	0.22	0.47	0.73	0.75	0.73	0.64
	28	0.20	0.11	0.06	0.06	0.02	0.08	0.04	0.11

Table 5.7.4. Female and male maturity ogives, sex ratios and numbers sampled for the eastern Baltic cod stock during the most recent time period .

A. Average female ogive 1995-1998

Year	Sub-div.	Age groups							
		1	2	3	4	5	6	7	8+
1995	25	0.00	0.04	0.61	0.95	0.96	0.98	1.00	1.00
	26	0.00	0.02	0.33	0.94	0.98	0.97	0.98	0.98
	28	0.01	0.04	0.25	0.90	0.97	1.00	1.00	1.00
	25-28	0.00	0.03	0.49	0.95	0.97	0.97	0.99	0.98
1996	25	0.00	0.03	0.43	0.83	0.94	0.93	0.96	0.90
	26	0.00	0.01	0.11	0.78	0.91	0.98	0.99	1.00
	28	0.00	0.02	0.11	0.97	0.99	0.99	1.00	0.90
	25-28	0.00	0.02	0.27	0.81	0.92	0.96	0.99	0.99
1997	25	0.00	0.04	0.60	0.67	0.95	0.96	0.60	1.00
	26	0.00	0.01	0.47	0.73	0.93	0.97	0.96	1.00
	28	0.00	0.00	0.23	0.77	0.97	1.00	0.50	1.00
	25-28	0.00	0.02	0.46	0.70	0.94	0.97	0.90	1.00
1998	25	0.01	0.02	0.07	0.76	0.88	0.96	0.86	1.00
	26	0.00	0.01	0.47	0.73	0.93	0.97	0.96	1.00
	28	0.00	0.01	0.09	0.88	1.00	1.00	1.00	1.00
	25-28	0.01	0.02	0.16	0.75	0.92	0.97	0.94	1.00

B. Average male ogive 1995-1998

Year	Sub-div.	Age groups							
		1	2	3	4	5	6	7	8+
1995	25	0.01	0.13	0.70	0.97	0.92	1.00	0.50	1.00
	26	0.00	0.31	0.62	0.92	1.00	0.97	1.00	1.00
	28	0.00	0.59	0.40	1.00	1.00	1.00	1.00	1.00
	25-28	0.00	0.27	0.66	0.95	0.97	0.97	0.97	1.00
1996	25	0.00	0.19	0.68	0.93	0.96	0.96	1.00	1.00
	26	0.00	0.34	0.76	0.95	1.00	0.98	0.94	1.00
	28	0.00	0.48	0.77	0.98	1.00	0.99	1.00	1.00
	25-28	0.00	0.26	0.72	0.94	0.98	0.97	0.95	1.00
1997	25	0.00	0.17	0.85	0.90	0.96	0.92	1.00	1.00
	26	0.08	0.23	0.44	0.83	0.97	0.97	1.00	0.86
	28	0.00	0.27	0.70	0.97	1.00	0.95	0.93	0.50
	25-28	0.03	0.21	0.60	0.88	0.97	0.96	1.00	0.84
1998	25	0.01	0.14	0.44	0.83	0.95	1.00	1.00	1.00
	26	0.00	0.31	0.61	0.95	0.97	1.00	1.00	1.00
	28	0.00	0.28	0.68	0.96	0.80	0.82	1.00	1.00
	25-28	0.01	0.19	0.49	0.89	0.96	0.99	1.00	1.00

C. Average proportion of females 1995-1998

Year	Sub-div.	Age groups							
		1	2	3	4	5	6	7	8+
1995	25	0.44	0.52	0.53	0.53	0.63	0.86	0.85	0.97
	26	0.69	0.48	0.51	0.48	0.63	0.70	0.79	0.80
	28	0.55	0.51	0.55	0.64	0.68	0.82	0.58	0.84
	25-28	0.65	0.49	0.52	0.51	0.63	0.72	0.75	0.81
1996	25	0.18	0.48	0.51	0.50	0.62	0.66	0.89	0.96
	26	0.23	0.54	0.59	0.49	0.65	0.73	0.70	0.92
	28	0.68	0.60	0.55	0.40	0.64	0.73	0.65	0.96
	25-28	0.26	0.51	0.55	0.49	0.64	0.71	0.72	0.93
1997	25	0.43	0.50	0.54	0.54	0.68	0.77	0.78	0.87
	26	0.41	0.47	0.52	0.41	0.48	0.64	0.71	0.59
	28	0.50	0.50	0.59	0.64	0.67	0.09	0.33	1.00
	25-28	0.42	0.49	0.54	0.49	0.55	0.63	0.69	0.66
1998	25	0.49	0.47	0.51	0.33	0.62	0.83	0.74	0.69
	26	0.54	0.47	0.45	0.39	0.54	0.65	0.59	0.86
	28	0.30	0.62	0.60	0.63	0.62	0.56	1.00	0.50
	25-28	0.46	0.49	0.50	0.37	0.56	0.67	0.64	0.78

D. Number of cod sampled 1995-1998

Year	Sub-div.	Age groups								Sum
		1	2	3	4	5	6	7	8+	
1995	25	170	537	520	470	208	42	15	9	1971
	26	13	259	426	348	342	177	78	115	1758
	28	102	278	119	91	76	33	12	6	717
	25-28	285	1074	1065	909	626	252	105	130	4446
1996	25	10	570	455	423	357	188	51	21	2075
	26	10	316	328	256	189	107	75	57	1338
	28	8	166	129	107	79	50	37	12	588
	25-28	28	1052	912	786	625	345	163	90	4001
1997	25	76	253	750	251	66	37	7	7	1447
	26	14	377	286	156	190	96	94	7	1220
	28	1	125	147	54	15	9	9	1	361
	25-28	91	755	1183	461	271	142	110	15	3028
1998	25	259	1134	748	495	194	55	55	16	2956
	26	39	457	505	336	170	78	75	13	1673
	28	33	120	109	64	13	9	1	5	354
	25-28	331	1711	1362	895	377	142	131	34	4983

E. Average combined ogive 1995-1998

Year	Sub-div.	Age groups							
		1	2	3	4	5	6	7	8+
1995	25	0.00	0.08	0.65	0.96	0.95	0.99	0.92	1.00
	26	0.00	0.18	0.36	0.88	0.99	0.98	1.00	1.00
	28	0.01	0.25	0.48	0.93	0.98	1.00	1.00	1.00
	25-28	0.00	0.15	0.53	0.93	0.98	0.98	1.00	1.00
1996	25	0.00	0.11	0.55	0.88	0.95	0.94	0.97	0.90
	26	0.00	0.16	0.51	0.94	0.98	0.97	0.97	0.98
	28	0.00	0.12	0.37	0.97	0.99	0.98	0.98	0.88
	25-28	0.00	0.12	0.53	0.91	0.97	0.96	0.97	0.97
1997	25	0.00	0.11	0.72	0.77	0.95	0.95	0.69	1.00
	26	0.05	0.13	0.27	0.81	0.94	0.98	0.99	0.94
	28	0.00	0.14	0.41	0.83	0.92	0.83	0.84	1.00
	25-28	0.02	0.12	0.42	0.79	0.94	0.97	0.96	0.95
1998	25	0.01	0.13	0.25	0.81	0.90	0.97	0.89	1.00
	26	0.00	0.17	0.54	0.87	0.95	0.98	0.98	1.00
	28	0.02	0.12	0.36	0.89	1.00	1.00	1.00	1.00
	25-28	0.01	0.14	0.32	0.84	0.94	0.98	0.96	1.00

Table 5.9.1

The SAS System

08:35 Wednesday, April 29, 1998

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

FLT14: ALLNEW:shiftmean: mean of all fleets shifted back in time.(Catch:

Year	Fishing effort	Catch, age 0	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
1981	1	15831.90	79552.80	35716.90	11623.00	7636.60	5379.90	1761.50	682.20	223.90	57.00
1982	1	2818.60	42328.50	44480.30	29251.00	8154.80	3681.70	1624.50	418.10	226.90	83.20
1983	1	6570.20	8622.50	13728.50	17992.50	10192.80	3810.70	1156.70	851.50	344.10	397.00
1984	1	3308.20	16858.80	20520.10	11178.70	7081.70	3120.70	864.50	413.00	206.40	198.40
1985	1	586.20	10722.30	8215.30	4168.80	2729.90	2177.00	659.10	221.50	49.70	67.00
1986	1	3935.60	21957.30	13225.40	6558.90	1689.50	364.10	294.80	134.10	93.10	55.10
1987	1	973.60	14884.20	12034.70	5336.00	1927.70	601.70	256.70	130.60	135.50	61.90
1988	1	4493.70	2848.20	6573.10	5584.60	2051.20	628.50	284.40	117.40	57.30	16.50
1989	1	2528.40	5226.50	8017.00	2884.30	1772.10	481.60	221.00	68.80	16.00	23.60
1990	1	913.40	1741.40	3817.90	2824.60	1945.20	511.30	164.80	90.30	31.20	28.90
1991	1	1848.80	2139.40	1583.90	477.30	251.50	140.50	70.80	25.80	5.20	14.20
1992	1	3416.20	13272.70	5870.90	1223.40	711.10	287.80	44.30	19.00	2.30	102.40
1993	1	5491.40	11191.50	13347.30	6059.80	2643.90	553.10	182.80	54.20	40.60	75.50
1994	1	7667.90	18562.00	8928.30	4657.20	2390.70	882.70	463.40	116.00	102.70	127.20
1995	1	928.50	12064.30	13967.80	7357.40	4237.10	1173.20	400.00	157.30	65.80	69.00
1996	1	609.30	3180.50	8834.10	2002.30	1304.70	495.40	166.70	75.30	29.30	11.80
1997	1	1417.70	8896.00	7404.50	1887.60	1444.30	328.80	181.50	66.80	20.70	14.30

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

FLT15: BYFSH: ALLAGE2: mean of all fleets shifted back in time

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	1	-11.00	79552.80	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00
1983	1	-11.00	42328.50	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00
1984	1	-11.00	8622.50	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00
1985	1	-11.00	16858.80	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00
1986	1	-11.00	10722.30	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00
1987	1	-11.00	21957.30	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00
1988	1	-11.00	14884.20	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00
1989	1	-11.00	2848.20	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00
1990	1	-11.00	5226.50	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00
1991	1	-11.00	1741.40	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00
1992	1	-11.00	2139.40	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00
1993	1	-11.00	13272.70	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00
1994	1	-11.00	11191.50	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00
1995	1	-11.00	18562.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00
1996	1	-11.00	12064.30	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00
1997	1	-11.00	3180.50	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00	-11.00

The SAS System

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

CANUM: Catch in Numbers (Total International Catch) (Total) (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	14395.3	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	83822.0	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
1996	163.0	10676.0	30543.0	26250.0	21553.0	5937.0	1422.0	301.0	64.0	19.0
1997	71.6	2645.1	25247.8	22057.1	12415.7	4681.5	1986.0	749.2	246.0	98.4

Table 5.9.1 (Cont'd)

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

CATON: Landings (Total International Catch) (Total) (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	347619
1981	330742
1982	316052
1983	332148
1984	391046
1985	315083
1986	252558
1987	207081
1988	194478
1989	179177
1990	152870
1991	122893
1992	54886
1993	45183
1994	93354
1995	107717
1996	121888
1997	88741

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

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

Year	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10
1966	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1967	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1968	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1969	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1970	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1971	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1972	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1973	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1974	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1975	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1976	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1977	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1978	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1979	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1980	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1981	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1982	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1983	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1984	0.01	0.08	0.45	0.78	0.92	0.95	0.98	0.99	0.99	0.99
1985	0.00	0.12	0.50	0.72	0.91	0.95	0.98	1.00	1.00	1.00
1986	0.00	0.12	0.50	0.72	0.91	0.95	0.98	1.00	1.00	1.00
1987	0.00	0.12	0.50	0.72	0.91	0.95	0.98	1.00	1.00	1.00
1988	0.00	0.12	0.50	0.72	0.91	0.95	0.98	1.00	1.00	1.00
1989	0.00	0.12	0.50	0.72	0.91	0.95	0.98	1.00	1.00	1.00
1990	0.02	0.27	0.60	0.88	0.97	1.00	1.00	1.00	1.00	1.00
1991	0.02	0.27	0.60	0.88	0.97	1.00	1.00	1.00	1.00	1.00
1992	0.02	0.27	0.60	0.88	0.97	1.00	1.00	1.00	1.00	1.00
1993	0.02	0.27	0.60	0.88	0.97	1.00	1.00	1.00	1.00	1.00
1994	0.02	0.27	0.60	0.88	0.97	1.00	1.00	1.00	1.00	1.00
1995	0.00	0.15	0.53	0.93	0.98	0.98	1.00	1.00	1.00	1.00
1996	0.00	0.12	0.53	0.91	0.97	0.96	0.97	0.97	0.97	0.97
1997	0.02	0.12	0.42	0.79	0.94	0.97	0.96	0.95	0.95	0.95

Table 5.9.1 (Cont'd)

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

WEST: Mean Weight in Stock (Total International Catch) (Total) (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	1.164	1.696	2.521	3.828	4.279	5.363	6.503
1994	0.057	0.293	0.670	1.166	1.908	2.690	3.427	4.738	5.704	8.186
1995	0.043	0.354	0.692	1.284	2.224	3.016	3.347	5.417	5.441	8.909
1996	0.065	0.241	0.700	0.932	1.511	2.326	2.955	5.417	5.441	8.909
1997	0.041	0.242	0.563	1.199	1.528	2.912	4.214	5.417	5.441	8.909

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

WECA: Mean Weight in Catch (Total International Catch) (Total) (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	0.580	0.748	0.960	1.201	1.525	2.433	3.459	4.908	5.796	6.780
1996	0.582	0.812	0.980	1.205	1.504	2.191	3.026	4.539	5.333	6.749
1997	0.603	0.594	0.832	1.086	1.500	2.375	3.431	4.445	6.184	7.485

Table 5.9.2

Lowestoft VPA Version 3.1

22-Apr-98 09:11:14

Extended Survivors Analysis

Cod in 25 to 32 (run: XSAMAR08/X08)

CPUE data from file /users/fish/ifad/ifapwork/wgbfas/cod_2532/FLEET.X08

Catch data for 32 years. 1966 to 1997. Ages 2 to 8.

Fleet,	First, Last,	First, Last,	Alpha,	Beta
	year, year,	age, age		
FLT14: ALLNEW:shiftm,	1981, 1997,	2, 7,	.990,	1.000
FLT15: BYFSH: ALLAGE,	1982, 1997,	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 < 4

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

Catchability independent of age for ages >= 4

Terminal population estimation :

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

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

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

Prior weighting not applied

Tuning converged after 23 iterations

Regression weights

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

Fishing mortalities

Age,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997
2,	.124,	.043,	.175,	.087,	.067,	.057,	.083,	.057,	.079,	.030
3,	.512,	.585,	.449,	.782,	.318,	.213,	.350,	.287,	.338,	.273
4,	.800,	1.112,	1.060,	1.265,	.676,	.302,	.508,	.572,	.660,	.439
5,	.750,	1.083,	1.389,	1.501,	.926,	.358,	.782,	.854,	1.066,	.777
6,	.927,	1.161,	1.236,	1.138,	.930,	.287,	.429,	.752,	.862,	.703
7,	.890,	1.103,	1.036,	1.402,	1.079,	.240,	.274,	.400,	.713,	.818

XSA population numbers (Thousands)

YEAR ,	2,	AGE 3,	4,	5,	6,	7,
1988 ,	2.04E+05,	2.33E+05,	1.05E+05,	3.62E+04,	1.23E+04,	5.94E+03,
1989 ,	1.18E+05,	1.47E+05,	1.14E+05,	3.85E+04,	1.40E+04,	3.99E+03,
1990 ,	1.17E+05,	9.26E+04,	6.72E+04,	3.07E+04,	1.07E+04,	3.59E+03,
1991 ,	7.87E+04,	8.01E+04,	4.83E+04,	1.91E+04,	6.27E+03,	2.54E+03,
1992 ,	1.31E+05,	5.91E+04,	3.00E+04,	1.12E+04,	3.48E+03,	1.64E+03,
1993 ,	1.76E+05,	1.00E+05,	3.52E+04,	1.25E+04,	3.62E+03,	1.12E+03,
1994 ,	1.30E+05,	1.36E+05,	6.62E+04,	2.13E+04,	7.15E+03,	2.23E+03,
1995 ,	1.52E+05,	9.77E+04,	7.86E+04,	3.26E+04,	7.98E+03,	3.81E+03,
1996 ,	1.55E+05,	1.18E+05,	6.00E+04,	3.63E+04,	1.14E+04,	3.08E+03,
1997 ,	9.79E+04,	1.17E+05,	6.86E+04,	2.54E+04,	1.02E+04,	3.93E+03,

Table 5.9.2 (Cont'd)

Estimated population abundance at 1st Jan 1998

, .00E+00, 7.78E+04, 7.29E+04, 3.62E+04, 9.57E+03, 4.15E+03,

Taper weighted geometric mean of the VPA populations:

, 1.60E+05, 1.31E+05, 7.68E+04, 3.21E+04, 1.11E+04, 4.05E+03,

Standard error of the weighted Log(VPA populations) :

, .4872, .5195, .6153, .7162, .8212, .8087,

Log catchability residuals.

Fleet : FLT14: ALLNEW:shiftm

Age	1981	1982	1983	1984	1985	1986	1987
2	-.10	.14	-.51	.29	-.28	-.01	-.31
3	-.05	.25	-.12	.08	-.31	.27	-.02
4	.17	.34	.15	-.05	-.45	-.38	-.12
5	.53	.44	.53	.17	-.31	-1.19	-.21
6	.55	.28	.28	.23	-.31	-.70	-.33
7	.63	.01	.44	.28	-.14	-.44	-.25

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
2	-.41	.25	-.30	-.80	-.12	.33	.29	.52	.10	.35
3	-.10	-.11	.23	-.77	-.09	.58	.17	.81	-.37	-.46
4	-.12	-.04	.53	-.98	-.05	.73	.20	.67	-.15	-.41
5	-.29	-.29	.30	-.40	.28	.26	.61	.54	-.22	-.56
6	.17	.02	.08	-.33	-.42	.32	.71	.77	-.35	-.32
7	-.02	.05	.37	-.18	-.37	.23	.34	.23	.02	-.24

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

Age	4	5	6	7
Mean Log q	-2.8191	-2.8191	-2.8191	-2.8191
S.E(Log q)	.4832	.4834	.4477	.2771

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	.92	.318	3.44	.61	17	.41	-2.69
3	.80	.757	4.84	.58	17	.46	-3.05

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

Age	Slope	t-value	Intercept	RSquare	No Pts	Reg s.e	Mean Q
4	1.07	-.274	2.20	.58	17	.54	-2.82
5	1.19	-.756	1.43	.62	17	.58	-2.84
6	1.12	-.634	2.02	.73	17	.52	-2.81
7	1.04	-.335	2.60	.89	17	.30	-2.80

Fleet : FLT15: BYFSH: ALLAGE

Age	1981	1982	1983	1984	1985	1986	1987
2	99.99	-.07	-.03	-.53	.07	-.27	-.14
3	99.99	99.99	99.99	99.99	99.99	99.99	99.99
4	99.99	99.99	99.99	99.99	99.99	99.99	99.99
5	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
7	99.99	99.99	99.99	99.99	99.99	99.99	99.99

Table 5.9.2 (Cont'd)

Age	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
2	.11	-.32	.06	-.20	-.59	.19	.40	.53	.26	-.07
3	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
4	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
5	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
6	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
7	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99

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

Age	4	5	6	7
Mean Log q	.0000	.0000	.0000	.0000
S.E(Log q)	.0000	.0000	.0000	.0000

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	.59	1.818	6.67	.66	16	.34	-2.95
3	.00	.000	.00	.00	0	.00	.00

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

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

4	.00	.000	.00	.00	0	.00	.00
5	.00	.000	.00	.00	0	.00	.00
6	.00	.000	.00	.00	0	.00	.00
7	.00	.000	.00	.00	0	.00	.00

1

Terminal year survivor and F summaries :

Age 2 Catchability dependent on age and year class strength

Year class = 1995

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, , Weights,	Estimated F
FLT14: ALLNEW:shiftm,	110391.	.424,	.000,	.00,	1, .268,	.021
FLT15: BYFSH: ALLAGE,	72689.	.372,	.000,	.00,	1, .349,	.032
P shrinkage mean ,	131460.	.52,,,,			.184,	.018
F shrinkage mean ,	33593.	.50,,,,			.199,	.069

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
77785.,	.22,	.28,	4,	1.276,	.030

Table 5.9.2 (Cont'd)

Age 3 Catchability dependent on age and year class strength

Year class = 1994

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Weights,	Scaled, Weights,	Estimated F
FLT14: ALLNEW:shiftm,	62735.,	.321,	.279,	.87,	2,	.371,	.311
FLT15: BYFSH: ALLAGE,	94825.,	.361,	.000,	.00,	1,	.282,	.216
P shrinkage mean ,	76752.,	.62,,,,				.138,	.261
F shrinkage mean ,	64595.,	.50,,,,				.209,	.303

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
72916.,	.21,	.12,	5,	.597,	.273

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

Year class = 1993

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Weights,	Scaled, Weights,	Estimated F
FLT14: ALLNEW:shiftm,	33391.,	.277,	.304,	1.10,	3,	.487,	.469
FLT15: BYFSH: ALLAGE,	61682.,	.370,	.000,	.00,	1,	.227,	.280
F shrinkage mean ,	27338.,	.50,,,,				.286,	.548

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
36238.,	.21,	.22,	5,	1.027,	.439

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

Year class = 1992

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Weights,	Scaled, Weights,	Estimated F
FLT14: ALLNEW:shiftm,	8969.,	.263,	.293,	1.12,	4,	.456,	.812
FLT15: BYFSH: ALLAGE,	14206.,	.362,	.000,	.00,	1,	.130,	.583
F shrinkage mean ,	9081.,	.50,,,,				.414,	.805

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
9569.,	.24,	.17,	6,	.692,	.777

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

Year class = 1991

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Weights,	Scaled, Weights,	Estimated F
FLT14: ALLNEW:shiftm,	3705.,	.290,	.163,	.56,	5,	.470,	.762
FLT15: BYFSH: ALLAGE,	5007.,	.367,	.000,	.00,	1,	.056,	.613
F shrinkage mean ,	4552.,	.50,,,,				.474,	.658

Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
4154.,	.27,	.11,	7,	.390,	.703

Table 5.9.2 (Cont'd)

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

Year class = 1990

Fleet,	Estimated, Survivors,	Int, s.e,	Ext, s.e,	Var, Ratio,	N, Scaled, , Weights,	Estimated F
FLT14: ALLNEW:shiftm,	1183.,	.233,	.100,	.43,	6, .610,	.924
FLT15: BYFSH: ALLAGE,	790.,	.395,	.000,	.00,	1, .021,	1.187

F shrinkage mean ,	1982.,	.50,,,,			.369,	.645
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Weighted prediction :

Survivors, at end of year,	Int, s.e,	Ext, s.e,	N, ,	Var, Ratio,	F
1419.,	.23,	.14,	8,	.601,	.818

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Table 5.9.3

Run title : Cod in 25 to 32 (run: XSAMAR08/X08)

At 22-Apr-98 09:12:03

Terminal Fs derived using XSA (With F shrinkage)

Table 8		Fishing mortality (F) at age	
YEAR,		1966,	1967,
AGE			
2,		.0852,	.1286,
3,		.6022,	.6839,
4,		.7979,	.8082,
5,		.9481,	.9907,
6,		.7549,	1.6628,
7,		.8423,	1.1679,
+gp,		.8423,	1.1679,
0 FBAR 4- 7,		.8358,	1.1574,

Table 8		Fishing mortality (F) at age									
YEAR,		1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE											
2,		.1094,	.1650,	.1342,	.0959,	.1330,	.0809,	.0559,	.0900,	.0338,	.0146,
3,		.6847,	.6571,	.6323,	.4113,	.5590,	.4166,	.4173,	.5272,	.3999,	.2336,
4,		1.0161,	.8107,	.8464,	.7321,	.8167,	.8226,	.6647,	.6465,	.7771,	.5816,
5,		1.1967,	1.3171,	1.1965,	1.1493,	.9923,	1.0790,	.8893,	.5696,	.9282,	.8949,
6,		1.1638,	1.1468,	1.3151,	.8468,	1.3076,	1.0048,	.9276,	.8605,	1.0561,	1.0337,
7,		1.1390,	1.1045,	1.1327,	.9193,	1.0509,	.9797,	.8358,	.6988,	.9306,	.8455,
+gp,		1.1390,	1.1045,	1.1327,	.9193,	1.0509,	.9797,	.8358,	.6988,	.9306,	.8455,
0 1 0	FBAR 4- 7,	1.1289,	1.0948,	1.1226,	.9119,	1.0419,	.9715,	.8293,	.6939,	.9230,	.8389,

Run title : Cod in 25 to 32 (run: XSAMAR08/X08)

At 22-Apr-98 09:12:03

Terminal Fs derived using XSA (With F shrinkage)

Table 8		Fishing mortality (F) at age									
YEAR,		1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE											
2,		.0589,	.1030,	.0571,	.0376,	.0661,	.0987,	.0915,	.1693,	.0548,	.1509,
3,		.2390,	.3012,	.3463,	.2063,	.2958,	.2739,	.4402,	.4014,	.3291,	.3931,
4,		.4357,	.4332,	.6550,	.6196,	.5641,	.5637,	.7196,	.6602,	.8283,	.7445,
5,		.6451,	.4768,	.7664,	.8882,	.7993,	.7473,	1.0015,	.7126,	1.0861,	1.0025,
6,		.5049,	.5502,	.7233,	.8545,	.7460,	.8014,	.9881,	.8737,	1.4175,	1.0065,
7,		.5329,	.4905,	.7218,	.7435,	.7009,	.6086,	.8229,	.7866,	1.2724,	1.0596,
+gp,		.5329,	.4905,	.7218,	.7435,	.7009,	.6086,	.8229,	.7866,	1.2724,	1.0596,
0 FBAR	4- 7,	.5297,	.4877,	.7166,	.7765,	.7026,	.6803,	.8830,	.7583,	1.1511,	.9533,

Table 8		Fishing mortality (F) at age									FBAR 95-97
YEAR,		1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	
AGE											
2,		.1236,	.0433,	.1755,	.0865,	.0666,	.0575,	.0832,	.0565,	.0794,	.0303,
3,		.5121,	.5846,	.4495,	.7816,	.3179,	.2127,	.3498,	.2867,	.3384,	.2726,
4,		.8001,	1.1122,	1.0605,	1.2650,	.6762,	.3022,	.5084,	.5716,	.6600,	.4388,
5,		.7504,	1.0831,	1.3895,	1.5012,	.9256,	.3581,	.7817,	.8543,	1.0657,	.7766,
6,		.9272,	1.1612,	1.2359,	1.1381,	.9303,	.2869,	.4288,	.7518,	.8619,	.7030,
7,		.8904,	1.1028,	1.0356,	1.4025,	1.0790,	.2402,	.2739,	.4003,	.7134,	.8183,
+gp,		.8904,	1.1028,	1.0356,	1.4025,	1.0790,	.2402,	.2739,	.4003,	.7134,	.8183,
0 FBAR 4- 7,		.8420,	1.1148,	1.1804,	1.3267,	.9028,	.2968,	.4982,	.6445,	.8253,	.6842,

Run title : Cod in 25 to 32 (run: XSAMAR08/X08)

At 22-Apr-98 09:12:03

Terminal Fs derived using XSA (With F shrinkage)

Table 10		Stock number at age (start of year)		Numbers*10**-3							
YEAR,		1966,	1967,								
AGE											
2,		392574,	332904,								
3,		222878,	295164,								
4,		68639,	99928,								
5,		21554,	25305,								
6,		5543,	6838,								
7,		1790,	2133,								
+gp,		197,	911,								
0 FBAR 4- 7,		713176,	763184,								

Table 10		Stock number at age (start of year)				Numbers*10**-3					
YEAR,		1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE											
2,		320464,	272326,	217942,	242113,	292819,	400916,	472227,	281368,	283976,	465023,
3,		239673,	235187,	189041,	156029,	180105,	209889,	302734,	365596,	210528,	224772,
4,		121951,	98941,	99811,	82243,	84670,	84316,	113295,	163303,	176686,	115551,
5,		36462,	36146,	36010,	35055,	32380,	30632,	30324,	47719,	70040,	66503,
6,		7693,	9021,	7928,	8911,	9094,	9828,	8525,	10202,	22103,	22665,
7,		1062,	1967,	2346,	1743,	3128,	2014,	2946,	2761,	3533,	6294,
+gp,		135,	345,	818,	732,	1061,	2411,	2546,	2377,	2402,	2687,
0 FBAR 4- 7,		727440,	653933,	553898,	526826,	603257,	740006,	932597,	873326,	769268,	903495,

Table 5.9.3 (Cont'd)

Run title : Cod in 25 to 32 (run: XSAMAR08/X08)

At 22-Apr-98 09:12:03

Terminal Fs derived using XSA (With F shrinkage)

Table 10	Stock number at age (start of year)					Numbers*10***-3				
YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
2,	788300,	570034,	403861,	654342,	651574,	433794,	280200,	228742,	244359,	330325,
3,	375208,	608512,	421043,	312299,	515982,	499335,	321771,	209356,	158110,	189389,
4,	145696,	241893,	368630,	243823,	208032,	314261,	310864,	169638,	114735,	93148,
5,	52884,	77157,	128420,	156780,	107432,	96888,	146423,	123939,	71770,	41033,
6,	22251,	22714,	39212,	48856,	52807,	39550,	37571,	44036,	49758,	19834,
7,	6600,	10995,	10727,	15576,	17019,	20504,	14529,	11451,	15049,	9871,
+gp,	2295,	5663,	4678,	6989,	9666,	5748,	10778,	7392,	6277,	5149,
0 TOTAL,	1393233,	1536967,	1376571,	1438665,	1562512,	1410081,	1122138,	794554,	660057,	688749,

Table 10		Stock number at age (start of year)					Numbers*10**+3						
AMST 66-95	YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,	1998,	GMST 66-95
	AGE												
	2,	203674,	118060,	116568,	78681,	130597,	176219,	129662,	151970,	154657,	97929,	0,	278249,
322187,	3,	232568,	147365,	92564,	80079,	59078,	100030,	136215,	97687,	117587,	116962,	77785,	212639,
246273,	4,	104663,	114099,	67244,	48348,	30007,	35198,	66204,	78605,	60045,	68636,	72916,	113582,
135481,	5,	36222,	38498,	30718,	19064,	11172,	12494,	21302,	32600,	36337,	25409,	36238,	44128,
55764,	6,	12328,	14003,	10671,	6268,	3478,	3625,	7150,	7982,	11359,	10248,	9569,	13908,
19015,	7,	5935,	3993,	3590,	2539,	1644,	1123,	2228,	3813,	3081,	3928,	4154,	4338,
6297,													
	+gp,	3980,	2720,	2762,	2269,	862,	710,	1453,	2399,	821,	2131,	2189,	
0	TOTAL,	599370,	438739,	324116,	237249,	236840,	329400,	364215,	375055,	383887,	325243,	202851,	
1													

Run title : Cod in 25 to 32 (run: XSAMAR08/X08)

At 22-Apr-98 09:12:03

Terminal Fs derived using XSA (With F shrinkage)

Table 12	Stock biomass at age (start of year)					Tonnes				
YEAR,	1966,	1967,								
AGE										
2,	79692,	67580,								
3,	149551,	198055,								
4,	59991,	87337,								
5,	30456,	35756,								
6,	12229,	15084,								
7,	6616,	7885,								
+gp,	1080,	5082,								
0 TOTALBIO,	339614,	416779,								

Table 12	Stock biomass at age (start of year)					Tonnes				
YEAR,	1968,	1969,	1970,	1971,	1972,	1973,	1974,	1975,	1976,	1977,
AGE										
2,	65054,	55282,	44242,	49149,	59442,	81386,	95862,	57118,	57647,	94400,
3,	160820,	157810,	126847,	104695,	120851,	140836,	203135,	245315,	141264,	150822,
4,	106585,	86475,	87235,	71880,	74002,	73692,	99020,	142727,	154423,	100991,
5,	51521,	51074,	50883,	49533,	45753,	43283,	42847,	67427,	98967,	93968,
6,	16971,	19901,	17490,	19658,	20061,	21681,	18807,	22506,	48758,	50000,
7,	3923,	7270,	8672,	6441,	11562,	7443,	10888,	10203,	13057,	23263,
+gp,	787,	1917,	4519,	4044,	6276,	13790,	14398,	14153,	14237,	15194,
0 TOTALBIO,	405661,	379729,	339887,	305401,	337946,	382110,	484957,	559449,	528353,	528638,
1										

Run title : Cod in 25 to 32 (run: XSAMAR08/X08)

At 22-Apr-98 09:12:03

Terminal Fs derived using XSA (With F shrinkage)

Table 12	Stock biomass at age (start of year)					Tonnes				
YEAR,	1978,	1979,	1980,	1981,	1982,	1983,	1984,	1985,	1986,	1987,
AGE										
2,	160025,	115717,	81984,	132832,	132270,	88060,	56881,	46435,	49605,	67056,
3,	251764,	408312,	282519,	209553,	346224,	335054,	215909,	140478,	106092,	127080,
4,	127338,	211414,	322183,	213101,	181820,	288177,	276047,	183209,	114046,	109449,
5,	74725,	109022,	181457,	221530,	151802,	131768,	198697,	195204,	104640,	71807,
6,	49086,	50106,	86502,	107776,	116493,	70953,	72173,	92652,	97873,	49743,
7,	24395,	40638,	39647,	57567,	62904,	49209,	37166,	27780,	34988,	29337,
+gp,	13199,	32578,	25993,	41378,	54804,	27067,	47963,	32915,	26544,	21109,
0 TOTALBIO,	700531,	967787,	1020285,	983736,	1046317,	990289,	904836,	718672,	533788,	475583,

Table 5.9.3 (Cont'd)

Table 12	Stock biomass at age (start of year)					Tonnes				
YEAR,	1988,	1989,	1990,	1991,	1992,	1993,	1994,	1995,	1996,	1997,
AGE										
2,	41346,	23966,	23663,	15972,	26511,	35772,	37991,	53797,	37272,	23699,
3,	156053,	98882,	62110,	53733,	39642,	67120,	91264,	67599,	82311,	65850,
4,	120048,	114328,	81634,	56278,	34928,	40971,	77194,	100929,	55962,	82294,
5,	63967,	58748,	53848,	32333,	18948,	21190,	40645,	72501,	54906,	38825,
6,	31263,	29462,	25504,	15800,	8769,	9139,	19234,	24073,	26420,	29843,
7,	20008,	11745,	11556,	9718,	6294,	4300,	7634,	12762,	9105,	16551,
+gp,	17709,	11431,	13006,	10856,	4300,	3331,	8214,	15320,	4593,	12227,
0 TOTALBIO,	450393,	348562,	271321,	194691,	139392,	181823,	282177,	346982,	270569,	269289,
1										

Run title : Cod in 25 to 32 (run: XSAMAR08/X08)

At 22-Apr-98 09:12:03

Table 16 Summary (without SOP correction)

Terminal Fs derived using XSA (With F shrinkage)

	RECRUITS,	TOTALBIO,	TOTSPBIO,	LANDINGS,	YIELD/SSB,	FBAR	4- 7,
	Age 2						
1966,	392574,	339615,	167655,	134867,	.8044,	.8358,	
1967,	332904,	416779,	222639,	152378,	.6844,	1.1574,	
1968,	320465,	405661,	228855,	164472,	.7187,	1.1289,	
1969,	272326,	379729,	217804,	169909,	.7801,	1.0948,	
1970,	217943,	339887,	205063,	154492,	.7534,	1.1226,	
1971,	242113,	305401,	181673,	118217,	.6507,	.9119,	
1972,	292819,	337946,	195554,	143833,	.7355,	1.0419,	
1973,	400916,	382110,	208730,	143164,	.6859,	.9715,	
1974,	472226,	484957,	258526,	147815,	.5718,	.8293,	
1975,	281368,	559449,	333712,	194649,	.5833,	.6939,	
1976,	283976,	528353,	352890,	203303,	.5761,	.9230,	
1977,	465023,	528638,	325986,	164692,	.5052,	.8389,	
1978,	788300,	700531,	377771,	154009,	.4077,	.5297,	
1979,	570034,	967787,	577880,	227699,	.3940,	.4877,	
1980,	403861,	1020285,	698699,	347619,	.4975,	.7166,	
1981,	654342,	983736,	674718,	330742,	.4902,	.7765,	
1982,	651574,	1046316,	674430,	316052,	.4686,	.7026,	
1983,	433794,	990288,	646250,	332148,	.5140,	.6803,	
1984,	280200,	904836,	652298,	391046,	.5995,	.8830,	
1985,	228742,	718672,	533516,	315083,	.5906,	.7583,	
1986,	244359,	533788,	390146,	252558,	.6473,	1.1511,	
1987,	330325,	475583,	312851,	207081,	.6619,	.9533,	
1988,	203674,	450394,	294649,	194478,	.6600,	.8420,	
1989,	118060,	348562,	239024,	179177,	.7496,	1.1148,	
1990,	116568,	271321,	217791,	152870,	.7019,	1.1804,	
1991,	78681,	194691,	153814,	122893,	.7990,	1.3267,	
1992,	130597,	139393,	99423,	54886,	.5520,	.9028,	
1993,	176219,	181823,	123309,	45183,	.3664,	.2968,	
1994,	129662,	282177,	207455,	93354,	.4500,	.4982,	
1995,	151970,	346982,	260486,	107717,	.4135,	.6445,	
1996,	154657,	270569,	190932,	121888,	.6384,	.8253,	
1997,	97929,	269289,	188462,	88741,	.4709,	.6842,	

Arith.							
Mean	309944,	503298,	325406,	185219,	.5976,	.8595,	
0 Units,	(Thousands),	(Tonnes),	(Tonnes),	(Tonnes),			
1							

Table 5.10.1. Input data for RCT3 analysis

Baltic Sea cod Sd 25-32 as age group 2

	1	17	2
'Year'	'VPA'	'ScMean'	
1980	651574	79552.8	
1981	433794	42328.5	
1982	280200	8622.5	
1983	228742	16858.8	
1984	244359	10722.3	
1985	330325	21957.3	
1986	203674	14884.2	
1987	118060	2848.2	
1988	116568	5226.5	
1989	78681	1741.4	
1990	130597	2139.4	
1991	176219	13272.7	
1992	129662	11191.5	
1993	151970	18562	
1994	154657	12064.3	
1995	97929	3180.5	
1996	-11	8896	

Table 5.10.2 Analysis by RCT3 ver3.1 of data from file :cod-age2.csv

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

Data for 1 surveys over 17 years : 1980 - 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.

Yearclass = 1992

I-----Regression-----I					I-----Prediction-----I				
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
ScMean	.55	7.15	.25	.858	12	9.32	12.30	.290	.799
VPA Mean =							12.18	.579	.201

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	.59	6.79	.31	.784	13	9.83	12.56	.362	.701
VPA Mean =							12.12	.554	.299

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	.60	6.57	.36	.691	14	9.40	12.25	.420	.603
VPA Mean =							12.08	.518	.397

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
ScMean	.61	6.52	.37	.653	15	8.06	11.41	.439	.543
VPA Mean =							12.04	.478	.457

Yearclass = 1996

I-----Regression-----I					I-----Prediction-----I				
Survey/ Series	Slope	Inter- cept	Std Error	Rsquare	No. Pts	Index Value	Predicted Value	Std Error	WAP Weights
ScMean	.59	6.68	.34	.663	16	9.09	12.03	.393	.578
						VPA Mean =	11.97	.460	.422
Year Class	Weighted Average Prediction	Log WAP	Int Std Error	Ext Std Error	Var Ratio	VPA	Log VPA		
1992	214811	12.28	.26	.05	.04	129662	11.77		
1993	249329	12.43	.30	.20	.44	151971	11.93		
1994	195440	12.18	.33	.09	.07	154658	11.95		
1995	120048	11.70	.32	.31	.95	97929	11.49		
1996	163515	12.00	.30	.03	.01				

Table 5.12.1

The SAS System

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Cod in Baltic Fishing Areas 25 to 32

Prediction with management option table: Input data

Year: 1998								
Age	Stock size	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
2	122288.00	0.2000	0.1300	0.0000	0.0000	0.275	0.0554	0.718
3	77785.000	0.2000	0.5100	0.0000	0.0000	0.651	0.2992	0.924
4	72916.000	0.2000	0.9100	0.0000	0.0000	1.138	0.5568	1.164
5	36238.000	0.2000	0.9700	0.0000	0.0000	1.755	0.8989	1.510
6	9569.000	0.2000	0.9700	0.0000	0.0000	2.752	0.7723	2.333
7	4154.000	0.2000	0.9800	0.0000	0.0000	3.505	0.6440	3.305
8+	2189.000	0.2000	0.9800	0.0000	0.0000	5.417	0.6440	4.631
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 1999								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
2	142087.00	0.2000	0.1300	0.0000	0.0000	0.275	0.0554	0.718
3	.	0.2000	0.5100	0.0000	0.0000	0.651	0.2992	0.924
4	.	0.2000	0.9100	0.0000	0.0000	1.138	0.5568	1.164
5	.	0.2000	0.9700	0.0000	0.0000	1.755	0.8989	1.510
6	.	0.2000	0.9700	0.0000	0.0000	2.752	0.7723	2.333
7	.	0.2000	0.9800	0.0000	0.0000	3.505	0.6440	3.305
8+	.	0.2000	0.9800	0.0000	0.0000	5.417	0.6440	4.631
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Year: 2000								
Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
2	142087.00	0.2000	0.1300	0.0000	0.0000	0.275	0.0554	0.718
3	.	0.2000	0.5100	0.0000	0.0000	0.651	0.2992	0.924
4	.	0.2000	0.9100	0.0000	0.0000	1.138	0.5568	1.164
5	.	0.2000	0.9700	0.0000	0.0000	1.755	0.8989	1.510
6	.	0.2000	0.9700	0.0000	0.0000	2.752	0.7723	2.333
7	.	0.2000	0.9800	0.0000	0.0000	3.505	0.6440	3.305
8+	.	0.2000	0.9800	0.0000	0.0000	5.417	0.6440	4.631
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : MANMAR02
Date and time: 23APR98:11:24

Table 5.12.2

The SAS System

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Cod in Baltic Fishing Areas 25 to 32

Prediction with management option table

Year: 1998					Year: 1999					Year: 2000	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
0.4000	0.2872	283595	218830	49930	0.0000	0.0000	349870	273788	0	497624	410590
.	0.1000	0.0718	.	273788	17177	473747	387711
.	0.2000	0.1436	.	273788	33283	451481	366395
.	0.3000	0.2154	.	273788	48393	430709	346527
.	0.4000	0.2872	.	273788	62578	411321	328000
.	0.5000	0.3590	.	273788	75901	393216	310717
.	0.6000	0.4308	.	273788	88424	376301	294585
.	0.7000	0.5026	.	273788	100200	360489	279523
.	0.8000	0.5744	.	273788	111283	345701	265452
.	0.9000	0.6462	.	273788	121718	331864	252301
.	1.0000	0.7180	.	273788	131550	318909	240004
.	1.1000	0.7898	.	273788	140821	306774	228500
.	1.2000	0.8616	.	273788	149567	295400	217732
.	1.3000	0.9334	.	273788	157824	284734	207649
.	1.4000	1.0052	.	273788	165625	274725	198201
.	1.5000	1.0770	.	273788	173000	265328	189345
.	1.6000	1.1488	.	273788	179976	256501	181038
.	1.7000	1.2206	.	273788	186580	248204	173243
.	1.8000	1.2924	.	273788	192836	240399	165924
.	1.9000	1.3642	.	273788	198767	233055	159049
.	2.0000	1.4360	.	273788	204393	226138	152586
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

(cont.)

Table 5.12.2 (Cont'd)

The SAS System

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Cod in Baltic Fishing Areas 25 to 32

Prediction with management option table
(cont.)

Year: 1998					Year: 1999					Year: 2000	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
0.6000	0.4308	283595	218830	70707	0.0000	0.0000	321706	246961	0	464977	378827
.	0.1000	0.0718	.	246961	15552	443449	358236
.	0.2000	0.1436	.	246961	30148	423357	339037
.	0.3000	0.2154	.	246961	43856	404597	321128
.	0.4000	0.2872	.	246961	56737	387072	304415
.	0.5000	0.3590	.	246961	68848	370691	288811
.	0.6000	0.4308	.	246961	80243	355374	274236
.	0.7000	0.5026	.	246961	90971	341042	260614
.	0.8000	0.5744	.	246961	101077	327625	247878
.	0.9000	0.6462	.	246961	110603	315057	235963
.	1.0000	0.7180	.	246961	119590	303280	224812
.	1.1000	0.7898	.	246961	128072	292235	214370
.	1.2000	0.8616	.	246961	136085	281873	204588
.	1.3000	0.9334	.	246961	143658	272144	195417
.	1.4000	1.0052	.	246961	150820	263006	186816
.	1.5000	1.0770	.	246961	157600	254417	178746
.	1.6000	1.1488	.	246961	164021	246338	171168
.	1.7000	1.2206	.	246961	170107	238735	164050
.	1.8000	1.2924	.	246961	175880	231576	157359
.	1.9000	1.3642	.	246961	181359	224831	151066
.	2.0000	1.4360	.	246961	186563	218470	145145
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

(cont.)

The SAS System

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Cod in Baltic Fishing Areas 25 to 32

Prediction with management option table
(cont.)

Year: 1998					Year: 1999					Year: 2000	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
0.8000	0.5744	283595	218830	89171	0.0000	0.0000	296971	223450	0	436203	350843
.	0.1000	0.0718	.	223450	14127	416736	332260
.	0.2000	0.1436	.	223450	27398	398554	314920
.	0.3000	0.2154	.	223450	39875	381561	298732
.	0.4000	0.2872	.	223450	51611	365672	283612
.	0.5000	0.3590	.	223450	62658	350807	269483
.	0.6000	0.4308	.	223450	73063	336893	256274
.	0.7000	0.5026	.	223450	82869	323861	243918
.	0.8000	0.5744	.	223450	92118	311649	232354
.	0.9000	0.6462	.	223450	100846	300199	221527
.	1.0000	0.7180	.	223450	109089	289456	211383
.	1.1000	0.7898	.	223450	116879	279371	201876
.	1.2000	0.8616	.	223450	124246	269899	192959
.	1.3000	0.9334	.	223450	131217	260996	184592
.	1.4000	1.0052	.	223450	137819	252623	176736
.	1.5000	1.0770	.	223450	144075	244744	169357
.	1.6000	1.1488	.	223450	150007	237325	162421
.	1.7000	1.2206	.	223450	155637	230334	155898
.	1.8000	1.2924	.	223450	160984	223744	149760
.	1.9000	1.3642	.	223450	166064	217526	143980
.	2.0000	1.4360	.	223450	170896	211656	138536
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

(cont.)

Table 5.12.2 (Cont'd)

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Cod in Baltic Fishing Areas 25 to 32

Prediction with management option table

(cont.)

Year: 1998					Year: 1999					Year: 2000	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.0000	0.7180	283595	218830	105620	0.0000	0.0000	275203	202809	0	410787	326137
.	0.1000	0.0718	.	202809	12874	393135	309320
.	0.2000	0.1436	.	202809	24981	376632	293615
.	0.3000	0.2154	.	202809	36375	361194	278940
.	0.4000	0.2872	.	202809	47105	346745	265222
.	0.5000	0.3590	.	202809	57215	333214	252391
.	0.6000	0.4308	.	202809	66749	320535	240384
.	0.7000	0.5026	.	202809	75745	308649	229142
.	0.8000	0.5744	.	202809	84239	297497	218611
.	0.9000	0.6462	.	202809	92264	287030	208741
.	1.0000	0.7180	.	202809	99853	277200	199484
.	1.1000	0.7898	.	202809	107032	267961	190799
.	1.2000	0.8616	.	202809	113830	259272	182645
.	1.3000	0.9334	.	202809	120271	251097	174986
.	1.4000	1.0052	.	202809	126378	243400	167787
.	1.5000	1.0770	.	202809	132172	236147	161018
.	1.6000	1.1488	.	202809	137673	229310	154648
.	1.7000	1.2206	.	202809	142901	222860	148650
.	1.8000	1.2924	.	202809	147871	216771	143000
.	1.9000	1.3642	.	202809	152601	211020	137674
.	2.0000	1.4360	.	202809	157104	205583	132651
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

(cont.)

The SAS System 08:35 Wednesday, April 29, 1998

Cod in Baltic Fishing Areas 25 to 32

Prediction with management option table

(cont.)

Year: 1998					Year: 1999					Year: 2000	
F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	F Factor	Reference F	Stock biomass	Sp.stock biomass	Catch in weight	Stock biomass	Sp.stock biomass
1.2000	0.8616	283595	218830	120309	0.0000	0.0000	256006	184652	0	388290	304279
.	0.1000	0.0718	.	184652	11770	372236	289017
.	0.2000	0.1436	.	184652	22852	357213	274752
.	0.3000	0.2154	.	184652	33292	343146	261411
.	0.4000	0.2872	.	184652	43135	329967	248927
.	0.5000	0.3590	.	184652	52421	317612	237241
.	0.6000	0.4308	.	184652	61187	306023	226294
.	0.7000	0.5026	.	184652	69468	295146	216034
.	0.8000	0.5744	.	184652	77296	284931	206414
.	0.9000	0.6462	.	184652	84701	275332	197388
.	1.0000	0.7180	.	184652	91712	266306	188915
.	1.1000	0.7898	.	184652	98353	257814	180956
.	1.2000	0.8616	.	184652	104648	249818	173476
.	1.3000	0.9334	.	184652	110620	242286	166442
.	1.4000	1.0052	.	184652	116290	235185	159823
.	1.5000	1.0770	.	184652	121676	228487	153592
.	1.6000	1.1488	.	184652	126796	222164	147722
.	1.7000	1.2206	.	184652	131668	216192	142189
.	1.8000	1.2924	.	184652	136305	210547	136971
.	1.9000	1.3642	.	184652	140724	205208	132046
.	2.0000	1.4360	.	184652	144936	200155	127396
-	-	Tonnes	Tonnes	Tonnes	-	-	Tonnes	Tonnes	Tonnes	Tonnes	Tonnes

Notes: Run name : MANMAR02
Date and time : 23APR98:11:24
Computation of ref. F: Simple mean, age 4 - 7
Basis for 1998 : F factors

The SAS System 08:35 Wednesday, April 29, 1998

Cod in Baltic Fishing Areas 25 to 32

Yield per recruit: Input data

Age	Recruit-ment	Natural mortality	Maturity ogive	Prop.of F bef.spaw.	Prop.of M bef.spaw.	Weight in stock	Exploit. pattern	Weight in catch
2	142087.00	0.2000	0.1300	0.0000	0.0000	0.275	0.0554	0.718
3	.	0.2000	0.5100	0.0000	0.0000	0.651	0.2992	0.924
4	.	0.2000	0.9100	0.0000	0.0000	1.138	0.5568	1.164
5	.	0.2000	0.9700	0.0000	0.0000	1.755	0.8969	1.510
6	.	0.2000	0.9700	0.0000	0.0000	2.752	0.7723	2.333
7	.	0.2000	0.9800	0.0000	0.0000	3.505	0.6440	3.305
8+	.	0.2000	0.9800	0.0000	0.0000	5.417	0.6440	4.631
Unit	Thousands	-	-	-	-	Kilograms	-	Kilograms

Notes: Run name : YLDMAR03
Date and time: 22APR98:18:14

Table 5.12.2 (Cont'd)

The SAS System

08:35 Wednesday, April 29, 1998

Cod in Baltic Fishing Areas 25 to 32

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	783845	1997851	584633	1878375	584633	1878375
0.1000	0.0718	27302	67907	647934	1354678	452148	1248937	452148	1248937
0.2000	0.1436	43689	96701	566583	994539	373100	896803	373100	896803
0.3000	0.2154	54592	108964	512636	772477	320876	679924	320876	679924
0.4000	0.2872	62370	113672	474288	626299	283914	537361	283914	537361
0.5000	0.3590	68208	114824	445608	525285	256403	439013	256403	439013
0.6000	0.4308	72767	114326	423302	452744	235118	368528	235118	368528
0.7000	0.5026	76439	113118	405403	398962	218131	316393	218131	316393
0.8000	0.5744	79473	111669	390669	357982	204230	276772	204230	276772
0.9000	0.6462	82033	110209	378281	325998	192611	245941	192611	245941
1.0000	0.7180	84232	108844	367678	300497	182727	221439	182727	221439
1.1000	0.7898	86148	107617	358464	279772	174191	201595	174191	201595
1.2000	0.8616	87840	106537	350354	262635	166724	185249	166724	185249
1.3000	0.9334	89350	105600	343135	248243	160119	171575	160119	171575
1.4000	1.0052	90710	104791	336649	235987	154220	159977	154220	159977
1.5000	1.0770	91945	104096	330771	225416	148908	150017	148908	150017
1.6000	1.1488	93075	103499	325407	216195	144090	141366	144090	141366
1.7000	1.2206	94115	102986	320481	208071	139692	133778	139692	133778
1.8000	1.2924	95077	102543	315931	200847	135655	127061	135655	127061
1.9000	1.3642	95972	102161	311709	194372	131931	121067	131931	121067
2.0000	1.4360	96807	101829	307774	188526	128480	115681	128480	115681
-	-	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes	Thousands	Tonnes

Notes: Run name : YLDMAR03
Date and time : 22APR98:18:14
Computation of ref. F: Simple mean, age 4 - 7
F-0.1 factor : 0.2665
F-max factor : 0.5074
F-0.1 reference F : 0.1913
F-max reference F : 0.3643
Recruitment : 142087 (Thousands)

Table 5.13.1

Medium-term projection: Cod SD 25-32

Spawning stock biomass

 $F=f \cdot F_{ref}$, where F_{ref} refers to status quo fishing mortality (=0.718)*

Fishing pattern: mean 1995-1997

 $f=0.5$

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.1	186	216	249	291	329	356	399	431	459	482
0.25	200	237	272	312	351	380	419	454	483	509
0.5	215	257	296	343	380	411	454	483	515	542
0.75	235	281	324	373	413	447	488	526	554	574
0.9	254	307	352	406	446	484	527	560	583	609

 $f=0.8$

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.1	187	190	194	211	226	239	254	266	271	278
0.25	202	200	209	228	244	255	267	280	292	296
0.5	216	219	226	248	263	273	291	303	313	318
0.75	231	236	250	270	288	298	315	328	334	339
0.9	254	264	280	299	309	324	336	344	349	359

 $f=1.0$

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.1	197	177	167	178	184	185	191	193	194	198
0.25	205	189	180	188	194	198	202	207	208	209
0.5	221	204	198	208	214	213	219	222	224	225
0.75	236	220	220	228	231	232	236	239	242	246
0.9	253	238	239	251	255	253	256	255	266	262

 $f=1.1$

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.1	189	163	155	163	163	166	169	171	172	172
0.25	202	177	171	179	182	179	180	180	182	185
0.5	217	191	185	194	195	195	196	196	198	197
0.75	235	210	207	210	211	211	210	211	211	214
0.9	250	224	222	223	225	225	227	230	230	232

 $f=1.2$

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.1	188	154	141	146	150	148	149	148	147	147
0.25	201	168	154	160	161	158	159	158	159	159
0.5	215	183	172	176	175	172	172	172	171	171
0.75	233	202	193	196	193	188	186	187	185	184
0.9	254	217	209	212	208	204	205	205	199	195

 $f=1.4$

Fractiles	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.1	189	144	129	130	126	121	116	113	109	109
0.25	202	155	138	139	139	131	126	123	120	117
0.5	220	168	152	153	149	143	138	134	131	127
0.75	236	183	168	172	164	154	151	147	141	137
0.9	251	201	188	186	174	163	162	156	152	150

Figure 5.6.1. Mean weight at age of cod in 1997 by countries and Subdivisions

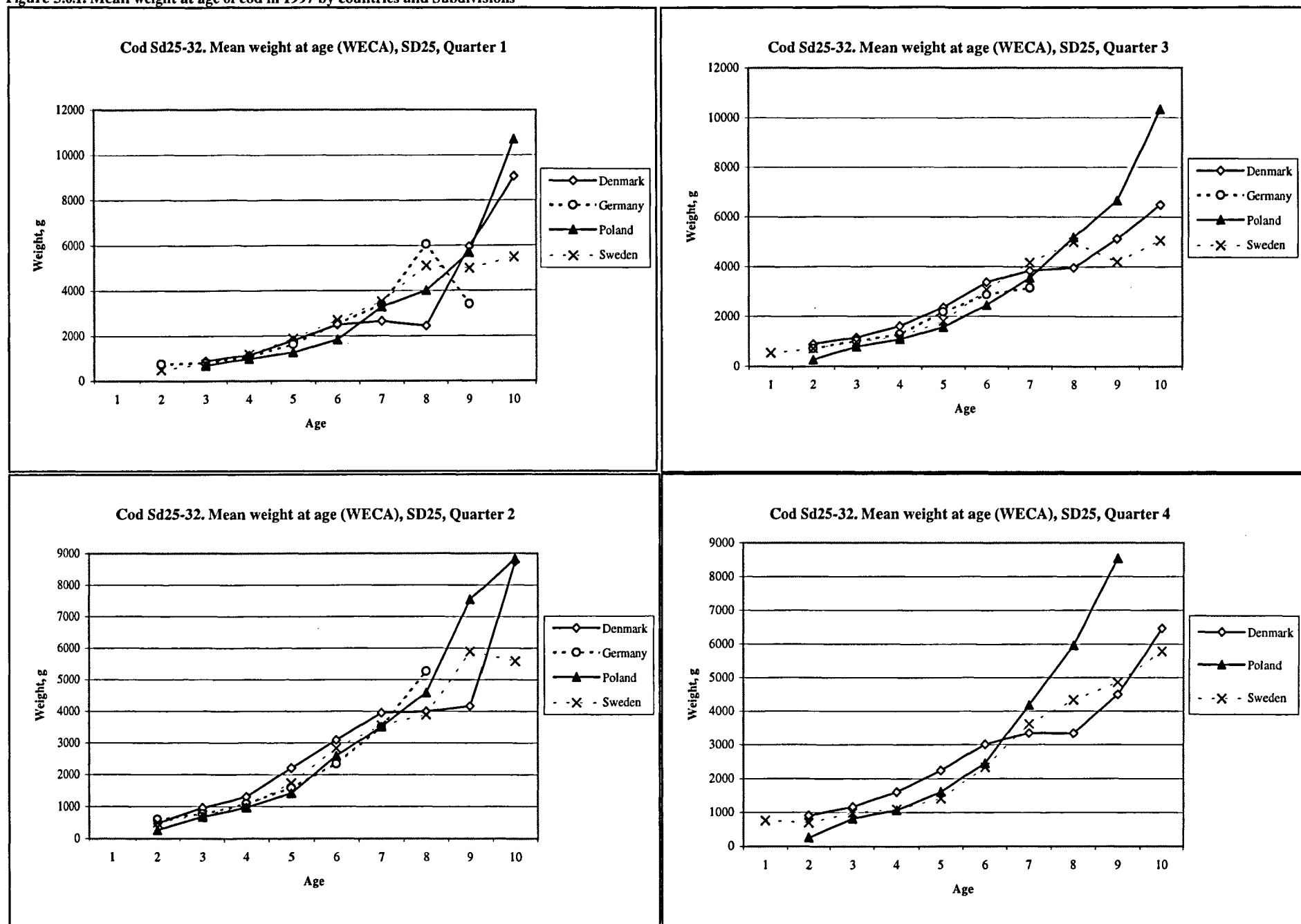
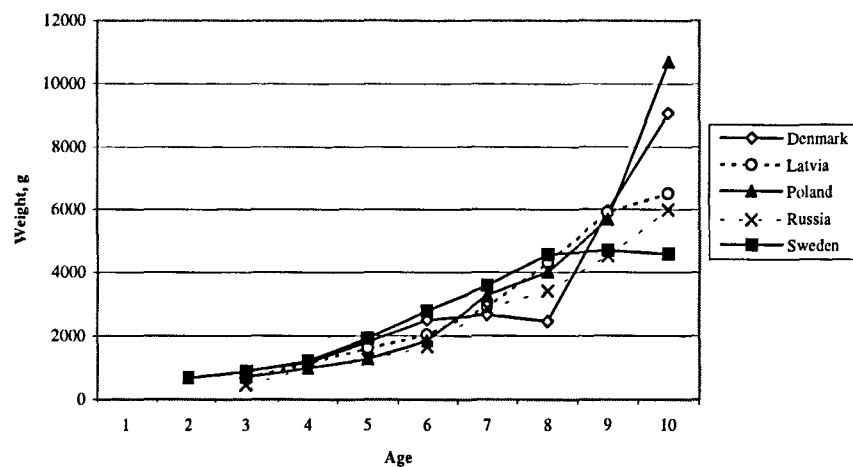
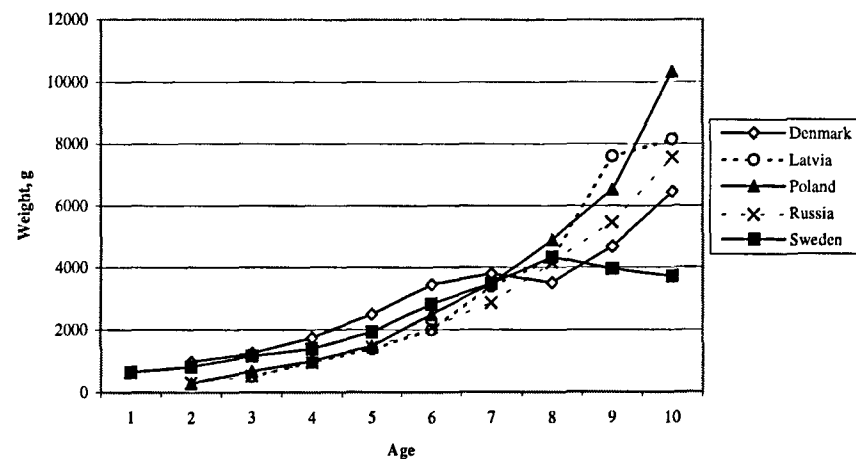


Figure 5.6.1.(continued).

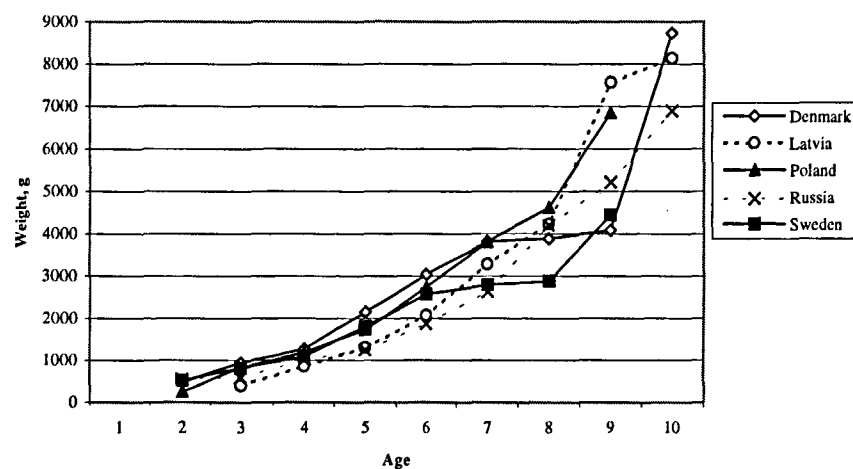
Cod Sd25-32. Mean weight at age (WECA), SD26, Quarter 1



Cod Sd25-32. Mean weight at age (WECA), SD26, Quarter 3



Cod Sd25-32. Mean weight at age (WECA), SD26, Quarter 2



Cod Sd25-32. Mean weight at age (WECA), SD26, Quarter 4

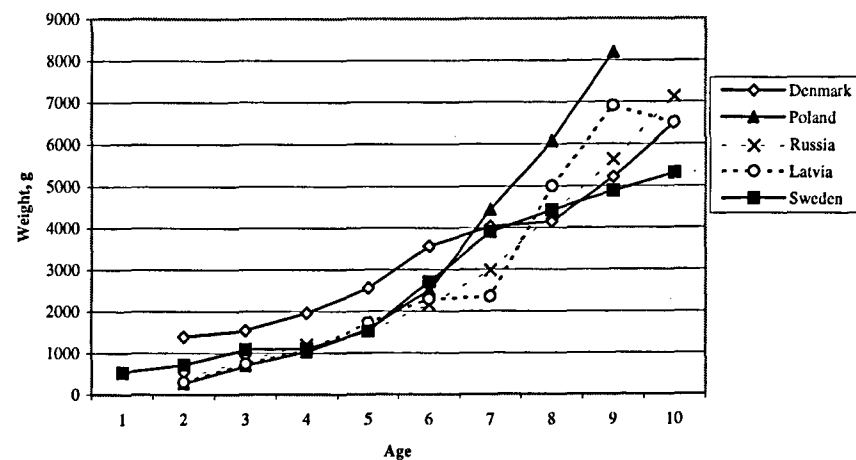


Figure 5.6.1.(continued).

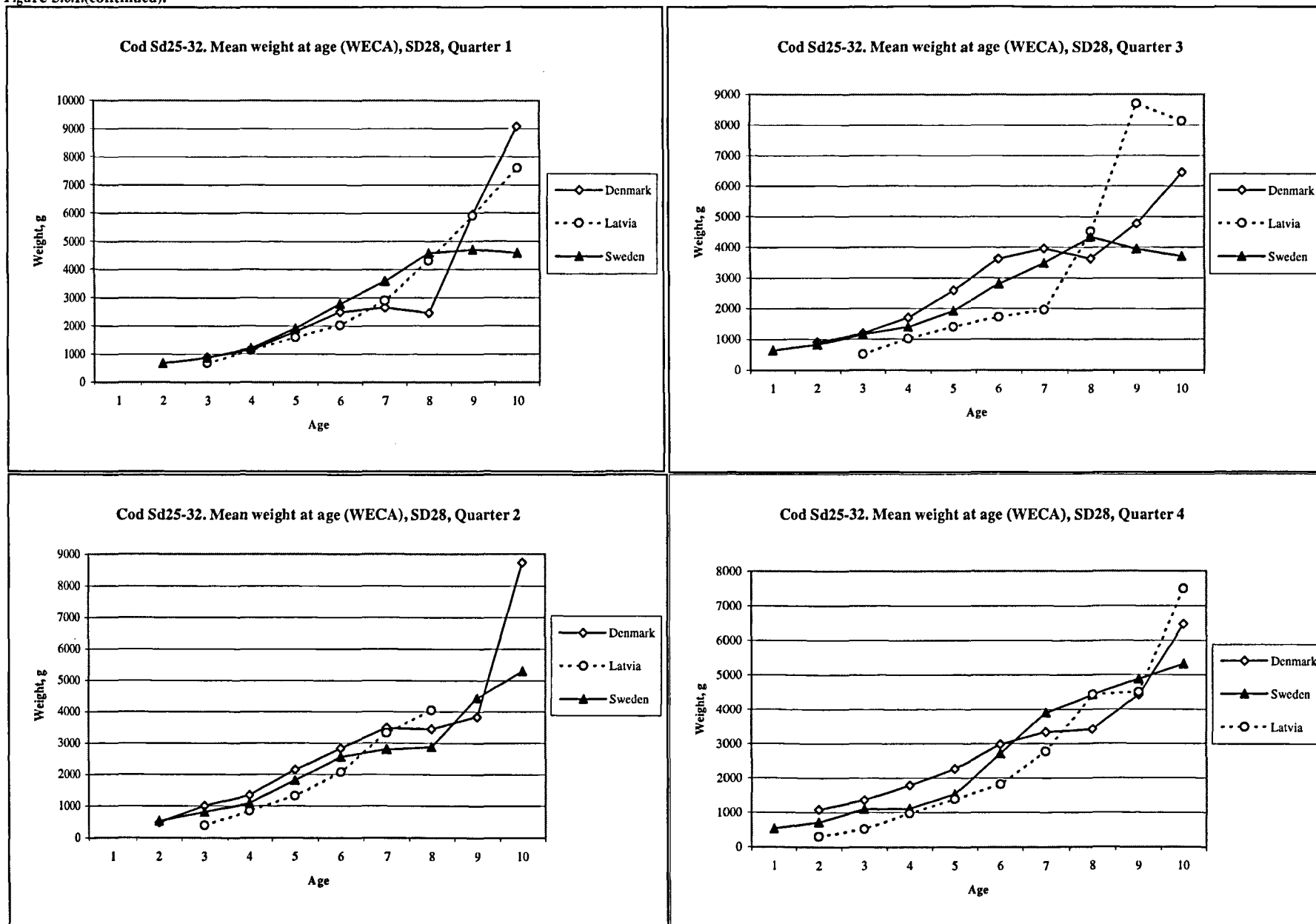


Figure 5.7.1. Maturity ogives for eastern Baltic cod estimated for different time periods.

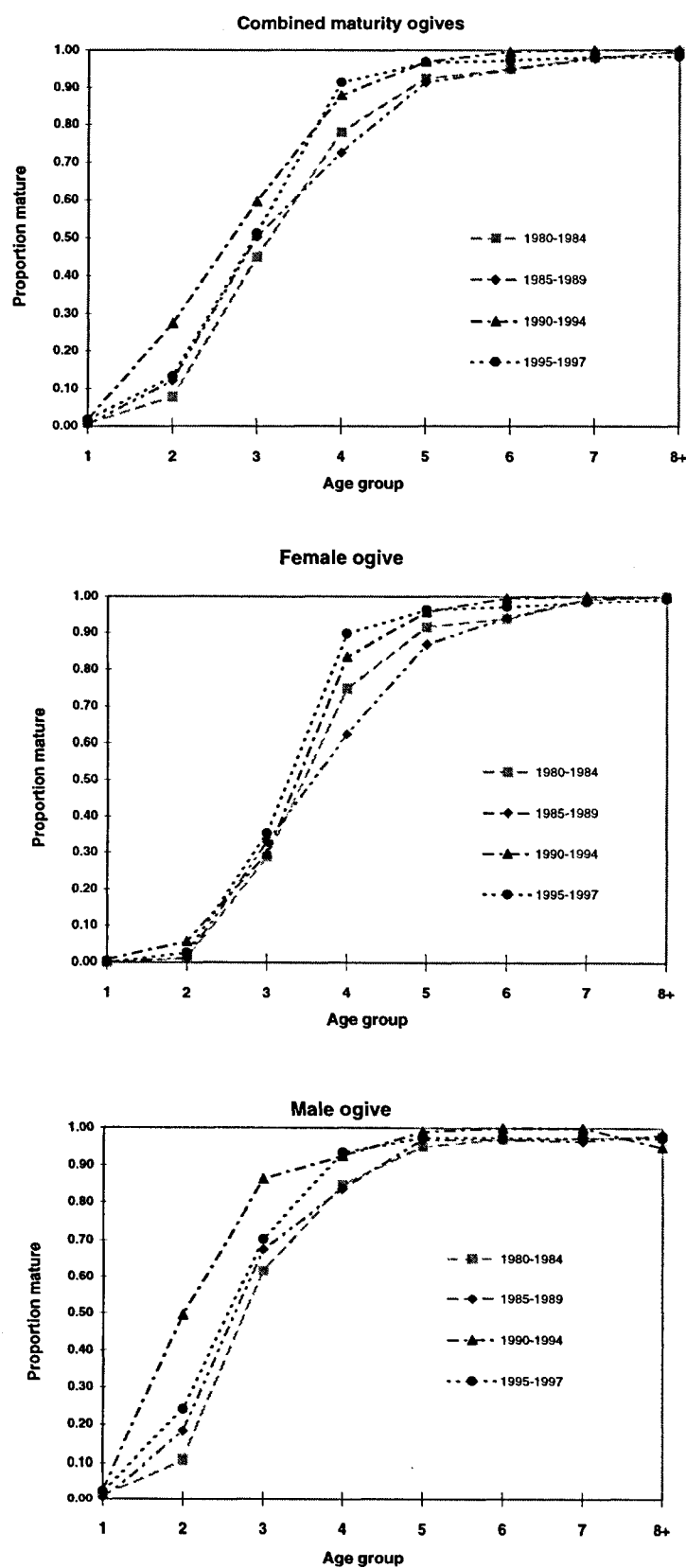


Figure 5.7.2.A. Average proportion of mature females and males at age by Sub-division in recent years.

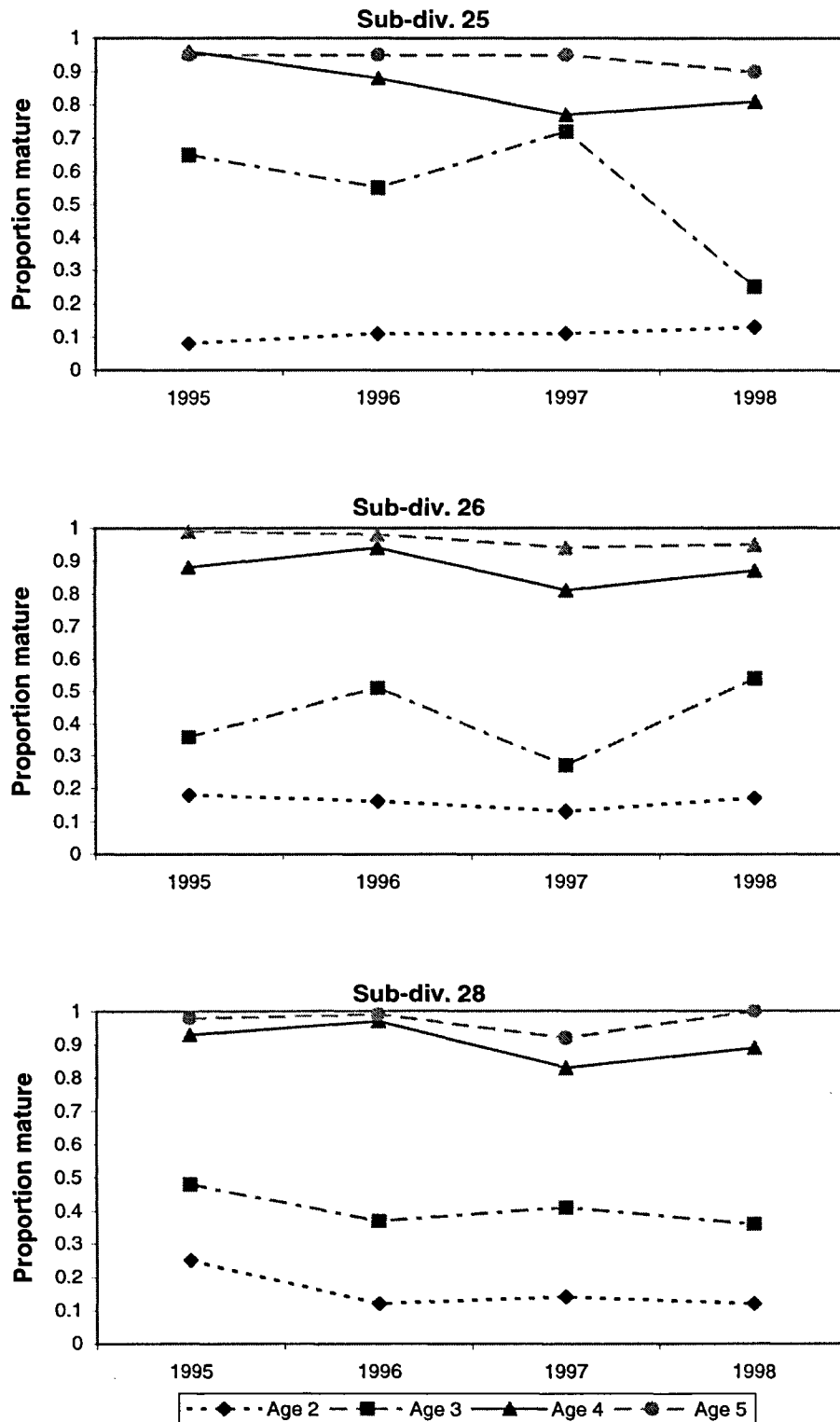


Figure 5.7.2.B. Average proportion of sexually mature females at age by Sub-division in recent years.

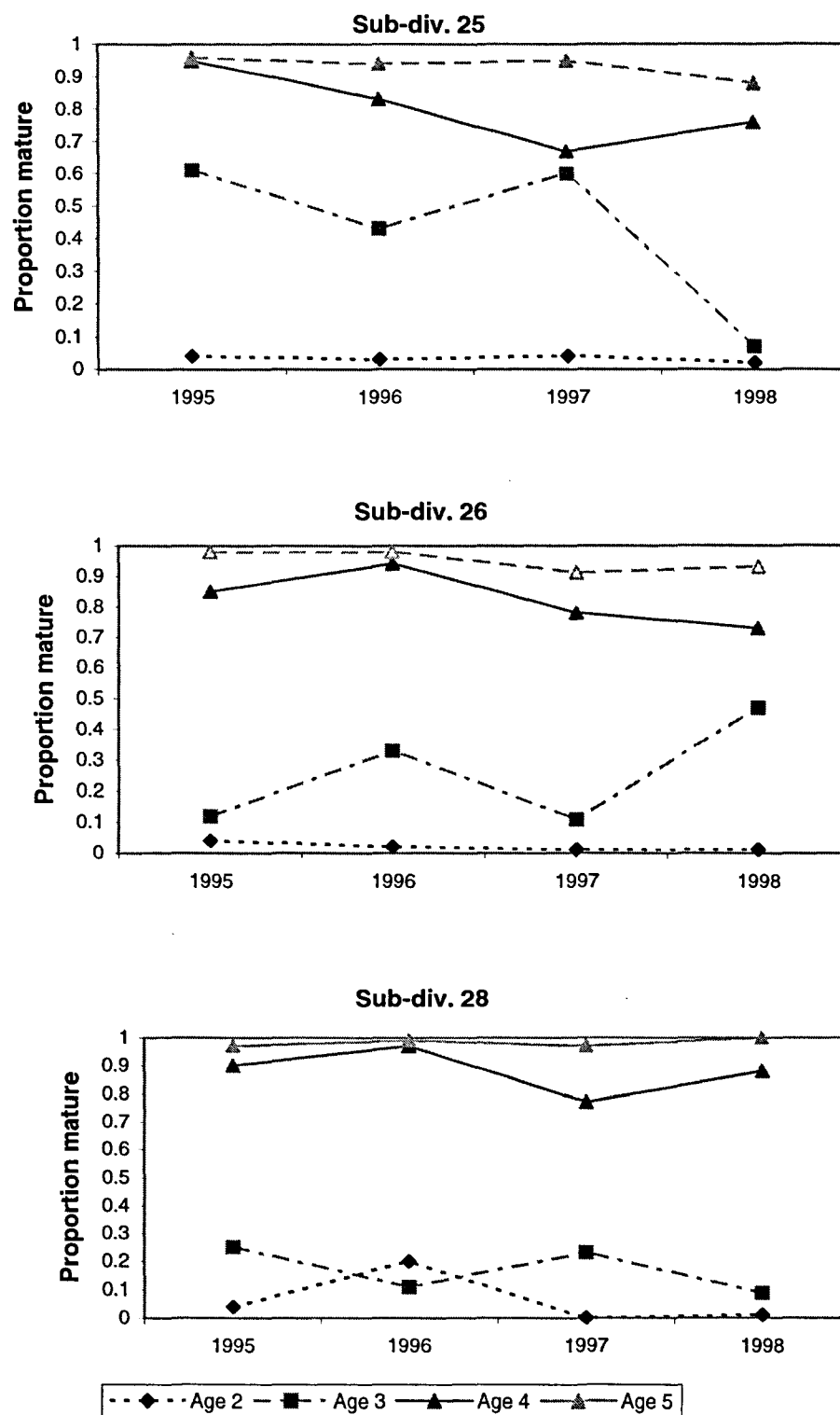
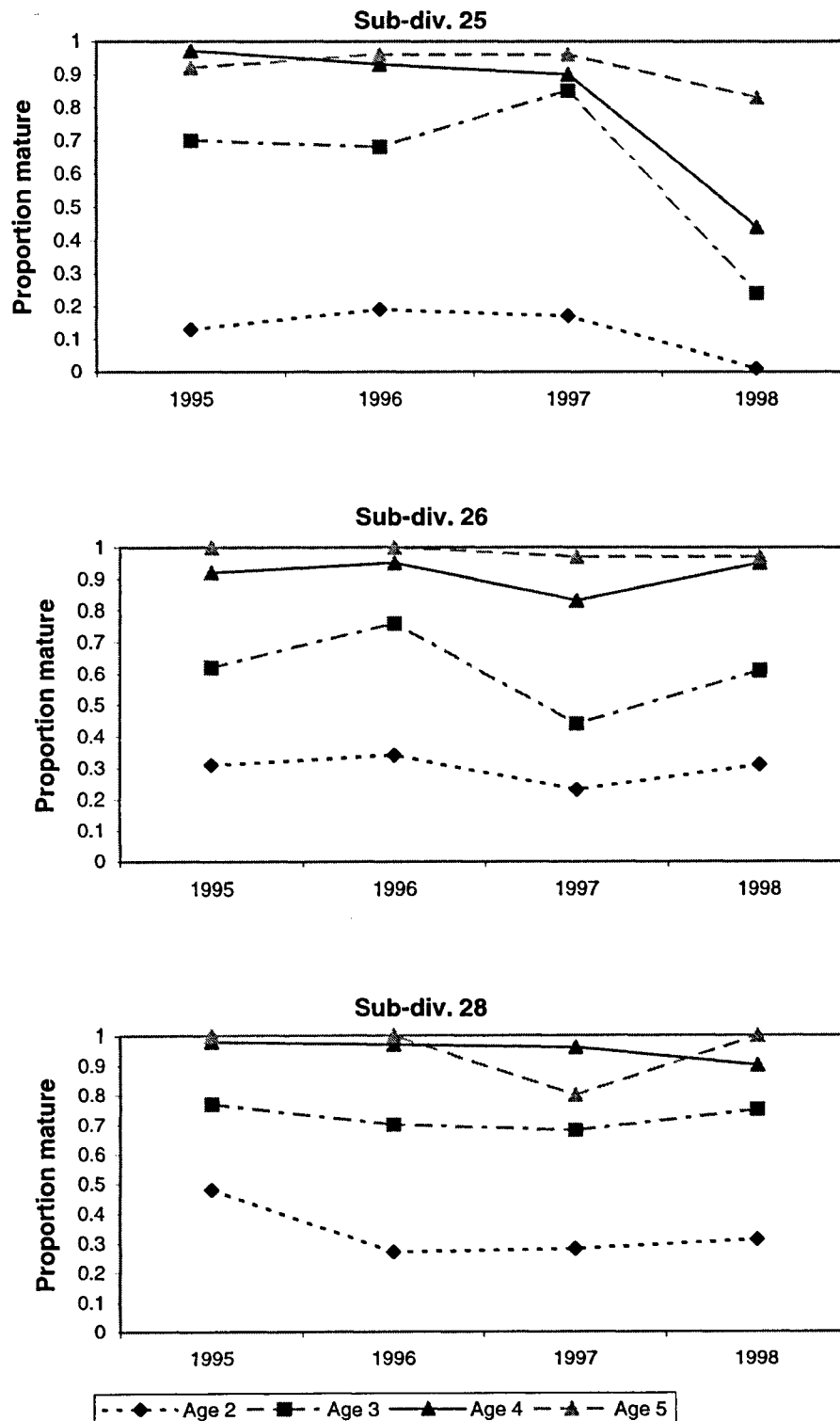


Figure 5.7.2.C. Average proportion of sexually mature males at age by Sub-division in recent years.



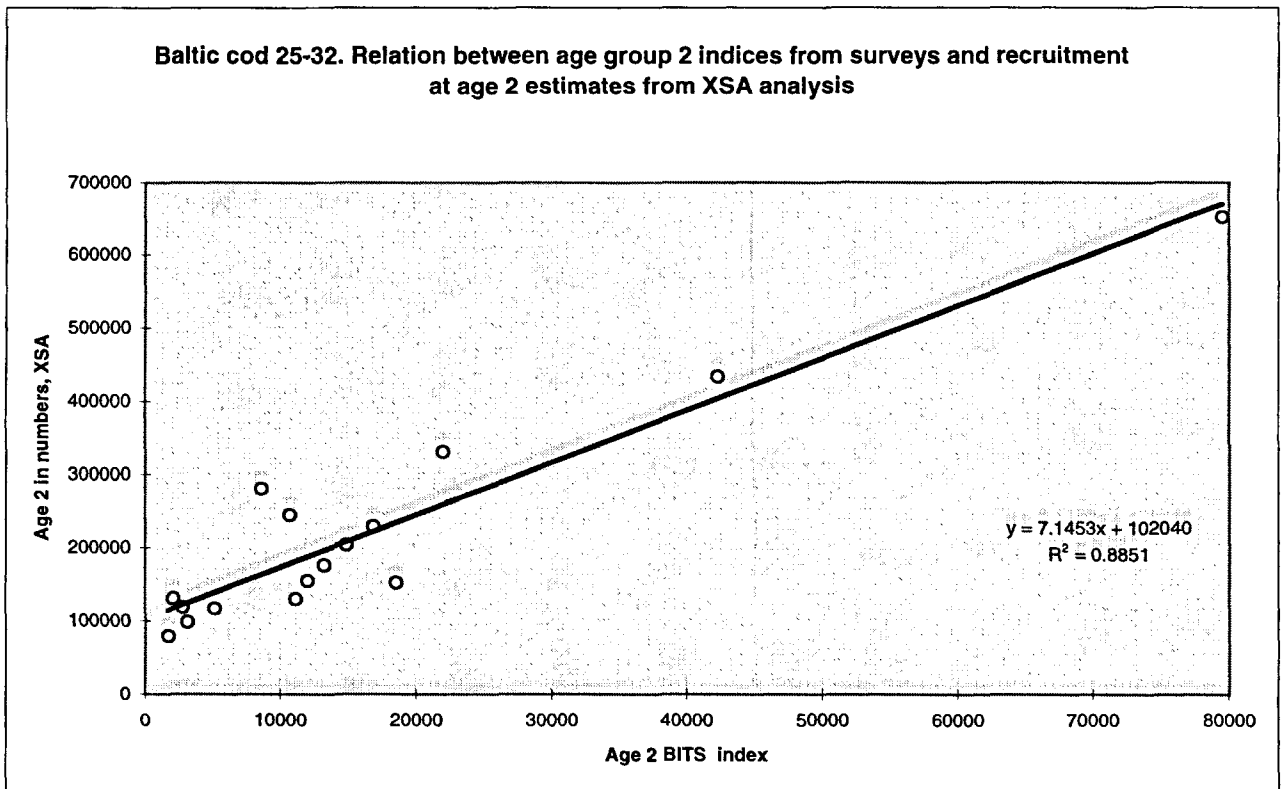
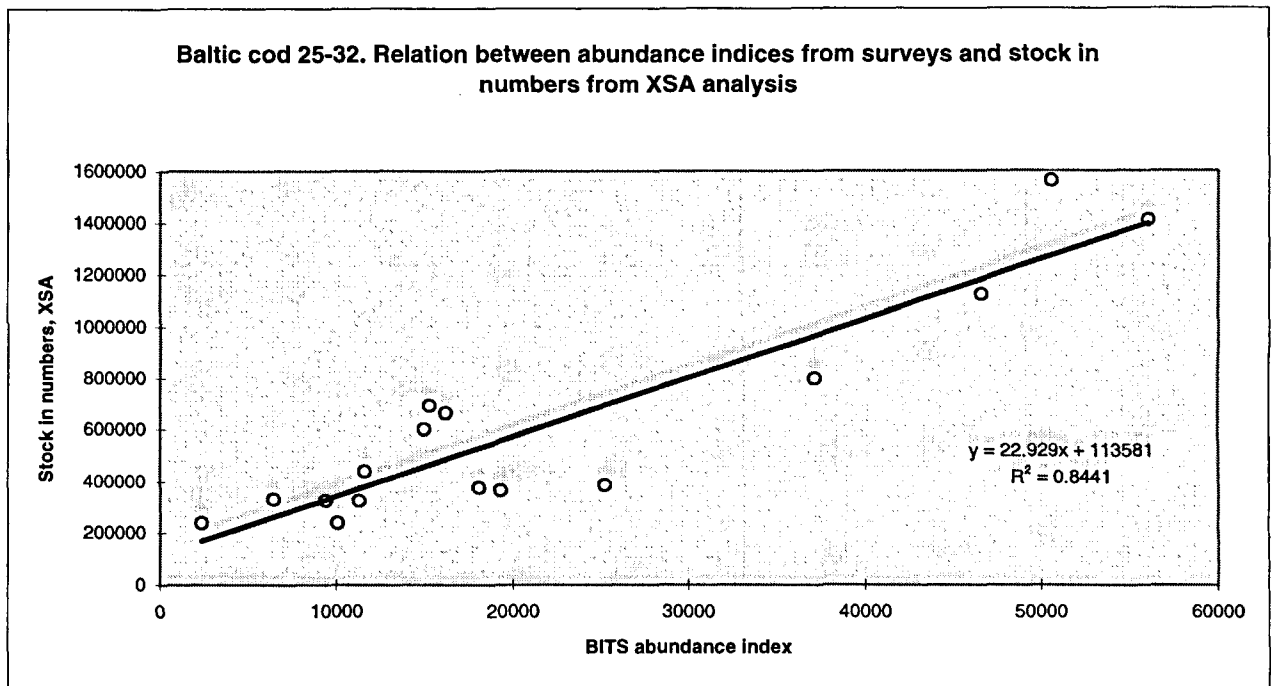


Figure 5.9.1.

Fish Stock Summary

Cod in Baltic Fishing Areas 25 to 32

22-4-1998

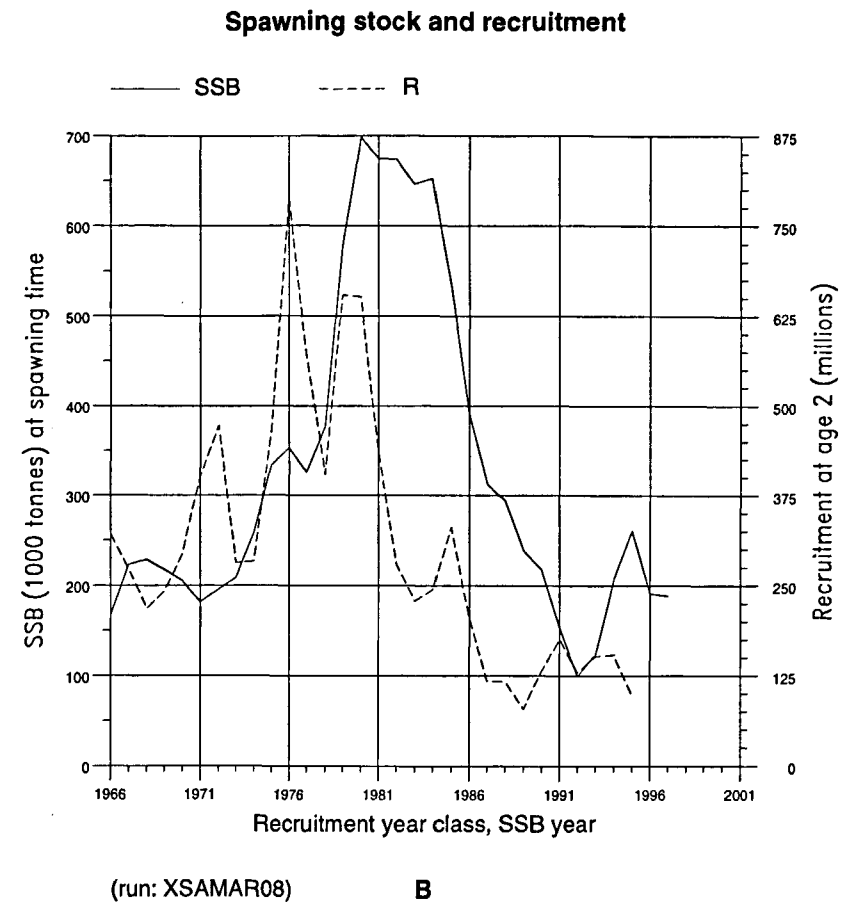
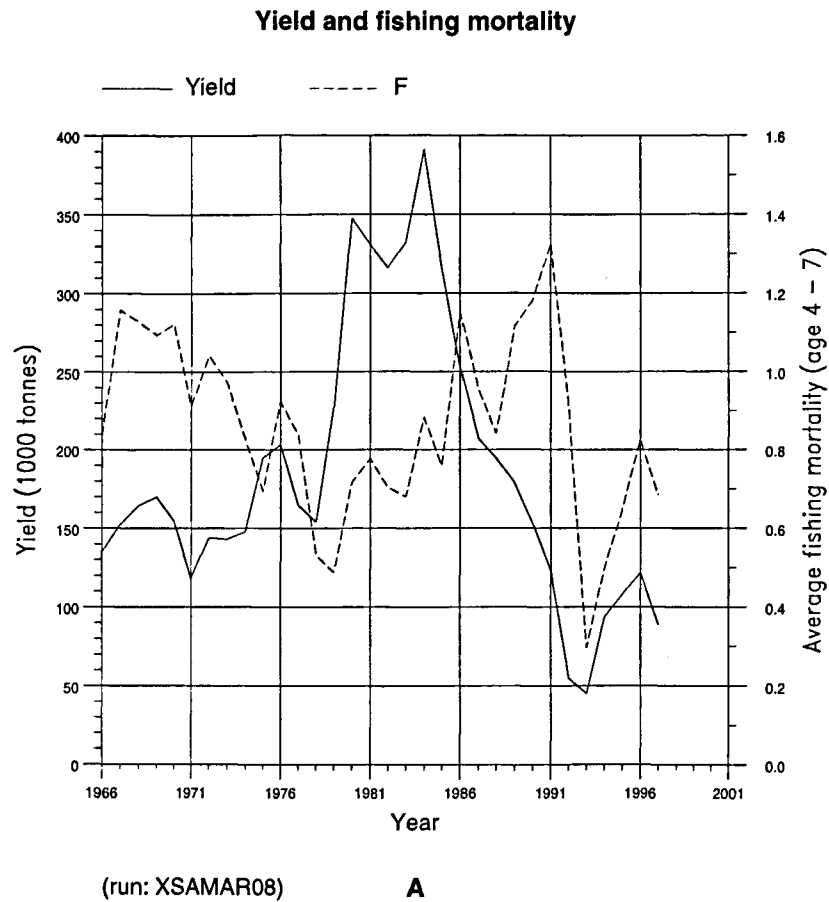


Figure 5.9.2

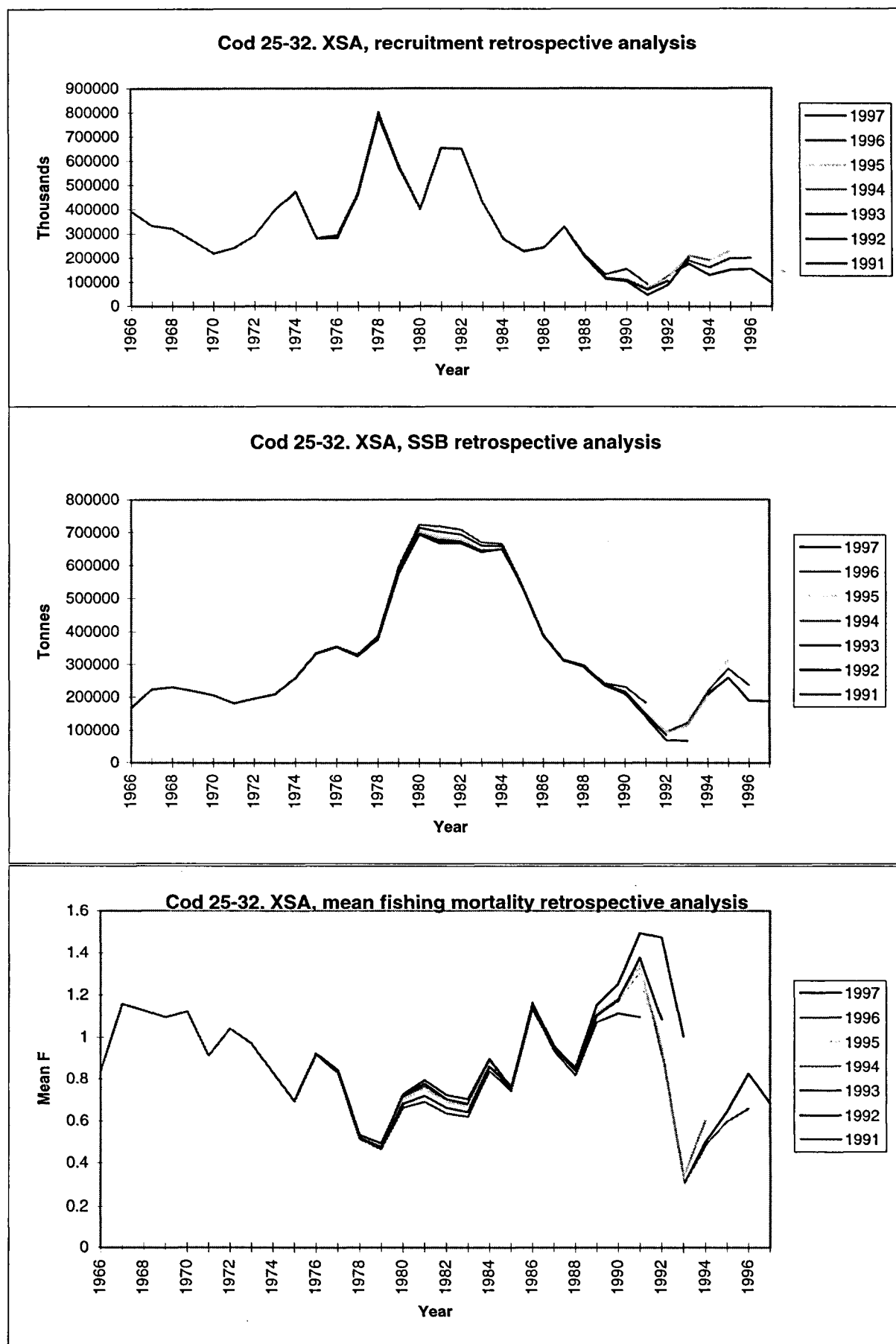


Figure 5.9.3.

Figure 5.13.1 Stock-Recruitment relationship for Cod SD 25-32
(Beverton-Holt model for 1981-1995 year classess)

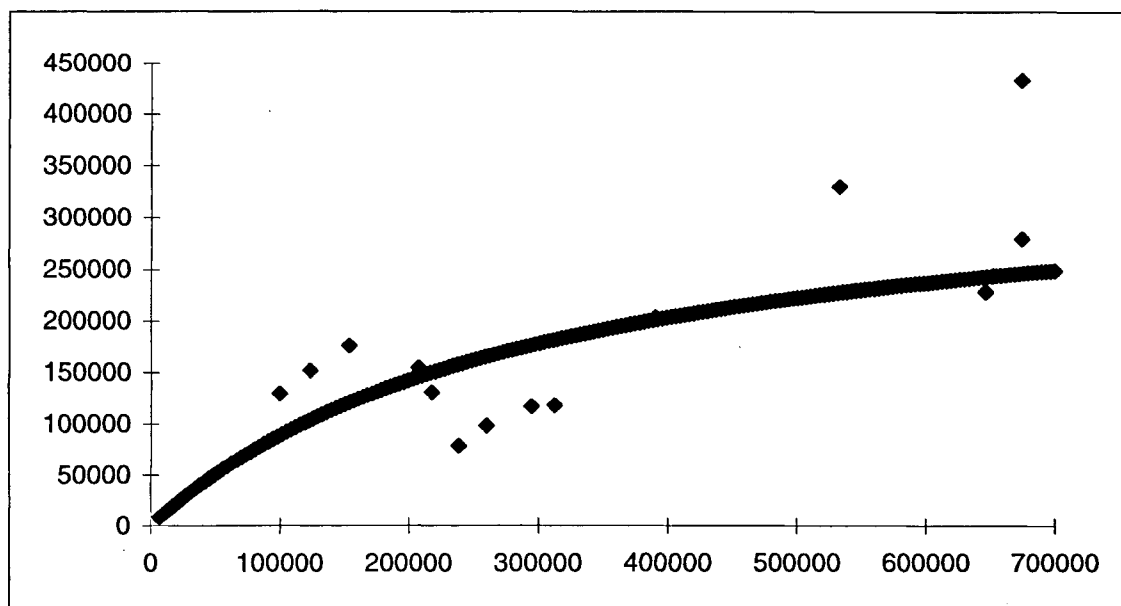


Figure 5.13.2. Comparison between female SSB and SSB combined for both sexes for cod in Sub-div 25-32

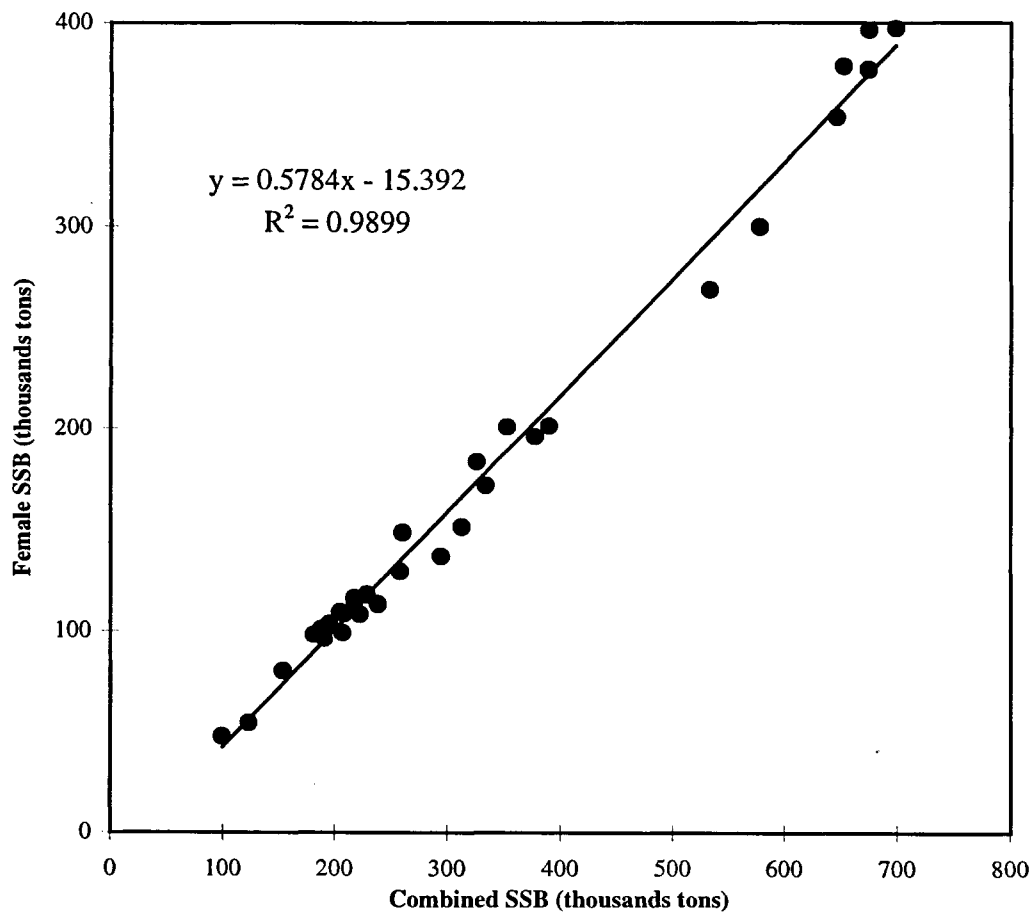
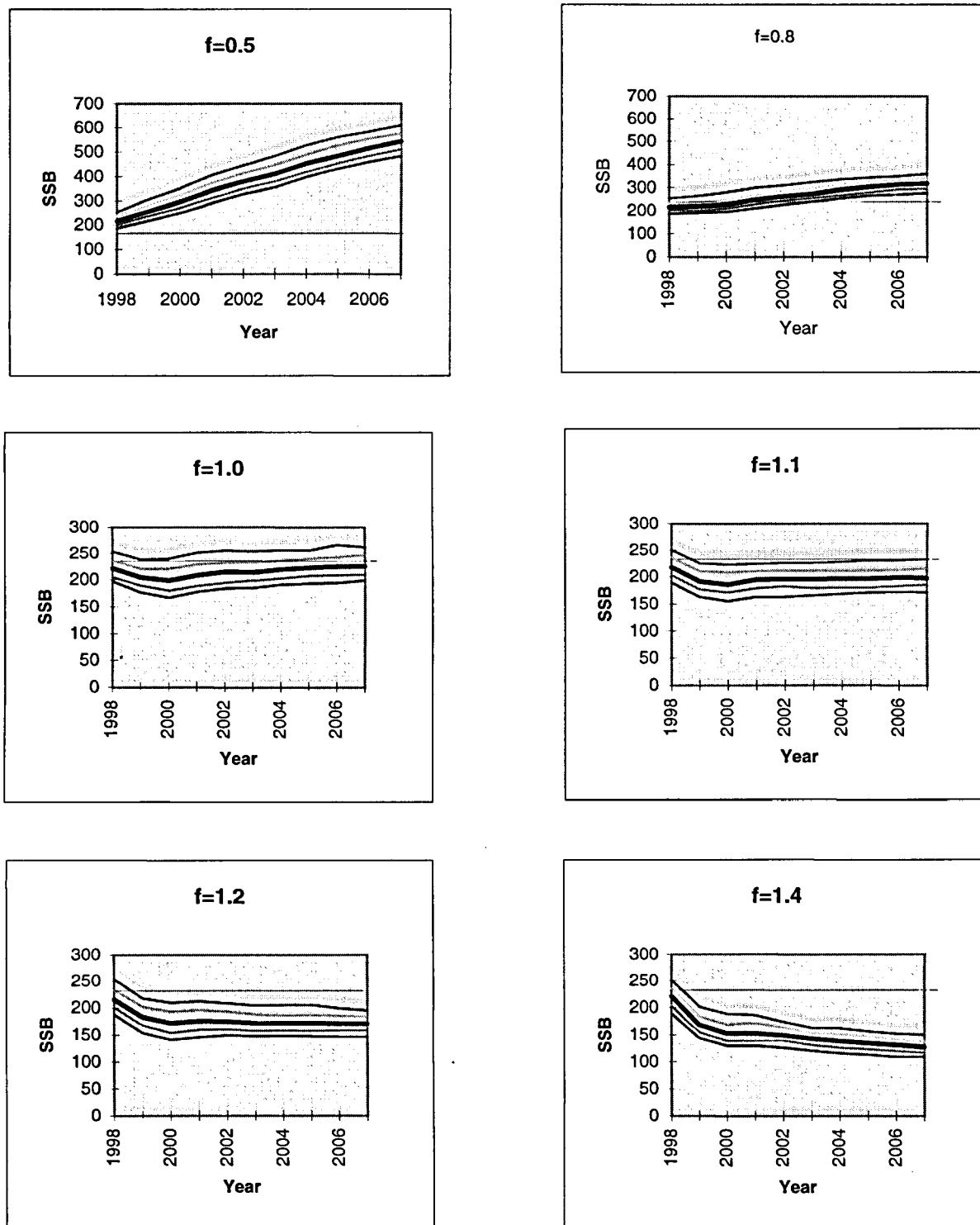


Figure 5.13.3. Medium-term projection of SSB: Cod SD 25-32

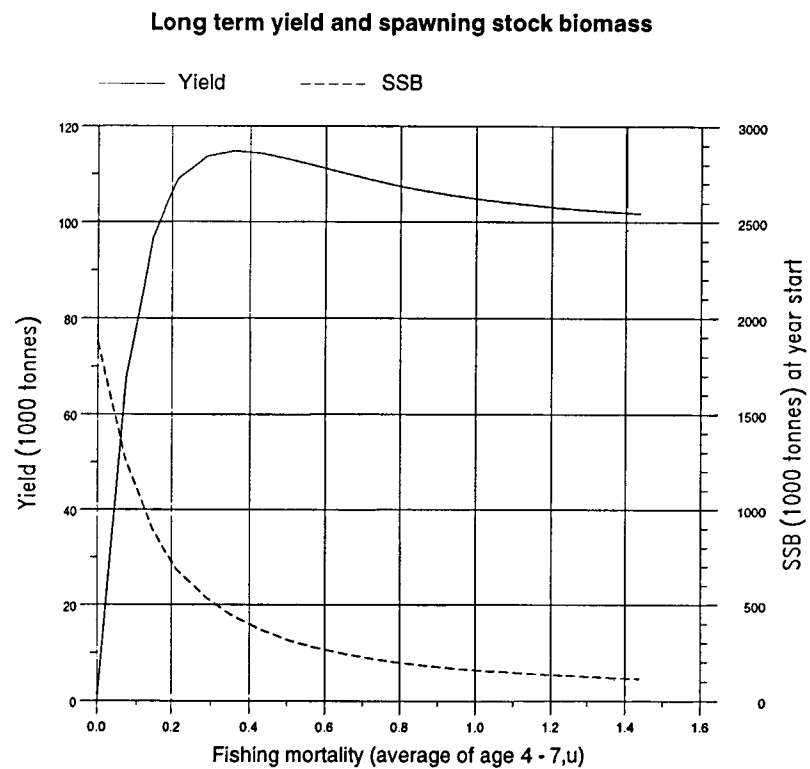
Fishing pattern: 1995-1997 mean; $F=f \cdot F_{ref}$, where F_{ref} refers to status quo fishing mortality ($=0.718$)

Lines present 10,25,50,75,90 percentile of biomass distribution

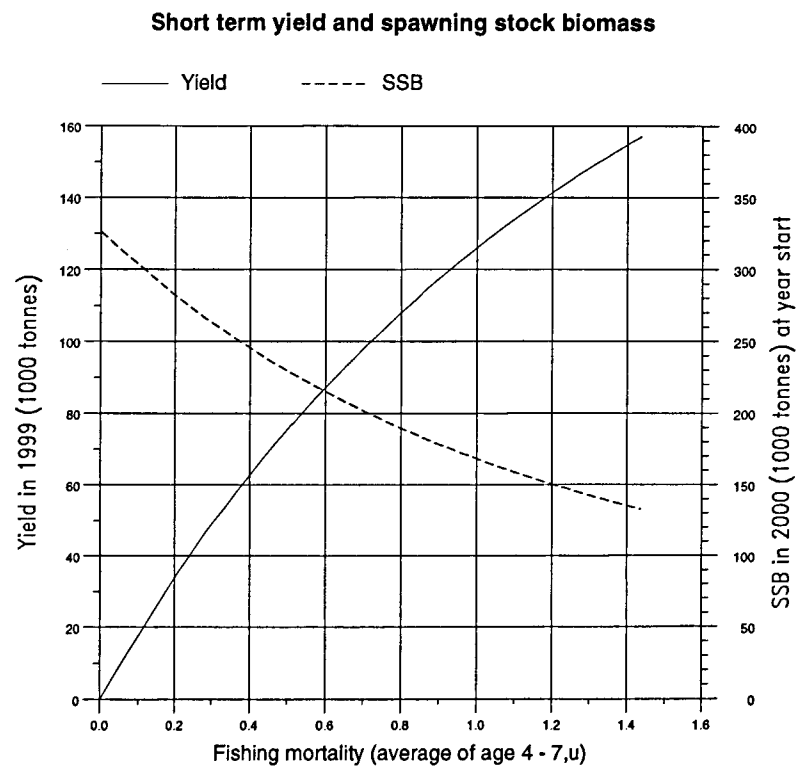
The straight presents $B_{pa}=240$ th.t



Fish Stock Summary Cod in Baltic Fishing Areas 25 to 32 22-4-1998



(run: YLDMAR03)

C

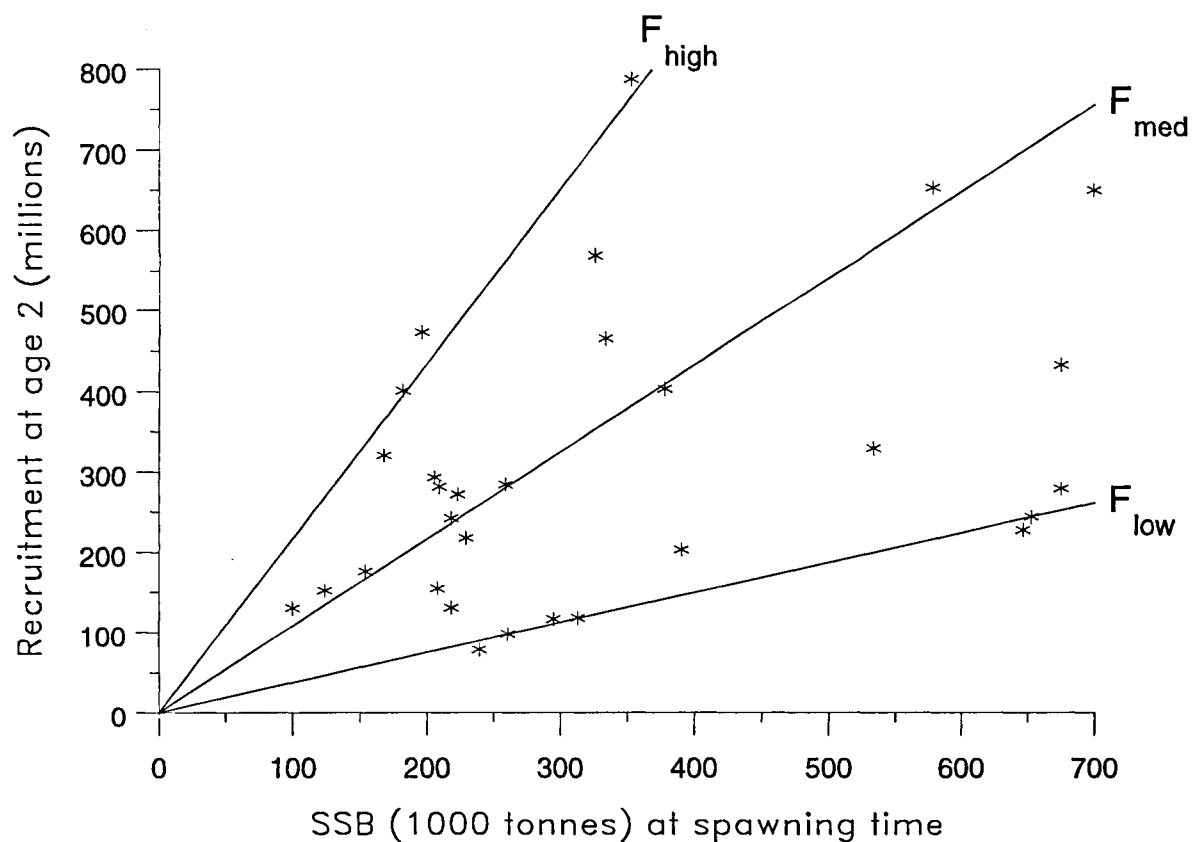
(run: MANMAR04)

D

Figure 5.13.4

Cod in Baltic Fishing Areas 25 to 32
22-4-1998

Stock - Recruitment



(run: XSAMAR08)

Figure 5.13.5